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PPDF-based retrievals of atmospheric methane from GOSAT observations

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We present over-globe retrievals of atmospheric methane column-averaged abundance (X_{CH4}) obtained with PPDF (Photon path-length Probability Density Function)-based algorithm from observations by Greenhouse gases Observing SATellite (GOSAT) for 22 months from June 2009. The algorithm retrieves both target gas amount and PPDF-parameters that are responsible for the optical path modification due to atmospheric light scattering. PPDF parameters were estimated by using the oxygen A-band data. The GOSAT scans with PPDF-parameters below an empirically chosen threshold were considered as "clear-sky" (i.e. with negligible optical path modification). These scans were used for methane retrievals from 1.67 μm absorption band at zero PPDF parameters. The retrieval state vector included vertical profile of the methane mixing ratio; scaling factor of prior water vapor profile; and stretch factor for adjusting the position of the wave-number grids. Meteorological temperature profiles and surface pressure data (GVP) were provided by Japan Meteorological Agency.

We focus on the comparison of the satellite-based methane retrievals with those available from TCCON (Total Carbon Column Observing Network) measurements. We found latitude dependent variations of PPDF versus TCCON X_{CH4} bias (up to 15 ppb) which are comparable with estimated GOSAT single scan precision. Comparison of the retrievals with transport model (NIES-TM) data revealed good agreement for GOSAT over-land observations and stable negative bias (0.3 – 0.8 %) of PPDF versus NIES-TM X_{CH4} for over-sea observations.