Healy 2012 ADCP Evaluation (HLY12TA)

Dr. Julia M Hummon

University of Hawaii

hummon@hawaii.edu

Revision History

May 12, 2012	Draft

Table of Contents

1 Introduction

USCGC Healy presently has two Doppler current profilers made by Teledyne RDI. Both are the Ocean Surveyor model, which uses a single phased-array transducer to generate all four acoustic beams. The two instruments differ in their operating frequency, nominally 75 kHz (OS75) and 150 kHz (OS150). The lower frequency allows profiling at greater range, but with reduced resolution, compared to the higher frequency.

The performance of these instruments during the 2010 season was poor, even taking into account the range reduction owing to signal attenuation by the thick acoustic window required for ice protection. A major cause of the poor range and, in some cases, biased velocity estimates seen in 2010, appears to be electro-magnetic interference (EMI). During the 2011 in-port period, the deck units were moved to a temporary location in MICA to see whether this would reduce EMI via the transducer cables. Various tests were run during the science sea trials (HLY11TA) transit from Seattle to San Francisco and back, and data quality was assessed from useful periods (eg. Multibeam calibrations). The key result was that the new location dramatically improved data quality by increasing range and decreasing bias. (see section 4)

During the 2012 winter in-port period, a permanent location was found for the ADCP deck units (on the aft bulkhead of MICA, starboard side). At the time of the HLY12TA science sea trials cruise, the deck units were still in a small rack, and were strapped to the shelving. A double-conversion UPS was supposed to arrive in time for the cruise, but the one the distributor shipped was not correct, so the ADCP deck units ran on ship's power. The final welding and appearance of the UPS, and permanent relocation of deck units and UPS are expected to occur prior to the first cruise.

ADCP data were evaluated during the HLY12TA science sea trials cruise. The data from the first half of the cruise were disappointing, with a high noise floor, strong biases, and very poor range. Running the deck units off a generic UPS (not double-conversion) made things worse. When the source of the AC power was changed to come from the same feed in the aft MICA that the 2011 season data used (rather than the dedicated line that had been provided (from IC-GYRO) for the purpose), the data were closer to their 2011 quality. It is strongly recommended that AC power for the ADCPs be tapped of a source in aft MICA, and not be run from IC-GYRO.

2 UHDAS and CODAS

Documentation for the shipboard ADCP data acquisition system (UHDAS) and for the automated data processing included in UHDAS (CODAS) is accessible at (http://currents.soest.hawaii.edu/docs/adcp_doc/index.html)

3 ADCP data from HLY12TA

3.1.1 Data Collection

The ship sailed June 6, 2012, with UHDAS data collection commencing at 18:00 UTC. During the transit west to the test site, data were collected using the 2011 defaults for each instrument (NB only), and adding the broadband mode, to see whether BB mode was still biased. The BB and NB data ensembles are processed and evaluated independently. Transducer alignment has not physically changed since last year, and calibrations show that the values used for processing (which incorporate POSMV alignment) remain valid.

During most of HLY12TA, the sea state was moderate. The ADCPs were able to return valid data for the entire cruise. Bottom-track calibrations during the return leg (end of HLY12TA_01) indicate that the present values for transducer angle (relative to POSMV1) are adequate to begin the season. The cruise was very short, so more evaluation is required using the data from the transit to Dutch Harbor.

Recommended settings remain the same as last year, but without OS75BB mode.

After the first reciprocal track (at 2000m depth) data were compared to 2011 HLY11TA (same region, same season) and it was obvious that the OS75 in particular was very noisy and suffered from decreased range. Because the double-conversion UPS was not available, we were running the deck units on ship's power, using a feed provided by the ship, coming from IC-GYRO. We tried powering the deck units with a standard UPS (not double-conversion), which increased the spurious “chatter” in the ocean velocities. It did decrease the background noise, so range was better, but velocities were plagued with artifacts. When we switched to the power source in aft MICA, 2-37-1 (using the same orange extension cord that was used in 2011) range was dramatically improved, and biases were reduced.

