Yuan-Sprintall MMP processing 10-26 June 2013

Summary of progress

1. Identified failed profiles, determined nominal causes, summarized in spreadsheet (see appendix). This was done by scanning the engineering summary file for non-normal terminations, and finding unpacked data files which were shorter than the norm (both tasks done using shell scripts rather than in Matlab).
2. Found and read MMP processing documentation, familiarized myself with the WHOI software. In addition to the reame html file that accompanies the whoi matlab routines, I recommend reading the tech report "BGFE 2003-2004 MMP EMCTD and CM Data Processing Procedures" by R. Krishfield et al"
3. Compass corrections and bias derived. (see spintest and related files ..).
4. First –pass gridded T and S data plotted – S data shows problems after cast 83. Casts 1-83 S is low by a significant amount compared to ctds taken before and after deployment
5. Post-83 S problems appear to be due to a damaged conductivity cell.
6. Made first pass at velocity bias and scale corrections. The results will require some further analysis and hand-editing to derived smooth bias estimates. So far, the bias estimates were derived only for casts 1-83, with down and up casts treated separately per recommendation in the WHOI documentation.

Matlab software – scripts and revisions

1. Revised parts of the whoi software to accommodate the short tails in this mmp data set (set below for full explanation)
2. Downcast_tails.m finds startup and rampdown parts of cast, plots diagnostics
3. Make_tpgrid - construct a time-pressure grid from grd format files output from the whoi mmp_pgrid routines
4. tsplot – trivial little routine to make a theta-sa plot for a range of mmp casts, and superimpose data from nbp1302 ctds 136-140 for comparison

Tasks remaining

1. finish bias and scale correction of velocity data. This requires considerable manual editing, and iterative application of the bias correction routines followed by re-gridding of the corrected data. Determine if the aquadopp data can be used in the bias estimate.
2. Merge final, gridded mmp data with SBE-derived temperature and salinity time series.
3. determine what can be done about the conductivity data. This may have to wait until the instrument returns and the nominal cause of the problem determined.

1. ACM Compass cal

A spin test file was located in Xiaojun's files dating from Sept 2008. The spin test data file spintest.txt is the raw capture from the MMP bench test, not the reduced 8-element file expected by the McLane routine acm_corr.m. The following are runs of acm_corr with field data. These results will be compared to the Word doc "std to the fit.doc" provided by Xiaojun, which I think lists bias and scale values for data reduced from the 2008 spintest.txt file.

Results from field profiles (even numbered casts are downcasts). "Partial" means that data were present in all 4 quadrants, but not a complete circle.

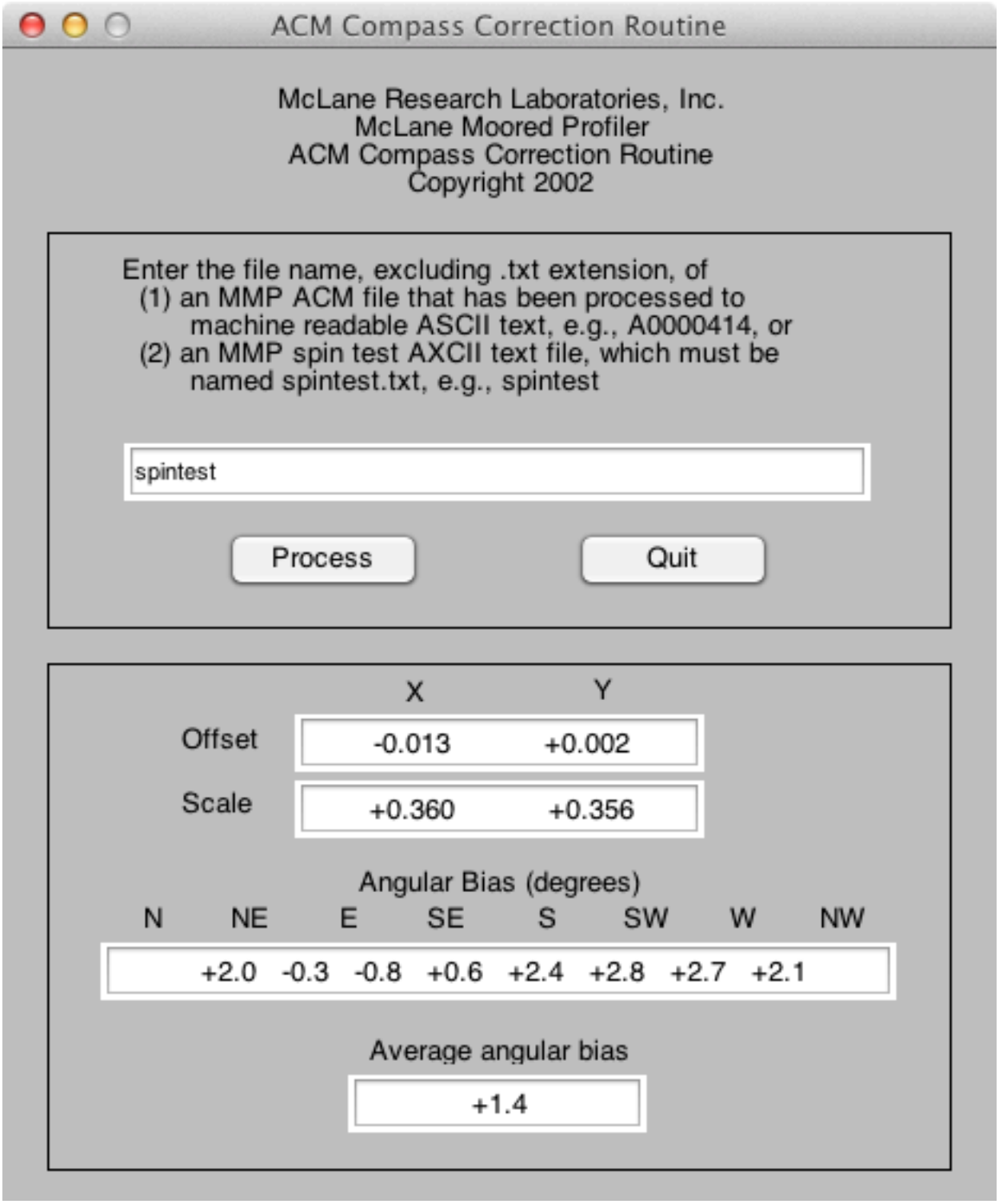
Profile #	Biases		Scales		Comments
	Hx	Hy	Hx	Hy	
Oct2008 spin	-0.0125	0.0041	0.3630	0.3605	
June2013 spin file	-0.013	0.002	0.360	0.356	File created from original spintest via excel average
003					No cal
004					No cal
007	0.018	0.015	0.347	0.339	
008	0.015	0.015	0.346	0.341	
031	0.009	0.013	0.355	0.344	partial
032	0.012	0.015	0.348	0.341	
061					No cal
062	0.009	0.010	0.355	0.346	partial
063	0.017	0.017	0.345	0.339	partial
099	0.019	0.021	0.347	0.340	
100	0.021	0.019	0.352	0.340	partial
101	0.019	0.019	0.346	0.340	
102	0.015	0.019	0.347	0.342	
131					No cal
132	0.018	0.021	0.349	0.343	partial
133					No cal
134	0.018	0.018	0.346	0.340	
135	0.018	0.019	0.346	0.341	
137	0.023	0.021	0.353	0.340	partial
165	0.020	0.019	0.349	0.341	partial
168	0.017	0.020	0.347	0.339	

