



Application of SCIAMACHY retrievals in inverse modelling of atmospheric CH₄

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We present the recently developed four-dimensional variational (4DVAR) data assimilation system for inverse modelling of atmospheric methane and its application to CH₄ retrievals from SCIAMACHY.

The TM5-4DVAR system is based on the atmospheric transport zoom model TM5 and can assimilate large volumes of measurements, in particular satellite observations and high-frequency in-situ observations. At the same time it enables the optimization of a large number of model parameters, specifically grid-scale emission rates. Furthermore, the variational method allows estimating the uncertainties in a posteriori emissions.

Here the TM5-4DVAR system is applied to SCIAMACHY retrievals of column-averaged methane mixing ratios, in combination with high-accuracy surface observations from the NOAA-ESRL network. This coupled inversion allows us to determine and correct large-scale biases in the satellite observations. In this way the TM5-4DVAR system can generally fit SCIAMACHY measurements quite well, while retaining high consistency with the surface CH₄ measurements. The SCIAMACHY observations yield considerable additional emission uncertainty reduction, particularly in the (sub-) tropical regions, which are poorly constrained by the surface network. We discuss the impact of recent improvements in the SCIAMACHY retrievals using

ECMWF pressure and temperature profiles, and improved spectroscopic parameters.