

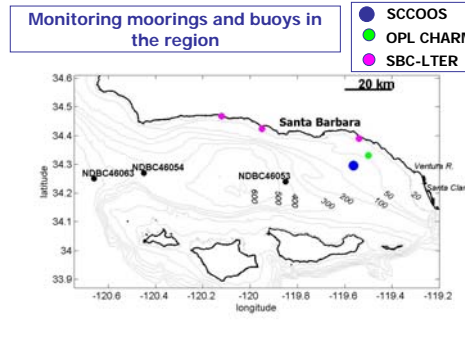
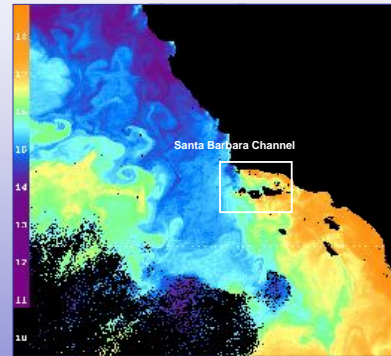
# The SCCOOS Shelf to Shoreline Observatory Development Santa Barbara Channel Mooring: An Ongoing Time Series of Currents, Thermal Structure and Optical Properties of the Water Column over the Continental Shelf.



Erika McPhee-Shaw, Moss Landing Marine Laboratories. California State University, Grace Chang, and Tommy Dickey, Ocean Physics Laboratory, University of California Santa Barbara.

## Abstract

The SCCOOS: Shelf to Shoreline Observatory Development project is funded by NOAA and is part of the Southern California Coastal Ocean Observing System (SCCOOS). We maintain a mooring at 80 -m depth on the eastern Santa Barbara Channel shelf. Data were recovered in October 2005 and include a high-quality time series of PAR, fluorescence, and light scattering in the near-surface waters, as well as ADCP-measured currents through the entire water column, and thermistors distributed over the entire depth. Most of the long time series in this region have been located in the shallow inner shelf or in mid-basin waters; this mooring provides a crucial link between the two regions and provides data at a depth-resolution rare in California long-term moorings. Importantly, we can now begin to assess the outer shelf conditions associated with onshore transport of micro- and macronutrients affecting the health of inner-shelf ecosystems and the timing of phytoplankton blooms. Pulses of elevated chlorophyll, each persisting about eight days, were seen during spring upwelling, but several intense bloom events were also observed in early fall. Comparison to time series collected by the Santa Barbara Channel Long-term Ecological Research Project (SBC-LTER) will allow us understand to what extent the density structure over the outer shelf controls the characteristics of upwelling and internal waves seen at the inner shelf. These long time series will increase our understanding of bloom dynamics and the transport of benthic material and pollutants in the Southern California Bight.

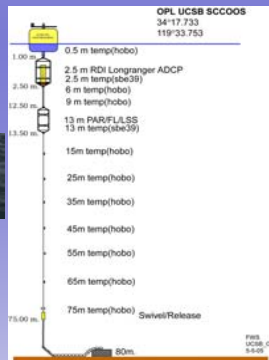


## A network of observing moorings in the Santa Barbara Channel

One of the most compelling aspects of the UCSB OPL SCCOOS mooring is its proximity to other long-term moorings in the region. These include the NOPP-funded OPL CHARM (CHAnnel Relocatable Mooring) testbed mooring at 24-m depth, and three moorings maintained on the inner shelf (12 to 17-m depth) by the Santa Barbara Coastal Long-Term Ecological Research Project (SBC-LTER). This gives an uninterrupted time series of cross-shelf coverage from the outer to inner shelf that is unprecedented in this region.

## Deployments

- First deployment: 2 February - 6 October 2005
- Second deployment: 18 October 2005 - 24 April 2006
- Third deployment: 4 May 2006 - ??



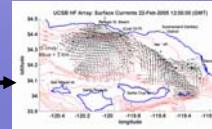
## Objectives

This mooring, coupled with the NOPP-funded OPL CHARM mooring at 24-m depth and the NSF-funded SBC-LTER mooring at 12 m, will provide insight into the following processes:

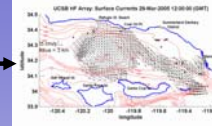
- Onset and intensity of spring upwelling
- Density structure over the shelf
- Cross-shelf transport events
- Cross-shelf structure of internal waves
- Effect of coastal trapped waves (see Pringle and Riser, 2003)
- Timing of phytoplankton blooms
- Impact of winter storm runoff

## Some oceanographic events that stand out from the first year's record:

Event 1: 22-Feb-2005. The entire water column warmed during an episode of extended westward flow into the Channel over the eastern sill. This brought in a Southern CA Bight water mass that was warmer than the typical winter mixture of SCB and CA Current waters found in the Channel. This event was likely a "flow west" Channel circulation state defined by Harms and Winant, 1998.