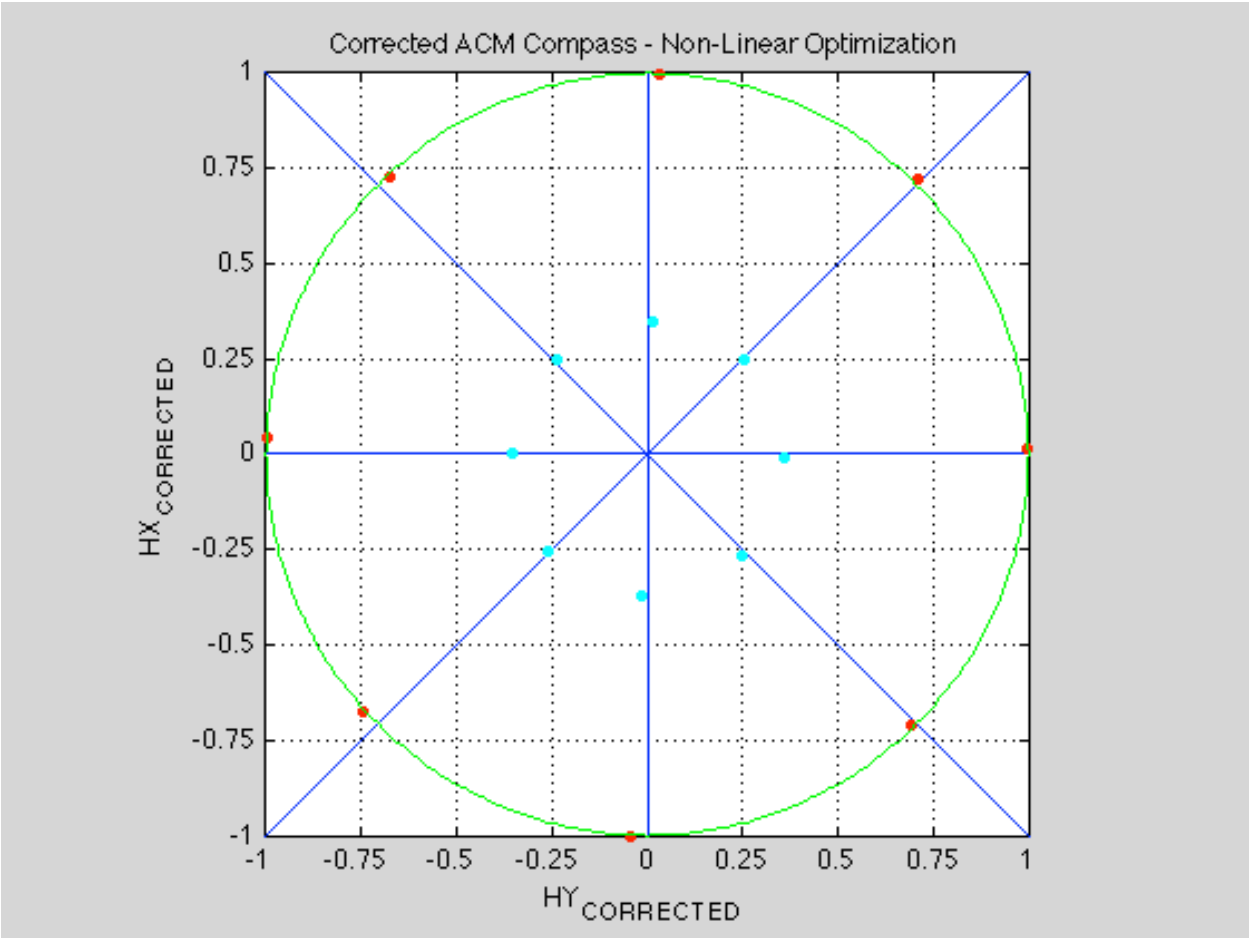
252	0.008	0.019	0.345	0.339	
257	0.014	0.019	0.348	0.343	
258	0.010	0.018	0.347	0.340	
355	0.008	0.017	0.348	0.342	
357	0.008	0.017	0.347	0.342	
358	0.007	0.019	0.346	0.342	
455	0.011	0.015	0.345	0.339	Partial
456	0.007	0.011	0.346	0.338	Partial
457	0.007	0.017	0.354	0.346	Partial
458					No good cals between 458 and 490
490	0.001	0.019	0.345	0.337	
491	0.008	0.018	0.344	0.339	
552	0.000	0.020	0.345	0.339	Partial
555	0.004	0.021	0.348	0.340	Partial
556	-0.005	0.019	0.352	0.343	
565	0.004	0.017	0.347	0.342	
651	0.000	0.019	0.344	0.340	Partial
654	0.000	0.019	0.346	0.341	Partial
655	0.002	0.018	0.347	0.341	
715	0.000	0.017	0.347	0.342	
716	-0.004	0.015	0.349	0.342	
717	-0.001	0.014	0.351	0.343	
714	-.002	0.017	0.349	0.341	

Per the John Toole mmp processing software documentation, and reference to WHOI tec rep "BGFE 2003-2004 MMP EMCTD and CM Data Processing Procedures" by R. Krishfield et al, I will use an average of the above offset/scale values, and the compass (angular) bias calculated from the spin test. We must also include a magnetic declination for the mooring site, to be determined using the NGDC web tool.

Recalculation of spintest.txt data

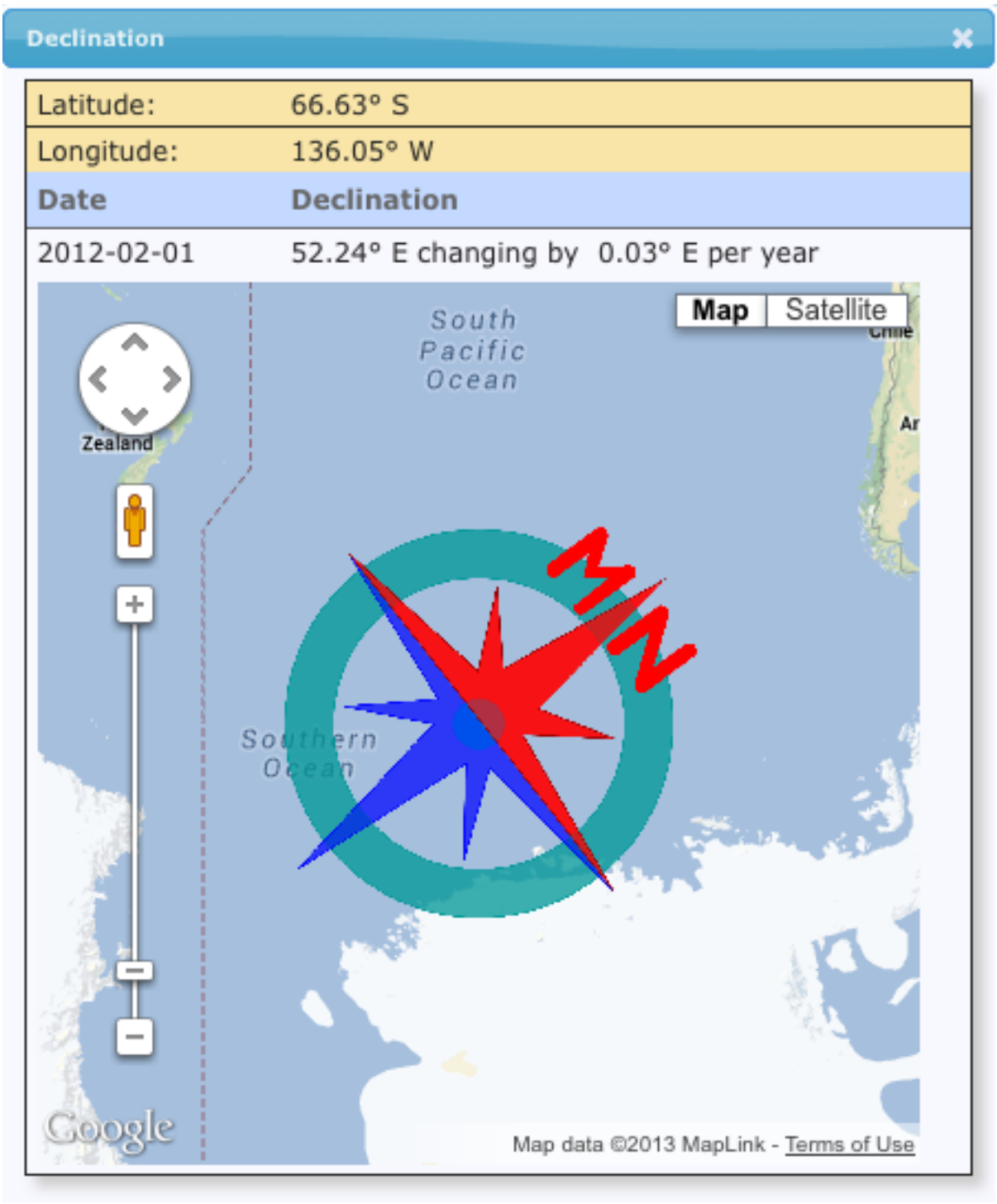
I cut the data columns from the original "spintest.txt" file, which was just the raw capture file from the mmp bench test. Imported it into excel, created 8 points by averaging over groups which appeared to be associated with the 8 test compass points. Screen captures of the acm_corr,m output are below:


ACM Compass Correction Routine
McLane Research Laboratories, Inc.
McLane Moored Profiler
ACM Compass Correction Routine
Copyright 2002
Enter the file name, excluding .txt extension, of
(1) an MMP ACM file that has been processed to
machine readable ASCII text, e.g., A0000414, or
(2) an MMP spin test AXCII text file, which must be
named spintest.txt, e.g., spintest
spintest
Process
Quit
X
Y
Offset
-0.013
+0.002
Scale
+0.360
+0.356
Angular Bias (degrees)
N
NE
E
SE
S
SW
W
NW
+2.0
-0.3
-0.8
+0.6
+2.4
+2.8
+2.7
+2.1
Average angular bias
+1.4



Acm cal file produced using averages from acm_corr output above. See excel file CompassCalFieldData.xlsx and cal files ctdcal130620 and acmcal130620.mat produced using WHOI routines create_ctd_calfile and create_acm_calfile. For the ctd, used dummy values of poly order =1, coeffs = 1,0.

