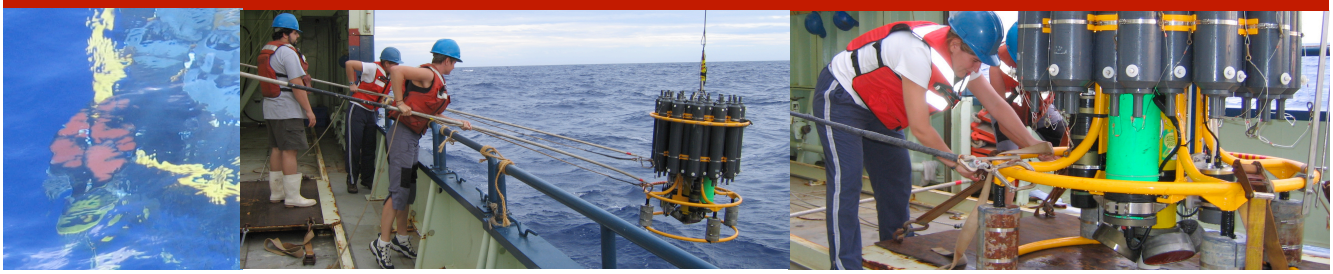
May 2005

RAPID-MOCHA LADCP Report, Kn182



LADCP Report, RAPID-MOCHA Cruise 3, Kn182, May 2005

Lisa Beal and Tania Casal

Instrumentation and Configuration

A configuration consisting of a downward-looking 150 kHz Broadband ADCP and an upward-looking 300 kHz Workhorse ADCP, each pressure-rated to 6000 m, was used for LADCP operations throughout this cruise. From hereon we refer to this configuration as "Hybrid" . Unlike the more common dual Workhorse configuration, for the Hybrid system there is no slaving, in other words, the pinging of the up-looker and down-looker is not asynchronised. Both instruments belong to NOAA/AOML and were used during MOCHA as a result of collaboration with Molly Baringer and Chris Meinen. The instrument serial numbers are: 150 kHz S/N 1133, 300 kHz S/N 1410. Both instruments worked without failures during the entire cruise, although it is noted that instrument 1133 has a weak beam 2, for which the echo amplitudes averaged 20-30% weaker when compared to the remaining three beams. No continued weakening occurred, indicating that it is not an early sign of failure.

The hybrid system was run off a single battery pack and for the most part this seemed satisfactory, although voltages were much less stable during the course of the cruise than LMB has experienced in the past. Maximising recharging time between casts was essential: when the charger was accidently left switched off the result was an hour delay for the following cast. The back-up battery pack was swapped in and used throughout the cruise, since the primary unit was found to be flat and not taking charge.

Of particular note for the set-up during this cruise was that the battery pack was vented between each and every cast during charging. Previously LMB has followed the procedures of Eric Firing and Teri Chereskin, who vent every ten casts. However, due to a dangerous incident aboard the Knorr a few years ago, when Dan Torres' LADCP battery pack exploded, the Captain insists on venting at all times while charging for safety's sake. To ensure no moisture entered the battery pack while the purge plug was removed, a 20 cm-long tube was attached to the vent plug. A length of red tape hanging from the tube made it visible should replacement of the purge plug be forgotten at deployment. This safety measure was very effective.

Deployment and Recovery

Both instruments were deployed using BBTalk, with standard tests for battery voltage, clock time, and available recorder space made prior to each deployment. The command files were as LMB used for last year's RAPID-MOCHA cruise, the most pertinent settings being: Staggered 1.2/0.8 s pinging for 150 kHz instrument, zero-blank after transmit for 300 kHz instrument. The remaining settings were fairly standard for LADCP set-up. Data was recovered in parallel: from the 150 kHz using BBSc and from the 300 kHz using BBTalk and a higher baud rate. Recovery time averaged 45 minutes to an hour

for deep casts (5000 m). Due to close station spacing within the Deep Western Boundary Current it was common to need 15-20 minutes longer than steaming time to recover, download and re-deploy the LADCP. Preliminary processing was carried out on the data-acquisition PC directly after recovery to check for download problems, before erasing the recorder for the next deployment. No peripheral data was required for preliminary processing. For a quick and robust check of the data, the maximum depth obtained from the integration of LADCP vertical velocity should fall within about 100 m of the maximum depth recorded on the CTD log sheet.

