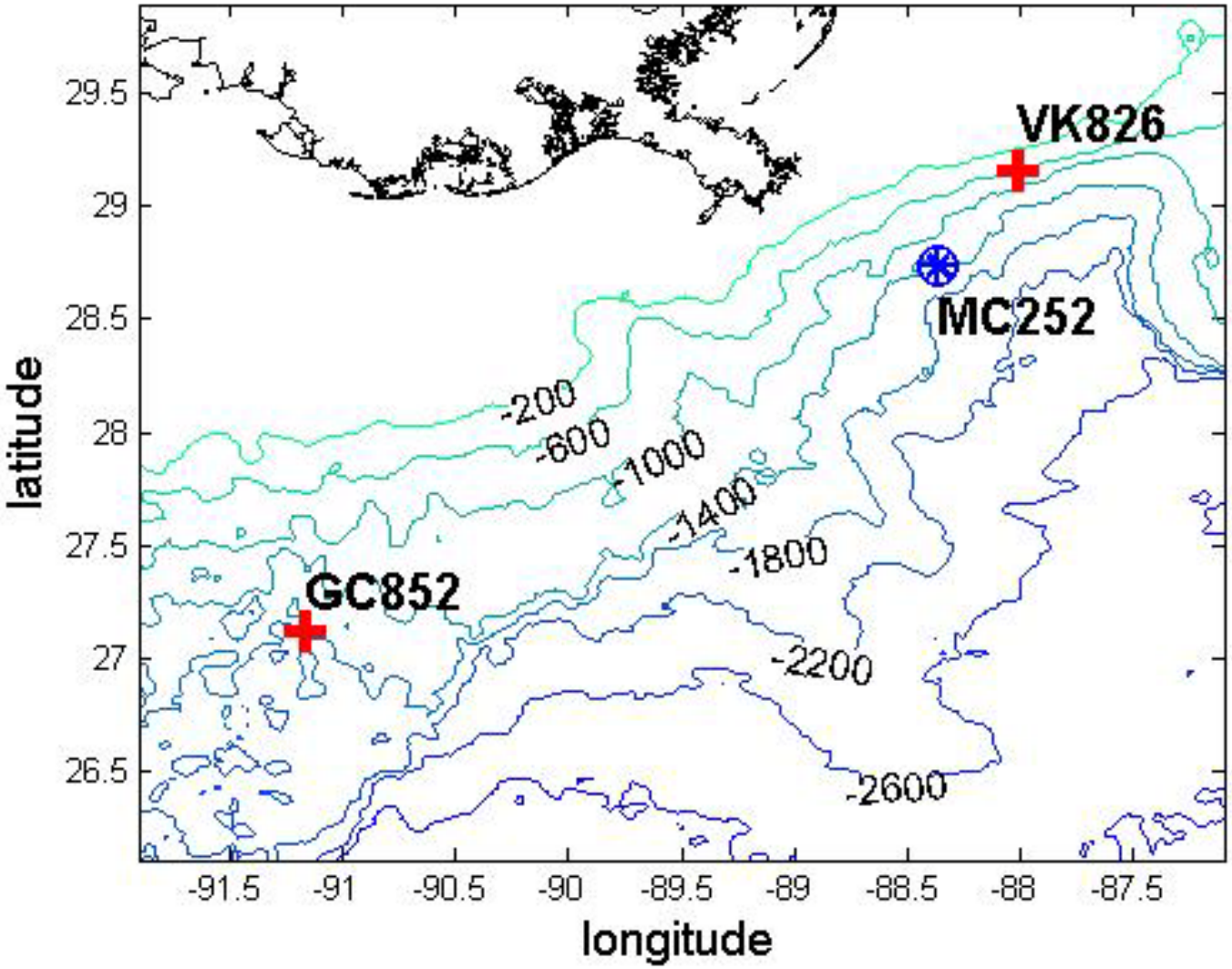
Physical Oceanography and Larval Dispersal Potential

Susan Welsh

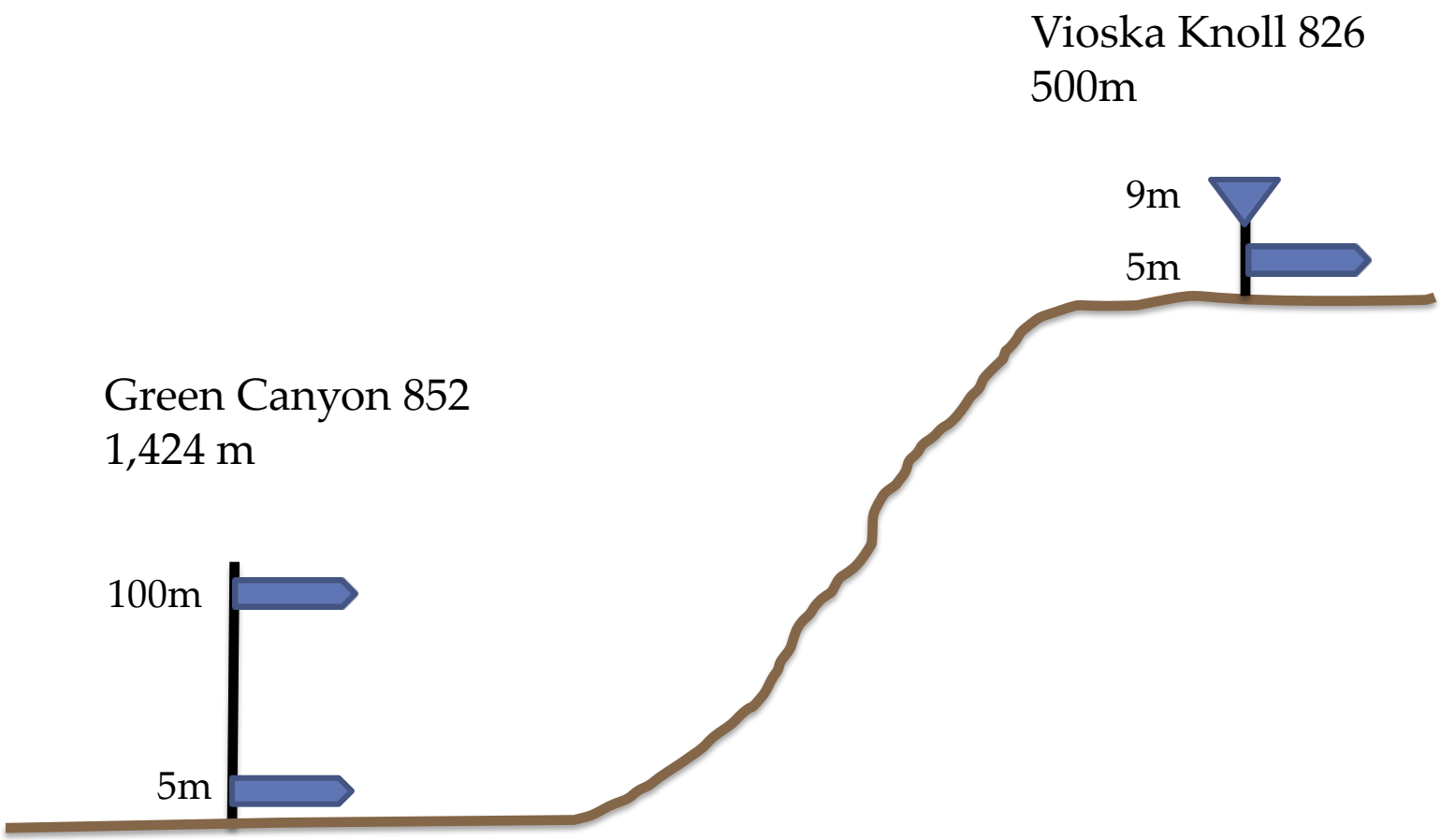
Department of Oceanography and Coastal Sciences

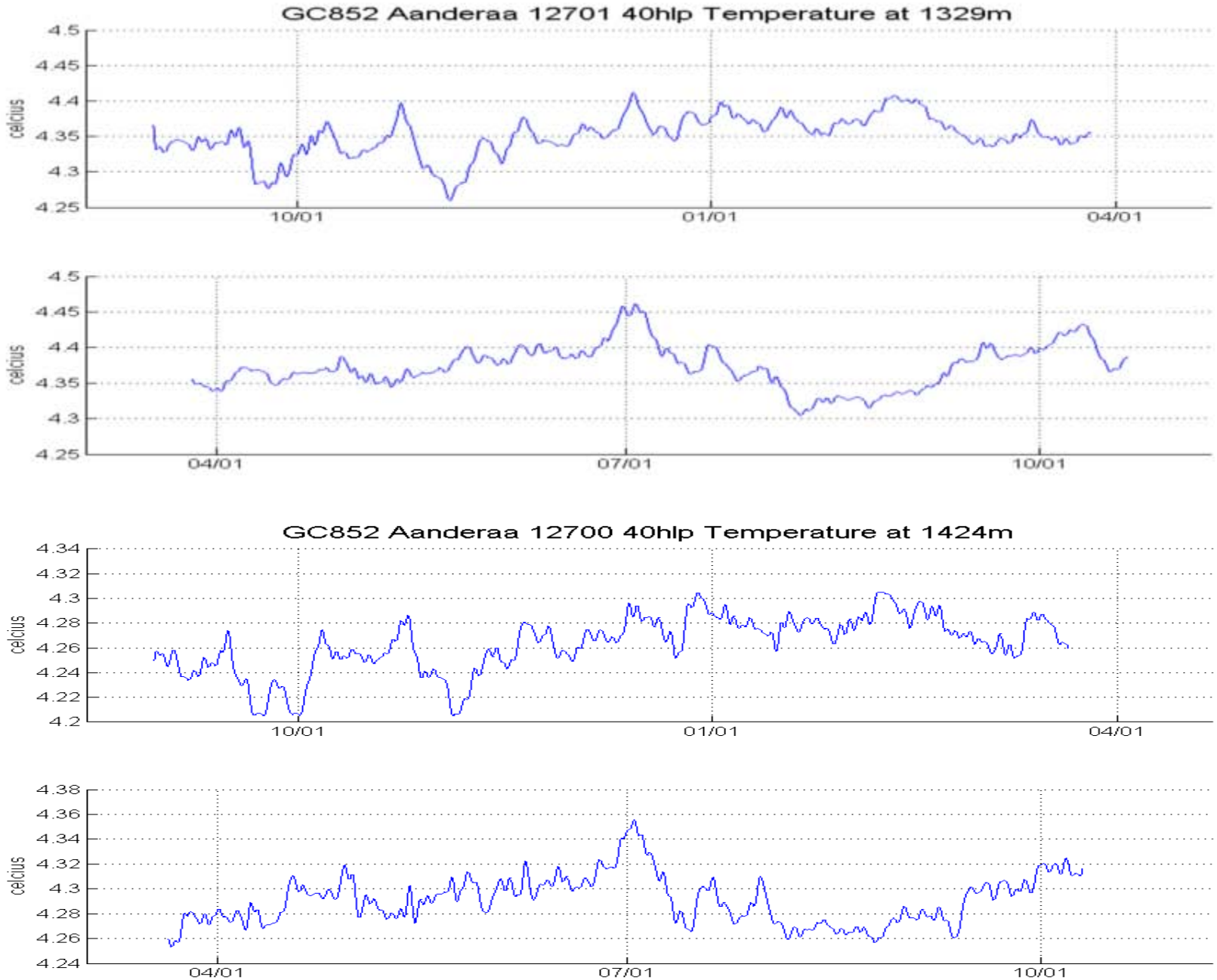
LSU SCHOOL OF THE COAST & ENVIRONMENT

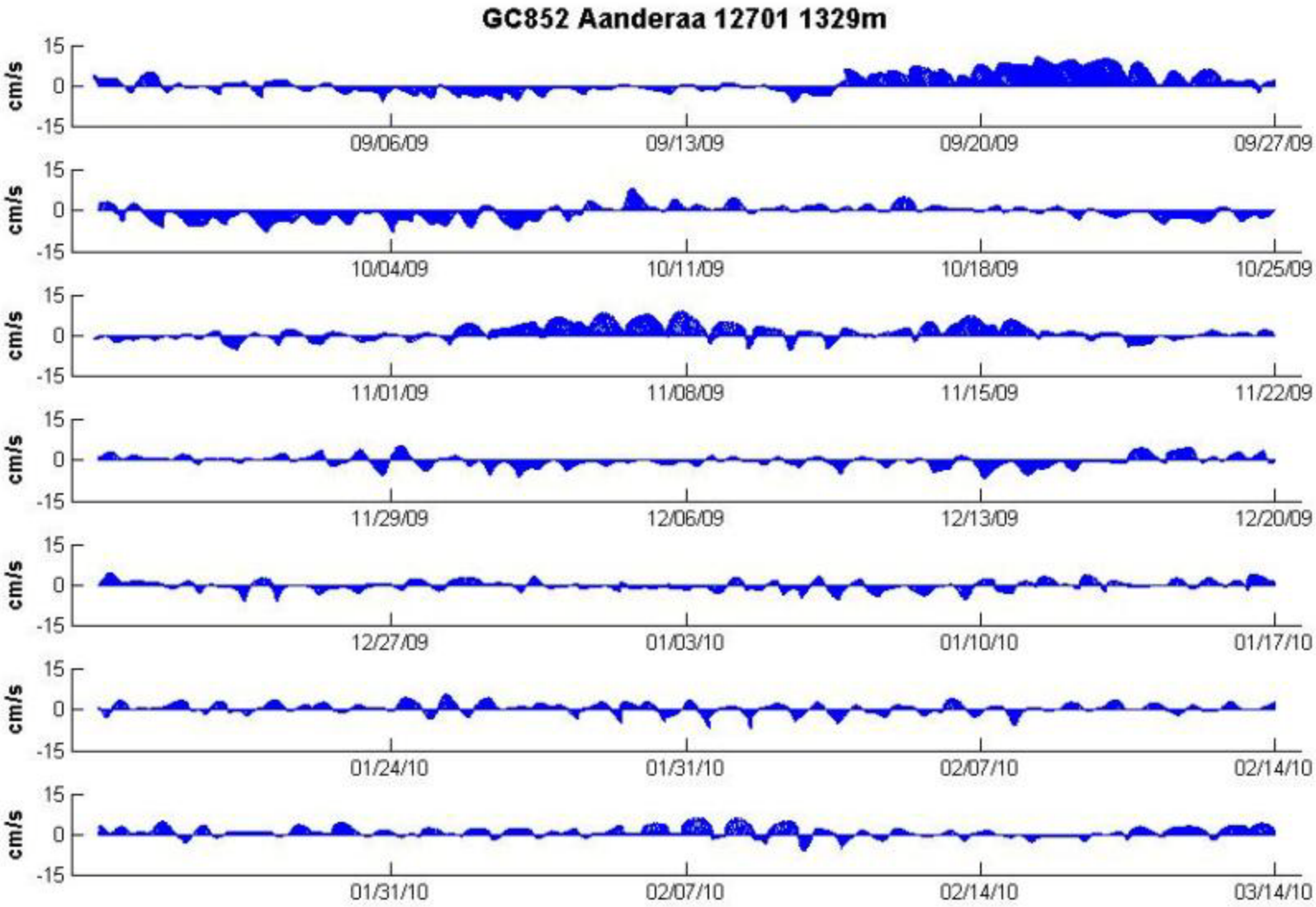
Mooring Locations



Mooring Design




GC852 Aanderaa 12701 40hlp Temperature at 1329m
celcius
4.5
4.45
4.4
4.35
4.3
4.25
10/01
01/01
04/01
04/01
07/01
10/01
GC852 Aanderaa 12700 40hlp Temperature at 1424m
4.34
4.32
4.3
4.28
4.26
4.24
4.22
4.2
4.38
4.36