Magnetic Declination calculated from http://www.ngdc.noaa.gov/geomag-web/#declination:



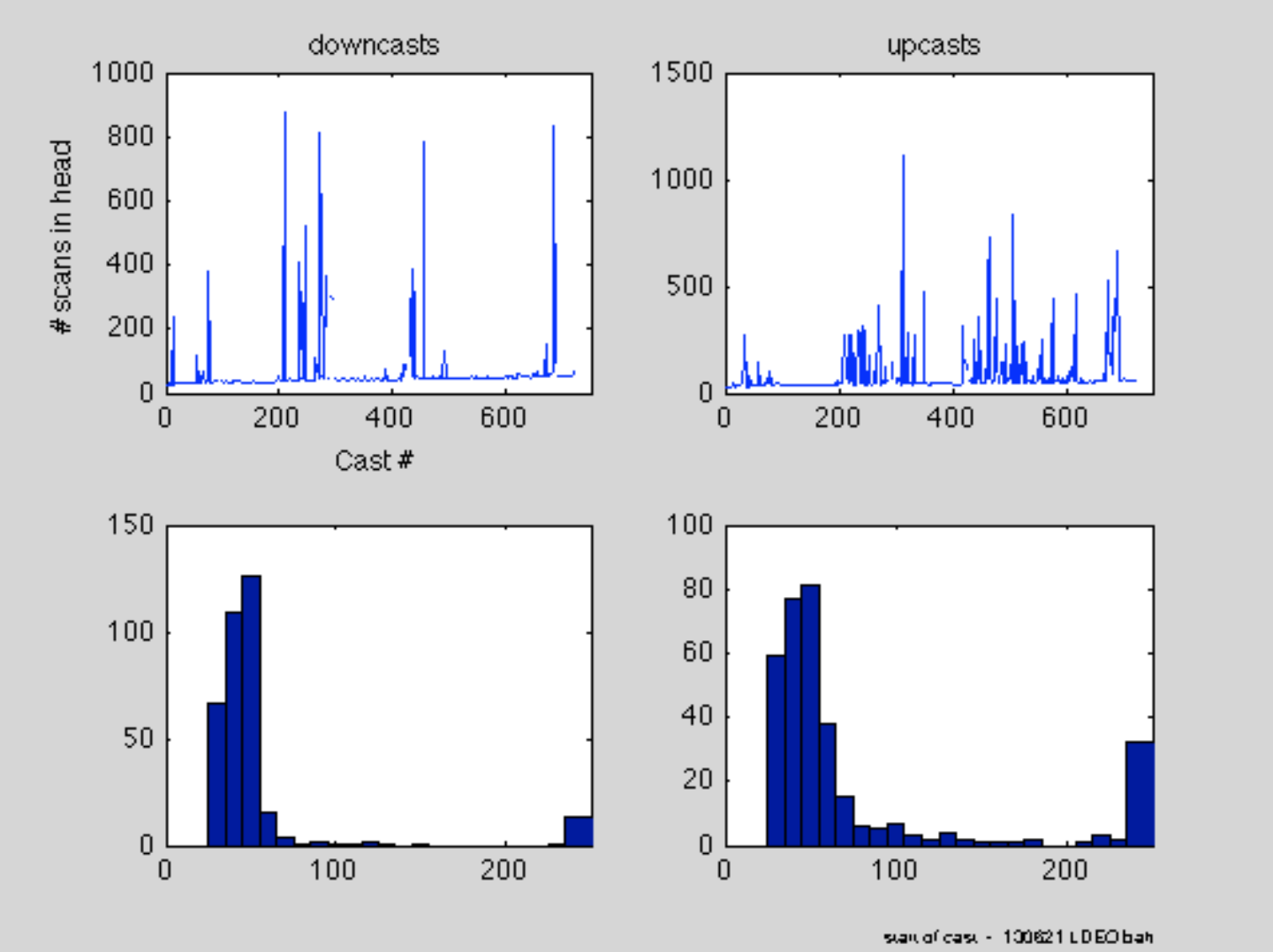
2. Merge and grid file production

Using WHOI MMP software

Preliminary processing indicates that the ramp down as the
% mmp reaches its max pressure is only 10 or so seconds long on the down casts, resulting in

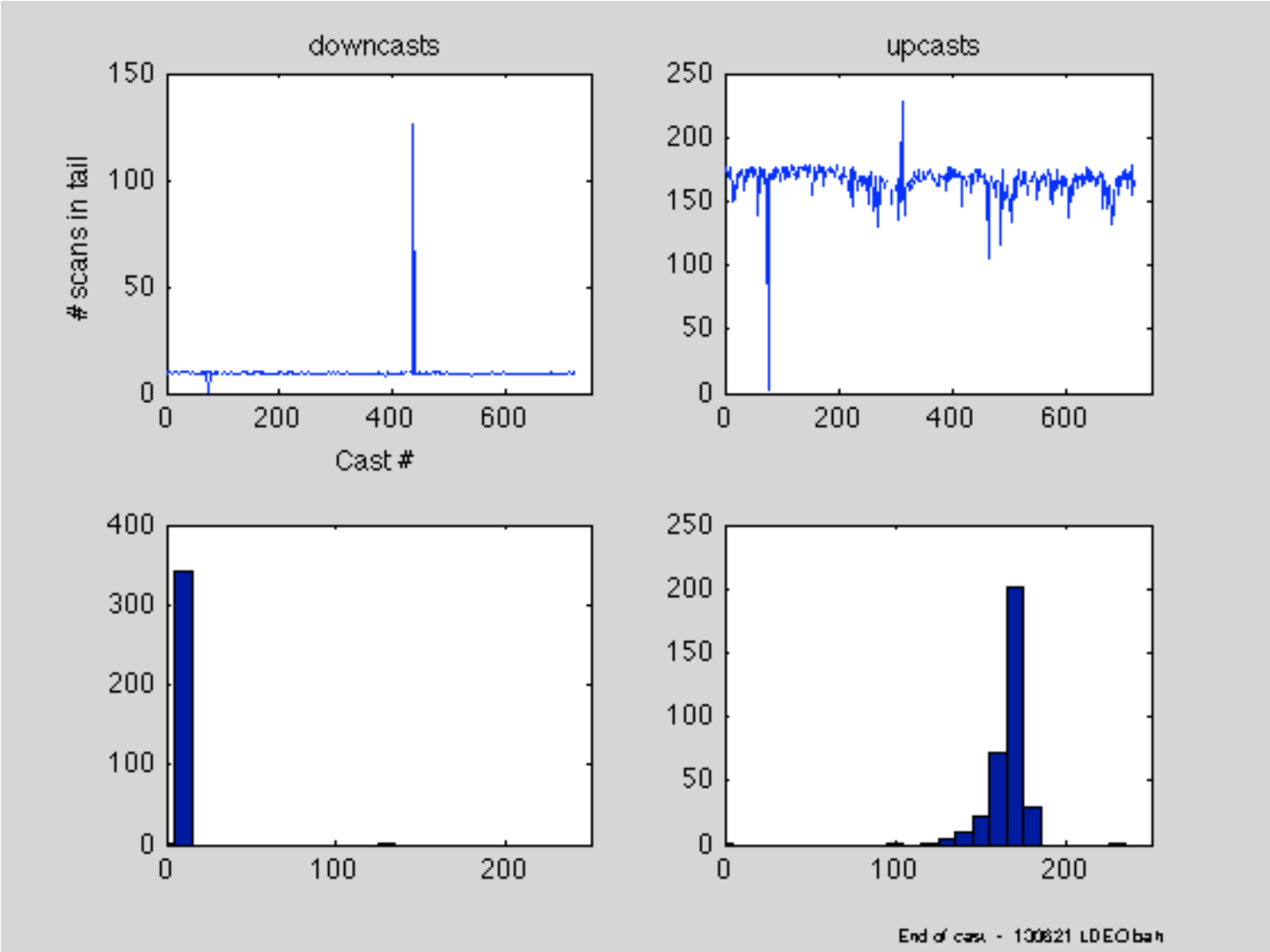
% a very short tail. The ramp up and ramp down in vertical velocity is
% used in processing to match the acm and ctd time series. The standard
% whoi mmp processing cuts the first and last 10 scans from the ctd time
% series to, as they say, "avoid problems with startup transients". This
% resulted in failure of mmp_pgrid_main for downcasts (even numbered casts)
% because this pre-edit cut off the transition needed to align the time
% series.
% Implied in the processing docs is that there should be a ~2-minute rest
% period at the end of the cast. this script will extract the tail,
% measure its length, and create a histogram and time-length plot for
% diagnostic purposes.

Output from downcast_tails.m – examine length of rampup and rampdown for down and up casts.

