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TESI DI LAUREA IN

78578 - PREVISIONI DI IMPATTO AMBIENTALE DI IMPIANTI PRODUTTIVI E DI TRATTAMENTO RIFIUTI M

PROCEDURA PER L'APPLICAZIONE DI MODELLI DI DISPERSIONE DEGLI INQUINANTI IN ATMOSFERA NELL'AMBITO DELLA VALUTAZIONE D'IMPATTO AMBIENTALE

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Introduzione

La seguente tesi di laurea punta creare una procedura completa per la modellistica della dispersione degli inquinanti in atmosfera, derivanti dell'installazione o dalla modifica di impianti industriali, tramite modello Lapmod, in un territorio ed un periodo di riferimento di interesse.

Questa procedura prenderà come riferimento una verifica di assoggettabilità a VIA (Valutazione di Impatto Ambientale) pubblicata sull'apposito sito di consultazione dell'Emilia Romagna, cercando inoltre di introdurre un criterio di significatività dell'impatto come richiesto dalla normativa vigente del testo unico ambientale.

L'elaborato sarà pertanto suddiviso in tre parti:

- la prima parte descrive i principali riferimenti normativi riguardo la qualità dell'aria e la regolamentazione in materia di inquinamento atmosferico.
- La seconda parte, invece, consiste in un riassunto della procedura utilizzata per il reperimento dei dati utili ai modelli, considerando i migliori dati ottenibili al fine di una valutazione il più accurata possibile edun sunto sulla procedura utilizzata per i modelli di dispersione.
  Il processore principale di dispersione utilizzato per il caso di studio è Lapmod, un modello Lagrangiano a particelle, tridimensionale e non stazionario, adatto a simulare la dispersione in atmosfera su terreno complesso di sostanze inerti o radioattive, emesse sia in fase gassosa sia in forma di aerosol. Oltre alla dispersione degli inquinanti convenzionali, LAPMOD è in grado di simulare anche la dispersione in atmosfera di sostanze odorigene.
- Infine, nella terza parte dell'elaborato, viene applicato il modello ad un caso di studio, ricalcando una valutazione d'impatto sulla parte applicativa della modellistica, per quando tecnicamente possibile.

Il lavoro è stato svolto in sede di tirocinio con il supporto dell'azienda Ecoricerche S.R.L., presso la quale è stato svolto e che ha reso possibile lo sviluppo.

Ecoricerche S.r.l. è una società di consulenza in materia di ambiente, sicurezza, merci pericolose, agroalimentare, qualità e formazione.

Nell'ambito ambientale l'azienda ha visto una crescente richiesta di modellistiche di dispersione da parte degli enti pubblici, valutando l'opportunità di aumentare la competenza interna.

Riferimenti normativi

La normativa italiana in materia di inquinamento atmosferico

L'apertura di nuovi stabilimenti produttivi è un diritto sancito dall'articolo 41 della costituzione, tuttavia questo diritto è soggetto a restrizioni sociali, di sicurezza di libertà e dignità umana.

Il 13 luglio del 1966 fu emanata la legge n. 615 che regolamentava e definiva, per la prima volta, l'inquinamento atmosferico.

Al fine di recepire quattro normative europee in materia di inquinamento e qualità dell'aria questa venne soppiantata dal DPR 203/1988.

Nel '96 fu pubblicata la direttiva quadro 96/62/CE sulla valutazione e la gestione della qualità dell'aria con l'obiettivo di definire concentrazioni di inquinanti tali da prevenire o ridurre gli effetti nocivi sulla salute umana e sull'ambiente, la quale venne recepita con il d.lgs.351/1999.

Infine, si tentò di racchiudere tutte le norme ambientali in un unico testo: il d.lgs.152/2006

Seppur chiamato "Testo Unico Ambientale" (TUA) questo decreto non è sufficiente a coprire tutti i campi necessari a tale scopo (non vengono trattate problematiche di acustica, elettrosmog ecc.) e, come infatti dimostra il suo vero titolo "Norme in materia ambientale", neanche la sua "forma" può ritenersi sufficiente.

Il TUA è stato originato a seguito della Legge 308/04 la quale delegava al governo il compito di emanare entro determinati limiti temporali un decreto, che poi si e tramutato nell'emanazione di più decreti legge.

In origine era suddiviso in 6 parti, con 317 articoli e 45 allegati, tuttavia, come spesso accade, l'evolversi della società e della tecnologia ha portato a dover apportare diverse modifiche al testo.

La prima modifica sostanziale del testo si osserva a seguito del recepimento della Direttiva Europea 50/08 relativa alla qualità dell'aria ambiente e per un'aria più pulita in Europa, dalla quale si sono susseguiti negli anni decine di modifiche.

Tuttavia, ad oggi, come riferito sul sito TUTTOAMBIENTE.IT, mancano tantissimi provvedimenti attuativi che renderebbero applicabili alcune norme che risultano ad oggi "buoni propositi" ed inoltre è di tutta evidenza che la gran parte della normativa "speciale" di settore è ancora fondamentalmente estranea al contenuto del TUA.

Inoltre, sempre lo stesso sito cita:

Ci sono all'interno del DLvo 152/2011 molti istituti e opportunità (tutte di derivazione europea) che potrebbero-dovrebbero trovare ben più attenzione ed applicazione da parte di tutti gli operatori del settore, ancorpiù in tempi come questi di estrema difficoltà economica mondiale.

Il D.Lgs 152/06 parte II cenni di VIA e tipi di autorizzazioni

Entrando più nel dettaglio il TUA nell'articolo 5 fornisce al lettore diverse definizioni utili alla comprensione del testo tra queste alcune di seguito ottenute dalla legge vigente aggiornata dal sito Normattiva:

Impatti ambientali: effetti significativi, diretti e indiretti, di un piano, di un programma o di un progetto, sui seguenti fattori:

popolazione e salute umana;

biodiversita', con particolare attenzione alle specie e agli

habitat protetti in virtu' della direttiva 92/43/CEE e della

direttiva 2009/147/CE;

territorio, suolo, acqua, aria e clima;

beni materiali, patrimonio culturale, paesaggio;

interazione tra i fattori sopra elencati.

Negli impatti ambientali rientrano gli effetti derivanti dalla

vulnerabilita' del progetto a rischio di gravi incidenti o calamita'

pertinenti il progetto medesimo. (112)

Già da qui si nota come il testo non possa considerarsi unico, infatti gli effetti derivanti da gravi incidenti o calamità è normato dal recepimento della direttiva europea Seveso con l'ultima modifica effettuata tramite il d.lgs. 105/2015 inerente agli incidenti rilevanti.

Nell'articolo 6 del D.lgs. 152/06 si ha una prima vera introduzione di valutazione di impatto ambientale, tuttavia facendo riferimento agli impatti significativi.

Il concetto di significatività non ha ancora avuto una quantificazione o un metodo di stima che possa rendere oggettiva quest'ultima definizione.

La normativa, però, esplica nel comma 2 è che fatto salvo quanto disposto al comma 3, esiste una serie di progetti a cui far riferimento negli allegati II, II bis, III e IV i quali impatti sono considerati sempre significativi.

Nel comma 3, si introduce la possibilità di valutare gli impatti per i piani, i programmi che determinano l'uso di piccole aree a livello locale e per piccole modifiche sule attività di cui al

comma 2 si può valutare se l'impatto risulta significativo e delega all'articolo 12 la procedura di valutazione per la significatività dell'impatto.

All'articolo 12, invece di una procedura che definisca un indice numerico per il principio di significatività, il decreto indica le modalità di presentazione ed elaborazione della verifica di assoggettabilità (screening) e rimandando all'allegato I il compito di individuare i parametri.

Tramite l'allegato in questione il decreto definisce effettivamente le caratteristiche di un impatto significativo, ma senza mai esplicitare indici di significatività.

Diagramma di flusso riassuntivo per verifica all'assoggettabilità a VIA

Inoltre, nella consuetudine interpretativa del D.lgs. 152/06, si tende a confondere impropriamente in sede procedurale la fase di VIA, atta a valutare un impatto ambientale, con la procedura autorizzativa, volta a regolamentare la gestione dell'impianto nel rispetto dei limiti e delle condizioni di esercizio.

Resta comunque il fatto che le due sono strettamente correlate.

Infine, nel grafico sottostante con "VIA unica" si intende una valutazione di impatto ambientale in cui la normativa (statale o regionale) dispone che il provvedimento finale comprende e sostituisce tutti gli altri atti di assenso, comunque denominati, in materia ambientale.

La Via unica in sede regionale è anche denominata PAUR, Provvedimento Autorizzatorio Unico Regionale.

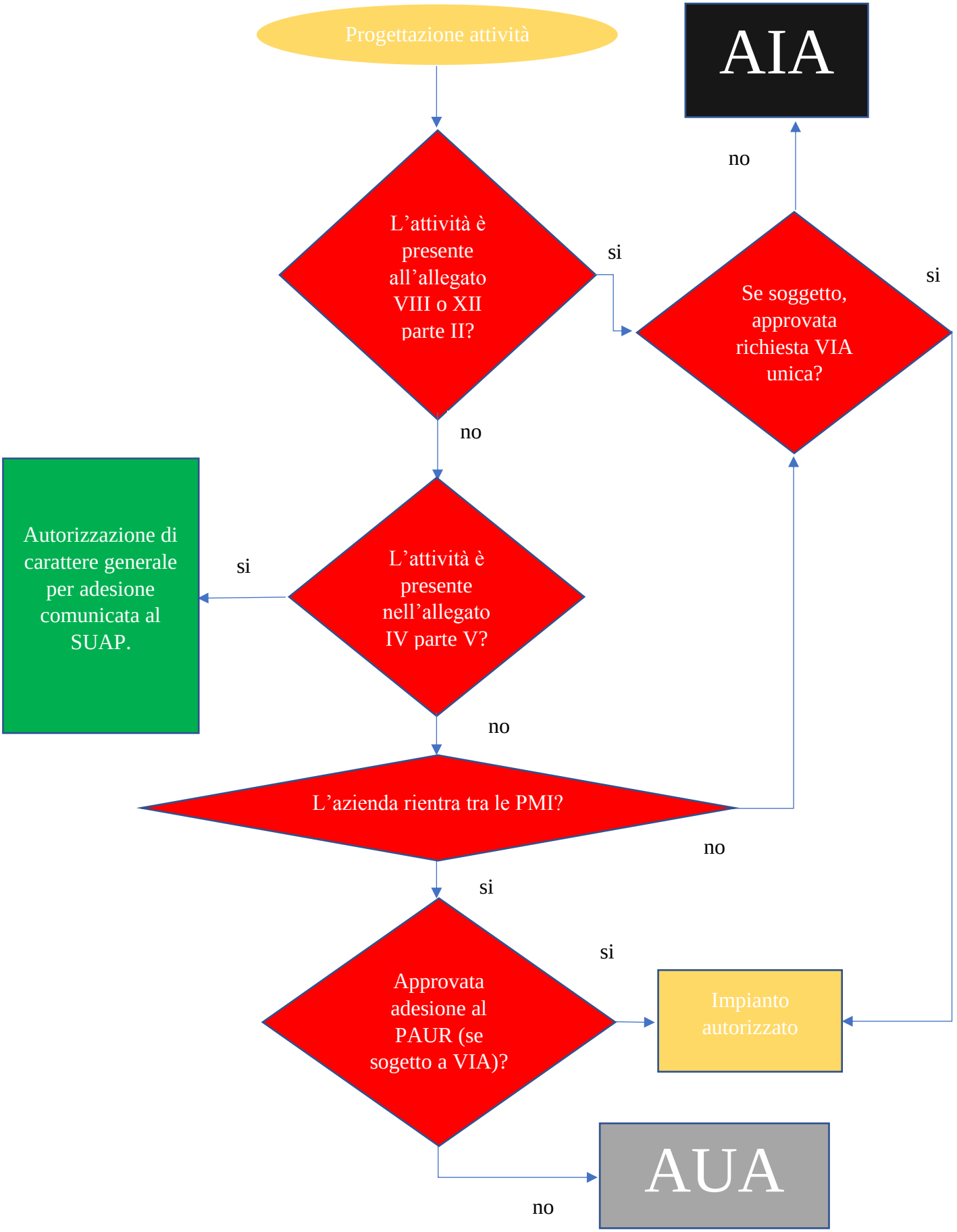


Diagramma di flusso riassuntivo per la determinazione del tipo di autorizzazione a cui l'attività è soggetta

L'AUTORIZZAZIONE DI CARATTERE GENERALE PER GLI IMPIANTI E LE ATTIVITA' IN DEROGA

All'articolo 272 al comma 2 permette all'autorità competente di predisporre autorizzazioni di carattere generale, relative a specifiche categorie di stabilimenti, individuate mediante al tipo ed alle modalità di produzione.

I limiti non possono in ogni caso derogare da quanto sancito dall'articolo 271, ma risulta una forte semplificazione burocratica, in quanto tali autorizzazioni fanno riferimento ad impianti standard, ove pertanto risulta banale la stima delle emissioni.

L'autorizzazione di carattere generale consiste in un modello semplificato in cui la quantità delle sostanze emesse e la pericolosità di queste dipende direttamente da specifici indici di produzione, quali per esempio le materie prime e ausiliarie utilizzate.

Nella parte V all'allegato IV si può trovare una lista delle attività che sicuramente possono rientrare nell'autorizzazione di carattere generale.

La possibilità di rientrare in un'estensione di questa categoria è fattibile se:

a) Non vi è emissione di sostanze pericolose, come individuate dalla parte II dell'allegato I alla parte V.
b) Non sono utilizzate sostanze classificate come mutagene, cancerogene o tossiche ai sensi del d.lgs. 52/97.
c) Non vi siano presenti nello stabilimento ulteriori impianti non soggetti a questo tipo di autorizzazione.

Esplicando il punto c: in uno stabilimento possono coesistere più autorizzazioni di carattere generale, ma non possono essere presenti autorizzazioni promiscue.

L'autorizzazione ha validità di 10 anni e permane anche in caso di cambiamenti non sostanziali dell'impianto.

Al comma 4-bis si deroga ai punti a e b sopracitati nei casi in cui le concentrazioni in ingresso e/o in emissione all'impianto delle suddette sostanze siano in quantità sufficientemente esigue da non comportare un rischio per la salute umana e l'ambiente.

L'AUTORIZZAZIONE UNICA AMBIENTALE (AUA)

Con il DPR del 13 marzo 2013 viene introdotta un'ulteriore semplificazione burocratica per le piccole e medie imprese (PMI): l'AUA.

Nel caso in cui una piccola o media impresa sia soggetta ad una o più autorizzazioni, allora potrebbe richiedere un'autorizzazione unica per tutti i titoli abilitativi al posto di dover richiedere e gestire più autorizzazioni diverse.

Un prerequisito essenziale quindi per richiedere questo tipo di abilitazione è quello di rientrare nella categoria di imprese sopra citata, in sostanza:

- L'attività deve avere meno di 250 occupati
- Il fatturato annuo deve essere inferiore a 50 milioni di euro
- Il bilancio annuo deve essere inferiore a 43 milioni di euro

Due ulteriori prerequisiti che l'attività deve possedere sono: la mancata presenza nell'allegato VIII, parte seconda nel d.lgs.152/06 e la non assoggettabilità ad VIA in seguito a screening.

In ogni caso per richiedere l'autorizzazione sarà necessario redigere una valutazione tecnica che vada a fare una valutazione preliminare sulle norme tecniche e dei limiti previsti dalla normativa per tutte le matrici coinvolte, come riportato nell'allegato IVbis parte II del d.lgs. 152/06 e smi.

L'AUTORIZZAZIONE INTEGRATA AMBIENTALE (AIA)

Il controllo e l'intervento su una singola fonte inquinante potrebbe risultare inefficace per l'intrinseca capacità dell'inquinante di passare da una matrice ad un'altra.

Quindi per poter meglio tenere in considerazione l'obiettivo della salvaguardia ambientale è stata istituita l'AIA.

L'autorizzazione integrata è l'esplicitazione, pertanto, dell'esigenza di integrare l'impatto ambientale a misure mitigative e/o compensative prescrivendo le misure necessarie ad elidere o, perlomeno a ridurre l'impatto di un'attività.

Questa esigenza nasce, oltre che da carattere sociale, dalla necessità di recepire inoltre la direttiva 96/61/CE, (c.d. IPPC integrated pollution and control"), confluita nella direttiva 2008/1/CE.

L'AIA entra all'interno del TUA al fine di rientrare in un unico testo legislativo "chiaro".

Potrebbero essere escluse dall'autorizzazione integrata le aziende soggette a VIA statale se quest'ultima sostituisce la prima.

Nel D.lgs.152/06 l'articolo 5 al comma 1 menziona gli impianti individuati dall'articolo 4 al comma 4 che a sua volta delega all'Allegato VIII parte II per l'applicazione di questa forma autorizzativa.

Da notare che l'AIA fa riferimento all'installazione, l'unità tecnica permanente in cui sia svolta qualunque attività che possa influire sulle emissioni o sull'inquinamento, sostituendo tutte le autorizzazioni di cui all'allegato IX parte seconda (emissioni in atmosfera, autorizzazioni allo scarico, smaltimento e recupero rifiuti e all'utilizzo di fanghi in agricoltura).

Ai sensi dell'articolo 29bis per rilasciare un'autorizzazione integrata per le attività in allegato VIII, si deve fare riferimento all'allegato XI e, secondo l'articolo 29terdecies comma 4, si deve inoltre tener conto dei documenti BREF (documenti prodotti dall'Europa che cercano di individuare le BAT per le attività industriali elencate nell'allegato 1 della direttiva sulle IPPC).

L'allegato VIII risulta essere diviso in sei capitoli dividendo di fatto le tipologie di impianto in diversi settori:

1) Attività energetiche
2) Produzione e trasformazione dei metalli
3) Industria dei prodotti minerali
4) Industria chimica
5) Gestione dei rifiuti
6) Altre attività

Da notare che un impianto già autorizzato con autorizzazione di altro tipo in caso di modifica sostanziale o di rinnovo potrebbe necessitare un cambio di autorizzazione ai sensi dell'art. 29ter, comma 1 redigendo una apposita domanda definita dall'articolo 29sexies.

Ai fini della stesura del modulo definito dall'ultimo articolo citato, è possibile utilizzare i dati contenuti: in un rapporto di sicurezza, in una documentazione UNI EN ISO 14001, prodotti da siti

registrati ai sensi del regolamento CE n.761/2001 (la documentazione EMAS) o da altre fonti da qualunque normativa accreditata.

L'articolo 7, nell'individuare le autorità competenti al rilascio delle AIA delega al Ministero dell'ambiente le attività di cui all'allegato XII, mentre per le aziende non rientranti in questa categoria, ma rientranti nell'allegato VIII delega le regioni, le quali con opportune leggi regionali individuano gli enti preposti.

L'autorizzazione viene rilasciata secondo l'iter definito dall'art.29quater.

Da notare che in fase di progettazione bisogna tener conto delle BAT disponibili e applicabili, tenendo conto del flusso economico disponibile.

L'art. 29octies definisce la durata dell'autorizzazione in base al tipo di certificazione:

- In assenza di certificazioni l'AIA risulta avere validità di 10 anni
- Con registrazione all'EMAS si estende a 16 anni
- Con certificato secondo la UNI EN ISO 14001 si estende a 12 anni

LA LEGGE REGIONALE 20 APRILE 2018, N4 DELL'EMILIA ROMAGNA

La legge regionale vigente che regolamenta la gestione dei procedimenti di VIA è la LR20/18.

Il provvedimento regionale è, nella fattispecie, diviso in 6 parti:

1) Disposizioni generali
2) Procedimento di verifica di assoggettabilità a VIA
3) Procedimento di autorizzazione unica di VIA
4) Procedure di VIA interregionali e sovraregionali
5) Monitoraggio e controlli
6) Disposizioni comuni, finali e transitorie

Questa legge recepisce il d.lgs. 152/06 con integrate le numerose modifiche apportate negli anni.

L'INTRODUZIONE DEI MODELLI DI DISPERSIONE NEL QUADRO NORMATIVO

Al netto delle lacune legislative dovute alla mancanza di un criterio oggettivo ed univoco, al di fuori delle liste di attività negli allegati, per la valutazione della significatività di un impatto ambientale, il TUA vede nei modelli di dispersione in atmosfera, mediante l'articolo 272 bis, strumenti utili alla valutazione di questo parametro astratto (significatività dell'impatto) nonostante esso non sia predefinito.

MODELLI DI DISPERSIONE: RICERCA ED ELABORAZIONE DATI

Storicamente, i primi modelli di dispersione degli inquinanti in atmosfera sono stati proposti dalla United States of Enviromental Protection Agency (US EPA), agenzia del governo federale americano per la protezione ambientale.

Il primo modello elaborato è stato Aermod, modello gaussiano che richiede l'adozione di diverse ipotesi semplificative.

Successivamente sono stati introdotti ulteriori modelli di dispersione, in particolare in questa sede si valuterà l'utilizzo dei programmi Calpuff e Lapmod.

Questi modelli si basano su simulazioni tridimensionali e possono utilizzare entrambi come preprocessore di dati meteo e del suolo Calmet scaricabile dal sito dell'EPA.

Calmet a sua volta, in seguito all'acquisto dei dati meteo già pronti, ha necessitato dell'uso di 2 preprocessori: ctgproc e terrel, forniti sempre dall'EPA, necessari all'elaborazione dei dati geomorfologici e di uso del suolo.

TERREL

Il primo preprocessore utilizzato è stato terrel V.7.

I dati in input, in formato GEOTIF, sono stati reperiti dal sito "earthexplorer.usgs.gov" sotto alla voce "digital elevation", procedendo con l'SRTM1 (con definizione di 1 arcosecondo, ovvero 30m).

Questo preprocessore può elaborare quindi i dati SRTM1 ed, eventualmente, i dati di costa al fine di tener conto del profilo superficiale del terreno.

Nel file di input, in allegato 1, si può già evidenziare come la difficoltà preliminare di questo applicativo sia l'assenza di una vera interfaccia grafica.

Di seguito i parametri più significativi che sono stati modificati:

```
Subgroup (0b)
     1 !GEOTIFF =n44e010.tif!     !END!
     2 !GEOTIFF =n44e011.tif!     !END!
INPUT GROUP: 1 -- Processing Options
! LCOAST = F  !
```

Il parametro LCOAST è importante nel caso la simulazione debba essere fatta in presenza di una costa.

Nel caso preso in esame non risultava rilevante, pertanto è stato soppresso mettendo F.

```
INPUT GROUP: 2 -- Map Projection and Grid Information for Output
! PMAP = UTM !
! IUTMZN = 32 !
! UTMHEM = N !
! DATUM = WGS-84  !
! IGRID = 1 !
! XREFKM = 640.000  !
! YREFKM = 4928.000 !
! NX =   100  !
! NY =   100  !
! DGRIDKM = 0.1 !
```

I parametri del gruppo 2 sono i parametri da tenere ben sotto controllo in uscita, infatti indicano la griglia in uscita da terrel.

Il parametro IGRID=1 indica che è stato preso come punto di origine (XREFKM e YREFKM) l'angolo in basso a sinistra. della griglia rappresentativa del dominio in studio.

Il sistema di riferimento adottato è il WGS-84 UTM 32N, NX ed NY indicano rispettivamente il numero di celle lungo gli assi X e Y della griglia di calcolo, mentre il parametro DGRIDKM ne indica il passo.

In uscita il Terrel genera 2 file di interesse, *.dat (estratta parte iniziale in allegato 2), utile per il passi succesivo della simulazione, ed il file *.grd, utile invece per la verifica "visiva" della buona riuscita della modellazione.

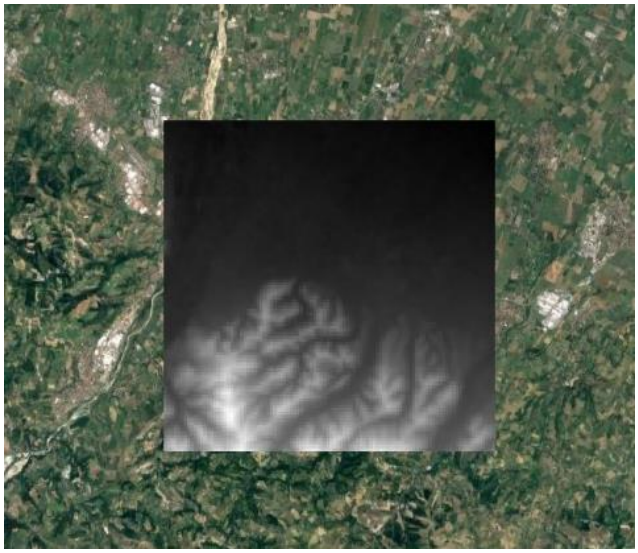


Figura 1-verifica corretto posizionamento del file in uscita da terrel

CTGPROC

I dati di copertura ed uso del suolo sono stati reperiti dal programma europeo COPERNICUS.

Questo è uno dei punti critici di elaborazione dei dati, infatti la classificazione CORINE (usata nel progetto europeo) è differente dalla classificazione Anderson richiesta in input dal preprocessore CTGPROC.

In questo caso si è proceduto a scrivere un algoritmo di codifica da CORINE ad Anderson con l'ausilio delle funzioni macro di Excel creando la funzione mediante il VBA, in allegato 3.

Una cosa importante da segnalare è che le classi 13 e 14 non risultano essere decodificate nella maniera ottimale, infatti risultano nella medesima categoria delle aree coltivate senza irrigazione.

Tuttavia, questa semplificazione non è limitante ai fini della presente tesi, ma lo potrebbe diventare nei casi di modellazione con deposizione secca.

Quindi, una volta cambiato il sistema di classificazione, si è proceduto a creare il file di input in formato generico (estratta parte iniziale in allegato 4), come descritto dal manuale di CAPUFF e si è elaborato il file.

MAKEGEO

I file in uscita da Terrel e CTGProc (allegato 6) necessitano di essere rielaborati dal programma MAKEGEO per poter riutilizzare i dati compressi in un unico file Geo.dat che deve essere utilizzato in input a Calmet.

Una necessità dell'applicativo è che le griglie spaziali dei due programmi precedentemente utilizzati devono coincidere, inoltre in fase di controllo i file *grd generati dal programma risultano traslati rispetto alla griglia che lo stesso programma immette dentro Calmet, probabilmente dovuto ad un errore non individuato sul codice fortrain del programma.

Nel Geo.dat, in uscita dal programma, l'uso del suolo viene convertito, mediante coefficienti standard presenti nelle classi segnate nel file di input, introducendo dei valori fondamentali per avere risultati ragionevoli nei modelli di dispersione poiché permettono di elaborare gli effetti cinematici del terreno e della temperatura sul vento.

Il disallineamento del file grd rispetto al tif deriva dalle conversioni di coordinate e dall'elaborazione dei dati.

Tuttavia l'errore introdotto può risultare da una traslazione di poche decine di metri su 3200 di griglia.

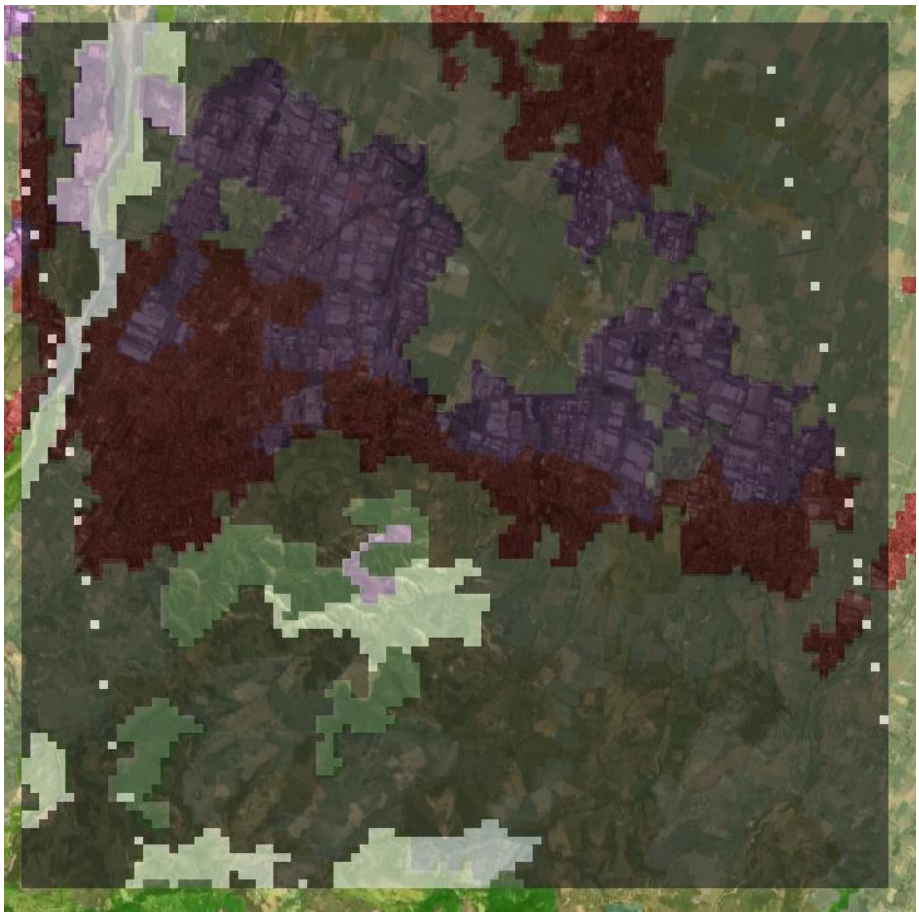


Figura 2 – sovrapposizione dati corine con dati in uscita da makegeo

CALMET

In seguito, dato che sono stati acquistati i dati meteo con una risoluzione spaziale di 3Km e passo temporale 1 ora, si è proceduto con il programma Calmet, il quale permette di creare un modello meterologico tridimensionale da dare in input ai modelli di dispersione.

Questo processore in particolareoltre a richiedere l'adozione degli stessi parametri grigliadei preprocessori Terrel, CTGPROC e MAKEGEO, è dipendente della griglia stessa.

Infatti, cause di alcune problematiche di esecuzione, ha richiesto la messa a punto della combinazione di set di variabili presenti nel file di controllo, necessarie a condurre correttamente l'elaborazione dei dati in input.

Quello che empiricamente è stato osservato è che, con la tipologia di dati utilizzati nel presente studio ed in base alle dimensioni del dominio considerato, la griglia presenta una risoluzione limite oltre la quale le grandezze elaborate da Calmet divengono anomale, mandando in crisi il sistema, che restituisce un messaggio di errore dovuto all'annullamento nei logaritmi per il calcolo della stabilità metereologica.

Di base, per esempio, se si prende una griglia di 60 Km la risoluzione massima ottenibile è risultata di 2Km, mentre per una griglia di 10 Km si può comodamente scendere anche a risoluzioni di 200m.

In ogni caso, una volta compreso questo limite, l'immissione dei file è sufficientemente veloce, ma i tempi di elaborazione del programma sono variabili, arrivando anche a qualche ora per prova, variando a seconda della velocità di clock del processore, del numero di celle della griglia e dell'arco temporale analizzato, alcune prove hanno richiesto qualche giorno.

Una volta conclusa con successo l'elaborazione, in uscita si ottiene il file Calmet.dat, che può essere introdotto come input nei Modelli citati nell'introduzione.

MODELLISTICA DI DISPRESIONE

I modelli di dispersione restituiscono in uscita valori di concentrazione in aria creando “pixel” di iso-concentrazione.

Questi pixel, corrispondenti alle celle della griglia utilizzata, possono essere elaborati per ottenere curve isoplete da analizzare per poter stimare l’impatto che le sostanze possono avere sull’ambiente.

LAPMOD

LAPMOD (LAgrangian Particle MODel), come detto nell’introduzione, è un modello lagrangiano a particelle, tridimensionale e non stazionario, adatto a prevedere la dispersione di diversi inquinanti, (PM10, inerti da combustione, SOx, Nox, odori, ecc.) emesse sia come Areosol sia come inquinanti gassosi.

A ciascuna particella è assegnato un certo quantitativo di inquinante, quindi ciò che il modello compie è quello, a fine simulazione, di convertire il numero delle particelle in quantità empiricamente significative (massa, becquerel, unità odorigene).

Semplificando:

- L’emissione viene suddivisa in più particelle.
- Le particelle vengono movimentate all’interno del modello sulla base dei dati del moto fluido atmosferico forniti da Calmet.
- In base al numero di particelle viste alla quota indicata come target dal suolo si ricavano le concentrazioni dell’inquinante.

A questo fine la velocità media del vento proviene, come indicato sul sito dell’Enviroware, dal modello meteorologico CALMET, mentre le fluttuazioni turbolente della velocità del vento vengono calcolate da LAPMOD mediante l'**equazione di Langevin** con coefficienti che dipendono dalle condizioni locali di stabilità attraverso le variabili di scala dello strato limite planetario (u⋆,w⋆,L,Hu⋆,w⋆,L,H).

dui=ai(x,u'i,t)dt+bij(x,u'i,t)dξj(t)

La traiettoria di ciascuna particella viene ricostruita mediante una successione di diversi spostamenti.

xi(t+Δt)=xi(t)+Δt(ui+u'i)xi(t+Δt)=xi(t)+Δt(ui+u′i)

Si tratta di un processo di Markov del primo ordine; ciò significa che la posizione della particella dipende solo dalla posizione che la particella occupava al tempo precedente.

Le tre componenti del moto non sono correlate tra loro.

In LAPMOD, le condizioni di stabilità da cui dipendono i coefficienti a e b dell'equazione di Langevin vengono classificate in base al numero di RichardsonL/zi (dove L è lunghezza di Monin-Obukov e zi è l'altezza dello strato di rimescolamento).

Associato al modello LAPMOD vi è il post-processore LAPOST, che permette di estrarre dai file in uscita LAPMOD le varie concentrazioni in determinati intervalli di tempo, consentendo l’analisi delle isoplete e/o gli andamenti delle concentrazioni su determinati recettori,in formato *.grd.

Un variabile assolutamente importante da controllare è “CCA”, ovvero il kernel.

In seguito a diversi contatti con esperti, che non saranno citati per questioni di privacy, è stato suggerito di attivare il CCA=5, Kernel smoother, che risulterebbe essere uno dei Kernel più aggiornati.

Il parametro signum è stato impostato a 3, mentre il signumx a 1000.

I FILE DI INPUT

Lapmod, oltre i dati meteo geologici in uscita da calmet, richiede ulteriori 3 file in input:

1. Sources.inp
2. lapmod_substances.dat
3. receptors.inp

Sources.inp

Questo modulo gestisce i tempi e le quantità emissive e necessita di questa struttura:

x1

x2i x3 x4 x5 x6 x7 x8 x9

#

x10

x11i

yyyy mm gg hh mm ss

x2i x12 x13 x14

dove:

- x1 è il numero delle sorgenti
- x2i è il numero assegnato alla sorgente
- x3 è un valore che indica il tipo di sorgente, fare riferimento al manuale per ulteriori approfondimenti
- x4 è la coordinata x in sistema wgs-84 utm
- x5 è la coordinata y in sistema wgs-84 utm
- x6, x7, x8, x9, sono da verificare dal manuale e dipendono dal tipo di sorgente
- x10 è il numero di specie rilasciate
- x11i è il codice della specie rilasciata, come segnata sul file lapmod_substances.dat
- yyyy mm gg hh mm ss è il formato di "inizio" emissione, deve essere precedente all'inizio del file meteo
- x12 è la temperatura di uscita dei fumi in K
- x13 è la velocità effettiva di uscita in m/s
- x14 è il rateo in uscita in g/s (sostanze) o UO/s (odori) o bq/s (radioattività)

da notare che x13 spesso è da calcolare.