GC852 Aanderaa 12701 1329m
cm/s
15
0
-15
09/06/09
09/13/09
09/20/09
09/27/09
10/04/09
10/11/09
10/18/09
10/25/09
11/01/09
11/08/09
11/15/09
11/22/09
11/29/09
12/06/09
12/13/09
12/20/09
12/27/09
01/03/10
01/10/10
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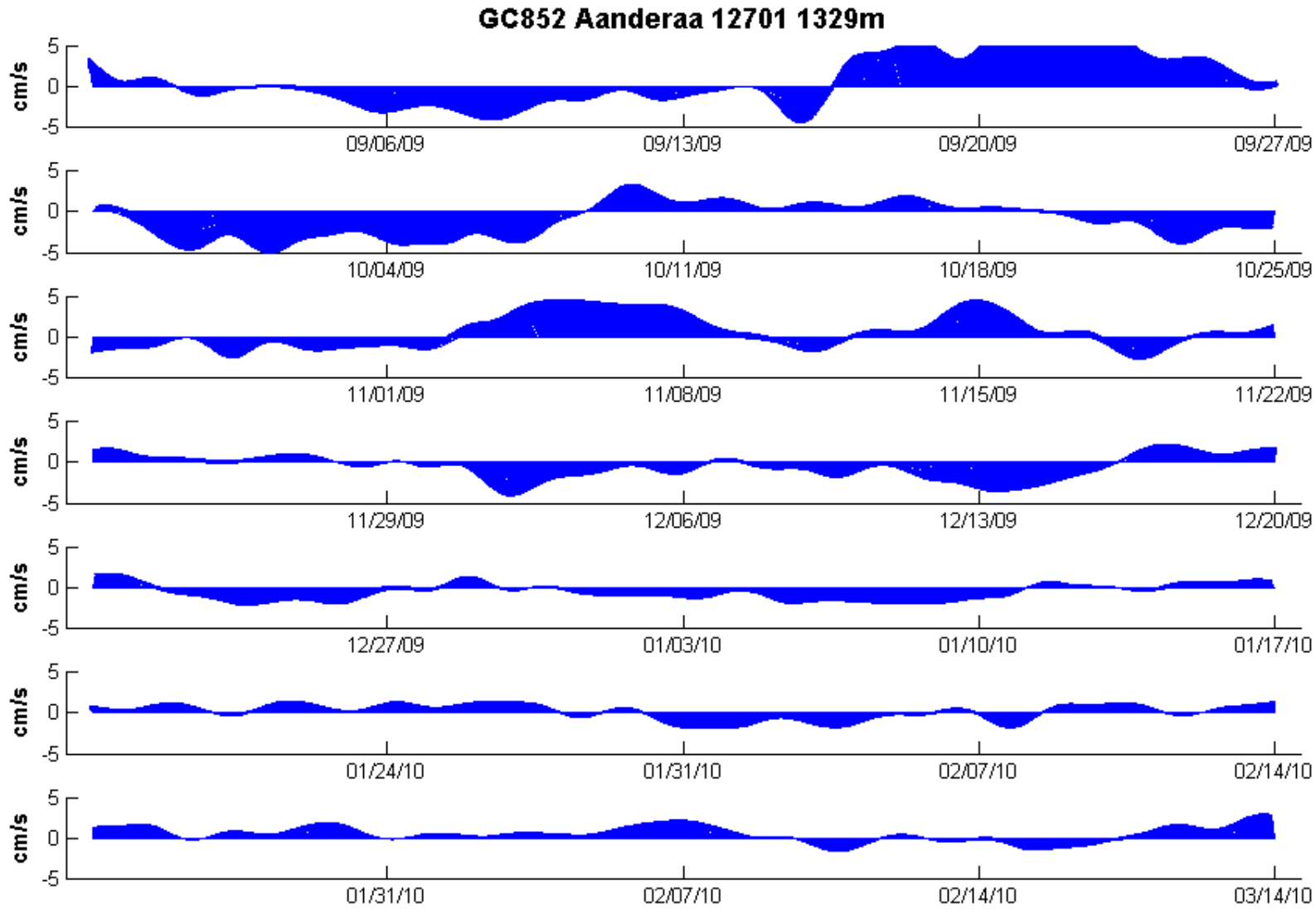
02/14/10
03/14/10


GC852 Aanderaa 12701 1329m
cm/s
5
0
-5
09/06/09
09/13/09
09/20/09
09/27/09
10/04/09
10/11/09
10/18/09
10/25/09
11/01/09
11/08/09
11/15/09
11/22/09
11/29/09
12/06/09
12/13/09
12/20/09
12/27/09
01/03/10
01/10/10
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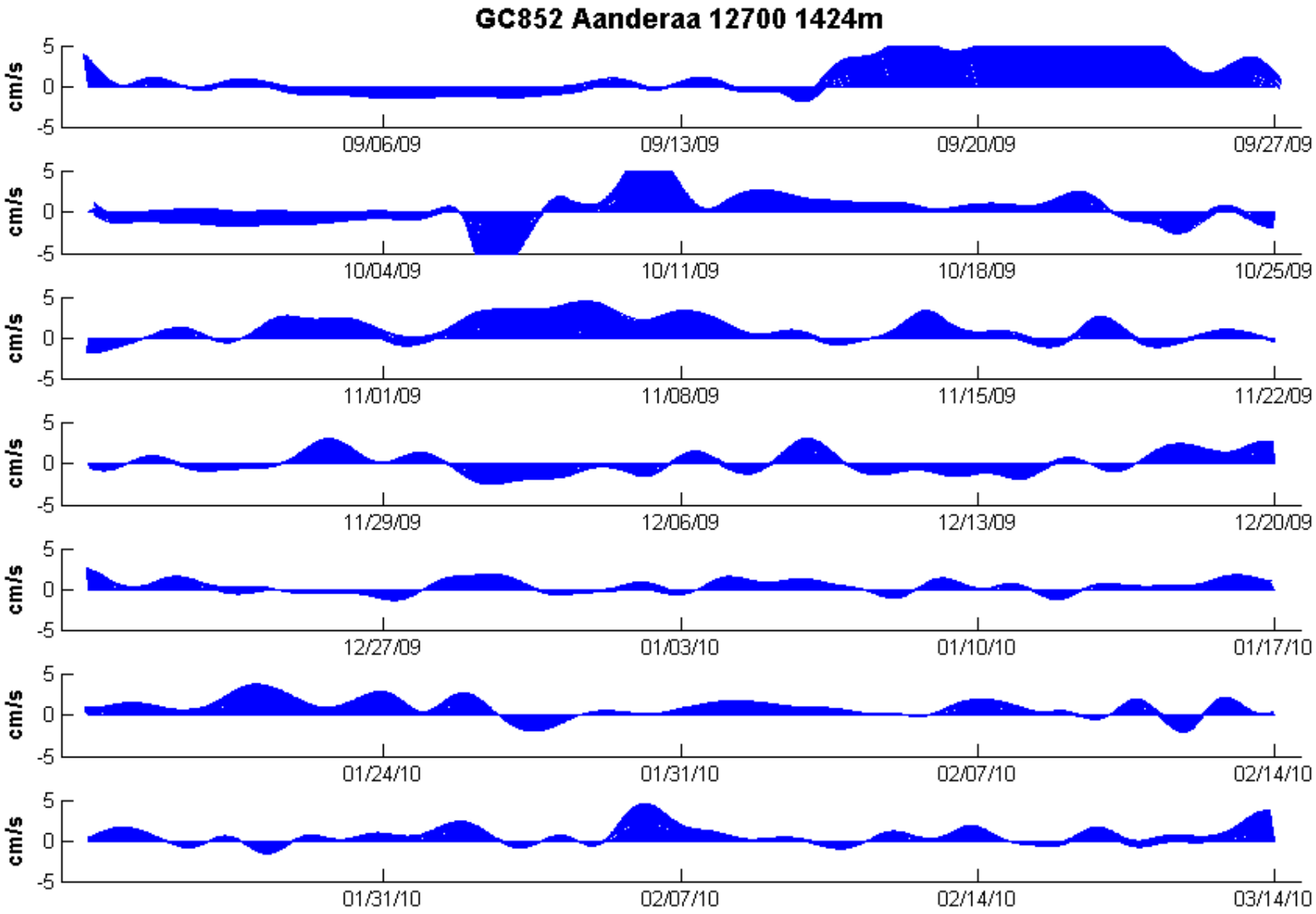
02/14/10
03/14/10


GC852 Aanderaa 12700 1424m
cm/s
5
0
-5
09/06/09
09/13/09
09/20/09
09/27/09
10/04/09
10/11/09
10/18/09
10/25/09
11/01/09
11/08/09
11/15/09
11/22/09
11/29/09
12/06/09
12/13/09
12/20/09
12/27/09
01/03/10
01/10/10
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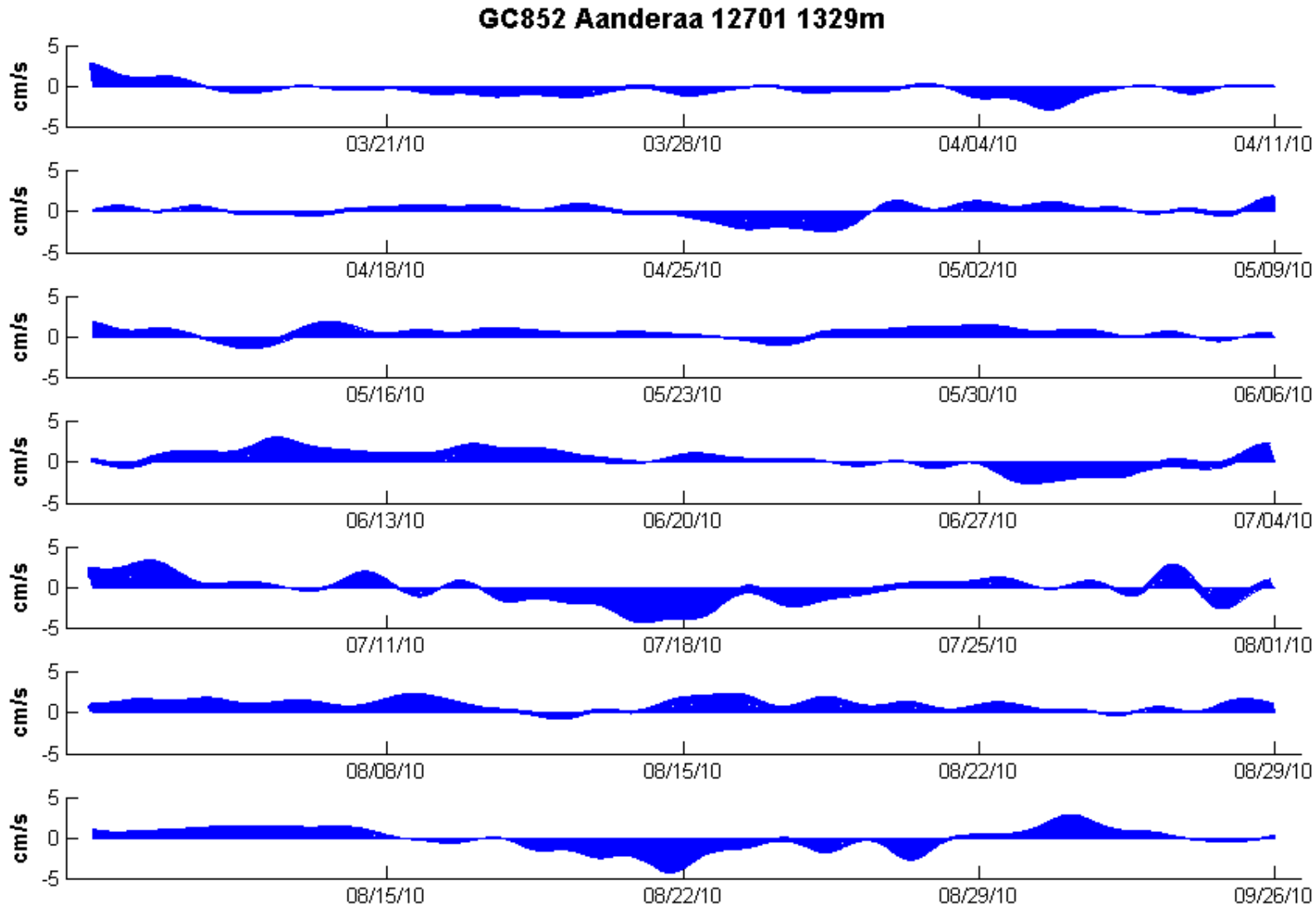
02/14/10
03/14/10


GC852 Aanderaa 12701 1329m
cm/s
5
0
-5
03/21/10
03/28/10
04/04/10
04/11/10
04/18/10
04/25/10
05/02/10
05/09/10
05/16/10
05/23/10
05/30/10
06/06/10
06/13/10
06/20/10
06/27/10
07/04/10
07/11/10
07/18/10
07/25/10
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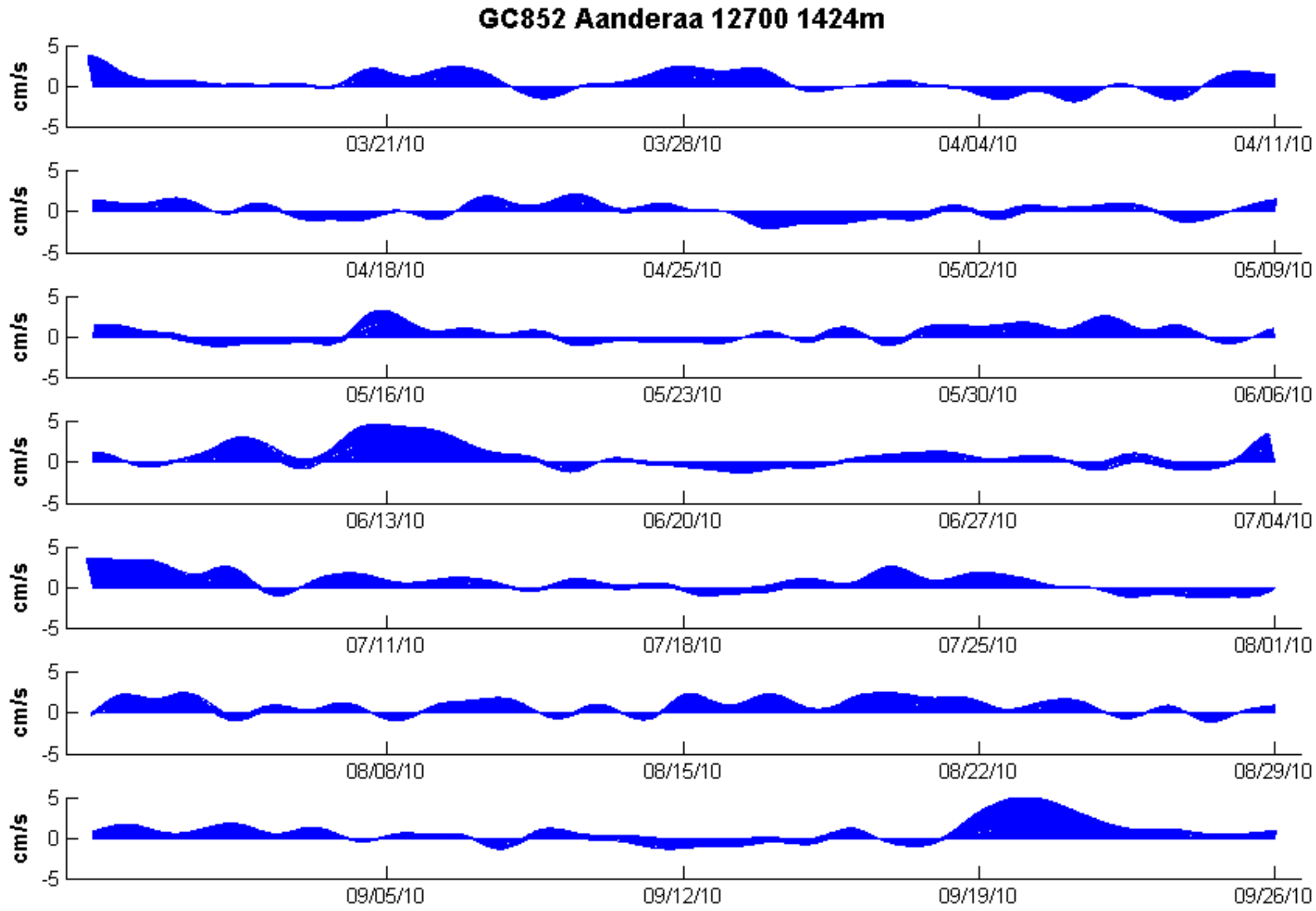
08/29/10
09/26/10