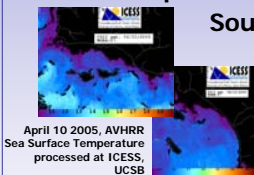


Event 2: 31-Mar-2005. The onset of upwelling saw cold temperatures and an unstratified water column. Optical instruments showed clear indicators of blooms associated with onset of upwelling. More detail is given in panel to lower left.

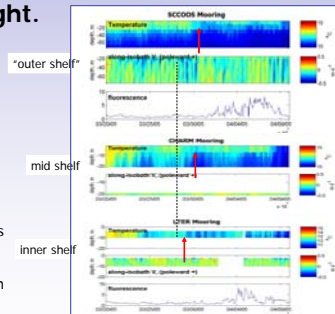


Events 3. Multiple phytoplankton blooms during summer and fall. These were distinct from the spring bloom associated with coastal upwelling (upwelling in SCB and SBC occurs in spring and has typically ceased by June). More detail is given in panel below.

## Coastal upwelling in the Santa Barbara Channel and Southern California Bight.

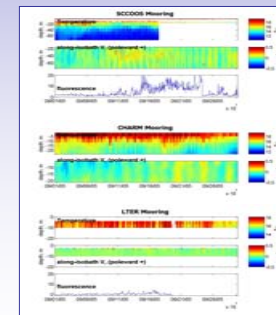


Moorings from all three observing programs showed the onset of upwelling at offshore, mid-shelf, and inner shelf. The water column became unstratified over the entire depth. Persistent pulses of equatorward are consistent with upwelling. The arrival of coldest temps ( $T < 11^\circ$ ) was seen first at inner shelf; the 80-m site lagged by about two days, consistent with offshore spreading of upwelling front. The optical instruments show clear indicators of blooms associated with onset of upwelling. Note that the upwelling onset in SCB occurred at the "typical" time of about 1 April. Southern CA did not experience the 2005 upwelling delays found along the northern CA, OR, and WA coasts.



## Mid-September phytoplankton bloom: Cross-shelf comparison

Moorings from the three locations showed significant differences in chlorophyll between offshore and the inner shelf. The strongest fluorescence signal of the year in the SCCOOS 2005 mooring record was observed during 15 to 25 September. In contrast to the blooms related to coastal upwelling during April and May, this bloom did not have a strong signature at the inner shelf. Frequent reversals in currents and the disconnect between outer and inner shelf suggest that eddies and/or water masses entering the region were linked to bloom dynamics. The surface water experienced cooling of  $> 1^\circ$  C during this period. Strong internal waves were seen at the base of thermocline, but their timing does not necessarily suggest a relationship to the phytoplankton bloom.



## Acknowledgements

The UCSB SCCOOS mooring is funded by NOAA through the SCCOOS program. CHARM is funded through NOPP.

The SBC-LTER project is funded by the National Science Foundation. We thank Libe Washburn, Dave Salazar, Brian Emery, Chris Gottschalk, Margaret O'Brien, and other UCSB researchers for access to LTER mooring data and surface current maps. Dave Siegel and Erik Fields of UCSB were helpful in providing satellite maps, their program is funded by NASA.

## References

Harms, S. and C.D. Winant, 1998. Characteristic patterns of the circulation in the Santa Barbara Channel. *J. Geophys. Res.* 103(C2), 3041-3065.

## Websites for Ocean Observing Data in Santa Barbara Channel

UCSB Ocean Physics Laboratory: <http://www.opl.ucsb.edu/>  
A variety of real-time data products from SCCOOS: <http://www.sccoos.org/>  
Archived HF Radar Surface Currents: <http://www.icesc.ucsb.edu/log/realtime/>  
ICESC AVHRR Sea Surface Temperature: <http://www.icesc.ucsb.edu/avhrr/>

