Satellite Constraints on the Latitudinal Distribution and Temperature Sensitivity of Wetland Methane Emissions

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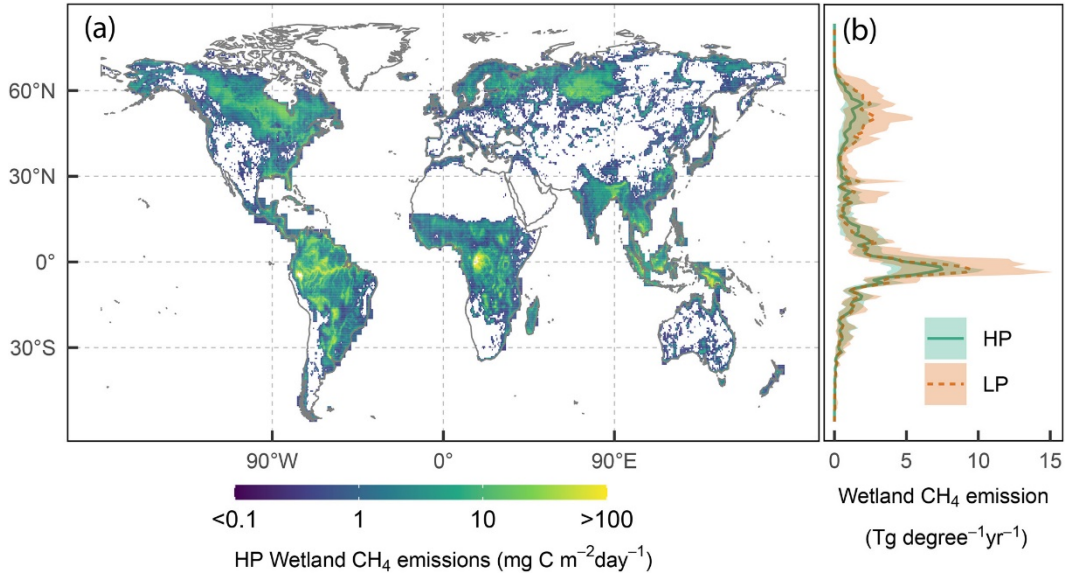

Figure 1: Mean wetland CH_4 emissions during 2010–2012 from the Highest-Performance (HP) model ensemble (a); Zonal profiles of wetland CH_4 emissions over 2010–2012 (b): Median and 5th-95th percentile range of Lowest-Performance model ensemble (LP) and HP.

Significance: Our approach demonstrates the potential for using satellite-inferred CH_4 flux estimates to quantitatively test bottom-up estimates and their sensitivity to climate

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Background: Wetland methane (CH_4) emissions represent about 30% of the global CH_4 source and remain its most uncertain component in part because wetland methane emissions models show a wide range of sensitivities to temperature and precipitation, the climatic drivers of emissions. As a consequence, the spatial distribution of wetland emissions is also highly uncertain. Testing these models is problematic because of a lack of in situ data that span the different wetland locations and temporal coverage to relate climatic drivers to emissions.

Method: We test a wide range of models using satellite based estimates of wetland fluxes derived from atmospheric CH_4 concentration data. Our optimal estimation approach accounts for cross-correlations in the uncertainties and spatial resolution in these flux estimates, which has not been possible before because typical top-down approaches do not provide the error characterization needed for these types of comparisons.

Results: We find ~25% less global emissions from best-fit models while the relative contribution of tropical emissions to the total is ~10% higher. We find a lower-than-expected sensitivity of global wetland CH_4 emissions to temperature.