Poiché i dati nella relazione davano la velocità dei fumi riferita a 20°C, si è proceduto a calcolare la velocità effettiva di uscita mediante la relazione fondamentale dei gas perfetti:

$$P * V = nRT$$

Dato che le caratteristiche del camino non variano (area di uscita costante), così come le moli in uscita e con R costante universale dei gas, rapportando:

$$\frac{P1 * v1 * A}{P2 * v2 * A} = \frac{n\ R\ T1}{n\ R\ T2}$$

Pertanto: $v1 = \frac{T1}{T2} * \frac{P2}{P1} * v2$

Si ricorda che la temperatura deve necessariamente essere espressa in K, mentre la pressione può essere espressa, nel caso esaminato, in qualunque delle tradizionali unità di misura (bar, atm, Pa) a patto di mantenere la coerenza tra numeratore e denominatore.

velocità rif	14.12	m/s			E5	sezione camino	
temperatura rif	20	°C	293.15	K		0.95	m2
pressione rif	101325	Pa				diametro camino	
pressione	101325	Pa				1.099808	m
temperatura	180	°C	453.15	K			
velocità eff.	21.83	m/s					
velocità rif	14.75	m/s			E15	sezione camino	
temperatura rif	20	°C	293.15	K		0.708	m2
pressione rif	101325	Pa				diametro camino	
pressione	101325	Pa				0.949449	m
temperatura	200	°C	473.15	K			
velocità eff.	23.81	m/s					
velocità rif	9.37	m/s			E45	sezione camino	
temperatura rif	20	°C	293.15	K		0.636	m2
pressione rif	101325	Pa				diametro camino	
pressione	101325	Pa				0.899878	m
temperatura	200	°C	473.15	K			
velocità eff.	15.12	m/s					

Tabella 1 - Excel impostato per il calcolo della velocità in input ai modelli

lapmod_substances.dat

Questo modulo gestisce le sostanze che lapmod può elaborare.

Esiste un file precompilato fornito dagli sviluppatori del modello, ma possono essere aggiunte delle sostanze, purché si rispetti la seguente sintassi:

n – corrisponde al numero di sostanze che seguono

c1,c2,c3,c4,c5,c6,c7,c8,c9,c10,commenti/nome per esteso

- c1 è il codice sostanza
- c2 1 per fase gassosa 0 per areosol
- c3 1 per sostanze radioattive 0 per sostanze inerti
- c4 1 se soggetto a deposizione secca 0 se la deposizione secca risulta trascurabile
- c5 1 se soggetto a deposizione umida 0 se la deposizione umida risulta trascurabile
- c6 tempo di idmezzamento del nuclide (s)
- c7 diametro dell'attività media aerodinamica (micrometri)

- c8 deviazione standard geometrica (micrometri)
- c9 peso molare (uma)
- c10 densità (g/cm3)

receptors.inp

questo risulta essere il modulo più semplice, permette di segnalare eventuali recettori notevoli che si vuole analizzare in particolare.

La struttura del file risulta semplice, infatti nella prima riga vanno indicati il numero di recettori, mentre dalla seconda bisogna inserire x,y,z del recettore seguito da Rx, ove x è il numero del recettore.

CALPUFF

Calpuff è un modello a puff sviluppato dal'EPA.

Nel corso di questa tesi non si entra nel merito della teoria di questo modello in quanto ampiamente ed esaustivamente trattato in letteratura.

Il modello è stato introdotto utilizzando gli stessi dati meteo di Lapmod, con le medesime sorgenti (vedesi ALLEGATO 12).

La parte complessa nello sviluppo del pacchetto di calpuff, più che nella compilazione, è stata nella fase di post-processo, nell'applicazione di Calpost.

Tuttavia, la procedura elaborata, non ha dato l'opportunità di confrontare i dati a causa dei lunghi periodi di tempo tra una simulazione e l'altra impedendo così di fare un'analisi critica e completa dei risultati.

APPLICAZIONE PRATICA

Dal sito https://serviziambiente.regione.emilia-romagna.it/viavas/servlet/AdapterHTTP?ACTION_NAME=LOGIN_ACTION si possono andare a reperire i dati riguardanti le VIA.

Dopo una serie di ricerche è stata individuata l'azienda x come modello per applicare lo studio di dispersione con i dati meteo dell'anno 2020.

L'attività è stata scelta poiché presentava la procedura di assoggettabilità a VIA più recente, con integrate delle modellistiche di dispersione.

Lo studio nel particolare si addentrerà ad un ulteriore modulo presente in alcuni modelli di dispersione: la dispersione di sostanze odorigene, come previsto dall'articolo 272bis del d.lgs. 152/06.

VALUTAZIONE ECONOMICA

In prima battuta si è proceduto a fare una valutazione di tipo economica delle varie opzioni disponibili per questo tipo di servizio, tenendo conto che la prima fase comincia con la ricerca dei dati necessari per elaborare il modello.

Le procedure individuate sono:

1. Acquisto dati meteo-geologici Calpuff-ready
2. Acquisto dati meteo elaborati Calmet-ready
3. Elaborazione dati da altre fonti

L'acquisto di dati Calpuff-ready ha un costo che si aggira attorno ad un migliaio di euro, contro i dati Calmet-ready che si aggirano introno ai cinquecento per una griglia che può variare da 60 a 150km e con una risoluzione di 3 Km.

Il ricorso ad altre fonti rappresenta un'alternativa gratuita che invece, estremamente onerosa, sia in termini di tempo per la ricerca dei dati che per la loro elaborazione preliminare.

Una stima temporale approssimativa ha portato alla conclusione che tali attività preliminare richiederebbero all'incirca una settimana lavorativa.

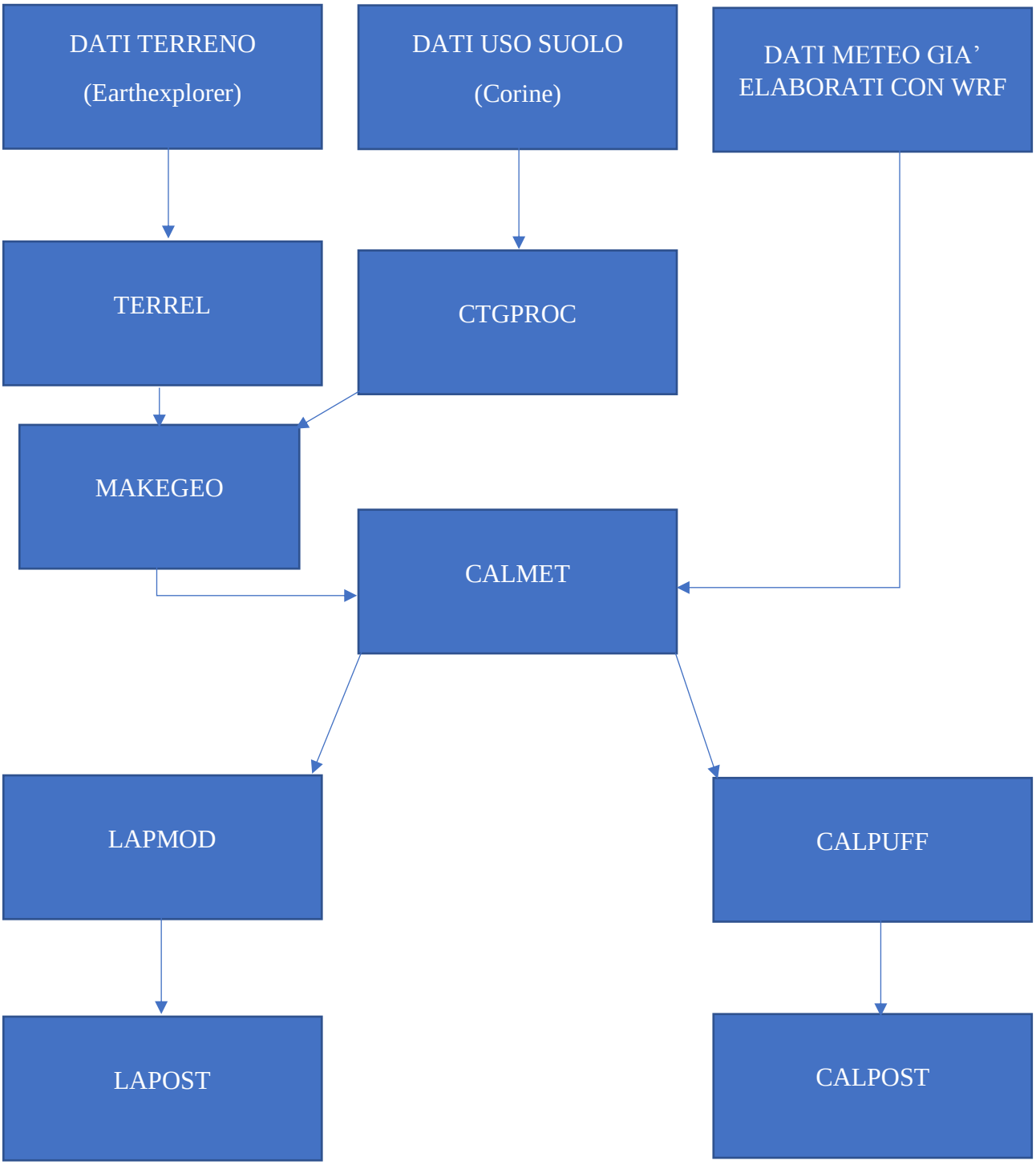
In conclusione, acquistando i dati meteo già pronti (caso 2) il cui costo risulta essere di 500 euro, si può sostenere che la seconda procedura, ad oggi, da un punto di vista economico risulta essere la più conveniente per uno studio di progettazione.

In seguito, l'elaborazione dei dati richiede qualche giorno di preparazione per utilizzare il modello inserendo i dati richiesti, verificando l'attendibilità dei risultati previsionali che l'elaboratore restituisce.

MODELLAZIONE DEI DATI

Una volta individuato il caso da modellare ed una volta individuata la modalità più conveniente da un punto di vista economico per acquisire i dati, si è proceduto ad effettuare la modellazione come descritto precedentemente.

Semplificando in maniera schematica la procedura adottata per ricalcare lo studio è la seguente:


DATI TERRENO
(Earthexplorer)
DATI USO SUOLO
(Corine)
DATI METEO GIA' ELABORATI CON WRF
TERREL
CTGPROC
MAKEGEO
CALMET
LAPMOD
CALPUFF
LAPOST
CALPOST

Un problema da segnalare nella fase di elaborazione dei dati è l'assenza di alcune celle di uso del suolo per 31 celle su 10000 per il file di input del ctgproc, come si può notare dalla figura 2 le celle bianche in diagonale.

L'errore introdotto da questa problematica può derivare dalla presenza di dati nulli nei file GEOTIFF, o dal file di input creato per l'elaborazione CTGPRO.

Date le tempistiche già limitanti dei processori a valle, che erano già stati utilizzati, dato l'errore esiguo (dell'ordine dell'un per mille) e data la non sovrapposizione al sito in esame delle celle mancanti si è deciso di mantenere i dati di uso del suolo elaborati, facendo presente inoltre che le celle non risulteranno vuote, bensì verranno sostituite con un valore predefinito.

Per risolvere la problematica si può agire direttamente sul file di output assegnando manualmente alle celle il valore effettivo.

Nelle condizioni di test utilizzate nel presente lavoro il tempo di elaborazione del Calmet è risultato essere di due/tre giorni.

Di seguito un'analisi critica dei dati:

Poiché la modellazione si trova a Sassuolo, basandoci sulla relazione effettuata dall'azienda presa a riferimento, l'ARPAE ha suggerito di utilizzare i dati della centralina meteo di Vignola, reperibili dall'applicativo dexter.

Una volta inoltrata la richiesta dei dati dall'applicativo Dexter, si è scoperto che la centralina meteo di Vignola risulta essere danneggiata, pertanto i dati meteo sono stati confrontati con quelli usati nella simulazione presa in esame (anno 2016).

Mediante l'ausilio di met-series e l'elaborazione dei dati con excel si possono introdurre i dati in uscita da Calmet dentro wr-plot e confrontando la rosa dei venti con quella della centralina suddetta.

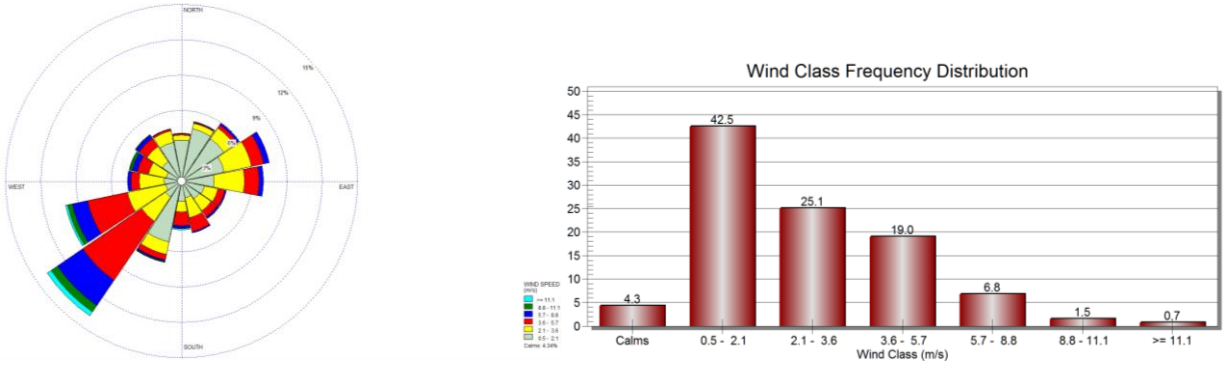


Figura 3-wr plot dati calmet elaborati

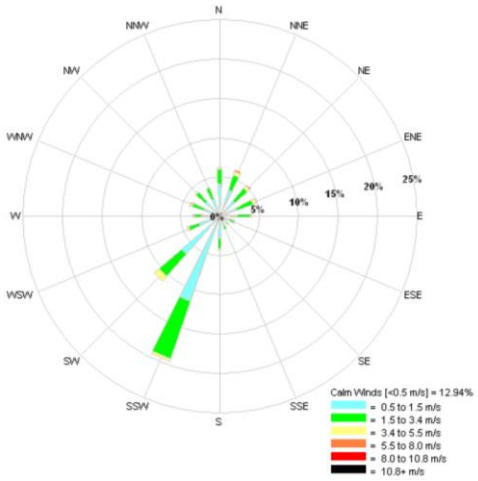


Figura 4 - rosa dei venti Vignola 2016

Ragionevolmente le rose dei venti risultano essere confrontabili come distribuzione al suolo, ma molto differenti come moduli di velocità:

Figura 5- analisi zona geografica in esame

Come si nota ambedue i paesi sono vicini al letto di un fiume.

Ebbene quest'ultimo, unito alla presenza delle montagne alle spalle (zona sud-est) causa un effetto "Canyon", cioè incanala l'aria e crea andamenti preferenziali.

Pertanto, sebbene le classi di velocità più elevate non siano presenti nella rosa dei venti in fig. 3 e 4, osservando analoghe direzioni prevalenti con moduli di velocità diversi (gli anni di riferimento sono differenti), l'accordo tra simulato ed osservato in termini di direzione del vento è più che buono e gli andamenti possono ritenersi più che ragionevolmente similari.

I dati acquistati si possono pertanto considerare validati in quanto confrontabili con quelli utilizzati nella modellazione, pur tenendo in considerazione che il 2020 è risultato più ventoso che il 2016.

Per ipotesi semplificativa, conservativa di compilazione dei modelli è stato assunto che gli impianti non subiscano fermo per manutenzione durante tutto l'anno in esame, quindi facendoli funzionare per tutte le 8784 ore esaminate, andando sicuramente a sovrastimare l'impatto.

I dati di input dei camini simulati sono evidenziati nelle tabelle seguenti, omettendo le coordinate geografiche:

sorgente	Camino 1	Camino 2	Camino 3
Altezza camino [m]	26	15	30
Portata autorizzata [Nmc/h]	45000	50000	20000
Sezione passaggio [m^2]	0.95	0.708	0.636
Diametro passaggio [m]	1.1	0.949	0.900
Temperatura uscita [K]	453.15	473.15	473.15
Velocità effettiva di uscita [m/s]	21.83	23.81	15.12
Velocità di uscita a 20°C,1 atm [m/s]	15.69	21.05	9.37
Portata odori [UO/s]	68420	53215	30410

Tabella 2-proprietà camimi per modellazione

Oltre che per la simulazione delle sostanze odorigene, si è proceduto a fare anche una modellazione inserendo come inquinante il piombo.

Per meglio comprendere come funziona il modello si è modellato il piombo sia come INERT sia inserendo nel file delle sostanze i dati:

Pb,1,0,1,0,-999,-999,-999,207.2,11.34,piombo da wikipedia

sorgente	Camino 1	Camino 2	Camino 3
Altezza camino [m]	26	15	30
Portata autorizzata [Nmc/h]	45000	50000	20000
Sezione passaggio [m]	0.95	0.708	0.636
Diametro passaggio [m]	1.1	0.949	0.900
Temperatura uscita [K]	453.15	473.15	473.15
Velocità effettiva di uscita [m/s]	21.83	23.81	15.12
Velocità di uscita a 20°C,1 atm [m/s]	15.69	21.05	9.37
Limiti Pb [mg/Nmc]	0.5	0.25	0.3
Portata Pb [g/s]	0.00625	0.00347	0.00167

ANALISI DEI RISULTATI

I dati ottenuti rispetto a quelli della modellazione effettuata in fase di screening dall'azienda, tenendo chiaramente conto della differenza delle rose dei venti e del fatto che gli anni presi a campione sono diversi, è ragionevole pensare che le isoplete risultino molto diverse, quindi non ha senso un confronto diretto.

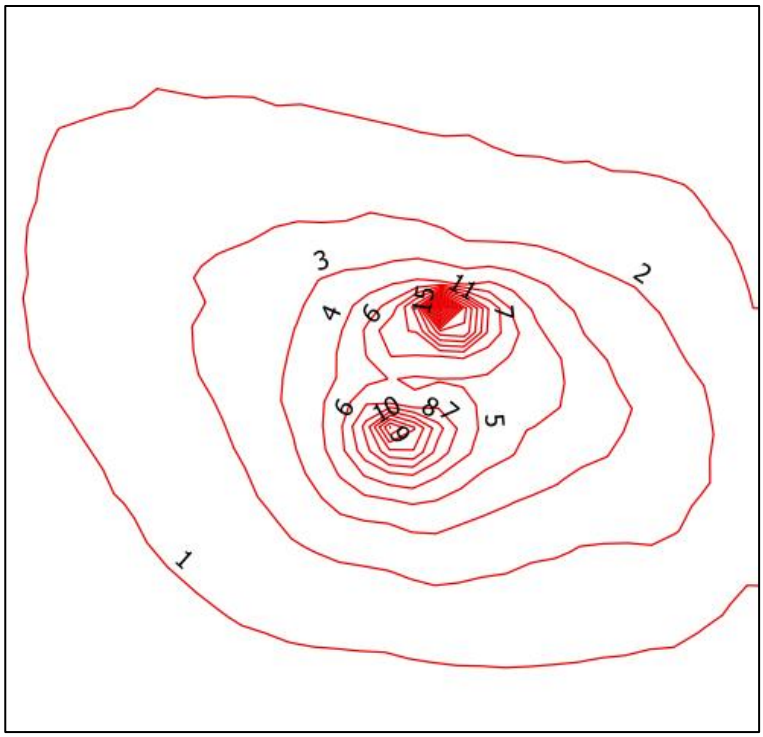


Figura 6 - isoplete UO in uscita da Lapmod con Tpeak dinamico-su griglia di 3,2km

L'estensione e i valori di unità olfattometriche in confronto con quelle della verifica di assoggettabilità risultano molto superiori.

Questo risulta essere spiegabile dai diversi anni in esame, che hanno andamenti molto differenti tra loro delle condizioni meteo.

Un ulteriore dubbio che ha ragione di essere analizzato è la distribuzione delle isoplete, diversa da quella che si potrebbe intuire dalla rosa dei venti in fig. 3.

Analizzando meglio il modello meteo sono stati estratti con wr-plot le rose dei venti a 50 e 100m, validando l'andamento delle isoplete della figura 6.

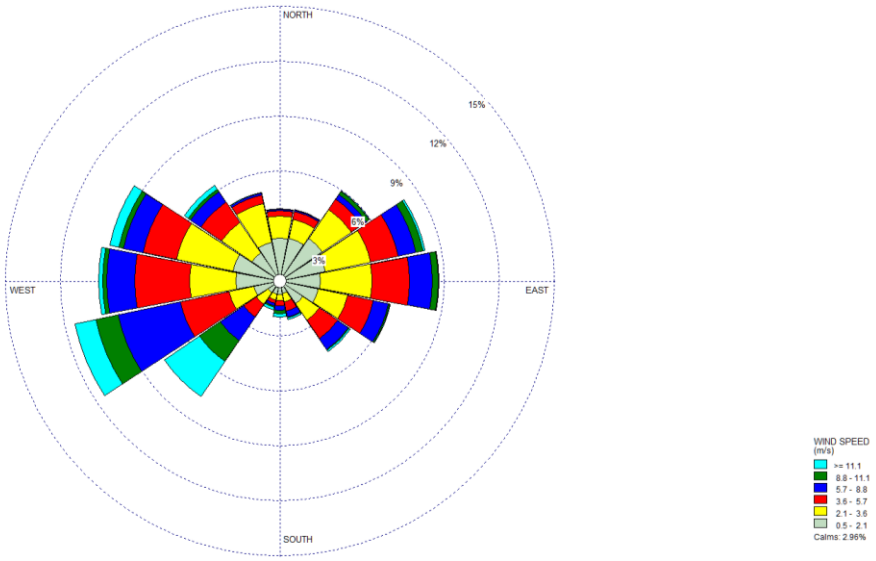


Figura 7- rosa dei venti a 100m

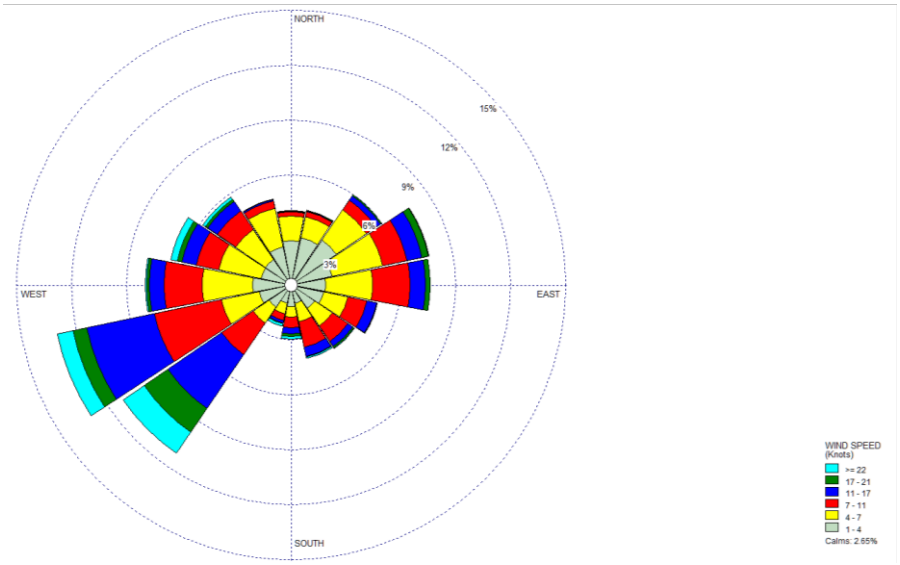


Figura 8 - rosa dei venti a 50m

L'altezza e la velocità di efflusso dal camino comportano una determinata altezza in quota del pennacchio che, interagendo con diverse distribuzioni del vento a quote diverse porta ad avere le isoplete come in figura 6.

In altre parole: lo sviluppo del campo di moto verticale in questa modellistica risulta di fondamentale importanza per la dispersione degli inquinanti in amosfera.

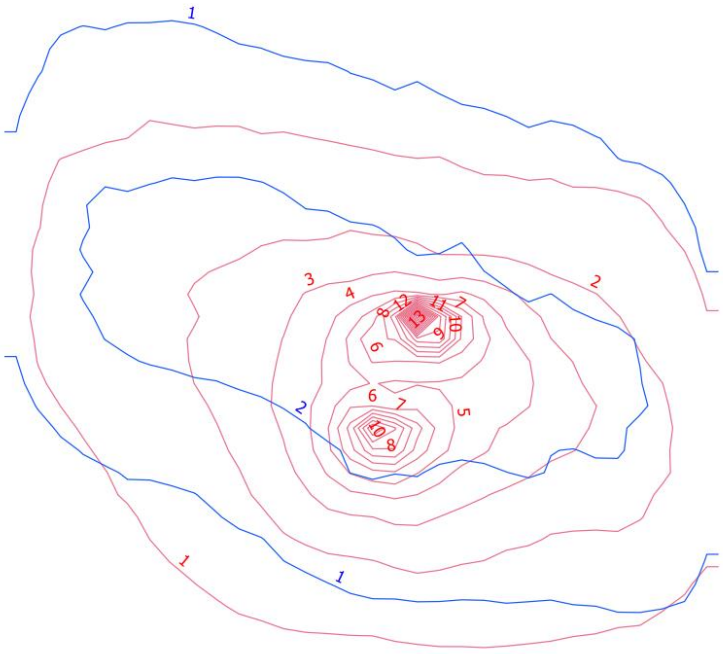


Figura 9 - confronto modelli lapmod con peak statico in blu e peak dinamico in rosso (odori)

Come già fatto evidenziato in letteratura [22] il peak dinamico tende a sovrastimare, nelle vicinanze della sorgente la concentrazione di odori, mentre per le lunghe distanze tende a dare valori più bassi.

A questo proposito se si attiva il peak dinamico si suggerisce di confrontare sempre i due modelli per capire quali curve possano risultare più ragionevolmente rilevanti.

Un ulteriore commento da fare è che nel metodo con peak statico si è usato un rateo di emissione di 60 particelle per ridurre i tempi di calcolo, rendendo più conservativo il modello, mentre per quello dinamico si è utilizzato un rateo di emissione di 180 particelle.

Questo comporta una contrazione delle curve rosse, mentre le curve blu avranno la massima conservatività.

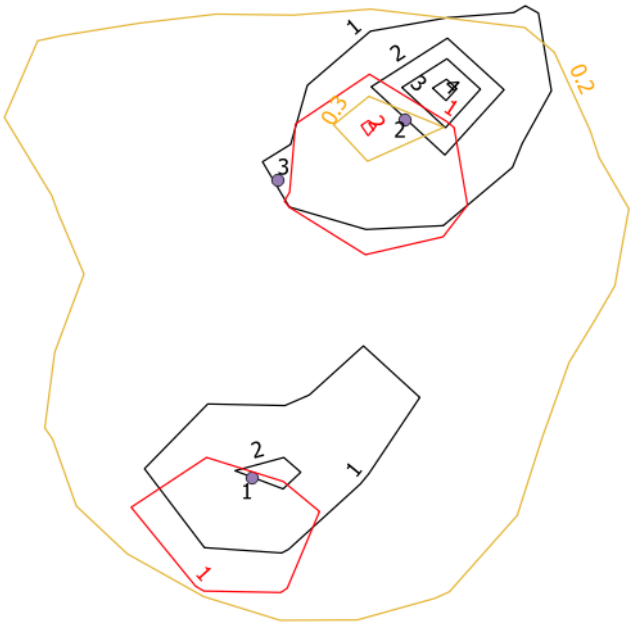


Figura 10 - confronto medie annue in uscita da Calpuff (nero),Lapmod "dinamico" (rosso), Lapmod "statico" (arancione)

Come si può notare in figura 10 risulta essere inutile confrontare le medie annue.

Nonostante la modellazione con Calpuff e Lapmod con Lpeak dinamico possa sembrare confrontabile, la media annua corrisponderebbe concettualmente ad un 50° percentile, il che porta a una forte dipendenza dei risultati dai minimi e massimi, quindi il confronto delle curve non ha fisicamente senso.

Questo si può affermare anche in virtù del fatto che gli andamenti delle due curve generate con Lapmod con il 98° percentile risultano confrontabili, mentre con la media annuale si osserva una differenza di almeno un ordine di grandezza.

Non è stato possibile estrarre il 98° percentile da Calpuff in quanto, sulla base delle informazioni ottenute, bisognerebbe scrivere un programma apposito.

Di seguito si è passati a modellare l'altra sostanza inquinante.

Come precedentemente accennato per la modellazione del piombo si è proceduto a fare diverse modellazioni:

1. Piombo modellato con il modulo Pb e parametri FACMUL=1 ed RMULT=1000000

2. Piombo modellato con il modulo Pb e parametri FACMUL=1.e6 ed RMULT=1
3. Piombo modellato come INERT e parametri FACMUL=1.e6 ed RMULT=1

Così modulando le isoplete saranno con un'unità di misura di ug/m3.

Un parametro che erroneamente non si è modificato nei 3 modelli è l'altezza dei recettori di griglia, quindi i dati in uscita da questa modellazione saranno all'altezza di 2m dal suolo e non a 0m, come si dovrebbe correttamente fare.

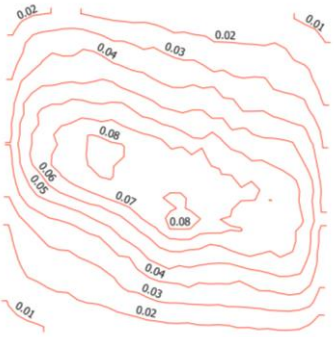


Figura 11 - isoplete di concentrazione di Piombo modello 1

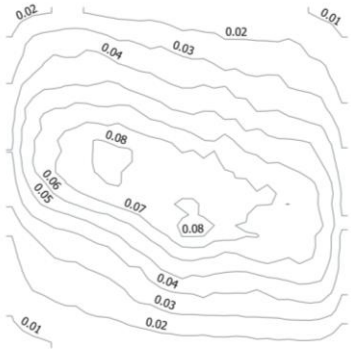


Figura 12 - isoplete di concentrazione di piombo modello 2

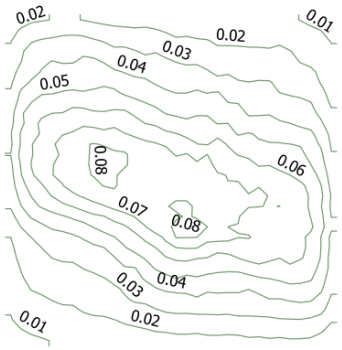


Figura 13 - isoplete di concentrazione di piombo modello 3

Le 3 curve sono identiche, quindi in fase di modellazione risulta sufficiente non implementare la stringa Pb.

Questo andamento era assolutamente atteso ed auspicabile, in quanto i parametri aggiunti dovrebbero influenzare solo la deposizione.

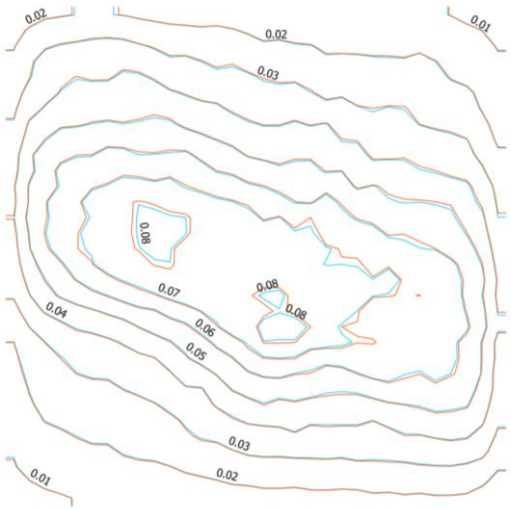


Figura 14- in azzurro isoplete Pb a z=0 contro le isoplete in rosso a z=2

Si è proceduto a rifare il modello 2 con z=0, ottenendo chiaramente risultati di poco differenti con isoplete leggermente più strette.

Conclusioni

Gli strumenti utilizzati sono risultati efficaci ed efficienti nello sviluppo dello studio.

L'estrema varietà dei modelli esistenti pone tuttavia in essere l'analisi ed il confronto dei valori in uscita, infatti diversi modelli porgono risultati che possono essere differenti, in termini di distanza, anche di diverse centinaia di metri.

Due cose molto importanti da tenere in conto sono che, per poter confrontare i modelli:

1. si necessita o di dati meteo del medesimo anno, in quanto di anno in anno si possono avere forti variazioni delle grandezze meterorologiche, oppure di prendere un numero di anni da modellare sufficientemente alto da costituire un andamento medio (almeno 3-5 anni);
2. nel confronto tra le modellistiche si deve preferire il 98° percentile, poiché risulta essere fisicamente più idoneo al confronto rispetto alla media annuale.

A fronte di questo si è voluta sviluppare la conoscenza di Lapmod principalmente perché risulta un'eccellenza italiana, che si è dimostrato efficace nell'effettuare la simulazione.

Altri modelli utilizzabili sono Calpuff e Gral, questi si basano su diverse fondamenta teoriche che, a parte alcune differenze, danno risultati confrontabili.[23]

Si nota come i processori in esame sono elaboratori da utilizzare in caso di impatti di notevole prevalenza, che restituiscono indicazioni progettuali.

Tuttavia, come altre modellistiche utilizzate a livello ambientale (per esempio: analisi previsionale del rumore, analisi del rischio ambientale per i liquidi nel suolo), i calcoli effettuati sono su base probabilistica, che non possono in nessun caso sostituirsi alla misura diretta dell'impatto del fenomeno rappresentato.

Per questo motivo è sempre consigliabile andare a verificare le previsioni effettuate con i modelli mediante misure in loco.

Un ulteriore limite a questi modelli sono le tempistiche del preprocessore Calmet, infatti quest'ultimo viene eseguito mediante l'utilizzo di un solo thread del sistema PC, che porta un aumento del tempo di calcolo all'aumentare del periodo analizzato.

Uno sviluppo futuro su cui si sta lavorando è quello di creare un modello di input che permetta al programma di essere utilizzato su più core del pc per ridurre le tempistiche di processamento dei dati.

Allo scopo di stimare la significatività con un parametro numerico confrontabile con i modelli in esame nel 2006 fu pubblicato dall'agenzia per la protezione dell'ambiente e per i servizi tecnici, nell'articolo -GLI EFFETTI SULL'AMBIENTE DOVUTI ALL'ESERCIZIO DI UN'ATTIVITÀ INDUSTRIALE: IDENTIFICAZIONE, QUANTIFICAZIONE ED ANALISI NELL'AMBITO DEI PROCEDIMENTI DI AUTORIZZAZIONE INTEGRATA AMBIENTALE-, una bozza per poter fornire una prima definizione.

Un ulteriore sviluppo, in questo caso per i disturbi odorigeni, è dato dall'articolo -Linee guida per la caratterizzazione, l'analisi e la definizione dei criteri tecnici e gestionali per la mitigazione delle emissioni delle attività ad impatto odorigeno-.

Queste tuttavia rimangono linee guida che definiscono una metodica a valori soglia per gli inquinanti, ma senza essere contemplate direttamente dalla normativa.

ringraziamenti

Un sincero ringraziamento al prof. Antonioni per avermi lasciato liberà e fiducia nella realizzazione di questo testo e per aver eliminato i dubbi che sono sorti lungo questo lungo processo, al Dott. Bassissi, per i consigli datimi nello sviluppo dell'elaborato, per la possibilità di tirocinio concessami e, soprattutto, per la fiducia che anche lui ha riposto nei miei confronti.

Un ringraziamento non può di certo mancare al Dott. Buffa, per le innumerevoli videochiamate passate a sviluppare la parte del pacchetto Calmet-Calpuff

Un ulteriore ringraziamento va al prof. Andretta, il quale mi introdusse nel 2019 per la prima volta al modello Lapmod, creando le basi per lo studio portato.

