

## VALIDATION OF SCIAMACHY COLUMNAR METHANE BY SOLAR FTIR SPECTROMETRY AT THE PERMANENT GROUND-TRUTHING FACILITY ZUGSPITZE/GARMISCH

### Abstract text

Methane total-vertical column retrievals from ground-based solar FTIR measurements at the Permanent Ground-Truthing Station Zugspitze (47.42 °N, 10.98 °E, 2964 m asl.), Germany are used to validate column averaged methane retrieved from ENVISAT/SCIAMACHY spectra by WFM-DOAS (WFMD) version 0.4 and 0.41 for 153 days in 2003. Smoothing errors are estimated to be below 0.10 % for FTIR and 0.14 % for SCIAMACHY-WFMD retrievals and can be neglected for the assessment of observed bias and day-to-day-scatter. In order to minimize the altitude-difference effect, dry-air column averaged mixing ratios (XCH<sub>4</sub>) have been utilized. From the FTIR-time series of XCH<sub>4</sub> an atmospheric day-to-day variability of 1 % was found, and a sinusoidal annual cycle with a ≈1.6 % amplitude. To obtain the WFMD bias, a polynomial fitted to the FTIR series was used as a reference. The result is  $\text{WFMD v0.4} / \text{FTIR} = 1.008 \pm 0.019$  and  $\text{WFMD v0.41} / \text{FTIR} = 1.058 \pm 0.008$ . WFMD v0.41 was significantly improved by a time-dependent bias correction. I can still not capture the natural day-to-day variability, i.e., the standard deviation calculated from the daily-mean values is 2.4 % using averages within a 2000-km radius, and 2.7 % for a 1000-km radius. These numbers are dominated by a residual time-dependent bias in the order of 3 % / month. The latter can be reduced, e.g., from 2.4 % to 1.6 % as shown by an empirical time-dependent bias correction. Standard deviations of the daily means, calculated from the individual measurements of each day, are excluding time-dependent biases, thus showing the potential precision of WFMD daily means, i.e., 0.3 % for a 2000-km selection radius, and 0.6 % for a 1000-km selection radius. Therefore, the natural variability could be captured under the prerequisite of further advanced time-dependent bias corrections, or the use of other channels, where the icing issue is less prominent. An outlook on our ongoing and near future ground-truthing activities with the Zugspitze FTIR (2964 m asl.) and the nearby Garmisch FTIR (734 m asl.) designed to accomplish the validation and maturation of satellite methane data products is presented.