Hawaii Ocean Mixing Experiment (HOME): Farfield Program Pb and HEF Experiment Plan

1. Overview

This document summarizes the plans for the bottom pressure fluctuation (Pb) and horizontal electric field (HEF) tidal energy budget measurements to be made as part of the Hawaii Ocean Mixing Experiment (HOME). An array of 10 bottom pressure gauges and 12 horizontal electric field recorders will be deployed at 12 sites around the Hawaiian Island Chain to provide measurements of barotropic tidal bottom pressure and current variations. The original planned experiment required 8 each of Pb and HEF instruments, so this deployment represents an extension on what was originally proposed. Alan Chave (WHOI) has responsibility for the field effort in this part of the experiment.

The deployment of the Pb and HEF instruments is closely coordinated with the installation of four acoustic tomography moorings northwest and south of Oahu in two separate campaigns. The barotropic currents measured by the tomography experiments will complement those determined from the HEFs. Peter Worcester (SIO) has responsibility for the tomography effort. The Pb and HEF deployment will also overlap with measurements of the modal content of the baroclinic tidal signal in the farfield to be made from R/P Flip. Rob Pinkel (SIO) has responsibility for this experimental effort.

2. Geometry and Instrumentation

Figure 1 shows the 12 sites at which Pb and/or HEF instruments will be installed. Six of these sites (N1, N2, N4, S1, S2, and S4) correspond to the locations of acoustic tomography moorings, and will be occupied by both Pb and HEF instruments. The remaining six sites extend the array to the southeast to provide a better picture of the large scale barotropic tides and related phenomena. Sites N5, N7, S5, and S7 will be occupied by both Pb and HEF instruments. Sites N6 and S6 will have only an HEF instrument.

Table 1 shows the projected schedule for installation which is subject to change depending on weather and related contingencies. The time budgeted for installation at each site is generous based on previous experience. Final instrument siting will be accomplished based on a local multibeam bathymetric survey to locate flat spots and/or sediment pockets. This is not important for installation of the Pb instruments, but can result in tilting and corresponding measurement bias for the HEF measurements.

2. Instrumentation

The pressure instruments use a custom-made double Bourdon tube sensor described by Filloux (1980), with some subsequent modifications. The data acquisition electronics were re-designed for the HOME experiment. Least count sensitivity is about 1 pascal or 0.1 mm of water head, and the noise level is typically below this point. Bourdon tube sensors are subject to slow creep due to pressure loading which is removable, and which is in any case of no consequence for high frequency tidal variations.

The horizontal electric field instruments are described by Filloux (1987). The potential difference across an orthogonal pair of 3 m salt bridges is measured using Ag-AgCl electrodes. Electrode drift is completely eliminated using a mechanical electrode reversing (water chopping) technique that is further described by Filloux (1987). As for the Pb instruments, the HEF data acquisition electronics were re-designed for HOME.

The Pb and HEF electronics, Li batteries, and acoustic release system are both housed in 17" glass instrument housings. Each instrument sits approximately 1 m high on its anchor tripod, which is attached using a vacuum cup release system. The latter ensures a very rigid connection between instrument and anchor at seafloor pressures, which is especially important for the pressure measurements. Both types of instruments are easily deployed and recovered from most oceanographic research vessels using a light crane.

Oceano Instruments acoustic release electronics are used for all of these instruments. This system is interrogated using a coded signal on a pair of frequencies between 6.5 and 13 kHz, with an uncoded reply ping on 12 kHz.