GC852 Aanderaa 12700 1424m
cm/s
5
0
-5
03/21/10
03/28/10
04/04/10
04/11/10
04/18/10
04/25/10
05/02/10
05/09/10
05/16/10
05/23/10
05/30/10
06/06/10
06/13/10
06/20/10
06/27/10
07/04/10
07/11/10
07/18/10
07/25/10
08/01/10
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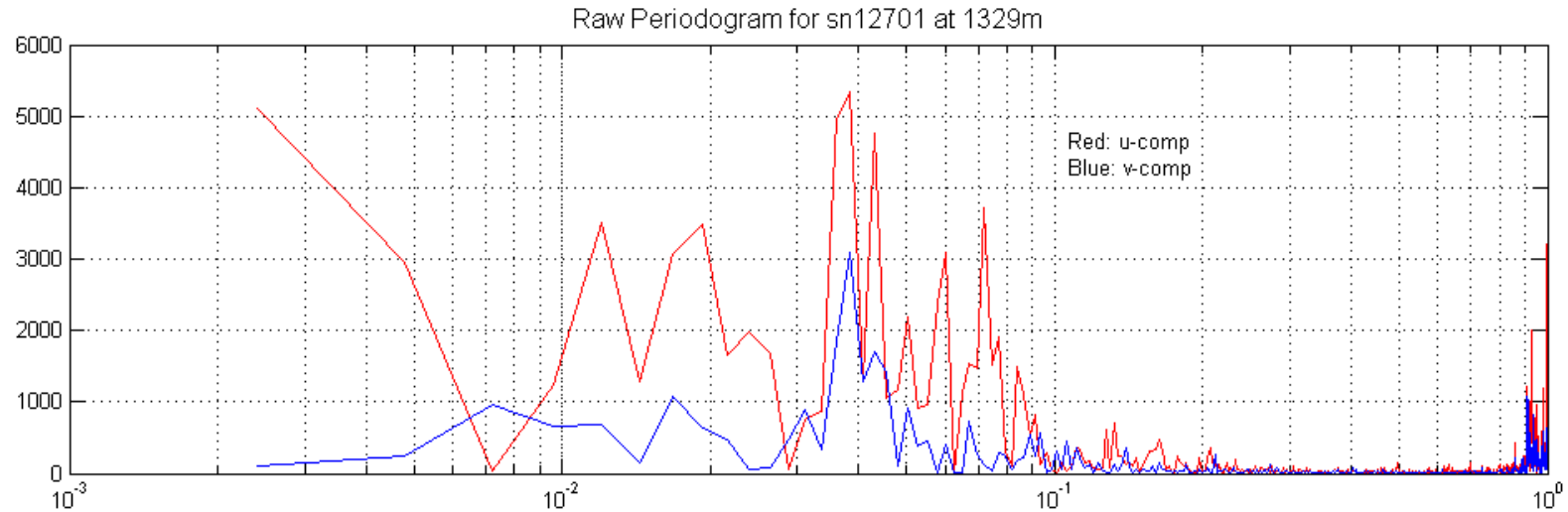
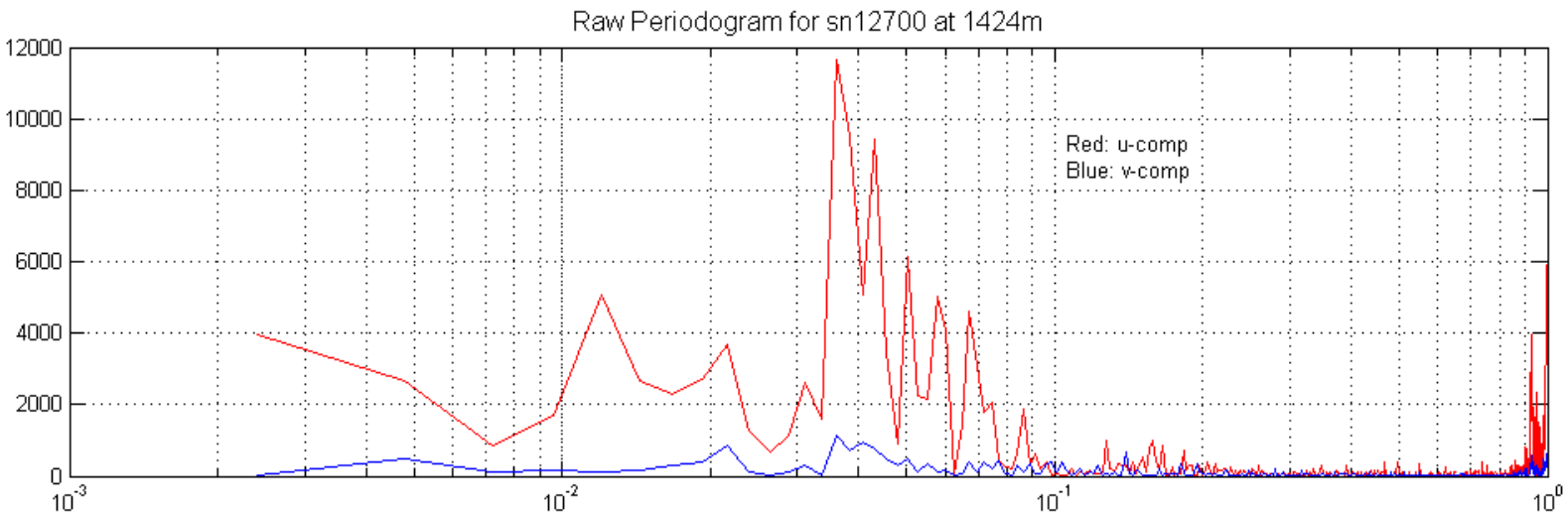
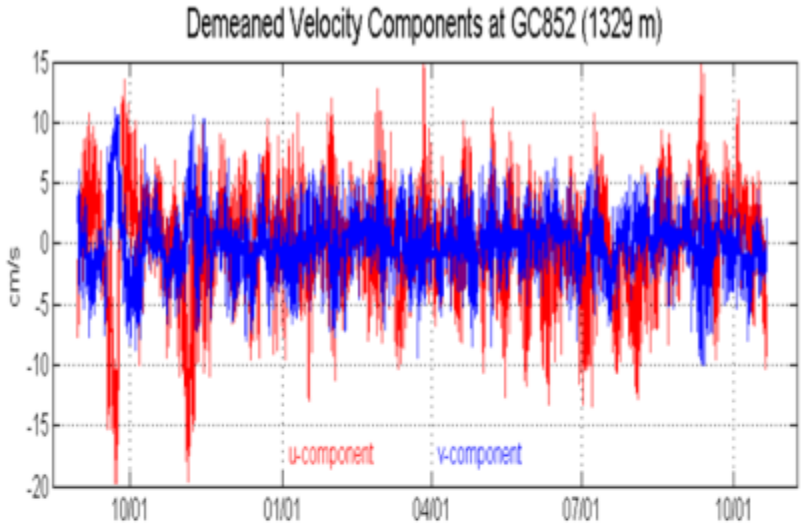
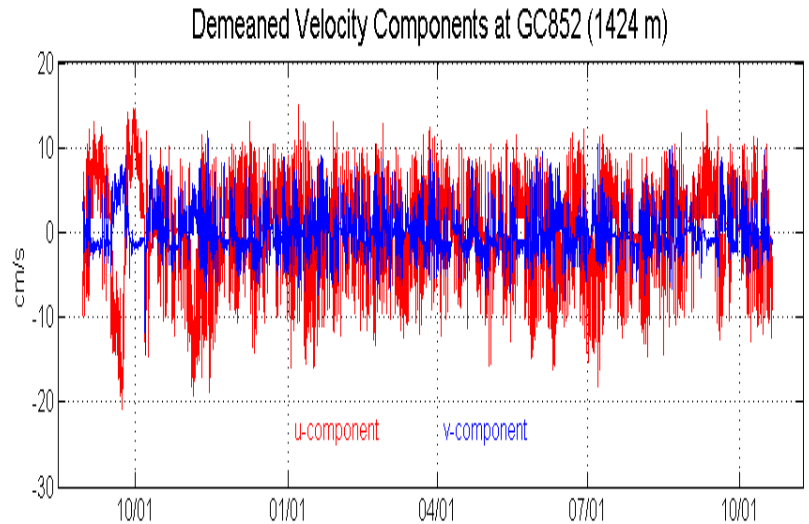
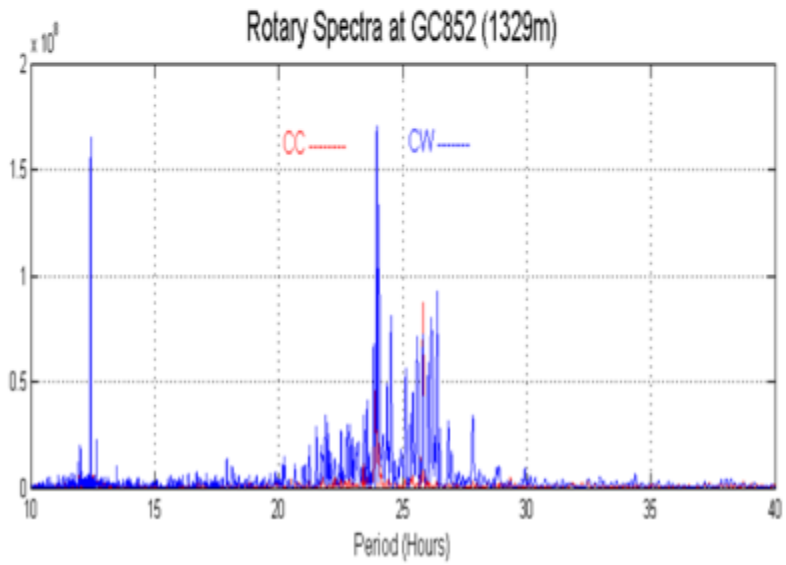
09/05/10
09/12/10
09/19/10
09/26/10

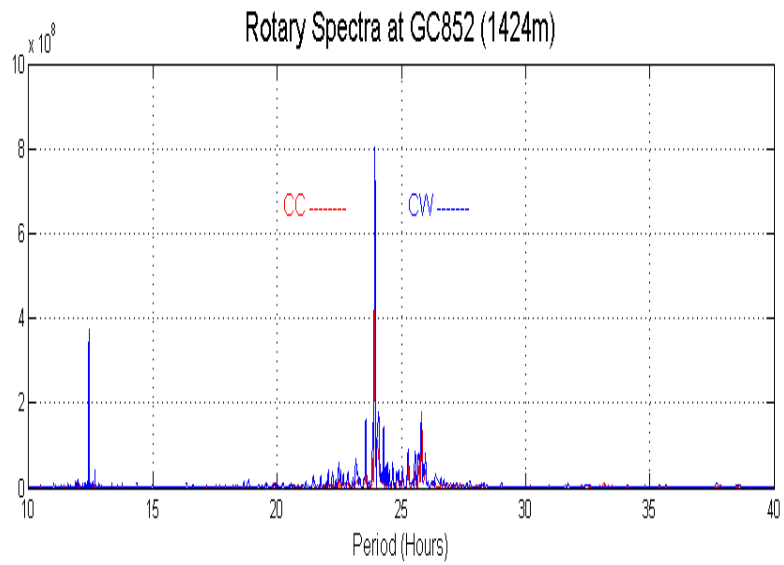

Raw Periodogram for sn12701 at 1329m
Red: u-comp
Blue: v-comp
6000
5000
4000
3000
2000
1000
0
10^{-3}
10^{-2}
10^{-1}
10^{0}

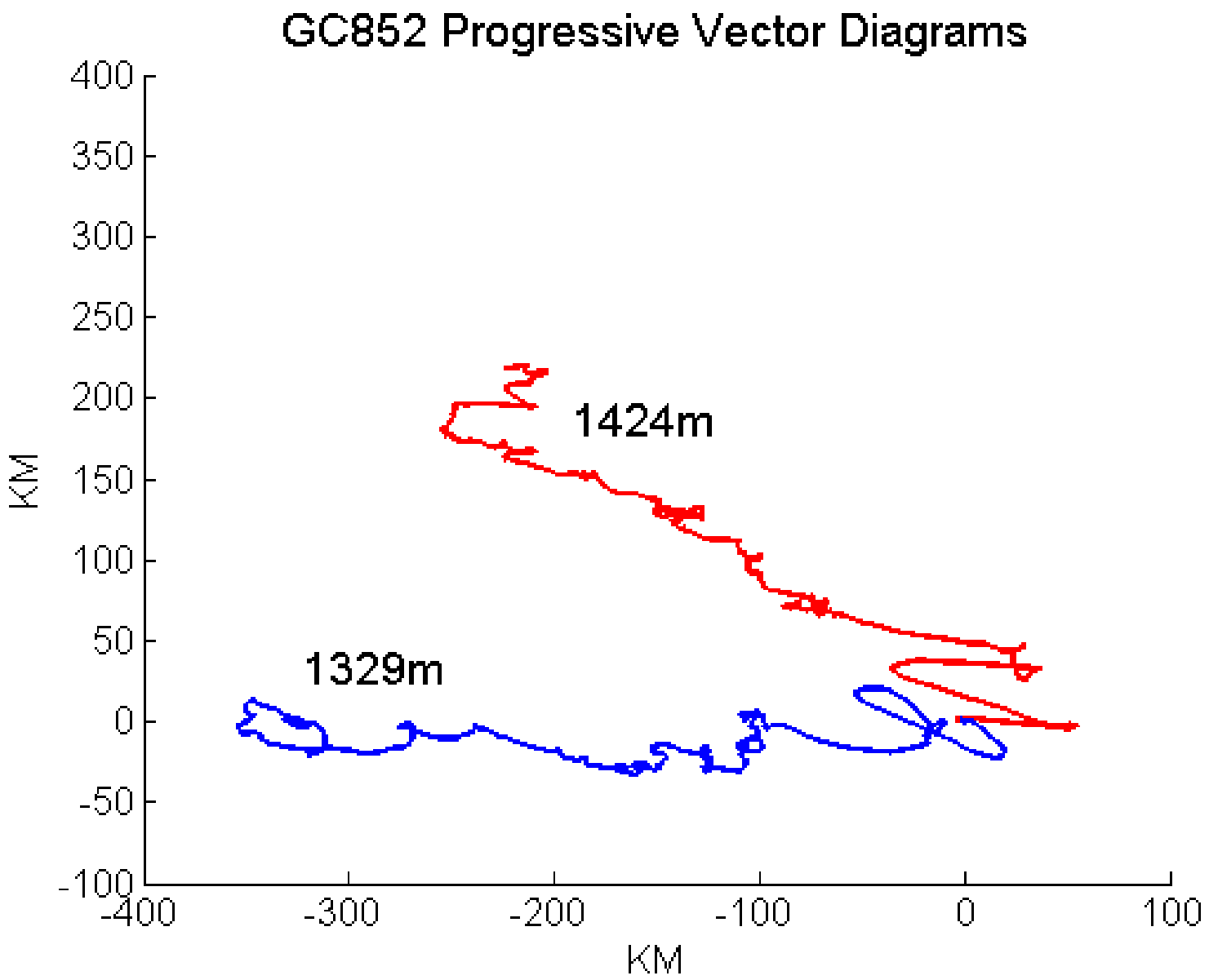

Raw Periodogram for sn12700 at 1424m
Red: u-comp
Blue: v-comp
12000
10000
8000
6000
4000
2000
0
10^{-3}
10^{-2}
10^{-1}
10^{0}

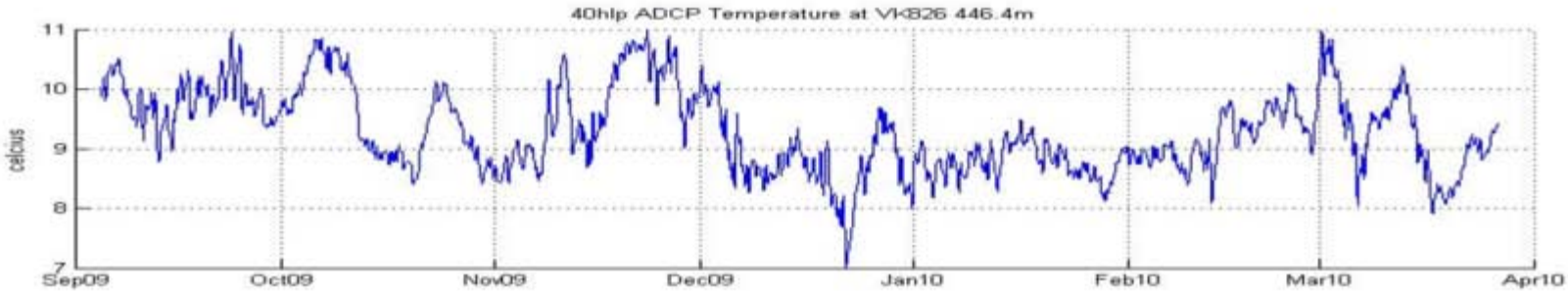

Demeaned Velocity Components at GC852 (1329 m)
cm/s
u-component
v-component
10/01
01/01
04/01
07/01
10/01

