A study of surface currents in the lower Chesapeake Bay region using HFRADAR

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OLD DOMINION UNIVERSITY

MACOORA
Mid-Atlantic Coastal Ocean Observing Regional Association

NOAA
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

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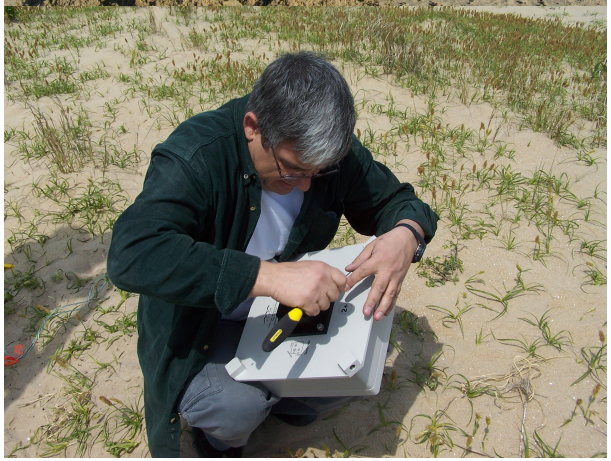
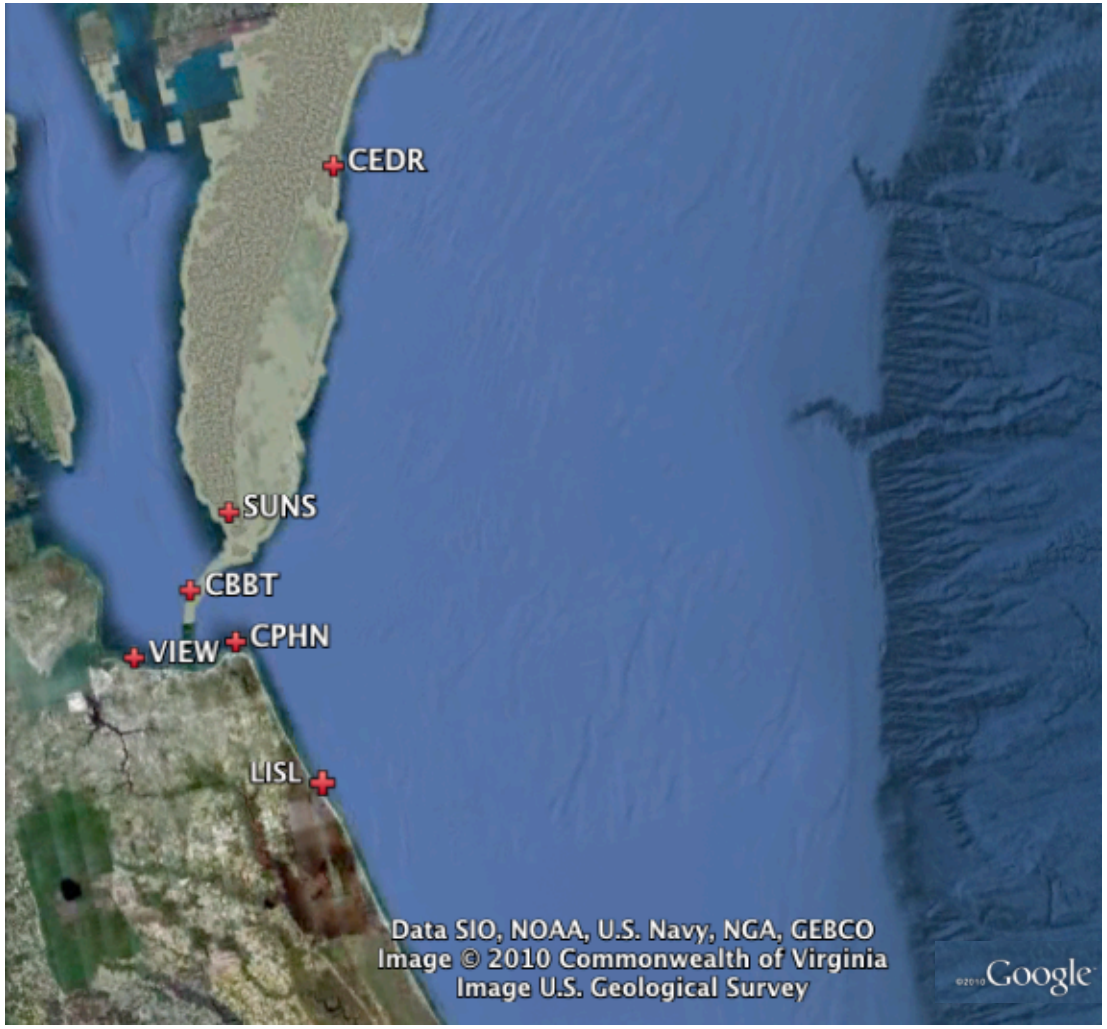
CENTER FOR INNOVATIVE TECHNOLOGY