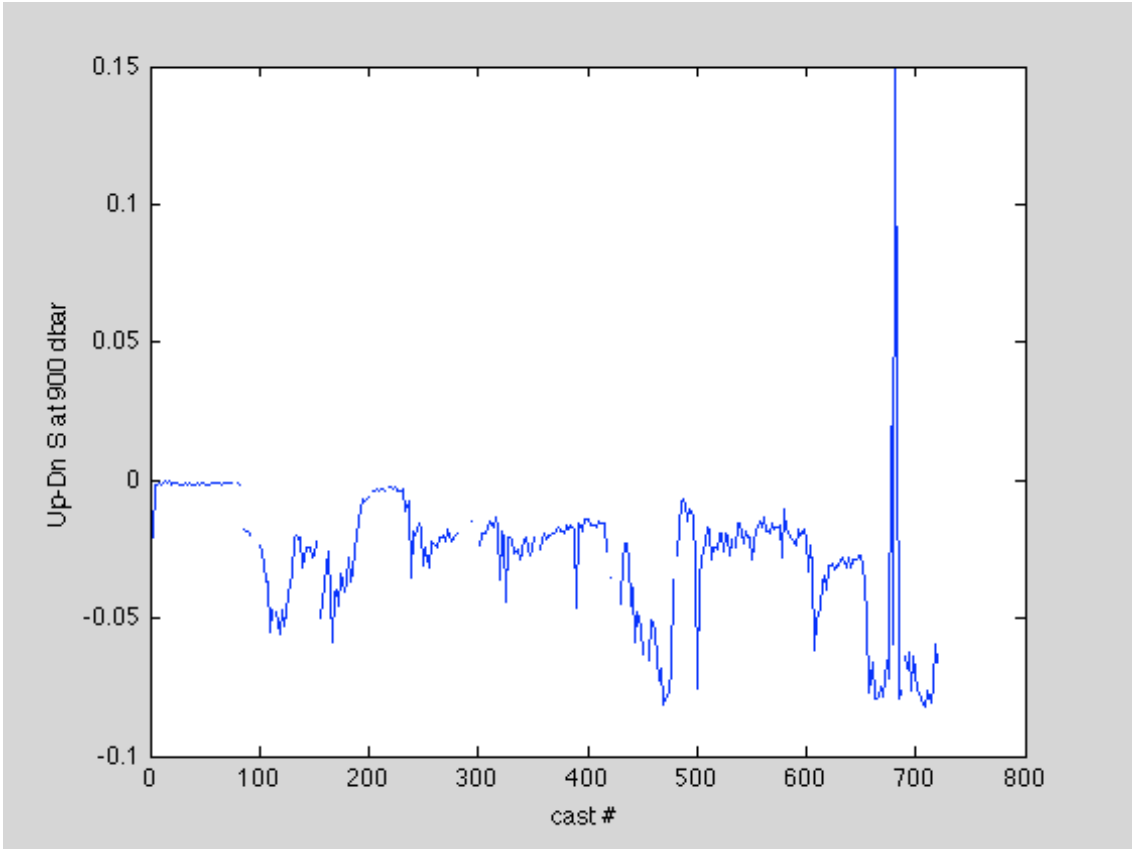


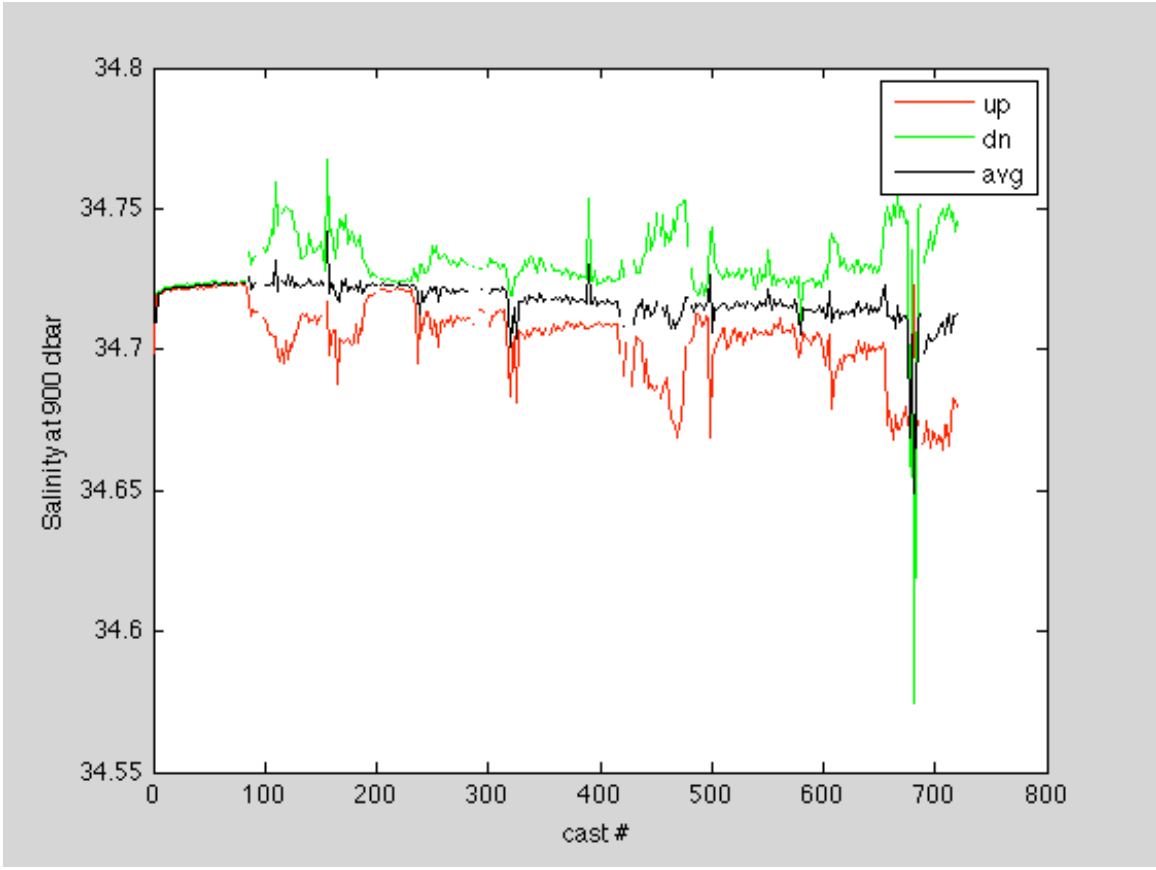
See comments in script for description of method (basically, same method as used in

mmp_align_ctdacm). Note that the end of cast tail for the downcasts is usually very short, 10 scans or less.



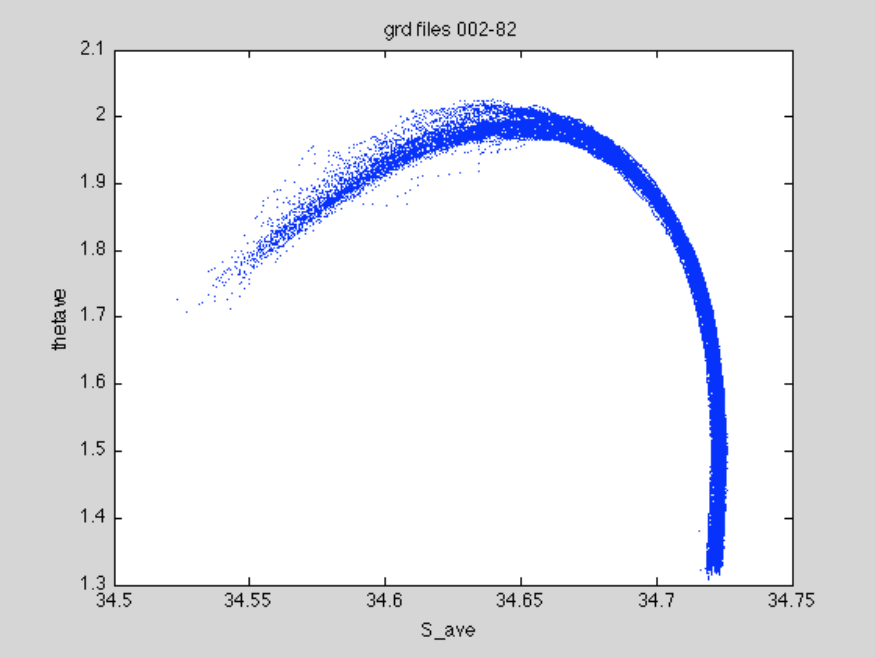
Fixed and ran mmp_pgrid_main and associated subprograms. First look at ctd data indicates a problem with the conductivity sensor. Up/down cast differences (day to day) at say 900 dbar are negligible at the outset, but after cast 83, the difference becomes large, in the range 0.01to 0.03. The figure below shows the quantity (upcast-downcast) salinity (successive days) at 900 dbar. Note the distinct break in behavior at about cast 83. Note that cast 84 failed. I don't think we can use one over the other – the subsequent figure show the salinity at 900 dbar for the down and up casts separately. They both appear to be erroneous, with errors in the opposite sense, possibly due to a vertical-velocity dependence (mechanical? Fracture in the co cell, or loose connector?)

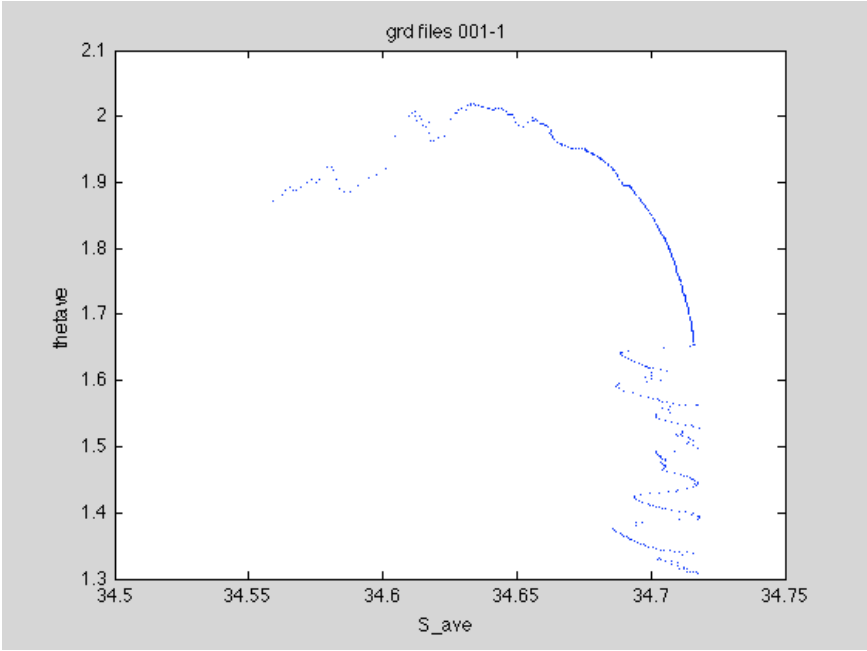

0.15
0.1
0.05
0
-0.05
-0.1
Up-Dn S at 900 dbar
0
100
200
300
400
500
600
700
800
cast #


