Geophysical Research Abstracts
Vol. 13, EGU2011-6594, 2011
EGU General Assembly 2011

Compiling columnar averaged CO2 and CH4 mixing ratios from ground-based in-situ measurements for evaluating satellite-based greenhouse gas products

Christoph Popp, Dominik Brunner, and Brigitte Buchmann

Empa, Swiss Federal Laboratories for Materials Testing and Research, Air Pollution / Environmental Technology, Dübendorf, Switzerland (christoph.popp@empa.ch)

In this study, an approach is presented to derive column averaged mixing ratios of CO2 and CH4 from continuous ground-based in-situ measurements with the aim to exploit their potential for evaluating satellite derived greenhouse gas products (e.g. SCIAMACHY and GOSAT). Due to their high precision and accuracy and relatively good global coverage, in-situ measurements of CO2 and CH4 mixing ratios can be a valuable complement to ground-based FTS derived columnar products for evaluating spaceborne greenhouse gas retrievals. It is important to link the satellite derived total columns to the stable long-term in-situ records and stations with both, in-situ and FTS measurements, can help establishing this link. Greenhouse gases are routinely measured worldwide at a large number of sites by different global and regional networks (e.g. GAW, AGAGE, NOAA GMD Tower Network) with a much higher geographical and temporal coverage than ground-based columnar FTS measurements. However, relating in-situ mass mixing ratios to columnar averaged dry air mole fractions is not trivial as surface mixing ratios can be influenced by local sources and the depth of the boundary layer and columnar quantities, in turn, might contain signals from long-range transport aloft not detectable at the surface. Atmospheric transport models can therefore be used to better understand these differences and to relate and compare in-situ trace gas measurements to those retrieved from spaceborne remote sensing data. The proposed approach is based on the compilation of average profile shapes from an ensemble of available model results (e.g. TM5, FLEXPART, Transcom, CarbonTracker, MACC) which should be representative for every location and considered temporal resolution (e.g. one month) for the investigated period (e.g. for the SCIAMACHY period from 2003 to date). Multiplying the compiled normalized profile shapes with in-situ trace gas mixing ratios results in scaled profiles which are integrated to yield the vertically averaged mixing ratio allowing an independent comparison with the respective satellite product. In this preliminary study, we test the described approach at a few sites with good data coverage from different instruments. Particular emphasis is put on the geographical, temporal, and vertical variability of the scaled profiles, e.g. to determine which temporal resolution is needed to achieve an accuracy of the in-situ based columns that is sufficient for satellite validation. In addition, a comparison with available coincident FTS measurements from TCCON sites is performed to discuss the potential of the presented approach for being globally applied for evaluation studies of satellite-based CO2 and CH4 products.