CANON Fall 2012 Experiment: Reconnaissance Planning

1. Recent conditions

Recent conditions inform expectations for the September experiment, as a basis for planning in situ reconnaissance (Figure 1).

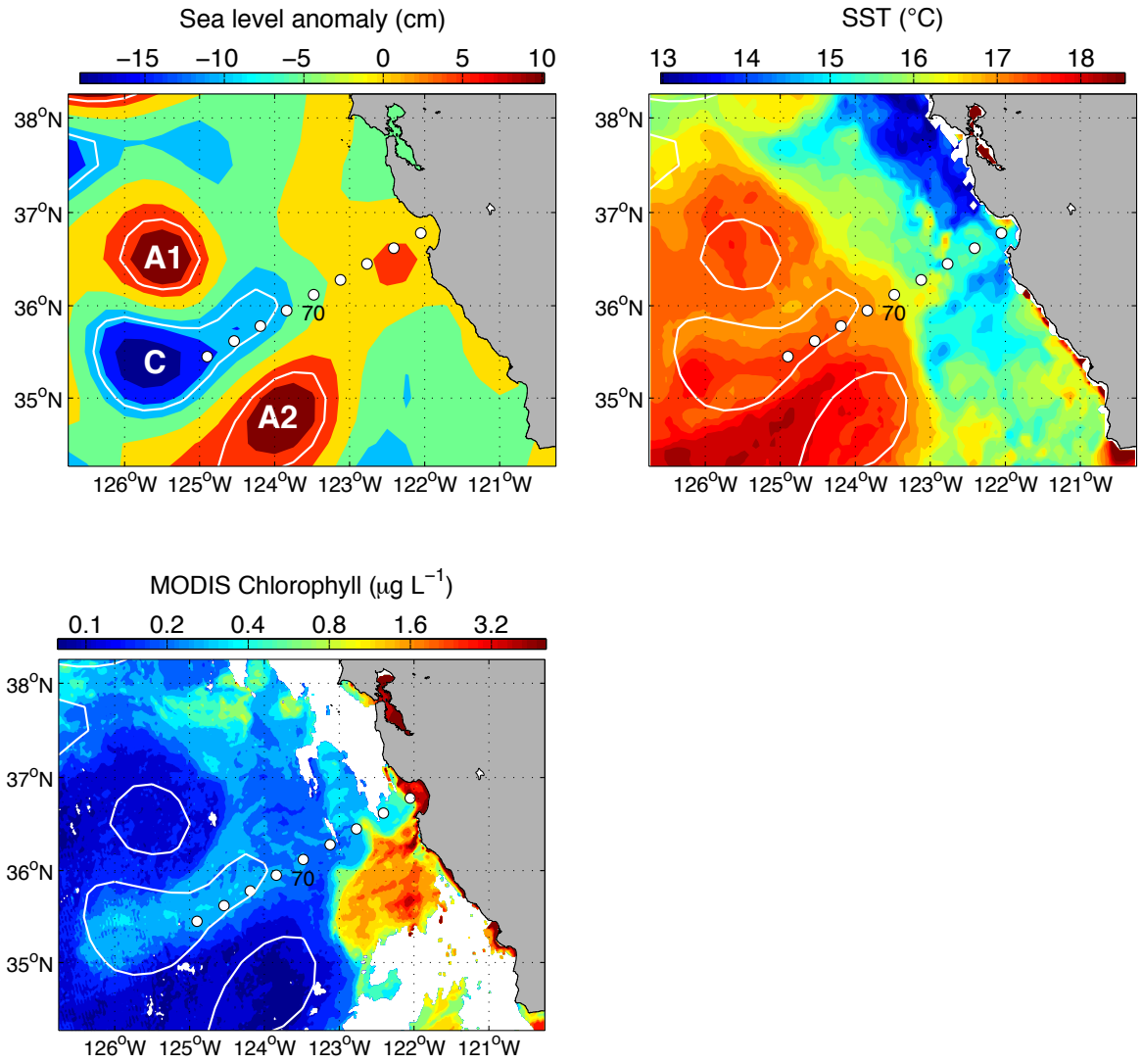

Figure 1. Near-present physical and bio-optical conditions across the study region. Sea level anomaly (SLA) is from AVISO multi-altimeter merged data, 17 August 2012. SST (GOES) and chlorophyll (MODIS Aqua) images are 3-day composites centered on 17 August.

The nominal starting point for the ESP drift (station 67-70, labeled in Figure 1) is in the California Current (CC) front. Further offshore is significant heterogeneity due to cross-frontal stirring, advection, and mixing. For example, a filament of relatively cool waters (<17°C), wrapped around a cyclonic eddy (labeled C, circulating counter-clockwise) at the end of Line 67, was evidently entrained between C and an anticyclonic eddy (A1), i.e.

counter-rotating flows with a shore-side "intake" between them. Origin of this filament in the coastal transition zone (CTZ), east of the CC front, is indicated by the trail of coolest patches along the eastern side of the filament. The relatively cool waters along the southern side of C also indicate a return (shoreward) flow between the second counter-rotating eddy pair: C and A2. Shoreward flow between C/A2 is also indicated by the filament of warmest offshore waters extending shoreward between them. The discontinuous structure of the cool filament along the southwestern boundary of C is consistent with lateral mixing.