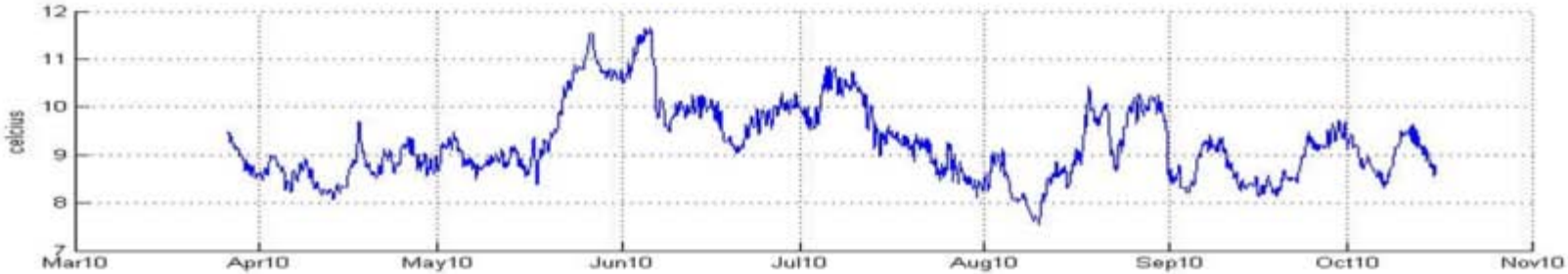

Demeaned Velocity Components at GC852 (1424 m)
cm/s
u-component
v-component
10/01
01/01
04/01
07/01
10/01

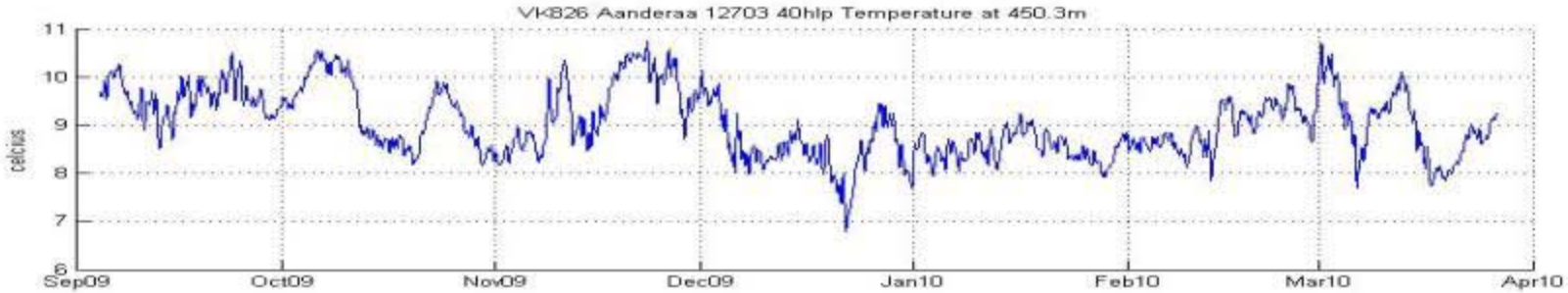

Rotary Spectra at GC852 (1329m)
CC
CW
Period (Hours)

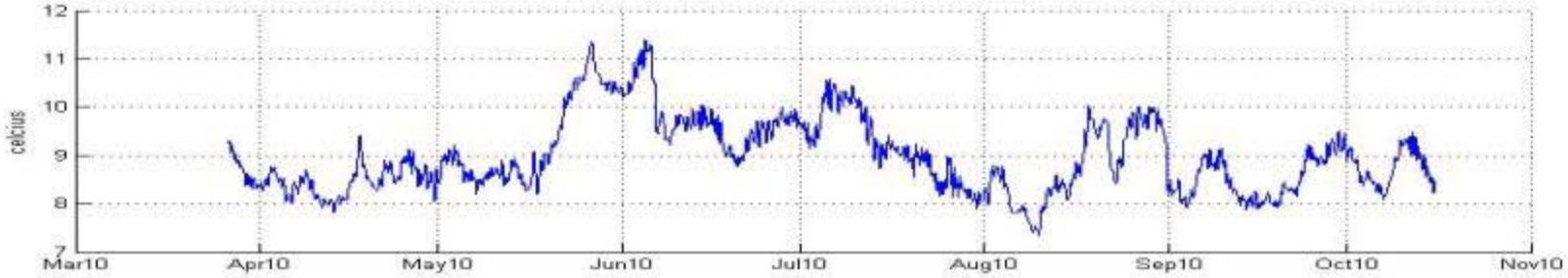

Rotary Spectra at GC852 (1424m)
CC
CW
Period (Hours)

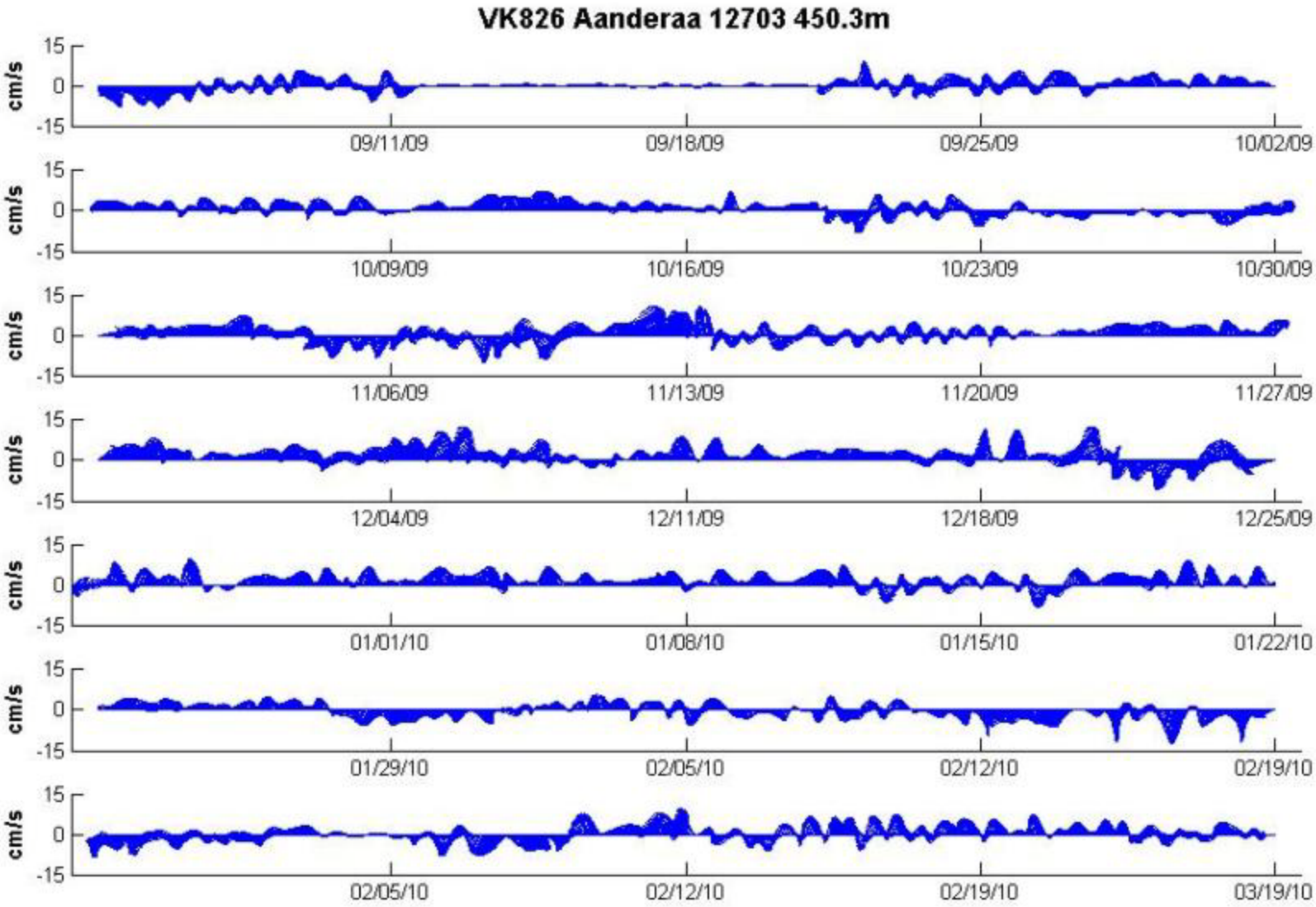

GC852 Progressive Vector Diagrams
400
350
300
250
200
150
100
50
0
-50
-100
KM
-400
-300
-200
-100
0
100
KM
1424m
1329m

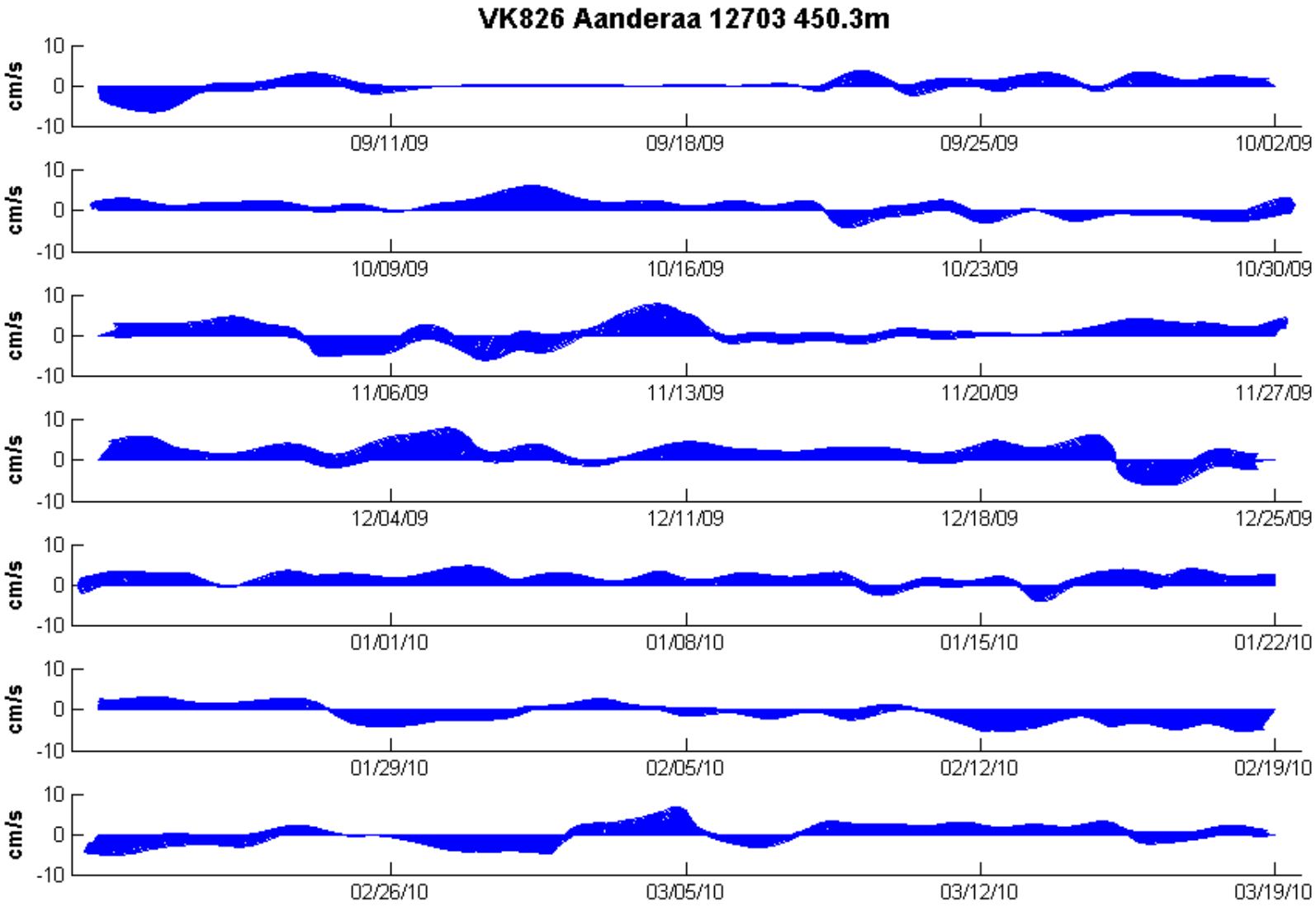

40hlp ADCP Temperature at VK826 446.4m
celcius
11
10
9
8
7
Sep09
Oct09
Nov09
Dec09
Jan10
Feb10
Mar10
Apr10

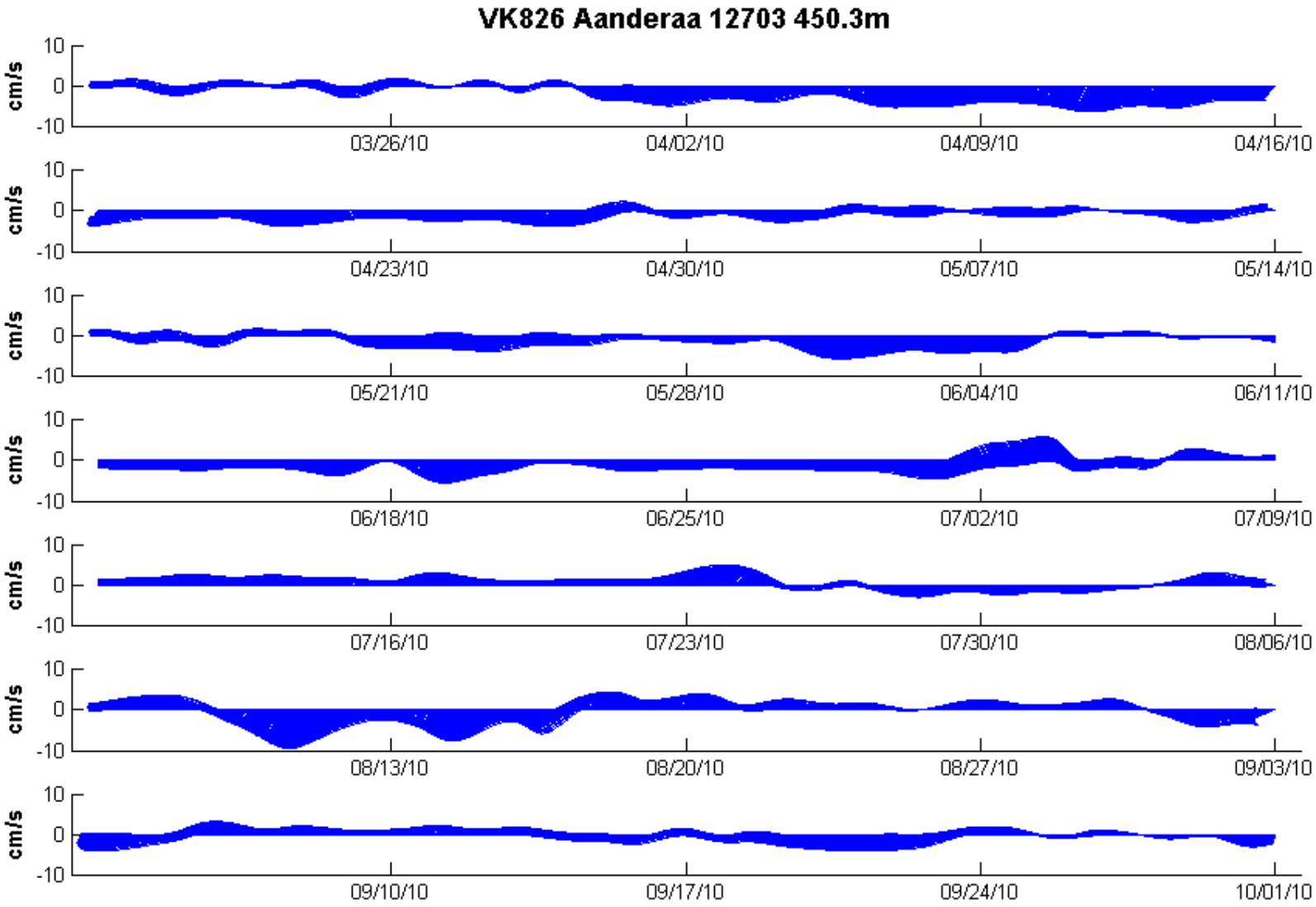

celcius
12
11
10
9
8
7
Mar10
Apr10
May10
Jun10
Jul10
Aug10
Sep10
Oct10
Nov10

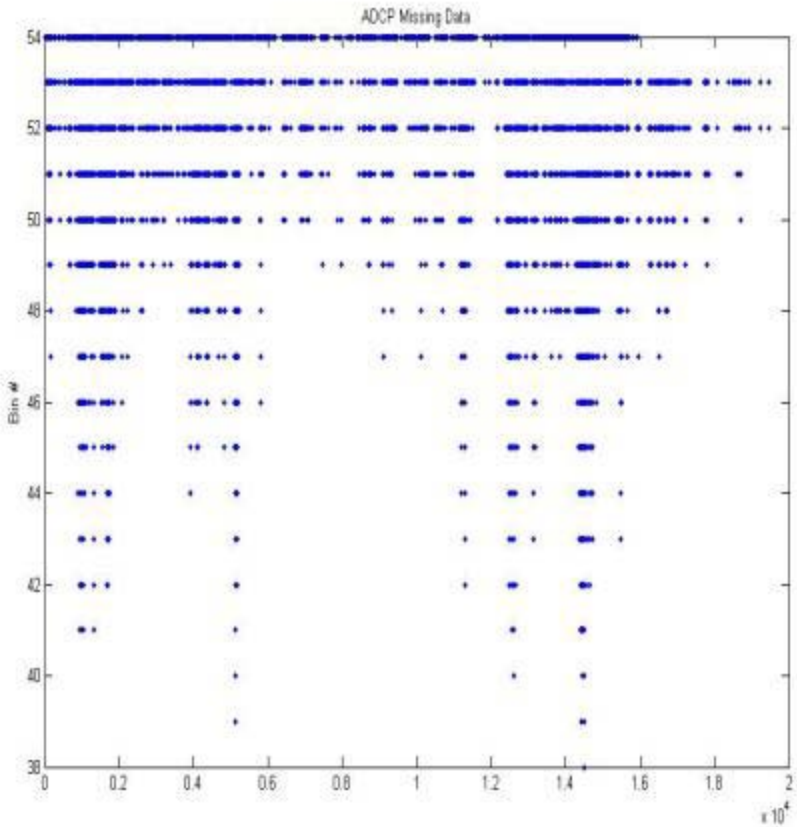

VK826 Aanderaa 12703 40hlp Temperature at 450.3m
celcius
11
10
9
8
7
6
Sep09
Oct09
Nov09
Dec09
Jan10
Feb10
Mar10
Apr10

