Exploring natural and anthropogenic controls on carbon budget at an urban wetland ecosystem in Taipei

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On a global and regional scale, low-latitude estuarial wetland ecosystems play important roles in carbon cycling and ecosystem functioning, but few studies have focused on these ecosystems. In this study, to quantify the CO_2 exchange and characterize how environmental factors affect the seasonal dynamics of this exchange in low-latitude estuarial wetland ecosystems, we used continuous eddy-covariance (EC) measurement to conduct the research at a subtropical estuarine wetland ecosystem close to the Taipei Metropolitan area in northern Taiwan. In this study site, two flux towers were built over two different but representative tropical-to-subtropical vegetation types, para grass and reed. We used EC techniques to analyze temporal variation in CO_2 exchange and determined the effect of environmental factors on the dynamics of CO_2 budget in these two different ecosystems. We aimed to (1) quantify the CO_2 budget, including GPP, ecosystem respiration, and NEE by examining EC data in terms of environmental variables; (2) analyze the effect of environmental factors on the CO_2 budget; and (3) interpret possible shifts and trends in C sequestration in this representative subtropical estuarine wetland ecosystem near a metropolitan area under environmental change.
The results suggest that gross primary production (GPP, in the order of 1700 gC m-2 yr-1) of CO_2 was higher in our low-latitude wetlands than in previous studies of northern peatlands and estuarial wetlands because of the direct effect of environmental factors. As for the role of environmental controls, temperature and radiation had more effect than water status (soil moisture content and vapor pressure deficit) on GPP for the two low-latitude vegetation types, which differs from the results for high-latitude regions. Environmental variables had a strong but different impact on the CO2 budget for para grass and reed areas. This diversity led to different potential shifts and trends of biomass accumulation and distribution of these two typical low-latitude vegetation types under different seniors of environmental changes in the future. The finding from this study can sufficiently provide quantitative understanding on managing wetland ecosystem close to metropolitan areas at different temporal and spatial scales.

