Ver 1.0
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WHOI Bay of Bengal Surface Mooring – Ocean Data Processing Notes

1. Overview

The surface mooring deployed in ASIRI-OMM was from Drs. Robert A. Weller and J. Thomas Farrar of the Woods Hole Oceanographic Institution, whose participation was funded by the U.S. Office of Naval Research. Please acknowledge the source of the data when using it. Feedback on data quality issues – please email rweller@whoi.edu

The surface buoy and mooring are shown in Figure 1. The mooring was deployed from the RV *Sagar Nidhi* on December 8, 2014 and recovered from RV *Sagar Kanya* on January 29, 2016. Water depth was close to 2,150 m, and the surveyed anchor position was 18° 00.60' N, 89° 27.29' E. Table 1 summarizes the instrumentation deployed.

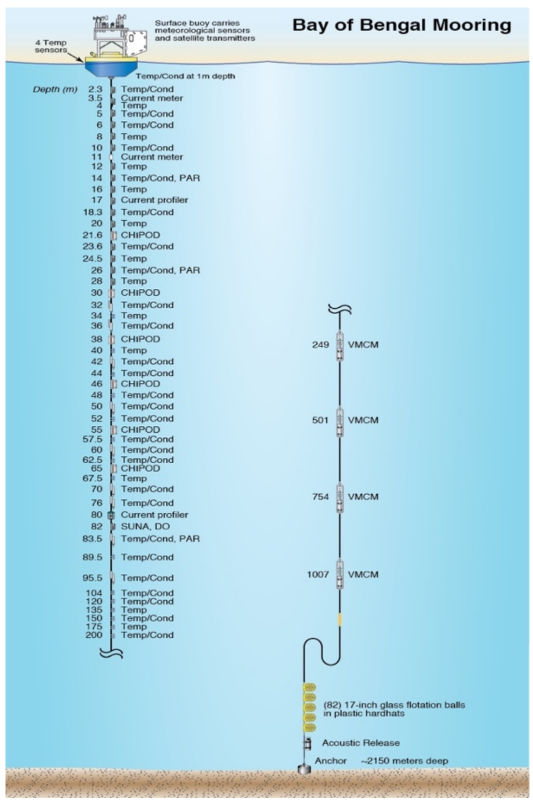

Figure 1 Diagram of the WHOI surface mooring deployed in the northern Bay of Bengal December 2014 to January 2016. Labels for instrumentations are as follows: Temp indicates an instrument recording temperature; TempCond indicates a temperature and conductivity recorder; a Current meter measures velocity and usually temperature; a CHIPOD is an instrument that measures turbulence; PAR indicates an optical instrument measuring photosynthetically available radiation; SUNA indicates an instrument measuring nitrate; DO indicates an instrument measuring dissolved oxygen; a current profiler measures velocity over a range of depths; a VMCM is a current meter called a Vector Measuring Current Meter.

Depth (m)	Instrument	Temp	Cond	Velocity	Sampling (sec)	Notes
~ .05	4 Solo T	x			60	in buoy hull; 3 short, 1 full length
1.0	2 SBE 37	x	x		60	Part of ASIMET, full
2.3	SBE 37	x	x		300	full length
3.5	Nortek CM			x	3600	single depth velocity
4.0	Solo T	x			2	short record
5.0	XR 420	x	x		120	full length
6.0	SBE 37	x	x		300	full length
8.0	Solo T	x			2	short record
10.0	SBE 37	x	x		300	full length
11.0	A CM	x	x	x	3600	also DO, single depth velocity
12.0	Solo T	x			2	short record
14.0	SBE 37, PAR	x	x		300, 900	full length
16.0	Solo T	x			2	full length
17.0	Nortek ADCP			x	3600	profiler, 2 m bins, looking up
18.3	SBE 37	x	x		300	full length
20.0	Solo T	x			2	short record
21.6	Chipod					
23.6	SBE 37	x	x		300	full length
24.5	Solo T	x			2	short record
26.0	SBE 37, PAR	x	x		300, 900	full length
28.0	Solo T	x			2	short record
30.0	Chipod					
32.0	SBE 37	x	x		300	lost
34.0	Solo T	x			2	lost
36.0	SBE 37	x	x		300	lost
38.0	Chipod					lost
40.0	Solo T	x			2	lost
42.0	SBE 37	x	x		300	full length
44.0	XR 420	x	x		120	full length
46.0	Chipod					
48.0	XR 420	x			120	full length
50.0	SBE 37	x	x		300	full length
52.0	XR 420	x	x		120	full length
55.0	Chipod					
57.5	XR 420	x	x		120	full length
60.0	SBE 37	x	x		300	full length
62.5	XR 420	x	x		120	short record
65.0	Chipod					
67.5	Solo T	x			2	short record

70.0	SBE 37	x	x		300	full length
76.0	SBE 37	x	x		300	full length
80.0	RDI ADCP			x	3600	profiler, 2 m bins, looking up
82.0	SUNA, DO					
83.5	SBE 37, PAR	x	x		300, 900	full length
89.5	XR 420	x			120	full length
95.5	SBE 37	x	x		300	full length
104.0	XR 420	x	x		120	full length
120.0	XR 420	x	x		120	full length
135.0	SBE 39	x			300	full length
150.0	XR 420	x	x		120	full length
175.0	SBE 39	x			300	full length
200.0	XR 420	x	x		120	full length
249.0	VMCM	x		x	60	full length
501.0	VMCM	x		x	60	full length
754.0	VMCM	x		x	60	full length
1007.0	VMCM	x		x	60	full length

Notes:

Chipod – turbulence measuring instrument, J. Moum and E. Shroyer, Oregon State University
Solo T – Richard Brancker Research, Ltd. Temperature logger, all subsurface from Moum and Shroyer
SBE 37 – Sea-Bird Electronics. Temperature and conductivity logger
SBE 39 – Sea-Bird Electronics. Temperature logger
XR420 – Richard Brancker Research, Ltd. Temperature and conductivity logger
Nortek CM – Nortek Aquadopp single point acoustic Doppler current meter
Nortek ADCP – Nortek Aquadopp acoustic Doppler current profiler
A CM – Aanderaa Seaguard RCM, single point Doppler current meter
PAR – photosynthetically available radiation logger, A. Mahadaven and M. Omand
SUNA – Satlantic nitrate logger, A. Mahadaven and M. Omand
DO – dissolved oxygen logger, A. Mahadaven and M. Omand
VMCM – vector measuring current meter

Table 1. Moored instrumentation deployed on the WHOI Bay of Bengal surface mooring December 2014 to January 2016. Instrument types are explained in the notes below the table. The Chipod, SUNA, PAR, and DO instruments are listed for completeness, but their data are not considered in this paper. Note, the notes column record length remark reflects the length of the record recovered when downloading raw data from the instrument; this does not reflect the length of the data record for any given variable that passed quality control processing. SUNA, PAR, DO, and Chipod data are not included in this processing and distribution.

Notes on the data:

1) Quality controlled time series have been truncated to include only the period when the mooring is deployed and in the water. Anchor over was 0828 UTC December 2014. Anchor release was 0630 Local January 29, 2016.

2) Time series use a yearday time variable called 'yday'. Yday is relative to January 1 2014. Yday = 1.5 is noon UTC on January 1, 2014.

3) Magnetic deviation has been corrected for so current directions are in absolute degrees.

2. Temperature Data

Temperature sensors are calibrated either by the manufacturer and/or by the Upper Ocean Processes (UOP) Group at WHOI. Temperature data from internal sensors in the Nortek, Aanderaa, and RDI current meters have not been considered as useful.

Temperature data were checked by comparing records from nearby sensors with each other, and by verifying record length of the temperature time series. Not some instruments were torn from the mooring by fishing activity; it is possible that fishing lines also caused some instruments to slide along the mooring wire to different depths but this has not yet been diagnosed. Merging the temperature files summarized here and making products such as contour plots has not as yet pointed to temperature quality issues; if found please email findings to rweller@whoi.edu

Solo-T

Between the WHOI UOP and Moum and Shroyer at Oregon State University, 14 Solo-T temperature loggers were deployed (https://rbr-global.com/products/compact-loggers/rbrsolo-t).

Depths:	4 in the buoy hull at ~0.05 m	SN 76104, 76106, 76110, 76111	
	1 at 4 m	SN 76573	
	1 at 8 m	SN 76574	
	1 at 12 m	SN 76575	
	1 at 16 m	SN 76576	
	1 at 20 m	SN 76577	
	1 at 24.5 m	SN 76578	no data
	1 at 28.0 m	SN 76579	
	1 at 34 m	SN 76580	lost
	1 at 40 m	SN 76581	lost
	1 at 67.5 m	SN 76582	

The major issue with the SOLO-T instruments is that they did not run the full length of the deployment (Figure 2). When they ran, temperature data were considered good.

