Methane sensitivity to perturbations in tropospheric oxidizing capacity

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Methane is an important greenhouse gas and has a 25 times greater global warming potential than CO_2 on a century timescale. Yet there are considerable uncertainties in the magnitude and variability of its sources and sinks. The response of the coupled non-linear methane-carbon monoxide–hydroxyl radical (OH) system is important in determining the tropospheric oxidizing capacity. Using the NASA Goddard Earth Observing System, Version 5 (GEOS-5) chemistry-climate model, we study the response of methane to perturbations of OH and wetland emissions. We use a computationally-efficient option of the GEOS-5 CCM that includes an OH parameterization that accurately represents OH predicted by a full chemical mechanism. The OH parameterization allows for studying non-linear CH_4-CO-OH feedbacks in computationally-fast sensitivity experiments. We compare our results with surface observations (GMD) and discuss the range of uncertainty in OH and wetland emissions required to bring modeling results in better agreement with surface observations. Our results can be used to improve projections of methane emissions and methane growth.