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Implementation of a sea-salt module within the NMMB/BSC Chemical Transport Model: global simulations and comparisons with observations

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A new sectional module for the forecasting of sea-salt aerosol has been implemented within the NMMB/BSC Chemical Transport Model (NMMB/BSC-CTM), currently under development at the Barcelona Supercomputing Center. Most of the state-of-the-art aerosol modules are off-line coupled with meteorology and thus cannot account for feedback processes, while most of the on-line models are not capable to reproduce meso-β or smaller scales. In our case, the meteorological core of NMMB/BSC-CTM, the Non-hydrostatic Multiscale Model on the B-grid (NMMB), allows simulations of both global and regional scales, within a fully on-line coupling of atmospheric physics and aerosol processes.

The sea-salt module uses 8 bins in the dry radius interval $[0.1 - 15]\mu$m to properly describe mass concentrations and optical depth. The description of cloud condensation nuclei is out of the aim of present work, thus ultrafine particles are not considered. A sub-bin lognormal approach is assumed to calculate the optical properties of the particles. Different open-ocean emission schemes are implemented, accounting both for bubble-bursting and spume production. SST-dependent emissions of sea-salt bubbles have been also implemented. The water uptake is taken into account by using prescribed growth factors for different relative humidity values. The parameterizations of the aerosol processes affected by the water-uptake (i.e. sedimentation, dry deposition, wet deposition, etc.) have been extended to wet particles from those implemented in the dust module of NMMB/BSC-CTM.

Global simulations have been performed at 1deg x 1.4deg horizontal resolution and 24 vertical layers for the years 2005–2007 and other specific temporal windows. We present the comparison of model results (monthly and daily means) for sea-salt surface concentrations and optical depth ver- sus observations from different datasets, such as the University of Miami Network, the AERONET Sunphotometers Network, cruise measurements, and satellite data.