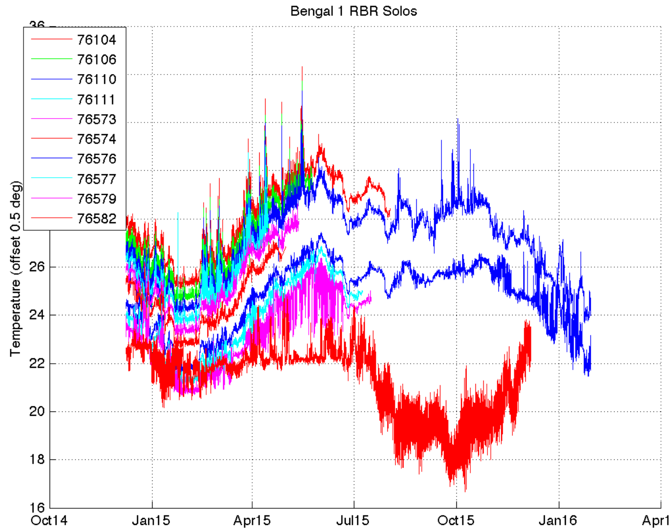

Figure 2. Time series of temperature from SOLO-T instruments.

SBE-39

WHOI UOP deployed two Seabird SBE-39 instruments, which measure temperature (http://www.seabird.com/sbe39plus-temperature-recorder).

Depths:	135 m	SN 0045
	175 m	SN 0051

The SBE 39s ran the full length and do not have quality issues (Figure 3).

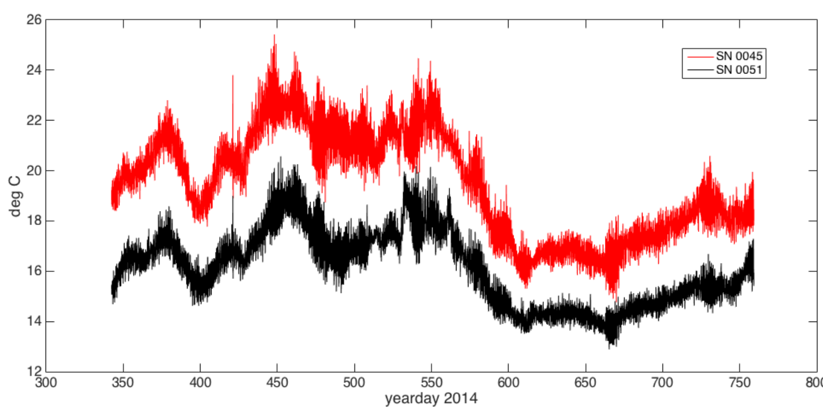

Figure 3. Time series from SBE 39s SN 0045 at 135 m and SN 0051 at 175 m.

SBE-37

WHOI UOP deployed 18 Seabird SBE 37 temperature and conductivity recorders (http://www.seabird.com/sbe37sm-microcat-ctd), and these provided temperature data.

Depths:	2 on the buoy bridle at ~0.05 m	SN 5995, 5994
	1 at 2.3 m	SN 12259
	1 at 6 m	SN 12260

1 at 10 m	SN 8214	
1 at 14 m	SN 8213	
1 at 18.3 m	SN 3639	
1 at 23.6 m	SN 1913	
1 at 26.0 m	SN 8222	
1 at 33 m	SN 2015	lost
1 at 36 m	SN 7717	lost
1 at 42 m	SN 8223	damaged
1 at 50 m	SN 2012	
1 at 60 m	SN 6730	
1 at 70 m	SN 7217	
1 at 76 m	SN 7219	
1 at 83.5 m	SN 7715	
1 at 95.5 m	SN 7716	

Data return for temperature was good for the SBE 37s, and Figure 4 shows a plot of the basic files from these instruments.

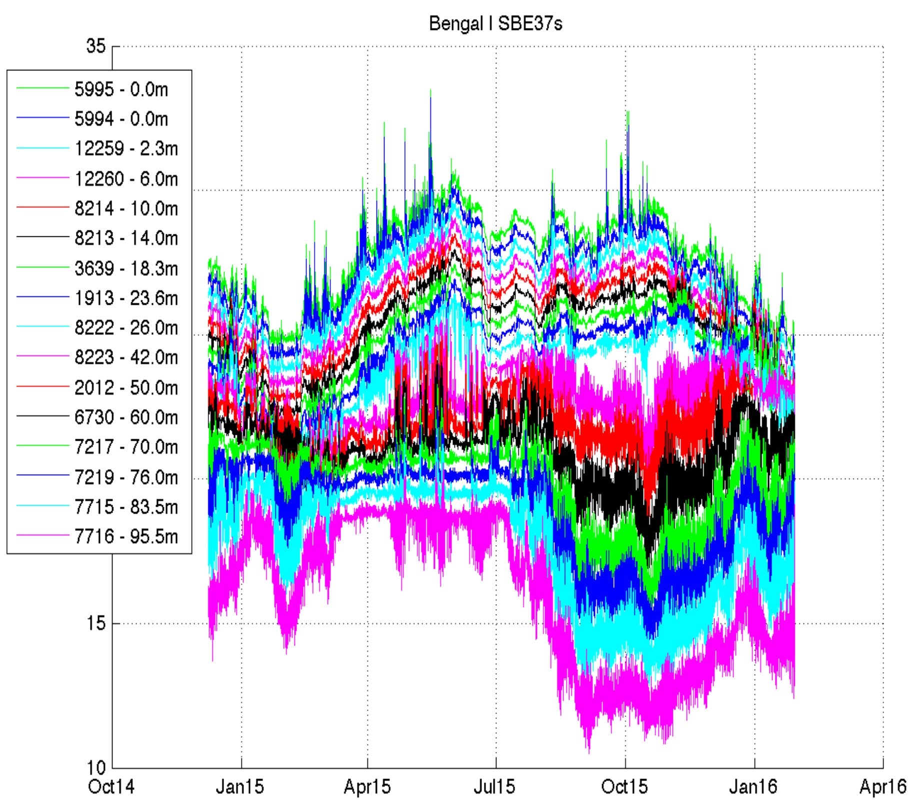

Figure 4. Time series of temperature from SBE 37s deployed on WHOI mooring, plotted with 0.5 deg C offsets.

XR-420

WHOI UOP deployed 11 XR 420 temperature and conductivity loggers (https://rbr-global.com/products/standard-loggers).

Depths:

1 at 4 m	SN 13249
1 at 44 m	SN 15218
1 at 48 m	SN 15223
1 at 52 m	SN 15224
1 at 57.5 m	SN 15225
1 at 62.5 m	SN 15247
1 at 89.5 m	SN 17263
1 at 104 m	SN 17559
1 at 120 m	SN 17560
1 at 150 m	SN 17561
1 at 200 m	SN 17562

The XR 420s temperature records from these 11 XR-420s were considered good. (Figure 5). SN 15247 was a short record.

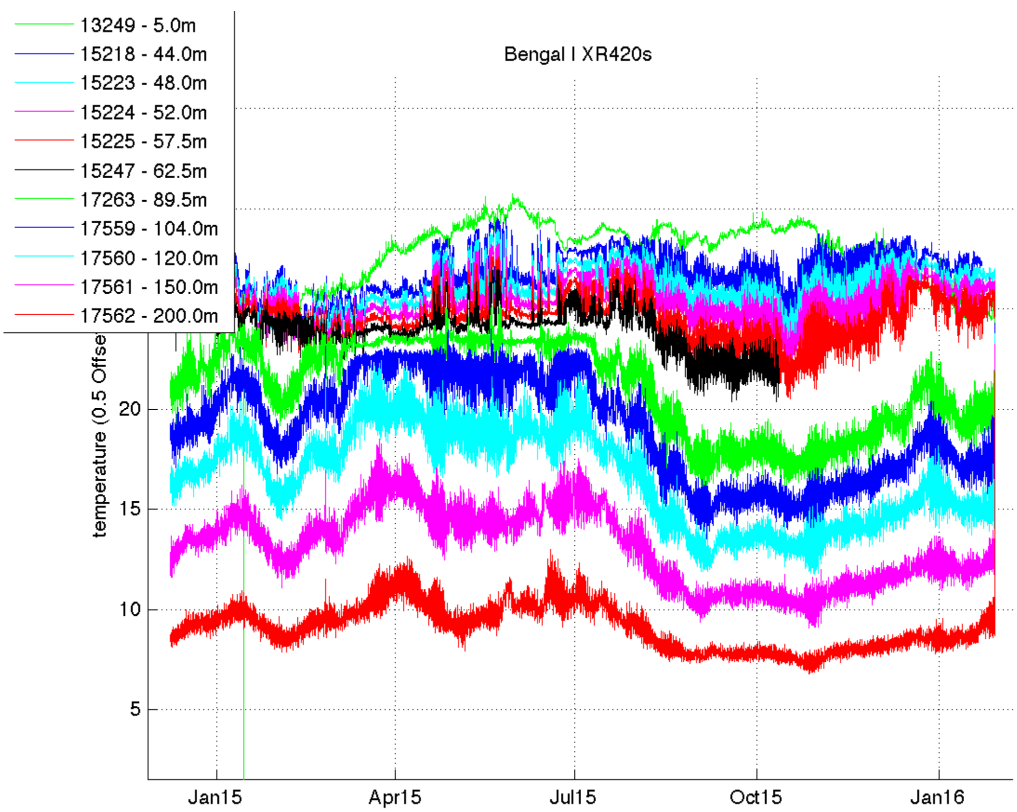

Figure 5. Temperature time series from the XR 420s.

Vector Measuring Current Meters or VMCMs

Four VMCMs (Weller, R.A. and R. E. Davis, 1980. A vector measuring current meter. *Deep-Sea Research*, **27A**, 565-582.) were deployed. These have external temperature sensors, precision temperature circuitry, and were calibrated at WHOI by UOP.

