

BASIC INFORMATION

Full Model Name

WinDimula 3.0 (version 3.0 fully integrated in MMS (Maind Model Suite) a Suite of diffusion models with a common graphic interface (detailed information are available at www.maind.it)

Model version and status

Version 3.0 improves the preceding 2.0 version introducing the implementation of the deposition algorithm (now the model include in addition to the possibilities to use meteorological time sequences for short term calculation and the use of complex orography both in Short Term and Climatological computation, the possibility to compute cumulated and mean hourly deposition. For the complete list of all the model performances and differences with 1.0 and 2.0 versions see <http://www.maind.it/software/windimulamod.htm>

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Intended field of application

Simulation of inert pollutant dispersion in atmosphere at local scale; regulatory purposes.

Model type and dimension

Gaussian model

Model description summary

WinDimula 3.0 (WD3) consists basically of three modules:

-) Short Term module: it uses series (also a single hour values) of hourly meteorological values (wind speed and direction, stability, and temperature) and gives, by defaults, mean and maximum concentration values over the computational domain and discrete receptor. An output option permits the generation of a binary output file containing all the hourly concentrations computed for each receptor at any simulation time. This file, which dimensions can also be huge depending on the time series selected, can be manipulate through a specific postprocessor software WD2PROC which permits the extraction of: single

hour values for each receptor (Cartesian and/or discrete); single receptor time series; evaluation of user specified percentiles at each receptor; the evaluation of present low limits (ex Decreto 2 Aprile n. 60); ...

Postprocessor WDPRO is not part of the software WinDimula but it is also integrated into the Mind Model Suite (MMS). All results both from model calculation and extracted by the postprocessor can be graphically (in 2D and 3D way) visualized by the graphical interface included into the model.

It is under development a series of data filter to import automatically into the model meteorological data typically obtainable.

-) Climatological module: it uses a statistical aggregation of meteorological conditions (Joint Frequency Function - JFF) over the period (year, seasons..) on which JFF are derived; WinDimula include an automatic filter to import A.M. JFF statistical data.

-) A module to compute effective heights for each source for any stability class. The algorithm used is the same used inside the WD2 model extracted to be used alone for information completeness.

Each module is based on Gaussian solution of diffusion equation; horizontal and vertical diffusion parameter are function of downwind distance, atmospheric stability, height of inversion and terrain characteristics (roughness);

WinDimula model can consider in all its modules the presence of a complex orography based on the implementation of the COMPLEX algorithm. The model can also treats variable roughness values over computational domain.

WinDimula permits calm condition treatment through the Cirillo – Poli model for calms

Since version 2.0 the model allows concentration computation also in discrete point into the domains also at heights grater than ground level; with version 3.0 algorithms to compute mean hourly and cumulated deposition are included

Detailed information are available at www.maind.it

Model limitations

Gaussian approximations,

Simple chemical and wet deposition removal mechanisms based on opportune decrement of concentration values.

Resolution

Temporal resolution

Depends on temporal resolution of meteorological data: minimum requirement for Short Term are hourly meteorological data; typical time series are 1 year hourly meteorological data.

Limitations are related to computer memory availability and execution times.

Horizontal resolution

Depends on applicability of gaussian conditions. No limitations on receptors (Cartesian and/or discrete) number; the real limit will depends on computer memory characteristics and execution times.

Vertical resolution

Depends on applicability of gaussian conditions

Schemes

WD3 model include point and area sources. Linear sources, considered as roads, area treated through Caline 4 model included into the MMS software package (see www.maind.it)

Briggs and Huber-Snyder Building downwash schemes included (not for area sources). Building/obstacle parameters are the same used by ISC model and are directly obtainable by BPIP model (not for area sources).

Orography effects included both in Short Term and Climatological computation (the model implement the COMPLEX algorithm)

Solution technique

Gaussian solution implementation

Input requirements

WD3 requires three set of basic input data. It is possible to consider the presence of orography and roughness matrices over the computational domain and the presence of discrete receptor apart from normal grid point (Cartesian) receptor. All input requests are manageable through a model internal editor.

Grid data: dimension (n. of grid points, mesh dimension); all coordinates are required in meters.

Source data: number and type of source, height of emission point, inner diameter, emission rate, exit velocity, exit temperature, settling velocity, open country or urban conditions domain roughness;

Meteorological data: wind velocity and direction, air temperature, atmosphere stability or Join Frequency Function (JFF) for Climatological Computation;

Orographical data: file path containing terrain height for every domain mesh. The file can be generate internally through the internal WD2 editor or built outside the program. MAIND provides an optional service related to the orographical domain data availability (see <http://www.maind.it/support/oro.htm> for a detailed information) Roughness values can be specified in this way for the computational domain.

Output

Default output are mean and maximum concentration values in every domain grid point, discrete receptors and, for both type, at ground level and heights greater than domain height). Model permits the creation of a binary output file including all hourly results at any receptor. The file is interpreted by a specific postprocessor program named WDPRO.

User interface

WD3 (as all MMS models) runs on PC under WINDOWS environment version 98 and greater.

User community

Web site www.maind.it is the point of the reference for all WD2 and MMS program users. The site include an extensive part related to general support (available documentation, FAQ, meteorological data ...).

Previous applications

WinDimula has been applied for routine applications related to Impact Assessment Analysis and regulatory purposes.

Documentation status (help)

WinDimula (3.0) and all related tools includes an on line help and an "How to use" paper manual.

Available documentation can be free downloaded at <http://www.maind.it/support/dwndoc.asp>.

Validation and evaluation

A lot of validation references are available for WinDimula 1.0 (i.e. Dimula 2.1) Validation of the

model has been performed in several ways especially against other models (see references). The version 2.0 as be validates through Model Validation Kit data set (National Environmental Research Institute (Roskilde Denmark)
<http://www.dmu.dk/AtmosphericEnvironment/harmoni.htm>
(see references)

PORTABILITY AND COMPUTER REQUIREMENTS

Portability

WinDimula 3.0 has been developed for WINDOWS 98 and greater

CPU Time

Depend on the PC capabilities; time series length, n. of sources, n. of receptors (domain dimensions), number of calm situations A simulation included one point source on a 150 x 150 grid points domain for 1 year of hourly meteorological data with 40% of calms runs in about 10 minutes on a Pentium 500 MHz.

Storage

Installation support consist of about 9 MB of compressed files included also the parts of operating systems used to run the package;
the installation depends on the actual status of operating system on the PC, WinDimula directory only can requires about 6 MB.

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