EGU21-14510
https://doi.org/10.5194/egusphere-egu21-14510
EGU General Assembly 2021

Inverse modelling of global methane emissions using TROPOMI

Jacob van Peet[1], Sander Houweling[1,2], Julia Marshall[3], Tonatiuh Nunez Ramirez[3], and Arjo Segers[4]
[1]Vrije Universiteit Amsterdam, Faculty of Science, Department of Earth Science, Netherlands
[2]SRON - Netherlands institute for space research, The Netherlands
[3]Max Planck Institure for Biogeochemistry, Germany
[4]TNO, The Netherlands

This study investigates the use of total column methane measurements from the TROPOMI satellite instrument for estimating the global sources and sinks of methane. A bias correction method has been developed based on a comparison between the satellite measurements and an inversion using surface measurements only, building on the experience using GOSAT data. The bias correction is applied to the satellite measurements prior to the use of the data in the inversion. Results will be shown of inversions using the TM5 4D-VAR and CarboScope inverse modelling systems applied to two years of TROPOMI data. The inversion-optimized methane mixing ratios are inter-compared and validated against independent surface (WMO-GAW), Aircraft (ATom) and total column (TCCON) observations. The derived methane fluxes are aggregated over selected geographic regions, to compare the optimised methane emissions from TM5-4DVAR, CarboScope, and GOSAT inversions from the Copernicus Atmospheric Monitoring Service.

Methane surface mixing ratios derived from the TROPOMI inversion show a good agreement with the surface measurements in general. Near areas with high aerosol optical thickness (e.g. the Sahara) we see significant adjustments in the surface fluxes, compensating for model-data differences, pointing to influences of residual uncorrected systematic errors in the data. The total column comparison with TCCON measurements shows a slight North-South bias gradient. These finding are investigated in further detail by comparing results using the operational retrieval product to the use of the scientific RemoTeC and WFMD retrievals. Encouragingly, both the TM5 and CarboScope inversions show similar increments in the aggregated fluxes over time. The seasonal cycle in the posterior fluxes is different from that of the a a priori fluxes, which were the same for both inversion systems.