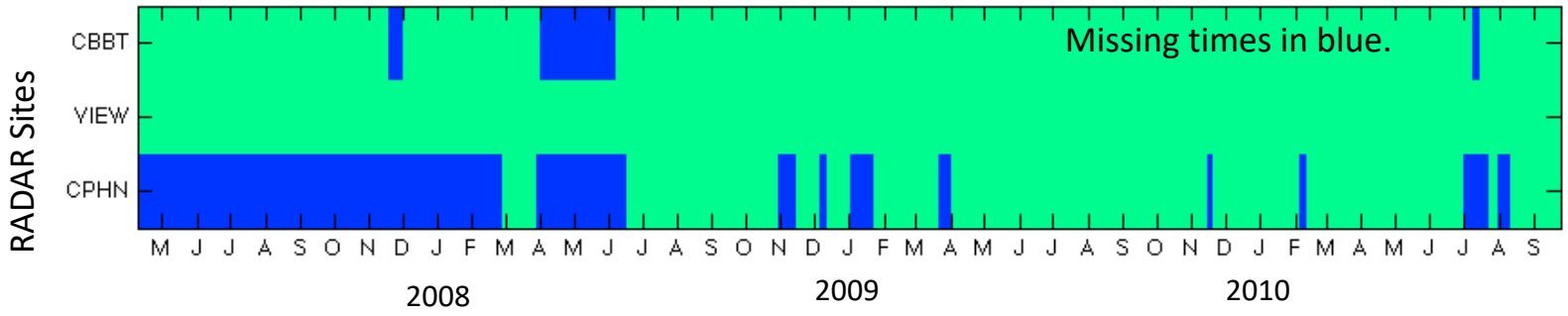


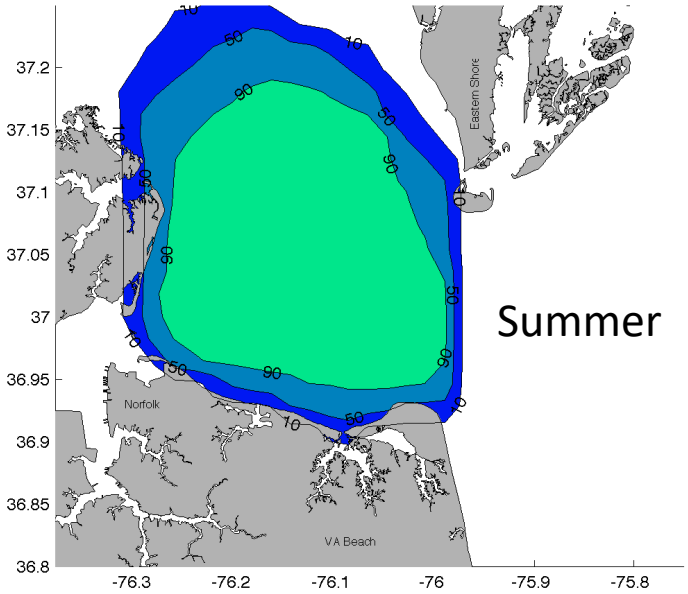
- Introduction to HFRADAR Sites & Data
- Quality Control Efforts
  - Instrument Comparisons
  - Pattern Measurements
  - New Test Site in Bay
  - New Visualization Software
- Circulation in the Bay
  - Tidal
  - Sub-tidal

