Modeling air quality
by Meteosim S.L.

meteosim

Air quality - Pollutant dispersion models

Meteosim S.L.

1 Introduction

The pollutants dispersion models play an important role in assessing and predicting the impact caused by industrial activity, vehicle traffic, fires, or any other situation in which they emit pollutants into the atmosphere. To have a more complete and accurate representation of reality it is necessary to make use of the meteorological models.

Meteosim S.L. carries out different types of dispersion models to calculate pollutant concentrations in space. The pollutant dispersion models work in the microscale and use a high-resolution digital terrain model (up to 30 metres horizontal resolution) and the mesoscale meteorological model simulations. Two pollutatns dispersion models are mainly used in Meteosim S.L., the **AERMOD** and the **CALPUFF**.

1.1 AERMOD

AERMOD: It is a model of stable pen which incorporates the air dispersion based on the structure of the turbulence of the planetary boundary layer and the concepts of different geographical scales, including their treatment both for flat terrain as well as those of complex terrain.

With these simulations it is possible to obtain pollutant concentrations in different time intervals. An example of the results that can be obtained is shown in figure 1. It represents the maximum concentration in an hour over a period of one year of operation of a cement factory.

The model uses data from a high-resolution digital elevation model as well as data from a mesoscale meteorological model from which meteorological variables are obteined on the surface and at different vertical levels. In the case of Meteosim SL, different meteorological models can be applied: MASS, MM5 and WRF.

This fact implies that the results of pollutants dispersion provided by Meteosim SL can incorporate an added value. Studies of dispersal can also be accompanied by an interpretation and management of the meteorological data used in the simulation. This Meteosim S.L. feature helps to understand the patterns of the obtained pollutantn dispersion. The figure 2 shows the wind rose for the year 2005 in a Catalonia study area.

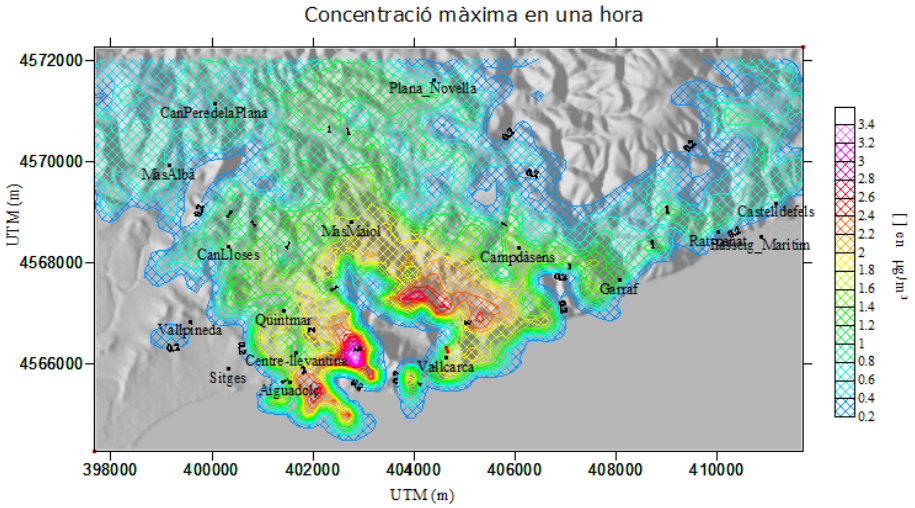

Figure 1: Maximum concentration in one hour along the entire one year in the county of Garraf, Catalonia.

The following data are needed to carry out a modelling of air quality using the AERMOD model. All these data are provided by Meteosim S.L. except for those relating to the source.

- Elevation data
- Representative meteorological data
- Land use
- Source data

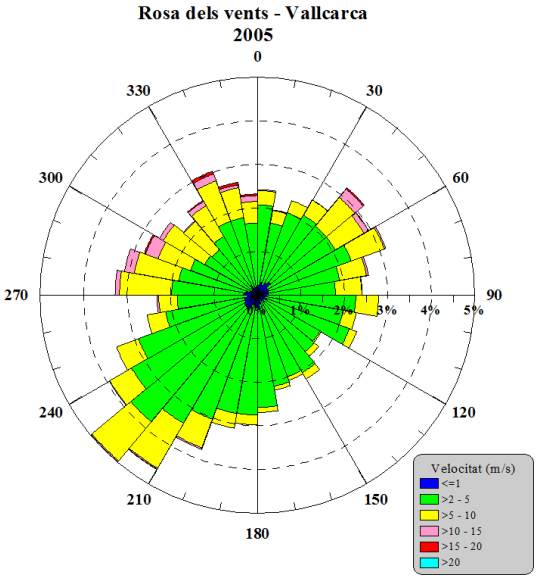

Figure 2: 2005 wind rose in the county of Garraf, Catalonia.

