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Saharan dust coarse mode effective radius retrieved from IASI over the Atlantic Ocean

S. Peyridieu (1,*), V. Capelle (1), C. Tsamalis (1), C. Pierangelo (2), and A. Chédin (1)

(1) Laboratoire de Météorologie Dynamique, UMR8539, CNRS/IPSL, Ecole Polytechnique, Palaiseau, France(virginie.capelle@lmd.polytechnique.fr), (2) Centre National d'Etudes Spatiales, Toulouse, France, (*) now at : M3 Systems c/o CLS, Space Oceanography Division, Ramonville-St-Agne, France

Infrared Atmospheric Sounder Interferometer (IASI) observations have been interpreted in terms of monthly mean, 1°x1°, 10 μm dust layer aerosol optical depth (DOD), mean altitude and coarse mode effective radius. The geographical area of the present study concerns the northern tropical Atlantic, a region regularly affected by strong dust events. The method developed relies on the construction of Look-Up-Tables computed for a large selection of atmospheric situations and observing conditions and follows three main steps: determination of the observed atmospheric thermodynamic situation, determination of the dust layer mean optical depth and altitude, and determination of the mean coarse mode effective radius, Reff. This presentation focuses on the latter variable. The main advantage of using infrared radiances is the fact that infrared radiation is mainly sensitive to coarse mode particles, the effect of the accumulation mode and of the width of the distribution being negligible, once the DOD is given. Therefore, the only remaining parameter to be retrieved is Reff. "Radius-Look-Up Tables", sampling different values of the dust infrared optical depth, mean altitude and Reff, using a monomodal lognormal size distribution, are built for four IASI channels close to 9.32 μm. They are selected for their high sensitivity to dust size and insensitivity to other atmospheric components or to dust asphericity. From an analysis of the performances of this algorithm made by Pierangelo et al. (2005) it results that the coarse mode effective radius is retrieved with an accuracy varying from 0.5 μm for smaller radii to 1 μm for larger radii.
The monthly mean, 1°x1°, dust coarse mode effective radius is retrieved from IASI over the Atlantic Ocean for the period July 2007 to December 2011. Results compare well with measurements from aircraft and ground based campaigns, or sun-photometer observations (AERONET). During the dust season (summer), we find that Reff remains almost constant ($\sim$1.8 μm) from the African coast to 50°W and then slowly decreases with westward transport reaching a value of $\sim$1.4 μm at 80°W. These results should contribute to better characterize dust aerosol size distribution, especially the coarse mode part, for which there are large uncertainties, and improve our knowledge of the effect of dust aerosols on the terrestrial radiation.