34.8
34.75
34.7
34.65
34.6
34.55
Salinity at 900 dbar
up
dn
avg
0
100
200
300
400
500
600
700
800
cast #

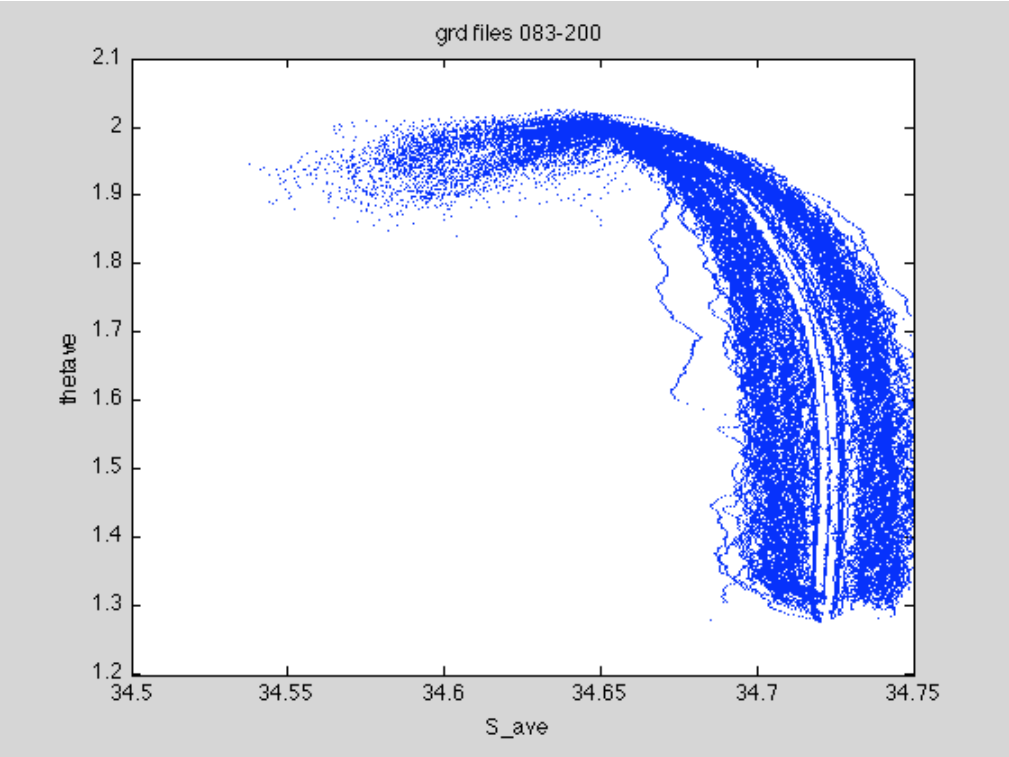
Cast 1 also appears to have a problem – see T/S plots below.

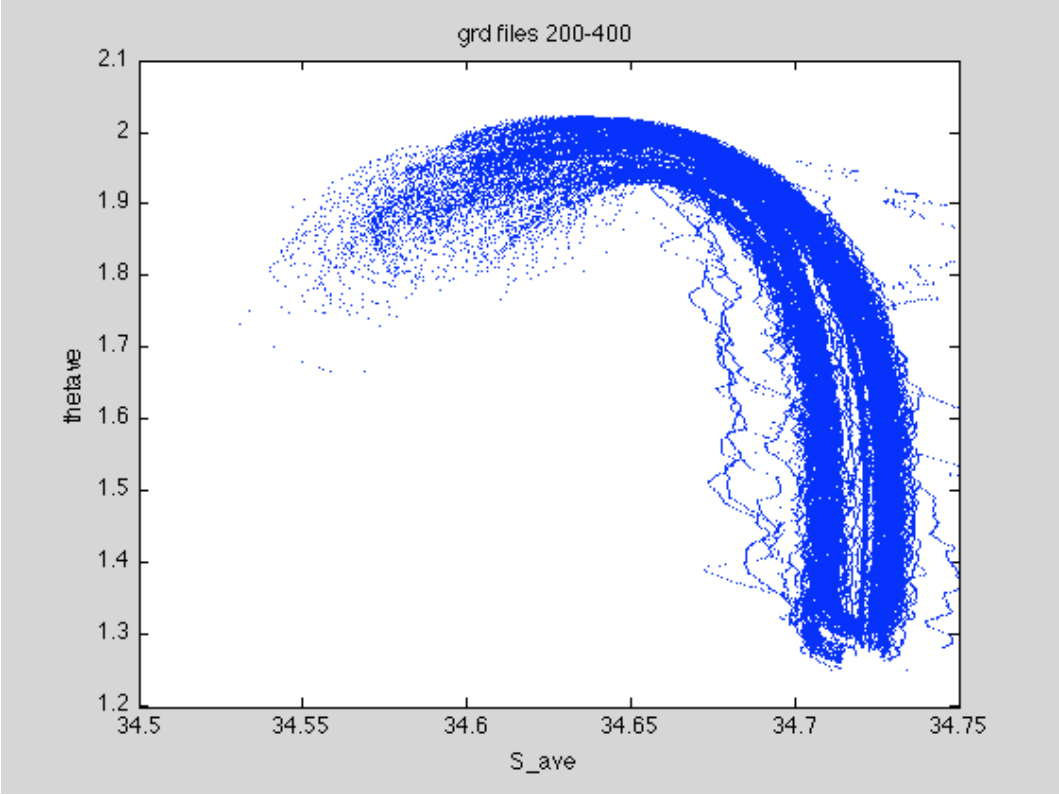
Theta/S of select groupings of casts:

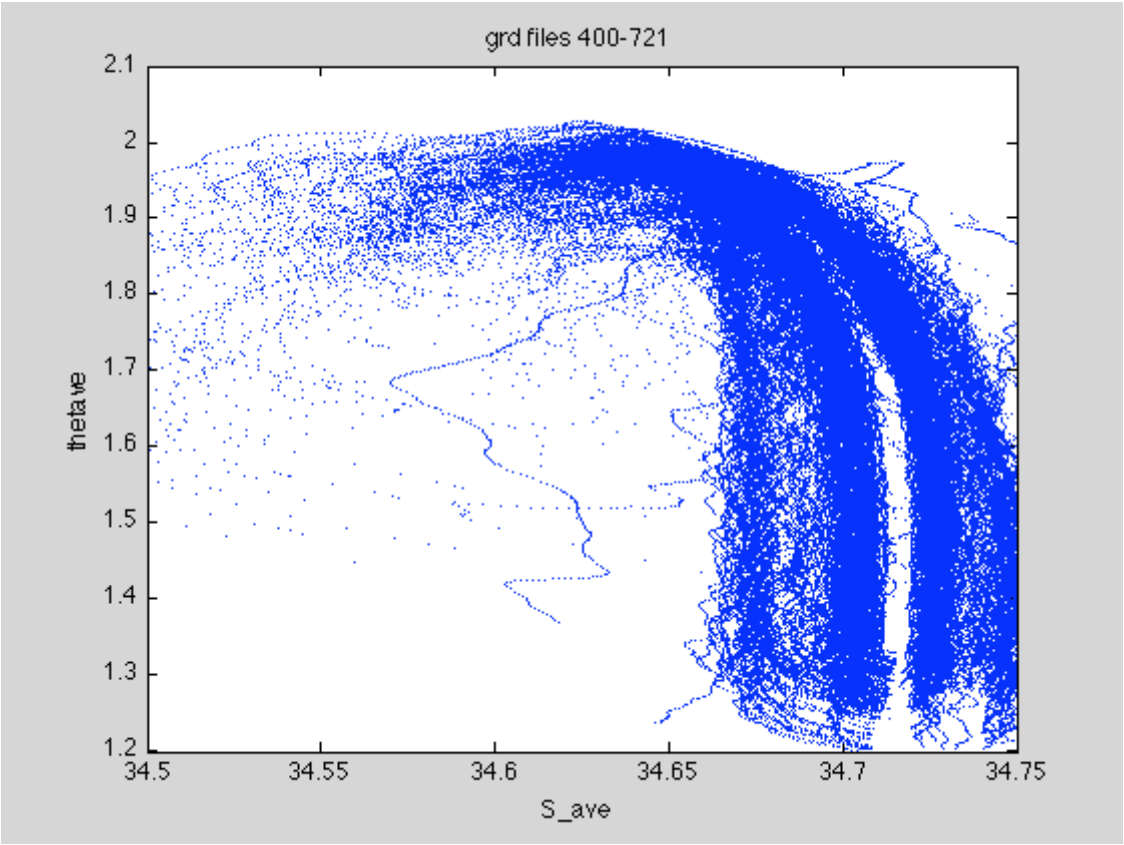




Problems begin after cast 83:


grd files 083-200
theta we
S_ave
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
34.5
34.55
34.6
34.65
34.7
34.75

