Validation of methane profile observed with FTIR at Tsukuba

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CH_4 is the second greenhouse gas and the concentration near the surface is increasing. But there are many emission sources and the increasing rate is varying year by year. The profile of CH_4 can be observed with a ground-based high-resolution Fourier transform spectrometer using spectral inversion analysis. However, the validation of the retrieved profile doesn't have been performed enough. Then, we compared some retrieval parameters and validated the retrieved tropospheric partial columns using aircraft sampling measurements.
We analyzed the spectra taken at Tsukuba between 2012 and 2017. SFIT4 spectral fitting program was used to derive the profiles from spectra in 3 micrometer region. H_2O as interference species affects the accuracy of the retrieved CH_4 profiles. Two initial profiles of H_2O are provided: monthly mean (v1) and daily analyzed (v5). Two kinds of microwindows for the retrieval are also provided according to Sussmann et al. (2011): 5 microwindows (5MW) and 3 microwindows (3MW). Fitting results were compared based on the root mean square residual (RMS) and degree of freedoms (DOFs). As a result, 5MWv1 is worse for both RNS and DOFs than other 3. Then, we compared the results of 5MWv5, 3MWv1, and 3MWv5 with aircraft sampling.
The monthly mean tropospheric partial columns integrated from 0 to 8 km were compared with those calculated from aircraft sampling observed by the center for atmospheric and oceanic studies, Tohoku University near Sendai from 2012 to 2017. When all derived partial columns were compared with aircraft results, all 3 cases (5MWv5, 3MWv1, and 3MWv5) showed 5 -10 % differences in summer when H_2O concentration is high. But when the derived partial columns for which RMS is less than 0.15 were compared, all 3 cases agreed with aircraft results within the uncertainty besides for the -2.9 % bias.

Keywords: FTIR, Methane, Height profile, Accuracy