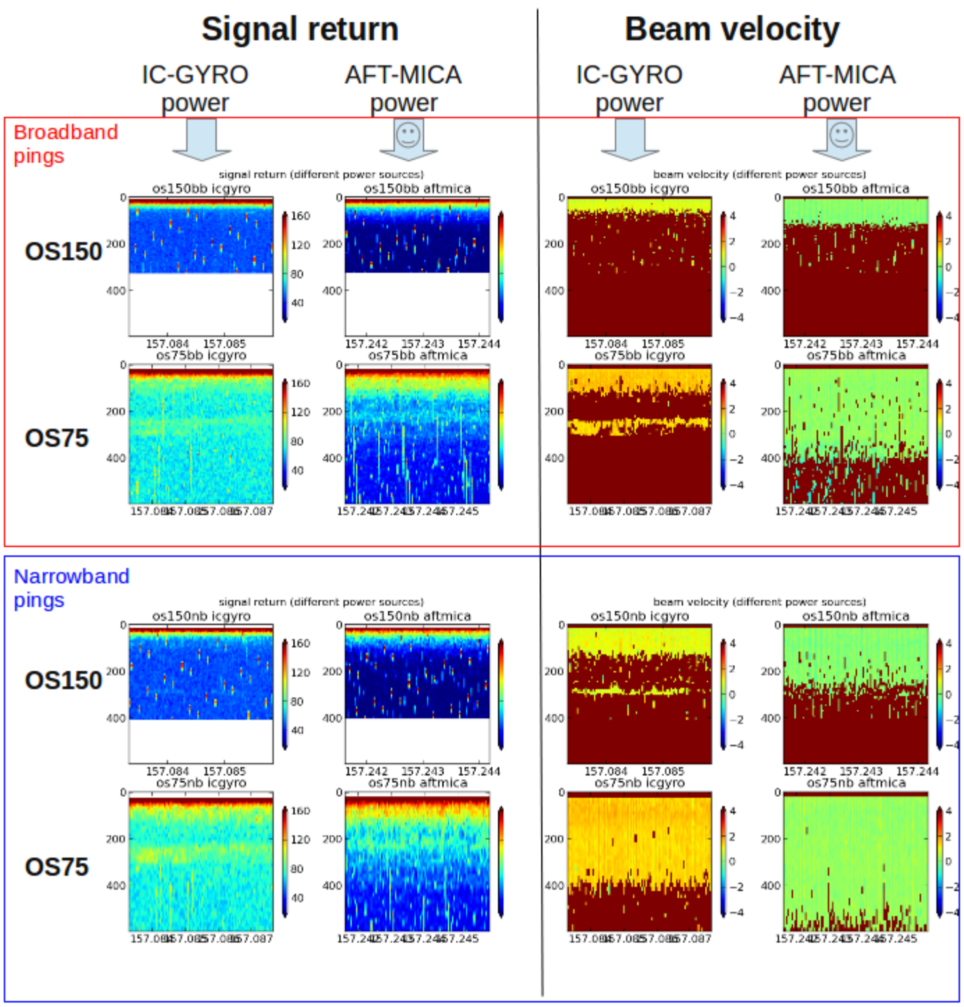

Illustration 1:Ocean velocity range is better using narrowband mode (lower panels) than broadband mode, regardless of power source; aft-mica increases range of each ping type.

The next two figures include 2011 data (which used aft-mica power), 2012 (IC-GYRO power) and 2012 (switching back to aft-MICA). The difference is clear in signal return: aside from the individual pings from other instruments, the background color should be dark blue at the bottom of each figure, but for IC-GYRO power it is much lighter (noisier).

