

Proposal for ChINP Internal Wave Experiment (CHIVE)

Craig Gelpi
Catalina Marine Society
19872 Collins Road
Canyon Country, CA 91351
cgelpi@catalinamarinesociety.com
cell: 805-390-8866

April 27, 2008

Introduction

Internal waves and tides are common on the California Channel Islands and are thought to contribute significantly to ocean mixing and larvae transport throughout the Bight. However, much is unknown about these waves, including the exact nature of the flow and related questions such as how deep and how far offshore do their effects extend. Insight into these phenomena will permit understanding nutrient and larvae transport for the islands. Temperature loggers, measuring the integrated effect of water advection, are a cost-effective method of investigating internal wave currents that are expected to be very small, on the order of 1 mm/s, and that cannot be measured with typical, affordable current meters. This note proposes a small experiment using loggers that will elucidate island internal-wave phenomena.

An opportunity to conduct an internal wave experiment may be provided by the Channel Islands National Park, which is engaged in a long-term measurement campaign, including temperature, associated with the establishment of Marine Life Protected Areas. A temporary extension of the existing thermograph array in both the crossshore dimension and in the water column will help answer some of the above questions. A small study has been conducted to determine the requirements for such an experiment that can be easily accommodated by the ChINP.

Study Findings and Requirements

Study sites should be easily accessible and have the stratification necessary to support temperature measurements for water current analysis. Fortunately, sites closer to the mainland support both requirements. In addition, the sites should be on the leeward side as stratification is larger there. Admiral's Reef off Anacapa meets these requirements. Data from thermographs (Figure 1) deployed at this site indicate the presence of strong internal waves. The present thermograph could be incorporated into an extended array. The site is also close to important shore ports, and on the leeward side, permitting easy access.

Temperature, Admiral Reef, Anacapa
August 26 to September 31, 1993
16 m

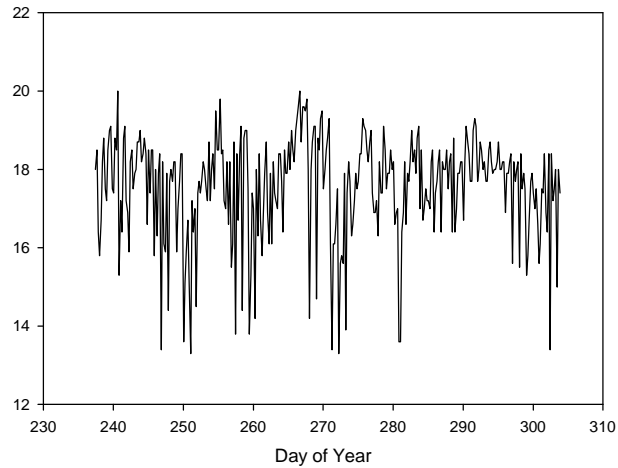


Figure 1. Temperature data from Admiral's Reef exhibit large internal waves, temperature in °C.

A proposed sensor array configuration is shown in Figure 2. Key components include a deep (greater than 100 ft, with between 150 and 200 ft preferred) thermograph to better define the depth dependence of the internal wave amplitude and a linear array of thermographs to measure the open-water column. A thermograph would be placed at the same depth as the existing one but in the water column above the deep thermograph as well as an additional one between the shallow and deep sensors. Resources permitting, additional thermographs would be placed on the buoy line and along the bottom in a line connecting the existing thermograph to the buoy placement. The depth of the buoy line can be determined via a depth finder to avoid deep SCUBA diving. The more thermographs on the line, the more likely one will be situated at a depth near the existing thermograph and the more risk is reduced if a thermograph fails. Variations in thermograph depth produced by current drag on the buoy are thought to be insignificant when consideration is given the large variations in the internal wave data shown in Figure 1.