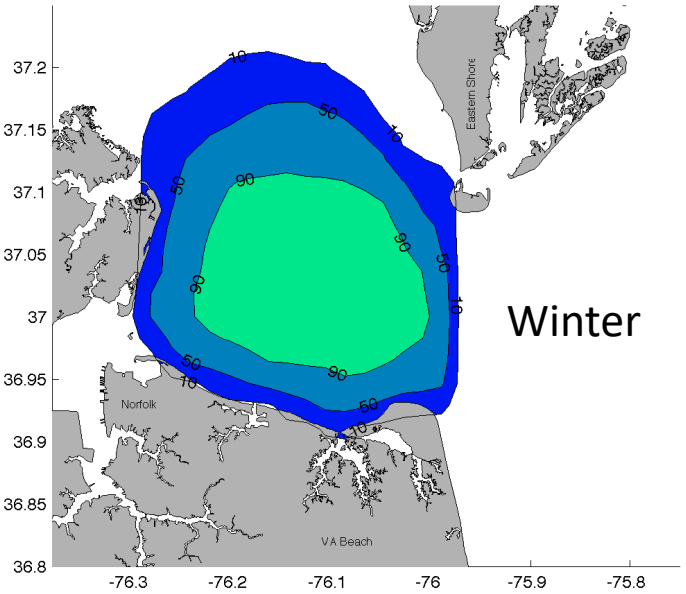
RADAR Site Locations

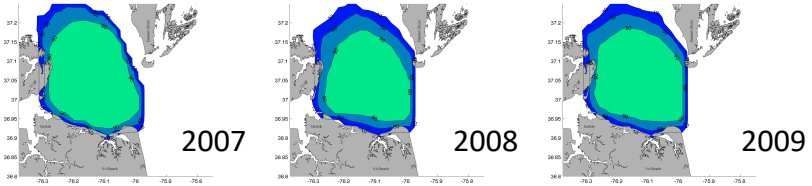


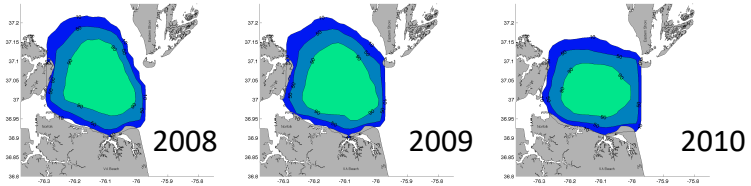
Chesapeake Bay Data Coverage





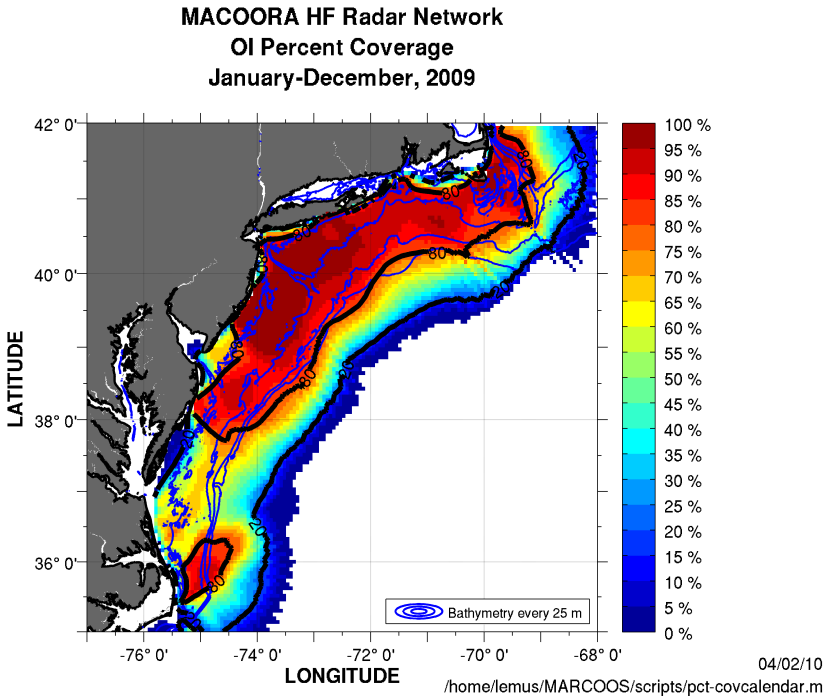


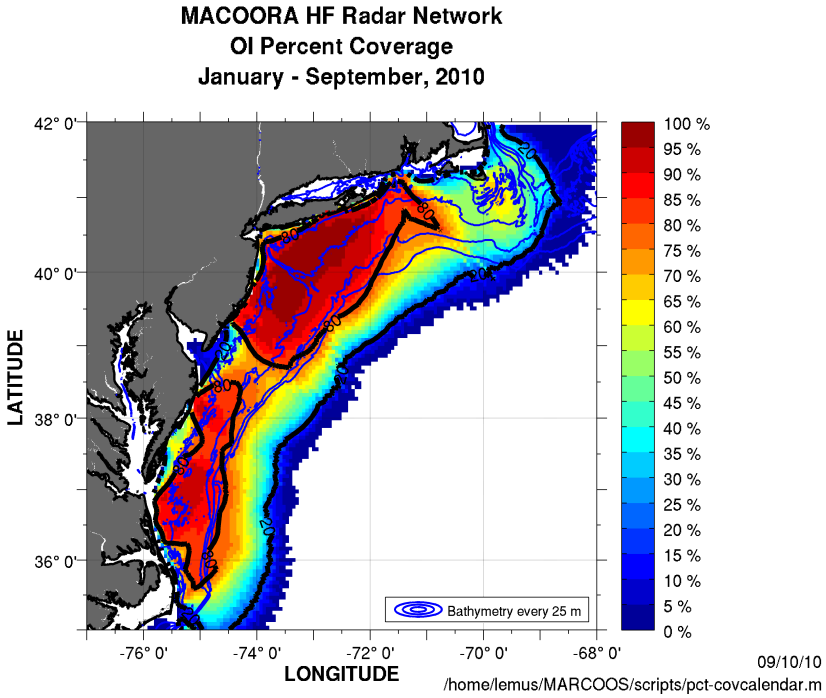


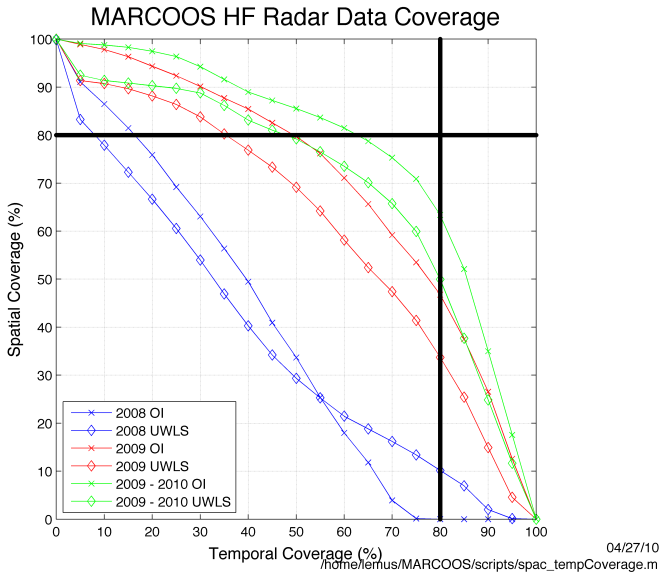


90% Coverage shown in green.

