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Diurnal variability of CO₂ flux at coastal zone of Taiwan based on eddy covariance observation

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Abstract

In this study, we employed shore-based eddy covariance systems for a continuous measurement of the coastal CO₂ flux near the northwestern coast of Taiwan from 2011 to 2015. To ensure the validity of the analysis, the data was selected and filtered with a footprint model and an empirical mode decomposition method. The results indicate that the nearshore air–sea and air–land CO₂ fluxes exhibited a significant diurnal variability and a substantial day–night difference. The net air–sea CO₂ flux was $-1.75 \pm 0.98 \mu\text{mol-C m}^{-2} \text{s}^{-1}$, whereas the net air–land CO₂ flux was $0.54 \pm 7.35 \mu\text{mol-C m}^{-2} \text{s}^{-1}$, which indicated that in northwestern Taiwan, the coastal water acts as a sink of atmospheric CO₂ but the coastal land acts as a source. The Random Forest Method was applied to hierarchize the influence of Chl-a, SST, DO, pH and U₁₀ on air-sea CO₂ fluxes. The result suggests that the strength of the diurnal air-sea CO₂ flux is strongly influenced by the local wind speed.

Keywords coastal zone; CO₂ flux; eddy covariance method; footprint; diurnal variation; carbon sink.

1. Introduction

Since the industrial revolution, the CO₂ concentration in the atmosphere has increased by 41%, and its growth rate is increasing (IPCC, 2013); by inducing global climate changes, CO₂ is causing the greatest environmental crisis ever encountered by

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