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Very-near surface salinity measurements during the SPURS field program

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With the launch of satellite sensors capable of measuring open ocean sea surface salinity, such as on the Soil Moisture and Ocean Salinity (SMOS) satellite and the Aquarius platform, is imperative to understand the challenges of calibration and validation of these measurements. Observations of open ocean surface salinity are generally made at a depth of 5 m, as this is the most common intake depth of thermosalinograph systems and the approximate depth at which the salinity sensor in Argo floats is disabled to prevent fouling by surface contaminants. While diurnal variations in temperature are well documented, observations of salinity changes at the air-sea interface are thus sparse. However, it is crucial to understand the difference in salinity between the surface layer and a depth of 5 m. As part of the Salinity Processes in the Upper Ocean Regional Study (SPURS), a novel sea surface salinity sampling apparatus was deployed on-board the R/V Endeavor. This apparatus (named the 'sea snake') consists of a reinforced hose that is stoppered at the end and has two small intake holes. This hose is towed from a boom mounted in such a way to ensure the sampling of undisturbed water outside of the ship's bow wake. A self-priming pump is used to pump seawater into a de-bubbler before being measured in a Seabird SBE-45 thermosalinograph. Concurrent measurements are made using an identical thermosalinograph with an intake depth of 5 m. During the March 2013 SPURS cruise, we found diurnal salinity enhancements exceeding 0.15 psu relative to 5 m depth during calm, sunny days. These measurements were validated by means of bottle samples that were analyzed in a salinometer. The uppermost 5 m appeared to be statically stable due to concurrent temperature increases of approximately 2-3°C at the surface. During the second deployment in September 2013, in addition to salinity enhancements on the order of 0.05 psu relative to 5 m, freshwater puddles were detected after rainfall. The strongest signature of a puddle relative to 5 m was approximately 2 psu. The temporal and spatial extend of these surface salinity anomalies is described using the aforementioned data and is compared with data from wave gliders gathered between September 2012 and September 2013.