Mid-Atlantic Regional RADAR Coverage







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Rutgers University
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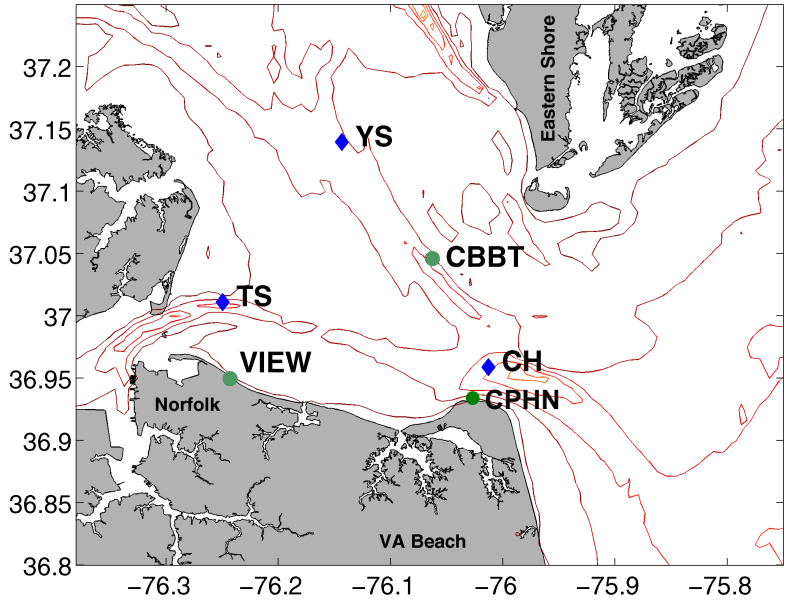
Institute of Marine and Coastal Sciences

Data Validation

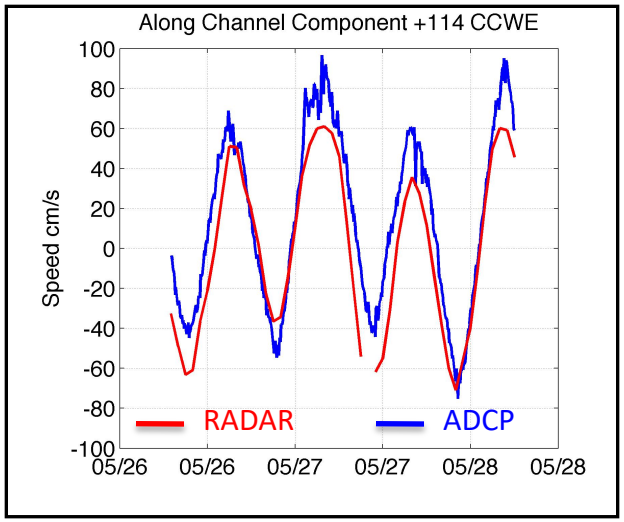
- Baseline (consistency between antennas)
- Tidal Analysis
- ADCP Comparisons
  - Real-time using NOAA PORTS data
  - City of Norfolk mooring off of Ocean View beach

Photo Source: NOAA OSTEP report

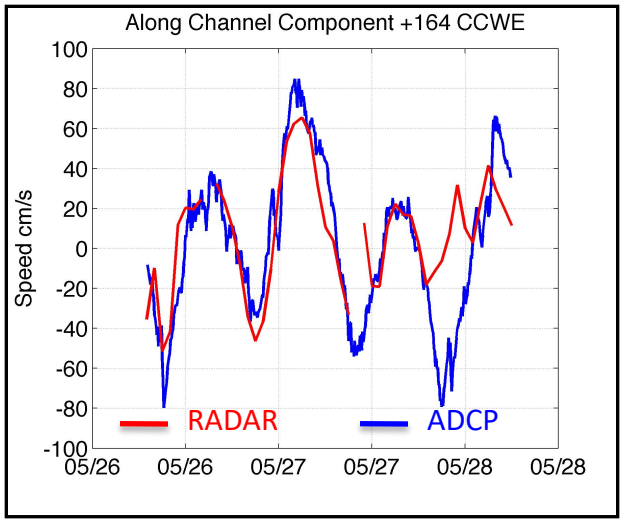
Comparisons with NOAA PORTS Doppler Current Profilers



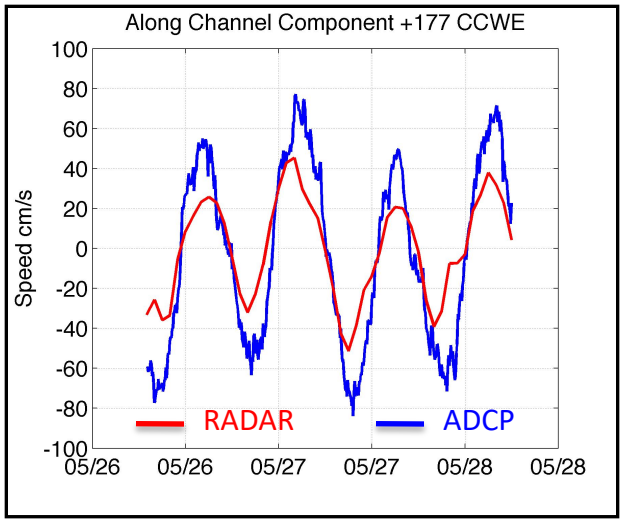
York Spit (YS)



