Geophysical Research Abstracts
Vol. 12, EGU2010-5228-1, 2010
EGU General Assembly 2010

Status of development and firsts results at global scale of NMMB/BSC-CHEM: an online multiscale air quality model

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The model NMMB/BSC-CHEM is a new fully on-line chemical weather prediction system for meso to global scale applications currently under development at Barcelona Supercomputing Center. The atmospheric driver is the NCEP/NMMB numerical weather prediction model developed at National Centers for Environmental Prediction (NCEP). Its unified non-hydrostatic dynamical core supports regional and global simulations. The new modeling system is intended to be a powerful tool for research and to provide efficient global and regional chemical weather forecasts at sub-synoptic and mesoscale resolutions.

Chemical species are advected and mixed at the corresponding time steps of the meteorological tracers using the same numerical scheme. Advection is eulerian, positive definite and monotone. The chemical mechanism and chemistry solver is based on the Kinetic PreProcessor KPP package with the main purpose of maintaining a wide flexibility when configuring the model. Two Carbond Bond family chemical mechanism have already been implemented, CB-IV and CB05. An emission process allows the coupling of different emission inventories sources such as POET, RETRO, EDGAR or GEIA for the global domain, EMEP for Europe and HERMES for Spain. The photolysis scheme is based on the Fast-J scheme, coupled with physics of each model layer (e.g., aerosols, clouds, absorbers as ozone) and it considers grid-scale clouds from the atmospheric driver. The Fast-J scheme has been upgraded with CB05 photolytic reactions. The dry deposition scheme follows the deposition velocity analogy for gases, enabling the calculation of deposition fluxes from airborne concentrations, and cloud-chemistry processes are included in the system considering grid-scale clouds (wet deposition and scavenging). The status of the modeling system development will be presented and first results of the gas-phase chemistry at global scale will be discussed comparing results with CB-IV and CB05 chemical mechanisms.