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Observations of near-surface fresh layers during SPURS-2

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One of the primary objectives of the ongoing SPURS-2 program is to understand the fate of rainfall deposited on the sea surface. Rain produces stable near-surface fresh layers that persist for O(1-10) hours. The depth, strength, and lifetime of surface fresh layers are known to be related to the local rain and wind conditions, but available observational data are too sparse to allow definitive quantification of cause-and-effect relationships.

In this paper, the formation and evolution of rain-formed fresh layers are examined using observations of near-surface salinity made during the 2016 SPURS-2 field experiment, which took place in the Intertropical Convergence Zone of the eastern tropical Pacific Ocean in August-September 2016. During 2016 SPURS-2, over 30 rain events were captured with the Surface Salinity Profiler (SSP), a towed platform that measures salinity and temperature at five discrete depths in the upper meter of the ocean. Differences in salinity measured by the SSP at depths of 0.02 m and at 1 m are correlated with local meteorological conditions. The field results show that the salinity difference increases linearly with rain rate, a result that is consistent with calculations done with a one-dimensional ocean turbulence model. The field data also demonstrate that there is an inverse correlation between wind speed and the vertical salinity difference, which is also consistent with numerical models. The implications of these results are discussed in the context of satellite salinity observations and the representation of rainfall events in climate models.