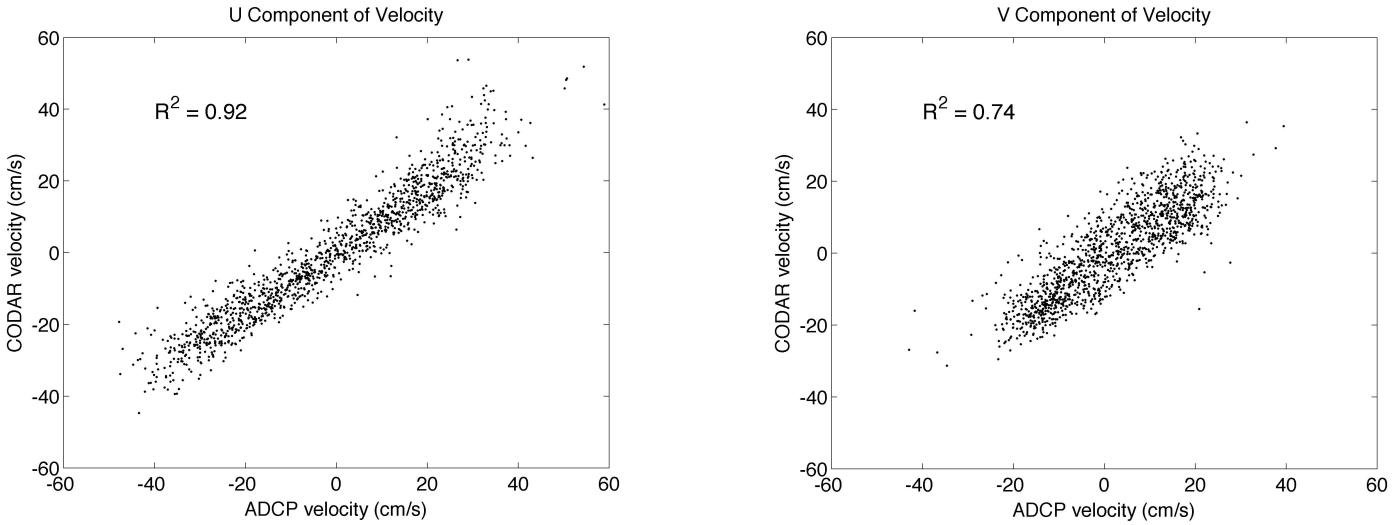
Cape Henry (CH)



Thimble Shoals (TS)



Comparisons with AWAC Current Profile Data



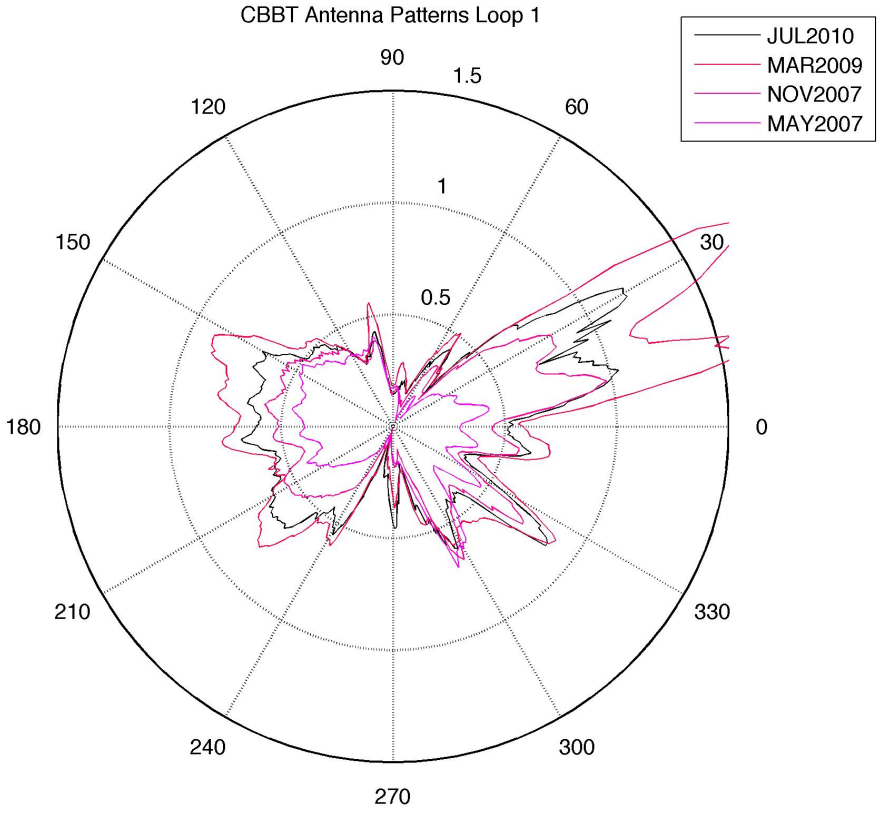
Scatter plots of ADCP data versus CODAR data for U and V velocity components during AWAC deployment 7 (Nov 13 2007 19:00 - Mar 7 2008 12:00 UTC).

