Abstract
This work presents a procedure for developing a high-resolution regional climatology estimate (RClimo) for the temperature and salinity fields off the central California coast for August. The methodology involves the use of a 2D-3D regional model initialized with a 20-km ROMS climatological initial field to compute a climatological average of the fields over the course of the year. The resulting dataset is used to generate a 1-degree grid climatology for the region with 5-km resolution OA (inner box) domain, and a 20-km grid (outer) and OA domain (inner).

Results and Applications
1. Dynamic height anomaly (Fig. 4) – Eddy activity in a coastal zone (< 100 km) is similar for both RClimo and Levitus data. However, in an offshore region, there are 2 distinct points for RClimo data: 1) more meso-scale features; 2) depth-persistent front existing ~250 km offshore (Figs. 4a, 4c and 4f). The Levitus exhibits the broadest coastal circulation with depth (Figs. 4b and 4d). At 100-m depth, the northward flow extends throughout the domain about 100 km offshore (Fig. 4g), whereas the flow exists only the northern portion of the domain (Fig. 4d) and not as strong as one in RClimo. The flow comparison at 200-m depth (Figs. 4e–4h) is similar to one at 100-m depth.

2. Applications
2.1) ROMS simulation w/o forcing (Figs. 5-8)

- Time series of kinetic energy density suggests both simulations initialized with RClimo and Levitus data reach a quasi-steady state around 100-day. Meanwhile potential energy density for both fields show little long-term variations but a daily (RClimo) or semi-daily (Levitus) cyclic variation.

- Temperature and salinity fields at 0-, 200- and 400-m depths: (left) initialized with RClimo, (right) with Levitus, at day 15: (left) with RClimo initialization; (right) with Levitus. No forcing applied.

- Geostrophic Kinetic Energy simulations – Under the geostrophic equilibrium assumption, a curl of sea-surface elevation results in geostrophic kinetic energy. Kaplan, 2004, high kinetic energy exists in the coastal zone for both the simulations. However, substantial stochastical activity occurs offshore with the RClimo (top), compared to a weak and rather organized energy band for the Levitus (bottom).

2.2) ROMS simulations with August monthly climatological forcing (Figs. 9-10)

- Temperature simulations – High meso-scale activities exist for the RClimo initialization (top), including the windward North Pacific Drift splitting to a north flow (part of the Alaska Gyre) and a southward flow (part of the North Pacific Gyre), eddies associated with the eastern boundary currents, and strong northern coastal currents. Whereas, the barotropic velocity simulation with Levitus (bottom) exhibits a relatively simple current pattern, composed of primarily northward flows.

Conclusions and Summary
A comparison of dynamic height anomaly fields between RClimo and Levitus data shows different levels of eddy activity and intensity of dominant current components such as the California Current and California Undercurrent. Application of RClimo to an initial field for ROMS simulation in the California Current system for a future simulation shows substantially different meso-scale features from those initialized with Levitus climatology, with and without atmospheric forcing applied. Simulations with RClimo initial field exhibit highly active eddy structures consistently in both deep and coastal regions, including local wind-induced coastal upwelling. Ekman convergence/divergence, coastal filaments and large current components such as the California Current and Undercurrent.

In summary, our high-resolution regional climatology, RClimo, provides a better data for a study in a complex oceanic region where multi-scale processes are dominant.

Reference