Retrieval of desert dust vertical distribution from hyperspectral thermal infrared measurements by IASI

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Oral presentation preference

Desert dust particles are composed of a mixture of minerals, which absorb and scatter solar and thermal radiation, and emit thermal radiation, resulting in direct climate forcing. They also affect climate indirectly, for example by altering cloud microphysics. A better knowledge of their optical properties, atmospheric aerosol load, sources and sinks may therefore significantly improve the modeling of climate changes. In particular, desert dust aerosols show strong spectral features in the thermal infrared (TIR) atmospheric window (800-1200cm^{-1}), where they are therefore a major actor in the amount of thermal energy transmitted to space.

Aerosol properties retrievals from satellite measurements at TIR wavelengths (e.g. by SEVIRI, AIRS or IASI) are less common than in the visible and near infrared spectral range (e.g. from MODIS, MISR, SEVIRI, CALIOP or POLDER), but has been receiving a growing interest in the recent years. TIR measurements have the advantage to be performed during both day and night. IASI on METOP has one further advantage for aerosol retrievals: its large continuous spectral coverage, allowing to better capture the broadband signature of aerosols. Furthermore, IASI will nominally be in orbit for 15 years and offers a quasi global Earth coverage twice a day.

Here we will show a recently developed strategy to retrieve dust vertical distribution (concentration profile) and total optical depth at 10µm, from IASI TIR measurements over ocean and over the desert. We use a sophisticated radiative transfer (RT) code and the optimal estimation formalism. The RT code consists of three separate codes: ASIMUT (BIRA-IASB, Belgium), (V)LIDORT (R. Spurr, RTsolutions Inc, US) and SPHER (M. Mishchenko, NASA GISS, USA), which are linked through a special interface.

We will briefly discuss the challenges of such retrievals and how to go past those in establishing a retrieval strategy. We will show test-case comparisons between our retrieval results and other measured aerosols data like CALIPSO/CALIOP extinction vertical profiles, MODIS and AERONET visible optical depths.