Geophysical Research Abstracts
Vol. 20, EGU2018-3718, 2018
EGU General Assembly 2018

Tidal Influence on CO_2 Exchange in a South Carolina Coastal Salt-marsh

Ivan Bogoev (1), Thomas O'Halloran (2), James LeMoine (2), and Erik Smith (3)

(1) Campbell Scientific, Inc., Research & Development, Logan, United States (ivan@campbellsci.com), (2) Clemson University, Clemson, SC, United States, (3) University of South Carolina, Columbia, SC, United States

Coastal ecosystems play an important role in mitigating the effects of climate change by storing significant quantities of carbon. A growing number of studies suggest that vegetated estuarine habitats, specifically salt marshes, have high long-term rates of carbon sequestration. Besides temperature, solar irradiance, and nutrient availability, carbon assimilation by intertidal ecosystems is strongly affected by tidal activity and salinity. Improved understanding of how these factors control energy and carbon exchange is needed to better guide restoration and conservation management practices. To that end, we recently established an observation system to study marsh—atmosphere interactions within the North Inlet-Winyah Bay National Estuarine Research Reserve. Near-surface fluxes of heat, water vapor (H_2O), and carbon dioxide (CO_2) were measured by an eddy-covariance system consisting of an aerodynamic, open-path H_2O/CO_2 gas analyzer with a spatially integrated 3D sonic anemometer/thermometer (IRGASON). The IRGASON instrument provides collocated and highly synchronized, fast response H_2O, CO_2, and air- temperature measurements, which eliminates the need for spectral corrections associated with the separation between the conventional sonic anemometer and gas analyzer configuration. This facilitates calculating the instantaneous CO_2 molar mixing ratio relative to dry air. Fluxes computed from CO_2 and H_2O mixing ratios, which are conserved quantities, do not require post-processing corrections for air-density changes associated with temperature and water vapor fluctuations. Concurrent water level and water quality measurements in the estuary's main creek, which floods the eddy-flux footprint, are made every 15 minutes. We examine the effects of tidal inundation patterns and surface water salinity on net ecosystem exchange. The performance of the integrated eddy-flux system is evaluated by comparing normalized frequency spectra of air temperature, water vapor, and CO_2, as well as their co-spectra with the collocated vertical wind. We also show mean daily cycles of sensible, latent, and CO_2 fluxes and analyze correlations with air/water temperature, wind speed, and tidal activity.