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Comparing satellite-retrieved atmospheric methane with a 3-D chemical transport model driven by bottom-up emission estimates.

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Global methane accounts for approximately 20% of the total direct radiative forcing by long-lived greenhouse gases ($0.5 \mathrm{Wm}^{-2}$), making it the second largest contributor after carbon dioxide. Variations in CH_4 emissions are likely to be rapidly observable in the atmospheric composition due to its relatively short lifetime (approximately 9 years). As a result emission values can be estimated using atmospheric retrievals. By comparing satellite retrievals (GOSAT) with various emission inventories put through a chemical transport model (TOMCAT) a better understanding can be made as to the accuracy of the input fluxes. Previous model experiments show that a large uncertainty in bottom-up CH_4 fluxes occurs over wetland regions.

The aim of this study is to investigate which inventory performs best over wetlands when compared with satellite retrievals. The comparison will help to identify model errors, which will allow for the development of model parameters. Improving modelled CH_4 emissions will improve understanding of regional CH_4 sources and increase the accuracy of climate change predictions.

We have used the TOMCAT off-line chemical transport model (CTM) to perform simulations over the period 2002 to 2010. The model is forced by ECMWF ERA-Interim reanalyses and run at a horizontal resolution of 2.8^o x 2.8^o with 60 levels from the surface to $\sim$60km. The model simulates atmospheric CH_4 based on surface emissions and atmospheric loss rates based on specified OH and $O(^1D)$ fields. A number of CH_4 tracers have been included in the simulation based on different emission scenarios. These include scenarios provided for the recent Transcom-CH4 study and bottom-up emissions provided by the UK JULES land surface model.

The quality of the different emission scenarios has been assessed by comparing with atmospheric observations. In addition to GOSAT retrievals, results have been compared with surface in-situ data and NDACC/TCCON ground-based column observations.