La gratitudine va inoltre a tutti quegli operatori di Arpa e a quegli esperti contattati, i quali hanno chiarito diversi dubbi sul funzionamento dei modelli e al corpo docenti, dalla cui formazione si è appreso un metodo di approccio, studio, analisi dei processi e delle problematiche determinante nello sviluppo di questo testo.

Infine, a tutte le persone che hanno supportato questo studente che più e più volte ha pensato di non essere all'altezza della mansione attribuitagli, un sincero grazie.

ALLEGATI

ALLEGATO 1-Input terrel

```
TERREL.INP      7.0             File Version
------------------------------------------------------------------------
------

                 TERREL PROCESSOR CONTROL FILE
                 -----------------------------

  TERREL accepts terrain surface elevation data from a number of
  digital data bases and forms grid-cell averages or point-values for
  use in particular dispersion modeling systems.  For the CALPUFF
  system, TERREL produces a gridded terrain file for the MAKEGEO
  processor, and it produces a file of point-values for discrete
  receptors for CALPUFF.  Use TERREL one or more times to build the
  requested file.

------------------------------------------------------------------------
------

INPUT GROUP: 0 -- Input and Output Files
--------------

-------------
Subgroup (0a)
-------------

     Number of Terrain Data Files provided in Subgroup 0b

     By default, no data files are expected, and running TERREL
     without input data files will allow it to complete its set-up
     procedures, and report the number of data files needed to cover
     the specified modeling domain.  This information can be helpful
     when assembling the data files for an application.

     (NTDF)                    Default: 0      ! NTDF = 2 !


     Other Input and Output files:
     -----------------------------

     Default Name    Type          File Name
     ------------    ----          ---------
    TERREL.DAT       output    ! OUTFIL = out\terr100m.dat      !
    TERREL.LST       output    ! LSTFIL = out\terr100m.lst      !
    TERREL.GRD       output    ! PLTFIL = out\terr100m.grd      !
    RAWECHO.DAT      output    * RAWECHO = rawdata5.dat     *
    ------------------------------------------------------------
    (Save-files)
    PREV.SAV         input     * PREVFIL =                  *
    TERREL.SAV       output    ! SAVEFIL = out\terr100m.sav     !
    ------------------------------------------------------------
    (Discrete (X,Y) Point Files)
    XYINP.DAT        input     * XYINP =   *
    XYOUT.DAT        output    * XYOUT = out\xy1005.dat *
```

```
    ------------------------------------------------------------
    (Coastline Data)
       USGS Global Self-consistent Hierarchical High-resolution
       Shoreline Database (GSHHS)
    GSHHS_F.B        input     !GSHHSIN  = E:\COASTS\GSHHS\GSHHS_F.B   !
       Processed coastline polygons for
       TERREL grid (BLN)
    COAST.BLN        input or  ! COASTBLN = ..\SHORE.BLN   !
                     output

     ------------------------------------------------------------------
------
     Raw elevation data from the database file(s) can be echoed to an
ASCII
     file (defined above as RAWECHO.DAT).  X and Y coordinates are in
grid
     units (km), and elevations are unfiltered.
     (LRAWECHO)            Default: F      ! LRAWECHO = F !

     All file names will be converted to lower case if LCFILES = T
     Otherwise, if LCFILES = F, file names will be converted to UPPER
CASE
     (LCFILES)         Default: T      ! LCFILES = F !
        T = lower case
        F = UPPER CASE

     NOTE: file/path names can be up to 70 characters in length

!END!


-------------
Subgroup (0b)
-------------

     The following NTDF Terrain Data Files are processed.
     Enter NTDF lines identifying the file name for each,
     followed by a group terminator.  The type of data base
     for each file is designated by the assignment name:

    (USGS90)   designates USGS 1-deg DEM files (~90m)
    (USGS30)   designates USGS 7.5-min DEM files (typically 30m)
    (ARM3)     designates ARM3 terrain data files(~900m)
    (3CD)      designates 3CD (binary) 1-deg DEM files (~90m)
    (DMDF)     designates Canadian DMDF files (~100m)
    (CDED)     designates Canadian DEM files (3 and 0.75 arcsec)
    (SRTM1)    designates 1-sec Shuttle RADAR Topo Mission files (~30m)
    (SRTM3)    designates 3-sec Shuttle RADAR Topo Mission files (~90m)
    (GTOPO30)  designates GTOPO30 30-sec data (~900m)
    (USGSLA)   designates USGS Lambert Azimuthal data (~1000m)
    (NZGEN)    designates New Zealand Generic data files
    (GEN)      designates Generic data files
    (GEOTIFF)  designates GEOTIFF data files

     1 !GEOTIFF =n44e010.tif!     !END!
     2 !GEOTIFF =n44e011.tif!     !END!
```

```
-------------
Subgroup (0c)
-------------

     Datum-Region
     ------------

     The Datum-Region for coordinates in each of the input Terrain Data
Files
     may be identified in the header records of the file.  Check the file
     documentation and change these defaults if needed.  The list of
Datum-Regions
     with official transformation parameters provided by the National
Imagery and
     Mapping Agency (NIMA).  Information in GEOTIFF files overrides the
choice here.

     Datum-region for input Terrain Data File coordinates
    (DUSGS90)       Default: WGS-72  ! DUSGS90  = WGS-72    !
    (DUSGS30)       Default: NAS-C   ! DUSGS30  = NAS-C     !
    (DARM3)         Default: NAS-C   ! DARM3    = NAS-C     !
    (D3CD)          Default: WGS-72  ! D3CD     = WGS-72    !
    (DDMDF)         Default: NAS-C   ! DDMDF    = NAS-C     !
    (DCDED)         Default: WGS-84  ! DCDED    = WGS-84    !
    (DSRTM1)        Default: WGS-96  ! DSRTM1   = WGS-96    !
    (DSRTM3)        Default: WGS-96  ! DSRTM3   = WGS-96    !
    (DGTOPO30)      Default: WGS-84  ! DGTOPO30 = WGS-84    !
    (DUSGSLA)       Default: ESR-S   ! DUSGSLA  = ESR-S     !
    (DNZGEN)        Default: WGS-84  ! DNZGEN   = WGS-84    !
    (DGEN)          Default: WGS-84  ! DGEN     = WGS-84    !
    (DGEOTIFF)      Default: WGS-84  ! DGEOTIFF = WGS-84    !

     Datum-region for input GSHHS Coastal Data File coordinates
    (DWVS)          Default: WGS-84  ! DWVS     = WGS-84 !

!END!

-------------------------------------------------------------------------
-------

INPUT GROUP: 1 -- Processing Options
--------------

   Intermediate data for the terrain grid are saved in a binary
   file for subsequent applications of TERREL.  When TERREL is
   applied more than once (with different terrain data files), the
   save file must be used to pass previous results along.

     Previous SAVE file used to start this run?
     (LPREV)                    Default: F      ! LPREV = F !
        T = PREV.SAV file is used
        F = PREV.SAV file is NOT used
```

TERREL constructs gridded terrain elevations (m MSL), and may also estimate the terrain elevation at discrete points by selecting the peak elevation within a prescribed distance (km) from each point. When processing discrete points, the XYINP.DAT provides the grid coordinates (km) of each point, and may also include a height above ground (m) for each point (e.g. for elevated receptors). The structure of the XYINP.DAT file is a free-format text file with either 2 columns (X,Y) or 4 columns (X,Y,Elevation,Height). When the 4-column form is used, data in the 3rd column are replaced with the elevations obtained from the terrain data base files.

```
Report elevations for discrete (X,Y) points?
  (LXY)                      Default: F      ! LXY = F !
  T = Yes (XYINP.DAT and XYOUT.DAT files are used)
  F = No  (XYINP.DAT and XYOUT.DAT files are NOT used)

Interpolate elevations for discrete points?
  (Used only if LXY=T)
  (LINTXY)              Default: F      ! LINTXY = F !
  T = Yes (elevations will be interpolated)
  F = No  (elevations will be terrain peaks)

Number of data columns in XYINP.DAT file
  (Used only if LXY=T)
  (NXYCOL)              Default: 4      ! NXYCOL = 2 !

Search radius (km) about each (X,Y) for locating terrain peak
  or for carrying out interpolation
  (Used only if LXY=T)
  (XYRADKM)            No Default      ! XYRADKM = 0.25 !
```

Some terrain data sets contain void areas where the data are missing. Others may contain areas where data are inaccurate (noisy). Both situations occur mostly over oceans or large lakes, but for SRTM data it can also occur over land due to the data set still evolving. These void (missing) or noisy input data can be replaced in several ways.

Noisy Data ---
Noise affects SRTM data for oceans and lakes and the adjacent shores, due to the scattering effects of water on radar measurements. The most obvious occurence of noise is negative elevations for water and adjacent land points. This can be filtered with the specification of a minimum acceptable elevation by water/land type. Extracted elevations that are greater than this minimum are retained, while those lower than this minimum value can be re-defined as missing for subsequent treatment by the missing values processing, or can be replaced with either the minimum value or with another default value defined for treatment of void (missing) data. The minimum values must be chosen judiciously for the region being treated since some regions have valid elevations below MSL.

Missing data ---
Cells with missing elevations can be interpolated from surrounding cells with valid values, and a maximum search radius is defined. Also, if coastline processing has been used, default elevations for each water/land type can be defined and used in place of voids. This replacement can be carried out as the final step before output on a cell-by-cell and receptor-by-receptor basis, or can be carried out for values extracted from the terrain files as missing. This latter option is best used only for oceans and lakes. For oceans and lakes it is also possible to not use extracted elevations but only use the default.

Coastline data are used to define coarse water/land type by point or cell, for several of the options available for treating missing or noisy data. Coarse water/land type definitions currently available in TERREL are:
1 = ocean
2 = mainland and marine islands

Coastline data are accepted in the form of either the USGS Global Self-consistent Hierarchical High-resolution Shoreline (GSHHS) Database file, or a BLN file produced in a previous application for the modeling domain (it must have correct grid limits and polygon headers). The processed coastline (BLN) file for the domain is automatically created when the GSHHS database is input. No BLN is created when an existing BLN file is input.

Process coastline data?
(LCOAST) Default: F ! LCOAST = F !
T = Process coastline data
F = Do not process coastline data

Read pre-processed coastline data (existing BLN file)?
(LBLNREAD) Default: F ! LBLNREAD = F !
T = Use pre-processed coastline data
F = Process raw coastline data

Noisy Data Replacement Options

--Filtering with minimum elevations by water/land type (2 values)
(INOISEREP) Default: 0,0
0 = Do not check for noise
1 = Set values lower than minimum to missing
2 = Replace values lower than minimum with minimum value
3 = Replace values lower than minimum with default value
(set in TERDEF below)

Minimum terrain elevations (m) for noise detection (2 values)
(ZNOISE) Default: 0.,1.

		mainland
		& marine
ocean	islands

```
                    ------ --------- -
       ! INOISEREP =   2,      2     !
       !    ZNOISE =   1.5,     4.  !
```

```
Missing Data Replacement Options
--------------------------------

--Application of default elevations by water/land type (2 values)
  (ITERREP)                  Default: 3,0
     0 = Do not replace voids
     1 = Replace voids on output only
     2 = Replace void point values on extraction and voids on output
     3 = Always replace all values for this water type with default
         (only valid for oceans and lakes)

  Default terrain elevations (m) (2 values)
  (TERDEF)                   Default: 0.,0.
```

```
                    |      |mainland |
                    |      |& marine |
                    |ocean |islands  |
                    ------ --------- -
         ! ITERREP =   3,      0     !
         !  TERDEF =   1.5,     0.   !
```

```
--Carry out interpolation to fill void cells?
  (LVOIDFILL)        Default: F      ! LVOIDFIL = T !
    T = Try interpolation to fill void cells
    F = Do not try interpolation to fill void cells

--Search radius (km) around grid cells for interpolation to fill
  voids   (Should be several times larger than DGRIDKM)
  (Used only if LVOIDFIL=T)
  (CELLRADKM)       No Default       ! CELLRADKM = 6 !


Terrain data may be prepared for one of several models, and the
structure of the output data file varies accordingly.

  Structure of output TERREL.DAT file
  (IMODEL)               Default: 1      ! IMODEL = 1 !
     1 = CALMET        (grid-cell-average elevations)
     2 = MESOPAC       (grid-cell-average elevations)
     3 = ISC POLAR     (grid-cell-peak elevations)
     4 = ISC CARTESIAN (grid-cell-peak elevations)
     5 = NUATMOS       (grid-cell-average elevations)
     6 = Generic       (grid-cell-average elevations)

Warnings are posted to the list file if grid cells contain fewer
data points than ITHRES(%) of the mean for all cells.  Such a
warning may indicate that insufficient data coverage is provided by
the terrain data files that are processed.

  Threshold (%) of the average number of data points in a cell
  (ITHRES)           Default: 75     ! ITHRES = 75 !
```

```
   Several data file types contain elevation data that are stored at a
fixed
   interval of latitude and longitude in fractional degrees.  Prior to
   TERREL v3.69 the method employed to map the (latitude,longitude)
locations
   to the output grid coordinates (x,y) transformed the coordinates at
the
   4 corners of a data-sheet (e.g., a 1-degree square), and then
interpolated
   the interior points between these.  The method introduced in TERREL
v3.69
   transforms the location of each individual data point read from the
file.
   Either method may be selected using MSHEET.  Datasets affected
include:
      USGS90     USGS 1-deg DEM files (~90m)
      ARM3       ARM3 terrain data files(~900m)
      3CD        3CD (binary) 1-deg DEM files (~90m)
      CDED       Canadian DEM files (3 and 0.75 arcsec)
      SRTM1      1-sec Shuttle RADAR Topo Mission files (~30m)
      SRTM3      3-sec Shuttle RADAR Topo Mission files (~90m)
      GTOPO30    GTOPO30 30-sec data (~900m)

     (MSHEET)          No Default      ! MSHEET = 1 !
        0 = Transform 4 corners of data sheet and interpolate
            --- Method used prior to TERREL v3.69
        1 = Transform each data point in sheet from (latitude,longitude)
to (x,y)
            --- Preferred (more accurate) method

!END!

-------------------------------------------------------------------------
-------

INPUT GROUP: 2 -- Map Projection and Grid Information for Output
--------------

     Projection
     ----------

     Map projection for all X,Y (km)
     (PMAP)             Default: UTM    ! PMAP = UTM !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
         PS  :  Polar Stereographic
         EM  :  Equatorial Mercator
         LAZA:  Lambert Azimuthal Equal Area

     TTM Scaling factor
     (used only if PMAP= TTM)
     (TMSCALE)         Default=1.0     ! TMSCALE = 0.9999 !
```

```
     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)            Default=0.0     ! FEAST  = 0.0 !
     (FNORTH)           Default=0.0     ! FNORTH = 0.0 !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN = 32 !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      * RLAT0 =   *
     (RLON0)                    No Default      * RLON0 =   *

         TTM :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of
projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
                RLAT0 identifies latitude of tangent-point of mapping
plane


     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (RLAT1)                    No Default      * RLAT1 =  *
     (RLAT2)                    No Default      * RLAT2 =  *

         LCC :  Projection cone slices through Earth's surface at RLAT1
and RLAT2
         PS  :  Projection plane slices through Earth at RLAT1
                (RLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E
```

```
     Datum-Region
     ------------

     The Datum-Region for the output coordinates is identified by a
character
     string.  Many mapping products currently available use the model of
the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in TERREL will make its
output
     consistent with local mapping products.  The list of Datum-Regions
with
     official transformation parameters is provided by the National
Imagery
     and Mapping Agency (NIMA).

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = WGS-84  !


     Grid
     ----

     Grid type
     (IGRID)                    Default: 1      ! IGRID = 1 !
        1 = Cartesian, with reference point at Lower Left CORNER
            of cell (1,1)    --- CALMET Convention ---
        2 = Cartesian, with reference point at CENTER of cell (1,1)
        3 = Polar, with reference point at center of rings
     ----------
     Note: cell (1,1) is at the SW corner of the grid

     Reference point coordinates X,Y (km) for grid
     where X is Easting, Y is Northing
     (XREFKM)        No Default      ! XREFKM = 640.000  !
     (YREFKM)        No Default      ! YREFKM = 4928.000 !

     Cartesian grid definition
     (Used only if IGRID=1,2)
     No. X grid cells (NX)   No default  ! NX =   100  !
     No. Y grid cells (NY)   No default  ! NY =   100  !
     Grid Spacing (km)(DGRIDKM) No default      ! DGRIDKM = 0.1 !

     Polar grid definition -- enter ring distances and ray angles
                              in Input Group 3
     (Used only if IGRID=3)
     No. of rings (NRING)       No default      ! NRING =   0  !
     No. of radials (NRAYS)     No default      ! NRAYS =   0  !

     Elevation processing method for polar grid
     (Used only if IGRID=3)
     (IPROC)                    Default: 2      ! IPROC = 2 !
        1 = NORMAL: terrain data for point at the intersection of ring
                    and ray is extracted from the region bounded by
                    rings and radials halfway to the adjacent rings and
                    radials
```

```
        2 = SCREEN: terrain data for point at the intersection of ring
                    and ray is extracted from the region bounded by the
                    current ring and the next larger ring, and radials
                    halfway to the adjacent radials

!END!

-------------------------------------------------------------------------
-------

INPUT GROUP: 3 -- Polar Grid Ring Distances (km) and Ray Angles (deg)
--------------

     Enter NRING lines identifying the radius (DISKM) of each ring in
     the polar grid, using a group terminator on each line.
     (Enter only if IGRID=3)
     * DISKM =  1.5  *   *END*
     * DISKM =  3.0  *   *END*


     Enter NRAYS lines identifying the angle (ANGDEG) from North of
     each radial in the polar grid, using a group terminator on each
line.
     (Enter only if IGRID=3)
     * ANGDEG =   0.  *   *END*
     * ANGDEG =  45.  *   *END*
     * ANGDEG =  90.  *   *END*

-------------------------------------------------------------------------
-------
NIMA Datum-Regions  (Documentation Section)
-------------------------------------------------------------------------
-------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage
(WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS
(NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere
```

ALLEGATO 2 – Estratto TERREL.DAT

```
TERREL.DAT      2.0             Header structure with coordinate
parameters
   2
Produced by TERREL Version: 7.0.0  Level: 141010
Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99
Level: 070921
UTM
  32N
WGS-84  02-21-2003
     100     100     640.000    4928.000       0.100       0.100
KM  M
W_E N_S
    91.7    91.7    92.3    90.6    89.5    88.9    87.5    83.9    78.9
81.7
    80.4    80.7    81.1    82.1    86.8    86.8    85.8    87.4    88.0
88.3
    85.8    77.1    77.2    76.3    75.1    81.2    85.5    84.9    85.0
84.4
    85.9    84.7    84.1    83.7    83.1    83.4    83.3    86.3    85.3
84.3
    84.3    85.2    85.3    82.7    80.9    80.8    81.1    84.9    85.2
84.5
    82.8    81.5    82.5    84.7    82.0    78.4    79.1    76.6    75.2
79.0
    78.1    78.8    79.1    77.9    77.3    80.2    76.1    74.5    77.0
76.8
    76.9    75.4    72.5    71.5    69.9    72.7    72.8    69.9    69.9
69.1
    70.9    69.8    69.7    70.3    71.4    72.0    71.0    70.3    69.1
68.3
    68.4    66.3    68.7    67.3    66.8    65.9    65.6    64.4    63.6
65.1
    90.9    91.4    90.9    90.4    88.7    86.9    87.7    81.2    79.3
80.8
    82.3    79.5    81.6    80.6    82.9    82.5    80.5    82.5    87.1
89.6
    89.2    76.9    76.5    77.6    74.5    82.8    85.1    83.8    85.0
83.7
    84.8    85.2    83.7    85.2    85.5    86.3    83.7    82.7    82.1
82.6
    84.1    82.5    84.3    85.2    83.9    85.0    80.6    82.7    86.8
85.2
    84.2    80.3    82.4    84.2    82.8    82.1    79.7    77.3    77.6
77.1
    78.4    78.9    78.6    79.2    76.9    80.7    77.2    77.2    79.1
78.4
    76.9    77.1    76.1    75.2    73.5    75.0    73.1    70.7    70.6
70.7
    70.3    71.7    71.4    71.5    71.3    71.3    72.7    72.0    71.2
70.5
    70.2    69.1    71.7    68.1    68.6    67.6    66.5    66.0    64.8
65.5
```

ALLEGATO 3 – Da corine a USGS

```
Function usgs_anderson(x As Integer) As Integer
If x = 14 Then
    usgs_anderson = 22
ElseIf x = 13 Then usgs_anderson = 21
ElseIf x = 1 Or x = 2 Then usgs_anderson = 11
ElseIf x = 4 Or x = 5 Or x = 6 Or x = 11 Then usgs_anderson = 14
ElseIf x = 3 Then usgs_anderson = 15
ElseIf x = 9 Or x = 10 Then usgs_anderson = 16
ElseIf x = 8 Then usgs_anderson = 17
ElseIf x = 18 Or x = 19 Then usgs_anderson = 21
ElseIf x = 15 Or x = 16 Or x = 17 Or x = 20 Or x = 22 Then usgs_anderson = 22
ElseIf x = 21 Then usgs_anderson = 23
ElseIf x = 12 Then usgs_anderson = 24
ElseIf x = 23 Then usgs_anderson = 41
ElseIf x = 24 Then usgs_anderson = 42
ElseIf x = 25 Then usgs_anderson = 43
ElseIf x = 40 Then usgs_anderson = 51
ElseIf x = 41 Then usgs_anderson = 52
ElseIf x = 42 Or x = 43 Then usgs_anderson = 54
ElseIf x = 44 Then usgs_anderson = 55
ElseIf x = 35 Or x = 36 Or x = 37 Or x = 39 Then usgs_anderson = 62
ElseIf x = 38 Then usgs_anderson = 71
ElseIf x = 30 Then usgs_anderson = 72
ElseIf x = 31 Then usgs_anderson = 74
ElseIf x = 7 Then usgs_anderson = 75
ElseIf x = 32 Then usgs_anderson = 76
ElseIf x = 27 Or x = 28 Then usgs_anderson = 81
ElseIf x = 26 Then usgs_anderson = 82
ElseIf x = 33 Then usgs_anderson = 83
ElseIf x = 29 Then usgs_anderson = 85
```

```
ElseIf x = 34 Then usgs_anderson = 91
ElseIf x = 48 Then usgs_anderson = 99
End If
End Function
```

ALLEGATO 4 -generic land use estratto

```
GENERIC.LANDUSE 1.0 LU, Longitude, Latitude (free-format)
3
Prepared by User, 3 è il numero di righe di descrizione
38 è il numero di settori seguito dai codici di settore
format tabella: code longitudine latitudine
LL
WGS-84 02-21-2003
DEG
38
11 12 13 14 15 16 17 21 22 23 24 31 32 33 41 42 43 51 52 53 54 55 61 62
71 72 73 74 75 76 77 81 82 83 84 85 91 92
24 10.303816 44.8753150
24 10.305080 44.8753114
24 10.306343 44.8753077
24 10.307606 44.8753040
```

ALLEGATO 5 – Input CTGPROC

```
CTGPROC.INP     7.0             File Version
------------------------------------------------------------------------
------

                 CTGPROC PROCESSOR CONTROL FILE
                 ------------------------------

  CTGPROC reads a Land Use and Land Cover (LULC) data file and determines
  fractional land use for each grid cell in a user-specified gridded
  domain.  If the domain requires multiple files, CTGPROC is applied
  iteratively (continuation option) to build the land use grid
  incrementally.  The LULC file types that are supported are listed in
  Input Subgroup 0b.

------------------------------------------------------------------------
------

INPUT GROUP: 0 -- Input and Output Files
--------------

-------------
Subgroup (0a)
-------------

     Number of Land Use Data Files provided in Subgroup 0b

     (NDBF)                     Default: 0      ! NDBF = 1 !


     Other Input and Output files:
     -----------------------------

     Default Name  Type          File Name
     ------------  ----          ---------
     PREV.DAT      input    * PREVDAT =             *
     LU.DAT        output   ! LUDAT   =out\LULC100m.dat  !
     CTGPROC.LST   output   ! RUNLST  =out\LULC100m.lst  !
    ------------------------------------------------------
    (Coastline Data)
       USGS Global Self-consistent Hierarchical High-resolution
       Shoreline Database (GSHHS)
    GSHHS_F.B      input    * GSHHSIN  = GSHHS_F.B   *
       Processed coastline polygons for
       CTGPROC grid (BLN)
    COAST.BLN      input or * COASTBLN = coast.bln   *
                   output
    ------------------------------------------------------

     All file names will be converted to lower case if LCFILES = T
     Otherwise, if LCFILES = F, file names will be converted to UPPER
CASE
     (LCFILES)                  Default: T      ! LCFILES = T !
        T = lower case
        F = UPPER CASE
```

```
     NOTE: File/path names can be up to 70 characters in length;
           PREV.DAT is used only if LPREV=T (Input Group 1)

!END!


-------------
Subgroup (0b)
-------------

     The following NDBF Land Use Data Files are processed.
     Enter NDBF lines identifying the file name for each,
     followed by a group terminator.  The type of data base
     for each file is designated by the assignment name:

     (CTG)     designates USGS CTG (compressed)
     (GEN)     designates Generic (no USGS translation is done)
     (NZGEN)   designates New Zealand Generic
     (GLAZNA)  designates USGS Global (Lambert Azimuthal) for North
America
     (GLAZSA)  designates USGS Global (Lambert Azimuthal) for South
America
     (GLAZEU)  designates USGS Global (Lambert Azimuthal) for Eurasia -
Europe
     (GLAZAS)  designates USGS Global (Lambert Azimuthal) for Eurasia -
Asia
     (GLAZAF)  designates USGS Global (Lambert Azimuthal) for Africa
     (GLAZAP)  designates USGS Global (Lambert Azimuthal) for Australia-
Pacific
     (NLCD92)  designates National Land Cover Dataset 1992 Flat
     (NLCDTF)  designates National Land Cover Dataset 1992 GeoTIFF
     (NLCD01)  designates National Land Cover Dataset 2001 GeoTIFF
     (GLC2K)   designates Global Land Cover 2000 GeoTIFF
     (UMDGLC)  designates Univ. of Maryland Global Land Cover GeoTIFF
     (MODIS)   designates Boston Univ. Modis Global Land Cover

    ! GEN  =  inp\LULC_rielaborato21_04_2021.csv !  !END!

------------------------------------------------------------------------
-------

INPUT GROUP: 1 -- Run control parameters
--------------

     When multiple applications of CTGPROC are needed, the gridded land
     use data file (LU.DAT) must be written in a continuation format
rather
     than in the fractional land use format expected by MAKEGEO.  This
     applies to all applications except the FINAL application, which must
     be in the fractional land use format.  Futhermore, if the
application
     is not the first one in a series, then a PREVIOUS LU.DAT file must
     be identified.  If GENERIC land use data base files are used, no
other
     database types can be combined with these unless the generic DB uses
```

```
     the USGS classes.

     Is this the final run?
     (LFINAL)                    Default: T      ! LFINAL = T !
        T = LU.DAT file written in fractional land use format
        F = LU.DAT file written in continuation format

     Is a previous LU.DAT output file used to start this run?
     (LPREV)                     Default: F      ! LPREV = F !
        T = PREV.DAT file is used
        F = PREV.DAT file is NOT used

     Control for distributing input land use within its cell to improve
     the sampling density.  A mesh density greater than one is used to
     split each input cell into a finer grid of cells.  A density of 2
     creates 2 cells per side; 3 creates 3 cells per side.  The input
     land use is assigned to the center of each of the new cells.
     Specify a mesh density for CTG and USGS GLAZ file types:
     (MESHCTG)      Default=1       ! MESHCTG  = 1 !
     (MESHGLAZ)     Default=1       ! MESHGLAZ = 1 !

     The coordinates of the center of each input landuse "cell", both
     before and after applying the mesh density factor, can be written
     to QA plot files named QACTG.DAT, QAGLAZ.DAT, and QAMESH.DAT.
     These files can become very large for large domains.
     Create QA plot files of land use data points?
     (LQACELL)                   Default: F      ! LQACELL = F !
        T = QA files are created
        F = QA files are not created

     Daily Snow Data Processing
     --------------------------
     Snow grids of USA SNODAS daily snow data can be resolved for
     CALMET and LU grids, so that daily snow information can be used
     in MAKEGEO to create daily variable geo.dat.

     Process snow grids?
     (LSNOW)                   Default: F       ! LSNOW = F !
       T = Process SNODAS snow data
       F = Do not process SNODAS snow data

     Marine Coastline Processing
     ---------------------------
     Land use data may be augmented with coastline information.
Coastline
     data are used to determine whether a particular point lies offshore,
     so that it may be given a marine (ocean) land use code.

     Process coastline data?
     (LCOAST)          Default: F      ! LCOAST = F !
       T = Process coastline data
       F = Do not process coastline data

     Coastline processing method for points offshore may SWAP a land use
     type as it is read from an input data file with the type for ocean,
     and it may FILL empty marine cells at the end of a run with the
```

```
type for ocean.

(LMARSWAP)           Default: F      ! LMARSWAP = F !
(Used only if LCOAST=T)
  T = Replace land use type read from data file with type IOCEAN
  F = Use land use type read from data file

(LMARFILL)           Default: T      ! LMARFILL = T !
(Used only if LCOAST=T and LFINAL=T)
  T = Fill empty marine grid cells with land use type IOCEAN
  F = Maintain empty grid cells

Marine land use type:
(Used only if LCOAST=T)
(IOCEAN)            Default: 55     ! IOCEAN = 55 !

Read pre-processed coastline data (existing BLN file)?
(Used only if LCOAST=T)
(LBLNREAD)         Default: F      ! LBLNREAD = F !
  T = Use pre-processed BLN coastline data
  F = Process GSHHS coastline data and create BLN


Input Datum-Region
------------------
The Datum-Region for coordinates in the input LULC Data File may be
identified in the header records of the file.  Check the file
documentation
and change these defaults as needed.  The list of Datum-Regions with
official transformation parameters is provided by the National
Imagery and
and Mapping Agency (NIMA).

Datum-region for input LULC Data File coordinates

(DCTG)        Default: NAS-C     ! DCTG     = NAS-C  !
for LULC type CTG (compressed)

(DUSGSLA)     Default: ESR-S     ! DUSGSLA  = ESR-S  !
for LULC type GLAZ** (Global Lambert Azimuthal)

(DNZGEN)      Default: WGS-84    ! DNZGEN   = WGS-84 !
for LULC type NZGEN (New Zealand Generic)

(DNLCD)        Default: NAR-C     ! DNLCD    = NAR-C  !
for LULC type NLCD** (National Land Cover Dataset)

(DGLC2K)       Default: WGS-84    ! DGLC2K   = WGS-84 !
for LULC type GLC2K (Global Land Cover 2000)

(DUMDGLC)     Default: WGS-84    ! DUMDGLC  = WGS-84 !
for LULC type UMDGLC (Univ. of Maryland Global Land Cover 2000)

(DMODIS)      Default: ESR-R     ! DMODIS   = ESR-R  !
for LULC type MODIS (Boston Univ. Modis Global Land Cover)
```

```
     Note: the input Datum-Region for LULC type GEN (the GENERIC format)
has
           no default, and is provided in the header of the file


     QA threshold (% of average number of data points/grid cell)
     for reporting cells with poor data coverage
     (ITHRESH)        Default: 75     ! ITHRESH = 75 !

!END!

-------------------------------------------------------------------------
-------

INPUT GROUP: 2 -- Map Projection and Grid Information for Output
--------------

     Projection
     ----------

     Map projection for all X,Y (km)
     (PMAP)                    Default: UTM    ! PMAP = UTM !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
         PS  :  Polar Stereographic
         EM  :  Equatorial Mercator
         LAZA:  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                   Default=0.0     ! FEAST  = 0.0 !
     (FNORTH)                  Default=0.0     ! FNORTH = 0.0 !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN = 32 !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                  Default: N      ! UTMHEM = N !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)        No Default      * RLAT0 = 42.55N *
     (RLON0)        No Default      * RLON0 = 108.55W *

         TTM :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
```

```
         PS  :  RLON0 identifies central (grid N/S) meridian of
projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
                RLAT0 identifies latitude of tangent-point of mapping
plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (RLAT1)              No Default      * RLAT1 = 30.0N *
     (RLAT2)              No Default      * RLAT2 = 60.0N *

         LCC :  Projection cone slices through Earth's surface at RLAT1
and RLAT2
         PS  :  Projection plane slices through Earth at RLAT1
                (RLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Output Datum-Region
     -------------------

     The Datum-Region for the output coordinates is identified by a
character
     string.  Many mapping products currently available use the model of
the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in TERREL will make its
output
     consistent with local mapping products.  The list of Datum-Regions
with
     official transformation parameters is provided by the National
Imagery
     and Mapping Agency (NIMA).

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = WGS-84 !



     Grid
     ----

     Reference coordinates X,Y (km) assigned to the southwest corner
     of grid cell (1,1)  (lower left corner of grid)
     (XREFKM)           No Default      ! XREFKM = 640.000 !
     (YREFKM)           No Default      ! YREFKM = 4928.000 !
```

```
     Cartesian grid definition
     No. X grid cells (NX)      No default   ! NX = 100 !
     No. Y grid cells (NY)      No default   ! NY = 100 !
     Grid Spacing (DGRIDKM)     No default   ! DGRIDKM = 0.1!
     in kilometers


!END!


-------------------------------------------------------------------------
-------
NIMA Datum-Regions  (Documentation Section)
-------------------------------------------------------------------------
-------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage
(WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS
(NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere
```

ALLEGATO 6 - CTGPROC estratto output

```
LU.DAT          2.1             Coordinate parameters and LandUse
categories
   2
Produced by CTGPROC Version: 7.0.0  Level: 150211
Internal Coordinate Transformations  ---  COORDLIB   Version: 1.99
Level: 070921
FRACTION
UTM
  32N
WGS-84  02-21-2003
     100     100     640.000    4928.000       0.100       0.100    38
KM
              11    12    13    14    15    16    17    21    22    23
24    31    32    33    41    42    43    51    52    53    54    55
61    62    71    72    73    74    75    76    77    81    82    83
84    85    91    92
    1    1 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.000 0.000 0.000    .
    2    1 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 1.000
0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
```

