From MM5 to WRF: consequences on the skills of the Chemistry Transport Model Chimere.

**Abstract**

The skills of offline chemistry and transport models are extremely sensitive to the driving mesoscale meteorological model. The CHIMERE model is historically used and benchmarked when switching from MM5 to the Weather Research and Forecast model. To present a thorough evaluation of the skill of the model for two high ozone episodes in Western Europe in 2003 and 2005, Scores of T2 and O3 are investigated at a significant number of surface air quality and meteorological stations for various model configurations in terms of physical parameterization, large scale forcing, and nudging. The impact of chemical boundary conditions is also assessed for the summer 2007.

**Models**

CHIMERE is an offline transport model based on the reduced MELCHIOR mechanism for gases chemistry with 44 species (including 19 tropospheric and 25 stratospheric). Photocatalytic reactions are described by the CT94 kinetic atmospheric chemistry (as a function of altitude). The aerosol module is based on INCA with 16 species in 3 size bins from 10 nm to 40µm. The LMDZ-INCA chemistry and aerosol (global) model is used to provide climatological background information through daily runs and can be used as illustrated in this paper. Anthropogenic emissions are those of the EDGAR inventory with NGF, VOCs, SO2, CO, PM10 and PM2.5 in 55° South - 90° North resolution. Emission inventories are calculated on the meteorology with the MEGAN model. In the present configuration, the resolution is in 35µg/m³ and the model has 8 layers extending up to 5000µg/m³.

The Weather Research and Forecast (WRF) model version ARW5.3.1 is used to compute 9km resolution meteorology driven by ERA-Interim 0.75° data or MM5 (2001-2005) resolution simulations. A reference MM5 simulation driven by AROME is used as a benchmark.

**Data**

Surface air quality data used for the present evaluation are extracted from the AIRBASE dataset. A significant work of data cleaning was performed to ensure the quality of the selected data. Observations with at least 75% annual coverage in Western Europe were selected and a visual inspection and an ordinal test was performed to filter out abnormal time series. About 125 stations were selected but mostly data for suburban background stations are shown here for consistency purposes. Meteorological data is obtained from the ECMWF dataset of analyzed fields, including about 8000 stations with hourly. Both hourly data and hourly

**Conclusions**

This change management study allows to ensure the continued performance of the model. The scores are even improved mostly because of a better diurnal cycle of surface temperature while using the appropriate configuration of WRF.

An optimum configuration is found and shows to perform well for different sources of large scale forcing.

A significant sensitivity to the chemical boundary conditions is also identified.