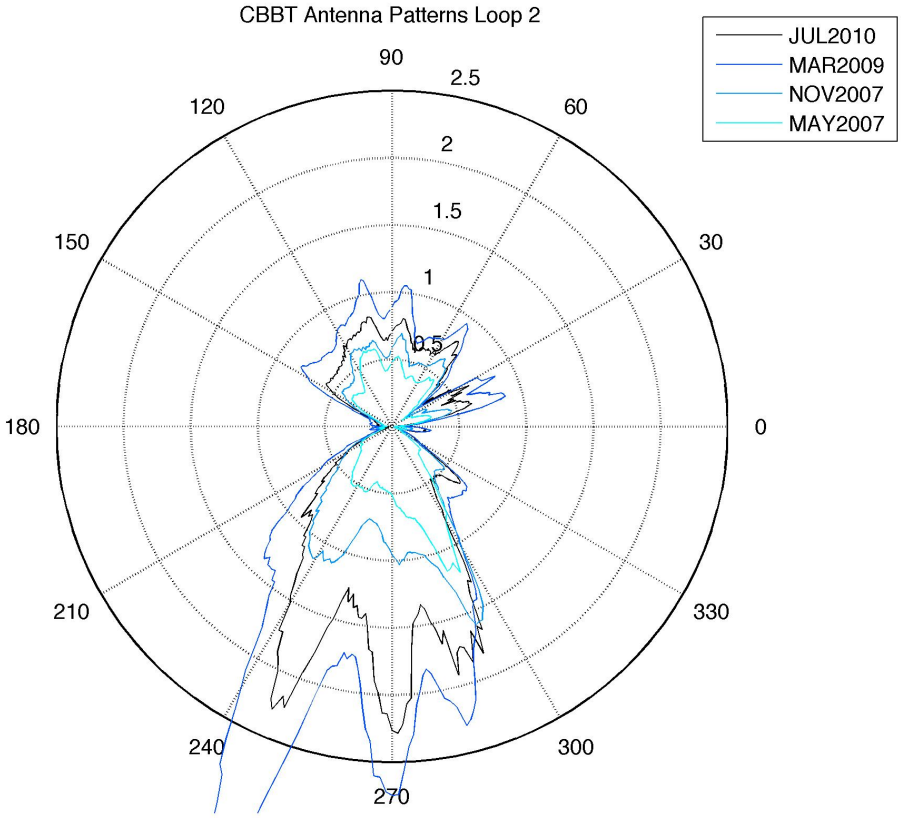
Deployment	**5**	**7**	**8**	**9**
Start Date	3/9/07	11/13/07	3/12/08	7/8/08
End Date	7/6/07	3/7/08	7/7/08	11/7/08
Npoints	1606	1345	659	2727
Mean (U)	-4.64	-1.04	-5.84	-5.01
Mean (V)	-0.29	1.21	-0.7	3.65
RMS (U)	10.57	6.19	13.09	11.74
RMS (V)	9.3	6.93	10.74	11.35

Mean and root-mean-square statistics for the difference in velocity between the Doppler profiler and CODAR in U and V components for four deployment periods.

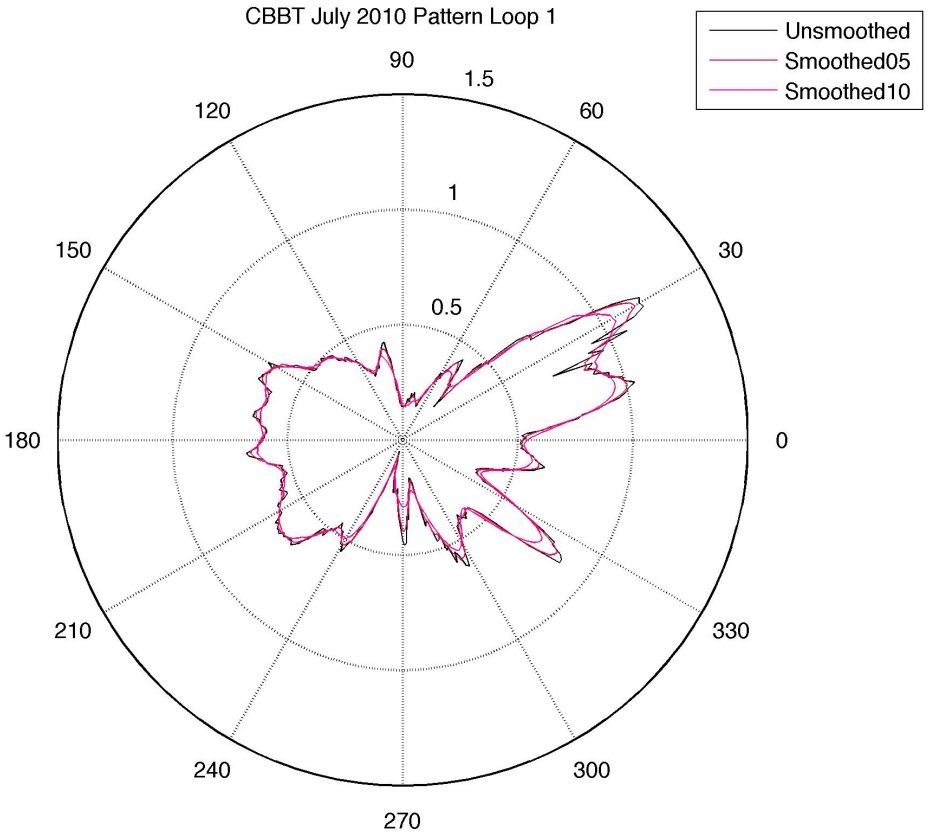
AWAC data courtesy of Moffat&Nichol and the City of Norfolk

