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Department of Marine Sciences
Presents a Seminar by

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Contrasting wind-driven ocean circulation along western and eastern North America: inner continental shelves vs. upwelling systems

Coastal ocean circulation is strongly influenced by the wind. Many previous studies of continental shelf flow have focused on the effect of along-coast wind forcing and the resulting Ekman layers and upwelling circulation. Following on this work, we used moorings to study the inner continental shelf, where the surface and bottom turbulent boundary layers overlap. This overlap reduces the effectiveness of the along-shelf wind in driving upwelling. Instead, the cross-shelf wind and surface gravity waves are more effective at driving cross-shelf flow on the inner shelf. The result can be a barrier to cross-shelf transport of larvae, nutrients, and pollutants between the surf zone and the open ocean. These processes are particularly important where the continental shelf is wide and shallow, such as in the Middle Atlantic Bight off the northeastern United States.

In contrast, on narrow steep shelves such as in the California Current Upwelling System (CCS), the inner shelf is very narrow or nonexistent. Here, we will focus on the character of the wind forcing itself. During upwelling season, although the wind forcing in the CCS is upwelling-favorable on average, the variability in the wind is strong. There are frequent wind “relaxations” or even reversal to downwelling-favorable wind stress. This weakens the upwelling and allows warm water to flow poleward against the prevailing California Current, which appears to influence larval transport. Using satellite data, we found that these wind relaxations extend hundreds to thousands of kilometers offshore. The wind relaxations in the northern and southern parts of the CCS tend to alternate in time, as part of a wind cycle that affects the entire CCS. This north-south alternation sheds light on the extreme marine heat waves experienced in the CCS during 2013-16. The southern half of the CCS entered a prolonged relaxation state and experienced less relief from the heat waves than the northern half, where upwelling held the warm water offshore. Wind stress curl is thought to drive perhaps half the upwelling in the CCS, and this north-south contrast also emerges in the wind stress curl anomalies. Our future plans include examining the wind field over other eastern boundary upwelling systems. The different coastline shapes and locations of deserts as compared to the offshore anticyclone may allow us to tease apart the relative influence of these factors in creating the north-south contrast in the CCS wind field.

Host: Michael Whitney
Time & Date: 11:00 am, Friday, April 21, 2017
Place: Marine Sciences Building, Seminar Room 103

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