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# Surface emissions of heat, water and GHGs from a NYC greenroof

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The budgets of heat, water, and GHGs from greenroofs in New York City, needed for adaptation and sustainable policy and infrastructure strategies, requires an accurate measure of their surface emissions. A high speed, Cavity Ring-Down Spectroscopy (CRDS) based analyzer for measuring carbon dioxide ($CO_2$), methane (CH4) and water ($H_2O$) and an ultrasonic wind and temperature anemometer for measuring heat and momentum is used to assess greenroof performance during seasonal, diurnal, and episodic weather conditions. The flux instrument has proven capable of raw 10 Hz precision (one standard deviation) better than 110 parts-per-billion (ppbv) for carbon dioxide, better than 3 ppbv for methane and better than 6 ppmv +0.3% of reading for water vapor.

In the water and heat budget, comparison and reconciliation of greenroof evapotranspiration (ET) using micrometeorological techniques, water balance, and heat balance was conducted. The water balance (month timescales), the heat balance (week timescale) show agreement to the micrometeorological surface ET (hour timescale). By using boundary layer flux measurements of ET, the fundamental performance of greenroofs on climate and weather conditions can be explored. These boundary layer measured surface fluxes provide critical information on the physiology of the built environment in New York City. Faced with sewage failures due to water management and exacerbated heating, the accurate assessment of greenroof performance on high spatial and temporal scales in required for the urban environment. Results will be presented and discussed.