Spatial and temporal variability of CO_2 and CH_4 gas transfer velocities in mangrove dominated estuaries

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Gas exchange fluxes of CO_2 and CH_4 in mangrove estuaries are an important component of the coastal carbon cycle. The highest uncertainty in the flux computation, however, remains in the estimate of the gas transfer velocity (k), which is system specific.

Gas transfer velocities of CO_2 ($k$$CO_2$) and CH_4 ($k$$CH_4$) were calculated from 215 floating chamber deployments in mangrove dominated estuaries in Australia and the Everglades, USA. High temporal and spatial variability of $k$$CO_2$ and $k$$CH_4$ was found (0.9 to 28.3 cm h^{-1}), mainly controlled by current generated turbulence.

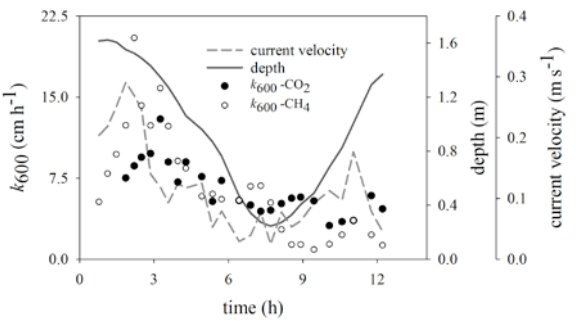

Figure 1: Temporal variability of $k$$CO_2$ and $k$$CH_4$ (normalized to the Schmidt number of 600) over a tidal cycle in Southern Moreton Bay, Australia.

A direct comparison of measurement pairs showed $k$$CH_4$ was on average 1.2 times higher than $k$$CO_2$, most likely reflecting a microbubble flux, which contributed up to 73 % of the total CH_4 flux. The potential for underestimating CH_4 evasion rates due to the presence of a microbubble flux contribution should be considered in future CH_4 flux studies, especially in ecosystems with high CH_4 saturation levels.