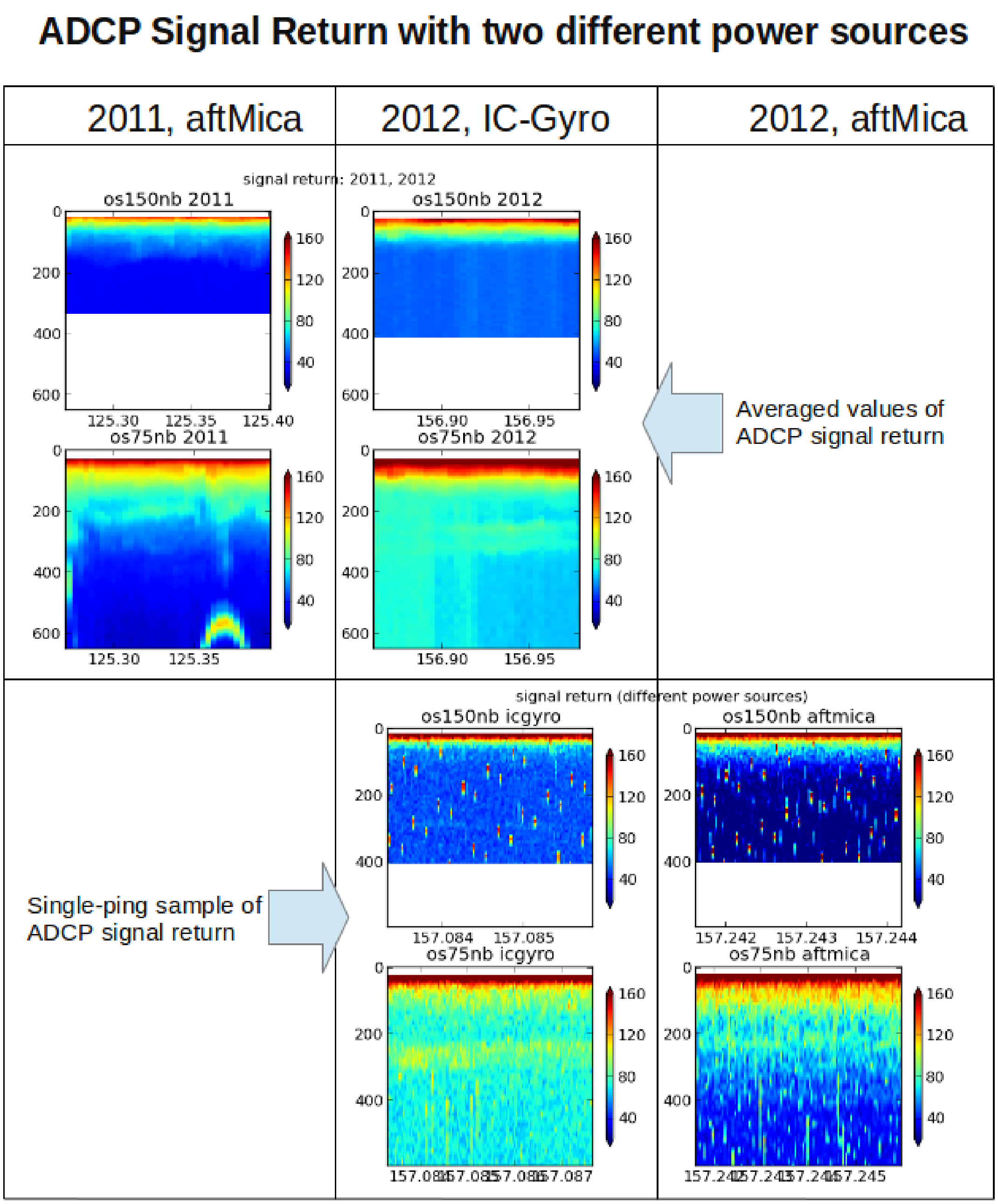

Illustration 2: Background signal return is very noisy using IC-GYRO power (center panels) compared to aft-MICA power (left and right panels). The results is reduced range if power comes from IC-GYRO. See next figure.

