CANON Fall 2012 Experiment: Reconnaissance Planning

1. Regional conditions

Regional conditions inform targeting of the ESP deployment location and associated in situ reconnaissance. The nominal starting point for the ESP drift (station 67-70, labeled in Figure 1) remains in the California Current frontal zone. In mid-August, this location was a meeting place of two water types: California Current (CC) and Coastal Transition Zone (CTZ) waters. It is currently a meeting place for these as well as coastal upwelling (CU) waters. A filament of cold, chlorophyll-rich CU water off Big Sur has been entrained by anticyclonic circulation inshore of the CC front and is intersecting Line 67 (NW boundary at station 70, Figure 1).

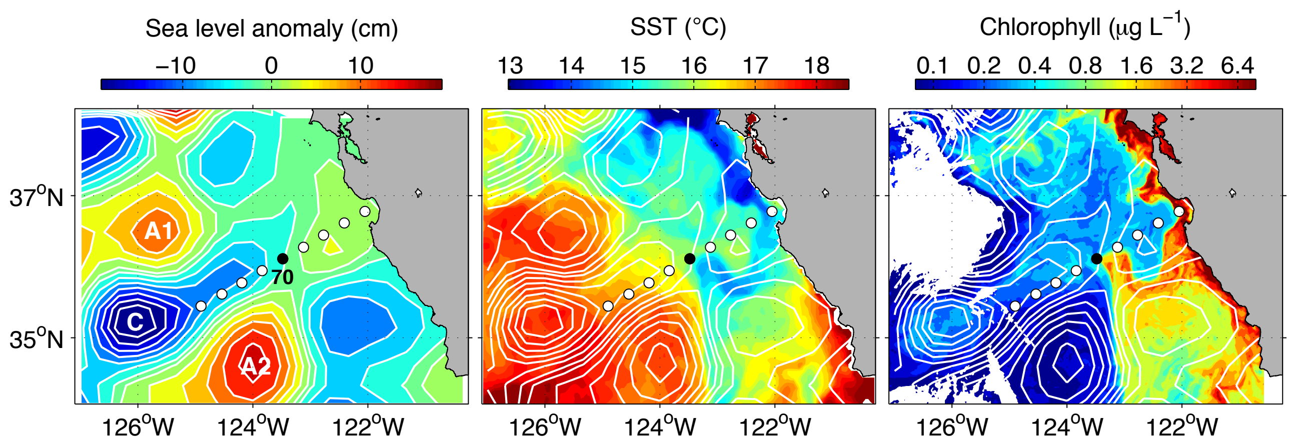

Figure 1. Regional physical and bio-optical conditions. Sea level anomaly (SLA) is from AVISO multi-altimeter merged data, 24-28 August 2012. SST (GOES) and chlorophyll (MODIS Aqua) images are from 28 August. SLA contours are overlaid in all panels.

As described in the summary for mid-August, synoptic patterns at the end of August indicate cross-shore transports over scales exceeding 200 km in the CC eddy field (A1/C/A2). Offshore transport between A1 and C is pronounced. A time-series of SST (Figure 2) indicates bifurcation of the filament of cool CTZ water at its offshore extent, wrapping around both A1 and C (compare Figures 1 and 2). The image series also indicates that entrainment by this eddy pair has increased in recent days, and mixing is very active (Figure 2). While lateral transport is key to the distribution of CTZ waters between and around A1 / C, along-isopycnal vertical motions in the meandering CC (Bower, 1989; Barth et al., 2002) may also be influencing SST patterns.

2. Currently active in situ reconnaissance along CalCOFI Line 67

CeNCOOS Glider-14 has been surveying CalCOFI Line 67. Section plots from the glider data (http://www.cencoos.org/sections/data/glider/MontBay_glider_14.shtml) indicate that a subsurface chlorophyll maximum layer has been present during mid-late August, extending across end-member water types (CU, CC) that are mixing within the CTZ. Optical and acoustic signals of phytoplankton and zooplankton have been strongest inshore of ~100 km. Outside of Monterey Bay, the strongest plankton signals were observed within CU waters, evidently at their frontal boundary with CC waters (reference the salinity section). If the CU end-member water type is a target for ESP deployment (Section 3), this data will be more closely examined.