Depths	1 at 249m	SN 003
	1 at 501 m	SN 009
	1 at 754 m	SN 011
	1 at 1007 m	SN 038

Figure 6 shows the temperatures from the four VMCMs.

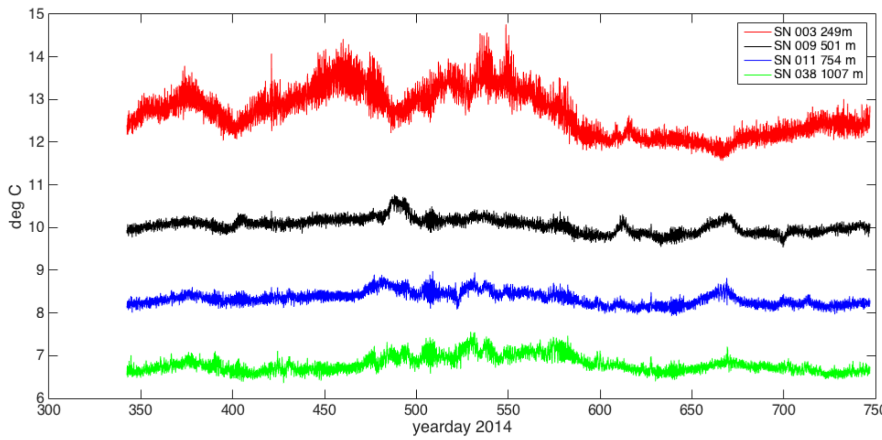

Figure 6. Temperature time series from the four VMCMs deployed on the BoB surface mooring.

3. Conductivity/salinity data

Quality control of conductivity and salinity data was a challenge. One major issue is the impact of biofouling on the conductivity sensors. We examined conductivity time series, comparing nearest neighbors for quality control. When that was not sufficiently informative, we looked at the density computed from the conductivity and then used agreement among nearest neighbor densities to guide judging if the conductivity data were good. Conductivity data, when in doubt or missing, are replaced by NaNs in our files.

The SBE 37s, the XR-420s, and the Aanderaa current meter had conductivity sensors. The Aanderaa conductivity sensor failed.

SBE-37

WHOI UOP deployed 18 Seabird SBE 37 temperature and conductivity recorders (http://www.seabird.com/sbe37sm-microcat-ctd), and these provided conductivity/salinity data.

Depths:	2 on the buoy bridle at ~0.05 m	SN 5995, 5994
	1 at 2.3 m	SN 12259
	1 at 6 m	SN 12260
	1 at 10 m	SN 8214
	1 at 14 m	SN 8213

1 at 18.3 m	SN 3639	
1 at 23.6 m	SN 1913	
1 at 26.0 m	SN 8222	
1 at 33 m	SN 2015	lost
1 at 36 m	SN 7717	lost
1 at 42 m	SN 8223	damaged
1 at 50 m	SN 2012	
1 at 60 m	SN 6730	
1 at 70 m	SN 7217	
1 at 76 m	SN 7219	
1 at 83.5 m	SN 7715	
1 at 95.5 m	SN 7716	

Data return for conductivity and hence salinity was good for the SBE 37s, and Figure 7 shows a plot of the basic files from these instruments.

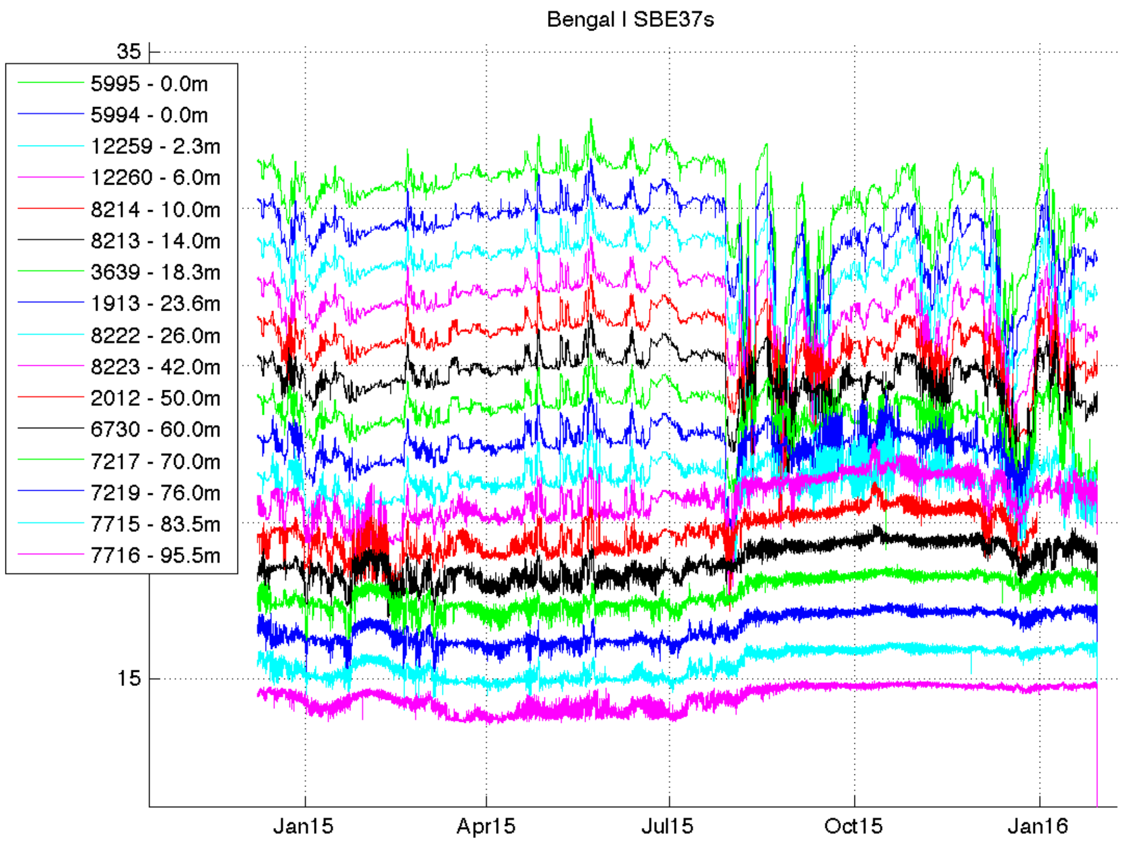

Figure 7. Time series of salinity from SBE 37s deployed on WHOI mooring, plotted with 1.0 psu offsets.

XR-420

WHOI UOP deployed 11 XR 420 temperature and conductivity loggers (https://rbr-global.com/products/standard-loggers).

Depths:

1 at 4 m	SN 13249
1 at 44 m	SN 15218
1 at 48 m	SN 15223
1 at 52 m	SN 15224
1 at 57.5 m	SN 15225
1 at 62.5 m	SN 15247
1 at 89.5 m	SN 17263
1 at 104 m	SN 17559
1 at 120 m	SN 17560
1 at 150 m	SN 17561
1 at 200 m	SN 17562

The XR 420 salinity records from these 11 XR-420s provided evidence of problems with the conductivity data. (Figure 8).

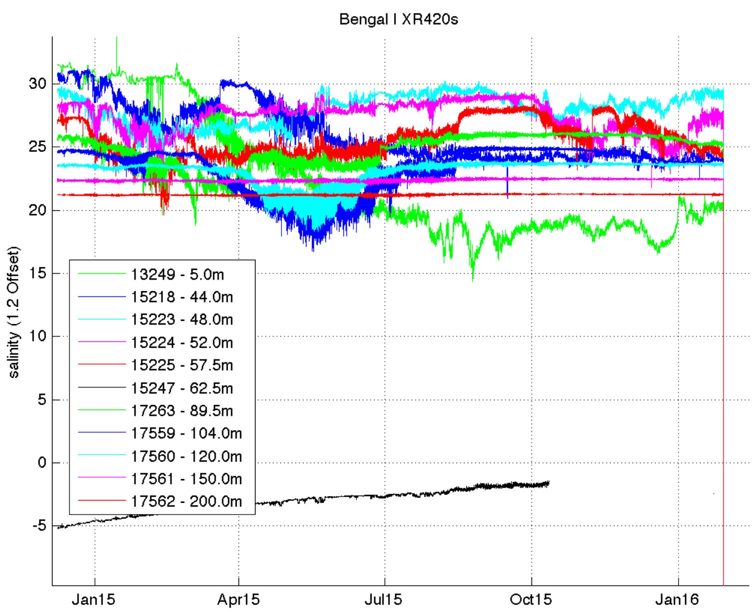

Figure 8. Raw salinity time series from the XR 420s, with 1.2 psu offsets.

Comparison of nearest neighbors and checking computed densities lead to replacing bad conductivity data with NaNs (Figures 9 and 10). Only the two deepest XR 420s produced full length salinity records, pointing to the XR 420 being compromised by bioufouling when near the surface.