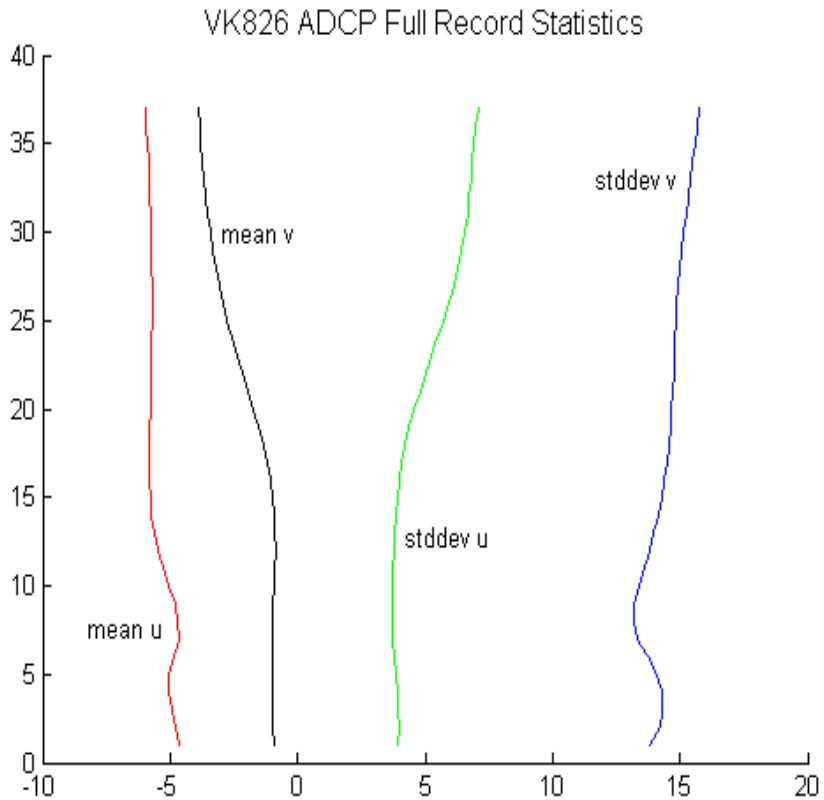

celcius
12
11
10
9
8
7
Mar10
Apr10
May10
Jun10
Jul10
Aug10
Sep10
Oct10
Nov10

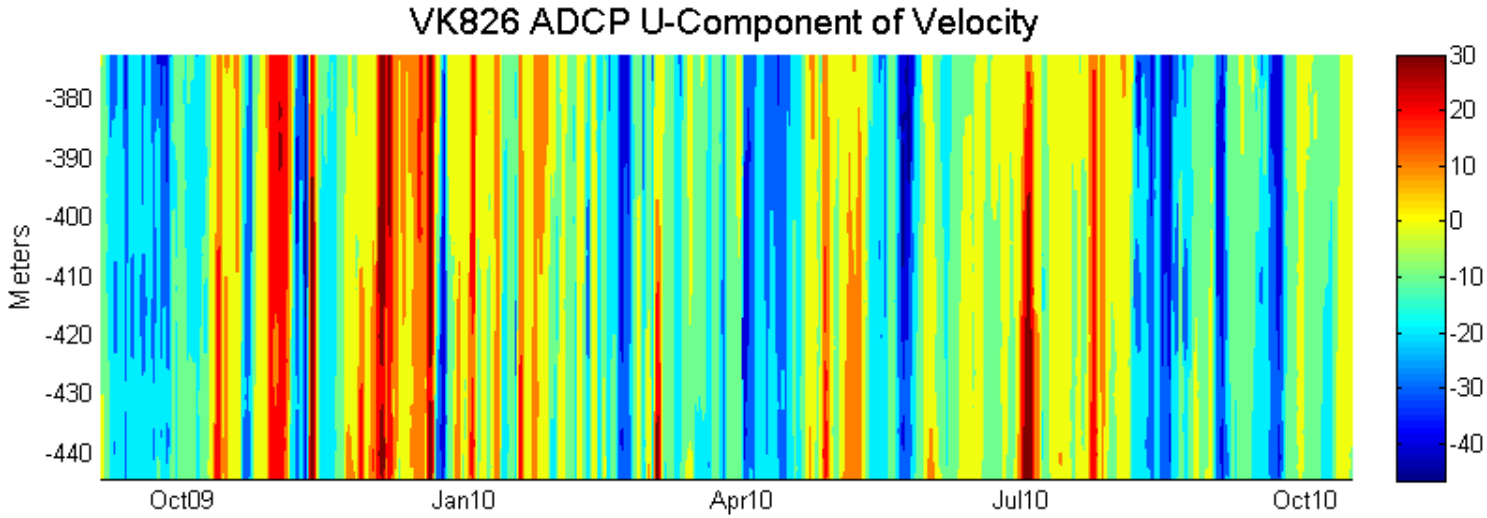

VK826 Aanderaa 12703 450.3m
cm/s
15
0
-15
09/11/09
09/18/09
09/25/09
10/02/09
10/09/09
10/16/09
10/23/09
10/30/09
11/06/09
11/13/09
11/20/09
11/27/09
12/04/09
12/11/09
12/18/09
12/25/09
01/01/10
01/08/10
01/15/10
01/22/10
01/29/10
02/05/10
02/12/10
02/19/10
02/05/10
02/12/10
02/19/10
03/19/10

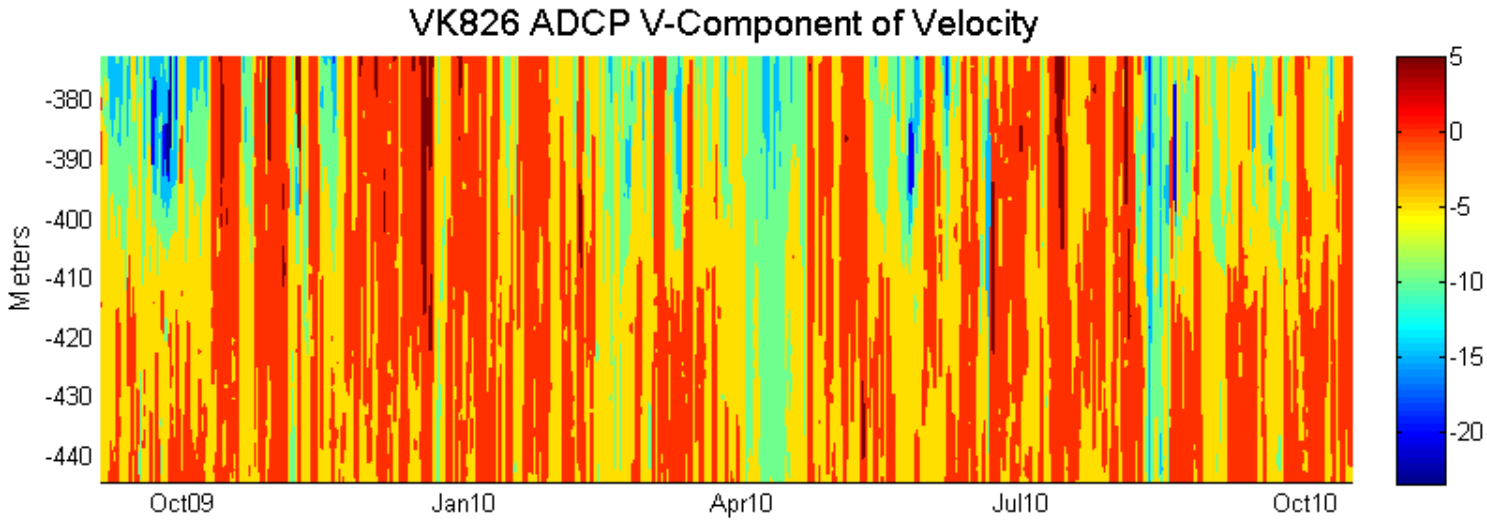

VK826 Aanderaa 12703 450.3m
cm/s
10
0
-10
09/11/09
09/18/09
09/25/09
10/02/09
10/09/09
10/16/09
10/23/09
10/30/09
11/06/09
11/13/09
11/20/09
11/27/09
12/04/09
12/11/09
12/18/09
12/25/09
01/01/10
01/08/10
01/15/10
01/22/10
01/29/10
02/05/10
02/12/10
02/19/10
02/26/10
03/05/10
03/12/10
03/19/10

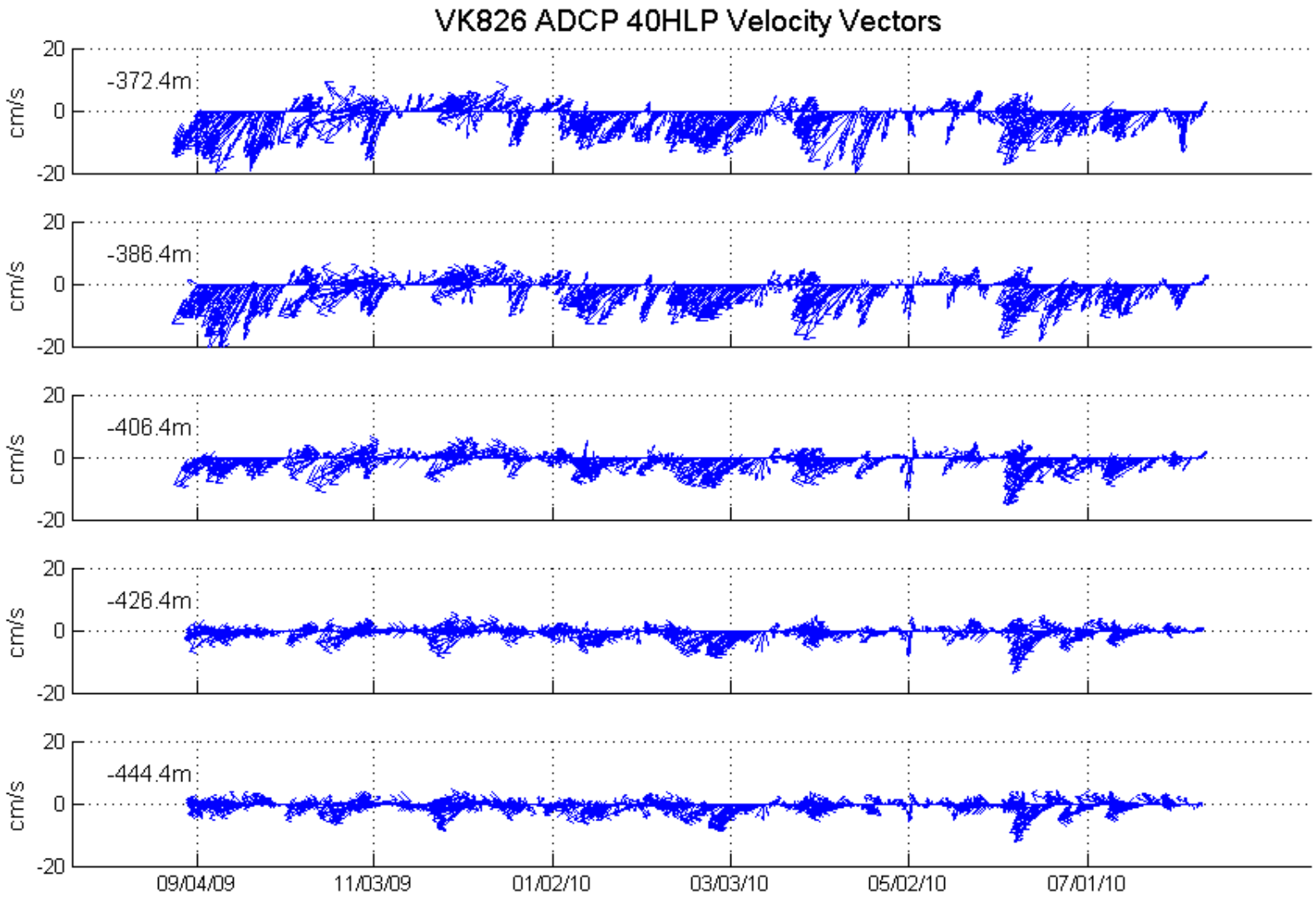

VK826 Aanderaa 12703 450.3m
cm/s
10
0
-10
03/26/10
04/02/10
04/09/10
04/16/10
04/23/10
04/30/10
05/07/10
05/14/10
05/21/10
05/28/10
06/04/10
06/11/10
06/18/10
06/25/10
07/02/10
07/09/10
07/16/10
07/23/10
07/30/10
08/06/10
08/13/10
08/20/10
08/27/10
09/03/10
09/10/10
09/17/10
09/24/10
10/01/10