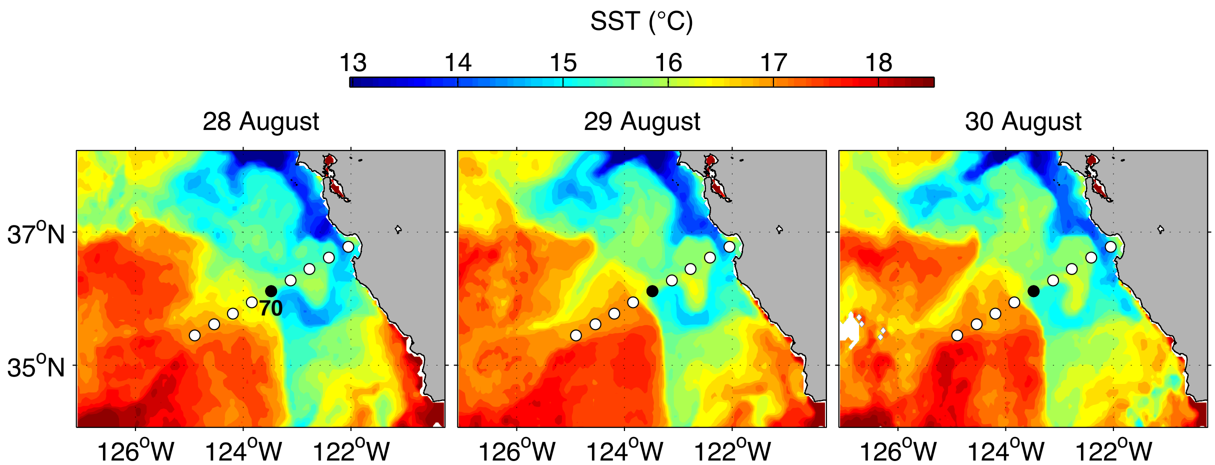

Figure 2. Time-series of SST, indicating highly variable entrainment of CTZ waters into the CC, anticyclonic flow over Line 67 inshore of the CC, and strong stirring of regional water types.

3. Where?

As we decide how to apply additional in situ reconnaissance platforms (WaveGlider and Tethys), we may consider localization across scales, starting big. At the regional scale, we may identify the target waters for which ESP deployment makes sense scientifically and logistically. Influences of the eddy field, within and inshore of the CC, are relevant. For logistical reasons do we want to avoid offshore entrainment by the A1/C eddy pair? For scientific reasons do we want to intentionally place ESP in the A1/C "transport highway" that is entraining CTZ waters deep into the boundary current system? *There and back again around a cyclone, a drifter's tale*? Do we want to deploy ESP in an end-member water type that is being stirred into the CTZ? For example, a cold, chlorophyll rich-filament of CU waters (Figure 1) would be readily identifiable by reconnaissance, and plankton community composition and activity in this end-member water type (having the strongest biogeochemical signals) could be observed as they are stirred into the CTZ / CC. A patch of the other end-member water type (CC) being stirred into the CTZ may also be accessible and identifiable by reconnaissance, and thus tagged and tracked with the Lagrangian array. For example, the warm patch centered near station 60 (two stations inshore of 70) was evidently injected from the CC into the CTZ (Figure 2). Instead of targeting end-member water types, do we seek the "middle road": find a patch that already represents a somewhat homogenized mixture of the end-member water types (CU and CC) within the CTZ?

Within the dynamically stirred CTZ, end-member water types evolve toward homogeneity. However, from the perspective of a quasi-Lagrangian experiment, the stirring and mixing processes will likely create significant heterogeneity as end-member water types meet and mix. Additionally, deviation of the drift from fully Lagrangian behavior will move the frame of reference across CTZ patchiness. Considering the improbability of remaining within an "undisturbed" patch for the duration of the drift, perhaps the key question is how to accurately target the initial (ESP deployment) water type within the end-member spectrum between CU and CC. Selection of an identifiable patch of this initial water type, using remote sensing, would then guide WaveGlider and Tethys operations to localize the deployment site at the smaller (patch / feature) scale.