Hawaii Ocean Experiment - Budget Of Energy (HOE-BOE)

cruise report for leg IIa

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This document is a short account on cruise activities. For more information on the operations carried out during the cruise, and for the timing of those operations please consult either the operational cruise plan, or the event log.

The cruise took place between June 4-8 on R/V Ka‘imikai-o-Kanaloa (University of Hawaii). The main cruise objectives were: 1) the vertical characterization of the turbulent diffusion of nutrient and organic compounds in the upper 500 meters; 2) the quantification and chemical characterization of the downward fluxes of particulate material. Individual cruise objectives are reported at the end of this document. Most of the cruise activities were centered on Station ALOHA, the site of the Hawaii Ocean Time-series, in the North Pacific subtropical gyre. Three other stations were occupied during the cruise for the assessment of the sea water air conditioning (SWAC) project.

On June 4, science personnel was on board R/V Ka‘imikai O Kanaloa at 8:00 am, and we left the harbor at about 8:20 am (before the scheduled departure at 9:00 am). In the morning, the ship reached the first SWAC station (SWAC 3) where CTD operations began. The SWAC sampling proceeded smoothly at all the three stations. We configured the CTD system as to have the following sensors:
- 2 seapoint fluorometers
- 1 sea-star transmissometer
- 1 PAR sensor
- 1 ISUS nitrate sensor
apart from double T, S, and oxygen sensors.
Andrei Natarov also tested the lowered ADCP on the first SWAC cast. The sensor worked properly, and showed the presence of pronounced shears close to the base of the mixed layer.

At about 2:00 pm, on June 4, we started our transit toward Station ALOHA that lasted about 12 hours. We deployed the sediment trap array, composed of 12 crosses, at 3 am of June 5, and we later verified that the argos sensors were communicating their position. The sediment trap array moved to the South during the cruise consistent with the direction of the surface currents shown by the ADCP mounted on the ship.

The group lead by Glenn Carter successfully deployed the VMP for the first time on June 5. The procedure of the deployment required several people helping with the A-frame, two lines, the cable of the instrument, and its winch. For the assessment of vertical variability of the xanthophyll cycle pigments (Robert Bidigare) a short CTD cast was used instead of the diaphragm pump.

Water sampling and instrument deployments were carried out as planned. Some of the cruise participants also performed on deck incubations (Robert Bidigare and Anne Gasc).

On June 6, ISUS profiles showed a relatively high concentration of nitrate at about 150 m. This feature was associated with a relative minimum in oxygen concentration possibly due to the intrusion of an older water mass in that layer. These observations need to be validated with the high vertical resolution nitrate profiles, but they appeared to be
different from the average observations at Station ALOHA.

List of cruise participants

Benedetto Barone  Post-Doc  UH/CMORE  
Bob Bidigare    Scientist  UH/CMORE  
Glenn Carter     Scientist  UH/SOEST  
Tara Clemente   Research Associate  UH/CMORE  
Christina Comfort Research Associate  UH/SOEST  
Ken Doggett     Research Associate  UH/CMORE  
Anne Gasc       Scientist  UH/CMORE  
Stuart Goldberg Post-Doc  UH/CMORE  
Eric Grabowski  Research Associate  UH/CMORE  
Florian Hillenhagen Graduate student  UH/SOEST  
Gavin Mura      Intern  UH/CMORE  
Andrei Natarov  Assistant Researcher  UH/IPRC  
Sarah Searson   Research Associate  UH/CMORE  

Individual cruise objectives

1. Surface mixing
   Measurements of turbulent kinetic energy dissipation rates from vertical microstructure profiles (upper 500 m). High resolution measurements of horizontal shears (leading to Kelvin Helmotz instabilities) from lowered ADCP. Estimate of the timescale of surface mixing from measurements of the concentration of pigments of the Xanthophyll cycle and hydrogen peroxide in the mixed layer using a diaphragm pump at noon.

2. Nutrient and organic matter diffusion
   Estimate inorganic nutrient and organic matter diffusion from turbulent diffusivity and high resolution sampling for compound concentrations.

3. Export
   Sediment traps deployed at several depths for about 20 days

4. Particle accumulation due to gradients of vertical diffusivity
   Optical assessment of particle accumulation associated with strong vertical gradients in eddy diffusivity.

5. Phytoplankton community at the nutricline
   Estimates of the vertical changes in the algal community in the layer of maximal diffusion of inorganic nutrients. High resolution measurements of pigment concentration and flow cytometry. Measurements of photosynthetic efficiency with variable fluorescence.

6. Heat content of the particulate matter
   Use of net tows to collect particulate material in different size fractions to estimate their caloric content.

7. Site assessment for the sea water air conditioning project

8. Characterization of the dynamics of hydrogen peroxide in the sea water