ALLEGATO 7 - Input Makegeo

```
Demo Application
--------------------------- Run Title (1 line) -------------------------
------

                    MAKEGEO PROCESSOR CONTROL FILE
                 ----------------------------------

Simulazione per ENEA - centrale di Goesgen
cella 50x50 km 25 righe 21 colonne
Sistema di riferimento LCC
dominio compreso tra punti con estremi LCC (EPSG: 3034) SW  (3704 , 1120)
e NE (4754 , 2370)

------------------------------------------------------------------------
------

INPUT GROUP: 0 -- Input and Output File Names
-----------------------------------------------------

    Default Name  Type          File Name
    ------------  ----          ---------
    LU.DAT        input    ! LUDAT = inp\lulc100m.dat !
    LU2.DAT       input    * LU2DAT =       *
    TERR.DAT      input    ! TERRDAT =  inp\TERR100M.DAT !
    GEO.DAT       output   ! GEODAT = out\makegeo100m.dat   !
MAKEGEO.LST  output   ! RUNLST = out\makegeo100m.lst      !
QALUSE.GRD   output   ! LUGRD  = out\lmakegeo100m.grd       !
 QATERR.GRD   output   ! TEGRD =  out\tmakegeo100m.grd    !

    ------------------------------------------------------------
    All file names will be converted to lower case if LCFILES = T
    Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
    (LCFILES)   Default: T    ! LCFILES = F     !
             T = lower case
             F = UPPER CASE
    NOTE: file/path names can be up to 70 characters in length

!END!

------------------------------------------------------------------------
-------

INPUT GROUP: 1 -- Run conrol parameters
-------------------------------------------------

    Terrain Processing Control

    Read in a gridded terrain file?
    (LTERR)          Default: T        ! LTERR = T    !
             T = terrain elevations in GEO.DAT read from TERR.DAT
             F = terrain elevations in GEO.DAT are zero

    Land Use Processing Control

    A second file of fractional land use (LU2.DAT) may be provided for
```

```
    use when a cell in the primary land use file (LU.DAT) has no
indicated
    land use.  This option allows a lower resolution dataset to
supplement
    a higher resolution dataset where the higher resolution data are
    unavailable.

    Read in a second fractional land use file?
    (LLU2)           Default: F        ! LLU2 = F    !
             T = supplemental fractional land use read from LU2.DAT
             F = no supplemental fractional land use data are available


    QA information for 1 cell in the grid can be written to the list
    file.  Identify the cell by its grid location (IX, IY).
    No QA output is generated if either index is outside your grid.  For
    example, using 0 for either turns the QA output off.

    Location of grid cell for QA output
    (IXQA)      Default:0            ! IXQA = 11   !
    (IYQA)      Default:0            ! IYQA = 88   !

!END!

-------------------------------------------------------------------------
-------
INPUT GROUP: 2 -- Map Projection and Grid Information for Output
-------------------------------------------------------------------
    Projection
    --------------------
    Map projection for all X,Y (km)
    (PMAP)           Default: UTM   ! PMAP = UTM     !
    UTM :  Universal Transverse Mercator
    TTM :  Tangential Transverse Mercator
    LCC :  Lambert Conformal Conic
    PS  :  Polar Stereographic
    EM  :  Equatorial Mercator
    LAZA:  Lambert Azimuthal Equal Area

    False Easting and Northing (km) at the projection origin
    (Used only if PMAP = TTM, LCC, or LAZA)
    (FEAST)          Default=0.0   * FEAST  = 4000     *    (FNORTH)
Default=0.0   * FNORTH = 2800          *

    UTM ZONE (1 to 60)
    (Used only if PMAP = UTM)
    (IUTMZN)         No Default   ! IUTMZN = 32  !

    Hemisphere for UTM projection?
    (Used only if PMAP = UTM)
    (UTMHEM)         Default: N   ! UTMHEM = N     !
        N    :  Northern hemisphere projection
        S    :  Southern hemisphere projection

    Latitude and Longitude (decimal degrees) for projection origin
    (Used only if PMAP = TTM, LCC, PS, EM, or LAZA)
```

```
    (RLAT0)           No Default   * RLAT0 =  52.N         *
    (RLON0)           No Default   * RLON0 =  10.E         *

        TTM :  RLON0 identifies central (true N/S) meridian of projection
               RLAT0 selected for convenience
        LCC :  RLON0 identifies central (true N/S) meridian of projection
               RLAT0 selected for convenience
        PS  :  RLON0 identifies central (grid N/S) meridian of projection
               RLAT0 selected for convenience
        EM  :  RLON0 identifies central meridian of projection
               RLAT0 is REPLACED by 0.0N (Equator)
        TTM :  RLON0 identifies longitude of tangent-point of mapping
plane
               RLAT0 identifies latitude of tangent-popint of mapping
plane

    Two standard parallel(s) of latitude (decimal degrees) of projection
origin
    (Used only if PMAP = LCC or PS)
    (RLAT1)           No Default   * RLAT1 =  35.0 N       *
    (RLAT2)           No Default   * RLAT2 =  65.0 N       *
        LCC :  Projection cone slices through Earth's surface at RLAT1
and RLAT2
        PS  :  Projection plane slices through Earth at RLAT1
               (RLAT2 is not used)

    -------------
    NOTE:  Latitides and longitudes should be positive, and include a
           letter N, S, E, or W indicating north or south latitude, and
           east of west longitude.  For example,
           35.9  N Latitude =   35.9N
           118.7 E Longitude = 118.7E

    Output Datum-Region
    -------------------

    The Datum-Region for the output coordinates is identified by a
character
    string.  Many mapping products currently available use the model of
the
    Earth known as the World Geodetic System 1984 (WGS-84).  Other local
    models may be in use, and their selection in MAKEGEO will make its
output
    consistent with local mapping products.  The list of Datum-Regions
with
    official transformation parameters is provided by the National
Imagery
    and Mapping Agency (NIMA)

    Datum-Region for output coordinates
    (DATUM)           Default: WGS-84  ! DATUM = WGS-84     !

    Grid
    -------

    Reference point coordinates X,Y (km) assigned to the southwest corner
```

```
    of grid cell (1,1)    (lower left corner fo grid)
    (XREFKM)    No Default          ! XREFKM = 640.000!
    (YREFKM)    No Default          ! YREFKM = 4928.000!

    Cartesian grid definition
    No. X grid cells (NX)  No Default  ! NX = 100    !
    No. Y grid cells (NY)  No Default  ! NY = 100    !
    Grid Spacing (DGRIDKM) No Default  ! DGRIDKM = 0.1    !

!END!

------------------------------------------------------------------------
-------
INPUT GROUP: 3 -- Output Land Use
------------------------------------------------------------------------

--------------
Subgroup (3a)
--------------

    Number of output land use categories
    (NOUTCAT)          Default:14          ! NOUTCAT = 14     !
    Output land use categories assigned to water
    range from IWAT1 to IWAT2 (inclusive)
    (IWAT1)          Default:50          ! IWAT1 = 50     !
    (IWAT2)          Default:55          ! IWAT2 = 55     !

!END!


--------------
Subgroup (3b)
--------------

                                                  a
    OUTPUT LAND USE CATEGORIES (NOUTCAT entries)
    -------------------------------------------
    ! OUTCAT = 10, 20, -20, 30, 40, 51, 54, 55, 60, 61!   !END!
    ! OUTCAT = 62, 70, 80, 90!   !END!
    a
     List categories in ascending (absolute value) order, with up to 10
per line.
     Each line is treated as a separate input subgroup and therefore
     must end with an input group terminator.

------------------------------------------------------------------------
-------
INPUT GROUP: 4 -- Input Land Use (Defaults are set for USGS categories)
------------------------------------------------------------------------


--------------
Subgroup (4a)
--------------

    Number of input land use categories
```

```
    (NINCAT)         Default:38          ! NINCAT = 38     !

    Number of input water categories
    (NUMWAT)         Default:5          ! NUMWAT = 5     !

    Number of input categories that are split
    by apportioning area among the other land
    use categories
    (NSPLIT)         Default:0          ! NSPLIT = 0     !

    Minimum fraction of cell covered by water required
    to define the dominant land use as water
    (CFRACT)         Default:0.5        ! CFRACT = 0.4     !

    Land use category assigned to cell when
    no land use data are found
    (IMISS)         Default:55          ! IMISS = 92     !

     Minimum total fractional land use expected
     in a cell when land use data are available
    (FLUMIN)        Default: 0.96       ! FLUMIN = 0.9     !


!END!

--------------
Subgroup (4b)
--------------
                                                          a
    LAND USE PROPERTIES AND OUTPUT MAP (NINICAT entries)
    ----------------------------------------------------
     Input                                Soil    Anthropogenic Leaf   Output
    Category     z0   Albedo  Bowen Heat Flux   Heat Flux   Area
Category
       ID        (m) (0 to 1) Ratio Parmater    (W/m**2)    Index    ID
    --------    ---- -------- ----- ---------  ------------ ----- -------
--

! X =   11,     0.5,    0.18,     1.0,     0.20,      0.0,      1.0,
10  !  !END!
! X =   12,     1.0,    0.18,     1.5,     0.25,      0.0,      0.2,
10  !  !END!
! X =   13,     1.0,    0.18,     1.5,     0.25,      0.0,      0.2,
10  !  !END!
! X =   14,     1.0,    0.18,     1.5,     0.25,      0.0,      0.2,
10  !  !END!
! X =   15,     1.0,    0.18,     1.5,     0.25,      0.0,      0.2,
10  !  !END!
! X =   16,     1.0,    0.18,     1.5,     0.25,      0.0,      0.2,
10  !  !END!
! X =   17,     1.0,    0.18,     1.5,     0.25,      0.0,      0.2,
10  !  !END!
! X =   21,    0.25,    0.15,     1.0,     0.15,      0.0,      3.0,
20  !  !END!
! X =   22,    0.25,    0.15,     1.0,     0.15,      0.0,      3.0,
20  !  !END!
```

```
! X =   23,    0.25,    0.15,     1.0,     0.15,      0.0,      3.0,
20  !  !END!
! X =   24,    0.25,    0.15,     1.0,     0.15,      0.0,      3.0,
20  !  !END!
! X =   31,    0.05,    0.25,     1.0,     0.15,      0.0,      0.5,
30  !  !END!
! X =   32,    0.05,    0.25,     1.0,     0.15,      0.0,      0.5,
30  !  !END!
! X =   33,    0.05,    0.25,     1.0,     0.15,      0.0,      0.5,
30  !  !END!
! X =   41,     1.0,     0.1,     1.0,     0.15,      0.0,      7.0,
40  !  !END!
! X =   42,     1.0,     0.1,     1.0,     0.15,      0.0,      7.0,
40  !  !END!
! X =   43,     1.0,     0.1,     1.0,     0.15,      0.0,      7.0,
40  !  !END!
! X =   51,   0.001,     0.1,     0.0,      1.0,      0.0,      0.0,
51  !  !END!
! X =   52,   0.001,     0.1,     0.0,      1.0,      0.0,      0.0,
51  !  !END!
! X =   53,   0.001,     0.1,     0.0,      1.0,      0.0,      0.0,
51  !  !END!
! X =   54,   0.001,     0.1,     0.0,      1.0,      0.0,      0.0,
54  !  !END!
! X =   55,   0.001,     0.1,     0.0,      1.0,      0.0,      0.0,
55  !  !END!
! X =   61,     1.0,     0.1,     0.5,     0.25,      0.0,      2.0,
61  !  !END!
! X =   62,     0.2,     0.1,     0.1,     0.25,      0.0,      1.0,
62  !  !END!
! X =   71,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   72,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   73,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   74,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   75,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   76,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   77,    0.05,     0.3,     1.0,     0.15,      0.0,     0.05,
70  !  !END!
! X =   81,     0.2,     0.3,     0.5,     0.15,      0.0,      0.0,
80  !  !END!
! X =   82,     0.2,     0.3,     0.5,     0.15,      0.0,      0.0,
80  !  !END!
! X =   83,     0.2,     0.3,     0.5,     0.15,      0.0,      0.0,
80  !  !END!
! X =   84,     0.2,     0.3,     0.5,     0.15,      0.0,      0.0,
80  !  !END!
! X =   85,     0.2,     0.3,     0.5,     0.15,      0.0,      0.0,
80  !  !END!
! X =   91,    0.05,     0.7,     0.5,     0.15,      0.0,      0.0,
90  !  !END!
```

```
! X =   92,    0.05,     0.7,     0.5,     0.15,      0.0,      0.0,
90  !  !END!
```

---

a
Data for each land use category are treated as a separate input subgroup and therefore must end with an input terminator.

Subgroup (4c)

---

a

INPUT CATEGORIES DEFINED AS WATER (NUMWAT entries)

```
! IWAT = 51 ! !END!
! IWAT = 52 ! !END!
! IWAT = 53 ! !END!
! IWAT = 54 ! !END!
! IWAT = 55 ! !END!
```

---

a
Each water category ID is read as a separate input subgroup and therefore must end with an input terminator.

Subgroup (4d)

---

a

CATEGORY SPLIT INFORMATION (NSPLIT Categories)

Split Category ID	To Category ID	Amount of Split (%)
* XSPLIT = 14,	76,	15.8 * *END*
* XSPLIT = 14,	77,	84.2 * *END*

---

a
Each assignment is read as a separate input subgroup and therefore therefore must end with an input terminator. A total of NSPLIT land use categories must be listed, and the % split from each one must sum to 100.0%

NIMA Datum-Regions (Documentation Section)

WGS-84	WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C	NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C	NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84	NWS 6370KM Radius, Sphere
ESR-S	ESRI REFERENCE 6371KM Radius, Sphere

ALLEGATO 8 – Estratto output Makegeo

```
GEO.DAT         2.1             Header structure with coordinate
parameters
   2
Produced by MAKEGEO Version: 3.2  Level: 110401
Demo Application
UTM
  32N
WGS-84  02-21-2003
     100     100     640.000    4928.000       0.100       0.100
KM  M
 1           - LAND USE DATA - (1=new categories)
   14  50  55 - NLU, IWAT1, IWAT2
   10  20 -20  30  40  51  54  55  60  61  62  70  80  90
     10,     20,     20,     20,     20,     20,     20,     20,     20,
20,
     70,     70,     70,     70,     70,     80,     80,     20,     20,
20,
     20,     20,     20,     20,     20,     20,     20,     20,     20,
20,
     20,     20,     20,     20,     20,     20,     20,     20,     20,
20,
```

ALLEGATO 9 – Input Calmet

```
CALMET.INP      2.1             Hour Start and End Times with Seconds
sassuolo TEST


---------------- Run title (3 lines) ------------------------------------
------

                    CALMET MODEL CONTROL FILE
                    -------------------------

-------------------------------------------------------------------------
------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=inp\MAKEGEO100M.DAT !
SURF.DAT      input    * SRFDAT= mr_surfer.dat*
CLOUD.DAT     input    * CLDDAT = *
PRECIP.DAT    input    * PRCDAT= *
WT.DAT        input    * WTDAT = *

CALMET.LST    output   ! METLST=out\calmet.lst !
CALMET.DAT    output   ! METDAT=out\calmet.dat !
PACOUT.DAT    output   * PACDAT = *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA = 0 !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA = 0 !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                 (NM3D) No default       ! NM3D = 12 !

    Number of IGF-CALMET.DAT files
                                 (NIGF)   No default     ! NIGF = 0 !

                       !END!
-------------------------------------------------------------------------
-------
Subgroup (b)
--------------------------------
Upper air files (one per station)
```

```
---------------------------------
Default Name  Type       File Name
------------  ----       ---------

* UPDAT= *  *END*

------------------------------------------------------------------------
-------
Subgroup (c)
---------------------------------------
Overwater station files (one per station)
---------------------------------------
Default Name  Type       File Name
------------  ----       ---------
* OVERWATERFILES = *
------------------------------------------------------------------------
-------
Subgroup (d)
-----------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
-----------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     1  ! M3DDAT=inp\2020-01-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-02-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-03-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-04-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-05-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-06-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-07-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-08-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-09-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-10-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-11-sassuolo-3d.dat ! !END!
MM51.DAT       input     1  ! M3DDAT=inp\2020-12-sassuolo-3d.dat ! !END!
------------------------------------------------------------------------
-------
Subgroup (e)
-----------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
-----------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
* IGFDATFILES = *
------------------------------------------------------------------------
-------
Subgroup (f)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT = *
PROG.DAT      input      * PRGDAT = *
```

```
TEST.PRT      output     * TSTPRT = *
TEST.OUT      output     * TSTOUT = *
TEST.KIN      output     * TSTKIN = *
TEST.FRD      output     * TSTFRD = *
TEST.SLP      output     * TSTSLP = *
DCST.GRD      output     * DCSTGD = *

------------------------------------------------------------------------
-------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) through (e) are included ONLY if the
corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each
must have
           an 'END' (surround by delimiters) at the end of EACH LINE

                          !END!


------------------------------------------------------------------------
------

INPUT GROUP: 1 -- General run control parameters
--------------

Starting date: Year(IBYR)  --    No default   ! IBYR = 2020 !
             Month  (IBMO)  --    No default   ! IBMO = 01 !
             Day    (IBDY)  --    No default   ! IBDY = 01 !
Starting time: Hour (IBHR)  --    No default   ! IBHR = 00 !
           Second (IBSEC) --    No default   ! IBSEC = 0000 !

 Ending date: Year(IEYR)  --    No default   ! IEYR = 2021 !
            Month  (IEMO)  --    No default   ! IEMO = 01 !
            Day    (IEDY)  --    No default   ! IEDY = 01 !
 Ending time:  Hour (IEHR)  --    No default   ! IEHR = 00 !
                       Second (IESEC) --    No default   ! IESEC = 0000 !

      UTC time zone    (ABTZ) -- No default  ! ABTZ = UTC+0100 !
         (character*8)
         PST = UTC-0800, MST = UTC-0700 , GMT = UTC-0000
         CST = UTC-0600, EST = UTC-0500

     Length of modeling time-step (seconds)
     Must divide evenly into 3600 (1 hour)
     (NSECDT)            Default:3600     ! NSECDT = 3600 !
                               Units: seconds

     Run type       (IRTYPE) -- Default: 1       ! IRTYPE = 1 !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)
```

```
     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      Flag to stop run after
      SETUP phase (ITEST)         Default: 2       ! ITEST = 2 !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP


     Test options specified to see if
     they conform to regulatory
     values? (MREG)               No Default        ! MREG = 0 !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height
overwater
                  ICOARE   0        OCD deltaT method for overwater
fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land
needed
                                    to sustain convective mixing height
growth
                  ISURFT   > 0      Pick one representative station, OR
                           -2       in NOOBS mode (ITPROG=2) average all
                                    surface prognostic temperatures to
get
                                    a single representative surface temp.
                  IUPT     > 0      Pick one representative station, OR
                           -2       in NOOBS mode (ITPROG>0) average all
surface
                                    prognostic temperatures to get a
single
                                    representative surface temp.

!END!

------------------------------------------------------------------------
------

INPUT GROUP: 2 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                    Default: UTM    ! PMAP = UTM !
```

```
         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)           Default=0.0     ! FEAST = 0.0 !
     (FNORTH)          Default=0.0     ! FNORTH = 0.0 !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)              No Default      ! IUTMZN = 32 !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)              Default: N      ! UTMHEM = N !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)               No Default      * RLAT0 = *
     (RLON0)               No Default      * RLON0 = *

         TTM :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of
projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
                RLAT0 identifies latitude of tangent-point of mapping
plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)               No Default      ! XLAT1 = 30N !
     (XLAT2)               No Default      ! XLAT2 = 60N !

         LCC :  Projection cone slices through Earth's surface at XLAT1
and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
```

letter N,S,E, or W indicating north or south latitude, and
east or west longitude. For example,
35.9 N Latitude = 35.9N
118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character string. Many mapping products currently available use the model of the Earth known as the World Geodetic System 1984 (WGS-84). Other local models may be in use, and their selection in CALMET will make its output consistent with local mapping products. The list of Datum-Regions with official transformation parameters is provided by the National Imagery and Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84	WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C	NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C	NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84	NWS 6370KM Radius, Sphere
ESR-S	ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates
(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

Horizontal grid definition:

Rectangular grid defined for projection PMAP,
with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 100 !
No. Y grid cells (NY) No default ! NY = 100 !

Grid spacing (DGRIDKM) No default ! DGRIDKM = 0.1!
Units: km

Reference grid coordinate of
SOUTHWEST corner of grid cell (1,1)

X coordinate (XORIGKM) No default ! XORIGKM = 640.000 !
Y coordinate (YORIGKM No default ! YORIGKM = 4928.000 !
Units: km

```
     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ) No default  ! NZ = 12 !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
        ! ZFACE = 0., 20., 50., 100., 150., 200., 250., 500., 1000.,
1500., 2000., 2500., 3000. !

!END!


------------------------------------------------------------------------
------

INPUT GROUP: 3 -- Output Options
--------------


    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?              (LSAVE)  Default: T     ! LSAVE = T !
       (F = Do not save, T = Save)

       Type of unformatted output file:
       (IFORMO)                            Default: 1    ! IFORMO = 1 !

            1 = CALPUFF/CALGRID type file (CALMET.DAT)
            2 = MESOPUFF-II type file     (PACOUT.DAT)


    LINE PRINTER OUTPUT OPTIONS:

       Print met. fields ?  (LPRINT)       Default: F     ! LPRINT = F !
       (F = Do not print, T = Print)
       (NOTE: parameters below control which
              met. variables are printed)

       Print interval
       (IPRINF) in hours     Default: 1     ! IPRINF = 1 !
       (Meteorological fields are printed
        every  6  hours)


       Specify which layers of U, V wind component
       to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T)        Defaults: NZ*0
       ! IUVOUT =  1,0,0,0,0,0,0,0,0,0,0,0  !
       ------------------------
```

```
   Specify which levels of the W wind component to print
   (NOTE: W defined at TOP cell face --  6  values)
   (IWOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T & LCALGRD=T)
   ----------------------------------
                                       Defaults: NZ*0
    ! IWOUT =  0,0,0,0,0,0,0,0,0,0,0,0  !


   Specify which levels of the 3-D temperature field to print
   (ITOUT(NZ)) -- NOTE: NZ values must be entered
   (0=Do not print, 1=Print)
   (used only if LPRINT=T & LCALGRD=T)
   ----------------------------------
                                       Defaults: NZ*0
    ! ITOUT =  0,0,0,0,0,0,0,0,0,0,0,0  !

   Specify which meteorological fields
   to print
   (used only if LPRINT=T)             Defaults: 0 (all variables)
   ----------------------


     Variable            Print ?
                       (0 = do not print,
                        1 = print)
     --------          ------------------

  ! STABILITY = 0 ! - PGT stability class
  ! USTAR = 0 ! - Friction velocity
  ! MONIN = 0 ! - Monin-Obukhov length
  ! MIXHT = 0 ! - Mixing height
  ! WSTAR = 0 ! - Convective velocity scale
  ! PRECIP = 0 ! - Precipitation rate
  ! SENSHEAT = 0 ! - Sensible heat flux
  ! CONVZI = 0 ! - Convective mixing ht.


   Testing and debug print options for micrometeorological module

      Print input meteorological data and
      internal variables (LDB) Default: F   ! LDB = F !
      (F = Do not print, T = print)
      (NOTE: this option produces large amounts of output)

      First time step for which debug data
are printed (NN1)          Default: 1       ! NN1 = 1 !

      Last time step for which debug data
      are printed (NN2)      Default: 1       ! NN2 = 1 !

      Print distance to land
   internal variables (LDBCST) Default: F ! LDBCST = F !
      (F = Do not print, T = print)
      (Output in .GRD file DCST.GRD, defined in input group 0)
```

```
       Testing and debug print options for wind field module
       (all of the following print options control output to
        wind field module's output files: TEST.PRT, TEST.OUT,
        TEST.KIN, TEST.FRD, and TEST.SLP)

          Control variable for writing the test/debug
          wind fields to disk files (IOUTD)
          (0=Do not write, 1=write)        Default: 0       ! IOUTD = 1 !

          Number of levels, starting at the surface,
          to print (NZPRN2)                Default: 1       ! NZPRN2 = 1
!

          Print the INTERPOLATED wind components ?
          (IPR0) (0=no, 1=yes)             Default: 0       ! IPR0 = 0 !

          Print the TERRAIN ADJUSTED surface wind
          components ?
          (IPR1) (0=no, 1=yes)             Default: 0       ! IPR1 = 0 !

          Print the SMOOTHED wind components and
          the INITIAL DIVERGENCE fields ?
          (IPR2) (0=no, 1=yes)             Default: 0       ! IPR2 = 0 !

          Print the FINAL wind speed and direction
          fields ?
          (IPR3) (0=no, 1=yes)             Default: 0       ! IPR3 = 0 !

          Print the FINAL DIVERGENCE fields ?
          (IPR4) (0=no, 1=yes)             Default: 0       ! IPR4 = 0 !

          Print the winds after KINEMATIC effects
          are added ?
          (IPR5) (0=no, 1=yes)             Default: 0       ! IPR5 = 0 !

          Print the winds after the FROUDE NUMBER
          adjustment is made ?
          (IPR6) (0=no, 1=yes)             Default: 0       ! IPR6 = 0 !

          Print the winds after SLOPE FLOWS
          are added ?
          (IPR7) (0=no, 1=yes)             Default: 0       ! IPR7 = 0 !

          Print the FINAL wind field components ?
          (IPR8) (0=no, 1=yes)             Default: 0       ! IPR8 = 1 !

!END!


------------------------------------------------------------------------
------

INPUT GROUP: 4 -- Meteorological data options
--------------
```

```
    NO OBSERVATION MODE              (NOOBS)  Default: 0     ! NOOBS = 2 !
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air
observations)
              Use MM4/MM5/3D.DAT for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D.DAT for surface, overwater, and upper air
data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations    (NSSTA)  No default     * NSSTA = 0 *

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D.DAT precip data)
                                     (NPSTA)  No default     ! NPSTA = -1
!

    CLOUD DATA OPTIONS
       Gridded cloud fields:
                                   (ICLOUD)  Default: 0     ! ICLOUD = 4
!
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
       ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity
                    at 850mb (Teixera)
       ICLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity
                    at all levels (MM5toGrads algorithm)

    FILE FORMATS

       Surface meteorological data file format
                                   (IFORMS)  Default: 2     ! IFORMS = 2
!
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                   (IFORMP)  Default: 2     ! IFORMP = 2
!
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                   (IFORMC)  Default: 2     ! IFORMC = 2
!
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!


------------------------------------------------------------------------
------
```

```
INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD = 1
!
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ = 1
!
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE = 0
!
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR = 0 !
       (0 = NO, 1 = YES)

       Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE = 1
!
       (0 = NO, 1 = YES)

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP = 1
!
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
        4 = similarity theory used
        -1, -2, -3, -4 = same as above except layer 1 data
            at upper air stations are ignored

       Extrapolate surface winds even
       if calm? (ICALM)                      Default: 0      ! ICALM = 0
!
       (0 = NO, 1 = YES)

       Layer-dependent biases modifying the weights of
       surface and upper air stations (BIAS(NZ))
         -1<=BIAS<=1
       Negative BIAS reduces the weight of upper air stations
         (e.g. BIAS=-0.1 reduces the weight of upper air stations
       by 10%; BIAS= -1, reduces their weight by 100 %)
       Positive BIAS reduces the weight of surface stations
         (e.g. BIAS= 0.2 reduces the weight of surface stations
       by 20%; BIAS=1 reduces their weight by 100%)
       Zero BIAS leaves weights unchanged (1/R**2 interpolation)
       Default: NZ*0
       ! BIAS =  -1,-1,-1,-1,-1,-1,-0.8,-0.3,0.3,0.7,1,1  !
```

```
       Minimum distance from nearest upper air station
       to surface station for which extrapolation
       of surface winds at surface station will be allowed
       (RMIN2: Set to -1 for IEXTRP = 4 or other situations
        where all surface stations should be extrapolated)
                                            Default: 4.    ! RMIN2 = 4
!

       Use gridded prognostic wind field model
       output fields as input to the diagnostic
       wind field model (IPROG)             Default: 0      ! IPROG = 14
!
       (0 = No, [IWFCOD = 0 or 1]
        1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
        2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD =
1]
        3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]
        4 = Yes, use winds from MM4.DAT file as initial guess field
[IWFCOD = 1]
        5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]
        13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD
= 0]
        14 = Yes, use winds from MM5/3D.DAT file as initial guess field
[IWFCOD = 1]
        15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD
= 1]

       Timestep (ore) of the prognostic
       model input data   (ISTEPPGS)        Default: 1   ! ISTEPPGS =
3600 !


       Use coarse CALMET fields as initial guess fields (IGFMET)
       (overwrites IGF based on prognostic wind fields if any)
                                            Default: 0      ! IGFMET = 0
!

    RADIUS OF INFLUENCE PARAMETERS

       Use varying radius of influence      Default: F      ! LVARY = T
!
       (if no stations are found within RMAX1,RMAX2,
        or RMAX3, then the closest station will be used)

       Maximum radius of influence over land
       in the surface layer (RMAX1)         No default      ! RMAX1 = 1
!
                                            Units: km
       Maximum radius of influence over land
       aloft (RMAX2)                        No default      ! RMAX2 = 1
!
                                            Units: km
       Maximum radius of influence over water
       (RMAX3)                              No default      ! RMAX3 = 1
!
                                            Units: km
```

```
    OTHER WIND FIELD INPUT PARAMETERS

       Minimum radius of influence used in
       the wind field interpolation (RMIN)   Default: 0.1    ! RMIN = 0.1
!
                                             Units: km
       Radius of influence of terrain
       features (TERRAD)                     No default      ! TERRAD =
1.5 !

                                             Units: km
       Relative weighting of the first
       guess field and observations in the
       SURFACE layer (R1)                    No default      ! R1 = 1 !
       (R1 is the distance from an           Units: km
       observational station at which the
       observation and first guess field are
       equally weighted)

       Relative weighting of the first
       guess field and observations in the
       layers ALOFT (R2)                     No default      ! R2 = 5 !
       (R2 is applied in the upper layers    Units: km
       in the same manner as R1 is used in
       the surface layer).

       Relative weighting parameter of the
       prognostic wind field data (RPROG)    No default      ! RPROG = 0
!
       (Used only if IPROG = 1)              Units: km
       ------------------------

       Maximum acceptable divergence in the
       divergence minimization procedure
       (DIVLIM)                              Default: 5.E-6  ! DIVLIM =
5.0E-6 !

       Maximum number of iterations in the
       divergence min. procedure (NITER)     Default: 50     ! NITER = 50
!

       Number of passes in the smoothing
       procedure (NSMTH(NZ))
       NOTE: NZ values must be entered
            Default: 2,(mxnz-1)*4
       ! NSMTH = 2,4,4,4,4,4,4,4,4,4,4,4  !

       Maximum number of stations used in
       each layer for the interpolation of
       data to a grid point (NINTR2(NZ))
       NOTE: NZ values must be entered       Default: 99.
       ! NINTR2 = 50,50,50,50,50,50,50,50,50,50,50,50  !
```

```
       Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN = 1
!

       Empirical factor controlling the
       influence of kinematic effects
       (ALPHA)                               Default: 0.1    ! ALPHA =
0.1 !

       Multiplicative scaling factor for
       extrapolation of surface observations
       to upper layers (FEXTR2(NZ))          Default: NZ*0.0
       ! FEXTR2 = 0,0,0,0,0,0,0,0,0,0,0,0 !
       (Used only if IEXTRP = 3 or -3)


    BARRIER INFORMATION

       Number of barriers to interpolation
       of the wind fields (NBAR)             Default: 0      ! NBAR = 0 !

       Level (1 to NZ) up to which barriers
       apply (KBAR)                          Default: NZ     ! KBAR = 12
!

       THE FOLLOWING 4 VARIABLES ARE INCLUDED
       ONLY IF NBAR > 0
       NOTE: NBAR values must be entered     No defaults
             for each variable               Units: km

          X coordinate of BEGINNING
          of each barrier (XBBAR(NBAR))      ! XBBAR =  !
          Y coordinate of BEGINNING
          of each barrier (YBBAR(NBAR))      ! YBBAR =  !

          X coordinate of ENDING
          of each barrier (XEBAR(NBAR))      ! XEBAR =  !
          Y coordinate of ENDING
          of each barrier (YEBAR(NBAR))      ! YEBAR =  !


    DIAGNOSTIC MODULE DATA INPUT OPTIONS

       Surface temperature (IDIOPT1)         Default: 0      ! IDIOPT1 =
0 !
          0 = Compute internally from
              hourly surface observations or prognostic fields
          1 = Read preprocessed values from
              a data file (DIAG.DAT)

          Surface met. station to use for
          the surface temperature (ISURFT)   Default: -1     ! ISURFT = -1
!
          (Must be a value from 1 to NSSTA,
           or -1 to use 2-D spatially varying
              surface temperatures,
           or -2 to use a domain-average prognostic
```

```
            surface temperatures (only with ITPROG=2))
         (Used only if IDIOPT1 = 0)
         --------------------------

      Temperature lapse rate used in the    Default: 0     ! IDIOPT2 = 0
!
         computation of terrain-induced
         circulations (IDIOPT2)
         0 = Compute internally from (at least) twice-daily
             upper air observations or prognostic fields
         1 = Read hourly preprocessed values
             from a data file (DIAG.DAT)

         Upper air station to use for
         the domain-scale lapse rate (IUPT) Default: -1    ! IUPT = -1 !
         (Must be a value from 1 to NUSTA,
          or -1 to use 2-D spatially varying lapse rate,
          or -2 to use a domain-average prognostic
             lapse rate (only with ITPROG>0))
         (Used only if IDIOPT2 = 0)
         --------------------------

         Depth through which the domain-scale
         lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT = 200
!
         (Used only if IDIOPT2 = 0)         Units: meters
         --------------------------

      Initial Guess Field Winds
      (IDIOPT3)                             Default: 0     ! IDIOPT3 = 0
!
         0 = Compute internally from
             observations or prognostic wind fields
         1 = Read hourly preprocessed domain-average wind values
             from a data file (DIAG.DAT)

         Upper air station to use for
         the initial guess winds (IUPWND)   Default: -1    ! IUPWND = -1
!
         (Must be a value from -1 to NUSTA, with
         -1 indicating 3-D initial guess fields,
         and IUPWND>1 domain-scaled (i.e. constant) IGF)
         (Used only if IDIOPT3 = 0 and noobs=0)
         --------------------------------------

         Bottom and top of layer through
         which the domain-scale winds
         are computed
         (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND=
1.0, 1000. !
         (Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>0)    Units:
meters
         --------------------------

      Observed surface wind components
      for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 = 0 !
```

```
          0 = Read WS, WD from a surface
              data file (SURF.DAT)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       Observed upper air wind components
       for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 = 0 !
          0 = Read WS, WD from an upper
              air data file (UP1.DAT, UP2.DAT, etc.)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       LAKE BREEZE INFORMATION

          Use Lake Breeze Module  (LLBREZE)
                                          Default: F      ! LLBREZE = F
!

           Number of lake breeze regions (NBOX)            ! NBOX = 0 !

        X Grid line 1 defining the region of interest
                                                          ! XG1 =  !
        X Grid line 2 defining the region of interest
                                                          ! XG2 =  !
        Y Grid line 1 defining the region of interest
                                                          ! YG1 =  !
        Y Grid line 2 defining the region of interest
                                                          ! YG2 =  !

         X Point defining the coastline (Straight line)
                   (XBCST)  (KM)   Default: none    ! XBCST =  !

         Y Point defining the coastline (Straight line)
                   (YBCST)  (KM)   Default: none    ! YBCST =  !

         X Point defining the coastline (Straight line)
                   (XECST)  (KM)   Default: none    ! XECST =  !

         Y Point defining the coastline (Straight line)
                   (YECST)  (KM)   Default: none    ! YECST =  !


       Number of stations in the region     Default: none ! NLB =  !
       (Surface stations + upper air stations)

       Station ID's  in the region   (METBXID(NLB))
       (Surface stations first, then upper air stations)
         ! METBXID =  !

!END!


------------------------------------------------------------------------
------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters
```

```
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                          Default: 1.41   ! CONSTB =
1.41 !
       Convective mixing ht. equation
       (CONSTE)                          Default: 0.15   ! CONSTE =
0.15 !
       Stable mixing ht. equation
       (CONSTN)                          Default: 2400.  ! CONSTN =
2400 !
       Overwater mixing ht. equation
       (CONSTW)                          Default: 0.16   ! CONSTW =
0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)               Default: 1.E-4  ! FCORIOL =
0.0001 !
                                         Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)           Default: 1      ! IAVEZI = 1
!

       Max. search radius in averaging
       process (MNMDAV)                  Default: 1      ! MNMDAV = 1
!
                                         Units: Grid
                                                cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)            Default: 30.    ! HAFANG =
30 !
                                         Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                Default: 1      ! ILEVZI = 1
!
       (must be between 1 and NZ)


    CONVECTIVE MIXING HEIGHT OPTIONS:
       Method to compute the convective
       mixing height(IMIHXH)             Default: 1      ! IMIXH = 1
!
          1: Maul-Carson for land and water cells
         -1: Maul-Carson for land cells only -
             OCD mixing height overwater
          2: Batchvarova and Gryning for land and water cells
         -2: Batchvarova and Gryning for land cells only
             OCD mixing height overwater

       Threshold buoyancy flux required to
       sustain convective mixing height growth
```

```
       overland (THRESHL)                    Default: 0.0    ! THRESHL =
0 !
       (expressed as a heat flux             units: W/m3
        per meter of boundary layer)


       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overwater (THRESHW)                   Default: 0.05   ! THRESHW =
0.05 !
       (expressed as a heat flux             units: W/m3
        per meter of boundary layer)


       Option for overwater lapse rates used
       in convective mixing height growth
       (ITWPROG)                             Default: 0      ! ITWPROG =
2 !
       0 : use SEA.DAT lapse rates and deltaT (or assume neutral
           conditions if missing)
       1 : use prognostic lapse rates (only if IPROG>2)
           and SEA.DAT deltaT (or neutral if missing)
       2 : use prognostic lapse rates and prognostic delta T
           (only if iprog>12 and 3D.DAT version# 2.0 or higher)

       Land Use category ocean in 3D.DAT datasets
       (ILUOC3D)                             Default: 16     ! ILUOC3D =
17 !
       Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
             if MM4.DAT,           typically iluoc3d = 7


    OTHER MIXING HEIGHT VARIABLES

       Minimum potential temperature lapse
       rate in the stable layer above the
       current convective mixing ht.         Default: 0.001  ! DPTMIN =
0.001 !
       (DPTMIN)                              Units: deg. K/m
       Depth of layer above current conv.
       mixing height through which lapse     Default: 200.   ! DZZI = 200
!
       rate is computed (DZZI)               Units: meters

       Minimum overland mixing height        Default:  50.   ! ZIMIN = 50
!
       (ZIMIN)                               Units: meters
       Maximum overland mixing height        Default: 3000.  ! ZIMAX =
3000 !
       (ZIMAX)                               Units: meters
       Minimum overwater mixing height       Default:   50.  ! ZIMINW =
50 !
       (ZIMINW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)
       Maximum overwater mixing height       Default: 3000.  ! ZIMAXW =
3000 !
```

```
       (ZIMAXW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)


    OVERWATER SURFACE FLUXES METHOD and PARAMETERS
          (ICOARE)                          Default: 10      ! ICOARE =
10 !
           0: original deltaT method (OCD)
          10: COARE with no wave parameterization (jwave=0, Charnock)
          11: COARE with wave option jwave=1 (Oost et al.)
              and default wave properties
         -11: COARE with wave option jwave=1 (Oost et al.)
              and observed wave properties (must be in SEA.DAT files)
          12: COARE with wave option 2 (Taylor and Yelland)
               and default wave properties
         -12: COARE with wave option 2 (Taylor and Yelland)
              and observed wave properties (must be in SEA.DAT files)

           Note:  When ICOARE=0, similarity wind profile stability PSI
functions
                  based on Van Ulden and Holtslag (1985) are substituted
for
                  later formulations used with the COARE module, and
temperatures
                  used for surface layer parameters are obtained from
either the
                  nearest surface station temperature or prognostic model
2D
                  temperatures (if ITPROG=2).


          Coastal/Shallow water length scale (DSHELF)
          (for modified z0 in shallow water)
          ( COARE fluxes only)
                                        Default : 0.        ! DSHELF =
0 !
                                        units: km

           COARE warm layer computation (IWARM)             ! IWARM = 0
!
           1: on - 0: off (must be off if SST measured with
           IR radiometer)               Default: 0

           COARE cool skin layer computation (ICOOL)        ! ICOOL = 0
!
           1: on - 0: off (must be off if SST measured with
           IR radiometer)               Default: 0

    RELATIVE HUMIDITY PARAMETERS

       3D relative humidity from observations or
       from prognostic data? (IRHPROG)      Default:0        ! IRHPROG =
1 !

          0 = Use RH from SURF.DAT file
              (only if NOOBS = 0,1)
```

```
          1 = Use prognostic RH
              (only if NOOBS = 0,1,2)

    TEMPERATURE PARAMETERS

       3D temperature from observations or
       from prognostic data? (ITPROG)        Default:0        ! ITPROG =
2 !

          0 = Use Surface and upper air stations
              (only if NOOBS = 0)
          1 = Use Surface stations (no upper air observations)
              Use MM5/3D.DAT for upper air data
              (only if NOOBS = 0,1)
          2 = No surface or upper air observations
              Use MM5/3D.DAT for surface and upper air data
              (only if NOOBS = 0,1,2)

       Interpolation type
       (1 = 1/R ; 2 = 1/R**2)                Default:1         ! IRAD = 1
!

       Radius of influence for temperature
       interpolation (TRADKM)                Default: 500.     ! TRADKM =
500 !
                                             Units: km

       Maximum Number of stations to include
       in temperature interpolation (NUMTS)  Default: 5        ! NUMTS =
5 !

       Conduct spatial averaging of temp-
       eratures (IAVET)  (0=no, 1=yes)       Default: 1        ! IAVET =
1 !
       (will use mixing ht MNMDAV,HAFANG
        so make sure they are correct)

       Default temperature gradient          Default: -.0098 ! TGDEFB = -
0.0098 !
       below the mixing height over          Units: K/m
       water (TGDEFB)

       Default temperature gradient          Default: -.0045 ! TGDEFA = -
0.0045 !
       above the mixing height over          Units: K/m
       water (TGDEFA)

       Beginning (JWAT1) and ending (JWAT2)
       land use categories for temperature                   ! JWAT1 =
999 !
       interpolation over water -- Make                      ! JWAT2 =
999 !
       bigger than largest land use to disable

   PRECIP INTERPOLATION PARAMETERS
```

```
       Method of interpolation (NFLAGP)      Default: 2       ! NFLAGP =
3 !
        (1=1/R,2=1/R**2,3=EXP/R**2)
       Radius of Influence  (SIGMAP)         Default: 100.0 ! SIGMAP = 6.
!
        (0.0 => use half dist. btwn          Units: km
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (CUTP)    Default: 0.01 ! CUTP = 0.01
!
        (values <CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


------------------------------------------------------------------------
------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station --  12  records in all)


            1     2
        Name     ID     X coord.   Y coord.    Time   Anem.
                          (km)       (km)       zone   Ht.(m)
       ------------------------------------------------------------

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit integer for station ID

!END!


------------------------------------------------------------------------
------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  3  records in all)

            1     2
        Name    ID      X coord.   Y coord.  Time zone
                          (km)       (km)
       ---------------------------------------------

-------------------
      1
```

```
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!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------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  2  records in all)
     (NOT INCLUDED IF NPSTA = 0)

           1          2
        Name   Station    X coord.  Y coord.
                 Code       (km)      (km)
        ------------------------------------


-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

ALLEGATO 10 – input LAPMOD