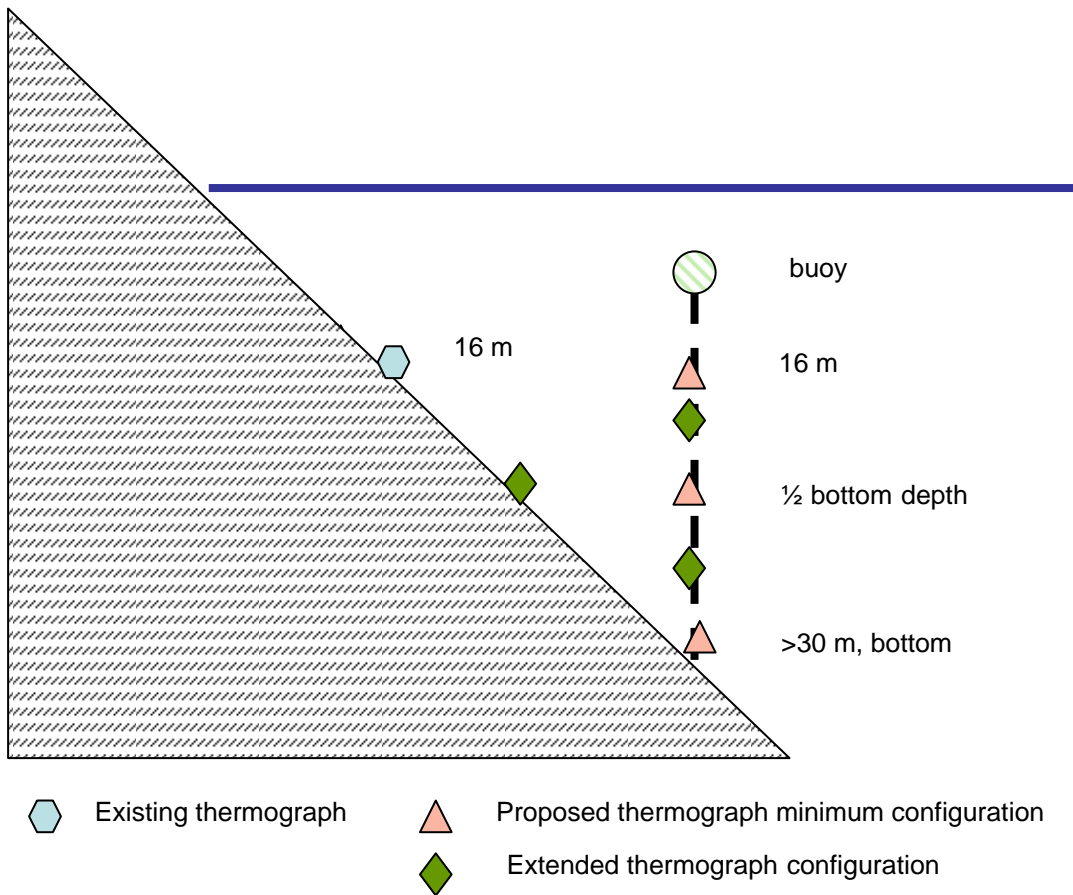


Figure 2. Spatial configuration of proposed thermograph array.

The parameters for the experiment are listed in Table 1. These are designed to insure valuable data collection.

Table 1. Experiment Configuration

Site	Admiral's Reef Anacapa Island (34.01N 119.34W)
Baseline Configuration	Single buoy line with 3 sensors attached
Depth of bottom sensor	Between 30 and 60 m
Duration	Minimum 1 month
Season	Late summer to late fall
Temporal Sampling	0.5 hour or shorter
Spatial Sampling	>+ 100 m from exiting AR thermograph, 20m in vertical
Extended Configuration	Additional bottom mounted sensors

Data Analysis and Expected Results

The Catalina Marine Society volunteers to analyze data gathered from the above experiment. The analysis will consist of determining the amplitude of the internal waves as a function of depth and cross-shore position and of making correlation measurements between the various temperature data sets. Internal wave flow will be explicitly determined for these island data.