In situ Measurements of Methane in the Benthic Boundary Layer Near Natural Hydrocarbon Seeps in the Deep Northern Gulf of Mexico

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Natural hydrocarbon seeps in the deep northern Gulf of Mexico feature gas and oil releases from sulfate-depleted brines and sediments associated with faults and density-driven flow. Stable isotopic values of dissolved sulfate and methane from seeps reveal microbial, thermogenic and mixing processes controlling light hydrocarbon production and distribution. However, quantifying gas fluxes and resulting deep-water methane plumes present formidable technological challenges. *In situ* measurements from ECOGIG-GOMRI landers deployed at lease block GC600 reveal near bottom methane concentrations ranging from 2 to over 1000 nM with higher values corresponding to water transport from known oil and gas seeps. Dissolved methane and physical parameters were continuously measured for periods of over two weeks from 1174 to 1226 meters depth near numerous oil and gas seeps. Currents measured utilizing single point acoustic Doppler generally revealed SSE water transport with velocities ranging from zero to over 30 cm/s. Highest methane corresponded to water transport from known oil and gas bubble release sites. Peak BBL concentrations during one six-week study matched near-bottom methane maxima observed in shipboard water column profile measurements. Bursts of methane over 1000 nM appeared related to gas bubble release events triggered by physical processes including tidal pressure (depth) decrease as previously observed in coastal environments.