Global distributions of IASI-CH₄

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ABSTRACT: The IR team of BIRA has developed an automated processing chain for the fast retrieval of tropospheric IASI CH₄ profiles with the ASIMUT Optimal Estimation Method (OEM) retrieval software [1]. Here we give a quality assessment of this new BIRA IASI CH₄ product and results of its validation with co-located NDACC ground-based observations. In addition first results will be shown of a comparison, on a global scale, with the IASI mid-tropospheric CH₄ product from Laboratoire de Météorologie Dynamique (LMD), that have been obtained as part of the ESA Climate Change Initiative Greenhouse Gas (GHG-CCI) project.

Tb1.1: BIRA IASI-CH₄ retrieval setup and typical IASI-CH₄ averaging kernel (AK). Sensitivity of the retrievals lies in the 4-17 km altitude range.

Fig. 1: Monthly mean column averaged BIRA IASI-CH₄ between 4 and 17 km for February and August 2013. Only daytime retrievals are shown. We see a clear increase in CH₄ at high latitudes in NH summer probably due to increased wetland emissions.

Fig. 2: Degrees Of Freedom for Signal (DOFS) for different latitudinal bands for February and August 2013 (daytime retrievals). On the global scale, the values range between 1 and 1.7 for NH summer, and between 0.5 and 1.7 for NH winter, when values can become less than 1 for latitudes > 40° N (between 0.9 and 1.6, and between 0.35 and 1.6 respectively for nighttime retrievals; not shown here). In the tropics, DOFS are typically around 1.4, hence 1 atmospheric column is retrieved.

Fig. 4: Timeseries of smoothed NDACC FTIR CH₄ (black) and BIRA IASI-CH₄ (blue) partial columns (surface-40 km) at Jungfraujoch. The vertical bars represent the retrieval error. The NDACC FTIR profiles are smoothed with the IASI AK and a common a priori profile is used for both IASI and NDACC retrievals. We see a good representation of the seasonal cycle by IASI and a mean relative difference of ~0.24%.

Fig. 5: Barchart of smoothed NDACC-IASI CH₄ partial columns (surface-40 km) at 11 NDACC sites for the timeperiod 2010-2015. The mean (IASI-NDACC)/NDACC (Δ) and standard deviation (σ) of the relative differences is given for each site. We have an overall negative bias for IASI < 1.7% with exception of the sites Altzomoni and Thule, who show a positive bias.

Fig. 6: Correlation plots of LMD qCH₄ and BIRA qCH₄ for February and August 2013. We see overall lower values of BIRA qCH₄ wrt LMD qCH₄ with relative differences of -1.84% for February and -1.13% for August, and a standard deviation (1-σ) of the difference below 2.4%.

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