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Modeling Aerosol Optical Properties with AODEM: accounting for non-sphericity of dust particles

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We present a new Aerosol Optical DEpth Module (AODEM) conceived as a post-processing tool for a general chemistry-transport model which simulates aerosol with a sectional approach. AODEM computes particle number concentrations and extinction coefficients for each grid-cell, species, size bin and time. The user may select three types of aerosol mixing: external, internal homogeneous and internal coated spheres (black carbon core and a well mixed shell). Mie calculations are carried out for each scene, avoiding use of lookup tables. A first application of AODEM to CHIMERE model output is reported for a three day summer period in 2007 over Northern Italy, under the assumption of spherical particles. The model qualitatively reproduces the vertical distribution of aerosol particles throughout the day as observed by a LIDAR in Milan, roughly reproducing the nighttime layer at 1500 m altitude and the daytime extinction enhancement just below the boundary layer top. The spectral dependence of aerosol optical depth (AOD), which is seen to decrease by a factor of 3 from 440 nm to 870 nm over the AERONET station in Modena, is also captured by the model. The distribution of AOD over the Po Valley as observed by MODIS is reproduced with a spatial correlation of 0.37 and a negative bias of -25%, pointing out most likely model deficiency in the simulation of vertical mixing and secondary aerosol formation. Furthermore, a case study with Saharan dust transport over Italy has been investigated, with a special focus on electromagnetic scattering computing performed under assumption of spherical vs. non-spherical particles.