```
        *************************
        *** LAPMOD INPUT FILE ***
        *** version  20200813 ***
        *************************
Modello con lpeak dinamico disattivato

 LAPMOD is copyright Enviroware srl (www.enviroware.com)


**********************
*** RUN PARAMETERS ***
**********************

1. ! IDINIS(6) = 2020 01 01 00 00 00 !        Initial time of simulation
                                            (YYYY MM DD HH MI SS)

2. ! IDFINS(6) = 2020 12 31 23 00 00 !        Final time of simulation
                                            (YYYY MM DD HH MI SS)

3. ! LDEPD = F !             Logical flag for dry deposition calculation


4. ! LDEPW = F !             Logical flag for wet deposition calculation

*******************
*** METEOROLOGY ***
*******************

NMET is the number of CALMET meteorological files to be used for the
LAPMOD simulation. If NMET=1, then the CALMET file name must be written
in FMET. If NMET > 1, then FMET must contain the name of a file which
will contain the list of the NMET CALMET files to read.

5. ! NMET = 1 !

FMET is the file for meteorology if NMET=1.
This file must be created by the diagnostic meteorological model CALMET.
The coordinates of the origin, the number of grids along X and Y, the
topography, roughness length and other variables will be read from this
file.
Optionally, the PREMET preprocessor can be used to construct a meteo
input file with the same structure of CALMET output, with constant
meteorology (e.g. for flat terrain)

If NMET > 1, FMET is a file which contains a list of NMET CALMET files.

6. ! FMET = inp\calmet.dat !

7. ! CLMVRS = 6.5.0 !   CALMET version (5.2 or 5.53a or 5.8.4 or 5.8.5 or
6.5.0)

8. ! ITDMRD = 3600 !   Time step to read meteorology (s).
                          NOTE that if the meteorological file is
produced
                          using CALMET this step must be 3600 s.
```

```
9. ! ITDMIRD  = 600 !  Time step to interpolate meteorology (s) between
two
                    CALMET output times.

10. ! LNOW = F !  Logical flag to suppress the vertical component of the
wind speed
                   deriving from CALMET or MMIF. TRUE to suppress.


*****************
*** EMISSIONS ***
*****************

11. ! FEMI = Inp\sources.inp !

12. ! LFEMIASC = T !

NPART is the number of particles emitted each 60 seconds per
- source
- species
- bin (if aerosol)

13. ! NPART = 60 !

File containing substance properties
14. ! FSUB = inp\lapmod_substances.dat !

15. ! IPRTYPE = 1 ! Plume rise type: 1 Janicke and Janicke; 2 Webster and
Thomson

Entrainment type to apply to the plume rise phase.
IENTR used only if IPRTYPE=1 (Janicke and Janicke)
1 - Janicke and Janicke (2001)
2 - Rezacova and Sokol (2000)
3 - Orville, Hirsch and May (1980)

16. ! IENTR = 1 !

Entrainment coefficients (A1,A2,A3 and drag coefficient CD
to apply to the plume rise phase.
Used only if IPRTYPE=2 (Webster and Thomson)
A1 and A2 are the coefficients for the entrainment due to the
relative motion of the plume and ambient air. A3 is the coefficient
for the entrainment due to ambient turbulence.

ADMS uses A1=0.057  A2=0.50 (A1 criticised by WT)
TAPM uses A1=0.100  A2=0.60
Other values of A1 and A2 are reported in the following table (table 1 of
WT, 2002).

Met. conditions                    Momentum dominated plume     Buoyancy
dominated plume
-------------------------------    ------------------------     ---------
---------------
```

```
Strong ambient wind (bent over)    A2=0.35 (Briggs)             A2=0.61
(Briggs)
Zero stratification                A2=0.60 (Weil)               A2=0.6
(Weil)

No ambient wind (vertical plume)   A1=0.11 (Weil)               A1=0.125
(Briggs)
Zero stratification                                             A1=0.11
(Weil)

Strong ambient wind                A2=0.6 (Weil)                A2=0.6
(Weil)
Stable stratification

Suggested value for A1 is 0.110
Suggested value for A2 is 0.500
Suggested value for A3 is 0.655
Suggested value for CD is 0.21

17. ! A1 = 0.110 !
18. ! A2 = 0.500 !
19. ! A3 = 0.655 !
20. ! CD = 0.21 !

Logical flag for considering stack tip downwash.

21. ! LSTD = F !

Logical flag for considering partial plume penetration of
elevated inversions.

22. ! LPPP = T !

Logical flag for considering plume induce turbulence
during plume rise.

23. ! LPIT = T !

**************************
*** GENERAL PARAMETERS ***
**************************

The Kolmogorov "constant" ranges between 2 and 7.

C0=2.0 - Luhar and Britter (1989) Atmos. Environ. 23, 1911
C0=3.0 - Du et al. (1995) Phys. Fluids 7, 3083-3090
C0=5.7 (neutral flows) - Rodean (1991) Phys. Fluids A 3, 1479
C0=7.0 - Sawford (1991) Phys. Fluids A 3, 1577

24. ! C0 = 3.0 !

ISRCATR is the numerical flag for activating the source attribution
algorithm (1 activate; any other number does not activate).
Such algorithm requires a single discrete receptor. The output on
the regular receptors is always produced, but it refers to the
total effect of all the sources.
```

25. ! ISRCATR = 0 !

****
*** OUTPUT PARAMETERS ***
****

The LAPMOD output domain, where concentrations and depositions are calculated,
is expressed by means of the lower left and upper right (in this precise order) coordinates. The size of the square grid is also required. All the values must be
expressed in meters. The output domain coordinates must be in the same UTM
zone as the CALMET coordinates.
Coordinates and grid resolution must be written as real numbers.

26. ! OUTCOO = 641800. 4933050. 645000. 4936250. !

By setting a negative value for the grid resolution, output on grid is suppressed and
Concentrations are computed for receptors, if they are defined.

27. ! OUTGRID = 100.0 !

ZCOO is the height a.g.l. (m) at which concentrations must be calculated.
If the value is negative, LAPMOD calculates the concentration at 0m, 2m and in
the middle of the CALMET vertical levels.
The height is added to output filenames.

28. ! ZCOO = 2. !

29. ! IDINIC(6) = 2020 01 01 01 00 00 ! Time of first output
(YYYY MM DD HH MI SS)

30. ! IDTORD = 3600 ! Time step (s) for output (depositions, integrated concentration, instantaneous concentration)

Time step for writing particle files (e.g. 3600).
Write a negative number if particle files are not desired.

31. ! IDTORP = 1800 !

Number of concentration samplings between two concentration outputs

32. ! NSAM = 6 !

When sampling is made between two concentration outputs, the concentration
written on file can be the average of the samplings or the maximum among samples.
Otherwise it must be 1.

1 - Concentration is the average among samples

```
 2 - Concentration is the maximum among samples

33. ! SAMTYPE = 1  !

CCA (Concentration Calculation Algorithm) is a numerical flag indicating
the algorithm to be used for calculating concentrations:
 1 - Classical LAPMOD method
 2 - Uliasz uniform kernel
 3 - Uliasz parabolic kernel
 4 - Enviroware kernel - costant area of influence
 5 - Enviroware kernel - time-variable area of influence

34. ! CCA = 5 !

SIGNUM is the number of sigmas units that define the volume associated to
each particle. It is also the number of sigmas to search for contributing
particles to receptors.
Used for CCA = 1, 4, 5.

35. ! SIGNUM = 3 !

AGELIM is the minimum age (s) that a particle must have in order to
apply the kernel for calculating the concentrations. The mass of
particles younger than AGELIM is assigned to the cell where the
particle is located, in order to avoid the smoothing effect of the
kernel. To avoid the use of AGELIM, put it equal 0.
AGELIM values depend on the output cell size and on the typical wind
speed.
Used for CCA = 2, 3.

36. ! AGELIM = 3600. !

BMFU (Bandwiths Multplication Factors Uniform) are the multiplication
factors used in the uniform kernel. It must be a tern of numbers,
one for each direction. Typical values are 0.5 (for each direction).
Used for CCA = 2.

37. ! BMFU = 0.5 0.5 0.5   !

HXA, HXB and HXC are the coefficients for the calculation of the
bandwidth of the parabolic kernel along X. It is calculated as
HX = HXA + HXB * SQRT(t) + HXC * t
where t is the particle age (s) and DX is the grid amplitude
along X (m).
Used for CCA = 3.

38. ! HXA HXB HXC = 5. 40. 0.75 !

HYA, HYB and HYC are the coefficients for the calculation of the
bandwidth of the parabolic kernel (CCA=3) along Y. It is calculated as
HY = HYA + HYB * SQRT(t) + HYC * t
where t is the particle age (s) and DY is the grid amplitude
along Y (m).
Used for CCA = 3.

39. ! HYA HYB HYC = 1.0 16.7 0.278 !
```

```
HZA and HZB are the coefficients for the calculation of the
bandwidth of the parabolic kernel (CCA=3) along Z. It is calculated as
HZ = HZA + HZB * SQRT(t)
where t is the particle age (s).
Used for CCA = 3.

40. ! HZA HZB = 10. 16.5 !

BWMAX (Maximum bandwidths) are the maximum values (m) that the
bandwidths can assume when using the parabolic kernel (CCA=3).
Typical values are of the order of 10^5 m for the horizontal
directions, and 10^2 or 10^3 for the vertical.
Used for CCA = 3.

41. ! BWMAX = 1000. 1000. 1000.   !

SIGMAX is the maximum extension (m) of the horizontal sigmas.
Values greater than SIGMAX will be truncated to SIGMAX.
Used for CCA = 1, 4, 5.

42. ! SIGMAX = 1000.0  !


*****************************
*** PEAK-TO-MEAN MODELING ***
*****************************

LPEAK is a logical variable to request the calculation of peak
concentrations.
The peak value is calculated within LAPMOD as peak-to-mean corrected
value according
to Smith (1973) with stability-dependent exponents and using Lagrangian
time dependent relaxing function by Mylne (1991).

This is typical for odors or flammable/explosive substances.
If this flag is set to true, the postprocessing with a RMUL input
different than 0 is prevented.

When setting LPEAK = T, NSAM must be a positive value.
43. ! LPEAK = F !
TPEAK is the short period tp in Smith's equation for the peak-to-mean
ratio.
As described in the manual, the value suggested by Shauberger et al
(2000),
based on Mylne's (1990) measurements, is 5 seconds.
THis variable is used if IODOR = 1.

44. ! TPEAK = 5. !
**********************
*** OUTPUT OPTIONS ***
**********************
45. ! LINTER = T !       Logical flag for intermediate output on file
                                (T for writing)

46. ! LMETER = T !       Logical flag for coordinates in output files
```

```
                                (T = meters, F  =kilometers)

File of discrete receptors.
Write NO if discrete receptors are not used.
Inp\receptors.inp
47. ! RECFILE = Inp\receptors.inp  !

Output directory

48. ! OUTDIR = out\ !

LCBIN is used to produce binary (T) or ASCII (F) output CONCENTRATION
files.

49. ! LCBIN = T !

LDBIN is used to produce binary (T) or ASCII (F) output DEPOSITION files.

50. ! LDBIN = T !

LPBIN is used to produce binary (T) or ASCII (F) output PARTICLES files.

51. ! LPBIN = T !

IPTCFMT is used to specify the variables to store within the binary
output
file with particles. Allowed values are:
       1 - Save only X, Y and Z of each particle
       2 - As 1, plus particle age and mass
       3 - Save all particle-related variables
       4 - As 3, plus the meteorology "felt" by each particle
The size of the particle binary output file increases with the value of
IPCTFMT

52. ! IPTCFMT = 1 !

Logical flag for GRD file type (T = Esri, F = Surfer)

53. ! LESRI = F !

Multiplication factor to apply to the output (concentration and
deposition).
For example, if release rate is in g/s, a multiplication factor of 1 will
give
concentrations in g/m3, while a multiplication factor of 1.E6 will give
concentrations in ug/m3.

54. ! FACMUL = 1.0 !

Logical flag indicating to write plume properties for each buoyant source
(if TRUE)

55. ! LPR = F !
```

ALLEGATO 11 – input LAPOST

```
        **********************************
        ***    LAPOST INPUT FILE       ***
        *** LAPOST Version 20161007    ***
        **********************************

 LAPOST is the LAPMOD postprocessor: it reads the binary concentration
 file and calculates the statistical parameters of interest, or
 extracts specific time intervals.

**************
*** OUTPUT ***
**************

All the output files and the log file will be written
in the following output directory (which must exist).

! OUTDIR = Out\ !

The log file will contain informative messages and
possible errors. Only the name is needed.

! LOGFIL = lapost_conc.log !

The output file can be written as ASCII GRD files of SURFER,
or as ASCII ESRI GRD files.

! LESRI = F !


******************
*** PARAMETERS ***
******************

The following flag indicates where the processor is working.
IWINDOWS=1 for Windows; IWINDOWS<>1 for Linux/Unix.

! IWINDOWS = 1 !

LAPMOD binary output file with concentration values

! LAPBIN = conc.bin !

Multiplication factor to apply to the concentrations

! RMULT = 1.0 !

Species to extract. It must be contained within the LAPMOD
binary output file.

! SPECIES = ODOR !

SPECIES is not important to extract particles from their
binary file. For particles only the next group of
input variables (EXTRACTOR) is used. Output file format for
```

particles is always CSV.

****
*** EXTRACTOR ***
****

Each single hour can be extracted if IEXTR=1
The user must be aware that, potentially, thousands of file may be produced.

! IEXTR = 0 !

The first hour to extract is specified in XTRINI (YYYY MM DD HH)

! XTRINI = 2020 01 01 00 !

The last hour to extract is specified in XTRFIN (YYYY MM DD HH)

! XTREND = 2020 12 31 23 !

To extract all the output hours XTRINI must preceed, or be equal to, the first
output hour of LAPMOD and XTRFIN must follow, or be equal to, the last output
hour of LAPMOD.

The extraction procedure can be used for all the output variables,
not only concentrations. When LAPOST is used, for example, for dry deposition,
the processing for odours or percentiles have no meaninig, therefore they must
be deactivated by means of this input file.

The output file has always the following name: VVVV_SSS_YYYYMMDDhhmm.EXT
where
- VVVV is the variable abbreviation (conc, tcon, ddep, tdep, wdep,ptcs)
- SSS is the species name (ANY when particles are extracted),
- YYYYMMDDhhmm is the date string,.
- EXT is the extension. It is CSV if the following variable LCSV is T, otherwise it follows LESRI. For particles only CSV files are produced.

! LCSV = F !

****
*** ODORS ***
****

Logical flag which specifies if processing for odours
must be carried out.
If this flag is TRUE (T), it requires that IMH=1, and the
odour threshold must be specified in CMH.

! LODOR = T !

VPCT_D is the value of the percentile of episode duration

to be calculated. (Used only if LODOR = T and IMH = 1).

! VPCT_D = 98.00 !

NAME (no path, no extension) of the output file with maximum
duration. (Used only if LODOR = T and IMH = 1).
Write NO as name if this file must not be produced.

! FOUT_MAXD = Max_dur !

NAME (no path, no extension) of the output file with the specified
percentile of durations. (Used only if LODOR = T and IMH = 1).
Write NO as name if this file must not be produced.

! FOUT_PCTD = Max_percentile_odor !

****
*** PROCESSING ***
****

--- 1 HOUR AVERAGES ---

Maximum 1 hour concentrations and percentile of 1 hour concentrations
will be calculated if IMH=1.

! IMH = 1 !

VPCT_MH is the value of the percentile of 1 hour concentrations
to be calculated. (Used only if IMH = 1).

! VPCT_MH = 98.0 !

Limit value of the 1h concentrations. Exceedances from this value
will be calculated. (Used only if IMH = 1).

! CMH = 1.0 !

Order of the hourly maximum to extract: 1 for extracting the first
hourly max in each cell; 2 to extract the second; etc.
(Used only if IMH = 1).

! IMAXH = 1 !

NAME (no path, no extension) of the output file with maximum 1h
concentrations. (Used only if IMH = 1).

! FOUT_MAXH = maxh_out !

NAME (no path, no extension) of the output file with the specified
percentile of 1h concentrations. (Used only if IMH = 1).

! FOUT_PCTH = percentile_1_ora !

```
   ------------------------
   --- 24 HOUR AVERAGES ---
   ------------------------

Maximum 24 hour concentrations and percentile of 24 hour concentrations
will be calculated if IMG=1.

! IMG = 0 !

VPCT_MG is the value of the percentile of 24 hour concentrations
to be calculated. (Used only if IMG = 1).

! VPCT_MG = 98.0 !

Limit value of the 24 h concentrations. Exceedances from this value
will be calculated. (Used only if IMG = 1).

! CMG = 50. !

Order of the daily maximum to extract: 1 for extracting the first
daily max in each cell; 2 to extract the second; etc.
(Used only if IMG = 1).

! IMAXG = 1 !

NAME (no path, no extension) of the output file with maximum 24h
concentrations. (Used only if IMG = 1).

! FOUT_MAXG = dummy.out !

NAME (no path, no extension) of the output file with the specified
percentile of 24h concentrations. (Used only if IMG = 1).

! FOUT_PCTG = dummy.out !

   ------------------------------
   --- 8 HOUR RUNNING AVERAGES ---
   ------------------------------

Maximum 8 hour running averages will be calculated if IM8=1.

! IM8 = 0 !

Limit value of the 8 h running averages. Exceedances from this value
will be calculated. (Used only if IM8 = 1).

! CM8 = 1. !

NAME (no path, no extension) of the output file with 8 h running
averages.
(Used only if IM8 = 1).

! FOUT_MAX8 = dummy.out !

   ----------------------
```

```
   --- ANNUAL AVERAGES ---
   ----------------------

Annual averages will be calculated if IMA=1.

! IMA = 1 !

NAME (no path, no extension) of the output file with annual mean
concentrations. (Used only if IMA = 1).

! FOUT_YEAR = 2020_out !
```

ALLEGATO 12 – input CALPUFF - esempio

```
CALPUFF.INP     7.01            AGDISP SPRAY Source Added
CALPUFF Demonstration Run
(Not intended as a guide for configuring options)

---------- Run title (3 lines) ------------------------------------------
  MODEL:  Version 7.3.0
  DEMONSTRATION FILE
------------------------------------------------------------------------------

                CALPUFF MODEL CONTROL FILE
                --------------------------

------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------
pagina 482 manuale lista veloce
Default Name  Type          File Name
------------  ----          ---------
input meteo
CALMET.DAT    input    ! METDAT =inp\CALMET.DAT   !
   or
ISCMET.DAT    input    * ISCDAT =            *
   or
PLMMET.DAT    input    * PLMDAT =            *
   or
PROFILE.DAT   input    * PRFDAT =            *
SURFACE.DAT   input    * SFCDAT =            *
RESTARTB.DAT  input    * RSTARTB=            *
------------------------------------------------------------------------------
```

CALPUFF.LST output ! PUFLST =out\listato.LST !

CONC.DAT output ! CONDAT =out\Concentration.CON !

DFLX.DAT output * DFDAT =out\CALPUFF.DRY * deposizione secca

WFLX.DAT output * WFDAT = * deposizione umida

VISB.DAT output * VISDAT = *

TK2D.DAT output * T2DDAT = *

RHO2D.DAT output * RHODAT = *

RESTARTE.DAT output * RSTARTE= *

Other Files

OZONE.DAT input * OZDAT = *

VD.DAT input * VDDAT = *

CHEM.DAT input * CHEMDAT= *

AUX input * AUXEXT = *

(Extension added to METDAT filename(s) for files

with auxiliary 2D and 3D data)

H2O2.DAT input * H2O2DAT= *

NH3Z.DAT input * NH3ZDAT= *

HILL.DAT input * HILDAT= *

HILLRCT.DAT input * RCTDAT= *

COASTLN.DAT input * CSTDAT= *

FLUXBDY.DAT input * BDYDAT= *

BCON.DAT input * BCNDAT= *

DEBUG.DAT output ! DEBUG = out\DEBUG.DAT !

MASSFLX.DAT output * FLXDAT= *

MASSBAL.DAT output ! BALDAT= out\MASSBAL.DAT !

FOG.DAT output * FOGDAT= *

RISE.DAT output * RISDAT= *

PFTRAK.DAT output * TRKDAT= out\PFTRAK.trk *

All file names will be converted to lower case if LCFILES = T

Otherwise, if LCFILES = F, file names will be converted to UPPER CASE

T = lower case ! LCFILES = T !

F = UPPER CASE

NOTE: (1) file/path names can be up to 132 characters in length

Provision for multiple CALMET Domains and files

Number of CALMET.DAT Domains (NMETDOM)

Default: 1 ! NMETDOM = 1 !

Number of CALMET.DAT files (NMETDAT)

(Total for ALL Domains)

Default: 1 ! NMETDAT = 1 !

Variable point/area/volume/flare emissions input files

Number of POINT source files (PTEMARB.DAT)

with time-varying data (NPTDAT)

Default: 0 ! NPTDAT = 0 !

Number of BUOYANT AREA source files (BAEMARB.DAT)

with time-varying data (NARDAT)

Default: 0 ! NARDAT = 0 !

Number of VOLUME source files (VOLEMARB.DAT)

with time-varying data (NVOLDAT)

Default: 0 ! NVOLDAT = 0 !

Number of FLARE source files (FLEMARB.DAT)

with time-varying data (NFLDAT)

Default: 0 ! NFLDAT = 0 !

Number of ROAD source files (RDEMARB.DAT)

with time-varying data (NRDDAT)

Default: 0 ! NRDDAT = 0 !

Number of SPRAY source files (SPEMARB.DAT)

with time-varying data (NSPDAT)

Default: 0 ! NSPDAT = 0 !

Number of BUOYANT LINE source files (LNEMARB.DAT)

with time-varying data (NLNDAT)

Default: 0 ! NLNDAT = 0 !

Note: Only 1 BUOYANT LINE source file is allowed

!END!

Subgroup (0a)

Provide a name for each CALMET domain if NMETDOM > 1

Enter NMETDOM lines.

a,b

Default Name Domain Name

--- ---

```
none              * DOMAIN1=    *   *END*
none              * DOMAIN2=    *   *END*
none              * DOMAIN3=    *   *END*
```

The following CALMET.DAT filenames are processed in sequence
if NMETDAT > 1

Enter NMETDAT lines, 1 line for each file name.

```
                              a,c,d
Default Name  Type          File Name
------------  ----          ---------
none          input    * METDAT1=    *   *END*
none          input    * METDAT2=    *   *END*
none          input    * METDAT3=    *   *END*
```

---

a

The name for each CALMET domain and each CALMET.DAT file is treated as a separate input subgroup and therefore must end with an input group terminator.

b

Use DOMAIN1= to assign the name for the outermost CALMET domain.
Use DOMAIN2= to assign the name for the next inner CALMET domain.
Use DOMAIN3= to assign the name for the next inner CALMET domain, etc.