3. Schedule

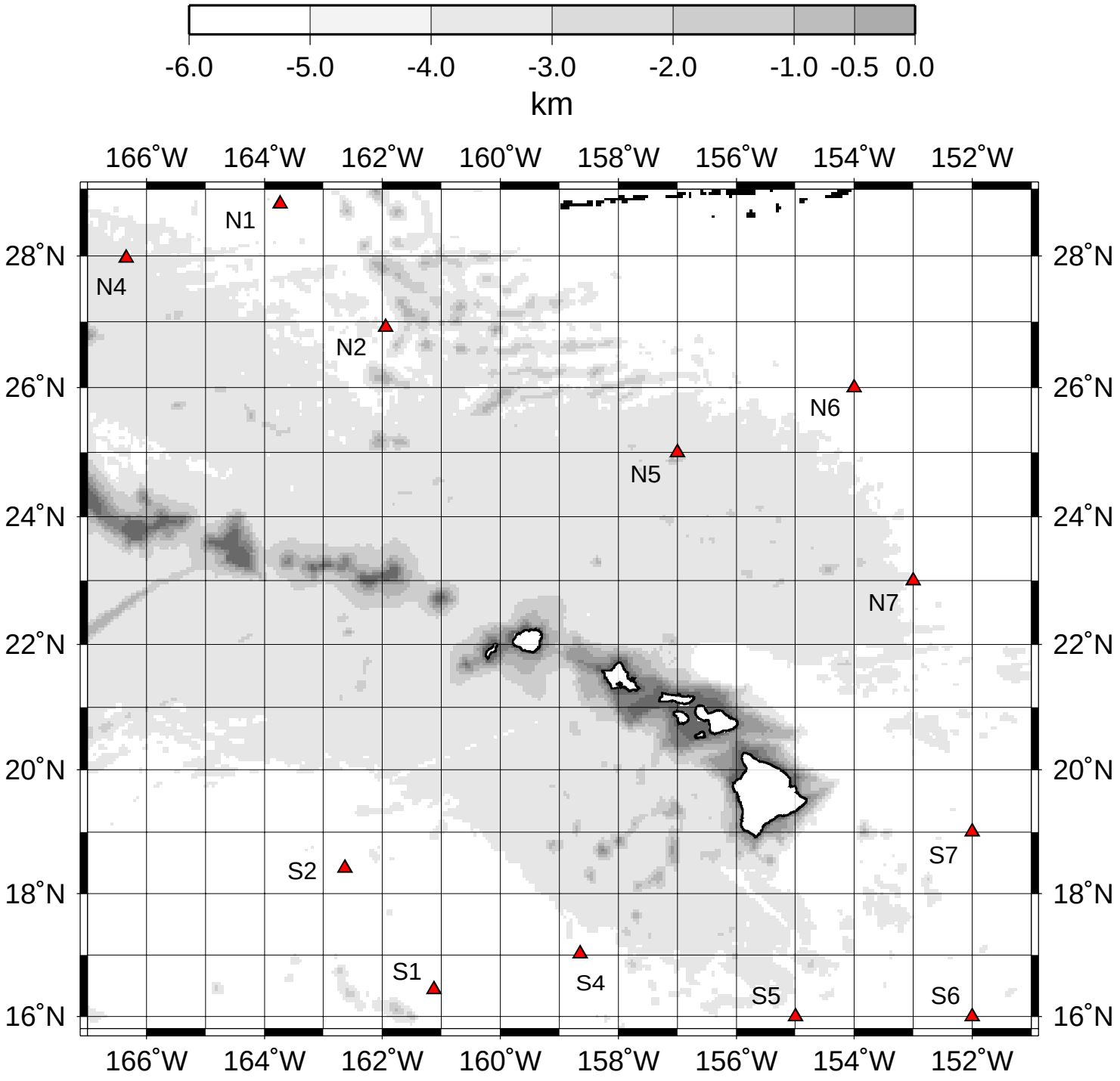
Table 1 summarizes the projected cruise schedule. The time allotted for instrument installation is generous based on past experience, so this plan has adequate time for contingencies.

Multibeam bathymetry will be collected while steaming between sites. The actual sailing tracks will be coordinated with the tomography installation and recovery cruises to ensure that track duplication is prevented.

4. References

Filloux, J.H., Pressure fluctuations on the open ocean floor over a broad frequency range: New program and early results, *J. Phys. Ocean., 10*, 1959-1971, 1980.

Filloux, J.H., Instrumentation and experimental methods for oceanic studies, in J.A. Jacobs (ed.), *Geomagnetism,* Vol. 1, New York: Academic Press, 143-248, 1987.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164˚W
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160˚W
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156˚W
154˚W
152˚W
28˚N
26˚N
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22˚N
20˚N
18˚N
16˚N
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N4
N5
N6
N7
S1
S2
S4
S5
S6
S7