Declining Methane Emissions from Tropical Wetlands Inferred from Four Years of CYGNSS Observations

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Poster

Wetlands are the largest and most uncertain natural source of atmospheric methane, contributing to nearly a third of total methane emissions. Despite its significance, accurate representation and understanding of seasonal and interannual variations in wetland methane emissions is challenging. A primary uncertainty remains characterization of wetland inundation extent, particularly under forest canopy, and its seasonal and multi-year variation. This study utilizes Cyclone Global Navigation Satellite System (CYGNSS) observations to map the inundation extent across the tropics (from 37.4◦ S to 37.4◦ N) from 2019 to 2022 with a resolution of 0.01◦ × 0.01◦. We use the CYGNSS-based inundation maps to drive an ensemble wetland methane emissions model (WetCHARTs) to examine seasonal and interannual variability in wetland methane emissions. We noted significant differences between the CYGNSS-driven extents and other traditional inundation products, particularly for the Sudd, Southeast Asia, Pantanal and Amazon wetlands. CYGNSS consistently exhibits much higher magnitudes and seasonality of inundation extents. Moreover, we observe a significant decline in inundation extent across the tropics, likely attributed to strong EI Niño in the early 2019 and subsequent La Niño events, impacting methane emissions variabilities. Contrary to previous assertions of increased wetland emissions during this period via inversion modeling, both CYGNSS- and ERA5 precipitation-driven WetCHARts models indicate a slight decrease in wetland methane emissions from 2019-2022, suggesting the need for further research to elucidate wetland emissions and the rising global atmospheric methane levels.

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