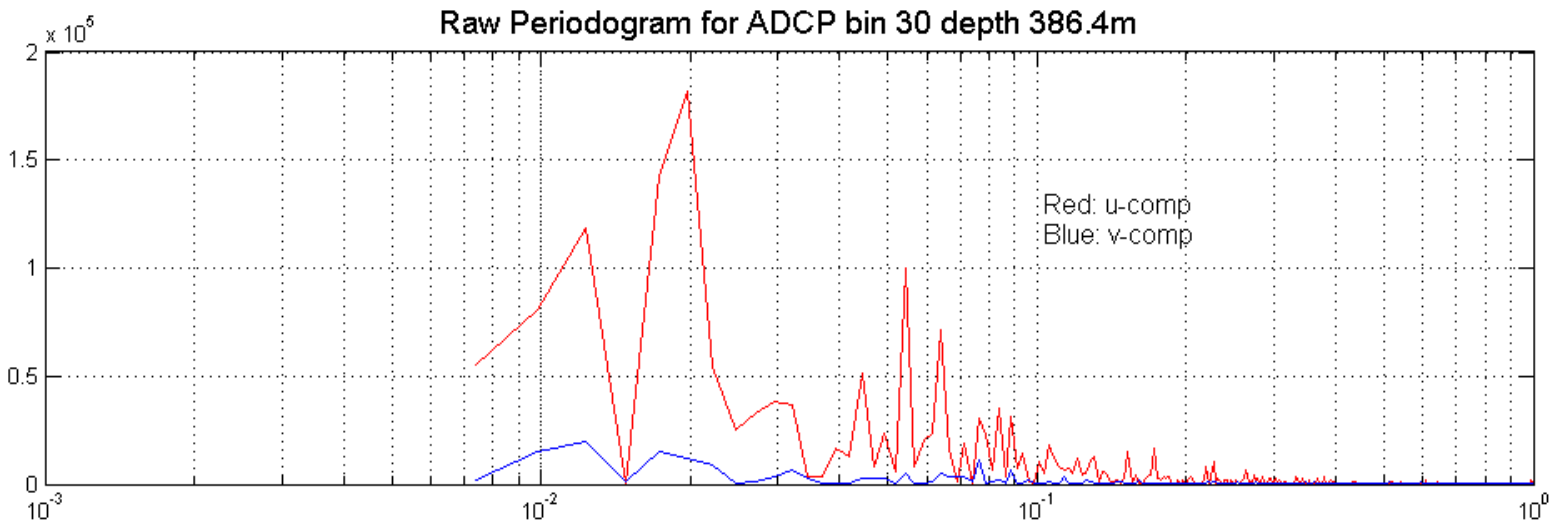

ADCP Missing Data
Bin #
x 10^4

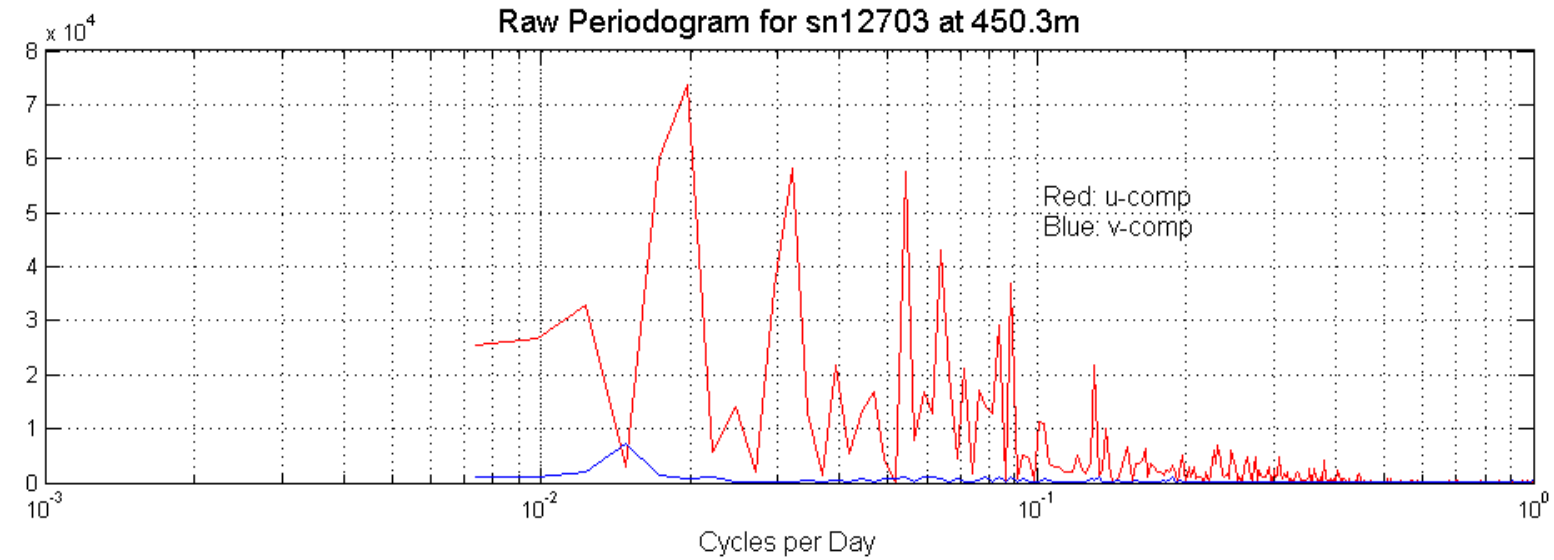

VK826 ADCP Full Record Statistics
mean u
mean v
stddev u
stddev v

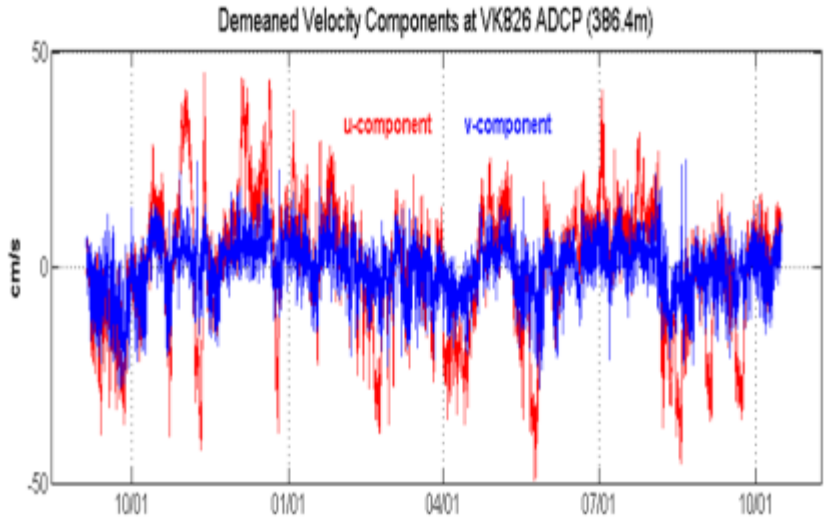

VK826 ADCP U-Component of Velocity
Meters
-380
-390
-400
-410
-420
-430
-440
Oct09
Jan10
Apr10
Jul10
Oct10
30
20
10
0
-10
-20
-30
-40

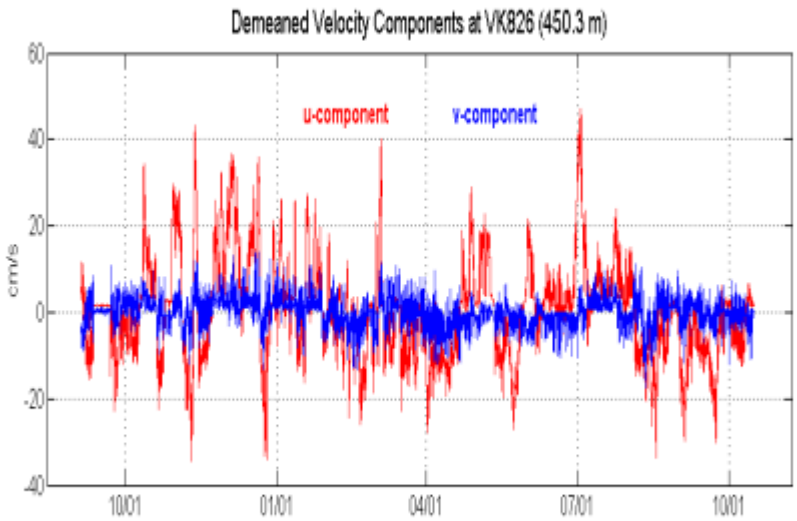

VK826 ADCP V-Component of Velocity
Meters
-380
-390
-400
-410
-420
-430
-440
Oct09
Jan10
Apr10
Jul10
Oct10
5
0
-5
-10
-15
-20

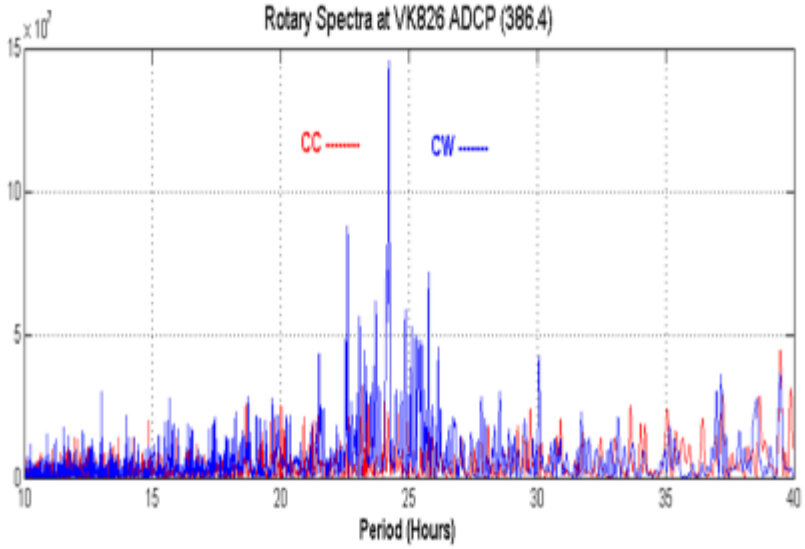

VK826 ADCP 40HLP Velocity Vectors
-372.4m
-386.4m
-406.4m
-426.4m
-444.4m
cm/s
20
0
-20
09/04/09
11/03/09
01/02/10
03/03/10
05/02/10
07/01/10

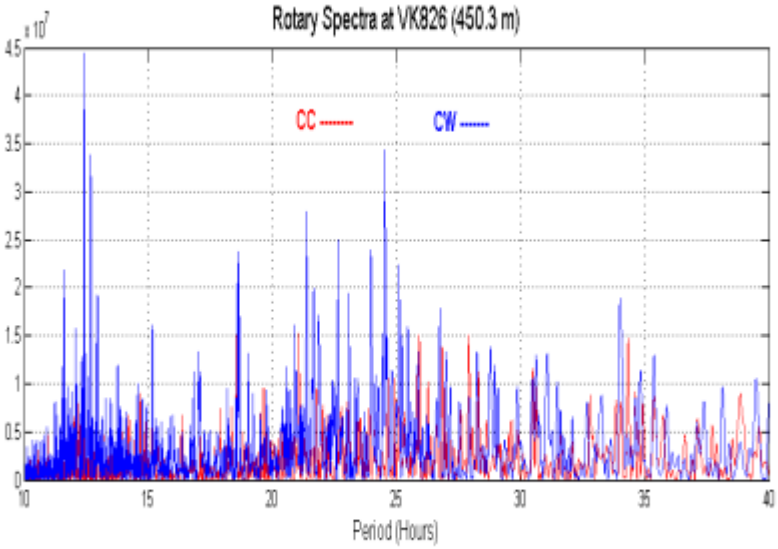

Raw Periodogram for ADCP bin 30 depth 386.4m
x 10^5
2
1.5
1
0.5
0
10^-3
10^-2
10^-1
10^0
Red: u-comp
Blue: v-comp

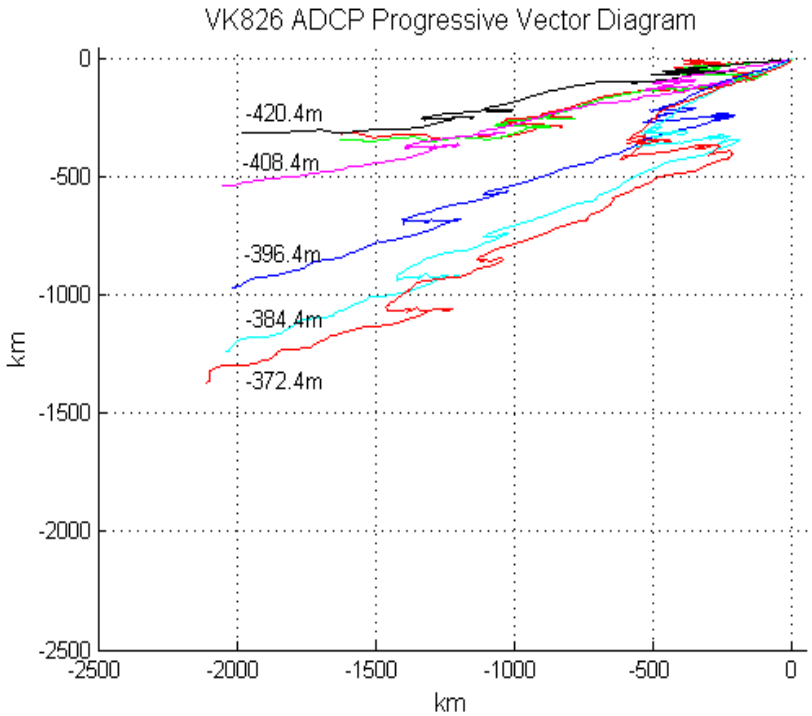

Raw Periodogram for sn12703 at 450.3m
x 10^4
8
7
6
5
4
3
2
1
0
10^-3
10^-2
10^-1
10^0
Red: u-comp
Blue: v-comp
Cycles per Day

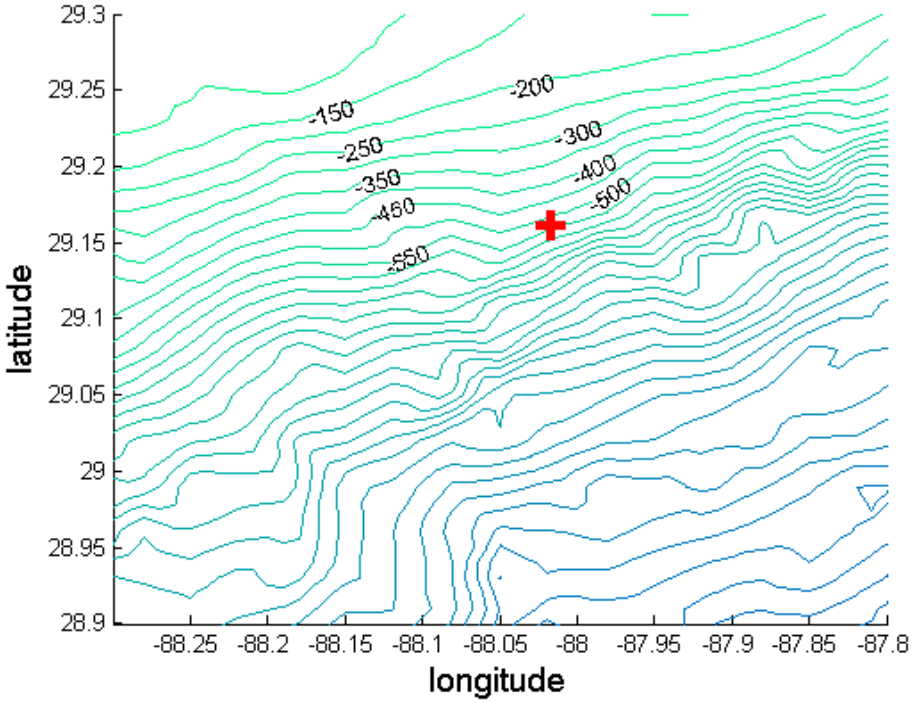

Demeaned Velocity Components at VK826 ADCP (386.4m)
u-component
v-component
cm/s
50
0
-50
10/01
01/01
04/01
07/01
10/01

