Abstract View

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Wind-Induced Currents and Bottom-Trapped Waves in the Santa Barbara Channel

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ABSTRACT

The Santa Barbara Channel (SBC) is a coastal basin about 100 km long bounded by the Southern California mainland on the north and by a chain of islands on the south. The SBC is at most 50 km wide and just over 600 m deep. The nature of current and wind variance peaks in the 2–4-day and 4–6-day bands in the channel are analyzed from January to July 1984. For both bands the dominant empirical mode of the currents is highly coherent with the dominant empirical mode of the winds over this region. Surface intensification of currents is revealed by measurements made between 25 and 300 m. In contrast the deeper currents are characterized by bottom trapping. Evidence for baroclinic bottom-trapped topographic Rossby waves is found on the northern shelf at the western mouth of the channel in both frequency bands. At 30 m the distribution of phases shows currents at the center of the western mouth leading the southern interisland passes by about 0.3 day and the eastern mouth by about 0.6 day. In both bands co- and quadrature vectors of currents and winds describe this wind–current system in detail. It is speculated from spatial and temporal eigenfunctions of currents and winds and from available satellite images that the dominant current mode described above is a channelwide response to upwelling north of Point Conception (northwestward of the SBC). The upwelling-related currents cause a net inflow of mass into the western end of the channel, which is compensated by an outflow passing through both the interisland passes and through the eastern mouth of the channel. As a result of the narrowness and shallowness of the passes and of the shallowness of the southern shelf in general, high flow speeds are attained there that, the authors speculate, seem to force deep high-frequency motions both at the center of the SBC and at the northern half of its western mouth.

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