Abstract of Contribution 272

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Ground-Based Remote Sensing FTIR Networks, their Complementarities and Usefulness for the Validation of Satellite GHG Products.

Mahesh Kumar Sha[1], Martine De Mazière[1], Justus Notholt[2], Thomas Blumenstock[3], Huilin Chen[4], Angelika Dehn[5], David W. T. Griffith[6], Frank Hase[3], Pauli Heikkinen[7], Benedikt Herkommer[3], Christian Hermans[1], Nicholas Jones[6], Rigel Kivi[7], Nicolas Kumps[1], Bavo Langerock[1], Neil Macleod[8], Christof Petri[2], Qiansi Tu[3], Corinne Vigouroux[1], Thorsten Warneke[2], Damien Weidmann[8], Minqiang Zhou[1]

[1]Royal Belgian Institute for Space Aeronomy (BIRA-IASB), Belgium; [2]University of Bremen, Germany; [3]Karlsruhe Institute of Technology, IMK-ASF, Germany; [4]University of Groningen, the Netherlands; [5]European Space Agency (ESA)/ ESRIN; [6]University of Wollongong, Australia; [7]Finnish Meteorological Institute, Finland; [8]Rutherford Appleton Laboratory, United Kingdom

Climate action plan is high on the agenda in Europe and worldwide with the goal to cut greenhouse gas emissions and reach carbon neutrality in the coming years. Continuous long-term monitoring by performing precise and accurate measurements of greenhouse gases (GHGs) and other climate relevant gases is key to measure the success of its implementation and/or identify the need for stronger actions. The nadir looking satellites, measuring the complete atmospheric column, provide the most powerful method for global mapping of these gases. However, the satellite measurements require accurate validation through high quality reference measurements. Total column concentrations of the GHGs and other climate relevant gases retrieved from ground-based solar absorption measurements using Fourier transform infrared (FTIR) spectrometers are a primary source of reference data for validating satellite data, because they sample the whole atmosphere, similar to the satellites.

The Total Carbon Column Observing Network (TCCON) and the Network for the Detection of Atmospheric Composition Change – Infrared Working Group (NDACC-IRWG) have been performing solar absorption measurements using high resolution FTIRs for many years. The retrieval of total and/or partial column concentrations of GHGs and other climate relevant gases are performed from the measured spectra in the near-infrared and mid-infrared regions. These data form the baseline for validation of satellite derived trace gas products. However, the number of stations is limited and has an uneven geographical coverage. To fill in this gap, several portable low-resolution FTIRs, one of which is the EM27/SUN that is used by the Collaborative Carbon Column Observing Network (COCCON), have been extensively tested and characterized in the framework of ESA's Fiducial Reference Measurements for Ground-Based Infrared Greenhouse Gas Observations (FRM4GHG; https://frm4ghg.aeronomie.be/) project and showed excellent performance. The spectrometers demonstrated their ability of providing high quality data comparable to that of TCCON. These low-resolution spectrometers are useful to achieve a denser distribution of the ground-based stations, cover geographical gaps for various atmospheric conditions, source regions of special interest, and to create a large latitudinal distribution of stations.

In this presentation, we will outlay the state-of-the-art of the current high- and low-resolution FTIR spectrometers and present plans for future improvements. Furthermore, with the help of exemplary satellite validation cases, we will show the benefits and complementarity of using ground-based FTIR data from different spectral regions and spectral resolutions, benefits of direct comparison or considering smoothing errors.