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Improved global methane distributions from IASI through joint pre-retrieval of temperature, humidity and surface spectral emissivity and other developments

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A continuous series of observations are planned by IASI on MetOp-A, -B and -C, followed by IASI-NG on MetOp-SG, covering the period 2007-2040. RAL has developed an optimal estimation scheme to retrieve global height-resolved information on methane from IASI's thermal infrared (7.9 micron) band. The retrieval scheme extracts two independent pieces of information on the profile, with sensitivity extending into the lower troposphere. The retrieval scheme has been extensively validated and shown to perform well in comparison with column-averages from both ground-based observations (TCCON) and from the satellite short-wave infrared sounder GOSAT.

Exploiting the JASMIN-CEMS computational infrastructure at RAL, the IASI MetOp-A mission 2007-2015 has been processed, resulting in the RAL IASI MetOp-A methane dataset version 1.0 (doi:10.5285/B6A84C73-89F3-48EC-AEE3-592FEF634E9B); an algorithm and validation paper based on this dataset is reported in AMT (R.Siddans et al., doi:10.5194/amt-2016-290). The methane processor has also been integrated into our MetOp near real-time chain, producing data within three hours of IASI measurements being made.

Several modifications have been incorporated into the methane processor and the entire IASI MetOp-A record (2007-2017) is being re-processed. The main improvement over version 1.0 is from implementation of our Infrared Microwave Sounder (IMS) pre-processor for the joint retrieval of temperature, humidity (ozone) and surface spectral emissivity from IASI, MHS and AMSU on board the MetOp platform in place of analysed or forecast met fields from ECMWF and surface spectral emissivity derived from the University of Wisconsin database. The IMS pre-processor has been shown to significantly reduce retrieval errors incurred by interpolation of the ECMWF met fields and use of the emissivity database.

In this paper, we outline modifications made to our IASI methane processor and illustrate the resulting improvement in retrievals compared to version 1.0. We also report progress on addition of the 3.9 micron band, for increased sensitivity to near-surface methane, an initial assessment of 13CH4 retrieval and recent results from our near real-time processing.