SATELLITE REMOTE SENSING OF THE REACTIVE LOWER ATMOSPHERE USING MEDIUM RESOLUTION INFRARED MEASUREMENTS: HIGHLIGHTS FROM IASI MISSION

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Human activities have significantly altered the equilibrium of the Earth atmosphere. If the steady increase in the concentration of greenhouse gases has attracted most of the attention, it is important as well to monitor the evolution of our reactive atmosphere, as shorter-lived atmospheric species impact human health and ecosystems directly (e.g. local air quality) or indirectly (e.g. chemistry-climate interactions), through poorly known and quantified processes. Optical instruments on board satellites, and especially those operating in the infrared with sufficient spectral resolution, provide unique opportunity for measuring reactive trace gases in the troposphere and the stratosphere on various scales. The presentation focuses on the measurements of the Infrared Atmospheric Sounding Interferometer IASI onboard Metop satellites.

IASI makes global measurements of the Earth atmosphere in a nadir view, i.e. looking downward at the terrestrial radiation, with a horizontal resolution of a few hundreds km^2. It provides more than 10^6 radiance spectra daily, which cover the infrared range between 645 and 2760 cm^{-1} at medium spectral resolution (0.5 cm^{-1} apodized) and low noise. This, coupled to the exceptional sampling performances of IASI, made breakthroughs in the fields of atmospheric spectroscopy and chemistry. In this talk, we will shortly describe IASI instrument and its spectral measurements, as well as the radiative transfer model and retrieval scheme set up for near-real-time processing. We will review the principal accomplishments of IASI in probing the reactive atmosphere by measuring simultaneously the concentrations of about 25 trace species with short (e.g. NH_3, SO_2) to medium (e.g. O_3, CO) residence time, and from the local emission hotspot to the planetary scale. We will put emphasis on the challenging measurements of the polluted planetary boundary layer and will also show a series of focused results on pollution outflow, transport and in-plume chemistry; possibly global budgets. We will briefly expose how five-years of global measurements can contribute to improve the modeling of processes in the low atmosphere.