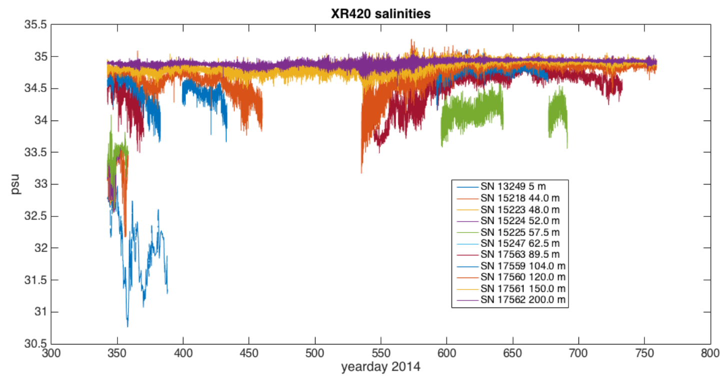

Figure 9. Overplot of XR 420 salinity data where considered good.

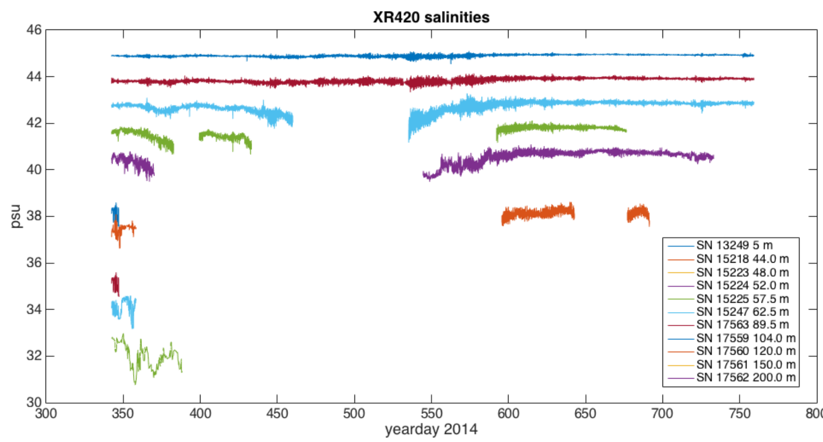

Figure 10. Overplot of XR 420 salinities with 1.0 psu offset. Only the two deepest, at top, returned full length salinity records.

4. Velocity Data

Six single depth current meters and two Acoustic Doppler Current Profilers (ADCPs) were deployed by UOP in order to collect velocity data in the water column: The six point current meters were: An Aanderaa Seaguard recording current meter at 11m; a Nortek Aquadopp current meter at 3.5 m; four VMCMs at 249, 501, 754 and 1007 m. The Aanderaa and Nortek use acoustic Doppler techniques to sample one depth. The upward looking Nortek ADCP was located at 17m, looking up, set up to sample 7 2m depth bins at depths 14m, 12m, 10m, 8m, 6m, 4m, and 2m. The upward looking RDI ADCP was located at 80m, set up to sample 35 2m depth bins starting at 74.5 m depth.

VMCMs

Four VMCMs (Weller, R.A. and R. E. Davis, 1980. A vector measuring current meter. *Deep-Sea Research*, **27A**, 565-582.) were deployed. These have external temperature sensors, precision temperature circuitry, and were calibrated at WHOI by UOP. The velocity sensors are propellers. Quality control checks verify that both propellers are turning and not bound up by fishing line or biofouling and that the compasses in the instruments are functioning. All four VMCMs returned full and good quality velocity data.

Depths	1 at 249m	SN 003
	1 at 501 m	SN 009
	1 at 754 m	SN 011
	1 at 1007 m	SN 038

Figure 11 shows the speeds and directions from the four VMCMs.

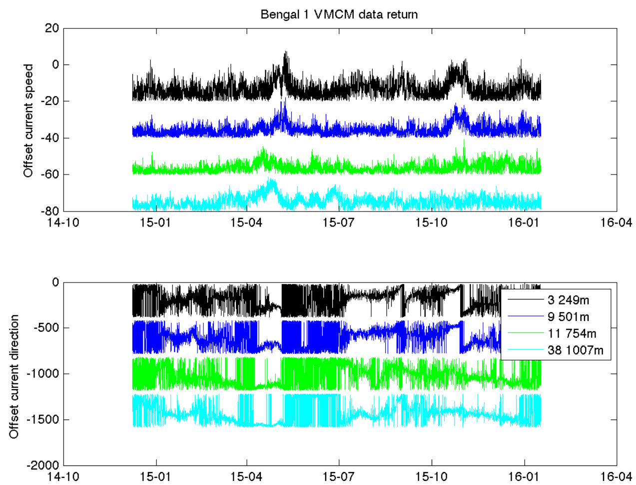

Figure 11. VMCM speed and direction time series from the four VMCMs deployed on the BoB surface mooring. Speeds (upper) offset by 0.2 m s^{-1} and directions by 400°.

Aanderaa Seaguard

The Aanderaa Seaguard recording current meter uses an acoustic Doppler sensor to sample velocities about 1 meter from the head. The instrument was also fitted with dissolved oxygen and conductivity sensors. The oxygen and conductivity sensors failed. Two sampling modes ran concurrently, one doing a burst sample for 5 minutes and one doing a 55-minute average every hour. The 5-minute sampling mode failed about 3/4 of the way through the record. For now, the data being carried forward are hourly velocity data based on the 55-minute sampling mode.

Depths	1 at 11 m	SN 33

The raw data file (labeled as the DCS file in Aanderaa output) has both the 55-minute data and the 5-minute data. Zeroes show up in the 5 minute records and hence in the raw file (Figure 12).

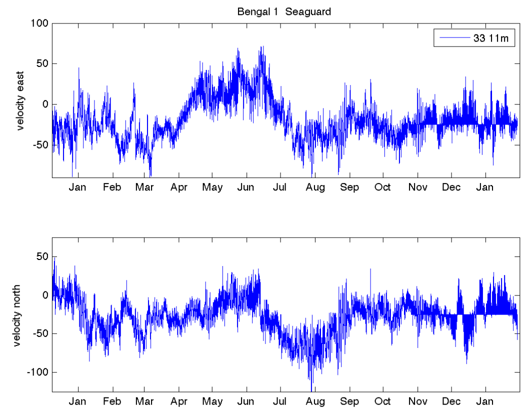

Figure 12. Raw velocity data from the Aanderaa Seaguard. Note the zeroes showing up in east and north when the 5-minute burst mode fails.

Using a variable called pingCount, failures of the burst mode were located and removed, then the remaining good 5 minute data and the 55 minute data were used to make a 60-minute time based velocity time series. Figure 13 shows the Aanderaa velocity time series that result.

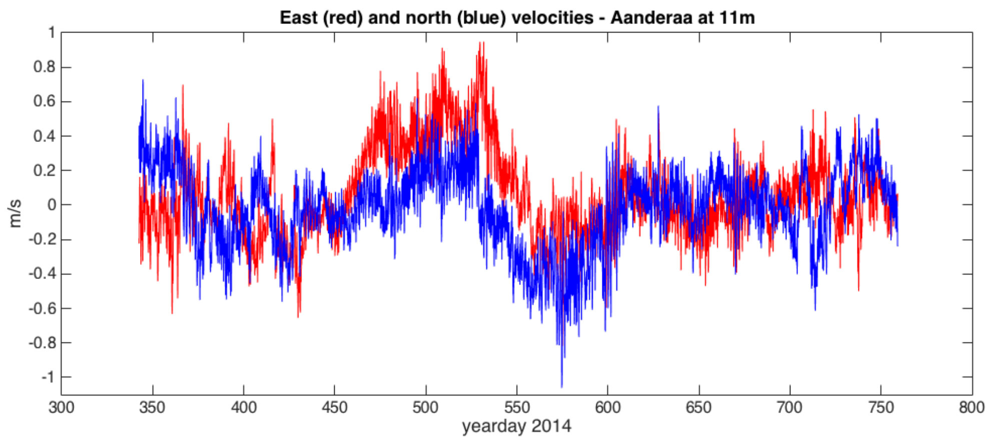

Figure 13. Hourly east and north velocities from the Aanderaa current meter at 11m.

Nortek Aquadopp

The Nortek Aquadopp was deployed as a fixed point current meter at 3.5 m depth.

Depth: 1 at 3.5 m SN 11975

This instrument returned a full length, hourly velocity record (Figure 14).

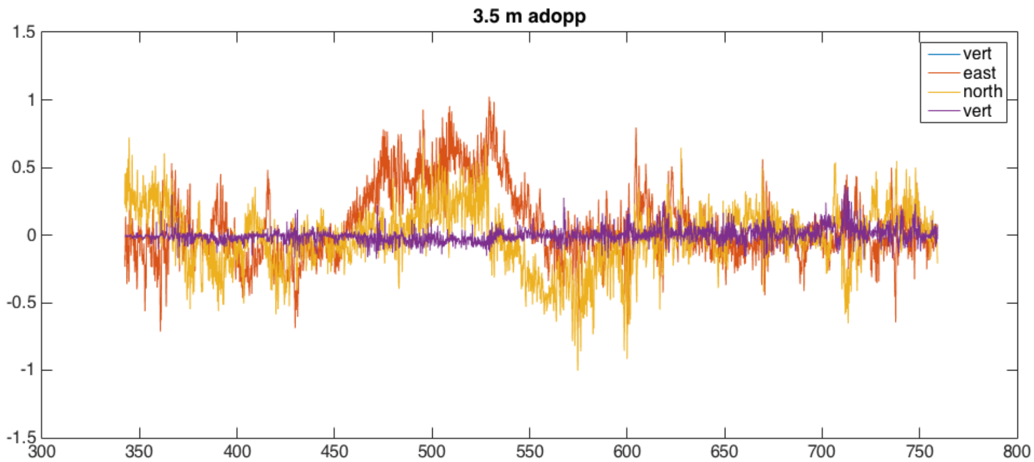

Figure 14. East, north, vertical velocities from 3.5 m Aquadopp.

