2.151 Comparing and improving methane emissions estimates in the UKCA chemistry climate model.

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Abstract:

Methane is the second most important anthropogenic greenhouse gas after carbon dioxide and a major ozone precursor. Its relatively short lifetime allows any changes in the methane burden to have near immediate effects on global climate. However, large uncertainties exist in the estimates of methane sources and hence in the global methane budget.

The UM-UKCA has been modified to use both prescribed (offline) oxidant fields and interactively simulated oxidant fields in parallel. Thus, in one simulation, methane oxidation can be treated as both a linear first order process, removing the methane feedback onto itself, and a fully interactive process, using the same model OH field. The linear oxidation scheme allows methane emissions to be tagged by source type and region. An OH climatology can also be used as the offline OH field.

We use surface methane observations to assess the performance of the model. Using interactive chemistry, and an OH field which compares well with the ACCMIP multi-model mean, methane concentrations are found to be low biased with respect to observations at all latitudes but with an acceptable hemispheric gradient. The methane lifetime with respect to tropospheric OH loss is at the lower end of the ACCMIP multimodel mean. In contrast, when an offline OH field (North-South gradient 1.01, taken from Spivakovsky / TRANSCOM-CH4) is used, good agreement with is found in concentration but with too strong a hemispheric gradient. The lifetime agrees well with observational constraints.

We will present an analysis of the footprints of the different source types and regions, deployed in both linear and interactive schemes, which allows us to perform detailed comparison to observations, and to identify regions where methane emissions databases may under-represent methane emissions. We will show that these data allow a quantitative assessment of the speciated methane source strengths.