

Aerial Surveys of the Ocean and Atmosphere off Central California

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LONG-TERM GOAL

The long-term goal is to enhance our understanding of air/sea interaction in the littoral zone by means of applying simple dynamical theories to high-quality observations obtained in the field. The Monterey Bay serves as our natural laboratory for these purposes. The grant is one of a continuing series of programs to study the bay funded by the National Ocean Partnership Program (NOPP) and the ONR Naval Ocean Modeling and Prediction (NOMP) Program.

OBJECTIVES

The objective of this project is to observe the half-dozen or so “characteristic states” of Monterey Bay air/sea system and the associated adjacent coastal ocean and atmosphere. These states include onset and retreat of summer upwelling, the advance and retreat of the Monterey Bay Eddy, the passage of winter fronts and storms, the diurnal monsoon, poleward propagating events in the atmosphere and ocean, and the occasional anomalous passing atmospheric systems. The observations will be used to enhance and improve existing and future coupled models of the coastal air/sea system.

APPROACH

A time series of forty (40) aircraft flights will be made over the Monterey Bay and adjacent waters between March 2003 and March 2004 to make high resolution maps of critical parameters in the ocean and atmosphere. The mapping portion of the flight path will be flown at a constant altitude of 130 m off the sea surface (Figure 1), beneath the usual regional stratus deck. Additionally, three sawtooth transects, elevating offshore, will be flown to map the height of the atmospheric inversion layer at the northern, middle, and southern section of the region (Figure 1). The flights will be conducted nominally every two weeks, with a concentration of flights during August 2003 in support of the ONR Autonomous Ocean Sensing Network – II (AOSN-II) experiment in the Monterey Bay. Flight times will be adjusted slightly to coordinate with cruises in the bay, primarily on the research vessel POINT SUR, which will provide ground truthing for remote sensors, and support operational education for U.S. Navy Officer Students at the Naval Postgraduate School.

The aircraft will be provided the NPS Center for Remotely-Piloted Aircraft Studies (CIRPAS), housed locally at the Marina Municipal Airport. The Twin Otter aircraft will be used when available (but definitely during August 2000) and the smaller payload "Pelican" aircraft (a modified Cessna Skymaster) will be used when the Twin Otter is deployed out of town. A basic suite of sensors will be deployed on all flights to include air temperature, dew point temperature, atmospheric pressure, and sea surface temperature. The Twin Otter will additionally carry a LIDAR altimeter, atmospheric turbulence sensors, aerosol sensors, and hopefully a hyperspectral radiometer.

The flights will produce an unprecedented time series of high-resolution air/sea observations for use in verifying Navy models such as COAMPS. We will cooperate with NRL MRV and NRL SSC on model initialization and verification issues.

WORK COMPLETED

Professors Ramp and Paduan serve on the AOSN-II Executive Steering Committee and have been active participants in the planning workshops held thus far. They also serve on the observations sub-panel (Ramp) and the modeling sub-panel (Paduan). These groups will shape the scientific program to be conducted during August 2003. Professors Ramp and Paduan have also been actively coordinating this grant with others in the bay to provide important ancillary measurements such as sea surface currents (Paduan), moored current profiles (Ramp), autonomous underwater vehicles (Healey), underwater acoustic networking (Rice), and atmospheric turbulence observations (Wang).

An Oceanographer/Engineer/Programmer has been recruited and hired to handle the day-to-day operations of conducting the flights, downloading the data (in cooperation with CIRPAS personnel) and maintaining the web site. The goal is to get all the data posted to the web in near-real time for use by area stakeholders such as weather forecasters, fishermen, the coast guard, and recreational users. The new hire has begun setting up the programming using output from a similar experiment held in the bay during August 2000.

RESULTS

The flights have not yet begun and there are no results to report at this time.