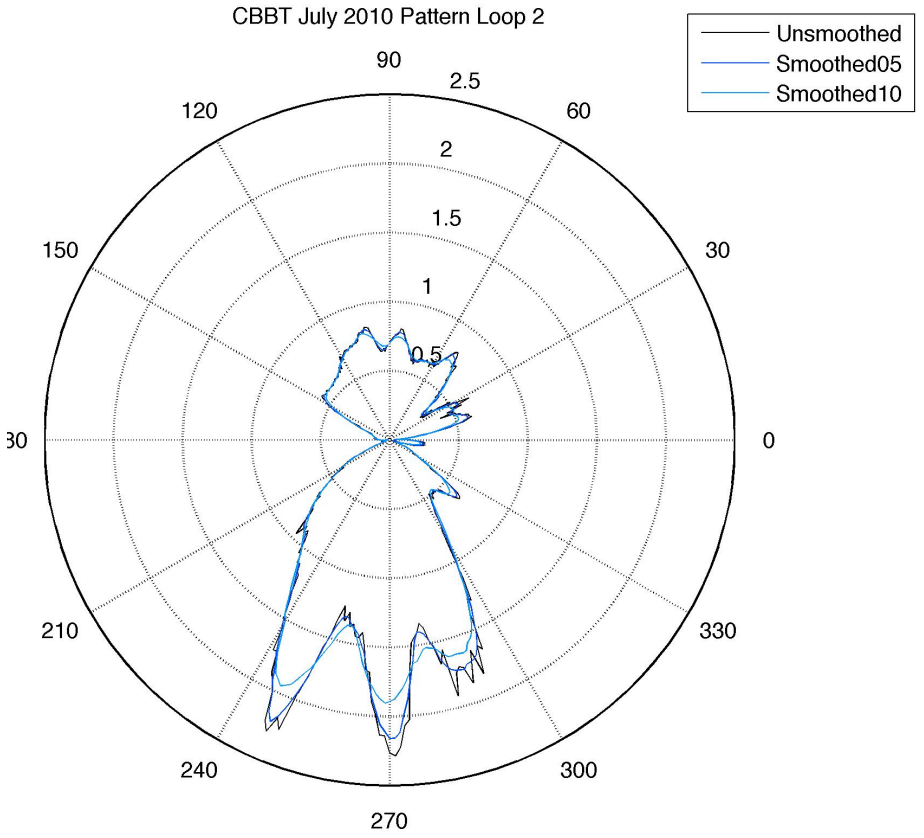
Antenna Patterns at CBBT





CBBT July 2010 Pattern Smoothing

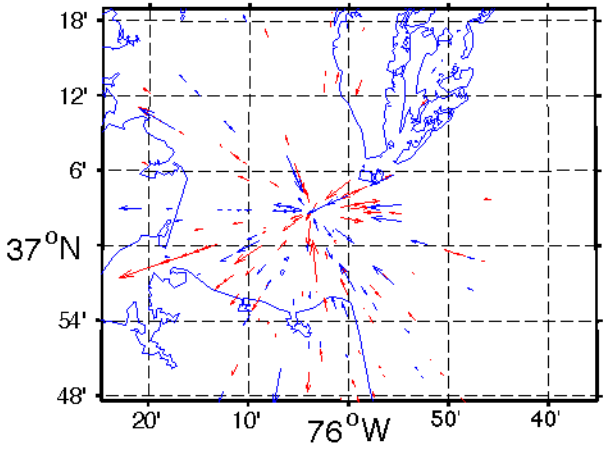




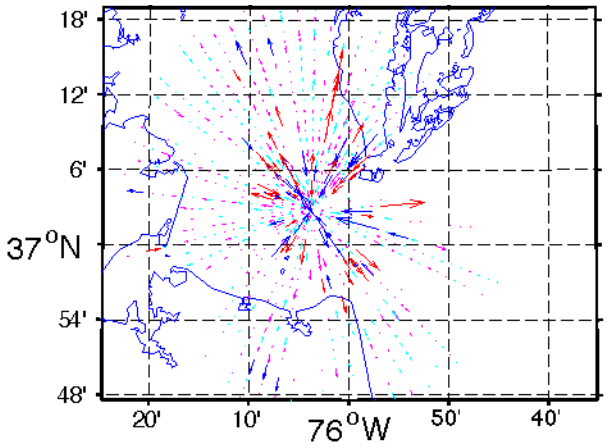
What difference does it make?

Changes in Radials with Different Smoothing of Antenna Pattern: CBBT

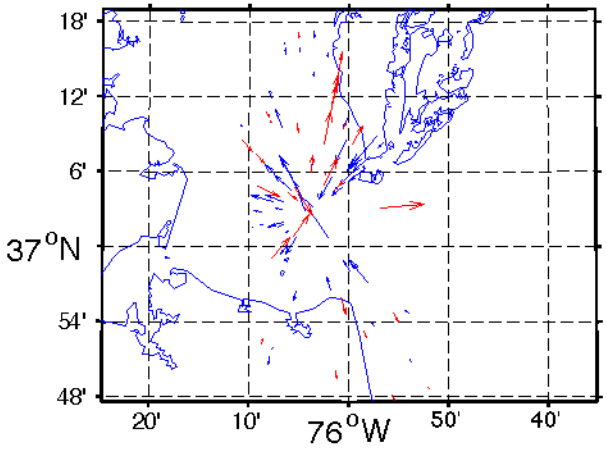
R1 Only: 96 count (red)
R2 Only: 66 count (blue)



