

THE SANTA BARBARA CHANNEL-SANTA MARIA BASIN CIRCULATION STUDY: A BRIEF HISTORY

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ABSTRACT

A brief history of the Santa Barbara Channel-Santa Maria Basin (SBC-SMB) Circulation Study, including field experiences of investigators while collecting and analyzing data from a variety of sources, including the National Oceanic and Atmospheric Administration (NOAA), Advanced Very High Resolution Radiometry (AVHRR) Satellites, the National Data Buoy Center (NDBC), Vector Measuring Current Meters (VMCM), Conductivity, Temperature and Depth (CTDs) measuring devices, Expendible Bathythermographs (XBTs), and Acoustic Doppler Current Profilers (ADCPs).

Keywords: Southern California Bight, Santa Barbara Channel, Santa Maria Basin, offshore, oil drilling, continental shelf, circulation.

INTRODUCTION

On February 9, 1989, responding to mounting concerns over the environmental risks associated with offshore oil drilling, President George Bush suspended oil leases for several continental shelf areas off the coasts of Florida and California. At the same time, he set in motion the governmental machinery to investigate the long-term environmental risks of outer continental shelf (OCS) exploration. He established a National Research Council (NRC) independent scientific committee to assess the adequacy of the existent scientific data covering the lease areas. He also created a cabinet level task force to review environmental issues associated with exploration and drilling. Drs. Clinton Winant and Myrl Hendershott, of Scripps Institution of Oceanography's (SIO) Center for Coastal Studies (CCS), served on the former committee. (U.S. Dept. of the Interior MMS 1991)

BACKGROUND

After careful study, the NRC committee concluded there was inadequate physical oceanographic data to assess the environmental impacts of re-opening the southern California OCS to oil exploration (Committee to Review the Outer Continental Shelf Environmental Studies Program 1989). The Minerals Management Service (MMS) convened a workshop at SIO on 27 November to 29 November 1990

to chart a course of action. To remedy the lack of data, MMS proposed a study of the Southern California Bight that would span several years and cost upwards of \$20 million. This sum proved too costly, prompting MMS to turn again to SIO. Scripps scientists eventually designed a study that would cost less and actually span a longer period of time. This became the Santa Barbara Channel-Santa Maria Basin (SBC-SMB) Circulation Study which, under the leadership of David Browne, has evolved into an 11-year, \$15 million field study of the overall circulation in the SBC-SMB area.

WORK, PHASES, AND TASKS

To expand the time period covered by the study and at the same time reduce the overall cost required scaling back the geographic scope. Rather than study the entire Southern California Bight, scientists decided to focus on that portion of the bight already under active oil exploration and production: Santa Barbara Channel and Santa Maria Basin areas.

Initial funding carried the study through Phase I, which encompassed initial planning, preparation, and start-up, and ran from spring 1991 through March 1996. As information was collected and evaluated, it became increasingly apparent that more data were needed. So despite bureaucratic uncertainties in Washington, MMS extended the project. Phase II ran from 1994 through 1997 and was comprised of field work and analysis focused on the Santa Barbara Channel. During Phase II, the need for a reliable modeling component became evident, leading MMS to expand the study once more. Phase III, currently underway, includes a modeling component and extended the geographic area of field work and analysis to include the Santa Maria Basin.

In all the phases, the study has focused on two broad goals: first, to identify specific patterns of circulation, and second, to translate scientific results into an immediately useful form for analysts in charge of resources development. To accomplish these goals, work has been divided roughly into five main categories: meteorology, moored observations, Lagrangian observations, surveys (expanded surveys and satellite imagery), and eventually modeling. From the outset, the intellectual challenge has been to integrate seemingly disparate results from these individual

components into a coherent picture of the circulation and its driving forces.

Researchers at CCS have realized significant scientific achievements all along the way. In Phase I, preliminary field observations were accomplished in SBC, resulting in the theory of “synoptic views,” or ocean equivalents of the atmospheric patterns employed by meteorologists to forecast weather. The CCS Data Zoo and Website were established, eventually offering (on the MMS/SIO Oil Spill Response page) near real-time Internet access to a wide-range of data gathered by project scientists and instrumentation.

In Phase II, the circulation in the Santa Barbara Channel was described in terms of six characteristic patterns (Figure 1). Together, these synoptic views account for a major part of the variability in the field study’s results over the years. The patterns’ forcing mechanisms have been identified (Figure 2), including the important role played by the upwelling favorable wind stress (from the northwest winds) and the opposing alongshore pressure gradients. As a result of the research, scientists working in related areas of study have begun to re-evaluate the entire dynamics of ocean circulation in various areas, such as CODE. Moreover, the data is leading to the development of effective current forecasting methods.

Phase III is expected to achieve similarly significant scientific results in the Santa Maria Basin, north of Point Conception (Figure 3).