Surface chlorophyll distributions indicate transport of phytoplankton from the CTZ to far offshore across C. Meandering of the CC under eddy influence also likely introduces strong local vertical circulations, and the locations of enhanced vertical flow are somewhat predictable, if we want to encounter or avoid them.

As we seek a relatively "homogeneous" water type under these dynamic conditions, perhaps the first question is whether we want to be in CTZ waters, which would place us within C or inshore of eddy influence — or in California Current waters, which would place us in A1/A2 (which may move relative to Line 67 in coming weeks). SLA indicates persistence of these eddies in their present locations for at least the last two weeks, so they may persist into the experiment in this approximate formation. As the experiment approaches, regional conditions will be monitored further, and near-real-time observations will help guide application of in situ reconnaissance platforms and selection of the deployment location for ESP.

2. Comparison with the September 2010 ESP drift

Comparison of recent conditions (Figure 1) with those during the previous ESP drift experiment off central California (Figure 2) shows some important differences that are relevant to planning the deployment location.

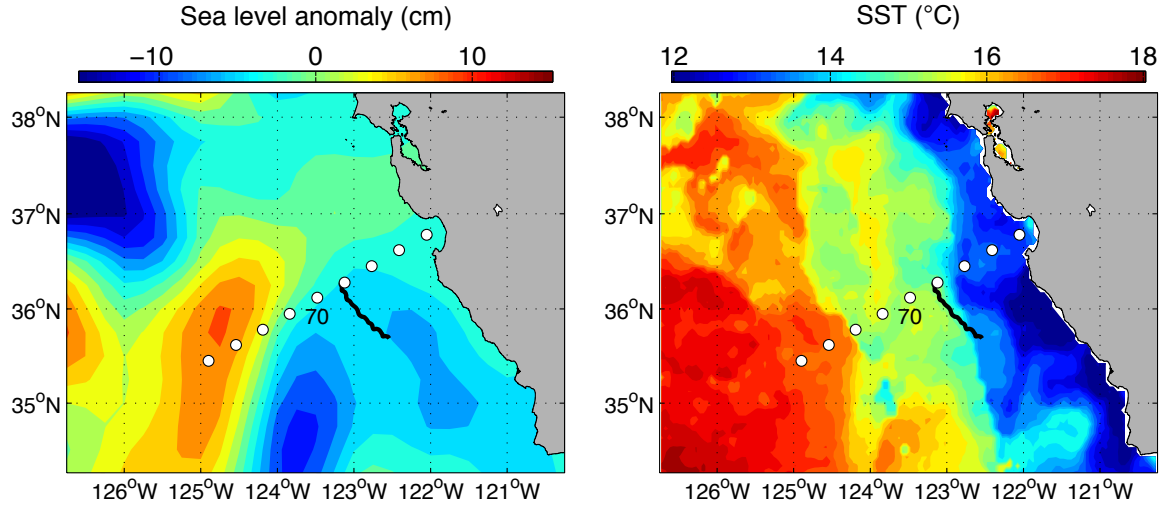

Figure 2. Physical conditions during the September 2010 ESP drift experiment. The drift track is shown as the black line.

The relatively warm homogeneous waters of the California Current were further offshore in September 2010 by ~ 70 km, and rotational flows were different in arrangement (C/A/C from N to S, opposite the recent A/C/A configuration). Flow of the southern A/C pair evidently entrained CTZ water seaward (Figure 2, south of Line 67), however this was well offshore of the ESP drift. Flow related to the northern C/A pair may have injected a filament of California Current waters into the CTZ (elongated warm filament between 36 and 38 N). While the two experiment periods both show strong lateral exchanges, the key differences this fall of a more onshore California Current and very strong offshore advection of CTZ water (200 km further than in 2010) introduce considerations for not only reconnaissance, but also the core experiment design.

3. In situ reconnaissance for September 2012

In situ reconnaissance will be informed by remote sensing (evolution of Figure 1). The in situ reconnaissance platforms will include the Wave Glider, deployed as early as the end of August, followed by the Tethys LRAUV, deployed in early September. Use of profiling gliders is uncertain.

Both Wave Glider and Tethys can help to identify "relatively homogeneous" conditions in the horizontal dimension, while Tethys can uniquely evaluate the vertical structure of the water column, also relevant to ESP placement. Goals may include not only evaluation of homogeneity and water column structure for ESP site selection, but possibly also use of passive drifting by Tethys at the depth of ESP (10 m).

Further development of in situ reconnaissance plans requires choice of a target zone, based on the recent remote sensing, lessons learned from the previous ESP drift experiments, and consideration of hypotheses, biological targets, etc.