Hawaii Coastal CO_2 Network: A Decade of Environmental Monitoring

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Nearly 10 years of high-resolution surface seawater carbon dioxide partial pressure (pCO_2) measurements from four coastal moorings around O'ahu, Hawaii demonstrate that coral reef ecosystems in these areas are a net source of CO_2 to the atmosphere. The CRIMP-2 site had the largest air-sea flux (1.24 ± 0.33 mol m^{-2} yr^{-1}) and the largest variability in seawater pCO_2 (950 μatm overall range). This site, near a shallow barrier coral reef system in Kaneohe Bay O'ahu, had eight times the variability of a nearby open ocean site. On the south shore of O'ahu, the Kilo Nalu and Ala Wai moorings measured net fluxes that were much closer to the open ocean, but the range of surface water pCO_2 variability was still about twice that of the open ocean. The biogeochemistry of Hawai'i's coastal waters is strongly influenced by land-derived nutrient inputs and fresh water runoff, which drive primary productivity and seawater density changes that impact the CO_2-carbonic acid system parameters. Calcification and primary productivity on the coral reefs around O'ahu also strongly influence the short-term and seasonal pCO_2 values. Each of the coastal sites are influenced differently by these coastal processes. Although daily to seasonal variations in pCO_2 are strongly affected by localized phenomena, variability on longer time-scales can be influenced by basin-scale climate oscillations and the accumulation of CO_2 in the atmosphere.