Quantification of Methane Emissions and the Role of Satellites Moving from Global to Local Scales

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Since the early 2000s satellites contribute significantly to the pool of atmospheric data that are available for quantifying global and regional methane emissions using inverse modelling. Despite important progress in the quality of satellite sensors and retrieval methods, our understanding of the processes that drive the global growth rate of methane is still largely based on ground-based networks, albeit supported increasingly by space-borne data. Measuring long-lived greenhouse gases at sufficient accuracy remains a challenge. Nevertheless, satellites are becoming an increasingly valuable complement to ground-based data already now, in ways that we have only started to explore.

With the launch of TROPOspheric Monitoring Instrument (TROPOMI) about a year and a half ago, the scientific landscape is changing quickly in the direction of higher resolution applications. Using SCanning Imaging Absorption SpectroMeter for Atmospheric CHartography (SCIAMACHY), some strong local sources could be detected, but only after averaging several years of data. With TROPOMI, evidence of local emissions is abundant, and detectable in single satellite overpasses. This major step forward has important implications not only for the kind of information that can be extracted from satellite data, but also for the inverse modelling methods that are used. TROPOMI offers a unique playground to develop and compare methods. Limitations in data availability and quality, as well as the performance of high-resolution transport models prompt for the development hybrid methods, combining pieces of information from the data and models that are useful. To this end, the instrument offers measurements of other compounds, such as NO_2 and CO, which are much easier to observe with regard, e.g., to signal over noise and can facilitate the methodological development.

This presentation discusses the methodological transition as well as its future prospects, illustrated with examples from the data collected so far.

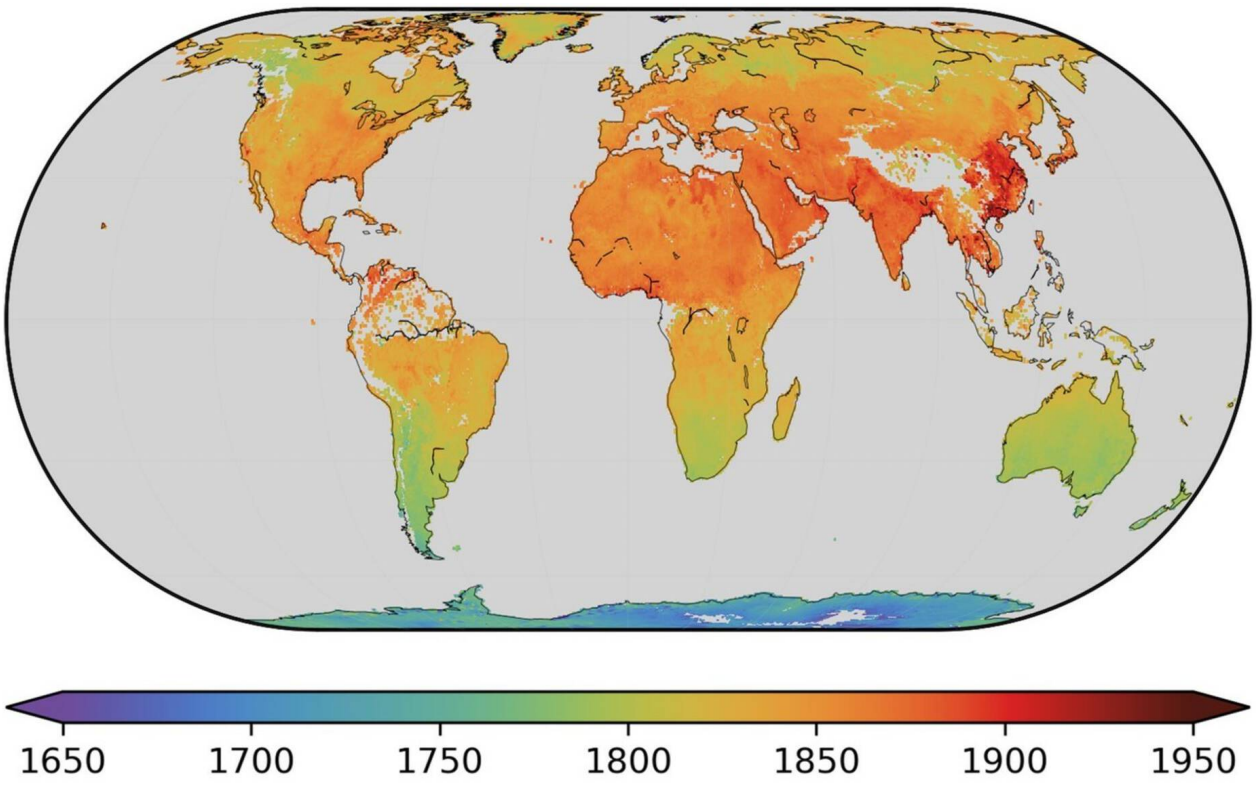

Figure 1. Total column methane from TROPOMI averaged over the second half of 2018.