```
 ---------------------------------------------------------------
 |  When inner domains with equal resolution (grid-cell size)  |
 |  overlap, the data from the FIRST such domain in the list will  |
 |  be used if all other criteria for choosing the controlling  |
 |  grid domain are inconclusive.                               |
```

---

c

Use METDAT1= to assign the file names for the outermost CALMET domain.

Use METDAT2= to assign the file names for the next inner CALMET domain.

Use METDAT3= to assign the file names for the next inner CALMET domain, etc.

d

The filenames for each domain must be provided in sequential order

---

Subgroup (0b) – PTEMARB.DAT files

POINT Source File Names

The following PTEMARB.DAT filenames are processed if NPTDAT>0

A total of NPTDAT lines is expected with one file name assigned per line

Each line is treated as an input group and must terminate with END

(surrounded by delimiters)

(Each file contains emissions parameters for the entire period modeled

for 1 or more sources)

Default Name	Type	File Name
none	input	* PTDAT= ..\inp\sourcepoint1 * *END*

Subgroup (0c) – BAEMARB.DAT files

BUOYANT AREA Source File Names

The following BAEMARB.DAT filenames are processed if NARDAT>0
A total of NARDAT lines is expected with one file name assigned per line
Each line is treated as an input group and must terminate with END
(surrounded by delimiters)
(Each file contains emissions parameters for the entire period modeled
for 1 or more sources)

Default Name	Type	File Name
none	input	* ARDAT= * *END*

Subgroup (0d) – VOLEMARB.DAT files

VOLUME Source File Names
The following VOLEMARB.DAT filenames are processed if NVOLDAT>0
A total of NVOLDAT lines is expected with one file name assigned per line
Each line is treated as an input group and must terminate with END
(surrounded by delimiters)
(Each file contains emissions parameters for the entire period modeled
for 1 or more sources)

Default Name	Type	File Name
none	input	* VOLDAT= * *END*

Subgroup (0e) – FLEMARB.DAT files

FLARE Source File Names

The following FLEMARB.DAT filenames are processed if NFLDAT>0

A total of NFLDAT lines is expected with one file name assigned per line

Each line is treated as an input group and must terminate with END

(surrounded by delimiters)

(Each file contains emissions parameters for the entire period modeled

for 1 or more sources)

Default Name	Type	File Name
none	input	* FLDAT= * *END*

Subgroup (0f) – RDEMARB.DAT files

ROAD Source File Names

The following RDEMARB.DAT filenames are processed if NRDDAT>0

A total of NRDDAT lines is expected with one file name assigned per line

Each line is treated as an input group and must terminate with END

(surrounded by delimiters)

(Each file contains emissions parameters for the entire period modeled

for 1 or more sources)

Default Name	Type	File Name
none	input	* RDDAT= * *END*

Subgroup (0g) – SPEMARB.DAT files

SPRAY Source File Names

The following SPEMARB.DAT filenames are processed if NRDDAT>0

A total of NSPDAT lines is expected with one file name assigned per line

Each line is treated as an input group and must terminate with END

(surrounded by delimiters)

(Each file contains emissions parameters for the entire period modeled

for 1 or more sources)

Default Name	Type	File Name
none	input	* SPDAT= * *END*

Subgroup (0h) – LNEMARB.DAT file

BUOYANT LINE Source File Name (not more than 1)

The following LNEMARB.DAT filename is processed if NLNDAT>0

The assignment is treated as an input group and must terminate with END

(surrounded by delimiters)

Default Name	Type	File Name
LNEMARB.DAT	input	* LNDAT= * *END*

INPUT GROUP: 1 -- General run control parameters

Option to run all periods found
in the met. file (METRUN) Default: 0 ! METRUN = 1 !

METRUN = 0 - Run period explicitly defined below
METRUN = 1 - Run all periods in met. file

Starting date: Year (IBYR) -- No default ! IBYR = 2020 !
Month (IBMO) -- No default ! IBMO = 01 !
Day (IBDY) -- No default ! IBDY = 01 !
Starting time: Hour (IBHR) -- No default ! IBHR = 01 !
Minute (IBMIN) -- No default ! IBMIN = 00 !
Second (IBSEC) -- No default ! IBSEC = 00 !

Ending date: Year (IEYR) -- No default ! IEYR = 2020 !
Month (IEMO) -- No default ! IEMO = 12 !
Day (IEDY) -- No default ! IEDY = 31 !
Ending time: Hour (IEHR) -- No default ! IEHR = 23 !
Minute (IEMIN) -- No default ! IEMIN = 0 !
Second (IESEC) -- No default ! IESEC = 0 !

(These are only used if METRUN = 0)

Base time zone: (ABTZ) -- No default ! ABTZ= UTC+0100 !
(character*8)
The modeling domain may span multiple time zones. ABTZ defines the
base time zone used for the entire simulation. This must match the

base time zone of the meteorological data.

Examples:

Greenwich Mean Time (GMT) = UTC+0000

EST = UTC-0500

CST = UTC-0600

MST = UTC-0700

PST = UTC-0800

Los Angeles, USA = UTC-0800

New York, USA = UTC-0500

Santiago, Chile = UTC-0400

UK = UTC+0000

Western Europe = UTC+0100

Rome, Italy = UTC+0100

Cape Town, S.Africa = UTC+0200

Sydney, Australia = UTC+1000

Length of modeling time-step (seconds)
Equal to update period in the primary
meteorological data files, or an
integer fraction of it (1/2, 1/3 ...)
Must be no larger than 1 hour
(NSECDT) Default:3600 ! NSECDT = 3600 !
Units: seconds

Number of chemical species (NSPEC)
Default: 5 ! NSPEC = 1 !

Number of chemical species
to be emitted (NSE) Default: 3 ! NSE = 1 !

Flag to stop run after

SETUP phase (ITEST) Default: 2 ! ITEST = 2 !

(Used to allow checking

of the model inputs, files, etc.)

ITEST = 1 - STOPS program after SETUP phase

ITEST = 2 - Continues with execution of program

after SETUP

Restart Configuration:

Control flag (MRESTART) Default: 0 ! MRESTART = 2 !

0 = Do not read or write a restart file

1 = Read a restart file at the beginning of

the run

2 = Write a restart file during run

3 = Read a restart file at beginning of run

and write a restart file during run

Number of periods in Restart

output cycle (NRESPD) Default: 0 ! NRESPD = 0 !

0 = File written only at last period

>0 = File updated every NRESPD periods

Meteorological Data Format (METFM)

Default: 1 ! METFM = 1 !

METFM = 1 - CALMET binary file (CALMET.MET)

METFM = 2 - ISC ASCII file (ISCMET.MET)

METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)

METFM = 4 - CTDM plus tower file (PROFILE.DAT) and

surface parameters file (SURFACE.DAT)

METFM = 5 - AERMET tower file (PROFILE.DAT) and
surface parameters file (SURFACE.DAT)

Meteorological Profile Data Format (MPRFFM)
(used only for METFM = 1, 2, 3)
Default: 1 ! MPRFFM = 1 !

MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

Sigma-y is adjusted by the factor (AVET/PGTIME)**0.2 to either decrease it if the averaging time selected is less than the base averaging time, or increase it if the averaging time is greater.
The base averaging time is denoted as PGTIME due to historical reasons as this adjustment was originally applied to the PG sigma option. It is now applied to all dispersion options.
The factor is applied to the ambient turbulence sigma-v (m/s) and does not alter buoyancy enhancement or far-field Heffter growth.

Averaging Time (minutes) (AVET)
Default: 60.0 ! AVET = 60. !
Base Averaging Time (minutes) (PGTIME)
Default: 60.0 ! PGTIME = 60. !

Output units for binary concentration and flux files
written in Dataset v2.2 or later formats
(IOUTU) Default: 1 ! IOUTU = 2 !
1 = mass - g/m3 (conc) or g/m2/s (dep)

2 = odour - odour_units (conc)

3 = radiation - Bq/m3 (conc) or Bq/m2/s (dep)

!END!

INPUT GROUP: 2 -- Technical options

Vertical distribution used in the

near field (MGAUSS) Default: 1 ! MGAUSS = 1 !

0 = uniform

1 = Gaussian

Terrain adjustment method

(MCTADJ) Default: 3 ! MCTADJ = 3 !

0 = no adjustment

1 = ISC-type of terrain adjustment

2 = simple, CALPUFF-type of terrain adjustment

3 = partial plume path adjustment

Subgrid-scale complex terrain

flag (MCTSG) Default: 0 ! MCTSG = 0 !

0 = not modeled

1 = modeled

Near-field puffs modeled as

elongated slugs? (MSLUG) Default: 0 ! MSLUG = 1 !

0 = no

1 = yes (slug model used)

Transitional plume rise modeled?

(MTRANS) Default: 1 ! MTRANS = 1 !

0 = no (i.e., final rise only)

1 = yes (i.e., transitional rise computed)

Stack tip downwash? (MTIP) Default: 1 ! MTIP = 0 !

0 = no (i.e., no stack tip downwash)

1 = yes (i.e., use stack tip downwash)

Method used to compute plume rise for

point sources not subject to building

downwash? (MRISE) Default: 1 ! MRISE = 1 !

1 = Briggs plume rise

2 = Numerical plume rise

Apply stack-tip downwash to FLARE sources?

(MTIP_FL) Default: 0 ! MTIP_FL = 0 !

0 = no (no stack-tip downwash)

1 = yes (apply stack-tip downwash)

Plume rise module for FLARE sources

(MRISE_FL) Default: 2 ! MRISE_FL = 2 !

1 = Briggs module

2 = Numerical rise module

Method used to simulate building

downwash? (MBDW) Default: 1 ! MBDW = 1 !

1 = ISC method

2 = PRIME method

Vertical wind shear modeled above

stack top (modified Briggs plume rise)?

(MSHEAR) Default: 0 ! MSHEAR = 0 !

0 = no (i.e., vertical wind shear not modeled)

1 = yes (i.e., vertical wind shear modeled)

Puff splitting allowed? (MSPLIT) Default: 0 ! MSPLIT = 1 !

0 = no (i.e., puffs not split)

1 = yes (i.e., puffs are split)

Chemical mechanism flag (MCHEM) Default: 1 ! MCHEM = 0 !

0 = chemical transformation not
modeled

1 = transformation rates computed
internally (MESOPUFF II scheme)

2 = user-specified transformation
rates used

3 = transformation rates computed
internally (RIVAD/ARM3 scheme)

4 = secondary organic aerosol formation
computed (MESOPUFF II scheme for OH)

5 = user-specified half-life with or
without transfer to child species

6 = transformation rates computed
internally (Updated RIVAD scheme with
ISORROPIA equilibrium)

7 = transformation rates computed

internally (Updated RIVAD scheme with
ISORROPIA equilibrium and CalTech SOA)

Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 6, or 7) Default: 0 ! MAQCHEM = 0 !
0 = aqueous phase transformation
not modeled
1 = transformation rates and wet
scavenging coefficients adjusted
for in-cloud aqueous phase reactions
(adapted from RADM cloud model
implementation in CMAQ/SCICHEM)

Liquid Water Content flag (MLWC)
(Used only if MAQCHEM = 1) Default: 1 ! MLWC = 1 !
0 = water content estimated from cloud cover
and presence of precipitation
1 = gridded cloud water data read from CALMET
water content output files (filenames are
the CALMET.DAT names PLUS the extension
AUXEXT provided in Input Group 0)

Wet removal modeled ? (MWET) Default: 1 ! MWET = 0 !
0 = no
1 = yes

Dry deposition modeled ? (MDRY) Default: 1 ! MDRY = 0 !
0 = no
1 = yes
(dry deposition method specified
for each species in Input Group 3)

Evaporation modeled ? (MEVAP) Default: 0 ! MEVAP = 0 !

0 = no

1 = yes (evaporation rates specified for each species in Input Group 11 -[not active])

2 = yes (internally calculated -[not currently available])

Gravitational settling (plume tilt)
modeled ? (MTILT) Default: 0 ! MTILT = 0 !

0 = no

1 = yes

(puff center falls at the gravitational
settling velocity for 1 particle species)

Restrictions:

- MDRY = 1
- NSPEC = 1 (must be particle species as well)
- sg = 0 GEOMETRIC STANDARD DEVIATION in Group 8 is
  set to zero for a single particle diameter

Method used to compute dispersion
coefficients (MDISP) Default: 3 ! MDISP = 2 !

1 = dispersion coefficients computed from measured values
of turbulence, sigma v, sigma w

2 = dispersion coefficients from internally calculated
sigma v, sigma w using micrometeorological variables
(u*, w*, L, etc.)

3 = PG dispersion coefficients for RURAL areas (computed using
the ISCST multi-segment approximation) and MP coefficients in
urban areas

4 = same as 3 except PG coefficients computed using

the MESOPUFF II eqns.

5 = CTDM sigmas used for stable and neutral conditions.
For unstable conditions, sigmas are computed as in
MDISP = 3, described above. MDISP = 5 assumes that
measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5) Default: 3 ! MTURBVW = 3 !

1 = use sigma-v or sigma-theta measurements
from PROFILE.DAT to compute sigma-y
(valid for METFM = 1, 2, 3, 4, 5)

2 = use sigma-w measurements
from PROFILE.DAT to compute sigma-z
(valid for METFM = 1, 2, 3, 4, 5)

3 = use both sigma-(v/theta) and sigma-w
from PROFILE.DAT to compute sigma-y and sigma-z
(valid for METFM = 1, 2, 3, 4, 5)

4 = use sigma-theta measurements
from PLMMET.DAT to compute sigma-y
(valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2) Default: 3 ! MDISP2 = 3 !
(used only if MDISP = 1 or 5)

2 = dispersion coefficients from internally calculated
sigma v, sigma w using micrometeorological variables
(u*, w*, L, etc.)

3 = PG dispersion coefficients for RURAL areas (computed using
the ISCST multi-segment approximation) and MP coefficients in
urban areas

4 = same as 3 except PG coefficients computed using
the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY) Default: 0 ! MTAULY = 0 !
0 = Draxler default 617.284 (s)
1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
10 < Direct user input (s) -- e.g., 306.9

[DIAGNOSTIC FEATURE]
Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV) Default: 0 ! MTAUADV = 0 !
0 = No turbulence advection
1 = Computed (OPTION NOT IMPLEMENTED)
10 < Direct user input (s) -- e.g., 800

Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB) Default: 1 ! MCTURB = 1 !
1 = Standard CALPUFF subroutines
2 = AERMOD subroutines

PG sigma-y,z adj. for roughness? Default: 0 ! MROUGH = 0 !
(MROUGH)
0 = no

1 = yes

Partial plume penetration of elevated inversion modeled for point sources? (MPARTL) Default: 1 ! MPARTL = 1 !

0 = no

1 = yes

Partial plume penetration of elevated inversion modeled for buoyant area sources? (MPARTLBA) Default: 1 ! MPARTLBA = 1 !

0 = no

1 = yes

Strength of temperature inversion provided in PROFILE.DAT extended records? (MTINV) Default: 0 ! MTINV = 0 !

0 = no (computed from measured/default gradients)

1 = yes

PDF used for dispersion under convective conditions? (MPDF) Default: 0 ! MPDF = 0 !

0 = no

1 = yes

Sub-Grid TIBL module used for shore line? (MSGTIBL) Default: 0 ! MSGTIBL = 0 !

0 = no

1 = yes

Boundary conditions (concentration) modeled?

Default: 0 ! MBCON = 0 !

(MBCON)

0 = no

1 = yes, using formatted BCON.DAT file

2 = yes, using unformatted CONC.DAT file

Note: MBCON > 0 requires that the last species modeled be 'BCON'. Mass is placed in species BCON when generating boundary condition puffs so that clean air entering the modeling domain can be simulated in the same way as polluted air. Specify zero emission of species BCON for all regular sources.

Individual source contributions saved?

Default: 0 ! MSOURCE = 0 !

(MSOURCE)

0 = no

1 = yes

Analyses of fogging and icing impacts due to emissions from arrays of mechanically-forced cooling towers can be performed using CALPUFF in conjunction with a cooling tower emissions processor (CTEMISS) and its associated postprocessors. Hourly emissions of water vapor and temperature from each cooling tower cell are computed for the current cell configuration and ambient conditions by CTEMISS. CALPUFF models the dispersion of these

emissions and provides cloud information in a specialized format for further analysis. Output to FOG.DAT is provided in either 'plume mode' or 'receptor mode' format.

Configure for FOG Model output?

Default: 0 ! MFOG = 0 !

(MFOG)

0 = no

1 = yes - report results in PLUME Mode format

2 = yes - report results in RECEPTOR Mode format

Test options specified to see if they conform to regulatory values? (MREG) Default: 1 ! MREG = 0 !

0 = NO checks are made

1 = Technical options must conform to USEPA Long Range Transport (LRT) guidance

METFM 1 or 2

AVET 60. (min)

PGTIME 60. (min)

MGAUSS 1

MCTADJ 3

MTRANS 1

MTIP 1

MRISE 1

MCHEM 1 or 3 (if modeling SOx, NOx)

MWET 1

MDRY 1

MDISP 2 or 3

MPDF 0 if MDISP=3

1 if MDISP=2

MROUGH 0

MPARTL 1

MPARTLBA 0

SYTDEP 550. (m)

MHFTSZ 0

SVMIN 0.5 (m/s)

!END!

INPUT GROUP: 3a, 3b -- Species list

Subgroup (3a)

The following species are modeled:

! CSPEC = Odor ! !END!

SPECIES NAME (Limit: 12 Characters in length)	MODELED (0=NO, 1=YES)	EMITTED (0=NO, 1=YES)	Dry DEPOSITED (0=NO, 1=COMPUTED-GAS 2=COMPUTED-PARTICLE 3=USER-SPECIFIED)	OUTPUT GROUP NUMBER (0=NONE, 1=1st CGRUP, 2=2nd CGRUP, 3= etc.)

! Odor = 1, 1, 0, 0 !

!END!

Note: The last species in (3a) must be 'BCON' when using the boundary condition option (MBCON > 0). Species BCON should typically be modeled as inert (no chem transformation or removal).

Subgroup (3b)

The following names are used for Species-Groups in which results for certain species are combined (added) prior to output. The CGRUP name will be used as the species name in output files. Use this feature to model specific particle-size distributions by treating each size-range as a separate species. Order must be consistent with 3(a) above.

INPUT GROUP: 4 -- Map Projection and Grid control parameters

Projection for all (X,Y):

Map projection

(PMAP) Default: UTM ! PMAP = UTM !

UTM : Universal Transverse Mercator

TTM : Tangential Transverse Mercator

LCC : Lambert Conformal Conic

PS : Polar Stereographic

EM : Equatorial Mercator

LAZA : Lambert Azimuthal Equal Area

False Easting and Northing (km) at the projection origin

(Used only if PMAP= TTM, LCC, or LAZA)

(FEAST) Default=0.0 ! FEAST = 6.500 !

(FNORTH) Default=0.0 ! FNORTH = 854.500 !

UTM zone (1 to 60)

(Used only if PMAP=UTM)

(IUTMZN) No Default ! IUTMZN = 32 !

Hemisphere for UTM projection?

(Used only if PMAP=UTM)

(UTMHEM) Default: N ! UTMHEM = N !

N : Northern hemisphere projection

S : Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin

(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)

(RLAT0) No Default ! RLAT0 = 55N !

(RLON0) No Default ! RLON0 = 125W !

TTM : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

LCC : RLON0 identifies central (true N/S) meridian of projection

RLAT0 selected for convenience

PS : RLON0 identifies central (grid N/S) meridian of projection

RLAT0 selected for convenience

EM : RLON0 identifies central meridian of projection

RLAT0 is REPLACED by 0.0N (Equator)

LAZA: RLON0 identifies longitude of tangent-point of mapping plane

RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection

(Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = 46.5N !

(XLAT2) No Default ! XLAT2 = 63.5N !

LCC : Projection cone slices through Earth's surface at XLAT1 and XLAT2

PS : Projection plane slices through Earth at XLAT1

(XLAT2 is not used)

Note: Latitudes and longitudes should be positive, and include a

letter N,S,E, or W indicating north or south latitude, and

east or west longitude. For example,

35.9 N Latitude = 35.9N

118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character

string. Many mapping products currently available use the model of the Earth known as the World Geodetic System 1984 (WGS-84). Other local models may be in use, and their selection in CALMET will make its output consistent with local mapping products. The list of Datum-Regions with official transformation parameters is provided by the National Imagery and Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84 WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84 NWS 6370KM Radius, Sphere
ESR-S ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates
(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

METEOROLOGICAL Grid (outermost if nested CALMET grids are used):

Rectangular grid defined for projection PMAP,
with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 100 !
No. Y grid cells (NY) No default ! NY = 100 !
No. vertical layers (NZ) No default ! NZ = 12 !

Grid spacing (DGRIDKM) No default ! DGRIDKM = 0.1 !
Units: km

Cell face heights

(ZFACE(nz+1)) No defaults

Units: m

! ZFACE = 0,20,50,100,150,200,250,500,1000,1500,2000,2500,3000 !

Reference Coordinates

of SOUTHWEST corner of

grid cell(1, 1):

X coordinate (XORIGKM) No default ! XORIGKM = 640.000 !

Y coordinate (YORIGKM) No default ! YORIGKM = 4928.000 !

Units: km

COMPUTATIONAL Grid:

The computational grid is identical to or a subset of the MET. grid.
The lower left (LL) corner of the computational grid is at grid point
(IBCOMP, JBCOMP) of the MET. grid. The upper right (UR) corner of the
computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
The grid spacing of the computational grid is the same as the MET. grid.

X index of LL corner (IBCOMP) No default ! IBCOMP = 2 !

(1 <= IBCOMP <= NX)

Y index of LL corner (JBCOMP) No default ! JBCOMP = 2 !

(1 <= JBCOMP <= NY)

X index of UR corner (IECOMP) No default ! IECOMP = 99 !

(1 <= IECOMP <= NX)

Y index of UR corner (JECOMP) No default ! JECOMP = 99 !
(1 <= JECOMP <= NY)

SAMPLING Grid (GRIDDED RECEPTORS):

The lower left (LL) corner of the sampling grid is at grid point (IBSAMP, JBSAMP) of the MET. grid. The upper right (UR) corner of the sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid. The sampling grid must be identical to or a subset of the computational grid. It may be a nested grid inside the computational grid. The grid spacing of the sampling grid is DGRIDKM/MESHDN.

Logical flag indicating if gridded
receptors are used (LSAMP) Default: T ! LSAMP = T !
(T=yes, F=no)

X index of LL corner (IBSAMP) No default ! IBSAMP = 2 !
(IBCOMP <= IBSAMP <= IECOMP)

Y index of LL corner (JBSAMP) No default ! JBSAMP = 2 !
(JBCOMP <= JBSAMP <= JECOMP)

X index of UR corner (IESAMP) No default ! IESAMP = 99 !
(IBCOMP <= IESAMP <= IECOMP)

Y index of UR corner (JESAMP) No default ! JESAMP = 99 !
(JBCOMP <= JESAMP <= JECOMP)

Nesting factor of the sampling
grid (MESHDN) Default: 1 ! MESHDN = 1 !
(MESHDN is an integer >= 1)

!END!

INPUT GROUP: 5 -- Output Options
---

* *

FILE	DEFAULT VALUE	VALUE THIS RUN
Concentrations (ICON)	1	! ICON = 1 !
Dry Fluxes (IDRY)	1	! IDRY = 0 !
Wet Fluxes (IWET)	1	! IWET = 0 !
2D Temperature (IT2D)	0	! IT2D = 0 !
2D Density (IRHO)	0	! IRHO = 0 !
Relative Humidity (IVIS) (relative humidity file is required for visibility analysis)	1	! IVIS = 0 !

Use data compression option in output file?
(LCOMPRS) Default: T ! LCOMPRS = F !

*

0 = Do not create file, 1 = create file

QA PLOT FILE OUTPUT OPTION:

Create a standard series of output files (e.g.
locations of sources, receptors, grids ...)
suitable for plotting?
(IQAPLOT) Default: 1 ! IQAPLOT = 1 !
0 = no
1 = yes

DIAGNOSTIC PUFF-TRACKING OUTPUT OPTION:

Puff locations and properties reported to
PFTRAK.DAT file for postprocessing?
(IPFTRAK) Default: 0 ! IPFTRAK = 0 !
0 = no
1 = yes, update puff output at end of each timestep
2 = yes, update puff output at end of each sampling step

DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

Mass flux across specified boundaries
for selected species reported?
(IMFLX) Default: 0 ! IMFLX = 0 !
0 = no
1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
are specified in Input Group 0)

Mass balance for each species

reported?

(IMBAL) Default: 0 ! IMBAL = 1 !

0 = no

1 = yes (MASSBAL.DAT filename is
specified in Input Group 0)

NUMERICAL RISE OUTPUT OPTION:

Create a file with plume properties for each rise
increment, for each model timestep?
This applies to sources modeled with numerical rise
and is limited to ONE source in the run.

(INRISE) Default: 0 ! INRISE = 0 !

0 = no

1 = yes (RISE.DAT filename is
specified in Input Group 0)

LINE PRINTER OUTPUT OPTIONS:

Print concentrations (ICPRT) Default: 0 ! ICPRT = 1 !

Print dry fluxes (IDPRT) Default: 0 ! IDPRT = 0 !

Print wet fluxes (IWPRT) Default: 0 ! IWPRT = 0 !

(0 = Do not print, 1 = Print)

Concentration print interval

(ICFRQ) in timesteps Default: 1 ! ICFRQ = 24 !

Dry flux print interval

(IDFRQ) in timesteps Default: 1 ! IDFRQ = 1 !

Wet flux print interval

(IWFRQ) in timesteps Default: 1 ! IWFRQ = 1 !

Units for Line Printer Output

(IPRTU) Default: 1 ! IPRTU = 5 !

	for Concentration	for Deposition
1 =	g/m**3	g/m**2/s
2 =	mg/m**3	mg/m**2/s
3 =	ug/m**3	ug/m**2/s
4 =	ng/m**3	ng/m**2/s
5 =	Odour Units	
6 =	TBq/m**3	TBq/m**2/s TBq=terabecquerel
7 =	GBq/m**3	GBq/m**2/s GBq=gigabecquerel
8 =	Bq/m**3	Bq/m**2/s Bq=becquerel (disintegrations/s)

Messages tracking progress of run

written to the screen ?

(IMESG) Default: 2 ! IMESG = 2 !

0 = no

1 = yes (advection step, puff ID)

2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)

SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

SPECIES /GROUP	---- CONCENTRATIONS ---- PRINTED?	SAVED ON DISK?	------ DRY FLUXES ------ PRINTED?	SAVED ON DISK?	------ WET FLUXES ------ PRINTED?	SAVED ON DISK?	-- MASS FLUX -- SAVED ON DISK?
-------	----------	----------	----------	----------	----------	----------	----------
! Odor =	1,	1,	0,	0,	0,	0,	1 !

Note: Species BCON (for MBCON > 0) does not need to be saved on disk.

OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

Logical for debug output
(LDEBUG) Default: F ! LDEBUG = F !

First puff to track
(IPFDEB) Default: 1 ! IPFDEB = 1 !

Number of puffs to track
(NPFDEB) Default: 1 ! NPFDEB = 1 !

Met. period to start output
(NN1) Default: 1 ! NN1 = 1 !

Met. period to end output
(NN2) Default: 10 ! NN2 = 10 !

!END!

INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs

---

Subgroup (6a)

Number of terrain features (NHILL) Default: 0 ! NHILL = 0 !

Number of special complex terrain
receptors (NCTREC) Default: 0 ! NCTREC = 0 !

Terrain and CTSG Receptor data for
CTSG hills input in CTDM format ?
(MHILL) No Default ! MHILL = 2 !
1 = Hill and Receptor data created
by CTDM processors & read from
HILL.DAT and HILLRCT.DAT files
2 = Hill data created by OPTHILL &
input below in Subgroup (6b);
Receptor data in Subgroup (6c)

Factor to convert horizontal dimensions Default: 1.0 ! XHILL2M = 1.0 !
to meters (MHILL=1)

Factor to convert vertical dimensions Default: 1.0 ! ZHILL2M = 1.0 !
to meters (MHILL=1)

X-origin of CTDM system relative to No Default ! XCTDMKM = 0 !
CALPUFF coordinate system, in Kilometers (MHILL=1)

Y-origin of CTDM system relative to No Default ! YCTDMKM = 0 !
CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

Subgroup (6b)

---

1 **

HILL information

HILL NO.	XC (km)	YC (km)	THETAH (deg.)	ZGRID (m)	RELIEF (m)	EXPO 1 (m)	EXPO 2 (m)	SCALE 1 (m)	SCALE 2 (m)	AMAX1 (m)	AMAX2 (m)
----	----	----	------	-----	------	------	------	-------	-------	-----	-----

---

Subgroup (6c)

COMPLEX TERRAIN RECEPTOR INFORMATION

XRCT (km)	YRCT (km)	ZRCT (m)	XHH
------	-----	------	----

1

Description of Complex Terrain Variables:

XC, YC = Coordinates of center of hill

THETAH = Orientation of major axis of hill (clockwise from North)

ZGRID = Height of the 0 of the grid above mean sea level

RELIEF = Height of the crest of the hill above the grid elevation

EXPO 1 = Hill-shape exponent for the major axis

EXPO 2 = Hill-shape exponent for the major axis

SCALE 1 = Horizontal length scale along the major axis

SCALE 2 = Horizontal length scale along the minor axis

AMAX = Maximum allowed axis length for the major axis

BMAX = Maximum allowed axis length for the major axis

XRCT, YRCT = Coordinates of the complex terrain receptors

ZRCT = Height of the ground (MSL) at the complex terrain Receptor

XHH = Hill number associated with each complex terrain receptor (NOTE: MUST BE ENTERED AS A REAL NUMBER)

**

NOTE: DATA for each hill and CTSG receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases

---

SPECIES NAME	DIFFUSIVITY (cm**2/s)	ALPHA STAR	REACTIVITY (s/cm)	MESOPHYLL RESISTANCE	HENRY'S LAW COEFFICIENT (dimensionless)
* SO2 =	.1509,	1000.0,	8.0,	.0,	.04 *

!END!

INPUT GROUP: 8 -- Size parameters for dry deposition of particles

---

For SINGLE SPECIES, the mean and standard deviation are used to compute a deposition velocity for NINT (see group 9) size-ranges, and these are then averaged to obtain a mean deposition velocity.

For GROUPED SPECIES, the size distribution should be explicitly specified (by the 'species' in the group), and the standard deviation for each should be entered as 0. The model will then use the deposition velocity for the stated mean diameter.

SPECIES NAME	GEOMETRIC MASS MEAN DIAMETER (microns)	GEOMETRIC STANDARD DEVIATION (microns)
* SO4 =	.48,	2.0 *

!END!

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters

Reference cuticle resistance (s/cm)

(RCUTR) Default: 30 ! RCUTR = 30.0 !

Reference ground resistance (s/cm)

(RGR) Default: 10 ! RGR = 10.0 !

Reference pollutant reactivity

(REACTR) Default: 8 ! REACTR = 8.0 !

Number of particle-size intervals used to

evaluate effective particle deposition velocity

(NINT) Default: 9 ! NINT = 9 !

Vegetation state in unirrigated areas

(IVEG) Default: 1 ! IVEG = 1 !

IVEG=1 for active and unstressed vegetation

IVEG=2 for active and stressed vegetation

IVEG=3 for inactive vegetation

!END!

INPUT GROUP: 10a, 10b -- Wet Deposition Parameters

Subgroup (10a)

Scavenging Coefficient -- Units: (sec)**(-1)

```
      Pollutant      Liquid Precip.       Frozen Precip.
      ---------      --------------       --------------
*         SO2 =         3.0E-05,              0.0E00 *
!END!

---------------
Subgroup (10b)
---------------

    Scavenging Coefficient for droplet species
    All species contained in a drop will have
    common scavenging coefficients based on the
    droplet.
    (SCSPRAY)

                Scavenging Coefficient -- Units: (sec)**(-1)

                Liquid Precip.       Frozen Precip.
                --------------       --------------
*     SCSPRAY =         1.0E-04,              3.0E-5 *


!END!

