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TROPOMI methane total column measurements: retrieval algorithm improvements, validation results and first applications

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The TROPOspheric Monitoring Instrument (TROPOMI) aboard of the Sentinel 5 Precursor (S5P) is operational since about one year and measurements of the total column concentration of methane is one of the primary targets of the mission. The CH4 retrieval algorithm used for the operational processing of TROPOMI data is developed by SRON Netherlands Institute for Space Research. It retrieves column averaged dry air volume mixing ratio of CH4 from backscatter radiances measured by TROPOMI in the near-infrared (NIR, 675-775 nm) and shortwave-infrared (SWIR, 2305-2385 nm) spectral range while accounting for atmospheric scattering with the RemoTeC full-physics retrieval algorithm. In this contribution, we present results from the first year of TROPOMI methane measurements. We have set-up an improved retrieval scheme and tested the impact of several molecular absorption cross sections databases on the retrieval. With the new retrieval approach, we reach a very good agreement with thirteen different TCCON sites located in North America, Asia, Europe and Oceania. The mean bias is lower than 5 ppb and the station-to-station variability lower than 6 ppb. Furthermore, the albedo dependent bias is reduced significantly compared to the proxy methane product from the Japanese GOSAT satellite. To illustrate the usage of the dataset, we show first case studies where we analyse in detail the temporal and spatial variability of methane over several regions in the United States.