1.2 CALPUFF

CALPUFF is an air quality model developed by the ASG (Atmospheric Studies Group) and recommended by the U.S. Environmental Protection Agency (U.S. Environmental Protection Agency) for assessing transport of pollutants from long range and in areas with complex topography. CALPUFF is a non-stable air plume dispersion model which simulates the effects of temporal and spatial variation of weather conditions in transportation, processing and disposal of pollution.

By CALPUFF model it is possible to make operational forecasts of pollutants dispersion and to estimate the areas that will be affected by the increased concentration in the next few hours. An example of the dispersion of pollutants along with the field of surface winds can be seen in figure 3.

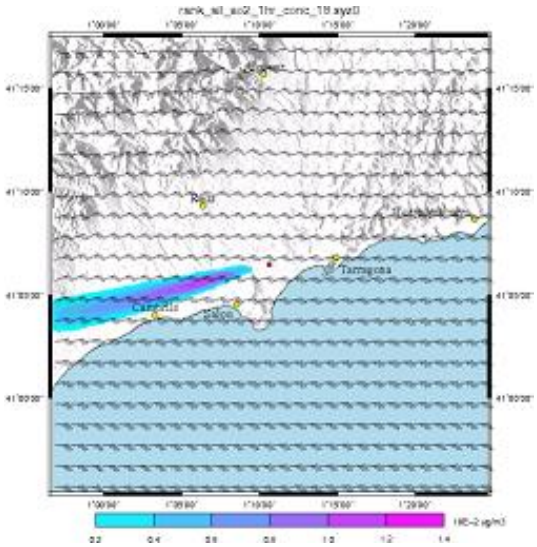

Figure 3: Projected concentration of SO_2 in Tarragona together with the surface winds.

Moreover, it is also possible to obtain forecasts for a certain receptor and obtain a temporary curve as shown in figure 4:

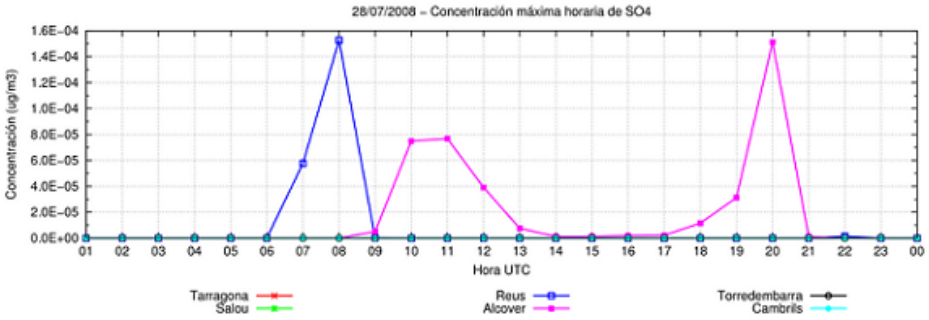

Figure 4: Projected concentration of SO_4 in different receptors located at the county of Tarragona.

The following data are needed to carry out an air quality modelling using the CALPUFF model. All these data are provided by Meteosim S.L. except for those relating to the source.

- Land use
- Elevation data
- Representative meteorological data
- Source data

Meteosim S.L. has the ability to adapt to any region the CALPUFF model and generate operational simulations as in the case of Tarragona (results displayed on the website of Meteosim S.L.)

2 Air quality brochure

2.1 AERMOD

- AERMOD simulations in differnt time periods:
  - Month
  - Annual
  - Specific period

- Calculation and/or graphic representation of maximum concentration values per hour in different time intervals:
  - 1, 3, 8 o 24 horas
  - Monthly
  - Specific period

- Calculation and/or graphic representation of average concentration values in different time intervals:
  - Daily
  - Monthly
  - Annual
  - Period

- Graphic representation of the used meteorological data used in the simulation:
  - Wind rose (speed and direction of predominant winds)
  - Average temperature values
  - Other variables

2.2 CALPUFF

- Real time CALPUFF simulations. Air quality forecasts:
  - Pollutant concentration forecasts
  - Graphic representation of concentration forecasts
  - Graphic representation of concentration forecasts along with meteorological variables

- CALPUFF simulations in specific periods:
  - Monthly
  - Annual
  - Specific period

- Calculation and/or graphic representation of maximum concentration values per hour in different time intervals:
  - 1, 3, 8 or 24 hours
  - Monthly
  - Period

- Calculation and/or graphic representation of average concentration values in different time intervals:
  - Daily
  - Monthly
  - Annual
  - Period

- Graphic representation of the meterological data used in the simulation:
  - Wind rose (speed and direction of predominant winds)
  - Average temperature values
  - Other variables