Further confirmation that the 3.5 m Nortek agrees well with the 11 m Seaguard comes from a comparison of their progressive vector diagrams (Figure 15).

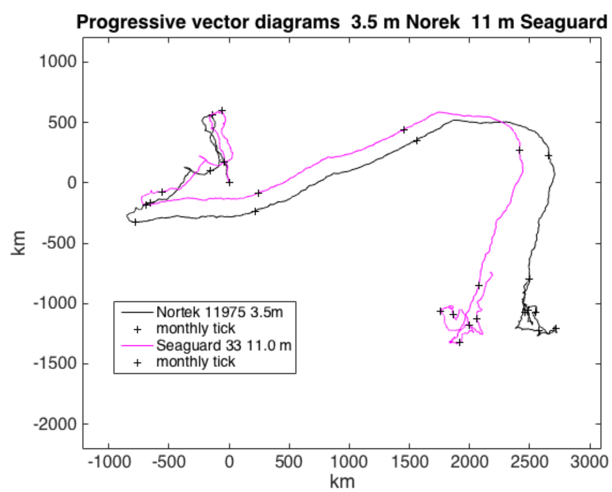

Figure 15. Overplot of the progressive vector diagrams of Seaguard SN 33 at 11 m (magenta) and the Nortek Aquadopp SN 11975 at 3.5 m.

Nortek Profiler

The Nortek profiler was deployed in an attempt to return velocities every 2m from 14 m upwards to the surface.

Depths 1 at 17 m SN 11437

Sampling bin	Depth
Bin 1	14 m
Bin 2	12 m
Bin 3	10 m
Bin 4	8 m
Bin 5	6 m

Bin 6	4 m
Bin 7	2 m

Among the diagnostic tools used to look at the velocity data were: 1) plotting progressive vector diagrams, 2) plotting rotary autospectra of velocity, 3) contour plots of east and north velocities, 4) contour plots of the vertical shear of the east and north velocities, 4) plots of signal strength (beam amplitude), 5) plots of speed, 6) plots of vertical velocities.

Progressive vector diagrams show the displacement associated with the velocity record and do well at showing differences in the low frequency speeds and directions. For the Nortek profiler the overplot of the progressive vector diagrams for all depths (Figure 16) points to the 2 m bin

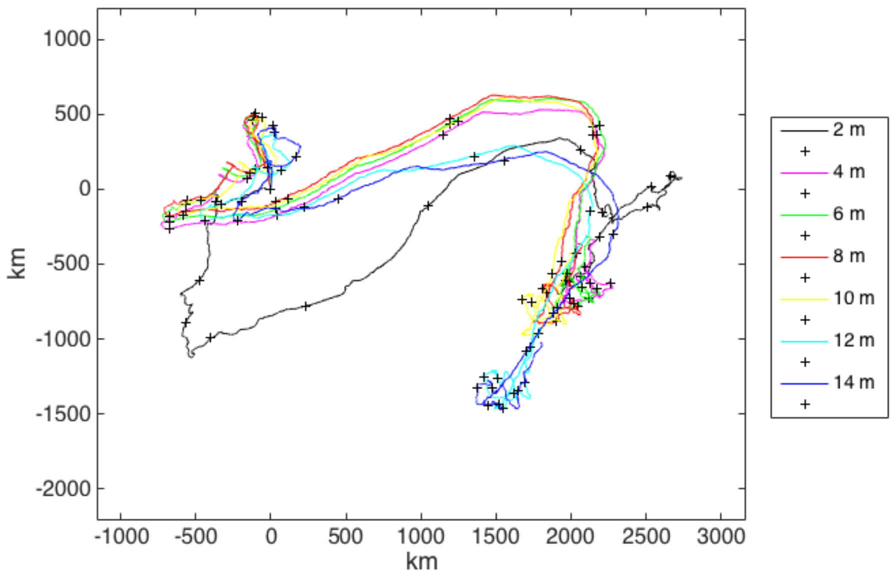

Figure 16. Overplot of progressive vector diagrams for the velocities from the 7 bins from the Nortek profiler.

being very different, the 4, 6 , 8, and 10 m bins being similar, and 12 and 14 m similar to each other but different from 4, 6, 8, and 10 m.

Plotting the beam amplitudes (Figure 17) shows very high amplitudes for 2m, and for 12 and 14m.

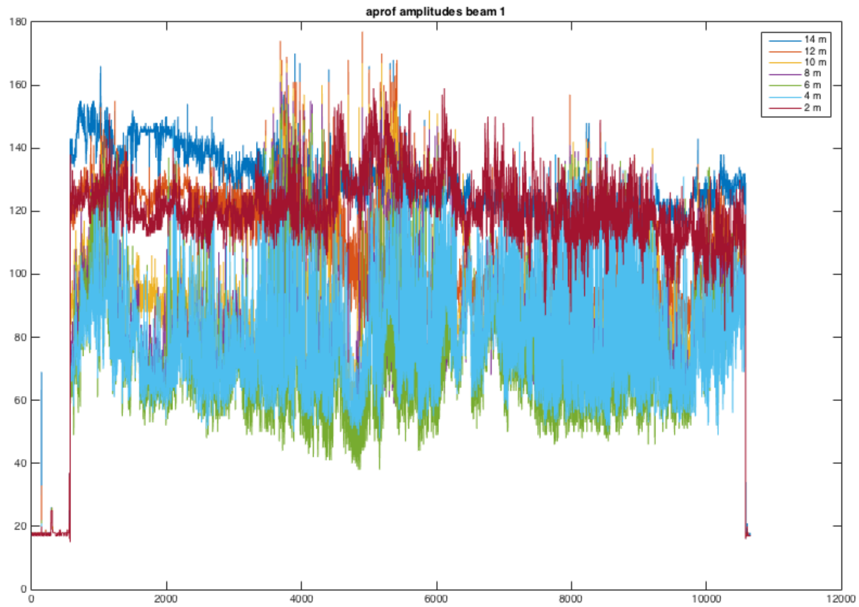

Figure 17. Beam 1 amplitudes for the 7 depth bins from the Nortek profiler.

So, the 2 m, 12 m, and 14 m bins of Nortek profiler data are considered suspect, perhaps from returns from the sea surface for 2m depth and from nearby instruments for 12 m and 14 m.

Computation of rotary autospectra for all depth bins for the Nortek profiler showed energetic high frequency spikes at harmonics of 24 hours in the 4m bin. The higher high frequency noise level of the 4 m ADCP bin together with the high frequency spectral peaks (Fig. 18) suggested that the 4m bin not be used and that the 3.5 m fixed depth Aquadopp performed better, with lower high frequency noise level and less spectral spikes at high frequency (Fig. 19).

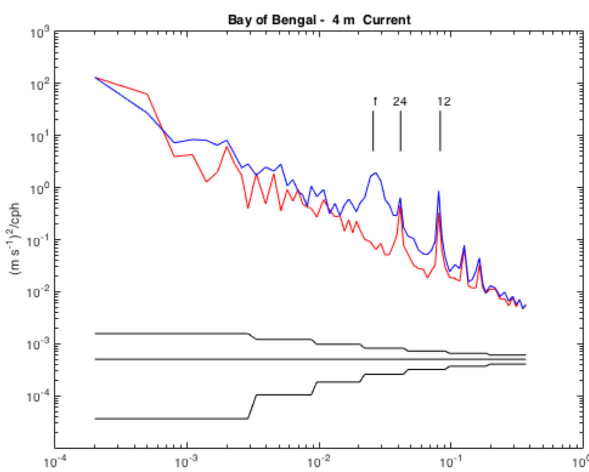

Figure 18. Rotary autospectra of velocity from 4 m bin of Nortek profiler SN 11437. Blue – clockwise; red counterclockwise. 95% confidence limits decrease with increasing band averaging.

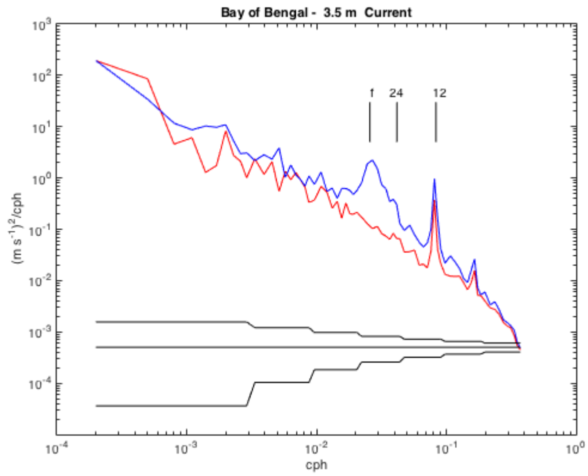

Figure 19. Rotary autospectra of velocity from the fixed depth single point Nortek current meter SN 11975 at 3.5 m.

