Exploring the Role of Interactive Methane and its Feedbacks in a Changing Earth System

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Abstract

Methane plays a crucial role in the Earth System. However, in Phase 6 of the Coupled Model Intercomparison Project (CMIP6), Earth System Models predominantly relied on prescribed surface methane concentrations derived from historical observations or predefined future pathways. This study uses novel Earth System Model capability to investigate the impact of an emissions-driven methane cycle, including interactive wetland emissions. Specifically, we explore the influence of interactive methane and its feedbacks on climate forcing and the model's climate response to forcing. The response of the climate to external forcings is intricately linked to climate feedbacks. With the inclusion of an interactive methane cycle in Earth System Models, understanding how changes in climate and enhanced vegetation growth from carbon dioxide affect the methane cycle becomes imperative. This work critically re-evaluates the CMIP6 assessment of methane feedbacks and, for the first time, disentangles the biophysical and radiative effects of carbon dioxide on wetland emissions and methane lifetime. By enabling the interaction of the biophysical and radiative effects of carbon dioxide with natural methane emissions, concentrations, and climate responses, this presentation highlights the necessity of incorporating interactive methane components in Earth System Models. Notably, this approach provides scientists with the means to assess the direct implications of methane emission reduction policies and climate feedbacks on meeting global climate and air quality targets.

Early Career Scientist

NO, I am not an early career scientist.

IGAC Activities

TOAR: Tropospheric Ozone Assessment Report, CCMi: Chemistry Climate Model Initiative