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Spatial Scales and Distribution of Hydrocarbon Seeps near Coal Oil Point, California

Natural hydrocarbon seeps originating at the sea floor contribute significantly flux of methane and other gases to the atmosphere. This occurs strongly offshore of Coal Oil Pt. near Santa Barbara, California where natural hydrocarbon seepage produces extensive bubble plumes. Quantifying the bubbling gas flux to the atmosphere from the ocean is important for constraining global budgets and understanding local air pollution sources. We developed a buoy to measure directly the gaseous flux of methane emanating from natural hydrocarbon seeps. Gas flux is quantified using a gas capture technique in which gas from rising bubble plumes is directed through an inverted cone at the base of the buoy. The cone directs the gas into a collecting chamber where the position of the gas-water interface is continuously measured by the differential pressure between the chamber and ambient seawater. Gas flux is estimated from the changing position of the gas-water interface. We have collected an extensive data set of flux observations in regions of strong seepage near Coal Oil Point. Spatial analysis and objective mapping techniques reveal patchy distributions of high flux regions. Spatial autocorrelation functions indicate two length scales. The first scale of a few meters describes the typical size of bubble plumes as they reach the sea surface. The second, larger scale describes the typical size of groups of bubble plumes. We also are examining the relationship between flux rates and gas composition. An array of thermal sensors on the buoy shows the effect of bubble plumes on near-surface temperature structure.