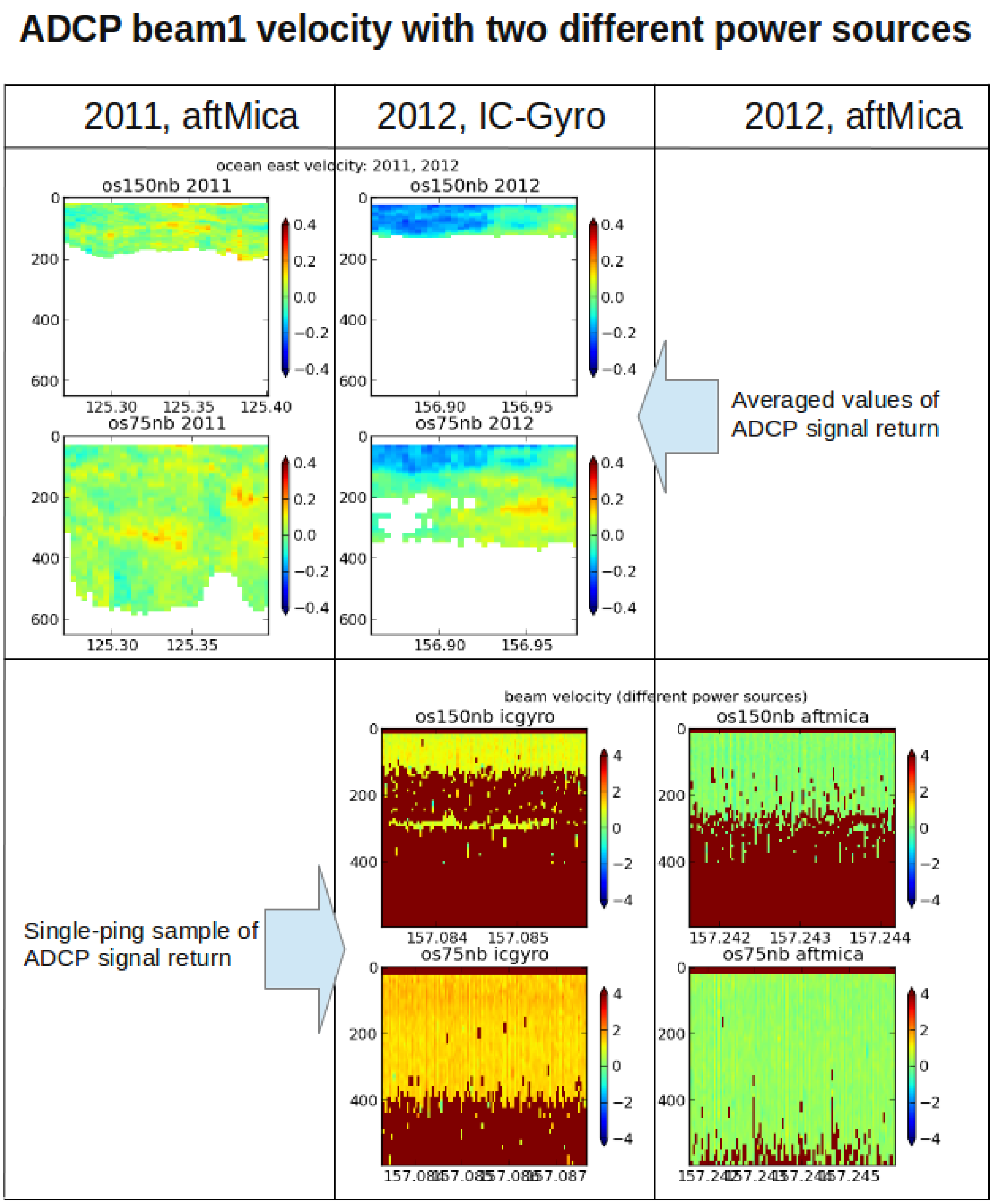

Illustration 3: Velocity range is greatly improved using aft-MICA power compared to IG-GYRO power

4 Data from 2011: HLY1102

Because of the improved range, it was possible to see small (20-30km radius) active (0.2m/s) subsurface eddies in the Beaufort Sea during part of a Multibeam survey during HLY1102. These figures illustrate how important it is to obtain maximum range with the OS75 ADCP. These data will be available at the JASADCP (Joint Archive for Shipboard ADCP) at http://ilikai.soest.hawaii.edu/sadcp/ .

