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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

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We establish the intercalibration of column-averaged methane (XCH4) retrieved from solar 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 all existing stations operating both measurement modes (Eureka, 80 N, Ny-Alesund, 78.9 N, Bremen, 53.1 N, Karlsruhe, 49.1 N, Garmisch, 47.5 N, Izana, 28.3 N, St Denis 20.9 S, Wollongong, 34.5 S).

Direct comparison of the retrieved MIR and NIR time series shows a phase shift in northern-hemisphere XCH4 seasonality (which typically is minus-sine type). I.e., a significant time-dependent bias is observed. After eliminating differences in a prioris by using ACTM-simulated profiles as a common prior, the seasonalities of the (corrected) MIR and NIR time series agree within the noise. The difference time series (NIR-MIR) are analyzed with respect to a possible significant trend in order to check whether a simple scaling factor can be used for the intercalibration, or a time-dependent linear or seasonal component is required. Furthermore we investigate whether the individual calibration factors per station agree within their error bars which would allow to use one overall calibration factor for all stations.

Applying the proposed intercalibration to all stations of the NDACC network will allow to set up a harmonized NDACC and TCCON XCH4 data set which can be exploited for joint trend studies, satellite validation, or the inverse modeling of sources and sinks.