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Recent methane trends derived from S5P/TROPOMI data

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Methane (CH_4) has a relatively long tropospheric lifetime and is consequently a well-mixed greenhouse gas. CH_4, released by several
types of human activity and natural processes, is one important driver of climate change. The global mean concentration of CH_4 has
increased by 156% between the beginning of the industrial revolution around 1750 and 2019, reaching roughly 1866 ppb in 2019 (IPCC).
The time dependence of this increase is not well understood. For example, it is not entirely clear why CH_4 growth rates reached record
high values in 2020 and 2021. Furthermore, the number of published growth rates (annual methane increases) is limited and includes data
from NOAA and the Copernicus Climate Change Service. Hence the rate of increase of CH_4 calculated from independent data sources are
valuable for cross-verification and in furthering our understanding of the methane cycle.
The TROPOMI instrument onboard the Sentinel-5P satellite provides daily CH_4 data with a spatial resolution of roughly 7x7 km²
and global coverage. We analyze the TROPOMI CH_4 data with the goal of determining robust values of the annual methane increases (AMI)
for both global and zonally resolved data. For this we utilize a dynamic linear model approach to separate the underlying methane level,
the seasonal and short-term variations. The AMIs are defined as the difference in the underlying (i.e. fitted) methane level between
the first and last day of a year. In this contribution, we present first results for global and zonal TROPOMI AMIs for the years 2019-2022.
We compare the resulting global TROPOMI AMIs with data from NOAA and Copernicus and discuss the distribution of zonal AMIs for the given years.