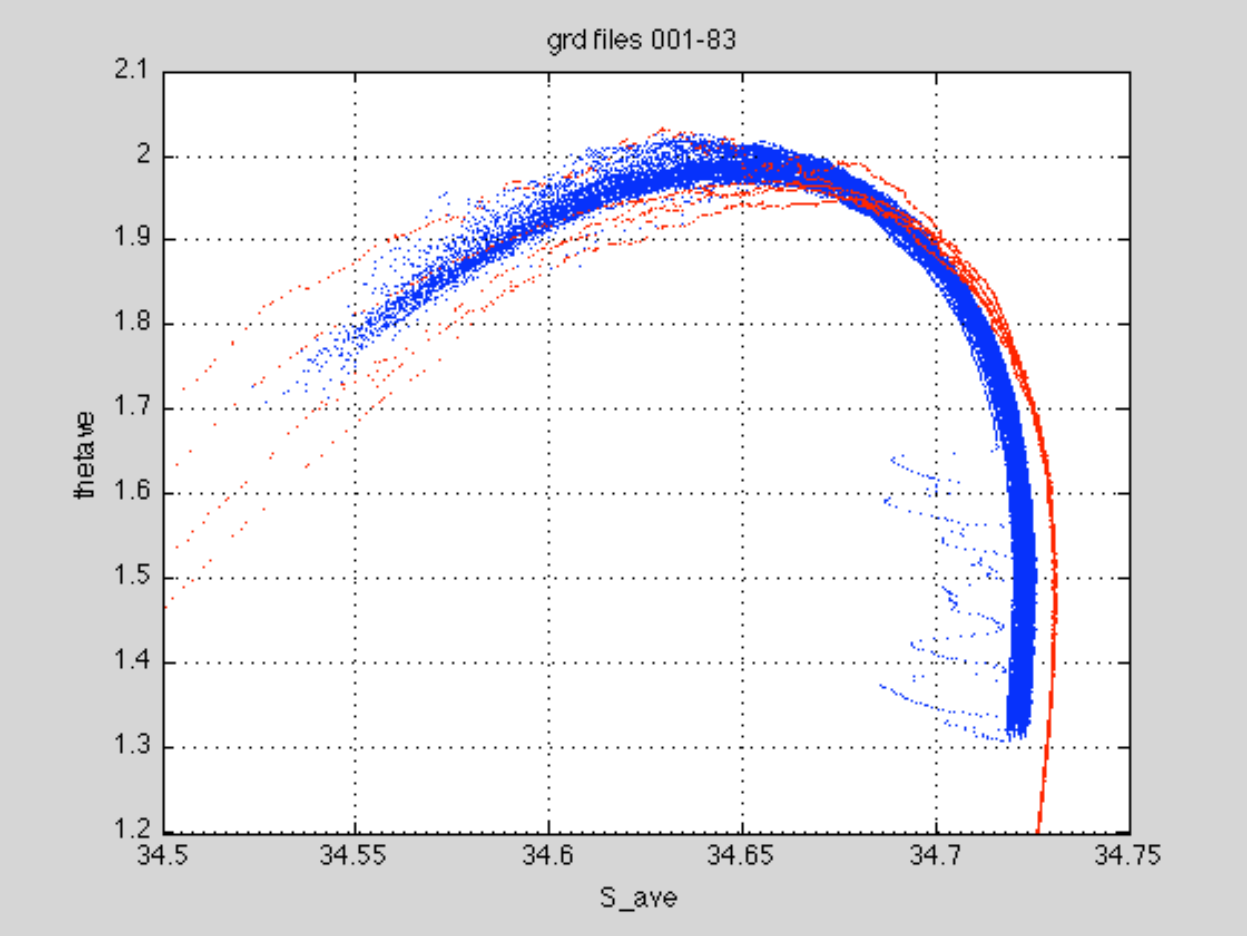

grd files 200-400
theta we
S_ave
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
34.5
34.55
34.6
34.65
34.7
34.75

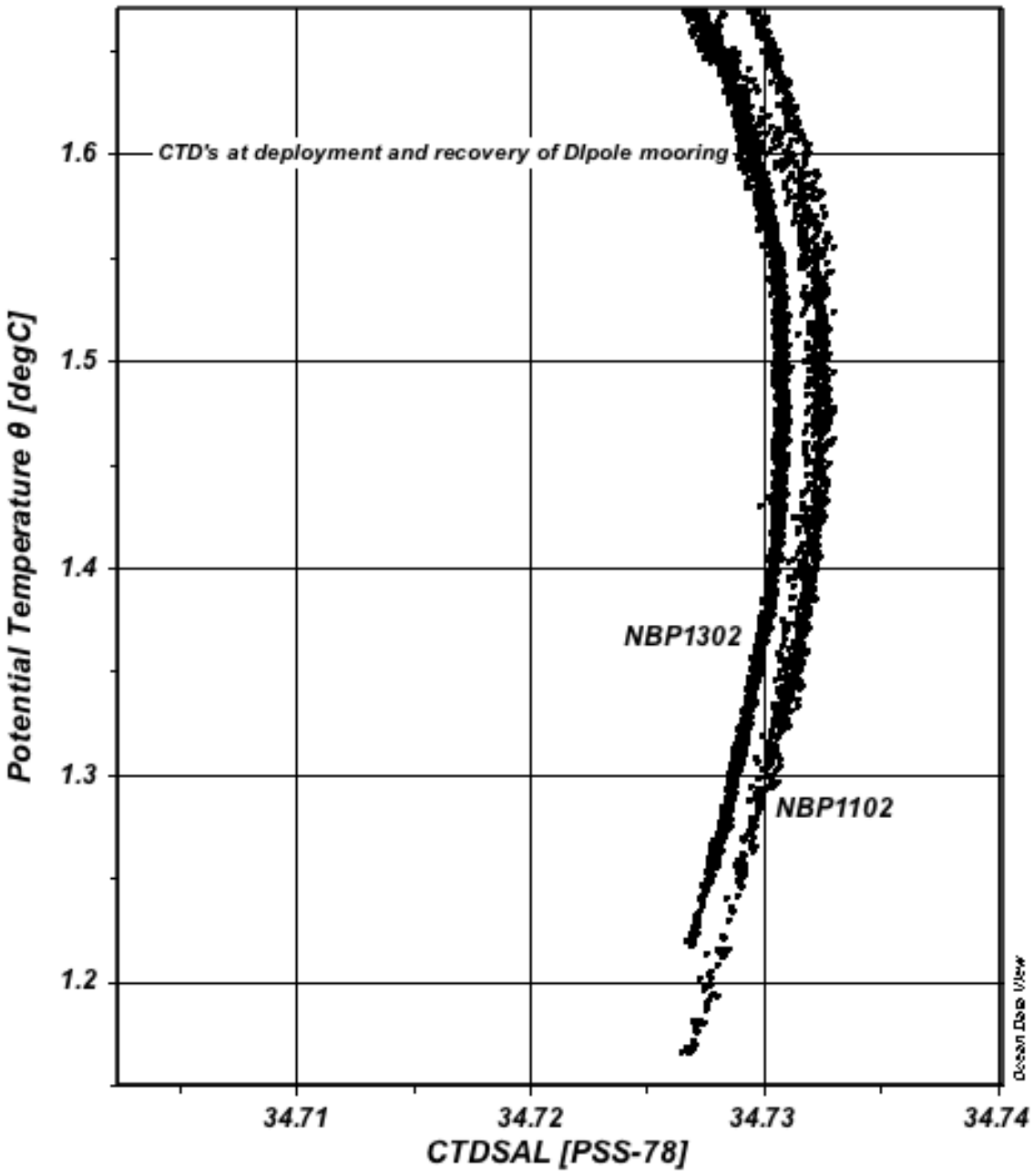


MMP – NBP ctd comparison

Plot of mmp ctd for cast 1:83 with ctd 136-140 from nbp1302 (red) shows:

1. mmp ctd is generally lower in S by ~ 0.01.
2. scatter in mmp s is much larger than that in evidence from NBP1302 CTDs in the mooring neighborhood. NBP1102 CTDs show similar tight curve to NBP132 (but S is about 0.002 higher on the NBP1102 stations…those data were collected by SIO with their ctd / autosal /processing as part of clivar repeat S4P line). Is the scatter due to monotonic drift?


grd files 001-83
2.1
2
1.9
1.8
1.7
1.6
1.5
1.4
1.3
1.2
theta_ve
34.5
34.55
34.6
34.65
34.7
34.75
S_ave


CTD's at deployment and recovery of DIpole mooring
NBP1302
NBP1102
Potential Temperature θ [degC]
1.6
1.5
1.4
1.3
1.2
34.71
34.72
34.73
34.74
CTDSAL [PSS-78]
Ocean Data View