Processing

LADCP data was processed using version 8a of Visbeck's MATLAB software. Three processing passes were set up:

Processing Pass	Peripheral Data	Calculations and Constraints
First Pass	+GPS data	Shear solution Inverse solution with barotropic constraint.
Second Pass	+GPS data +CTD data	Depth and sound speed from CTD Inverse solution with barotropic and bottom-track constraints.
Third Pass	+GPS data +CTD data +SADCP data	Depth and sound speed from CTD Inverse solution with barotropic, bottom-track, and surface-current constraints.

The first pass allows an assessment of the LADCP ping data quality without obscuring runaway shear or other problems resulting from low signal-to-noise ratio in low-scatter and/or deep waters. The shear solution is calculated for comparison. The second and third passes build on the complexity of the solution by adding additional constraints. Once the SADCP data is set-up as a routine input to the LADCP processing stream, pass two can be skipped to obtain a "final" solution directly after assessing data quality during pass one.

Handling peripheral data for use in LADCP processing is different on every cruise, depending on the format and frequency of the data streams. For this cruise on the RV *Knorr* the GPS NMEA stream was logged directly onto a networked laptop and an *awk* script written to decimate (to 10 s intervals) and extract position data from the NMEA file and write the output as an ascii file with columns of: time (in decimal day since the beginning of the year), latitude, and longitude (the last two in decimal degrees). CTD time series data was provided by Carlos Fonseca of NOAA AOML in SeaBird file format. He performed initial editing, that is wild-edit, cell thermal mass adjustment, and box filtering, but no loop editing since it is a time series file. The file was parsed using another *awk* script to strip off the header and extract columns of: time (in decimal day since beginning of year), depth, *in-situ* temperature, and salinity. Finally, SADCP data was extracted from the new UHDAS, which was installed on the Knorr by Teri Chereskin directly prior to our cruise. Standard CODAS output in the form of MATLAB files

cont_uv.m and cont_xy.m were obtained by logging into ADCP home (as user adcp), going to directory /home/adcp/teri and typing adcpsect as_cont800.tmp. This script was set up for us by Teri Chereskin to extract underway data from the 75 kHz Ocean Surveyor down to 800 m. In MATLAB, script adp = adp_in('cont_uv','cont_xy') was run to parse these files into vectors of time (decimal day since beginning of year), latitude, longitude, and depth and matrices of east and north velocities; u and v.

Each processing run took an average of 45 minutes on a Mac Powerbook G4, 800 MHz, 512 Mb RAM. This meant a lot of processing time, tying up a laptop almost exclusively during CTD/LADCP operations.

Testing Version 9

In addition to the version 8a processing, version 9 of the Visbeck processing software was tested during the cruise. The modifications to Version 9 are: an implementation of a more transparent weighting system for bottom-tracking and SADCP constraints, one which is based on the errors of each data set; a default weighting of the inversion to prefer adjustment of low-mode shear (ps.smallfac); wake and bottom interference editing; separate bin-1 editing choices for uplooker and downlooker (very useful for hybrid systems); and a new wrapper to run and follow the processing more transparently step-by-step (the last three implemented by Andreas Thurnherr). Due to the changes to the wrapper and various new factors (such as ps.smallfac) that required understanding and setting, it took a couple of days to integrate Version 9 into LMBs directory structure and three-pass protocol. Only a couple of stations were looked at during the cruisewe found solutions from version 9 to be substantially different from those found using version 8a. the differences mainly manifested in the high-mode (solutions from v9 are noisier), but discrepancies were also observed in the large-scale shear. Hence this software is still under review.