--------------------------------------------------------------------------------


INPUT GROUP: 11a, 11b, 11c -- Chemistry Parameters
--------------------
```

Subgroup (11a)

Several parameters are needed for one or more of the chemical transformation mechanisms. Those used for each mechanism are:

Mechanism (MCHEM)	Z	3	3	3	3	1	2	3	2	2	P	P	F	C	X	Y
											S					
											M		B	R	O	
											A	B	R	R	R	C	H	4	B		N
										B		V	C	N	N	N	M	K	-	-	C	O		D
										C	M	G	K	I	I	I	H	H	I	I	K	F	V	E
									M	K	N	N	N	T	T	T	2	2	S	S	P	R	C	C
									O	O	H	H	H	E	E	E	O	O	R	R	M	A	N	A
0 None	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1 MESOPUFF II	X	X	.	.	X	X	X	X	.	.	.	.	.	.	.	.
2 User Rates	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3 RIVAD	X	X	.	.	X	.	.	.	.	.	.	.	.	.	.	.
4 SOA	X	X	.	.	.	.	.	.	.	.	X	X	X	.		
5 Radioactive Decay	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	X
6 RIVAD/ISORRPIA	X	X	X	X	X	X	.	.	X	X	X	X	.	.	.	.
7 RIVAD/ISORRPIA/SOA	X	X	X	X	X	X	.	.	X	X	X	X	X	X	.	.

Ozone data input option (MOZ) Default: 1 ! MOZ = 0 !

(Used only if MCHEM = 1,3,4,6, or 7)

0 = use a monthly background ozone value

1 = read hourly ozone concentrations from the OZONE.DAT data file

Monthly ozone concentrations in ppb (BCKO3)

(Used only if MCHEM = 1,3,4,6, or 7 and either

MOZ = 0, or

MOZ = 1 and all hourly O3 data missing)

Default: 12*80.

! BCKO3 = 12*80 !

* BCKO3 = 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00 *

Ammonia data option (MNH3) Default: 0 ! MNH3 = 0 !

(Used only if MCHEM = 6 or 7)

0 = use monthly background ammonia values (BCKNH3) - no vertical variation

1 = read monthly background ammonia values for each layer from

the NH3Z.DAT data file

Ammonia vertical averaging option (MAVGNH3)

(Used only if MCHEM = 6 or 7, and MNH3 = 1)

0 = use NH3 at puff center height (no averaging is done)

1 = average NH3 values over vertical extent of puff

Default: 1 ! MAVGNH3 = 1 !

Monthly ammonia concentrations in ppb (BCKNH3)

(Used only if MCHEM = 1 or 3, or

if MCHEM = 6 or 7, and MNH3 = 0)

Default: 12*10.

! BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00 !

Nighttime SO2 loss rate in %/hour (RNITE1)

(Used only if MCHEM = 1, 6 or 7)

This rate is used only at night for MCHEM=1

and is added to the computed rate both day

and night for MCHEM=6,7 (heterogeneous reactions)

Default: 0.2 ! RNITE1 = .2 !

Nighttime NOx loss rate in %/hour (RNITE2)

(Used only if MCHEM = 1)

Default: 2.0 ! RNITE2 = 2.0 !

Nighttime HNO3 formation rate in %/hour (RNITE3)

(Used only if MCHEM = 1)

Default: 2.0 ! RNITE3 = 2.0 !

H2O2 data input option (MH2O2) Default: 1 ! MH2O2 = 1 !

(Used only if MCHEM = 6 or 7, and MAQCHEM = 1)

0 = use a monthly background H2O2 value

1 = read hourly H2O2 concentrations from

the H2O2.DAT data file

Monthly H2O2 concentrations in ppb (BCKH2O2)

(Used only if MQACHEM = 1 and either

MH2O2 = 0 or

MH2O2 = 1 and all hourly H2O2 data missing)

Default: 12*1.

! BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

--- Data for ISORROPIA Option

(used only if MCHEM = 6 or 7)

Minimum relative humidity used in ISORROPIA computations (RH_ISRP)

Default: 50. ! RH_ISRP = 50.0 !

Units: %

Minimum SO4 used in ISORROPIA computations (SO4_ISRP)

Default: 0.4 ! SO4_ISRP = .4 !

Units: ug/m3

--- Data for SECONDARY ORGANIC AEROSOL (SOA) Options

(used only if MCHEM = 4 or 7)

The MCHEM = 4 SOA module uses monthly values of:

Fine particulate concentration in ug/m^3 (BCKPMF)

Organic fraction of fine particulate (OFRAC)

VOC / NOX ratio (after reaction) (VCNX)

The MCHEM = 7 SOA module uses monthly values of:

Fine particulate concentration in ug/m^3 (BCKPMF)

Organic fraction of fine particulate (OFRAC)

These characterize the air mass when computing

the formation of SOA from VOC emissions.

Typical values for several distinct air mass types are:

Month	1	2	3	4	5	6	7	8	9	10	11	12
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

Clean Continental

BCKPMF	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
OFRAC	.15	.15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.15
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.

Clean Marine (surface)

BCKPMF .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5

OFRAC .25 .25 .30 .30 .30 .30 .30 .30 .30 .30 .30 .25

VCNX 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50. 50.

Urban - low biogenic (controls present)

BCKPMF 30. 30. 30. 30. 30. 30. 30. 30. 30. 30. 30. 30.

OFRAC .20 .20 .25 .25 .25 .25 .25 .25 .20 .20 .20 .20

VCNX 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4. 4.

Urban - high biogenic (controls present)

BCKPMF 60. 60. 60. 60. 60. 60. 60. 60. 60. 60. 60. 60.

OFRAC .25 .25 .30 .30 .30 .55 .55 .55 .35 .35 .35 .25

VCNX 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15.

Regional Plume

BCKPMF 20. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20. 20.

OFRAC .20 .20 .25 .35 .25 .40 .40 .40 .30 .30 .30 .20

VCNX 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15. 15.

Urban - no controls present

BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.

OFRAC .30 .30 .35 .35 .35 .55 .55 .55 .35 .35 .35 .30

VCNX 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2. 2.

Default: Clean Continental

! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00 !

! OFRAC = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.15 !

! VCNX = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00 !

--- End Data for SECONDARY ORGANIC AEROSOL (SOA) Options

Number of half-life decay specification blocks provided in Subgroup 11b

(Used only if MCHEM = 5)

(NDECAY) Default: 0 ! NDECAY = 0 !

!END!

Subgroup (11b)

Each species modeled may be assigned a decay half-life (sec), and the associated mass lost may be assigned to one or more other modeled species using a mass yield factor. This information is used only for MCHEM=5.

Provide NDECAY blocks assigning the half-life for a parent species and mass yield factors for each child species (if any) produced by the decay.

Set HALF_LIFE=0.0 for NO decay (infinite half-life).

	a	b
SPECIES NAME	Half-Life (sec)	Mass Yield Factor
---	---	---

* SPEC1 = 3600., -1.0 * (Parent)

* SPEC2 = -1.0, 0.0 * (Child)

END

---

a

Specify a half life that is greater than or equal to zero for 1 parent species
in each block, and set the yield factor for this species to -1

b

Specify a yield factor that is greater than or equal to zero for 1 or more child
species in each block, and set the half-life for each of these species to -1

NOTE: Assignments in each block are treated as a separate input
subgroup and therefore must end with an input group terminator.
If NDECAY=0, no assignments and input group terminators should appear.

Subgroup (11c)

Each species modeled as evaporating in Input Group 3a
should have an evaporation rate set here for their carrier species.
(Option currently not active.)

Evaporation Rates -- Units: (um2/deg C/sec)

Pollutant	Evaporation Rate
Active =	84.76 *

!END!

INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters

---

Horizontal size of puff (m) beyond which
time-dependent dispersion equations (Heffter)
are used to determine sigma-y and
sigma-z (SYTDEP) Default: 550. ! SYTDEP = 5.5E02 !

Switch for using Heffter equation for sigma z
as above (0 = Not use Heffter; 1 = use Heffter
(MHFTSZ) Default: 0 ! MHFTSZ = 0 !

Stability class used to determine plume
growth rates for puffs above the boundary
layer (JSUP) Default: 5 ! JSUP = 5 !

Vertical dispersion constant for stable
conditions (k1 in Eqn. 2.7-3) (CONK1) Default: 0.01 ! CONK1 = .01 !

Vertical dispersion constant for neutral/
unstable conditions (k2 in Eqn. 2.7-4)
(CONK2) Default: 0.1 ! CONK2 = .1 !

Factor for determining Transition-point from
Schulman-Scire to Huber-Snyder Building Downwash
scheme (SS used for Hs < Hb + TBD * HL)
(TBD) Default: 0.5 ! TBD = .5 !
  TBD < 0 ==> always use Huber-Snyder
  TBD = 1.5 ==> always use Schulman-Scire
  TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which
urban dispersion is assumed

(IURB1, IURB2) Default: 10 ! IURB1 = 10 !
19 ! IURB2 = 19 !

Site characterization parameters for single-point Met data files ---------
(needed for METFM = 2,3,4,5)

Land use category for modeling domain
(ILANDUIN) Default: 20 ! ILANDUIN = 20 !

Roughness length (m) for modeling domain
(Z0IN) Default: 0.25 ! Z0IN = .25 !

Leaf area index for modeling domain
(XLAIIN) Default: 3.0 ! XLAIIN = 3.0 !

Elevation above sea level (m)
(ELEVIN) Default: 0.0 ! ELEVIN = .0 !

Latitude (degrees) for met location
(XLATIN) Default: -999. ! XLATIN = -999.0 !

Longitude (degrees) for met location
(XLONIN) Default: -999. ! XLONIN = -999.0 !

Specialized information for interpreting single-point Met data files -----

Anemometer height (m) (Used only if METFM = 2,3)
(ANEMHT) Default: 10. ! ANEMHT = 10.0 !

Form of lateral turbulance data in PROFILE.DAT file
(Used only if METFM = 4,5 or MTURBVW = 1 or 3)

(ISIGMAV) Default: 1 ! ISIGMAV = 1 !

0 = read sigma-theta

1 = read sigma-v

Choice of mixing heights (Used only if METFM = 4)

(IMIXCTDM) Default: 0 ! IMIXCTDM = 0 !

0 = read PREDICTED mixing heights

1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)

(XMXLEN) Default: 1.0 ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in grid units) during one sampling step

(XSAMLEN) Default: 1.0 ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from one source during one time step

(MXNEW) Default: 99 ! MXNEW = 99 !

Maximum Number of sampling steps for one puff/slug during one time step

(MXSAM) Default: 99 ! MXSAM = 99 !

Number of iterations used when computing the transport wind for a sampling step that includes gradual rise (for CALMET and PROFILE winds)

(NCOUNT) Default: 2 ! NCOUNT = 2 !

Minimum sigma y for a new puff/slug (m)

(SYMIN) Default: 1.0 ! SYMIN = 1.0 !

Minimum sigma z for a new puff/slug (m)

(SZMIN) Default: 1.0 ! SZMIN = 1.0 !

Maximum sigma z (m) allowed to avoid

numerical problem in calculating virtual

time or distance. Cap should be large

enough to have no influence on normal events.

Enter a negative cap to disable.

(SZCAP_M) Default: 5.0e06 ! SZCAP_M = 5.0E06 !

Default minimum turbulence velocities sigma-v and sigma-w

for each stability class over land and over water (m/s)

(SVMIN(12) and SWMIN(12))

	LAND						WATER					
Stab Class :	A	B	C	D	E	F	A	B	C	D	E	F
Default SVMIN :	.50,	.50,	.50,	.50,	.50,	.50,	.37,	.37,	.37,	.37,	.37,	.37
Default SWMIN :	.20,	.12,	.08,	.06,	.03,	.016,	.20,	.12,	.08,	.06,	.03,	.016

* SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370, 0.370, 0.370, 0.370, 0.370* old

! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500!

! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080, 0.060, 0.030, 0.016!

Divergence criterion for dw/dz across puff

used to initiate adjustment for horizontal
convergence (1/s)
Partial adjustment starts at CDIV(1), and
full adjustment is reached at CDIV(2)
(CDIV(2)) Default: 0.0,0.0 ! CDIV = .01, .01 !

Search radius (number of cells) for nearest
land and water cells used in the subgrid
TIBL module
(NLUTIBL) Default: 4 ! NLUTIBL = 4 !

Minimum wind speed (m/s) allowed for
non-calm conditions. Also used as minimum
speed returned when using power-law
extrapolation toward surface
(WSCALM) Default: 0.5 ! WSCALM = .5 !

Maximum mixing height (m)
(XMAXZI) Default: 3000. ! XMAXZI = 3000.0 !

Minimum mixing height (m)
(XMINZI) Default: 50. ! XMINZI = 50.0 !

Temperatures (K) used for defining upper bound of
categories for emissions scale-factors
11 upper bounds (K) are entered; the 12th class has no upper limit
(TKCAT(11))

Default : 265., 270., 275., 280., 285., 290., 295., 300., 305., 310., 315. (315.+)

< < < < < < < < < < <

Temperature Class : 1 2 3 4 5 6 7 8 9 10 11 (12)

---- ---- ---- ---- ---- ---- ---- ---- ---- ---- ----

! TKCAT = 265., 270., 275., 280., 285., 290., 295., 300., 305., 310., 315. !

Wind Speeds (m/s) used for defining upper bound of
categories for emissions scale-factors
5 upper bounds (m/s) are entered; the 6th class has no upper limit
(WSCAT(5)) Default :

ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8 (10.8+)

Wind Speed Class : 1 2 3 4 5

--- --- --- --- ---

! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

Default wind speed profile power-law
exponents for stabilities 1-6
(PLX0(6)) Default : ISC RURAL values

ISC RURAL : .07, .07, .10, .15, .35, .55
ISC URBAN : .15, .15, .20, .25, .30, .30

Stability Class : A B C D E F

--- --- --- --- --- ---

! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55 !

Default potential temperature gradient
for stable classes E, F (degK/m)
(PTG0(2)) Default: 0.020, 0.035

! PTG0 = 0.020, 0.035 !

Default plume path coefficients for
each stability class (used when option
for partial plume height terrain adjustment

is selected -- MCTADJ=3)

(PPC(6)) Stability Class : A B C D E F

Default PPC : .50, .50, .50, .50, .35, .35

--- --- --- --- --- ---

! PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35 !

Slug-to-puff transition criterion factor
equal to sigma-y/length of slug
(SL2PF) Default: 10. ! SL2PF = 5.0 !

Receptor-specific puff/slug properties (e.g., sigmas and height above ground at the time when the trajectory is nearest the receptor) may be extrapolated forward or backward in time along the current step using the current dispersion, for receptors that lie upwind of the puff/slug position at the start of a step, or downwind at the end of a step.
Specify the upwind/downwind extrapolation zone in sigma-y units.
Using FCLIP=1.0 clips the the upwind zone at one sigma-y at the start of the step and the downwind zone at one sigma-y at the end of the step.
This is consistent with the sampling done in CALPUFF versions through v6.42 prior to the introduction of the FCLIP option.
The default is No Extrapolation, FCLIP=0.0.
(FCLIP) Default: 0.0 ! FCLIP = 0.0 !

Puff-splitting control variables ----------

VERTICAL SPLIT

Number of puffs that result every time a puff is split - nsplit=2 means that 1 puff splits into 2

(NSPLIT) Default: 3 ! NSPLIT = 3 !

Time(s) of a day when split puffs are eligible to
be split once again; this is typically set once
per day, around sunset before nocturnal shear develops.
24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
0=do not re-split 1=eligible for re-split
(IRESPLIT(24)) Default: Hour 17 = 1
! IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

Split is allowed only if last hour's mixing
height (m) exceeds a minimum value
(ZISPLIT) Default: 100. ! ZISPLIT = 100.0 !

Split is allowed only if ratio of last hour's
mixing ht to the maximum mixing ht experienced
by the puff is less than a maximum value (this
postpones a split until a nocturnal layer develops)
(ROLDMAX) Default: 0.25 ! ROLDMAX = 0.25 !

HORIZONTAL SPLIT

Number of puffs that result every time a puff
is split - nsplith=5 means that 1 puff splits
into 5
(NSPLITH) Default: 5 ! NSPLITH = 5 !

Minimum sigma-y (Grid Cells Units) of puff
before it may be split

(SYSPLITH) Default: 1.0 ! SYSPLITH = 1.0 !

Minimum puff elongation rate (SYSPLITH/hr) due to
wind shear, before it may be split
(SHSPLITH) Default: 2. ! SHSPLITH = 2.0 !

Minimum concentration (g/m^3) of each
species in puff before it may be split
Enter array of NSPEC values; if a single value is
entered, it will be used for ALL species
(CNSPLITH) Default: 1.0E-07 ! CNSPLITH = 1.0E-07 !

Integration control variables ----------

Fractional convergence criterion for numerical SLUG
sampling integration
(EPSSLUG) Default: 1.0e-04 ! EPSSLUG = 1.0E-04 !

Fractional convergence criterion for numerical AREA
source integration
(EPSAREA) Default: 1.0e-06 ! EPSAREA = 1.0E-06 !

Trajectory step-length (m) used for numerical rise
integration
(DSRISE) Default: 1.0 ! DSRISE = 1.0 !

Boundary Condition (BC) Puff control variables ----------

Minimum height (m) to which BC puffs are mixed as they are emitted
(MBCON=2 ONLY). Actual height is reset to the current mixing height
at the release point if greater than this minimum.

(HTMINBC) Default: 500. ! HTMINBC = 500.0 !

Search radius (km) about a receptor for sampling nearest BC puff.
BC puffs are typically emitted with a spacing of one grid cell
length, so the search radius should be greater than DGRIDKM.
(RSAMPBC) Default: 10. ! RSAMPBC = 15.0 !

Near-Surface depletion adjustment to concentration profile used when
sampling BC puffs?
(MDEPBC) Default: 1 ! MDEPBC = 0 !
0 = Concentration is NOT adjusted for depletion
1 = Adjust Concentration for depletion

!END!

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters

Subgroup (13a)

Number of point sources with
parameters provided below (NPT1) No default ! NPT1 = 2 !

Units used for point source
emissions below (IPTU) Default: 1 ! IPTU = 5 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species
combinations with variable
emissions scaling factors
provided below in (13d) (NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with
variable emission parameters
provided in external file (NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point
source emissions are read from
the file: PTEMARB.DAT)

!END!

Subgroup (13b)

---

a

POINT SOURCE: CONSTANT DATA

---

b c

Source X Y Stack Base Stack Exit Exit Bldg. Emission

No. Coordinate Coordinate Height Elevation Diameter Vel. Temp. Dwash Rates

(km) (km) (m) (m) (m) (m/s) (deg. K)

------ ---------- ---------- ------ ------ -------- ----- -------- ----- --------

INSERITI X E Y AL POSTO DELLE COORDINATE PER SALVAGUARDARE LA PRIVACY DELL'AZIENDA

1 ! SRCNAM = S1 !

1 ! X = X, Y, 26.0, 0.0, 1.1, 24.25, 453.15, .0, 76020!

1 ! ZPLTFM = .0 !

1 ! FMFAC = 1.0 ! !END!

2 ! SRCNAM = S2 !

2 ! X = X, Y, 15.0, 0.0, 0.949, 33.98, 473.15, .0, 76020!

2 ! ZPLTFM = .0 !

2 ! FMFAC = 1.0 ! !END!

3 * SRCNAM = STK3 *

3 * X = X, Y, 43.0, 121.5, 3.1, 7.6, 340.0, .0,

1.1E01, 0.0E00, 5.0E00, 1.1E00, 0.0E00, 0.0E00, 1.1E01 *

3 * ZPLTFM = .0 *

3 * FMFAC = 1.0 * *END*

---

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source

(No default)

X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent
the effect of rain-caps or other physical configurations that
reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated
structure that has a significant open area between the surface
and the bulk of the structure, such as an offshore oil platform.
The Base Elevation is that of the surface (ground or ocean),
and the Stack Height is the release height above the Base (not
above the platform). Building heights entered in Subgroup 13c
must be those of the buildings on the platform, measured from
the platform deck. ZPLTFM is used only with MBDW=1 (ISC
downwash method) for sources with building downwash.
(Default: 0.0)

b

0. = No building downwash modeled

1. = Downwash modeled for buildings resting on the surface

2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)

NOTE: must be entered as a REAL number (i.e., with decimal point)

c

An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by IPTU
(e.g. 1 for g/s).

Subgroup (13c)

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

Source a

No. Effective building height, width, length and X/Y offset (in meters) every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for MBDW=2 (PRIME downwash option)

---

1 * SRCNAM = STK1 *

1 * HEIGHT = 50.0, 50.0, 50.0, 50.0, 50.0, 50.0,
50.0, 50.0, 50.0, 50.0, 50.0, 50.0,
50.0, 50.0, 50.0, 50.0, 50.0, 50.0,
50.0, 50.0, 50.0, 50.0, 50.0, 50.0,
50.0, 50.0, 50.0, 50.0, 50.0, 50.0,
50.0, 50.0, 50.0, 50.0, 50.0, 50.0 *

1 * WIDTH = 62.26, 72.64, 80.8, 86.51, 89.59, 89.95,
87.58, 82.54, 75.0, 82.54, 87.58, 89.95,
89.59, 86.51, 80.8, 72.64, 62.26, 50.0,
62.26, 72.64, 80.8, 86.51, 89.59, 89.95,
87.58, 82.54, 75.0, 82.54, 87.58, 89.95,
89.59, 86.51, 80.8, 72.64, 62.26, 50.0 *

1 * LENGTH = 82.54, 87.58, 89.95, 89.59, 86.51, 80.80,
72.64, 62.26, 50.00, 62.26, 72.64, 80.80,
86.51, 89.59, 89.95, 87.58, 82.54, 75.00,
82.54, 87.58, 89.95, 89.59, 86.51, 80.80,
72.64, 62.26, 50.00, 62.26, 72.64, 80.80,
86.51, 89.59, 89.95, 87.58, 82.54, 75.00 *

```
 1  *  XBADJ =  -47.35, -55.76, -62.48, -67.29, -70.07, -70.71,
              -69.21, -65.60, -60.00, -65.60, -69.21, -70.71,
              -70.07, -67.29, -62.48, -55.76, -47.35, -37.50,
              -35.19, -31.82, -27.48, -22.30, -16.44, -10.09,
               -3.43,   3.34,  10.00,   3.34,  -3.43, -10.09,
              -16.44, -22.30, -27.48, -31.82, -35.19, -37.50 *
 1  *  YBADJ =   34.47,  32.89,  30.31,  26.81,  22.50,  17.50,
               11.97,   6.08,   0.00,  -6.08, -11.97, -17.50,
              -22.50, -26.81, -30.31, -32.89, -34.47, -35.00,
              -34.47, -32.89, -30.31, -26.81, -22.50, -17.50,
              -11.97,  -6.08,   0.00,   6.08,  11.97,  17.50,
               22.50,  26.81,  30.31,  32.89,  34.47,  35.00 *
*END*
```

---

a

Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)

---

a

POINT SOURCE: EMISSION-RATE SCALING FACTORS

Use this subgroup to identify temporal variations in the emission rates given in 13b. Factors assigned multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

Sets of emission-rate scale factors are defined in Input Group 19, and are referenced by the FACTORNAME. Provide NSPT1 lines that identify the emission-rate scale factor table for each source-species combination that uses the scaling option. Note that a scale-factor table can be used with more than one source-species combination so a FACTORNAME can be repeated.

Source-Species No.	Source Name b (SRCNAM)	Species Name c (CSPEC)	Scale-factor table Name d (FACTORNAME)
1	* SCALEFACTOR = STK1,	SO2,	POINTS1 * *END*
2	* SCALEFACTOR = STK1,	PM10,	POINTS_DIURNAL * *END*
3	* SCALEFACTOR = STK3,	SO2,	MONTHLY_HEATING * *END*
4	* SCALEFACTOR = STK2,	SO2,	MONTHLY_HEATING * *END*

---

a

Assignment for each source-specie is treated as a separate input subgroup and therefore must end with an input group terminator.

b

Source name must match one of the SRCNAM names defined in Input Group 13b

c

Species name must match one of the CSPEC names of emitted species defined in Input Group 3

d

Scale-factor name must match one of the FACTORNAME names defined in Input Group 19

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with
parameters specified below (NAR1) No default ! NAR1 = 0 !

Units used for area source
emissions below (IARU) Default: 1 ! IARU = 1 !

1 = g/m**2/s
2 = kg/m**2/hr
3 = lb/m**2/hr
4 = tons/m**2/yr
5 = Odour Unit * m/s (vol. flux/m**2 of odour compound)
6 = Odour Unit * m/min
7 = metric tons/m**2/yr
8 = Bq/m**2/s (Bq = becquerel = disintegrations/s)
9 = GBq/m**2/yr

Number of source-species
combinations with variable
emissions scaling factors

provided below in (14d) (NSAR1) Default: 0 ! NSAR1 = 0 !

Number of buoyant polygon area sources
with variable location and emission
parameters (NAR2) No default ! NAR2 = 0 !
(If NAR2 > 0, ALL parameter data for
these sources are read from the file: BAEMARB.DAT)

!END!

Subgroup (14b)

---

a

AREA SOURCE: CONSTANT DATA

---

b

Source No.	Effect. Height (m)	Base Elevation (m)	Initial Sigma z (m)	Emission Rates
-------	------	------	--------	---------

---

a

Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by IARU

(e.g. 1 for g/m**2/s).

Subgroup (14c)

COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON

Source a

No. Ordered list of X followed by list of Y, grouped by source

------ ---

---

a

Data for each source are treated as a separate input subgroup

and therefore must end with an input group terminator.

Subgroup (14d)

---

a

AREA SOURCE: EMISSION-RATE SCALING FACTORS

Use this subgroup to identify temporal variations in the emission

rates given in 14b. Factors assigned multiply the rates in 14b.

Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

Sets of emission-rate scale factors are defined in Input Group 19, and are referenced by the FACTORNAME. Provide NSAR1 lines that identify the emission-rate scale factor table for each source-species combination that uses the scaling option. Note that a scale-factor table can be used with more than one source-species combination so a FACTORNAME can be repeated.

Source-Species No.	Source Name b (SRCNAM)	Species Name c (CSPEC)	Scale-factor table Name d (FACTORNAME)
1	* SCALEFACTOR = 1,	SO2,	AREAS * *END*

---

a

Assignment for each source-specie is treated as a separate input subgroup and therefore must end with an input group terminator.

b

Source name must match one of the SRCNAM names defined in Input Group 14b

c

Species name must match one of the CSPEC names of emitted species defined in Input Group 3

d

Scale-factor name must match one of the FACTORNAME names defined in Input Group 19

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters

Subgroup (15a)

Number of buoyant line sources
with variable location and emission
parameters (NLN2) No default ! NLN2 = 0 !

(If NLN2 > 0, ALL parameter data for
these sources are read from the file: LNEMARB.DAT)

Number of buoyant line sources (NLINES) No default ! NLINES = 0 !

Units used for line source
emissions below (ILNU) Default: 1 ! ILNU = 1 !

1 = g/s
2 = kg/hr
3 = lb/hr
4 = tons/yr
5 = Odour Unit * m**3/s (vol. flux of odour compound)
6 = Odour Unit * m**3/min
7 = metric tons/yr
8 = Bq/s (Bq = becquerel = disintegrations/s)
9 = GBq/yr

Number of source-species
combinations with variable
emissions scaling factors
provided below in (15c) (NSLN1) Default: 0 ! NSLN1 = 0 !

Maximum number of segments used to model

each line (MXNSEG) Default: 7 ! MXNSEG = 7 !

The following variables are required only if NLINES > 0. They are used in the buoyant line source plume rise calculations.

Number of distances at which transitional rise is computed Default: 6 ! NLRISE = 6 !

Average building length (XL) (in meters) No default ! XL = .0 !

Average building height (HBL) (in meters) No default ! HBL = .0 !

Average building width (WBL) (in meters) No default ! WBL = .0 !

Average line source width (WML) (in meters) No default ! WML = .0 !

Average separation between buildings (DXL) (in meters) No default ! DXL = .0 !

Average buoyancy parameter (FPRIMEL) (in m**4/s**3) No default ! FPRIMEL = .0 !

!END!

Subgroup (15b)

BUOYANT LINE SOURCE: CONSTANT DATA

---

a

Source No.	Beg. X Coordinate (km)	Beg. Y Coordinate (km)	End. X Coordinate (km)	End. Y Coordinate (km)	Release Height (m)	Base Elevation (m)	Emission Rates

---

a

Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by ILNTU (e.g. 1 for g/s).

Subgroup (15c)

---

a

BUOYANT LINE SOURCE: EMISSION-RATE SCALING FACTORS

Use this subgroup to identify temporal variations in the emission rates given in 15b. Factors assigned multiply the rates in 15b. Skip sources here that have constant emissions. For more elaborate

variation in source parameters, use LNEMARB.DAT and NLN2 > 0.

Sets of emission-rate scale factors are defined in Input Group 19, and are referenced by the FACTORNAME. Provide NSLN1 lines that identify the emission-rate scale factor table for each source-species combination that uses the scaling option. Note that a scale-factor table can be used with more than one source-species combination so a FACTORNAME can be repeated.

Source-Species No.	Source Name b (SRCNAM)	Species Name c (CSPEC)	Scale-factor table Name d (FACTORNAME)
1	* SCALEFACTOR = 1,	SO2,	LINES * *END*

---

a

Assignment for each source-specie is treated as a separate input subgroup and therefore must end with an input group terminator.

b

Source name must match one of the SRCNAM names defined in Input Group 15b

c

Species name must match one of the CSPEC names of emitted species defined in Input Group 3

d

Scale-factor name must match one of the FACTORNAME names defined in Input Group 19

INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters

Subgroup (16a)

Number of volume sources with
parameters provided in 16b,c (NVL1) No default ! NVL1 = 0 !

Units used for volume source
emissions below in 16b (IVLU) Default: 1 ! IVLU = 1 !

1 = g/s
2 = kg/hr
3 = lb/hr
4 = tons/yr
5 = Odour Unit * m**3/s (vol. flux of odour compound)
6 = Odour Unit * m**3/min
7 = metric tons/yr
8 = Bq/s (Bq = becquerel = disintegrations/s)
9 = GBq/yr

Number of source-species
combinations with variable
emissions scaling factors
provided below in (16c) (NSVL1) Default: 0 ! NSVL1 = 0 !

Number of volume sources with
variable location and emission
parameters (NVL2) No default ! NVL2 = 0 !

(If NVL2 > 0, ALL parameter data for
these sources are read from the VOLEMARB.DAT file(s))

!END!

Subgroup (16b)

---

a

VOLUME SOURCE: CONSTANT DATA

---

b

Source No.	X Coordinate (km)	Y Coordinate (km)	Effect. Height (m)	Base Elevation (m)	Initial Sigma y (m)	Initial Sigma z (m)	Emission Rates
------	----------	----------	------	------	--------	--------	--------

---

a

Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

b

An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by IVLU
(e.g. 1 for g/s).

Subgroup (16c)

---

a

VOLUME SOURCE: EMISSION-RATE SCALING FACTORS

Use this subgroup to identify temporal variations in the emission rates given in 16b. Factors assigned multiply the rates in 16b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

Sets of emission-rate scale factors are defined in Input Group 19, and are referenced by the FACTORNAME. Provide NSVL1 lines that identify the emission-rate scale factor table for each source-species combination that uses the scaling option. Note that a scale-factor table can be used with more than one source-species combination so a FACTORNAME can be repeated.

Source-Species No.	Source Name b (SRCNAM)	Species Name c (CSPEC)	Scale-factor table Name d (FACTORNAME)
1	* SCALEFACTOR = 1,	SO2,	VOLS_SO2 * *END*

---

a

Assignment for each source-specie is treated as a separate input subgroup and therefore must end with an input group terminator.

b

Source name must match one of the SRCNAM names defined in Input Group 16b

c

Species name must match one of the CSPEC names of emitted species defined in Input Group 3
d

Scale-factor name must match one of the FACTORNAME names defined in Input Group 19

INPUT GROUP: 17 -- FLARE source control parameters (variable emissions file)

Number of flare sources defined in FLEMARB.DAT file(s)

(NFL2) Default: 0 ! NFL2 = 0 !

(At least 1 FLEMARB.DAT file is needed if NFL2 > 0)

!END!

INPUT GROUPS: 18a, 18b, 18c, 18d -- Road Emissions parameters

---

Subgroup (18a)

Emissions from roads are generated from individual line segments defined

by a sequence of coordinates provided for each road-link. Each link

is entered as a discrete source and is defined as a section of the road

for which emissions are uniform.

A long, winding isolated road might be characterized by a single link made up of many coordinate triples (x,y,z) that describe its pathway. These points should be sufficient to resolve curves, but need not have uniform spacing. For example, a straight flat segment can be defined by 2 points, regardless of the distance covered. Long line segments are automatically divided further within the model into segments that are limited by the grid-cell boundaries (no segment may extend across multiple cells). One emission rate (g/m/s) for each species is used for the entire road.

Near a congested intersection, many short links may be required to resolve the spatial and temporal distribution of emissions. Each is entered and modeled as a discrete source.

Number of road-links with emission parameters
provided in Subgroup 18b (NRD1) No default ! NRD1 = 0 !

Number of road-links with arbitrarily time-varying
emission parameters (NRD2) No default ! NRD2 = 0 !
(If NRD2 > 0, ALL variable road data
are read from the file: RDEMARB.DAT)

Emissions from one or more of the roads presented in Subgroup 18b may vary over time-based cycles or by meteorology. This variability is modeled by applying an emission-rate scale factor specified for particular road links and species in Subgroup 18c.

Number of road links and species combinations
with variable emission-rate scale-factors

(NSFRDS) Default: 0 ! NSFRDS = 0 !

!END!

Subgroup (18b)

---

a

DATA FOR ROADS WITH CONSTANT OR SCALED EMISSION PARAMETERS

---

b

Road No.	Effect. Height (mAGL)	Initial Sigma z (m)	Initial Sigma y (m)	Emission Rates (g/s/m)
c				
1 *SRCNAM = MAIN_ST_32 *				
1 * X =	2.0,	3.0,	4.2,	0.1 * *END*
2 *SRCNAM = CENTRAL *				
2 * X =	1.0,	1.5,	3.5,	0.03 * *END*

---

a

Data for each of the NRD1 roads are treated as a separate input subgroup and therefore must end with an input group terminator.

b

NSPEC Emission rates must be entered (one for every pollutant modeled). Enter emission rate of zero for secondary pollutants.

c

Road-source names are entered without spaces, and may be 16 characters long.

Subgroup (18c)

---

a

EMISSION-RATE SCALING FACTORS

Use this subgroup to identify temporal variations in the emission rates given in 18b. Factors assigned multiply the rates in 18b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use RDEMARB.DAT and NRD2 > 0.

Sets of emission-rate scale factors are defined in Input Group 19, and are referenced by the FACTORNAME. Provide NSFRDS lines that identify the emission-rate scale factor table for each source-species combination that uses the scaling option. Note that a scale-factor table can be used with more than one source-species combination so a FACTORNAME can be repeated.

Source-Species No.	Source Name b (SRCNAM)	Species Name c (CSPEC)	Scale-factor table Name d (FACTORNAME)
1	* SCALEFACTOR = 1,	PM2.5,	MAJOR_HIGHWAY_004 * *END*

---

a

Assignment for each source-specie is treated as a separate input subgroup

and therefore must end with an input group terminator.

b

Source name must match one of the SRCNAM names defined in Input Group 18b

c

Species name must match one of the CSPEC names of emitted species defined in Input Group 3

d

Scale-factor name must match one of the FACTORNAME names defined in Input Group 19

Subgroup (18d)

---

a

COORDINATES FOR EACH NAMED ROAD

Coordinate No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)

*SRCNAM = MAIN_ST_32 *
*NPTROAD = 2 *
END

1 * XYZ = 340.000, 4875.500, 101.000 * *END*
2 * XYZ = 342.087, 4875.492, 100.500 * *END*

*SRCNAM = CENTRAL *
*NPTROAD = 2 *
END
1 * XYZ = 339.000, 4879.500, 96.000 * *END*

2 * XYZ = 334.021, 4876.600, 101.000 * *END*

---

a

Each line of coordinates is treated as a separate input subgroup
and therefore must end with an input group terminator.

INPUT GROUPS: 19 -- Spray Emissions parameters

Subgroup (19)

Emissions from spray lines are generated from individual line segments defined
by a sequence of coordinates provided for each spray-link. Each link
is entered as a discrete source and is defined as a section of the spray
line for which emissions are uniform.

Long spray line segments are automatically
divided further within the model into segments that are limited by the
grid-cell boundaries (no segment may extend across multiple cells).
One emission rate (g/m/s) for each species is used for the entire line.

Number of spray-lines with emission parameters
provided in Subgroup 20b (NSP1) No default ! NSP1 = 0 !

Number of spray-lines with arbitrarily time-varying
emission parameters (NSP2) No default ! NSP2 = 0 !

(If NSP2 > 0, ALL variable road data
are read from the file: SPEMARB.DAT)

!END!

INPUT GROUPS: 20a, 20b -- Emission rate scale-factor tables

Use this group to enter variation factors applied to emission rates for any source-specie combinations that use this feature. The tables of emission-rate scale factors are referenced by the name assigned to FACTORNAME. These names do not need to include specific source or species names used in the simulation, particularly if one factor table is used for many types of sources and species, but should be descriptive. But if a factor table applies to just one source, the reference name for it should generally contain that source-name. FACTORNAME must NOT include spaces.

The FACTORTYPE for each table must be one of the following:

CONSTANT1	1	scaling factor
MONTH12	12	scaling factors: months 1-12
DAY7	7	scaling factors: days 1-7
		[SUNDAY,MONDAY, ... FRIDAY,SATURDAY]
HOUR24	24	scaling factors: hours 1-24
HOUR24_DAY7	168	scaling factors: hours 1-24,
		repeated 7 times: SUNDAY, MONDAY, ... SATURDAY
HOUR24_MONTH12	288	scaling factors: hours 1-24,
		repeated 12 times: months 1-12
WSP6	6	scaling factors: wind speed classes 1-6
		[speed classes (WSCAT) defined in Group 12]

WSP6_PGCLASS6 36 scaling factors: wind speed classes 1-6

repeated 6 times: PG classes A,B,C,D,E,F

[speed classes (WSCAT) defined in Group 12]

TEMPERATURE12 12 scaling factors: temperature classes 1-12

[temperature classes (TKCAT) defined in Group 12]

The number of tables defined may exceed the number of tables referenced in the input groups for each source type above (for convenience), but tables for all FACTORNAME names referenced must be present here.

Subgroup (20a)

Number of Emission Scale-Factor tables (NSFTAB) Default: 0 ! NSFTAB = 0 !

!END!

Subgroup (20b)

---

a,b,c

Enter factors for NSFTAB Emission Scale-Factor tables

---

a

Assignments for each table are treated as a separate input subgroup
and therefore must end with an input group terminator.

b

FACTORNAME must be no longer than 40 characters

c

Spaces are NOT allowed in any FACTORNAME or FACTORTYPE assignment,
and the names are NOT case-sensitive

INPUT GROUPS: 21a, 21b, 21c -- Non-gridded (discrete) receptor information

---

Subgroup (21a)

Number of non-gridded receptors (NREC) No default ! NREC = 15 !

Group names can be used to assign receptor locations in
Subgroup 20c and thereby provide an identification that
can be referenced when postprocessing receptors. The
default assignment name X is used when NRGRP = 0.

Number of receptor group names (NRGRP) Default: 0 ! NRGRP = 0 !

!END!

Subgroup (21b)

Provide a name for each receptor group if NRGRP>0.

Enter NRGRP lines.

a,b

Group Name

---

a

Each group name provided is treated as a separate input subgroup

and therefore must end with an input group terminator.

b

Receptor group names must not include blanks.

Subgroup (21c)

---

a

NON-GRIDDED (DISCRETE) RECEPTOR DATA

---

c X Y Ground Height b

Receptor Group Coordinate Coordinate Elevation Above Ground

No. Name (km) (km) (m) (m)

--- --- --- --- --- ---

1 ! X = 643.756, 4934.526, 0.000, 2.0! !END!

2 ! X = 643.750, 4934.418, 0.000, 2.0! !END!

3 ! X = X, Y, 0.000, 2.0! !END!

4 ! X = X, Y, 0.000, 2.0! !END!

5 ! X = X, Y 0.000, 2.0! !END!

6 ! X = X, Y, 0.000, 2.0! !END!

7 ! X = X, Y, 0.000, 2.0! !END!

8 ! X = X, Y, 0.000, 2.0! !END!

[…] per brevità omesso

15 ! X = X, Y, 0.000, 2.0! !END!

X , Y , ALTIMETRIA, ALTEZZA RILEVAMENTO

---

a

Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

b

Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

c

Receptors can be assigned using group names provided in 20b. If no group names are used (NRGRP=0) then the default assignment name X must be used.

ALLEGATO 13 input CALPOST - esempio

```
CALPOST.INP     7.0          Group 4 Species data _ Discrete Rec Groups
CALPUFF Demonstration



---------- Run title (3 lines) ----------------------------------------

                CALPOST MODEL CONTROL FILE
                -------------------------


--------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                  Default File Name
----                  -----------------
Conc/Dep Flux File       MODEL.DAT        ! MODDAT = inp\concentration.con   !
Relative Humidity File    VISB.DAT         * VISDAT =   *
Background Data File      BACK.DAT         * BACKDAT =   *
Transmissometer or        VSRN.DAT         * VSRDAT =   *
Nephelometer Data File     or
DATSAV Weather Data File   or
Prognostic Weather  File