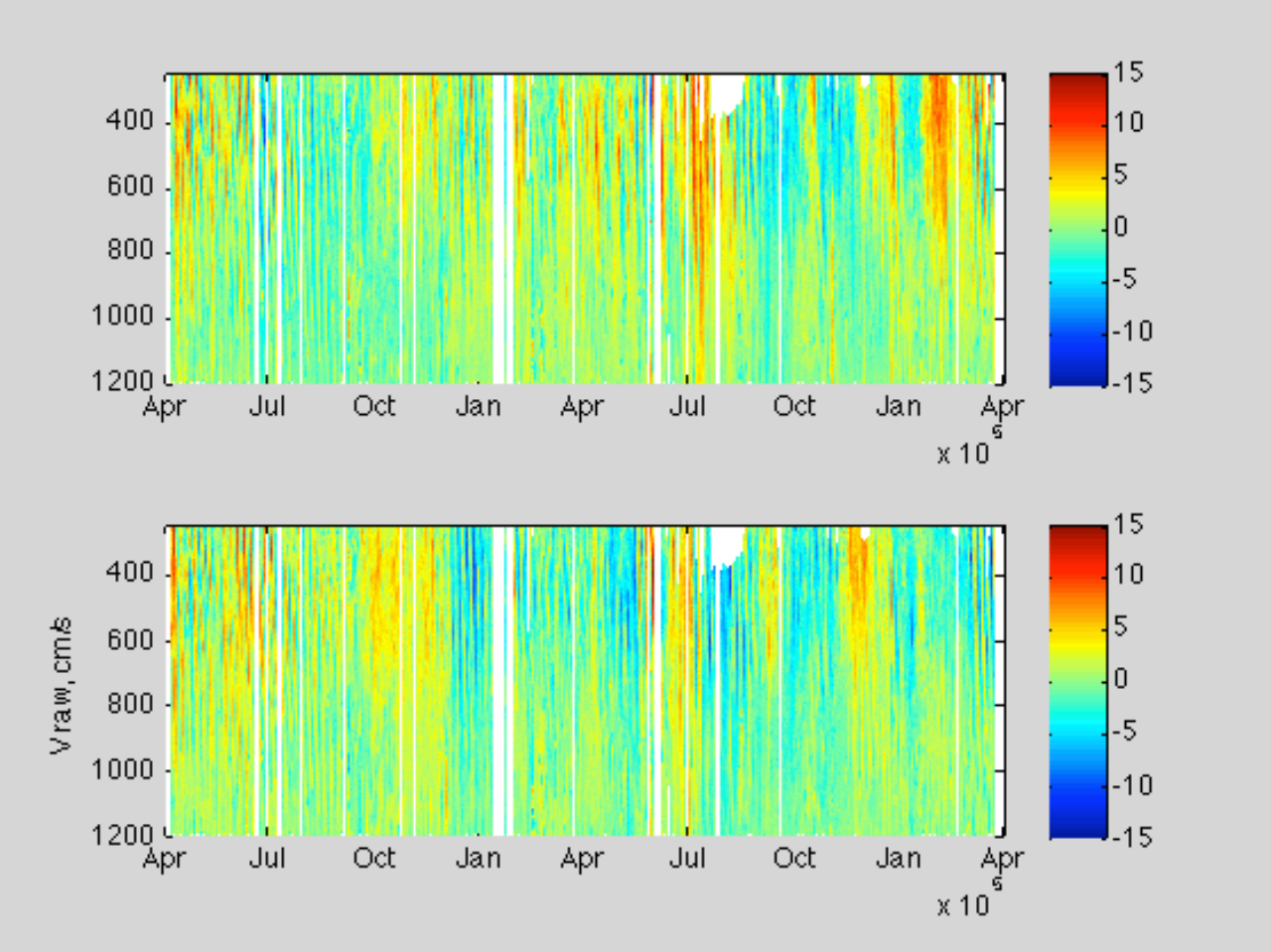
Appendix

1. List of failed profiles

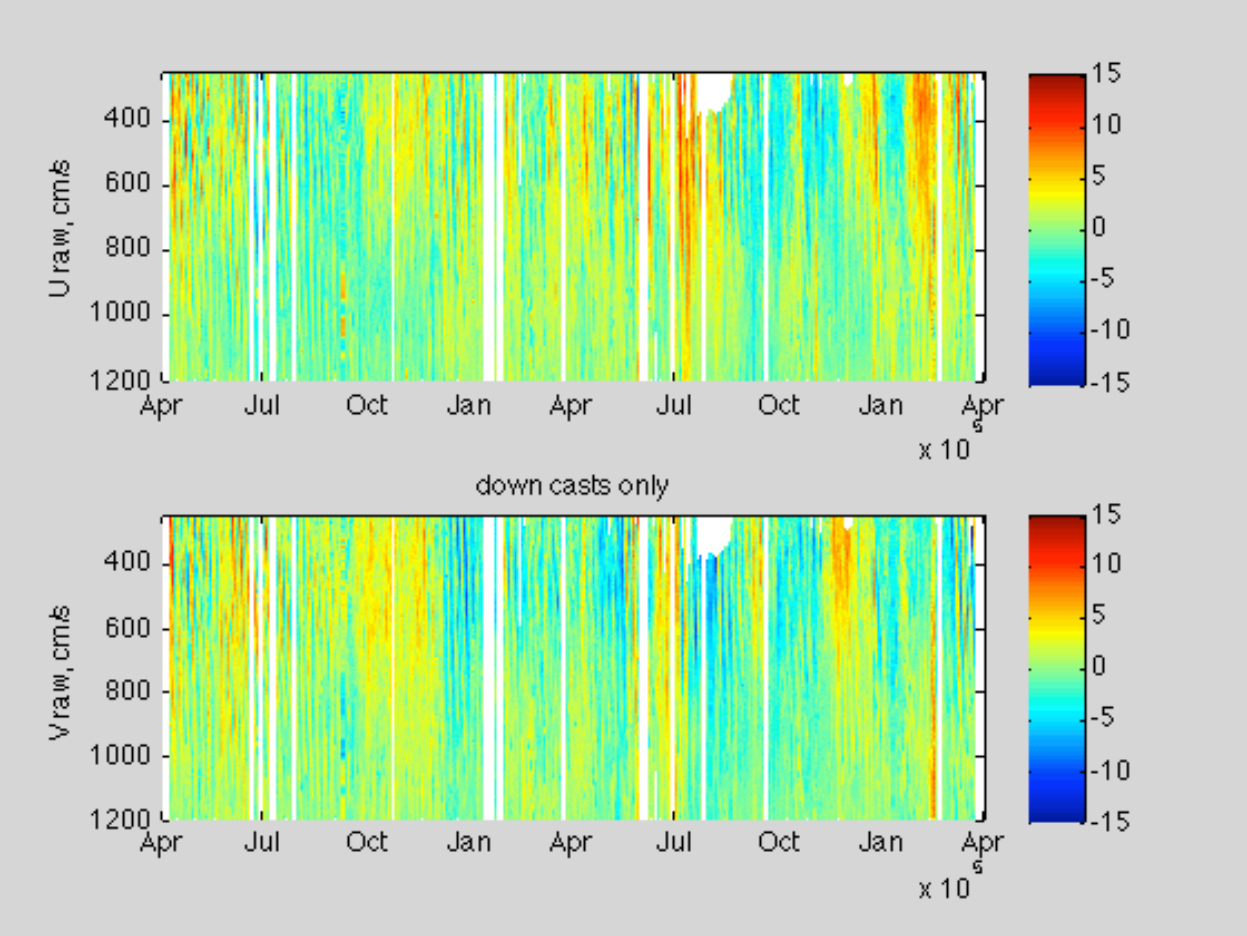
	CTD		ACM		Profile Exit
	76		76		PRZ
	77		77		no profile - stuck at top; out of sequence?
	84				TE - stuck at top
	94		94		PRZ
	95		95		no profile - stuck at top; out of sequence?
	96		96		PRZ - stuck at top
	97		97		no profile. Thought it reached top pressure but was already there
	114				TE partial profile - stuck near top
	153				TE
	201		201		missing files
	202				TE - probably valid data but over a very narrow pressure range, near the top of the profiler travel
	215				TE
	284		284		PRZ-stuck at top
	285		285		no profile. Thought it reached top pressure but was already there
	288		288		PRZ-stuck at top
	289		289		no profile. Thought it reached top pressure but was already there
	290		290		PRZ-stuck at top
	291		291		no profile. Thought it reached top pressure but was already there
	296		296		PRZ-stuck at top
	297		297		no profile. Thought it reached top pressure but was already there
	298		298		PRZ-stuck at top
	299		299		no profile. Thought it reached top pressure but was already there
	313		313		PRZ - but partial profile, 1196 to apprx 500 m, salvageable.
	314		314		short file, but OK. 500 to 1196
	353		353		missing files
	354				TE - probably valid data but over a very narrow pressure range, near the top of the profiler travel

	419				TE - cast started at top, should have been at bottom from prev. cast
	424		424		PRZ-stuck at top
	425		425		no profile. Thought it reached top pressure but was already there
	427		427		PRZ - stuck at bottom
	428		428		no profile. Thought it had reached bottom but was already there
	452		452		PRZ-stuck at top
	453		453		no profile. Thought it reached top pressure but was already there
	479		479		PRZ - stuck at 756 dbar on upcast.
	480		480		short cast - 760 to 1196 dbar but otherwise ok
	533				PRZ - stuck at 895 on upcast
	534		534		short cast - 912 to 1196 dbar but otherwise ok
	687		687		PRZ - stuck at bottom
	688		688		no profile. Thought it had reached bottom but was already there
	723		723		post-recovery - no valid data
Abbreviations:				PRZ	Pressure Rate Zero
				TE	Timer Expired