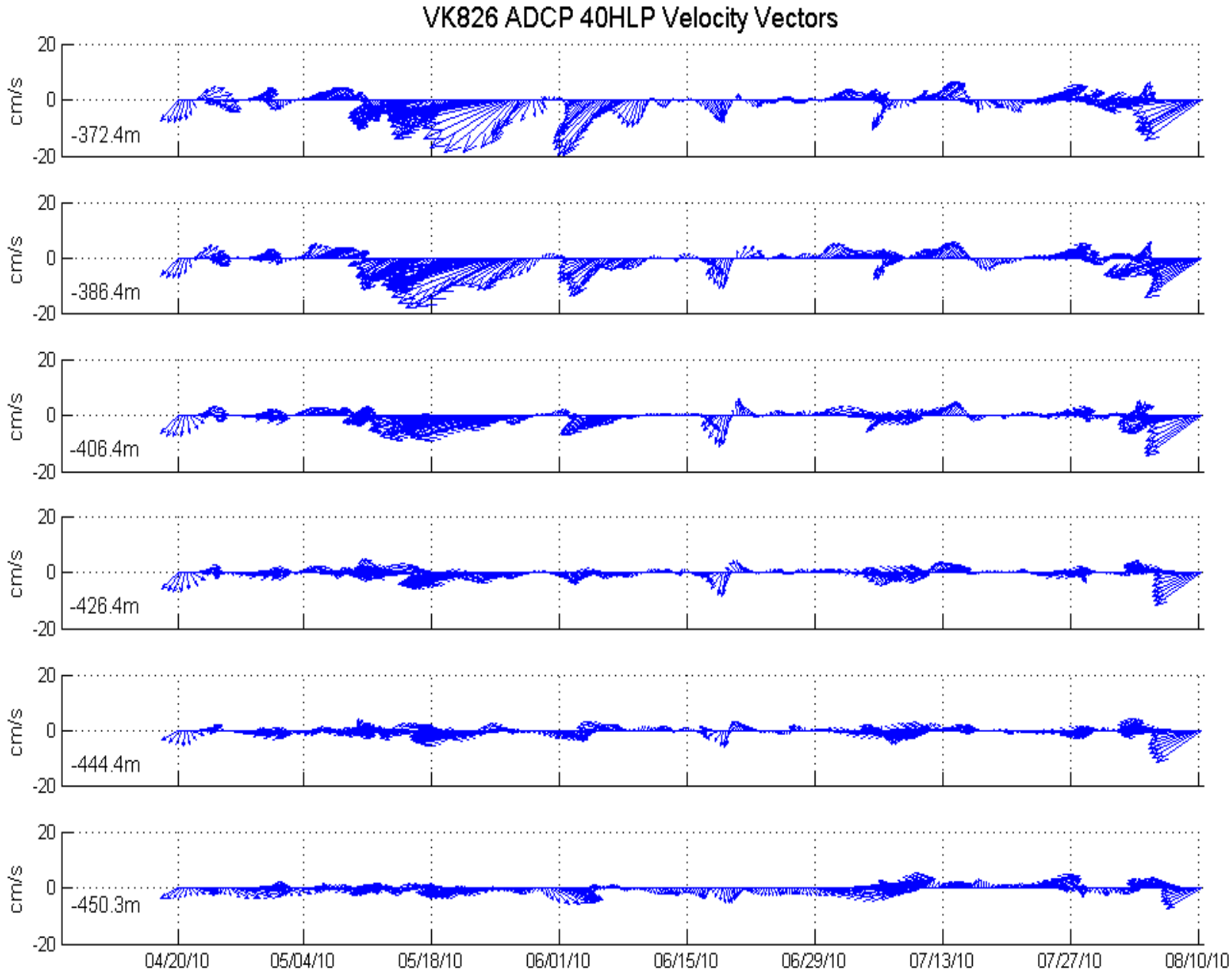

Demeaned Velocity Components at VK826 (450.3 m)
u-component
v-component
cm/s
60
40
20
0
-20
-40
10/01
01/01
04/01
07/01
10/01


Rotary Spectra at VK826 ADCP (386.4)
x 10^7
CC
CW
15
10
5
0
10
15
20
25
30
35
40
Period (Hours)


Rotary Spectra at VK826 (450.3 m)
x 10^7
CC
CW
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
10
15
20
25
30
35
40
Period (Hours)

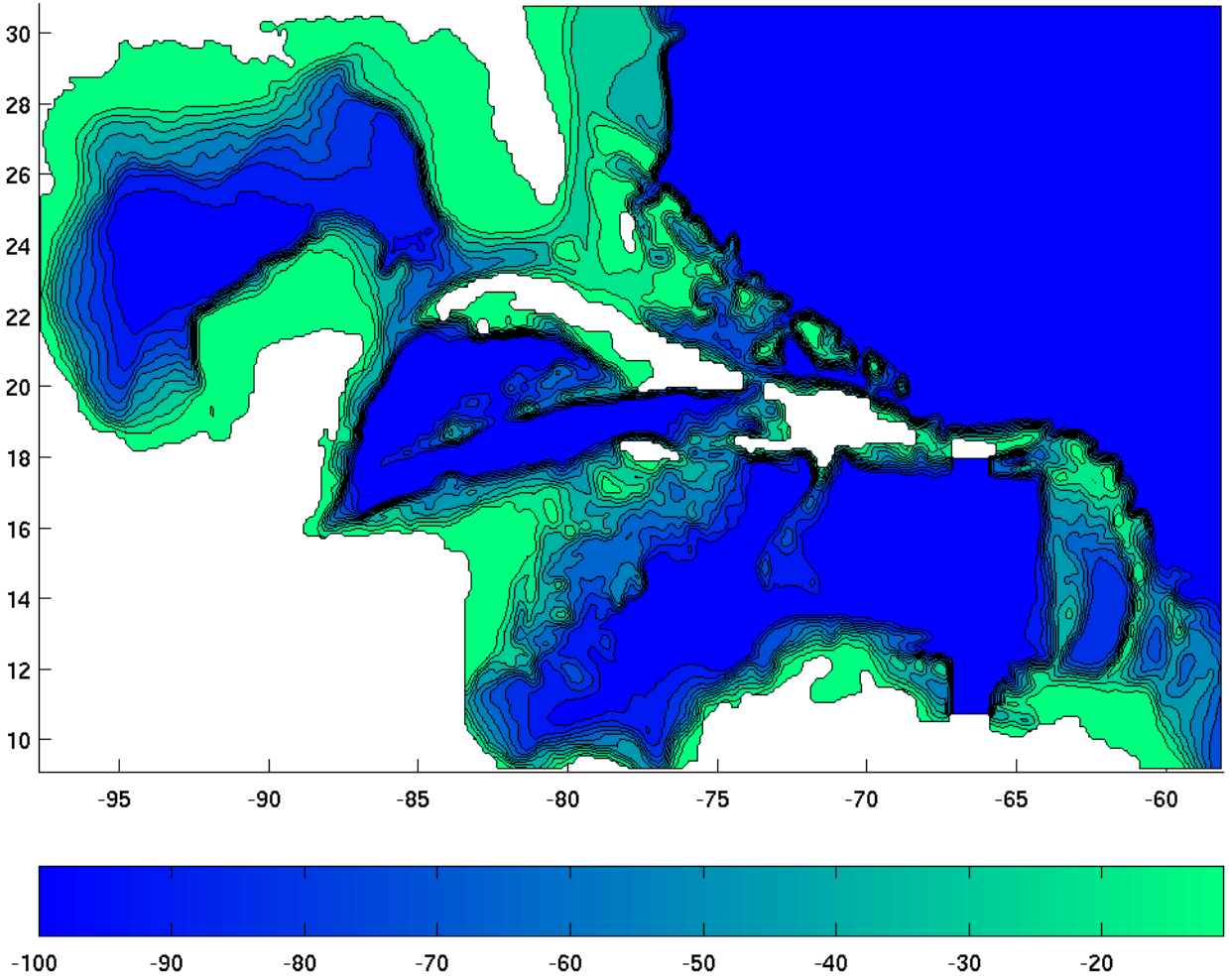

VK826 ADCP Progressive Vector Diagram
-420.4m
-408.4m
-396.4m
-384.4m
-372.4m
km
km
0
-500
-1000
-1500
-2000
-2500
-2500
-2000
-1500
-1000
-500
0


latitude
longitude
29.3
29.25
29.2
29.15
29.1
29.05
29
28.95
28.9
-88.25
-88.2
-88.15
-88.1
-88.05
-88
-87.95
-87.9
-87.85
-87.8
-150
-200
-250
-300
-350
-400
-450
-500
-550

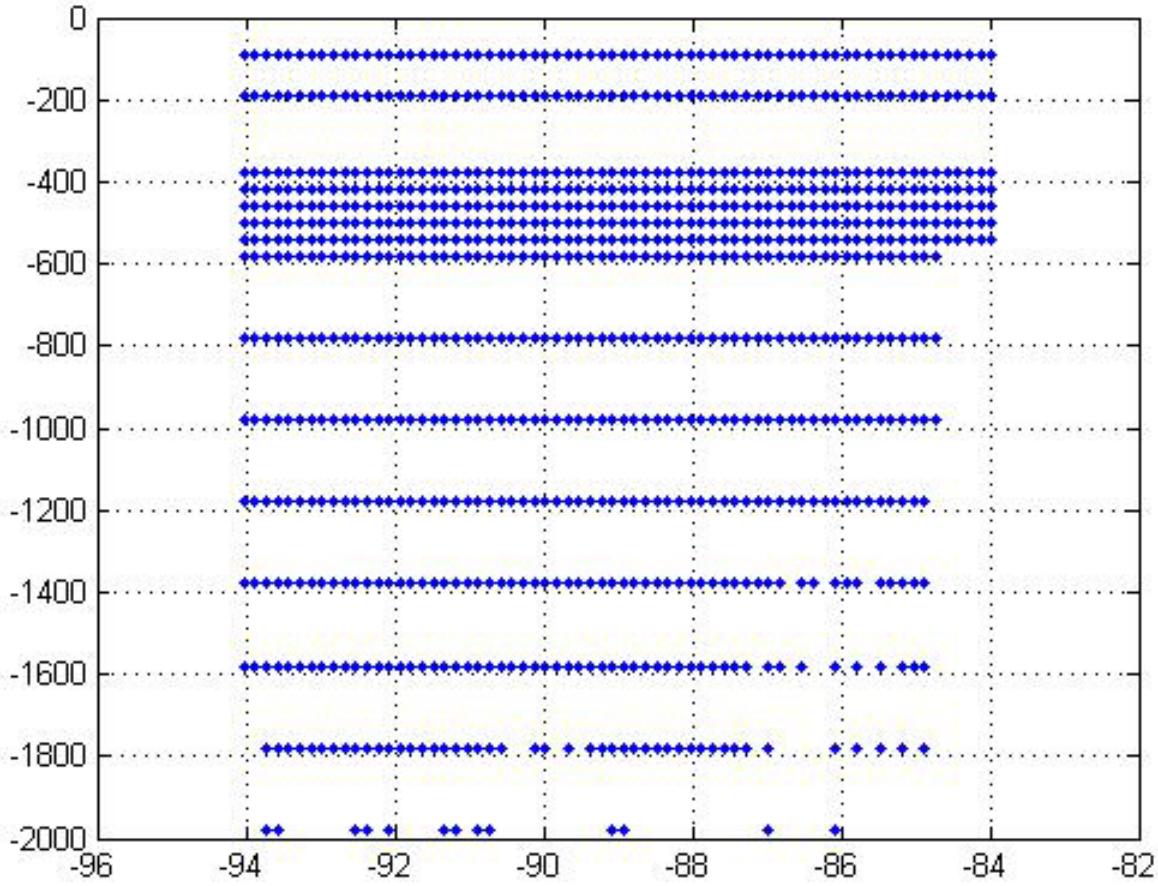

VK826 ADCP 40HLP Velocity Vectors
cm/s
20
0
-20
-372.4m
-386.4m
-406.4m
-426.4m
-444.4m
-450.3m
04/20/10
05/04/10
05/18/10
06/01/10
06/15/10
06/29/10
07/13/10
07/27/10
08/10/10

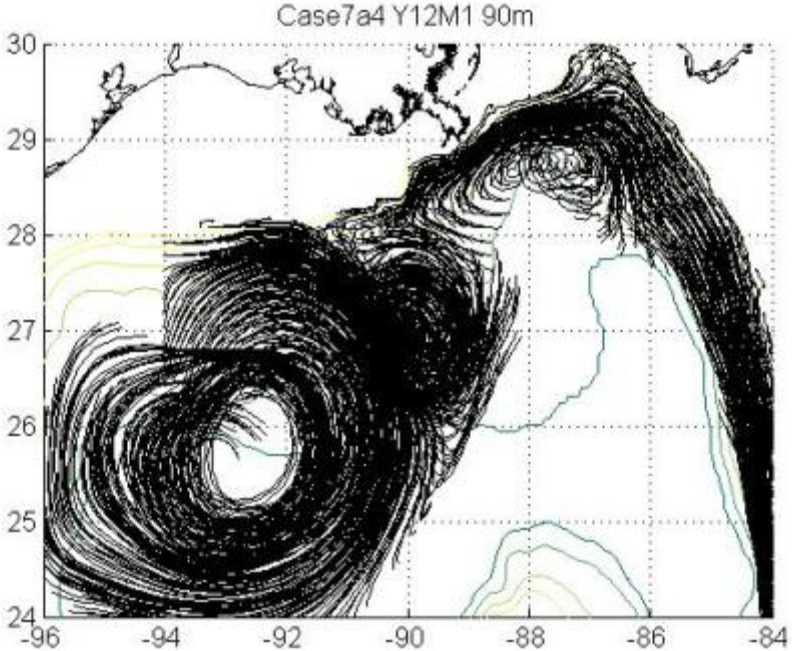
Numerical Model Description

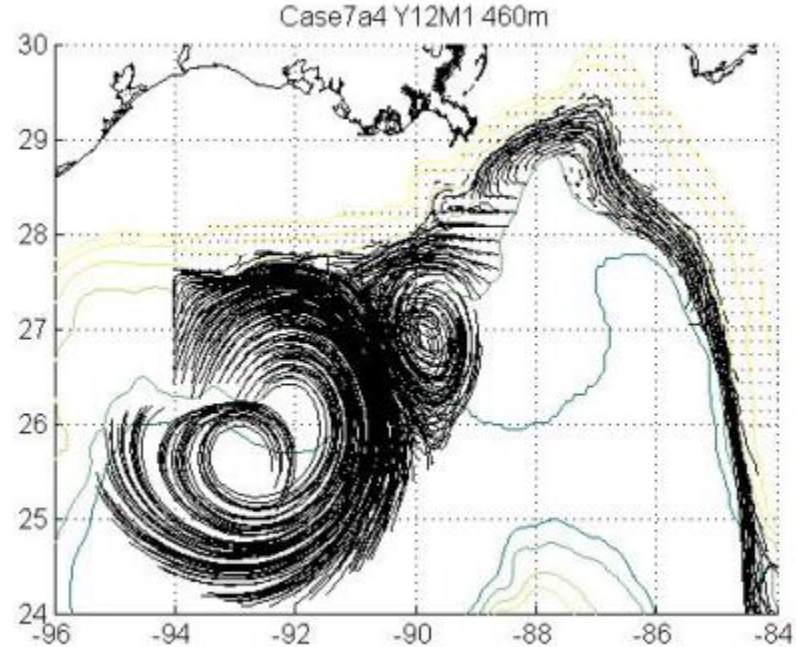
- Modular Ocean Model
- Primitive equation 3-D ocean circulation model
- 1/20 degree horizontal grid resolution (~5km)
- 100 levels in the vertical:
    - o 20m vertical spacing in upper 200m
    - o 40m vertical spacing from 200m to 3,800m
- Forced with climatological winds, SST and SSS
- Lagrangian particle tracing method

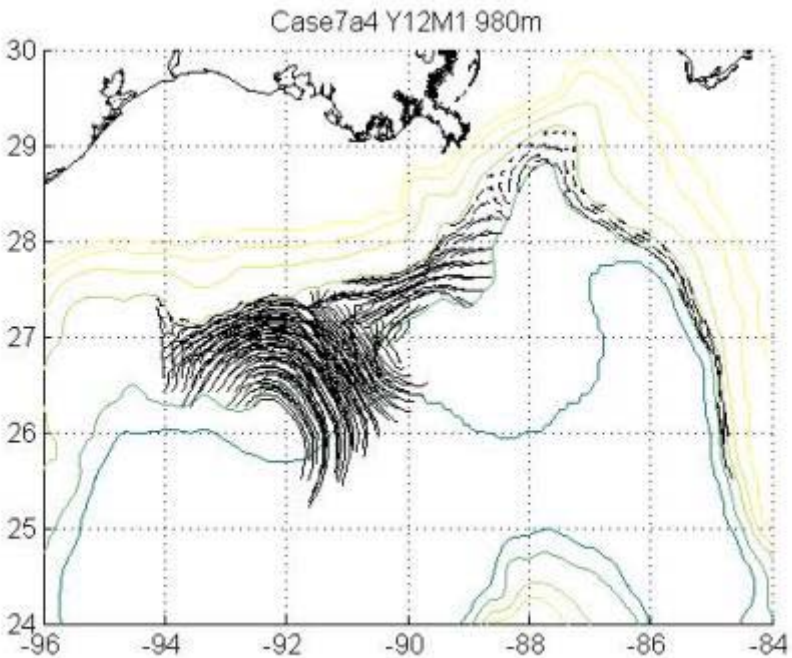

30
28
26
24
22
20
18
16
14
12
10
-95
-90
-85
-80
-75
-70
-65
-60
-100
-90
-80
-70
-60
-50
-40
-30
-20

