FjordEco VMP data: Supporting information

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1 Overview

FjordEco microstructure data was collected during two cruises to Andvord Bay, a glacial fjord on the West Antarctic Peninsula. The cruises were part of the FjordEco project, supported by NSF under grant OPP 1443680. Øyvind Lundesgaard, (*oyvindl@hawaii.edu*) was responsible for the measurements and processing. Principal investigators on the FjordEco project were Brian Powell (UHM), Craig R. Smith (University of Hawaii at Manoa), Maria Vernet (Scripps Institute of Oceanography), Mark Merrifield (UHM), Martin Truffer (University of Alaska Fairbanks), and Peter Winsor (UAF).

An overview the two cruises can be found in Table 1, and Figure 1 shows an overview of station locations. Both cruises began and ended in Punta Arenas, Chile. All VMP measurements were taken in Andvord Bay or in the area outside the fjord, on a mostly opportunistic basis based on the ship schedule. Due to an electronics board malfunction which was eventually resolved, VMP measurements were delayed during LMG15-10. During NBP16-03, VMP measurements were focused particularly on Errera Channel near the mouth of Andvord Bay, as this was hypothesized to be a site of turbulence generated by tidal flow.

Cruise reports from the two cruises are available from the Marine Geoscience Data System data browser (*marine-geo.org*).

2 Instrument

Measurements were taken using a VMP-500, manufactured by Rockland Scientific (*RSI*). In the standard configuration of this model, power is supplied to the instrument from the ship through the tether cable. However, the instrument was rebuilt by RSI before LMG15-10. In the present

Cruise ID	*Vessel*	*Chief scientist*	*Cruise dates*	*# Stations*
LMG15-10	*L. M. Gould*	Craig R. Smith	18/11/15 to 28/11/15	12
NBP16-03	*N. B. Palmer*	Craig R. Smith	30/03/16 to 30/04/16	22

Table 1: Data overview.

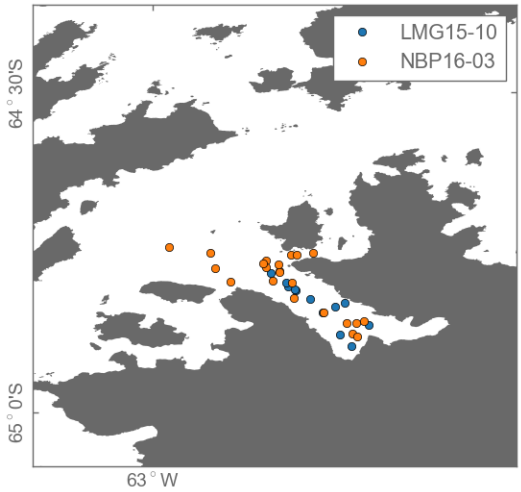

Figure 1: Map of stations locations inside and outside Andvord Bay.

configuration, the instrument is powered by a rechargeable internal battery, and data is recorded internally onto a flash memory card. This configuration is similar to that used on the VMP-6000 model from RSI.

Dual micro-shear probes were mounted on the tip of the instrument along with dual FP07 micro-temperature sensors and a single micro-conductivity sensor. All micro-sensors sampled at a rate of 512 Hz.

An internal sensor provided pressure. RSI Seabird temperature and conductivity sensors were mounted on an external bracket on the instrument. The conductivity sensor was not pumped, and neither sensor was calibrated for the particular cruise, but we found overall good agreement with the ship CTD. The one obvious exception is station 13 during NBP16-03, where the salinity sensor appears to have malfunctioned during 2 of 3 drops.

Prior to the cruise, a buoyancy/drag collar was built at UH in order to decrease the fall rate. After initial test casts, the collar was adjusted to obtain the stable target fall rate of 65-70 cm s^{-1}.

3 Deployment

The VMP was deployed using a winch located on the aft deck. The instrument wire was run through a block on the ship A-frame. Ship steaming speed during deployment was limited to an absolute minimum, and for most VMP deployments the ship was very close to stationary.

During deployment, the tether cable was spooled out by hand in order to decouple the sensors from any ship-induced noise. Typically, fall rate increased within the top 30 m or so until reaching

an approximate terminal velocity. In some cases this adjustment period was longer, in other cases shorter. Once terminal velocity was attained, the fall rate was relatively steady around 68 db/s, typically varying within a range of a few db/s. Our practice has been to discard data from above 50 m; in this range the instrument was still accelerating towards terminal velocity and therefore subjected to significant vibration.

Due to the secluded sampling location, there was very little swell throughout the cruise. Ocean currents were also fairly weak in general. The biggest challenge posed by the environment was ice. During very icy conditions, it was occasionally necessary to push pieces of ice away with a long rod. In one case deployment was aborted as there were several large pieces of ice moving towards the stern.

The Seabird sensor bracket was mounted 90° from the axis normal to the pressure port. The Seabirds should therefore act to tilt the VMP along the x-axis. Inclination along this axis was relatively constant at 2.5° below 10 m depth.

Instrument time was synchronized (manually) with the ship clock before each deployment. There was generally little drift, and the VMP clock was only adjusted once during the cruise. The discrepancy between the VMP and ship clocks amounted to a few seconds at this point.

4 Processing

Only the shear sensors were used to calculate TKED. In general, we found good agreement with the other micro-sensors, in that profile sections of high shear-based TKED generally coincided with elevated micro-temperature and -conductivity gradients.

TKED was calculated using the RSI *quick_look* software, using standard parameters. Point estimates of TKED were computed for overlapping segments of length 8 seconds. Within each segment, TKED was computed from spectra calculated from FFTs of subsegments of length 2 seconds.

For each station, profiles of TKED were computed for each drop and interpolated onto a fixed 1 m grid. The epsilon profile for each drop is taken as the average between the estimates from the two shear probes.

5 File structure

VMP data are collected in the netCDF files *FjordEco_vmp_lmg1510_XX.nc* and *FjordEco_vmp_nbp1603_XX.nc*, where *XX* is the station number. Each file contain the average profiles of TKED (*epsilon*) for each drop interpolated onto a 1-m depth grid. Also included are salinity (S) and temperature (T) measured by the SeaBird sensors, interpolated onto the same grid.

Raw data files including micro-temperature and -conductivity are available upon request.

6 Acknowledgements

Glenn Carter at the University of Hawaii at Manoa kindly provided the VMP instrument as well as assistance before and during the cruises. Rockland Scientific provided invaluable instruction and support during the cruises. We are grateful to the captain, crew and Antarctic Support Contract staff of the *Gould* and *Palmer*, who all were instrumental in facilitating the collection of these measurements.