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Dust altitude and infrared optical depth retrieved from 6 years of AIRS observations : a focus on Saharan dust using A-Train synergy (MODIS, CALIOP)

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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). Our results of the dust optical depth at 10 μm have been compared to the 0.55 μm Aqua/MODIS optical depth product for this period. The detailed study of Atlantic regions shows a very good agreement between the two products, with a VIS/IR ratio around 0.3-0.5 during the Saharan dust season. Comparing these two AOD products should allow separating different aerosols signals, given that our retrieval algorithm is specifically designed for dust coarse mode whereas MODIS retrieves both accumulation and fine aerosol modes.

Mean aerosol layer altitude has also been retrieved from AIRS data and we show global maps and time series of altitude retrieved from space. Altitude retrievals are compared to the CALIOP/Calipso Level-2 product starting June 2006. This comparison, for a region located downwind from the Sahara, again shows a good agreement demonstrating that our algorithm effectively allows retrieving reliable mean dust layer altitude.

A global climatology of the dust optical depth at 10 μm and of the aerosol layer mean altitude has also been established.

An interesting conclusion is the fact that if the AOD decreases from Africa to the Caribbean as a result of transport and dilution, altitude decreases less rapidly. This is in agreement with in situ measurements made during the Puerto Rico Dust Experiment (PRIDE) campaign and modelled forward trajectories.