Single-point Met File     SURFACE.DAT       * MET1DAT =   *
 (Used ONLY to identify CALM hours for plume model
  output averaging when MCALMPRO option is used)
```

Output Files

File Default File Name

---- ----------

List File CALPOST.LST ! PSTLST =OUT\CALPOST.LST !

Pathname for Timeseries Files (blank) * TSPATH = *

(activate with exclamation points only if

providing NON-BLANK character string)

Pathname for Plot Files (blank) * PLPATH = *

(activate with exclamation points only if

providing NON-BLANK character string)

User Character String (U) to augment default filenames

(activate with exclamation points only if

providing NON-BLANK character string)

Timeseries TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT

Peak Value PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

! TSUNAM = 3d !

Top Nth Rank Plot RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT

or RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

! TUNAM = 3d !

Exceedance Plot EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT

or EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD

! XUNAM = 3d !

Echo Plot

(Specific Days)

yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT

or yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD

Visibility Plot DAILY_VISIB_VUNAM.DAT * VUNAM =VTEST *

(Daily Peak Summary)

Auxiliary Output Files

File Default File Name

---- ----------

Visibility Change DELVIS.DAT * DVISDAT = *

All file names will be converted to lower case if LCFILES = T

Otherwise, if LCFILES = F, file names will be converted to UPPER CASE

T = lower case ! LCFILES = T !

F = UPPER CASE

NOTE: (1) file/path names can be up to 132 characters in length

NOTE: (2) User-supplied character string can be up to 24 characters in length (20 if 3D concentrations are processed as these include the 4-character level text)

NOTE: (3) Filenames for ALL PLOT and TIMESERIES FILES are constructed
using a template that includes a pathname, user-supplied
character(s), and context-specific strings, where
ASPEC = Species Name
CONC = CONC Or WFLX Or DFLX Or TFLX
tt = Averaging Period (e.g. 03)
ii = Rank (e.g. 02)
hhmm = Time (at start) in LST
szzzz = LST time zone shift (EST is -0500)
yyyy = Year(LST)
mm = Month(LST)
dd = day of month (LST)
are determined internally based on selections made below.
If a path or user-supplied character(s) are supplied, each
must contain at least 1 non-blank character.

!END!

INPUT GROUP: 1 -- General run control parameters

Option to run all periods found
in the met. file(s) (METRUN) Default: 0 ! METRUN = 1 !

METRUN = 0 - Run period explicitly defined below
METRUN = 1 - Run all periods in CALPUFF data file(s)

Starting date: Year (ISYR) -- No default ! ISYR = 2020 !
Month (ISMO) -- No default ! ISMO = 01 !
Day (ISDY) -- No default ! ISDY = 01 !

Starting time: Hour (ISHR) -- No default ! ISHR = 00 !

Minute (ISMIN) -- No default ! ISMIN = 00 !

Second (ISSEC) -- No default ! ISSEC = 00 !

Ending date: Year (IEYR) -- No default ! IEYR = 2020 !

Month (IEMO) -- No default ! IEMO = 12 !

Day (IEDY) -- No default ! IEDY = 31 !

Ending time: Hour (IEHR) -- No default ! IEHR = 23 !

Minute (IEMIN) -- No default ! IEMIN = 00 !

Second (IESEC) -- No default ! IESEC = 00 !

(These are only used if METRUN = 0)

Base Time Zone for the CALPUFF simulation:

(character*8) (ABTZ) -- No default ! ABTZ= UTC+0100 !

All times are in the base time zone of the CALPUFF simulation.

CALPUFF Dataset Version 2.1 contains the zone, but earlier versions

do not, and the zone must be specified here.

Examples:

Los Angeles, USA = UTC-0800

New York, USA = UTC-0500

Santiago, Chile = UTC-0400

Greenwich Mean Time (GMT) = UTC+0000

Rome, Italy = UTC+0100

Cape Town, S.Africa = UTC+0200

Sydney, Australia = UTC+1000

Process every period of data?

(NREP) -- Default: 1 ! NREP = 1 !

(1 = every period processed,

2 = every 2nd period processed,

5 = every 5th period processed, etc.)

Selectively process data only within certain hours?

(This feature is NOT used with Visibility or CALM Processing)

Provide 24 values. The first value is for the hour

between 0000 and 0100, the second is for the hour

between 0100 and 0200, (etc.) and the last is for the hour

between 2300 and 2400.

(HRPROC) -- Default: 24*1, or

Hour: 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24

Default: 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1

! HRPROC = 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1 !

0 = data within hour are NOT processed

1 = data within hour are processed

Species & Concentration/Deposition Information

Multiple species-levels contained in a single CALPUFF output file

can be processed in 1 application. These are identified by name

(ASPEC) in Group 4, along with several related inputs. For

visibility there must be only 1 species listed and it must be

called VISIB.

Number of species (NSPEC) -- Default: 1 ! NSPEC = 1 !

Add Hourly Background Concentrations/Fluxes?

- Current implementation allows hourly data for 1 species, and
  is restricted to NSPEC=1
- Units must be mass-based and the conversion factor to either
  g/m**3 or g/m**2/s must be provided in the header of the file
- Option cannot be used with volume-based (e.g. ppb) units

(LBACK) -- Default: F ! LBACK = F !

NO2 Configuration

Source of NO2 when ASPEC=NO2 (Group 4) or LVNO2=T (Group 2) may be from CALPUFF NO2 concentrations OR from a fraction of CALPUFF NOx concentrations. Specify the fraction of NOx that is treated as NO2 either as a constant or as a table of fractions that depend on the magnitude of the NOx concentration:

(NO2CALC) -- Default: 1 ! NO2CALC = 1 !

0 = Use NO2 directly (NO2 must be in file)

1 = Specify a single NO2/NOx ratio (RNO2NOX)

2 = Specify table of NO2/NOx ratios for short-term and long-term concentration averages: Short-Term (TNO2NOX_S)
Long-Term (TNO2NOX_L)

(NOTE: Scaling Factors must NOT be used with NO2CALC=2)

Single NO2/NOx ratio (0.0 to 1.0) for treating some or all NOx as NO2, where [NO2] = [NOX] * RNO2NOX (used only if NO2CALC = 1)

(RNO2NOX) -- Default: 1.0 ! RNO2NOX = 1.0 !

Table of NO2/NOx ratios that vary with NOx concentration.
Provide a series of NOx concentrations (ppb) and the corresponding

NO2/NOx ratio, with NOx increasing in magnitude. The ratio used for a particular NOx concentration is interpolated from the values provided in the table. The ratio for the smallest tabulated NOx concentration (the first) is used for all NOx concentrations less than the smallest tabulated value, and the ratio for the largest tabulated NOx concentration (the last) is used for all NOx concentrations greater than the largest tabulated value.
(used only if NO2CALC = 2)

(a) NOx concentration conversion factor from ppb to ug/m3
(1.0 ppb NOx = PPB_UGM3 ug/m3 NOx)
Default value assumes T=25.0 C
P=1.0 atm
MW=46.0
(PPB_UGM3) -- Default: 1.880 ! PPB_UGM3 = 1.880 !

(b) Short-Term Average Conversion Table

NOx concentration (CNOX_S) -- No Default(ppb)
NO2/NOx ratio for each NOx concentration
(TNO2NOX_S) -- No Default

! CNOX_S = 5.0, 15.0, 30.0, 50.0, 70.0, 90.0, 112.5, 137.5,
162.5, 187.5, 212.5, 237.5, 262.5, 287.5, 312.5, 337.5,
362.5, 387.5, 425.0, 475.0, 550.0, 650.0, 750.0, 875.0!

! TNO2NOX_S = 0.9938, 0.9922, 0.9844, 0.9094, 0.7477, 0.6085, 0.4976, 0.4173,
0.3543, 0.3056, 0.2684, 0.2404, 0.2194, 0.2035, 0.1912, 0.1813,
0.1726, 0.1645, 0.1527, 0.1506, 0.1474, 0.1432, 0.1390, 0.1337!

(c) Long-Term Average Conversion Table

NOx concentration (CNOX_L) -- No Default(ppb)

NO2/NOx ratio for each NOx concentration

(TNO2NOX_L) -- No Default

! CNOX_L = 5.0, 15.0, 30.0, 50.0, 70.0, 90.0, 112.5, 137.5,
162.5, 187.5, 212.5, 237.5, 262.5, 287.5, 312.5, 337.5,
362.5, 387.5, 425.0, 475.0, 550.0, 650.0, 750.0, 875.0!

! TNO2NOX_L = 0.8130, 0.8130, 0.7306, 0.6250, 0.5400, 0.4700, 0.4000, 0.3500,
0.3100, 0.2800, 0.2500, 0.2300, 0.2194, 0.2035, 0.1912, 0.1813,
0.1726, 0.1645, 0.1527, 0.1506, 0.1474, 0.1432, 0.1390, 0.1337!

(d) Minimum number of hours in average
for using the long-term average
conversion table

(MINHR_L) -- Default: 8000 ! MINHR_L = 8000 !

Source information

Option to process source contributions:

0 = Process only total reported contributions

1 = Sum all individual source contributions and process

2 = Run in TRACEBACK mode to identify source
contributions at a SINGLE receptor

(MSOURCE) -- Default: 0 ! MSOURCE = 0 !

Plume Model Output Processing Options

Output from models other than CALPUFF and CALGRID can be written in the CONC.DAT format and processed by CALPOST. Plume models such as AERMOD typically do not treat CALM hours, and do not include such hours in multiple-hour averages, with specific rules about how many calm hours can be removed from an average. This treatment is known as CALM PROCESSING. Calm periods are identified from wind speeds in the meteorological data file for the application, which must be identified in Input Group 0 as the single-point meteorological data file MET1DAT.

0 = Option is not used for CALPUFF/CALGRID output files

1 = Apply CALM processing procedures to multiple-hour averages

(MCALMPRO) -- Default: 0 ! MCALMPRO = 0 !

Format of Single-point Met File

1 = AERMOD/AERMET SURFACE file

(MET1FMT) -- Default: 1 ! MET1FMT = 1 !

Receptor information

Gridded receptors processed? (LG) -- Default: F ! LG = T !

Discrete receptors processed? (LD) -- Default: F ! LD = T !

CTSG Complex terrain receptors processed?

(LCT) -- Default: F ! LCT = F !

--Select DISCRETE receptors (only used when LD = T)

Use ONE of the methods listed below to identify the receptors to process.

The default settings configure the application to use all receptors because

both methods 1 and 3 are OFF, and method 2 (with -1) uses all.

METHOD #1: Report results by DISCRETE receptor RING?

--------- (set NDRECP to -1 and NDRGRP to 0 when using LDRING)

(LDRING) -- Default: F ! LDRING = F !

METHOD #2: Identify receptors by their order in the MODEL output file

--------- (set NDRING to F and NDRGRP to 0 when using NDRECP)

Select ALL DISCRETE receptors by setting NDRECP flag to -1;

OR

Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each

0 = discrete receptor not processed

1 = discrete receptor processed

using repeated value notation to select blocks of receptors:

23*1, 15*0, 12*1

Flag for all receptors after the last one assigned is set to 0

(NDRECP) -- Default: -1 ! NDRECP = -1 !

METHOD #3: Report results by DISCRETE Receptor-Group Name

--------- (set NDRING to F and NDRECP to -1 when using NDRGRP)

Number of DISCRETE Receptor-Group Names provided in Subgroup (1a)

(NDRGRP) -- Default: 0 ! NDRGRP = 0 !

--Select range of GRIDDED receptors (only used when LG = T):

X index of LL corner (IBGRID) -- Default: -1 ! IBGRID = 2 !

(-1 OR 1 <= IBGRID <= NX)

Y index of LL corner (JBGRID) -- Default: -1 ! JBGRID = 2 !
(-1 OR 1 <= JBGRID <= NY)

X index of UR corner (IEGRID) -- Default: -1 ! IEGRID = 98 !
(-1 OR 1 <= IEGRID <= NX)

Y index of UR corner (JEGRID) -- Default: -1 ! JEGRID = 98 !
(-1 OR 1 <= JEGRID <= NY)

Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1

--Specific gridded receptors can also be excluded from CALPOST
processing by filling a processing grid array with 0s and 1s. If the
processing flag for receptor index (i,j) is 1 (ON), that receptor
will be processed if it lies within the range delineated by IBGRID,
JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
processed in the run. By default, all array values are set to 1 (ON).

Number of gridded receptor rows provided in Subgroup (1a) to
identify specific gridded receptors to process
(NGONOFF) -- Default: 0 ! NGONOFF = 0 !

!END!

Subgroup (1a) -- Names of DISCRETE Receptor-Groups to process

---

Starting with TNG, the names of specific receptor-groups identified
in the model application are available here and can be used to select
groups of receptors to include in the post-processing. ALL groups are
selected if the single name DISCRETE is used. This name is not
valid if combined with another name.
Provide NDRGRP lines, 1 per name.

(DRGRPNAM) -- Default: DISCRETE

```
* DRGRPNAM = FENCELINE      * *END*
* DRGRPNAM = SOUTH_FIELDS   * *END*
* DRGRPNAM = FAR_FIELD      * *END*
```

One name is assigned on a line and is read as a separate input subgroup
and therefore each line must end with an input group terminator.

Subgroup (1b) -- Specific gridded receptors included/excluded

---

Specific gridded receptors are excluded from CALPOST processing
by filling a processing grid array with 0s and 1s. A total of
NGONOFF lines are read here. Each line corresponds to one 'row'
in the sampling grid, starting with the NORTHERNMOST row that
contains receptors that you wish to exclude, and finishing with
row 1 to the SOUTH (no intervening rows may be skipped). Within
a row, each receptor position is assigned either a 0 or 1,
starting with the westernmost receptor.
0 = gridded receptor not processed

1 = gridded receptor processed

Repeated value notation may be used to select blocks of receptors:

23*1, 15*0, 12*1

Because all values are initially set to 1, any receptors north of
the first row entered, or east of the last value provided in a row,
remain ON.

(NGXRECP) -- Default: 1

* NGXRECP = 10*1, 25*0, 12*1, 0, 1, 3*0 * *END*

* NGXRECP = 23*1, 15*0, 12*1, 14*0 * *END*

* NGXRECP = 54*1, 0, 0, 0 * *END* (Southernmost row of gridded receptors)

Data for each row are read as a separate input subgroup and
therefore each row must end with an input group terminator.

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)

Test visibility options specified to see
if they conform to FLAG 2010 configuration?

(MVISCHECK) -- Default: 1 ! MVISCHECK = 1 !

0 = NO checks are made

1 = Technical options must conform to FLAG 2010 visibility guidance
ASPEC = VISIB
LVNO2 = T

NO2CALC = 1

RNO2NOX = 1.0

MVISBK = 8

M8_MODE = 5

Some of the data entered for use with the FLAG 2010 configuration are specific to the Class I area being evaluated. These values can be checked within the CALPOST user interface when the name of the Class I area is provided.

Name of Class I Area (used for QA purposes only)

(AREANAME) -- Default: User ! AREANAME = USER !

Particle growth curve f(RH) for hygroscopic species

(MFRH) -- Default: 4 ! MFRH = 2 !

1 = IWAQM (1998) f(RH) curve (originally used with MVISBK=1)

2 = FLAG (2000) f(RH) tabulation

3 = EPA (2003) f(RH) tabulation

4 = IMPROVE (2006) f(RH) tabulations for sea salt, and for small and large SULFATE and NITRATE particles;
Used in Visibility Method 8 (MVISBK = 8 with M8_MODE = 1, 2, or 3)

Maximum relative humidity (%) used in particle growth curve

(RHMAX) -- Default: 98 ! RHMAX = 98 !

Modeled species to be included in computing the light extinction

Include SULFATE? (LVSO4) -- Default: F ! LVSO4 = T !

Include NITRATE? (LVNO3) -- Default: F ! LVNO3 = T !

Include ORGANIC CARBON? (LVOC) -- Default: F ! LVOC = F !

Include COARSE PARTICLES? (LVPMC) -- Default: F ! LVPMC = F !

Include FINE PARTICLES? (LVPMF) -- Default: F ! LVPMF = F !

Include ELEMENTAL CARBON? (LVEC) -- Default: T ! LVEC = T !

Include NO2 absorption? (LVNO2) -- Default: F ! LVNO2 = T !

With Visibility Method 8 -- Default: T

FLAG (2010)

And, when ranking for TOP-N, TOP-50, and Exceedance tables,

Include BACKGROUND? (LVBK) -- Default: T ! LVBK = T !

Species name used for particulates in MODEL.DAT file

COARSE (SPECPMC) -- Default: PMC ! SPECPMC = PMC !

FINE (SPECPMF) -- Default: PMF ! SPECPMF = PMF !

Extinction Efficiency (1/Mm per ug/m**3)

MODELED particulate species:

PM COARSE (EEPMC) -- Default: 0.6 ! EEPMC = 0.6 !

PM FINE (EEPMF) -- Default: 1.0 ! EEPMF = 1 !

BACKGROUND particulate species:

PM COARSE (EEPMCBK) -- Default: 0.6 ! EEPMCBK = 0.6 !

Other species:

AMMONIUM SULFATE (EESO4) -- Default: 3.0 ! EESO4 = 3 !

AMMONIUM NITRATE (EENO3) -- Default: 3.0 ! EENO3 = 3 !

ORGANIC CARBON (EEOC) -- Default: 4.0 ! EEOC = 4 !

SOIL (EESOIL)-- Default: 1.0 ! EESOIL = 1 !

ELEMENTAL CARBON (EEEC) -- Default: 10. ! EEEC = 10 !

NO2 GAS (EENO2) -- Default: .1755 ! EENO2 = 0.17 !

Visibility Method 8:

AMMONIUM SULFATE (EESO4S) Set Internally (small)

AMMONIUM SULFATE (EESO4L) Set Internally (large)

AMMONIUM NITRATE (EENO3S) Set Internally (small)

AMMONIUM NITRATE (EENO3L) Set Internally (large)

ORGANIC CARBON (EEOCS) Set Internally (small)

ORGANIC CARBON (EEOCL) Set Internally (large)

SEA SALT (EESALT) Set Internally

Background Extinction Computation

Method used for the 24h-average of percent change of light extinction:
Hourly ratio of source light extinction / background light extinction
is averaged? (LAVER) -- Default: F ! LAVER = F !

Method used for background light extinction
(MVISBK) -- Default: 8 ! MVISBK = 8 !
FLAG (2010)

1 = Supply single light extinction and hygroscopic fraction
- Hourly F(RH) adjustment applied to hygroscopic background and modeled sulfate and nitrate

2 = Background extinction from speciated PM concentrations (A)
- Hourly F(RH) adjustment applied to observed and modeled sulfate and nitrate
- F(RH) factor is capped at F(RHMAX)

3 = Background extinction from speciated PM concentrations (B)
- Hourly F(RH) adjustment applied to observed and modeled sulfate and nitrate
- Receptor-hour excluded if RH>RHMAX
- Receptor-day excluded if fewer than 6 valid receptor-hours

4 = Read hourly transmissometer background extinction measurements
- Hourly F(RH) adjustment applied to modeled sulfate and nitrate

- Hour excluded if measurement invalid (missing, interference, or large RH)
- Receptor-hour excluded if RH>RHMAX
- Receptor-day excluded if fewer than 6 valid receptor-hours

5 = Read hourly nephelometer background extinction measurements
- Rayleigh extinction value (BEXTRAY) added to measurement
- Hourly F(RH) adjustment applied to modeled sulfate and nitrate
- Hour excluded if measurement invalid (missing, interference, or large RH)
- Receptor-hour excluded if RH>RHMAX
- Receptor-day excluded if fewer than 6 valid receptor-hours

6 = Background extinction from speciated PM concentrations
- FLAG (2000) monthly RH adjustment factor applied to observed and and modeled sulfate and nitrate

7 = Use observed weather or prognostic weather information for background extinction during weather events; otherwise, use Method 2
- Hourly F(RH) adjustment applied to modeled sulfate and nitrate
- F(RH) factor is capped at F(RHMAX)
- During observed weather events, compute Bext from visual range if using an observed weather data file, or
- During prognostic weather events, use Bext from the prognostic weather file
- Use Method 2 for hours without a weather event

8 = Background extinction from speciated PM concentrations using the IMPROVE (2006) variable extinction efficiency formulation (MFRH must be set to 4)
- Split between small and large particle concentrations of SULFATES, NITRATES, and ORGANICS is a function of concentration and different extinction efficiencies are used for each
- Source-induced change in visibility includes the increase in extinction of the background aerosol due to the change in the

extinction efficiency that now depends on total concentration.

- Fsmall(RH) and Flarge(RH) adjustments for small and large particles are applied to observed and modeled sulfate and nitrate concentrations
- Fsalt(RH) adjustment for sea salt is applied to background sea salt concentrations
- F(RH) factors are capped at F(RHMAX)
- RH for Fsmall(RH), Flarge(RH), and Fsalt(RH) may be obtained from hourly data as in Method 2 or from the FLAG monthly RH adjustment factor used for Method 6 where EPA F(RH) tabulation is used to infer RH, or monthly Fsmall, Flarge, and Fsalt RH adjustment factors can be directly entered.

  Furthermore, a monthly RH factor may be applied to either hourly concentrations or daily concentrations to obtain the 24-hour extinction.

  These choices are made using the M8_MODE selection.

Additional inputs used for MVISBK = 1:

Background light extinction (1/Mm)

(BEXTBK) -- No default ! BEXTBK = 12 !

Percentage of particles affected by relative humidity

(RHFRAC) -- No default ! RHFRAC = 10 !

Additional inputs used for MVISBK = 6,8:

Extinction coefficients for hygroscopic species (modeled and background) are computed using a monthly RH adjustment factor in place of an hourly RH factor (VISB.DAT file is NOT needed). Enter the 12 monthly factors here (RHFAC). Month 1 is January.

(RHFAC) -- No default ! RHFAC = 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !

Additional inputs used for MVISBK = 7:

The weather data file (DATSAV abbreviated space-delimited) that is identified as VSRN.DAT may contain data for more than one station. Identify the stations that are needed in the order in which they will be used to obtain valid weather and visual range. The first station that contains valid data for an hour will be used. Enter up to MXWSTA (set in PARAMS file) integer station IDs of up to 6 digits each as variable IDWSTA, and enter the corresponding time zone for each, as variable TZONE (= UTC-LST).

A prognostic weather data file with Bext for weather events may be used in place of the observed weather file. Identify this as the VSRN.DAT file and use a station ID of IDWSTA = 999999, and TZONE = 0.

NOTE: TZONE identifies the time zone used in the dataset. The DATSAV abbreviated space-delimited data usually are prepared with UTC time rather than local time, so TZONE is typically set to zero.

(IDWSTA) -- No default * IDWSTA = 000000 *
(TZONE) -- No default * TZONE = 0. *

Additional inputs used for MVISBK = 2,3,6,7,8:

Background extinction coefficients are computed from monthly CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),

coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and elemental carbon (BKEC). Month 1 is January.
(ug/m**3)

(BKSO4) -- No default ! BKSO4 = 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !
(BKNO3) -- No default ! BKNO3 = 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !
(BKPMC) -- No default ! BKPMC = 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !
(BKOC) -- No default ! BKOC = 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !
(BKSOIL) -- No default ! BKSOIL= 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !
(BKEC) -- No default ! BKEC = 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !

Additional inputs used for MVISBK = 8:

Extinction coefficients for hygroscopic species (modeled and background) may be computed using hourly RH values and hourly modeled concentrations, or using monthly RH values inferred from the RHFAC adjustment factors and either hourly or daily modeled concentrations, or using monthly RHFSML, RHFLRG, and RHFSEA adjustment factors and either hourly or daily modeled concentrations.

(M8_MODE) -- Default: 5 ! M8_MODE= 5 !

FLAG (2010)

1 = Use hourly RH values from VISB.DAT file with hourly
modeled and monthly background concentrations.

2 = Use monthly RH from monthly RHFAC and EPA (2003) f(RH) tabulation
with hourly modeled and monthly background concentrations.
(VISB.DAT file is NOT needed).

3 = Use monthly RH from monthly RHFAC with EPA (2003) f(RH) tabulation
with daily modeled and monthly background concentrations.
(VISB.DAT file is NOT needed).

4 = Use monthly RHFSML, RHFLRG, and RHFSEA with hourly modeled
and monthly background concentrations.
(VISB.DAT file is NOT needed).

5 = Use monthly RHFSML, RHFLRG, and RHFSEA with daily modeled
and monthly background concentrations.
(VISB.DAT file is NOT needed).

Background extinction coefficients are computed from monthly
CONCENTRATIONS of sea salt (BKSALT). Month 1 is January.
(ug/m**3)

(BKSALT) -- No default ! BKSALT= 0, 0, 0, 0,
0, 0, 0, 0,
0, 0, 0, 0 !

Extinction coefficients for hygroscopic species (modeled and
background) can be computed using monthly RH adjustment factors
in place of an hourly RH factor (VISB.DAT file is NOT needed).
Enter the 12 monthly factors here (RHFSML,RHFLRG,RHFSEA).

Month 1 is January. (Used if M8_MODE = 4 or 5)

Small ammonium sulfate and ammonium nitrate particle sizes

(RHFSML) -- No default ! RHFSML= 0, 0, 0, 0,

0, 0, 0, 0,

0, 0, 0, 0 !

Large ammonium sulfate and ammonium nitrate particle sizes

(RHFLRG) -- No default ! RHFLRG= 0, 0, 0, 0,

0, 0, 0, 0,

0, 0, 0, 0 !

Sea salt particles

(RHFSEA) -- No default ! RHFSEA= 0, 0, 0, 0,

0, 0, 0, 0,

0, 0, 0, 0 !

Additional inputs used for MVISBK = 2,3,5,6,7,8:

Extinction due to Rayleigh scattering is added (1/Mm)

(BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10 !

!END!

INPUT GROUP: 3 -- Output options

Documentation

Documentation records contained in the header of the
CALPUFF output file may be written to the list file.
Print documentation image?

(LDOC) -- Default: F ! LDOC = F !

Types of tabulations reported

---

1) Visibility: daily visibility tabulations are always reported
for the selected receptors when ASPEC = VISIB.
In addition, any of the other tabulations listed
below may be chosen to characterize the light
extinction coefficients.
[List file or Plot/Analysis File]

2) Top 50 table for each averaging time selected
[List file only]

(LT50) -- Default: T ! LT50 = T !

3) Top 'N' table for each averaging time selected
[List file or Plot file]

(LTOPN) -- Default: F ! LTOPN = T !

-- Number of 'Top-N' values at each receptor
selected (NTOP must be <= 4)

(NTOP) -- Default: 4 ! NTOP = 4 !

-- Specific ranks of 'Top-N' values reported
(NTOP values must be entered)

(ITOP(4) array) -- Default: ! ITOP = 1,2,3,4 !

1,2,3,4

-- Screen applied to values before updating stored ranks

(ITOPS) -- Default: 0 ! ITOPS = 0 !

0 = No screen: all values at each receptor are ranked
(rank 1 and rank 2 may be in same day)

1 = Day screen: only peak value in day at each receptor is ranked
(rank 1 and rank 2 may not be in same day)

4) Threshold exceedance counts for each receptor and each averaging time selected

[List file or Plot file]

(LEXCD) -- Default: F ! LEXCD = F !

-- Counts for the shortest averaging period selected can be tallied daily, and receptors that experience more than NCOUNT counts over any NDAY period will be reported. This type of exceedance violation output is triggered only if NDAY > 0.

Accumulation period(Days)

(NDAY) -- Default: 0 ! NDAY = 0 !

Number of exceedances allowed

(NCOUNT) -- Default: 1 ! NCOUNT = 1 !

5) Selected day table(s)

Echo Option -- Many records are written each averaging period

selected and output is grouped by day

[List file or Plot file]

(LECHO) -- Default: F ! LECHO = T !

Timeseries Option -- Averages at all selected receptors for each selected averaging period are written to timeseries files. Each file contains one averaging period, and all receptors are written to a single record each averaging time.

[TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]

(LTIME) -- Default: F ! LTIME = T !

Peak Value Option -- Averages at all selected receptors for each selected averaging period are screened and the peak value each period is written to timeseries files. Each file contains one averaging period.

[PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT files]

(LPEAK) -- Default: F ! LPEAK = T !

-- Days selected for output

(IECHO(366)) -- Default: 366*0

! IECHO = 366*1 !

(366 values must be entered)

Plot output options

Plot files can be created for the Top-N, Exceedance, and Echo tables selected above. Several formats for these files are available:

- Tabular listings for ALL selected receptors, reporting the (x,y) location and value(s) in columns

.DAT -- Columns are formatted for direct viewing in text editors

.CSV -- Columns are delimited by commas

- Raster formats in which results at GRIDDED receptors ONLY are written using a compact representation.

.GRD -- SURFER(R) plotting software format

.ASC -- ESRI ASCII Grid format

The CSV (comma-separated-variable) format is useful for importing results into software that automatically recognizes CSV files.
The SURFER and ESRI raster formats are similar, but are specific to the type of software indicated. GRD files can be read directly into SURFER. ASC files can be read into ArcMap/ArcGIS systems.

A plotting and analysis file can also be created for the daily peak visibility summary output, in DAT format only.

Generate Plot file output in addition to writing tables to List file (ECHO goes to either List or Plot)?

(LPLT) -- Default: F ! LPLT = T !

Plot cumulative values in addition to incremental values?

(LCUM) -- Default: F ! LCUM = F !

Plot file format? (PLOTFM) -- Default: 1 ! PLOTFM = 3 !

1 = .DAT CALVIEW/SURFER (formatted columns)

2 = .CSV ArcMap/ArcGIS (comma-separated-variable columns)

3 = .GRD CALVIEW/SURFER (SURFER 2D grid raster format)

4 = .ASC ArcMap/ArcGIS (ESRI ASCII 2D grid raster format)

Auxiliary Output Files (for subsequent analyses)

Visibility

A separate output file may be requested that contains the change in visibility at each selected receptor when ASPEC = VISIB. This file can be processed to construct visibility measures that are not available in CALPOST.

Output file with the visibility change at each receptor?

(MDVIS) -- Default: 0 ! MDVIS = 0 !

0 = Do Not create file

1 = Create file of DAILY (24 hour) Delta-Deciview

2 = Create file of DAILY (24 hour) Extinction Change (%)

3 = Create file of HOURLY Delta-Deciview

4 = Create file of HOURLY Extinction Change (%)

Additional Debug Output

Output selected information to List file for debugging?

(LDEBUG) -- Default: F ! LDEBUG = F !

Output hourly extinction information to REPORT.HRV? (Visibility Method 7)

(LVEXTHR) -- Default: F ! LVEXTHR = F !

!END!

INPUT GROUP: 4 -- Species processing information

Definitions:

Species to process (ASPEC) -- No default

Notes --

a. ASPEC = VISIB for visibility processing

Layer/deposition code (ILAYER) -- Default: 1

'1' for CALPUFF concentrations,

'-1' for dry deposition fluxes,

'-2' for wet deposition fluxes,

'-3' for wet+dry deposition fluxes.

Notes --

a. Use actual model layer when processing

3D gridded concentration data

Units for Output (IPRTU) -- Default: 0

	Concentration	Deposition	
-4 =	ppt		parts per trillion
-3 =	ppb		parts per billion
-2 =	ppm		parts per million
-1 =	%		percent
0 =	(data)	(data)	use units from data file
1 =	g/m**3	g/m**2/s	
2 =	mg/m**3	mg/m**2/s	
3 =	ug/m**3	ug/m**2/s	

4 = ng/m**3 ng/m**2/s

5 = Odour Units

11 = TBq/m**3 TBq/m**2/s TBq=terabecquerel

12 = GBq/m**3 GBq/m**2/s GBq=gigabecquerel

13 = Bq/m**3 Bq/m**2/s Bq=becquerel (disintegrations/s)

Notes --

a. Use IPRTU=0 to retain the units in the data file

b. Mass concentration output units (e.g. ug/m**3) are allowed
only if input data are in mass concentration units

c. Volume concentration output units (e.g. ppb) are allowed
only if input data are in volume concentration units

d. Radiation output units (e.g. GBq/m**3) are allowed
only if input data are in radiation units

e. Visibility extinction expressed in 1/Mega-meters (IPRTU is ignored)

Scaling of the form: X(new) = X(old) * A + B

Multiplicative Factor (A) -- Default: 0.0

Additive Term (B) -- Default: 0.0

Notes --

a. Scaling is NOT applied if A = B = 0.0

b. Additive term B must be provided in the IPRTU output units

Averaging time(s) reported

1-pd averages (L1PD) -- Default: T

(pd = averaging period of model output)

1-hr averages (L1HR) -- Default: T

3-hr averages (L3HR) -- Default: T

24-hr averages (L24HR) -- Default: T

Run-length averages (LRUNL) -- Default: T

User-specified averaging time in hours, minutes, seconds

(results for averaging time are reported if it is not zero)

(NAVGH) -- Default: 0

(NAVGM) -- Default: 0

(NAVGS) -- Default: 0

Threshold concentrations (output units)
used to tally threshold exceedance counts for each averaging time
(used only if LEXCD = T)

Threshold for 1-hr averages (THRESH1) -- Default: -1.0

Threshold for 3-hr averages (THRESH3) -- Default: -1.0

Threshold for 24-hr averages (THRESH24) -- Default: -1.0

Threshold for NAVG-hr averages (THRESHN) -- Default: -1.0

Values:

Assign NSPEC comma-separated values on a line for each of the variables
in this group to identify which species are processed, and to provide
species-related inputs.
Species names must have 12 non-blank characters or less.
Visibility applications must have only 1 species, and it must be VISIB.

Variable Default Assignment (VARIABLE = v(1), v(2), ... v(NSPEC))

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Species (none) !ASPEC = Odor !

Layer 1 !ILAYER = 1 !

Units 1 !IPRTU = 5 !

Multiply 0.0 !A = 2.3 !

Add 0.0 !B = 0.0 !

Averages --

1-pd T !L1PD = F !

1-hr T !L1HR = F !

3-hr T !L3HR = F !

24-hr T !L24HR = F !

Run-len T !LRUNL = T !

User-Hr 0 !NAVGH = 8783 !

User-Min 0 !NAVGM = 0 !

User-Sec 0 !NAVGS = 0 !

Exceedance Thresholds --

1-hr -1.0 !THRESH1 = -1.0 !

3-hr -1.0 !THRESH3 = -1.0 !

24-hr -1.0 !THRESH24= -1.0 !

NAVG-hr -1.0 !THRESHN = -1.0 !

!END!

FONTI

[1] https://www.enviroware.it/lapmod/
[2] https://eur-lex.europa.eu/legal-content/IT/TXT/HTML/?uri=LEGISSUM:ev0002
[3] https://www.tuttoambiente.it/commenti-premium/testo-unico-ambientale-cose-e-come-si-e-evoluto/
[4] https://www.normattiva.it/atto/caricaDettaglioAtto?atto.dataPubblicazioneGazzetta=2006-04-14&atto.codiceRedazionale=006G0171&atto.articolo.numero=0&atto.articolo.sottoArticolo=1&atto.articolo.sottoArticolo1=10&qId=03cc134c-431b-4a55-baab-60cf4d6e6ffc&tabID=0.1903684262752654&title=lbl.dettaglioAtto
[5] http://www.src.com/
[6] https://earthexplorer.usgs.gov/
[7] https://www.enviroware.it/lapmod/lapmod_theory.html
[8] L'inquinamento atmosferico da stabilimenti industriali - https://www.verticale.net/linquinamento-atmosferico-da-stabilimenti-industriali
[9] https://www.dirittoconsenso.it/2020/11/07/autorizzazioni-ambientali-nel-tu-ambientale/
[10] https://demetra.regione.emilia-romagna.it/al/articolo?urn=er:assemblealegislativa:legge:2018;4&dl_t=text/xml&dl_a=y&dl_id=10&pr=idx,0;artic,1;articparziale,0&ev=1
[11] https://www.normattiva.it/atto/caricaDettaglioAtto?atto.dataPubblicazioneGazzetta=2013-05-29&atto.codiceRedazionale=13G00101&atto.articolo.numero=0&atto.articolo.sottoArticolo=1&atto.articolo.sottoArticolo1=10&qId=47164e01-e7dc-4b97-8f1c-6d8750f76fdd&tabID=0.15006631201957188&title=lbl.dettaglioAtto
[12] https://www.rischioindustriale.isprambiente.gov.it/seveso-query-105/inventario_listatolist.php
[13] https://servizimoka.regione.emilia-romagna.it/mokaApp/apps/AIAHTM5/
[14] https://www.arpae.it/it/autorizzazioni-e-concessioni/autorizzazioni-ambientali/emissioni-in-atmosfera/autorizzazione-con-procedura-ordinaria
[15] https://serviziambiente.regione.emilia-romagna.it/viavas/servlet/AdapterHTTP?ACTION_NAME=LOGIN_ACTION
[16] https://land.copernicus.eu/pan-european/corine-land-cover/lcc-2012-2018?tab=download
[17] CALPUFF_Modeling_System_Version_6_User_Instruction
[18] Il Sistema modellistico lapmod per la simulazione dell'inquinamento atmosferico in orografia complessa- R.Bellasio, R.Bianconi
[19] LAPMOD - Manuale d'uso
[20] LAPOST - Manuale d'uso
[21] https://simc.arpae.it/dext3r/
[22] https://www.sciencedirect.com/science/article/pii/S0160412020319450
[23] https://www.enea.it/it/Ricerca_sviluppo/documenti/ricerca-di-sistema-elettrico/sicurezza-nucleare/2014/rds-par2014-136.pdf
[24] https://www.researchgate.net/publication/270569283_Determination_of_optimal_spatial_databases_for_the_area_of_Poland_to_the_calculation_of_air_pollutant_dispersion_using_the_CALMETCALPUFF_model
[25] LAPEMI – manuale d'uso
[26] https://www.youtube.com/watch?v=e4GyzqrZDhk

[27] https://www.youtube.com/watch?v=Z_a5u2ypcFY&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=1
[28] https://www.youtube.com/watch?v=Uswhww9U1EQ&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=2&t=134s
[29] https://www.youtube.com/watch?v=odd3D8SnTik&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=4
[30] https://www.youtube.com/watch?v=C6xbdi5oDCw&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=5
[31] https://www.youtube.com/watch?v=bAy1Rh5b8hY&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=6
[32] https://www.youtube.com/watch?v=Xpt5KL4Xo0M&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=7
[33] https://www.youtube.com/watch?v=1QFL7NWvLOA&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=8
[34] https://www.youtube.com/watch?v=t8vIt6uwSdw&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=9
[35] https://www.youtube.com/watch?v=w1muHvMzwkE&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=10
[36] https://www.youtube.com/watch?v=M_w8IEADIo0&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=11
[37] https://www.youtube.com/watch?v=1IS2d_mbT8s&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=17
[38] https://www.youtube.com/watch?v=Lrpc8n0o9Bk&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=28
[39] https://www.youtube.com/watch?v=UbNgktKctc8&list=PLsmuwXl1TWLbY1mCH7sbarwnFCOb3VSNe&index=27
[40] https://www.isprambiente.gov.it/files/ippc/valutazione-degli-effetti-nella-procedura-di-aia.pdf
[41] Ambiente 2021 manuale normo-tecnico a cura di Erica Blasizza
[42] https://it.wikipedia.org/wiki/Piombo
[43] CONFRONTO DEI CONTRIBUTI EMISSIVI E DEL LORO IMPATTO SULLA QUALITA' DELL'ARIA DI DIVERSE TECNOLOGIE DI VERNICIATURA- Lanzarini Giovanni, Antonioni Giacomo