Looking at expanded plots of beam intensity from the Nortek profiler shows unexplained spikes in the intensity at 4 m (Fig. 20), further disqualifying data that depth from being judged good.

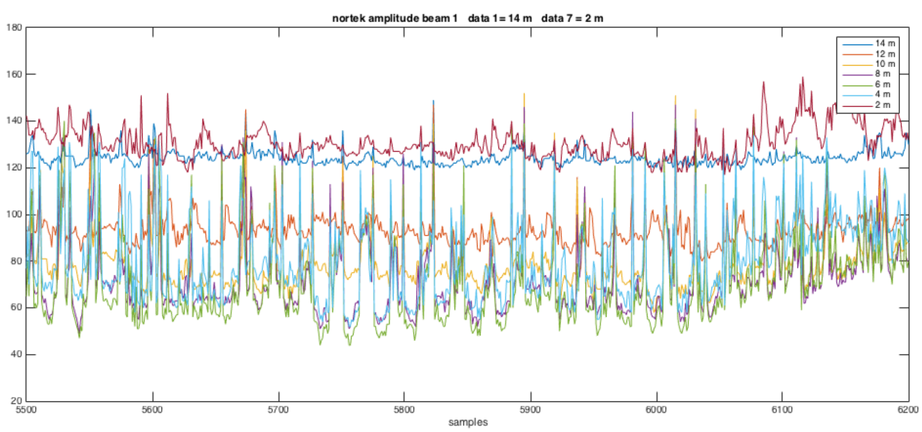

Figure 20. Amplitudes of beam1 for the seven depths. Note the high frequency spiking in the amplitude from the 4 m bin. 2m and 14m amplitudes are very high and 12 m amplitudes are elevated above other depths.

So, for the Nortek profiler, only data from the 6m, 8m, 10m bins have been judged good.

RDI Profiler

The RDI profiler was deployed in an attempt to return velocities every 2m from ~80 m upwards to the surface, with overlapping with other current meters. The bins have been ordered so the first bin is the shallowest, and there were 35 bins processed initially.

Depths 1 at 80 m SN 14193

Sampling bin	Depth
Bin 1	6.52 m
Bin 2	8.52 m
Bin 3	10.52 m
Bin 4	12.52 m
Bin 5	14.52 m
Bin 6	16.52 m
Bin 7	18.52 m
Bin 8	20.52 m
Bin 9	22.52 m
Bin 10	24.52 m
Bin 11	26.52 m
Bin 12	28.52 m
Bin 13	30.52 m
Bin 14	32.52 m
Bin 15	34.52 m
Bin 16	36.52 m
Bin 17	38.52 m
Bin 18	40.52 m
Bin 19	42.52 m
Bin 20	44.52 m
Bin 21	46.52 m
Bin 22	48.52 m
Bin 23	50.52 m
Bin 24	52.52 m
Bin 25	54.52 m
Bin 26	56.52 m
Bin 27	58.52 m
Bin 28	60.52 m
Bin 29	62.52 m
Bin 30	64.52 m
Bin 31	66.52 m
Bin 32	68.52 m
Bin 33	70.52 m
Bin 34	72.52 m
Bin 35	74.52 m

Various plots were made using the data from these 35 bins. Figure 21, for example, overplots the hourly east velocities from all 35 bins.

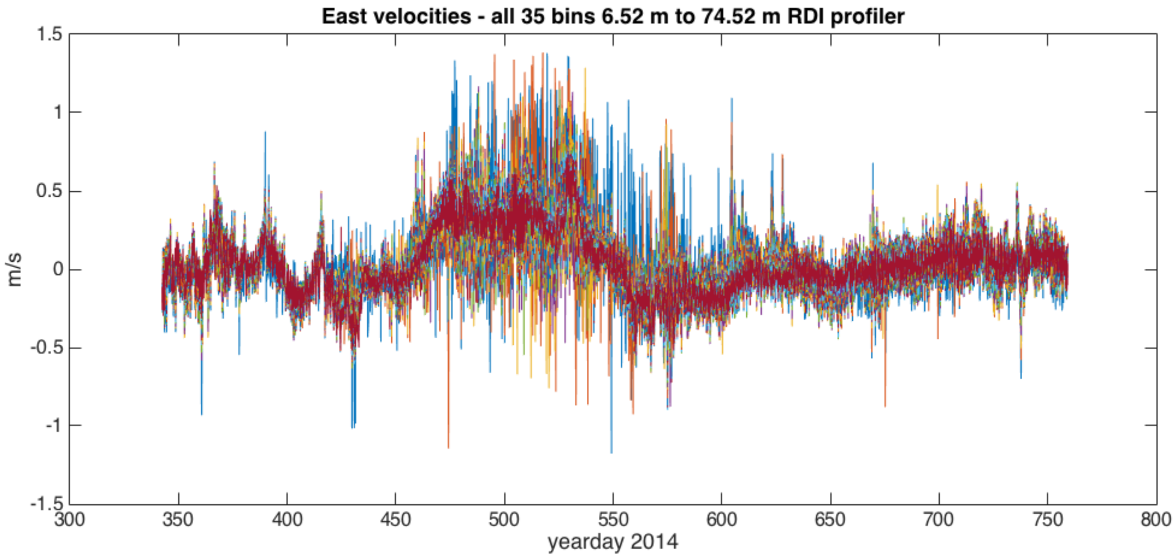

Figure 21. East velocities from all 35 m bins of the RDI.

Figure 21 generated concern about why difference, of both signs, and enhanced high frequency variability were apparent from yeardays ~450 to ~600. It is interesting to note that this period when the RDI velocities are noisy coincides with the large feature in the velocity data from mid-April to mid-August when strong flow to the east turns clockwise with time and becomes strong flow to the southwest (Figure 22 shows vector sticks, progressive vector diagrams such as Fig. 15 also show this feature).

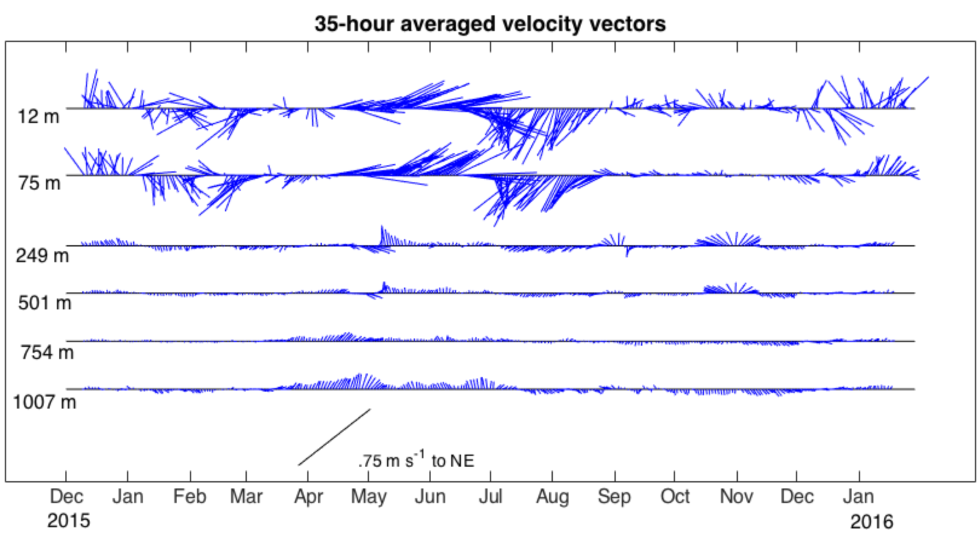

Figure 22. Velocity vectors from the Aanderaa Seaguard (labeled 12 m), RDI bin 35 (labeled 75 m), and the four VMCMs at 249, 501, 754 and 1007 m.

To look at the possibility of variability in scattering intensity associated with the large velocity feature being the source of velocity error, intensities were plotted at various depths. The overplot of the shallowest four bins shows Bin 1 – 6. 52m, much higher than the next 3 bins downs, so Bin 1 data is considered suspect (Figure 23). Note also that intensity variability was seen in the middle of the record.

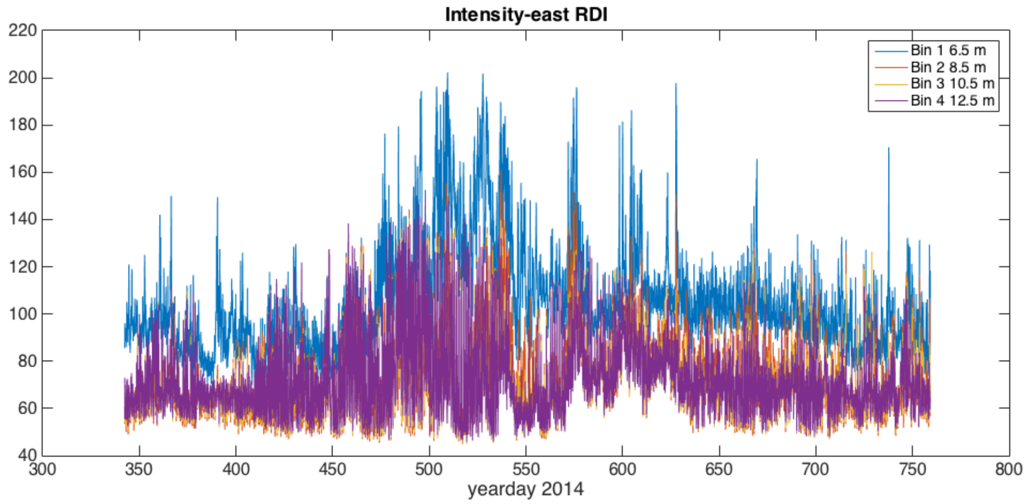

Figure 23. East intensity for the shallowest four bins of the RDI ADCP.

