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Intercalibration of column-averaged methane from the Total Carbon Column Observing Network and the Network for the Detection of Atmospheric Composition Change: An Update

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We present the intercalibration of dry-air column-averaged mole fractions of methane (XCH_4) retrieved from solar Fourier transform infrared (FTIR) measurements of the Network for the Detection of Atmospheric Composition Change (NDACC) in the mid-infrared (MIR) versus near-infrared (NIR) soundings from the Total Carbon Column Observing Network (TCCON). The study uses multi-annual quasi-coincident MIR and NIR measurements from the stations Garmisch, Germany (47.48 ˚N, 11.06 ˚E, 743 m a.s.l.) and Wollongong, Australia (34.41 ˚S, 150.88 ˚E, 30 m a.s.l.).

Direct comparison of the retrieved MIR and NIR XCH_4 time series for Garmisch shows a quasi-periodic seasonal bias leading to a standard deviation (*stdv*) of the difference time series (NIR-MIR) of 7.2 ppb. After reducing time dependent a priori impact by using realistic site- and time-dependent ACTM-simulated profiles as a common prior, the seasonal bias is reduced (*stdv* = 5.2 ppb). A linear fit to the MIR-NIR scatter plot of monthly means based on same-day coincidences does not show a significant intercept, and the MIR/NIR intercalibration factor is found to be close to ideal within 2 sigma uncertainty, i.e. 0.9996(8). The difference time series (NIR-MIR) do not show a significant trend. The same basic findings hold for Wollongong. In particular an overall MIR/NIR intercalibration factor close to the ideal 1 is found within 2 sigma uncertainty. Differently to Garmisch, the original Wollongong MIR and NIR data can be jointly used without using a common a priori because of the less pronounced (southern-hemisphere) seasonal cycle.

In addition the study has been extended by the MIR and NIR measurements of the stations Karlsruhe, Germany (49.1 ˚N, 910 ˚E, 110 m a.s.l.) and Izana, Spain (28.30 ˚N, 16.48 ˚W, 2370 m a.s.l.).

Our results suggest that it is possible to set up a harmonized NDACC and TCCON XCH_4 data set which can be exploited for joint trend studies, satellite validation, or the inverse modeling of sources and sinks.