1 Background on the circulation in Monterey Bay

Several authors [*Paduan and Rosenfeld*, 1996; *Paduan and Cook*, 1997] used HF-radar data to provide an extensive description of circulation patterns in Monterey Bay. Paduan and Cook [1997] showed that the circulation can be divided into three equally important parts: (1) low-frequency (days to weeks) circulation due to changes in regional wind patterns, (2) semi-diurnal tidal circulation, and (3) circulation due to diurnal sea breeze.

The low-frequency circulation is driven by intensification, relaxation, and reversal of predominant equator-ward winds. (See Figure 1.e for the timeseries of along-shore winds and Figure 1.a for the mean circulation field). When upwelling winds dominate, a strong (~0.1-0.2 m/s) equator-ward jet develops across the mouth of the Monterey Bay (Figure 1.b). During upwelling, circulation inside of the Bay is characterized by weakening of the circulation leeway of Santa Cruz Mountains and a bay-wide counter-clockwise retentive eddy. When upwelling winds relax, circulation over the entire region becomes weak and confused (Figure 1.c). The only remaining coherent pattern is the offshore expansion of the counter-clockwise eddy that was previously trapped inside of the Monterey Bay by a strong upwelling jet. During infrequent periods of strong winter storms, the direction of the flow inside and outside of the bay becomes pole-ward, with a strong coastal jet developing inside of the Monterey Bay (Figure 1.d).

Tidal circulation in Monterey Bay is dominated by barcolinic (internal) tides [*Paduan and Cook*, 1997; *Rosenfeld et al.*, 2009]. Intensity of surface currents associated with baroclinic tides depends on the time-varying density structure of the ocean and on the bathymetry. The map of tidal ellipses computed from the HF-radar data (Figure 4 in Paduan and Cook [1997]) shows that M2 tidal velocities vary from almost zero over the deep-waters of the canyon to 0.25 m/s at the head of the canyon.

The diurnal circulation in the Bay is dominated by the sea breeze [*Paduan and Cook*, 1997]. Figure 4 in Paduan and Cook [1997] shows high coherence of the diurnal currents across the entire bay. The circulation ellipses are oriented consistent with direction of the Salinas valley that serves as conduit for marine air entering inland. The diurnal circulation is strongest in the middle of the bay (~0.20 m/s), and decays offshore and in proximity of the land boundary.

2 References:

Paduan, J. D., and L. Rosenfeld (1996), Remotely sensed surface currents in Monterey Bay from shorebased HF radar (Coastal Ocean Dynamics Application Radar), *Jounral of Geophysical Research*, *101*(C9), 20,669-620,686.

Paduan, J. D., and M. Cook (1997), Mapping surface currents in Monterey bay with CODAR-type HF Radar, *Oceanography*, *10*(2).

Rosenfeld, L., I. Shulman, M. Cook, J. Paduan, and L. Shulman (2009), Methodology for a regional tidal model evaluation, with application to central California, *Deep-Sea Res Pt Ii*, *56*(3-5), 199-218.

3 Figures

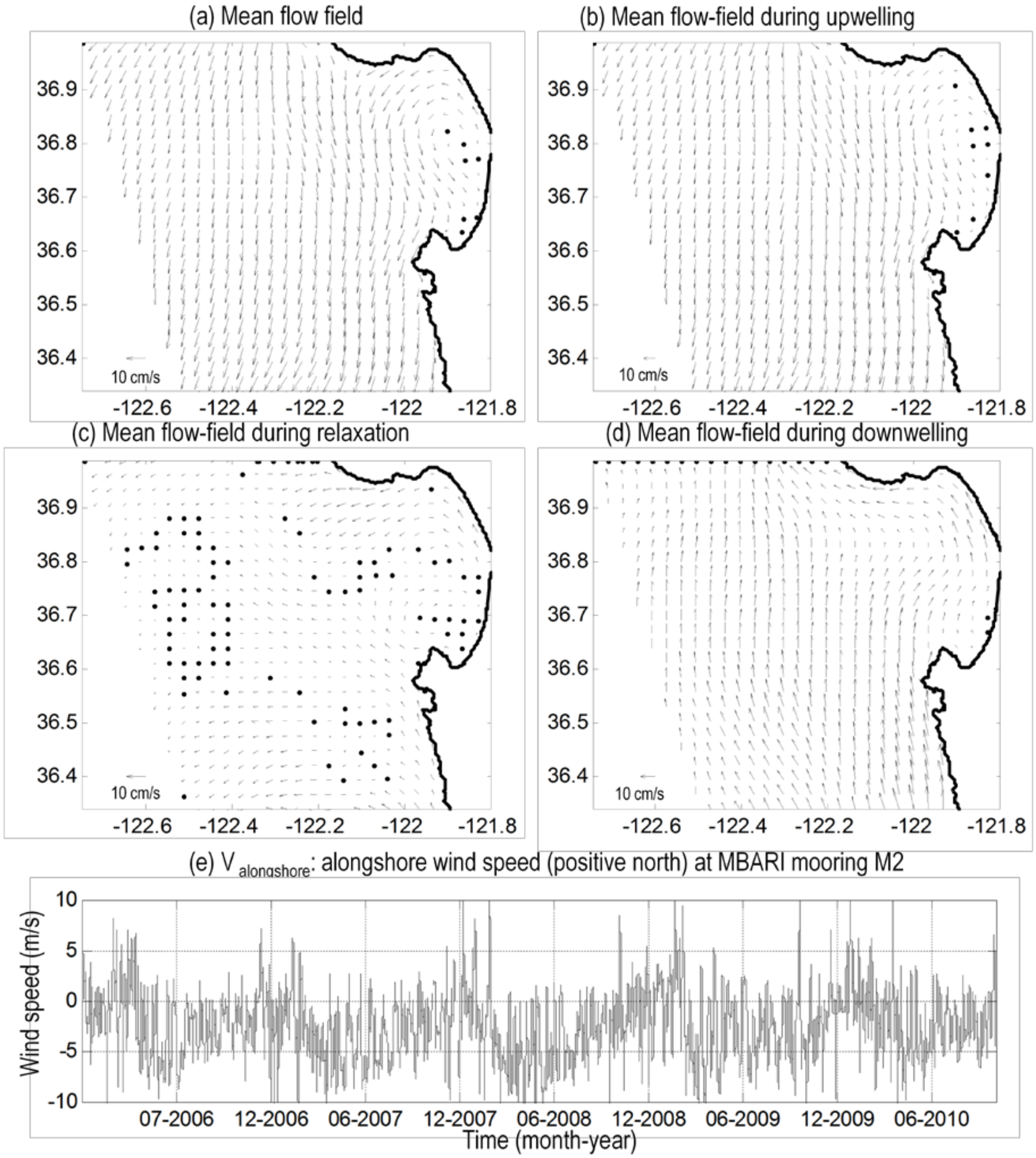

Figure 1: Climatology of HF-Radar currents. (a) Mean flow-field for all data (01/01/2006-10/30/2010). (b) Mean flow field during upwelling-favorable winds ($V_{alongshore}$ <-0.5 m/s). (c) Mean flow field during relaxation-favorable winds ($V_{alongshore}$ between -0.5 and 0.5 m/s). (d) Mean flow field during downwelling-favorable winds ($V_{alongshore}$ >0.5 m/s). (e) Timeseries of along shore winds (positive north) that were used to segment the flow field in panels (b-d). Winds were rotated 30 degrees to the left to orient wind direction with the shoreline direction.