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Aerosol Mineralogical and Microphysical Study from Laboratory to Satellite Remote Sensing IASI Measurements: Application to East Asian Deserts

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Mineral dust is the most abundant natural dust in the atmosphere. It has direct and indirect effects on the radiative budget altering climate and air quality. These effects are directly dependent of the mineralogical composition and microphysical properties of the transported dust in the atmosphere.

High spectral resolution Infrared remote sensing technology has shown the ability to characterize different atmospheric components from local to global scale. In particular, the atmospheric aerosols are quantified using hyperspectral infrared spectrometers and processing algorithms since to achieve these measurements, a perfect knowledge of mineral dust optical properties is required i.e. extinction coefficient and complex refractive indices.

East Asia presents the second largest dust source in the world after Sahara. The atmospheric dust in this region has a diversity in its mineralogical composition; rich in silicates but also in carbonates that present a tracer of this region. On the other hand, the dust is uplifted in the low troposphere leaving satellite remote sensing detections with Land Surface Emissivity (LSE) constraints.

To cross these challenges, Infrared Atmosphere Sounding Interferometer (IASI) observations were used with all its advantages: continuous spectrum, day and night, ocean and land detections, high spectral resolution and low radiometric noise. A new LSE optimization method was developed to correct the IASI spectra. Then, a semi-quantitative method was applied based on laboratory measurements of suspended mineral dust coupled with optimized spectral detections, to obtain new mineralogical dust extinction weights. These weights depend on the chemical composition, the size distribution and the concentration, by this means a retrieval of the latter parameters was performed using a new radiative transfer algorithm (ARAHMIS) developed at Laboratoire d'Optique Atmosphérique (LOA).

Therefore, we present the results of dust chemical and physical parameters (mineralogy, effective radius and concentration) obtained using Infrared Atmospheric Sounding Interferometer IASI data with laboratory optical properties, during dust storm events in East Asia.