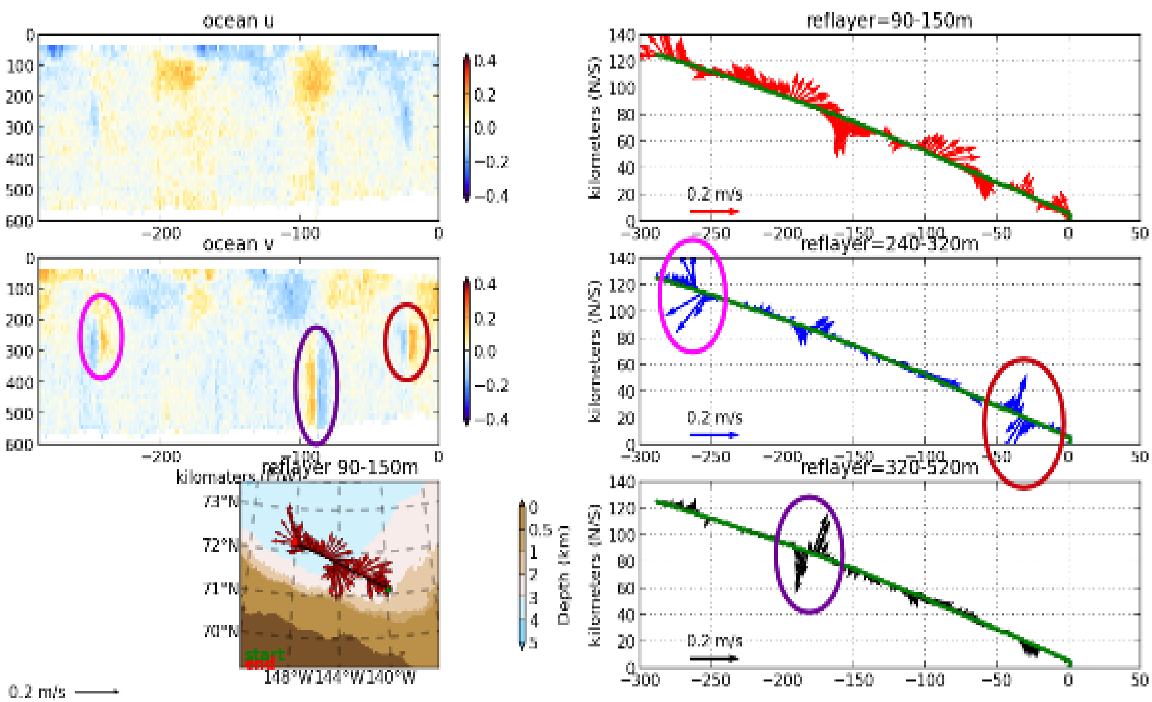

Illustration 4: Eddies are seen below the pycnocline in two vertical layers. These eddies have peak speeds of about 0.2m/s and diameters of 25-30km. The shallower eddies (200-300m) are anticyclonic, the deeper one (300-500m) is cyclonic.

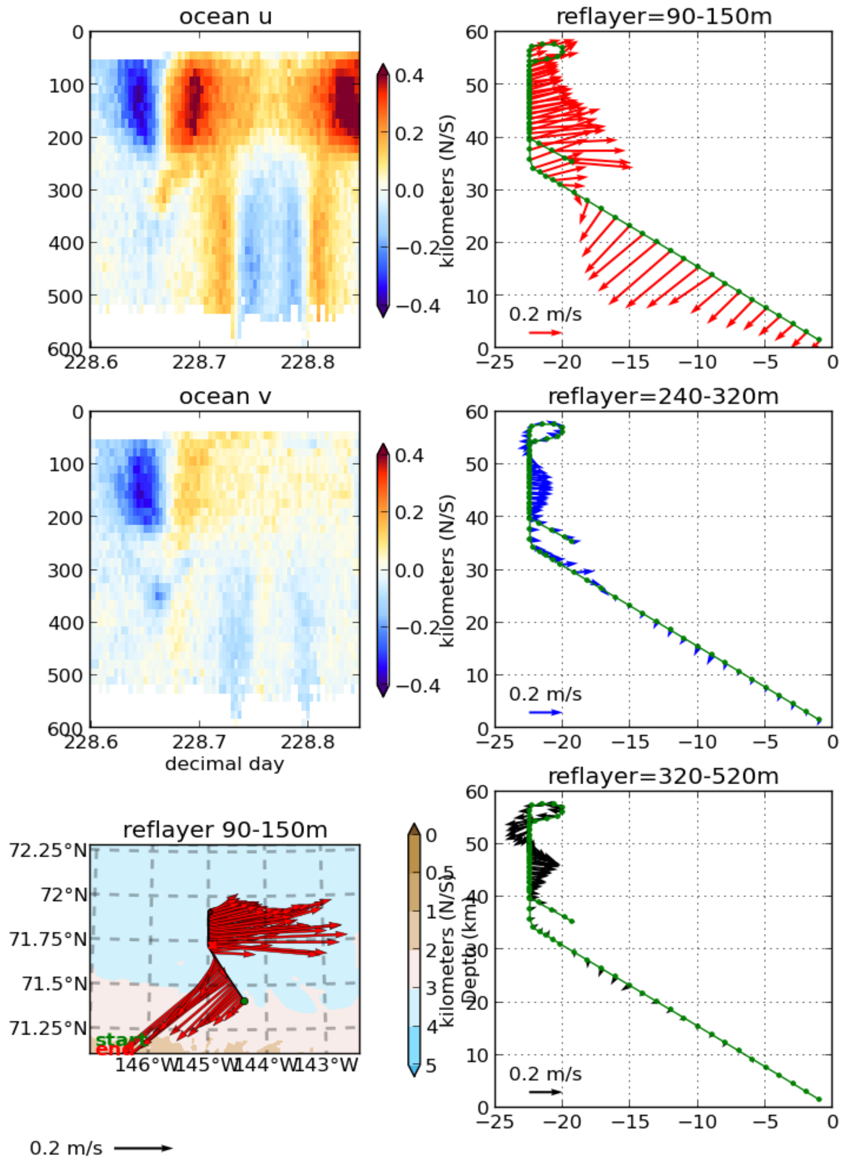

Illustration 5: Two eddies have different diameters, speeds, direction, and vertical extent. The shallow anticyclonic eddy (upper 200m) has a 60km diameter and peak speeds of 0.5m/s; the deeper (300-500m or more) cyclonic eddy is centered at a different location, with a diameter of 15-20km and peak speeds of 0.2m/s.