The RDI ADCP with four beams provides a measure of error velocity which indicates how well the four beams are seeing the same velocity and is suggested in RDI technical literature as a better measure of data quality than echo intensity. Looking at error velocity for the shallowest four bins (Figure 24)

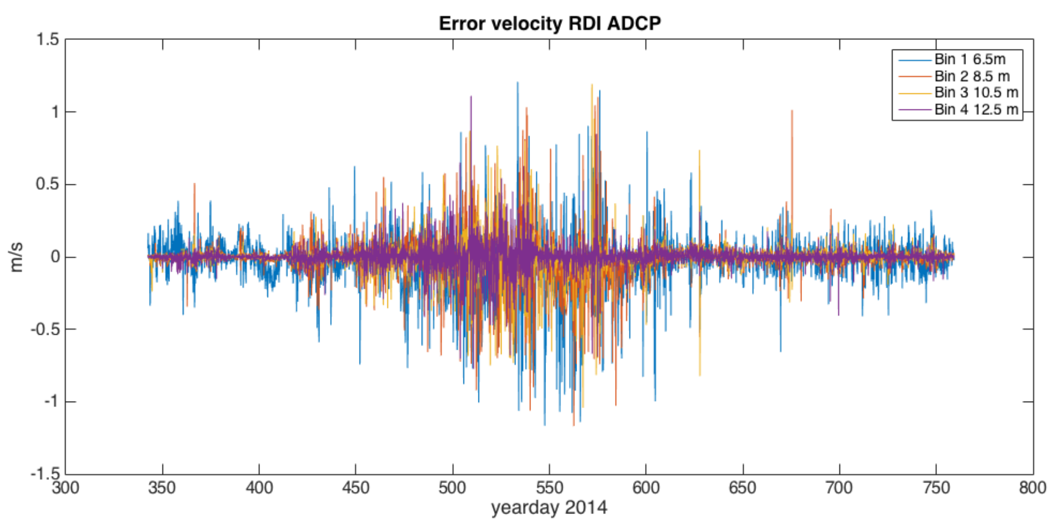

Figure 24. Error velocity from the shallowest 4 bins of the RDI ADCP.

Comparison of shallow RDI velocities with the Nortek fixed depth current meter at 3.5 m and the Aandera at 11 m confirms that the shallow RDI velocity data has large error, mostly concentrated during the strong velocity event in the middle of the record (Figure 25).

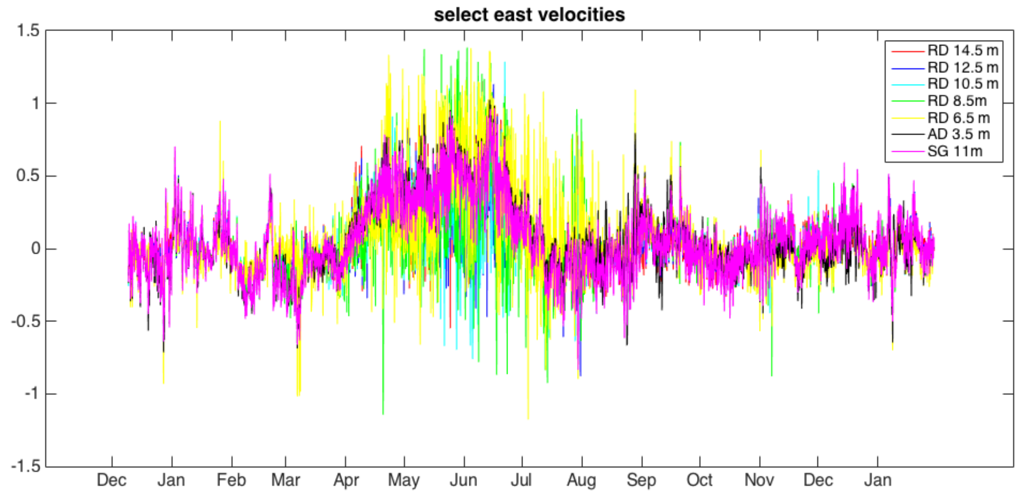

Figure 25. Comparison of the east velocity time series in the shallowest 5 bins of RDI ADCP data with the east velocities from the 3.5 m Nortek Aquadopp and the 11 m Aanderaa Seaguard.

An effort was made to assess the extent to which all depth bins of the RDI data. The error velocities, for example, in Fig. 26 are much smaller (an order of magnitude) than those in the shallowest four bins (Fig 24).

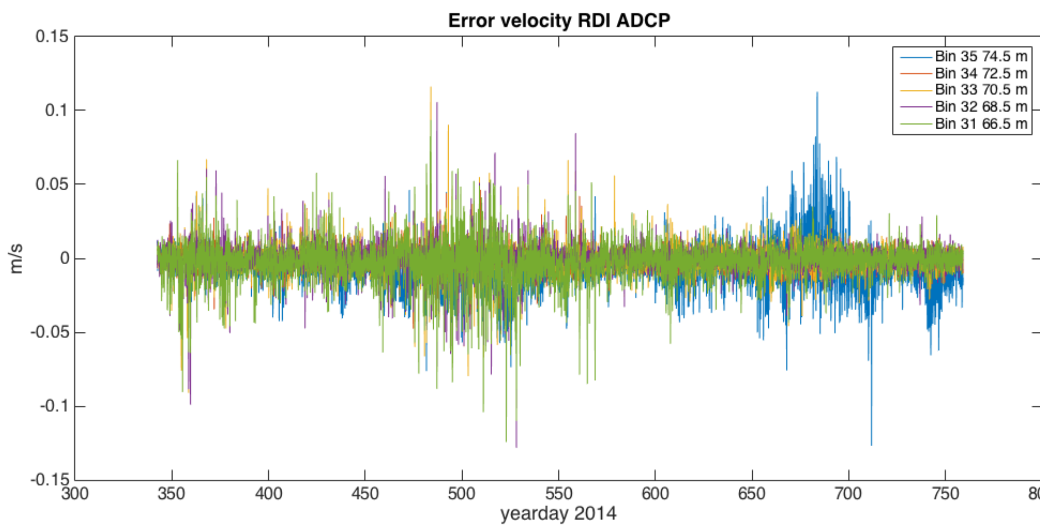

Figure 26. Error velocity time series for the deepest 5 bins of the RDI ADCP.

Error velocity grows going up in the water column, becoming large at depths shallower than about 50 m (Figure 27). An additional check was a comparison of RDI velocities against the fixed depth current meters at 3.5 m and 11 m. Bins 35 (74.5 m) and 34 (72.5 m) overplotted with the shallow fixed depth current meters show good comparisons (Fig. 28). However, differences showed up that grow larger as shallower RDI bins were examined; and the differences were largest at the mid-record time of large error velocities (Fig 29 shows an example).

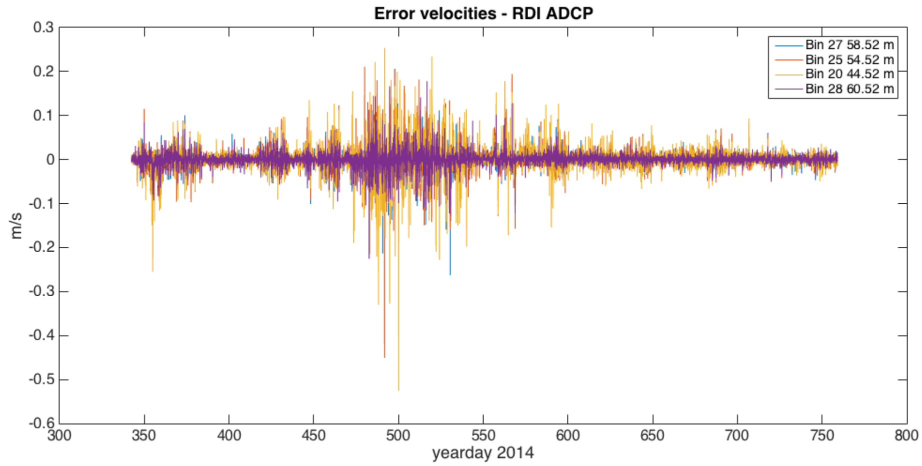

Figure 27. Error velocities from select bins of the RDI data. Error grows with distance away from the instrument, getting larger at depth of about 50 m and shallower.