IMPACT/APPLICATION

The aircraft flying below the clouds for a time series of flights throughout the year provides and unprecedented view of the characteristic states of the Monterey Bay air/sea system. We know of no other data set capable of rigorously testing the 9-km COAMPS model under such a wide variety of atmospheric conditions. The three-dimensional maps of inversion layer height will also allow improved understanding and prediction of atmospheric visibility (i.e. fog), one of the Oceanographer of the Navy's top five priority needs for FY2003. We will cooperate with I. Shulman (USM), funded under an associated AOSN-II grant to continue development of the NOPP/ICON triply-nested model.

This program utilizes many sensors, both in-situ and remote, which are of interest to the Navy for innovation in MIW and expeditionary warfare. We have been actively coordination with NWDC (Baker) and the NPS MOVES Institute (Horner) to establish an Expeditionary Sensor Grid Enabling Experiment (EEE) in the bay during August 2003. A high-speed SDREN internet connection to NPS

will be established to facilitate this experiment. The EEE will learn how to move information from innovative sensors into the operational Navy world using the appropriate “wrappers” and cooperative agent-based systems (COABS).

TRANSITIONS

None yet.

RELATED PROJECTS

Paduan (NPS) – Center for Integrated Marine Technology (CIMT) (NOAA)

Sanctuary Integrated Monitoring Network (SIMoN) (NOAA)

Cal State - Center for Integrative Coastal Observation and Research (CI-CORE) (NOAA)

Bellingham (MBARI) (AOSN-II)

Haddock (MBARI) (AOSN-II)

Shulman (USM) (AOSN-II)

Rice (NPS/SPAWAR)

Horner (NPS) (NWDC)

Frantantoni (WHOI) (AOSN-II)

Robinson (Harvard) (AOSN-II)

Healey (NPS) (NOMP)

Leonard (Princeton) (AOSN-II)

Bishop (NRL) (AOSN-II)

Case (UCSB) (AOSN-II)

PUBLICATIONS

Publications are anticipated once the program gets started.



Twin Otter Aircraft

PELICAN Aircraft

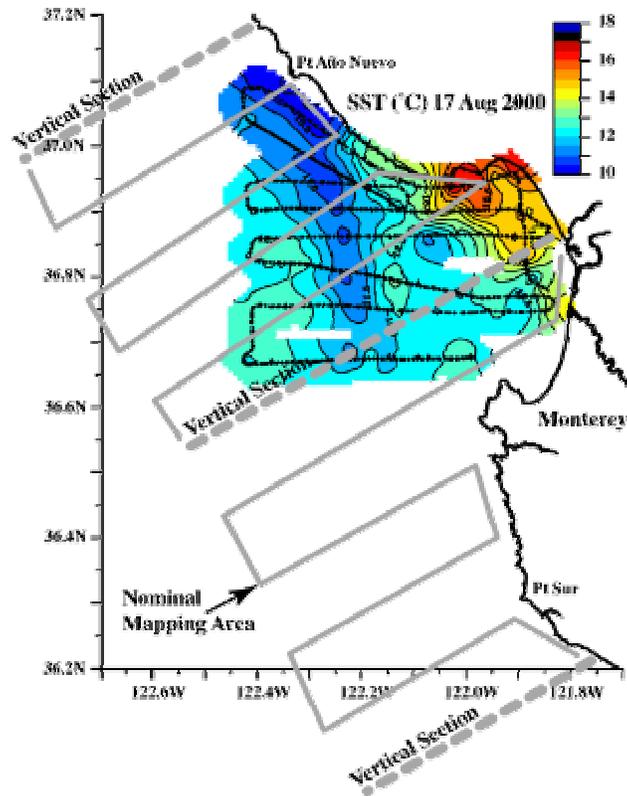


Figure 1. The proposed sampling plan for weekly aircraft flights over the Monterey Bay and vicinity. The primary grid will be flown at an elevation of 130 m to sample air temperature, relative humidity, wind speed and direction, and ocean sea surface temperature. The vertical sections to map the inversion height will be flown north of Point Año Nuevo, along the center section of the bay, and just south of Point Sur. Additional instrumentation will be flown on some flights (see text).