EGU21-6104
https://doi.org/10.5194/egusphere-egu21-6104
EGU General Assembly 2021

Quantifying the contribution of regional methane emissions to the global methane budget between 2008 and 2018 using the TOMCAT chemical transport model

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Methane (CH_4) is the second most important atmospheric greenhouse gas after carbon dioxide. Global concentrations of CH_4 have been rising in the last decade and our understanding of what is driving the increase remains incomplete. Natural sources, such as wetlands, contribute to the uncertainty of the methane budget. However, anthropogenic sources, such as fossil fuels, present an opportunity to mitigate the human contribution to climate change on a relatively short timescale, since CH_4 has a much shorter lifetime than carbon dioxide. Therefore, it is important to know the relative contributions of these sources in different regions.

We have investigated the inter-annual variation (IAV) and rising trend of CH_4 concentrations using a global 3-D chemical transport model, TOMCAT. We independently tagged several regional natural and anthropogenic CH_4 tracers in TOMCAT to identify their contribution to the atmospheric CH_4 concentrations over the period 2009 – 2018. The tagged regions were selected based on the land surface types and the predominant flux sector within each region and include subcontinental regions, such as tropical South America, boreal regions and anthropogenic regions such as Europe. We used surface CH_4 fluxes derived from a previous TOMCAT-based atmospheric inversion study (Wilson et al., 2020). These atmospheric inversions were constrained by satellite and surface flask observations of CH_4, giving optimised monthly estimates for fossil fuel and non-fossil fuel emissions on a 5.6° horizontal grid. During the study period, the total optimised CH_4 flux grew from 552 Tg/yr to 593 Tg/yr. This increase in emissions, particularly in the tropics, contributed to the increase in atmospheric CH_4 concentrations and added to the imbalance in the CH_4 budget. We will use the results of the regional tagged tracers to quantify the contribution of regional methane emissions at surface observation sites, and to quantify the contributions of the natural and anthropogenic emissions from the tagged regions to the IAV and the rising methane concentrations.

Wilson, C., Chipperfield, M. P., Gloor, M., Parker, R. J., Boesch, H., McNorton, J., Gatti, L. V., Miller, J. B., Basso, L. S., and Monks, S. A.: Large and increasing methane emissions from Eastern Amazonia derived from satellite data, 2010–2018, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-1136, in review, 2020.