

Seasonal Variation of Methane Fluxes in a Mangrove Ecosystem in South India: An Eddy Covariance-Based Approach

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Abstract

The atmospheric methane (CH_4) concentration has increased in recent years due to natural and anthropogenic causes. Hence, it is essential to quantify the potential sources of CH_4 to understand the factors responsible for its fluxes on a local to regional scale through in situ observations. Coastal wetlands, particularly the mangrove ecosystems in the tropical and subtropical coasts, are significant sources of CH_4 . In this study, we used an eddy covariance-based technique to measure the CH_4 fluxes in a mangrove ecosystem in Pichavaram, South India. The daily mean CH_4 flux ranged from 12 to 26 $\text{nmol m}^{-2} \text{s}^{-1}$ during the wet season and from 6 to 20 $\text{nmol m}^{-2} \text{s}^{-1}$ during the dry season. The monthly mean flux during the wet period was between 0.8 and 1.8 $\text{g CH}_4 \text{m}^{-2} \text{month}^{-1}$, and in the dry season, it was between 0.4 and 0.6 $\text{g CH}_4 \text{m}^{-2} \text{month}^{-1}$. The visual correlogram and structural equation modelling technique revealed that air temperature, creek water dissolved oxygen, soil organic carbon, and redox potential are important factors that control the CH_4 fluxes. The results suggest that the Pichavaram mangrove wetland acts as a source for CH_4 . Our results also indicate that tidal inundation and seasonal variations in atmospheric temperature and water salinity are key factors affecting the CH_4 flux in the Pichavaram mangrove ecosystem.