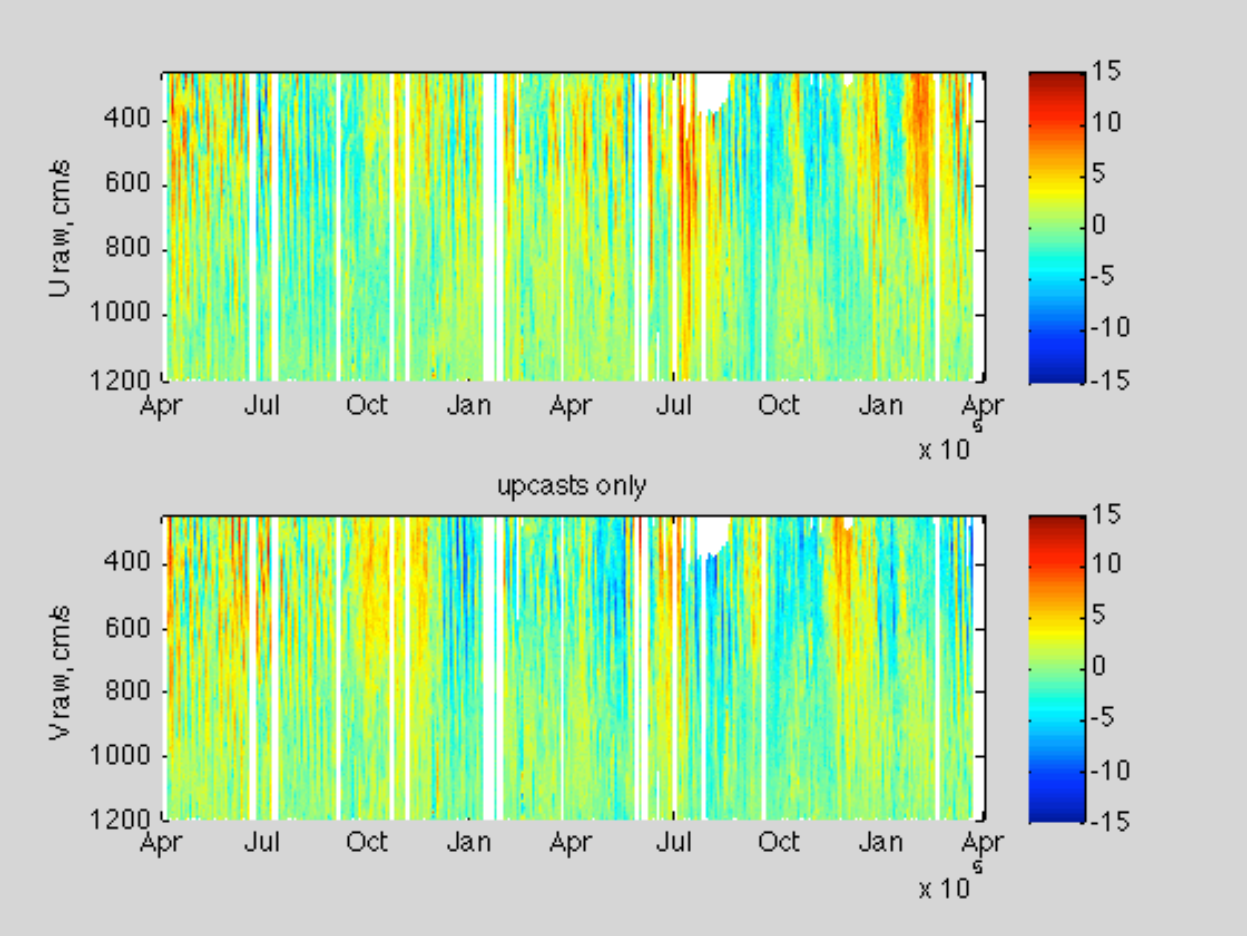
App2: preliminary velocity figures



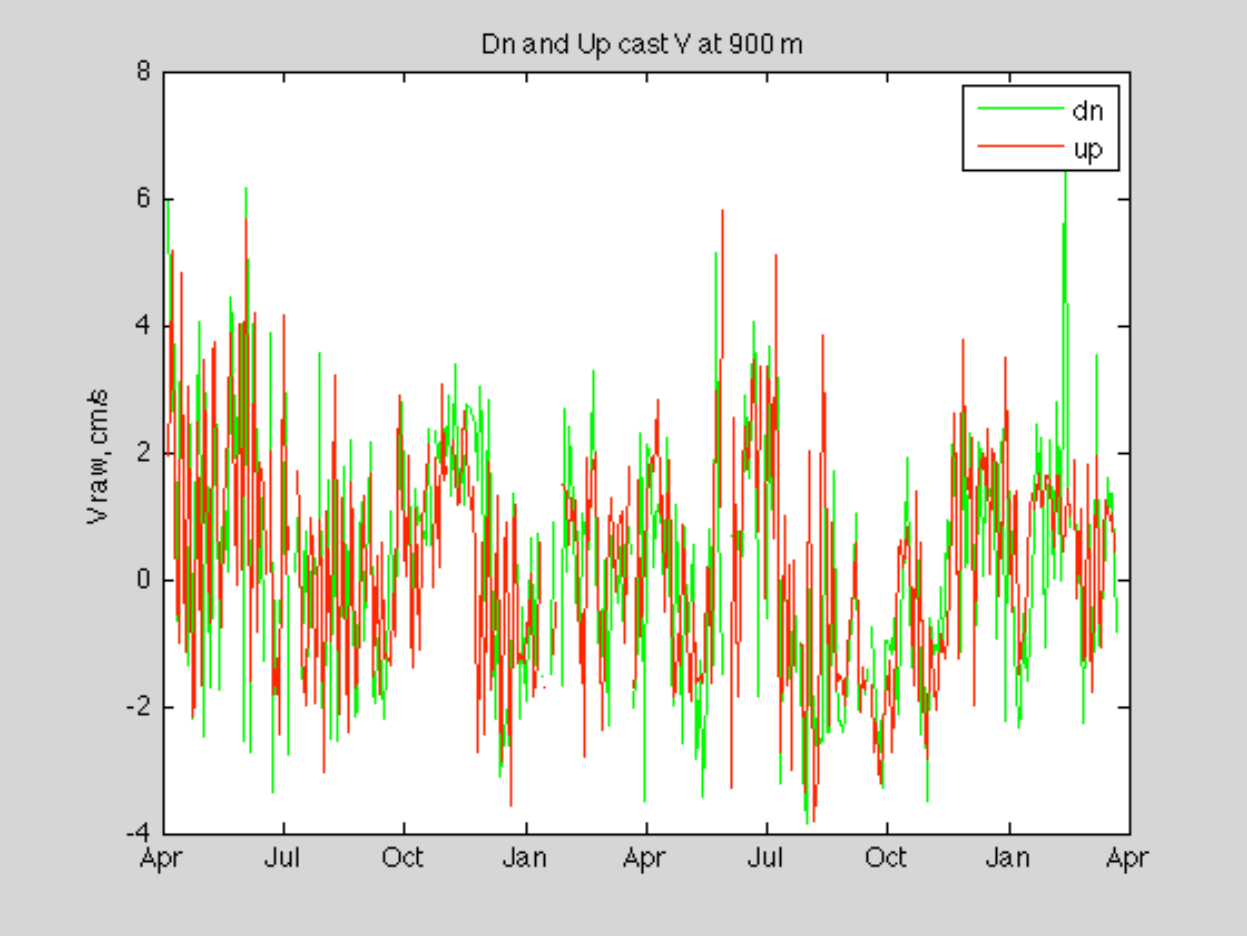
raw, no bias correction, up and down casts

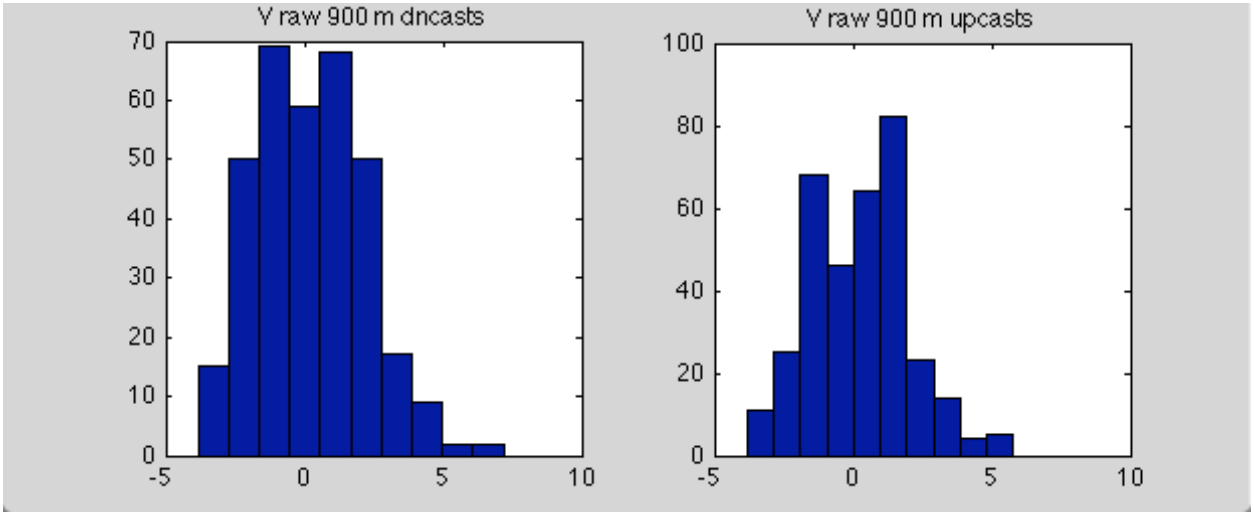


Raw, downcast only



Raw, upcasts only


Dn and Up cast V at 900 m
dn
up
V raw, cm/s
8
6
4
2
0
-2
-4
Apr
Jul
Oct
Jan
Apr
Jul
Oct
Jan
Apr


V raw 900 m dncasts
70
60
50
40
30
20
10
0
-5
0
5
10
V raw 900 m upcasts
100
80
60
40
20
0
-5
0
5
10