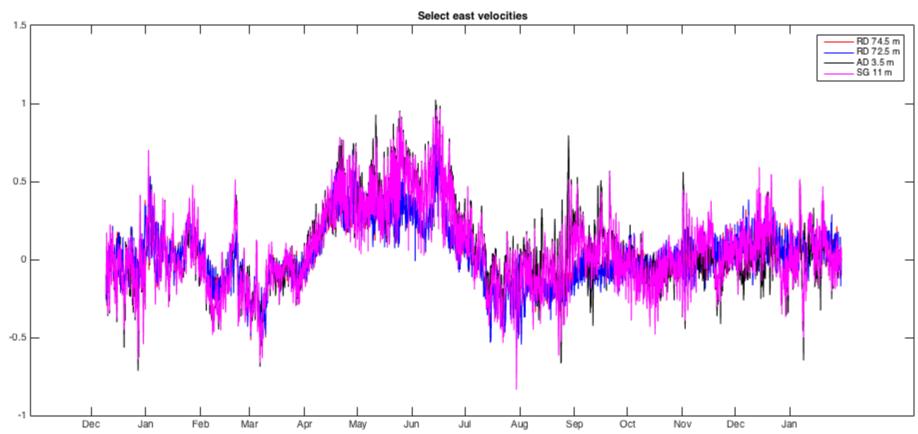

Figure 28. Overplot of east velocities from the two deepest RDI bins and the fixed depth Aquadopp and Seaguard.

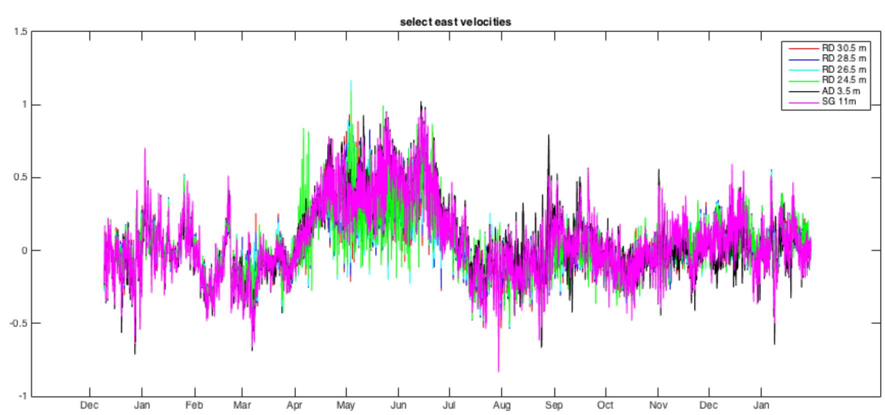

Figure 29. Overplot of east velocities from select RDI bins at depth 24.52m to 30.52 m with the 3.5 m Aquadopp and 11 m Seaguard.

For now, RDI data from only Bins 28 to 35, inclusive are being distributed. Work on understanding and, if possible, mitigating the large velocity errors in the RDI data at shallower depths continues.

5. Data Files

All files are in Matlab .mat format. Yday is the time UTC relative to Jan 1 2014 with noon Jan 1 2014 = 1.5. Velocity has had the magnetic deviation correction applied.

The inclusion of 'fixed' in a file name means it has been subject to truncation to the period of good data, had corrections applied.

Solo-T

Beng1_solo_76104_fixed.mat
Beng1_solo_76106_fixed.mat
Beng1_solo_76110_fixed.mat
Beng1_solo_76111_fixed.mat
Beng1_solo_76573_fixed.mat
Beng1_solo_76574_fixed.mat
Beng1_solo_76576_fixed.mat
Beng1_solo)76577_fixed.mat
Beng1_solo_76579_fixed.mat
Beng1_solo_76582_fixed.mat

In Matlab

Your variables are:

depth	infile	lon	note	yday
experiment	inst_type	mday	sn	year
fix_date	lat	meta	temp	

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday
press=pressure db
sn=serial number

XR-420

B1_xr420_17623_fixed.mat
B1_xr420_17561_fixed.mat
B1_xr420_17652_fixed.mat
B1_xr420_17560_fixed.mat
B1_xr420_13249_fixed.mat
B1_xr420_17559_fixed.mat
B1_xr420_15225_fixed.mat
B1_xr420_15218_fixed.mat
B1_xr420_15224_fixed.mat
B1_xr420_15223_fixed.mat
B1_xr420_15247_fixed.mat

In Matlab

Your variables are:

cond	infile	mday	rawsal	sigma	yday
depth	inst_type	meta	rawsigma	sn	year
experiment	lat	note	rawspeccond	sos	
fix_date	lon	rawcond	sal	temp	

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday
press=pressure db
sn=serial number
sal=salinity psu
sigma=potential density kg m^{-3}
rawsal=unedited, original data
rawsigma=unedited, original data
cond=conductivity mS/cm
rawcond=unedited conductivity data

SBE 39

Beng1_sbe39_0045_fixed.mat
Beng1_sbe39_0051_fixed.mat

In Matlab

Your variables are:

depth	fix_date	inst_type	lon	meta	temp	year
experiment	infile	lat	mday	sn	yday	

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday
press=pressure db
sn=serial number

SBE 37

beng1_sbe37_3639_fixed.mat
beng1_sbe37_7716_fixed.mat
beng1_sbe37_7715_fixed.mat
beng1_sbe37_7219_fixed.mat
beng1_sbe37_6730_fixed.mat
beng1_sbe37_7217_fixed.mat
beng1_sbe37_2012_fixed.mat
beng1_sbe37_8222_fixed.mat
beng1_sbe37_8223_fixed.mat
beng1_sbe37_1913_fixed.mat
beng1_sbe37_8213_fixed.mat
beng1_sbe37_8214_fixed.mat
beng1_sbe37_12260_fixed.mat
beng1_sbe37_5994_fixed.mat
beng1_sbe37_12559_fixed.mat

In Matlab

Your variables are:

cond	fix_date	lat	meta	sn	year
depth	infile	lon	sal	temp	
experiment	inst_type	mday	sigma	yday	

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
meta=metadata

depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday
sn=serial number
sal=salinity psu
sigma=potential density kg m^{-3}
cond=conductivity mS/cm

<u>Aanderaa Seaguard current meter</u>

Beng1_SG33fixfullhr.mat

In Matlab

Your variables are:

asathr	depth	longitude	oxygenhr	speedhr	vvelhr
cndhr	dirhr	meta	presshr	tmphr	ydaynew
ctemphr	latitude	otemphr	ptemphr	uvelhr	

ydaynew = time UTC in days relative to Jan 1 2014
tmphr = temperature deg C
uvelhr, vvelhr = east, north velocity components m s^{-1}
speedhr=flow speed m s^{-1}
dirhr=flow direction degrees
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday
sn=serial number
asathr=optode data – no good
sigma=potential density kg m^{-3}
cndhr=conductivity data – no good
presshr=pressure db
ctemphr=temp from conductivity cell
oyemphr=temp from optode
ptemphr=temp from pressure sensor

Nortek Aquadopp current meter

Beng1_nortek_11975_fixed.mat

In Matlab

Your variables are:

amp1	batt	depth	lat	mday	note	roll	yday
amp2	curdir	east	lon	meta	pitch	temp	year
amp3	curspd	head	magvar	north	press	vert	

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
east, north = velocity components m s^{-1}
curspd=speed m s^{-1}
curdir=current direction degrees
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday
press=pressure db
amp1, amp2, amp3 = beam amplitudes
pitch, roll = pitch, roll degrees
batt=battery voltage volts
head+instrument heading degrees

Nortek ADCP

Beng1_aqdpro_11437_fixed_sub.mat

In Matlab

Your variables are:

ans	infile	magvar	pitch	subcurdir	subnorth
batt	instdepth	mday	press	subcurspd	temp
experiment	lat	meta	roll	subdepth	yday
head	lon	note	sn	subeast	year

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
subeast, subnorth = velocity components m s^{-1} at 6, 8, and 10 m
subcurspd=speed m s^{-1} at 6, 8, and 10 m
subcurdir=current direction degrees at 6, 8, and 10 m
sn=serial number
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday

batt=battery voltage volts

RDI ADCP

Beng1_rdi_14193_fixed_new_sub.mat

In Matlab

Your variables are:

err	magvar	subcurdir	subintensityvert
experiment	mday	subcurspd	subnorth
head	meta	subdepth	subvert
infile	note	subeast	temp
instdepth	pitch	subintensityeast	yday
lat	sal_ref_val	subintensityerr	year
lon	sn	subintensitynorth	

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
subeast, subnorth = velocity components m s^{-1} at 60.5200 62.5200 64.5200 66.5200 68.5200 70.5200 72.5200 74.5200 m
subcurspd=speed m s^{-1} at 60.5200 62.5200 64.5200 66.5200 68.5200 70.5200 72.5200 74.5200 m
subcurdir=current direction degrees at 60.5200 62.5200 64.5200 66.5200 68.5200 70.5200 72.5200 74.5200
sn=serial number
meta=metadata
subdepth=depth meters for the 8 bins passing QC
lat=latitude
lon=longitude
year=reference year for yday
subintensityeast = for each east, north, vertical, error intensities for the 8 bins
err= error velocoities m s^{-1} for the 8 bins

VMCMs

Beng1_vmcm_38_fixed.mat
Beng1_vmcm_11_fixed.mat
Beng1_vmcm_09_fixed.mat
Beng1_vmcm_03_fixed.mat

In Matlab

Your variables are:

curdir	east	infile	lon	meta	temp
curspd	experiment	inst_type	magvar	north	yday
depth	fix_date	lat	mday	sn	year

yday = time UTC in days relative to Jan 1 2014
temp = temperature deg C
east, north = velocity components m s^{-1}
curspd=speed m s^{-1}
curdir=current direction degrees
sn=serial number
meta=metadata
depth=depth meters
lat=latitude
lon=longitude
year=reference year for yday