Detection of methane enhancements over the Eastern United States with improved TROPOMI retrievals

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The TROPOspheric Monitoring Instrument (TROPOMI) aboard the Sentinel 5 Precursor (S5P) has provided methane measurements for more than two years. The high accuracy together with the exceptional spatial resolution (7 x 7 km², 7 x 5.2 km² since August 2019) and temporal coverage (daily) of TROPOMI provides a unique perspective on local to regional methane enhancements. In this contribution, we discuss observations of enhanced methane concentrations over the United States. We analyse in detail temporal and spatial variability of methane over wetlands and agricultural areas along the Mississippi river and in Florida. To understand the observed CH₄ anomalies regarding both natural and anthropogenic sources and transport at regional scales, we support our analysis with simulations from the GEOS-Chem atmospheric chemistry and transport model. We also investigate the possibility to use other datasets as a proxy for CH₄ emissions (e.g. NO₂ for agricultural areas, land surface temperature for wetlands). These results are based on an improved TROPOMI methane product that features among others a new bias correction that is fully independent of any reference measurements. The verification of the TROPOMI XCH₄ data with ground-based measurements by the TCCON network yields a station-to-station variability of the XCH₄ error below 10 ppb, in agreement with the comparison with the proxy methane product from the Japanese GOSAT and GOSAT-2 missions. The improved TROPOMI methane product is planned as a future update of the operational TROPOMI processor.