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First results of the IMECC aircraft campaign: Comparisons of CH4 measurements from ground based FTIR systems and airborne in-situ instruments

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Ground-based FTIR instruments can provide a link between satellite (e.g. GOSAT) measurements of CO2, CH4 and other greenhouse gases to the existing ground-based in-situ network. To accomplish this, the total column measurements provided by the FTIR first have to be calibrated against established WMO standards for in-situ measurements.

In September/October 2009, the Max Planck Institute for Biogeochemistry (MPI BGC) organized an aircraft campaign within the EU infrastructure project IMECC. Aboard the aircraft, a Learjet 35A, were in-situ instruments (PICARRO for CO2 and CH4, CO analyzer) and a flask sampler. Profiles were taken from 300 m to 12000 m over the TCCON stations in Bremen (Germany), Bialystok (Poland) and Orleans (France), Karlsruhe (Germany), Jena (Germany) and Garmisch-Partenkirchen (Germany). After the campaign, the flasks were analyzed according to WMO standards at MPI BGC Jena.

For the analyses of the CH4 data, the continuous in-situ profiles were first validated with the flask results. After that, partial columns over the whole flight altitude range were calculated. Extensions of this columns to the ground were done assuming constant CH4 volume mixing ratio in the mixing layer. The missing stratospheric part of the column, which amounts to roughly 20% of the total column, was estimated using CH4 climatology data from UARS and other satellite instruments.

The methods and experiences gained from this aircraft campaign can be applied to similar efforts for the validation of other ground-based as well as satellite instruments.