Multiscale Simulation, Data Assimilation, and Forecasting in Support of the SPURS-2 Field Campaign

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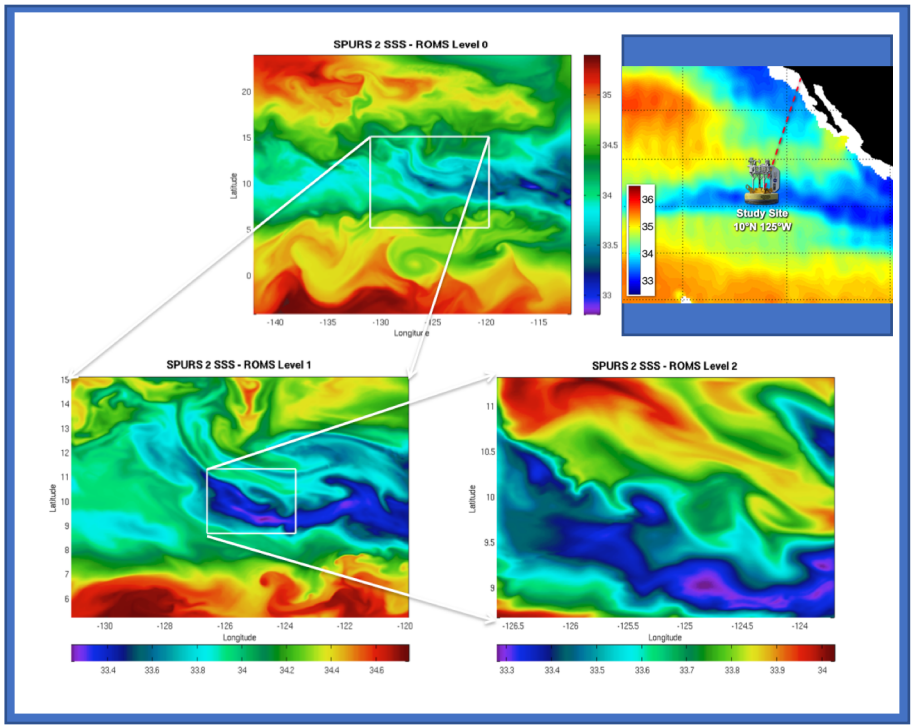

Figure: Three nested model domains at resolutions of 9 km (top), 3 km (bottom left), and 1 km (bottom right). Colors show simulated sea surface salinity (SSS in psu) from the nested domains on October 1, 2015. Note different color scales for each panel. **Inset:** Location of the SPURS-2 study area within the eastern tropical Pacific's low-salinity, high precipitation region.

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Problem: The Salinity Processes Upper-ocean Regional Study 2 (SPURS-2) field campaign was designed to examine processes affecting the near-surface salinity structure and variability beneath the Intertropical Convergence Zone (ITCZ). Within the tropical Pacific, seasonally-varying rainfall driven by the ITCZ coincides with the formation of a vast low salinity band crossing the entire Pacific Ocean. To better understand this, a high-resolution numerical model was formulated focusing on small-scale processes impacting sea surface salinity (SSS) in the region.

Data and methods: The model combined the use of multiscale simulations, assimilation of in situ and satellite data, and a numerical forecasting system based on the Regional Ocean Modeling System (ROMS), which has been used often to study small and large-scale physical processes affecting the near-surface ocean. The model was configured to represent these scales to a maximum degree and ROMS was configured with a set of nested domains. A Multiscale Data Assimilation (MSDA) scheme was implemented to incorporate not only observations from SPURS-2 but also those from routine and operational observing networks.

Key Findings: In SPURS-2, the simulation, data assimilation, and numerical forecasting effort was identified as an integral component and assisted in formulating sampling plans. During the field experiment, the system integrated SPURS-2 measurements with those from routine operational observing networks and provided real-time skillful daily forecasts of ocean conditions. After the field experiment, the data assimilation system was used to produce a reanalysis product to help quantify contributions of different processes to salinity variability in the region.

Broader significance: The success of the model in the SPURS-2 campaign should inform future research on SSS and the conduct of field campaigns. A field campaign could be designed to provide observations that can be assimilated into models that augment the routine observing networks to resolve smaller scales and higher frequency variability, and/or measure variables that the routine observing networks do not provide.