Last evolutions of the mid-troposphere column of methane as seen by IASI onboard three successive Metop platforms

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ABSTRACT

The great stability of IASI infrared sounders between the different Metop-A, B and C platforms offers the possibility to monitor on the long term several essential climate variables, including mid-tropospheric columns of the 3 major greenhouse gases influenced by human activities: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O).

To tackle the very small seasonal variability of these gases compared to their background values, combined to the strong dependence of IR radiances to atmospheric temperature and the simultaneous sensitivity of the channels to several gases, a non-linear inference scheme has been developed at LMD. Since 2007, mid-tropospheric columns of methane have been derived for both day and night conditions, over land and over sea. The retrieval scheme strongly relies on careful validation of level1c spectra, characterization of systematic radiative biases and severe cloud and aerosol screening. CH_4 fields are delivered on 'near real time' (D-1) basis to the Copernicus Atmosphere Monitoring Service (CAMS) and are assimilated in ECMWF C-IFS system, along with total columns from GOSAT, to produce forecast of vertical profiles of atmospheric concentration. Owing to its 20 year-program, IASI also participates to the establishment of long time series in the Copernicus Climate Change Service (C3S). The retrievals are thus used for a variety of purpose: assimilation to produce CH_4/CO_2 profile forecasts; estimation of surface fluxes using "top-down" atmospheric inversions; characterization of specific emissions such as biomass burnings.

In this talk we will present the latest development of the retrieval and application of CH_4. First, we will present the extension and validation of the retrieval to the high latitude regions achieved during the ESA MethaneCAMP project, yielding a full coverage of the globe twice a day al around the year. We will show that this enables to better characterize the anomaly in the 2020-2021 growth rate of methane by identifying emissions responsible for this, as well as follow specific plume such as the one from Nordstream leak. Validation will be performed using AirCore 0-25 km profiles of methane concentration acquired at Sodankylä and Kiruna and several stations of the French AirCore network. Second, we will focus the presentation on the possibility of replacing the AMSU microwave channels in the retrieval scheme with a selection of temperature levels coming from products such as IASI L2. The impacts of these changes on the mid-tropospheric CH_4 from IASI observations will be presented and compared with the previous retrieval scheme in term of long times series, geographical distributions and in term of accuracy.