EGU24-9814, updated on 08 Dec 2024
https://doi.org/10.5194/egusphere-egu24-9814
EGU General Assembly 2024

Towards retrieval of CO from MTG-IRS in the Fourier space with IASI as a demonstrator

Nejla Eco[1], Sébastien Payan[1], and Laurence Croizé[2]
[1]LATMOS, Sorbonne Univeristé, Paris, France.
[2]DOTA, ONERA, Université Paris Saclay (Palaiseau), France.

On board of MetOp satellite series is Infrared Atmospheric Sounding Interferometer (IASI), a Fourier Transform, Michelson-based spectrometer which aims to provide a high-resolution atmospheric emission spectrum to derive temperature and humidity profiles with high spectral resolution. Having been operational since 2006, this spectrometer has been exploited for numerous research articles and can serve as a reliable reference instrument. We will use IASI archive to test the retrieval approach in the Fourier space which we believe is well suited for analysis of a large set of spectra to be recorded by next generation spatial tropospheric sounder as MTG-IRS.

The technique of partially scanned interferograms applied to the retrieval of trace gases from the IASI was rarely used. However, there exist works that indicate the potential of this methodology for the specific cases of CO, CO2, CH4 and N2O that should allow us to retrieve trace gases column abundances at an unprecedented accuracy and at the level of the single IASI footprint. As IASI interferograms are not available, we must transform the IASI spectra back to the interferogram domain and identify regions sensitive to the single gas species. The retrieval is then performed using Least Squares estimation to these small segments of interferometric radiances. The expected advantage to the usual methods (retrieval in the spectral domain) is an efficient use of the information contained in all the IASI channels that are available in the absorption bands of a specific gas species. We will present the first step of our study on the retrieval of CO from partial interferogram of IASI observations. More specifically, the set of simulations of IASI interferograms that will be noised and then used for CO retrievals.

The simulation of IASI spectra, was performed using LATMOS Atmospheric Retrieval Algorithm (LARA), a robust and affirmed radiative transfer model. [Segonne at al., 2021] LARA was conjoined with the TIGR, a climatological library of atmospheric situations representing the Earth's atmosphere called the Thermodynamic Initial Guess Retrieval (TIGR). [Chédin et al., 1985]. Each atmospheric situation is described by values of temperature, water vapor and ozone concentrations for a given pressure grid, from the ground surface to the TOA (top of the atmosphere). This case study includes all of the 2311 TIGR profiles available. Furthermore, the study considers carbon monoxide, a trace gas crucial for understanding both the air quality and climate forcing. Carbon monoxide typically appears in the range of 2050 to 2350 cm^{-1}

wavenumber, with its characteristic “comb” shaped absorption signature. [Serio et al.,2012]The simulations are performed for surface temperatures ranging from -15 to 15 K in steps of 5 K from the base surface temperature, to explore the impact of thermal contrast. [Baudin et al., 2016]. Expected are number of radiance simulations in the CO-corresponding wavelength range, obtained by using LARA. Finally, FFT (Fast Fourier Transform) of simulated radiances are generated, leading to a 130 000 spectra interferogram dataset on which statistical analysis of CO signatures will be presented. If applicable, first full CO retrieval from the dataset should be presented.