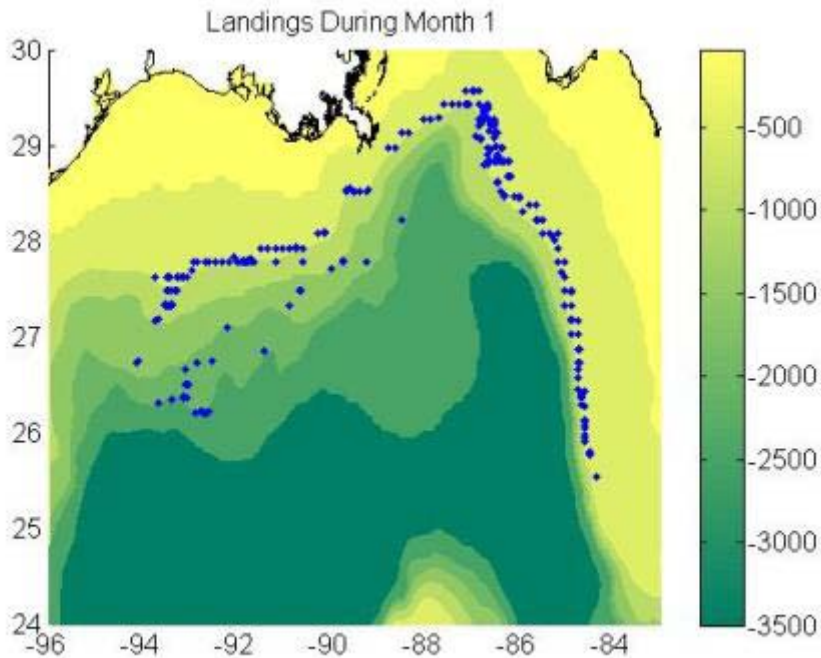
Initial particle depths over the northern slope in water depths greater than 2,000m

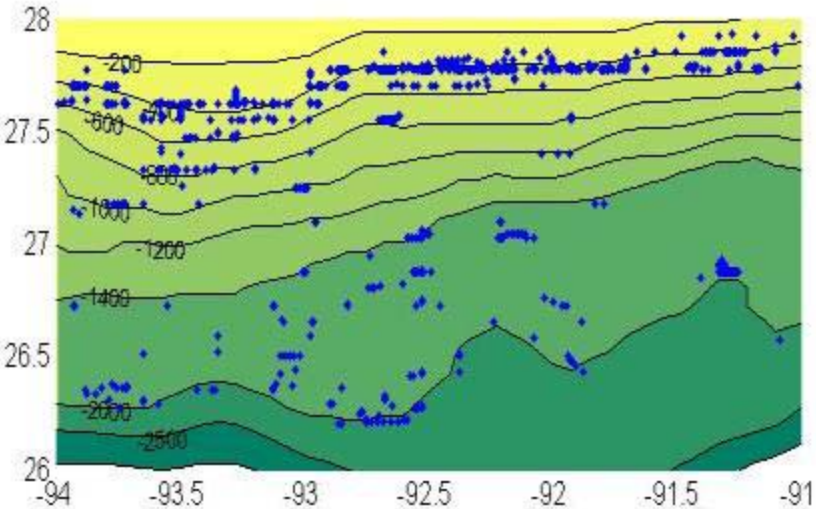


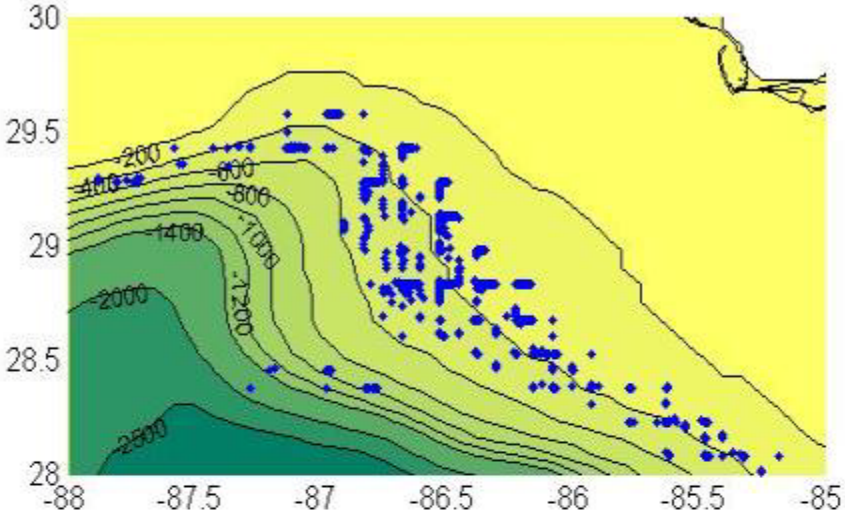

Case7a4 Y12M1 90m
30
29
28
27
26
25
24
-96
-94
-92
-90
-88
-86
-84

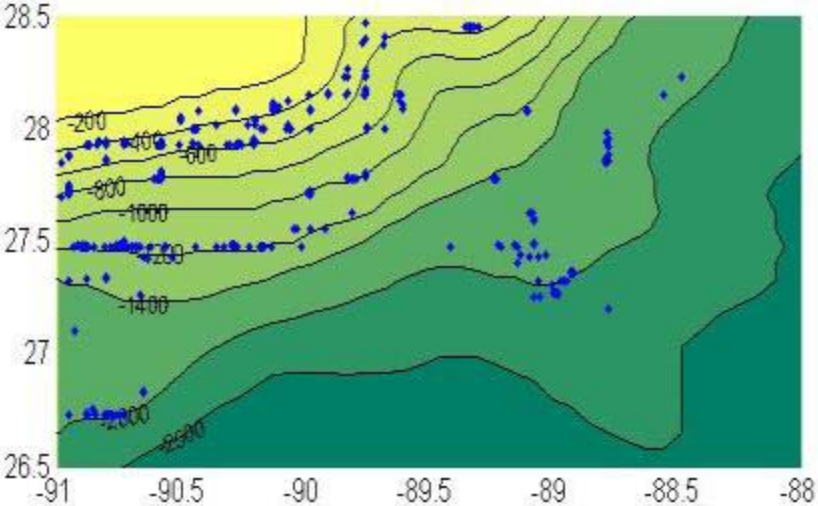

Case7a4 Y12M1 460m
30
29
28
27
26
25
24
-96
-94
-92
-90
-88
-86
-84

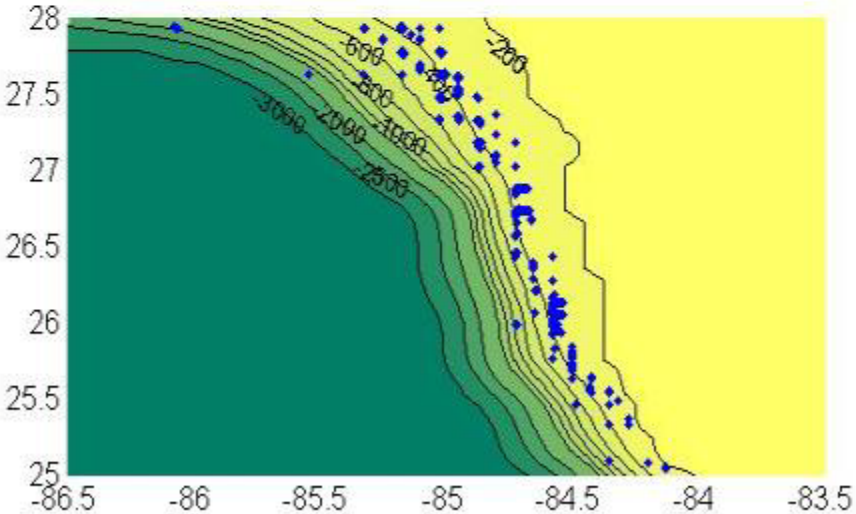

Case7a4 Y12M1 980m
30
29
28
27
26
25
24
-96
-94
-92
-90
-88
-86
-84

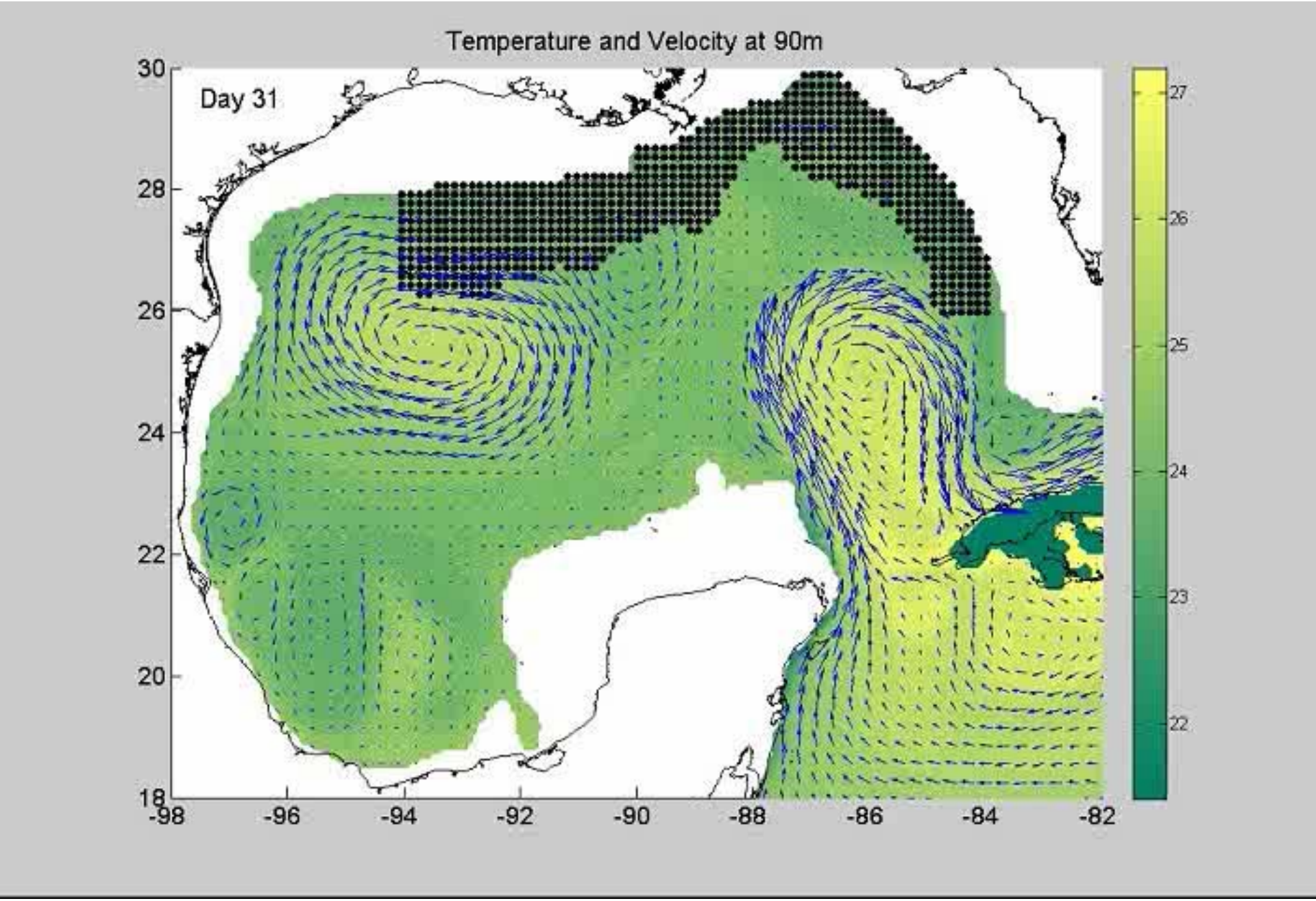

Landings During Month 1
30
29
28
27
26
25
24
-96
-94
-92
-90
-88
-86
-84
-500
-1000
-1500
-2000
-2500
-3000
-3500

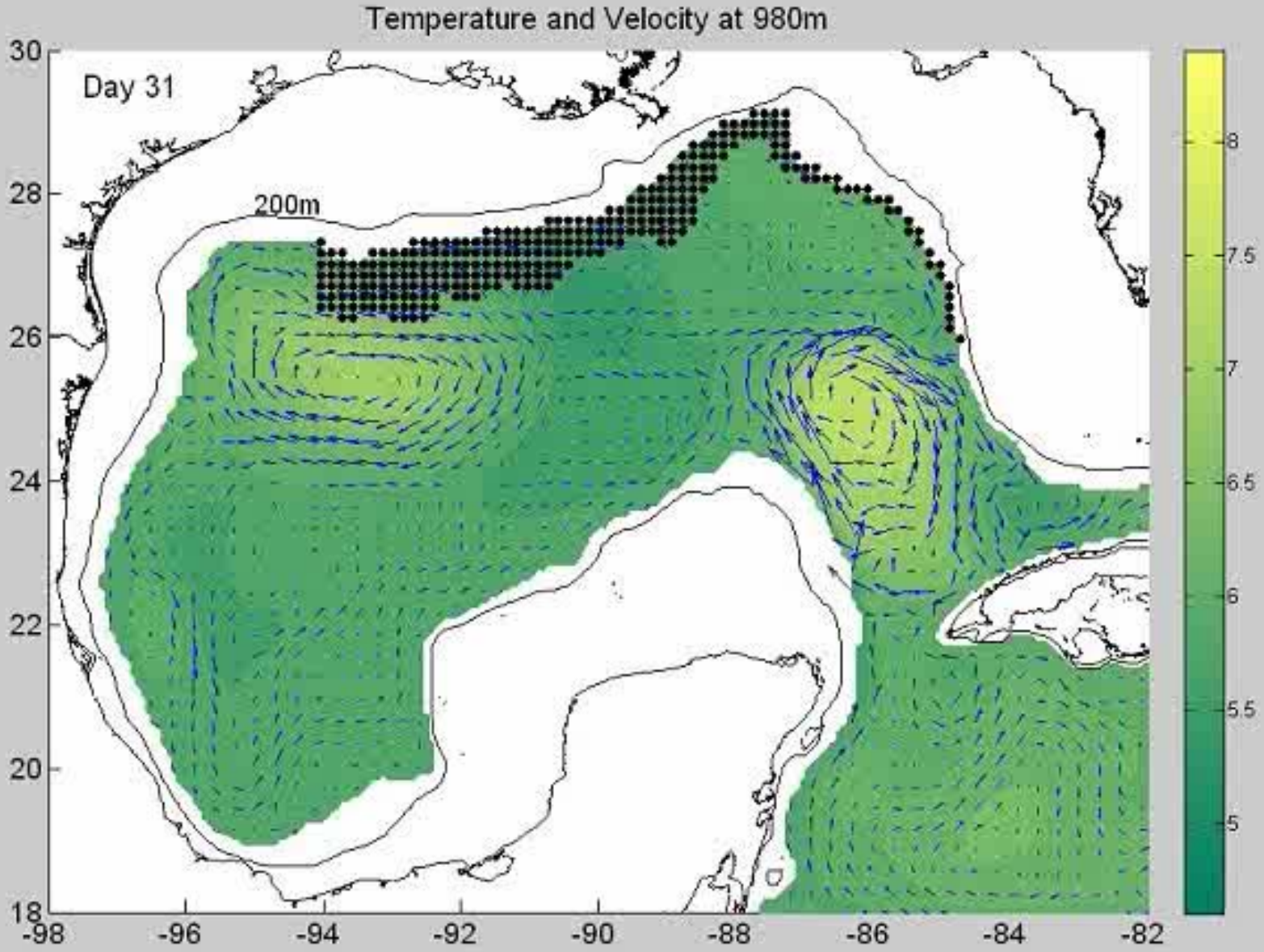

28
27.5
27
26.5
26
-94
-93.5
-93
-92.5
-92
-91.5
-91
-200
-600
-800
-1000
-1200
-1400
-2000
-2500


30
29.5
29
28.5
28
-88
-87.5
-87
-86.5
-86
-85.5
-85
-200
-400
-600
-800
-1000
-1200
-1400
-2000
-2500


28.5
28
27.5
27
26.5
-91
-90.5
-90
-89.5
-89
-88.5
-88
-200
-400
-600
-800
-1000
-1200
-1400
-2000
-2500


28
27.5
27
26.5
26
25.5
25
-86.5
-86
-85.5
-85
-84.5
-84
-83.5
-200
-400
-600
-800
-1000
-2000
-2500


Temperature and Velocity at 90m
Day 31
30
28
26
24
22
20
18
-98
-96
-94
-92
-90
-88
-86
-84
-82
27
26
25
24
23
22


Temperature and Velocity at 980m
Day 31
200m
30
28
26
24
22
20
18
-98
-96
-94
-92
-90
-88
-86
-84
-82
8
7.5
7
6.5
6
5.5
5

Summary

- Stronger inertial motions at the Green Canyon site
- Broader frequency response at the VK site
- Strong bathymetric control of flow above the boundary layer
- More analysis is needed