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Retrieving dust aerosols properties (optical depth and altitude) from very high resolution infrared sounders : from AIRS to IASI.

S. Peyridieu (1), A. Chédin (1), V. Capelle (1), C. Pierangelo (1,2), N. Lamquin (1), and R. Armante (1)

(1) Laboratoire de Météorologie Dynamique, CNRS/IPSL, Ecole Polytechnique, Palaiseau Cedex, France, (2) Centre National d'Etudes Spatiales, Toulouse Cedex 9, France

Observation from space, being global and quasi-continuous, is a first importance tool for aerosol studies. Remote sensing in the visible domain has been widely used to obtain better characterization of these particles and their effect on solar radiation. On the opposite, remote sensing of aerosols in the thermal infrared domain still remains marginal. However, knowledge of the effect of aerosols on terrestrial radiation is needed for the evaluation of their total radiative forcing. Infrared remote sensing provides a way to retrieve other aerosol characteristics, including their mean altitude. Moreover, observations are possible at night and day, over ocean and over land. In this context, six years (2003-2008) of the 2nd generation vertical sounder AIRS observations have been processed over the tropical belt (30°N-30°S).

Aerosol properties (10 μm infrared optical depth and mean layer altitude) are retrieved using a Look-Up Table (LUT) approach. The forward radiative transfer model 4A (Automatized Atmospheric Absorption Atlas) coupled with the DISORT algorithm accounting for atmospheric diffusion is used to feed the LUTs with simulations of the brightness temperatures of AIRS channels selected for their sensitivity to dust aerosols. LUTs degrees of freedom are : instrument viewing angle, surface pressure and surface emissivity, a parameter particularly important for dust retrieval over bright surfaces, such as deserts. AODs (resp. altitude) are sampled over the range 0.0-0.8 (resp. 0-5800 m).
The retrieval algorithm follows two main steps : (i) retrieval of the atmospheric situation observed (temperature and water vapour profiles) ; (ii) retrieval of aerosol properties.

Results have been compared to instruments commonly used in aerosol studies and also part of the Aqua Train : MODIS/Aqua and CALIOP/CALIPSO. The agreement obtained from these comparisons is quite satisfactory, demonstrating that our algorithm effectively allows the simultaneous retrieval of dust AOD and mean altitude.

This algorithm has been designed for processing high spectral resolution infrared sounders in general. Here applied to AIRS, it will soon be extended to the processing of IASI observations, and should allow an even more accurate determination of aerosol properties.