Geophysical Research Abstracts
Vol. 14, EGU2012-940, 2012
EGU General Assembly 2012
© Author(s) 2011

Future methane, OH, and their uncertainties: parametric relations with emissions and climate change

C. D. Holmes (1), M. J. Prather (1), M. Mu (1), I. S. A. Isaksen (2), and O. A. Sovde (2)

(1) UC Irvine, Earth System Science, Irvine, United States (cdholmes@post.harvard.edu), (2) Center for International Climate and Environmental Research, Oslo, Norway

Methane and hydrofluorocarbons (HFCs) are chemically reactive greenhouse gases whose future atmospheric abundances will change as a result of socioeconomic and climate forces. Accurate projections of these climate forcing agents requires knowing the sensitivity of their abundances to emissions, meteorological factors, and chemical feedbacks. Uncertainties in each of these processes implies uncertainty in future methane and HFC abundances and their radiative forcing. We conduct simulations of methane lifetime over the last 15 years in several atmospheric chemistry and transport models (CTMs) and use sensitivity tests to determine the key processes controlling interannual variability in these models. Across several CTMs (UCI CTM, GEOS-Chem, Oslo CTM3) we find that temperature, water vapor, biomass burning, and lightning NO_x are the dominant sources of year-to-year changes in methane lifetime. We also evaluate the model responses to forcings that change on slower time scales, such as methane feedback, and anthropogenic emissions magnitude and location. From the range of CTM responses, we construct a parametric model for future methane and OH that includes their uncertainties. We show that this simple parametric model is consistent with the ensemble spread from the Atmospheric Chemistry and Climate Modeling Intercomparison Project (ACC-MIP). This parametric model provides a foundation for methane and HFCs along multiple socioeconomic and climate trajectories.