Throughout the study’s history, there has been a clear and direct relationship between MMS’s consistent support and the high quality of the work. The value and significance of CCS’s research and scientific results have been in direct proportion to the persistence of MMS’ funding. And, while

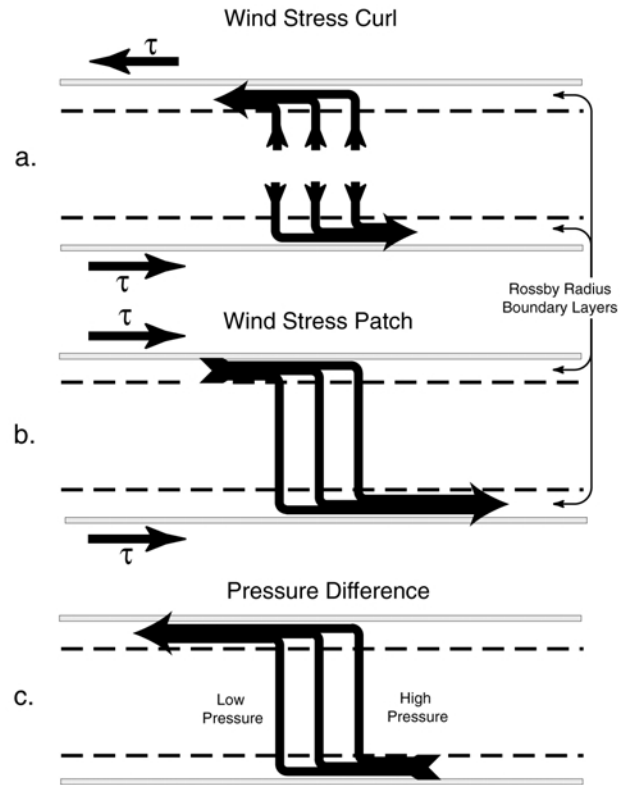


Figure 2. Illustration of the effects of wind stress curl (a) or a patch of uniform wind stress, (b) or a pressure difference, and (c) on various circulation patterns within the channel.

UPWELLING/ RELAXATION



(a)

CYCLONIC



(c)

FLOODS



(e)



(b)



(d)



(f)

Figure 1. Different characteristic patterns of the surface circulation in the Santa Barbara Channel, derived by subjective review of 900 daily maps of average currents. These patterns account for the circulation over 60% of the time.

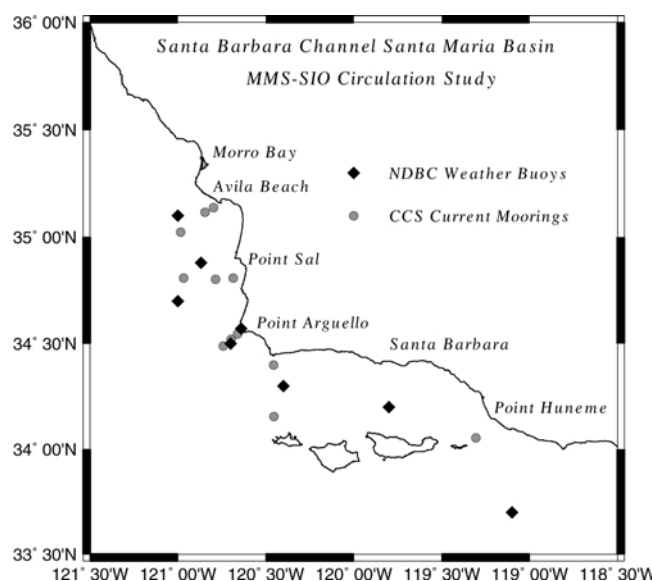


Figure 3. Site of the experiment. Circles indicate location of current meter, temperature and pressure moorings. In the Santa Maria Basin, moorings are located on three major transects extending out from Avila Beach (the AB line), from Point Sal (the SA line), and from Point Arguello (the AR line). Three moorings are maintained in the Santa Barbara Channel to determine the synoptic state of surface circulation in that area.

complying with MMS's strict procurement rules has not always been a trivial enterprise, nor always compatible with scientific research, the work has continued apace – mostly thanks to the unswerving advocacy of David Browne. Time and again, David has managed to translate the vital importance of the study and its results into language easily understandable to the Washington officials in charge of funding, thus guaranteeing continued federal support for what has become an important, ground-breaking study.

LITERATURE CITED

- Committee to Review the Outer Continental Shelf Environmental Studies Program, Board on Environmental Studies and Toxicology, et. al. 1989. The Adequacy of Environmental Information for Outer Continental Shelf Oil and Gas Decisions: Florida and California. 1-12.
- Santa Barbara Channel-Santa Maria Basin Circulation Study Phase 1 Proposal. 1991.
- U. S. Department of the Interior, Minerals Management Service. 1991. Southern California Bight Physical Oceanography, Proceedings of a Workshop. Prepared by MBC Applied Environmental Sciences, Costa Mesa, CA. 157 p. plus appendices.
- Winant, C. D., M. C. Hendershott, C. E. Dorman. 1998. Quality Review Board Minutes of Meeting No. 6.