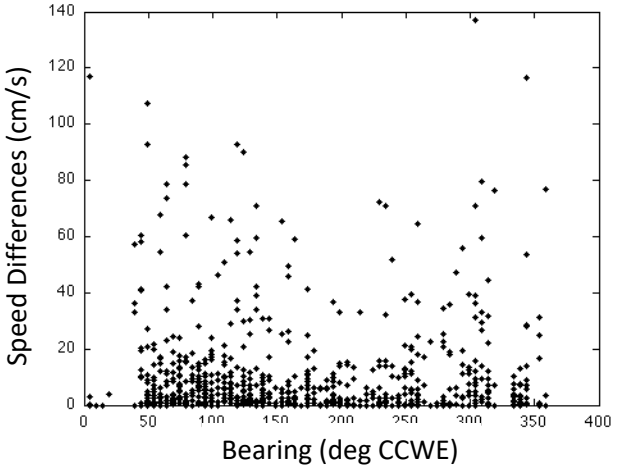
Velocity Differences (R1-R2) for All Shared Radials: 783 count
R1 slower (pink/red) R2 slower (cyan/blue) Darker shades > 30 cm/s
Average Speed Difference = 10.3 cm/s



Direction Changes (Subset of Shared Radials: 82 count)
Average Speed Difference = 38.2 cm/s



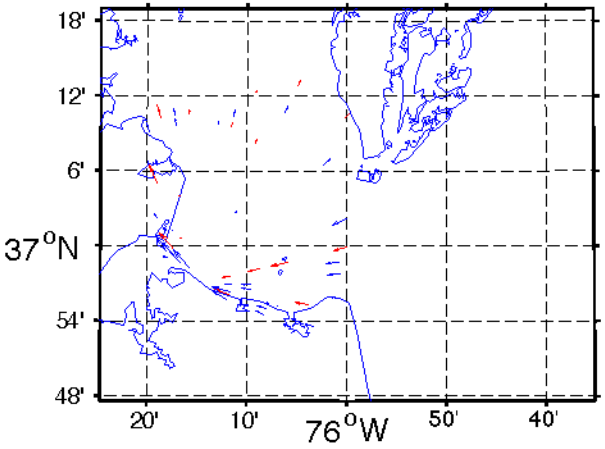
Bearing vs Speed Differences
for All Shared Radials



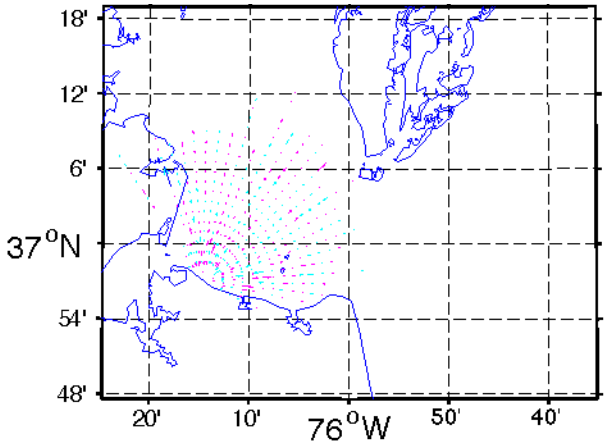
R1 = /Users/garner/RADAR_GUIS/RadialEdits/CBBT/Radials From July2010 APM52deg smooth5/RDLm CBBT 2010 07 21 2100.ruv (879 count)
R2 = /Users/garner/RADAR_GUIS/RadialEdits/CBBT/Radials From July2010 APM52deg smooth0/RDLm CBBT 2010 07 21 2100.ruv (849 count)

Changes in Radials with Different Smoothing of Antenna Pattern: VIEW

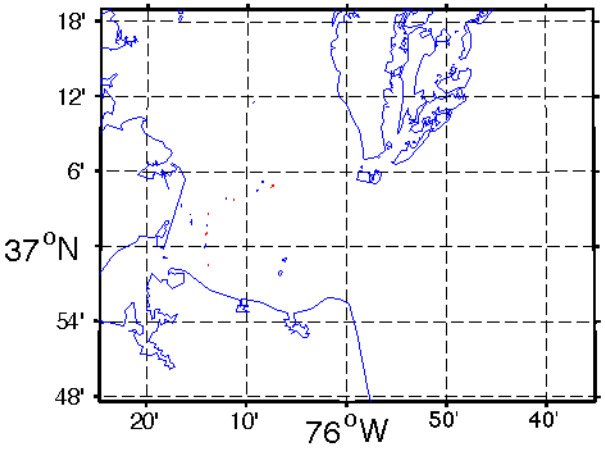
R1 Only: 18 count (red)
R2 Only: 31 count (blue)



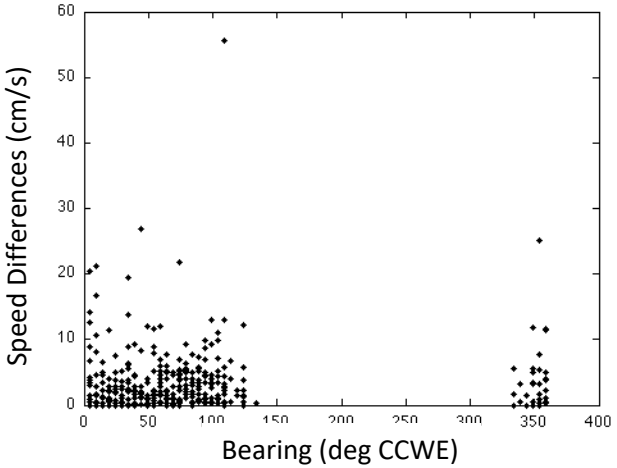
Velocity Differences (R1-R2) for All Shared Radials: 368 count
R1 slower (pink/red) R2 slower (cyan/blue) Darker shades > 30 cm/s
Average Speed Difference = 3.4 cm/s



Direction Changes (Subset of Shared Radials: 82 count)
Average Speed Difference = 8.0 cm/s



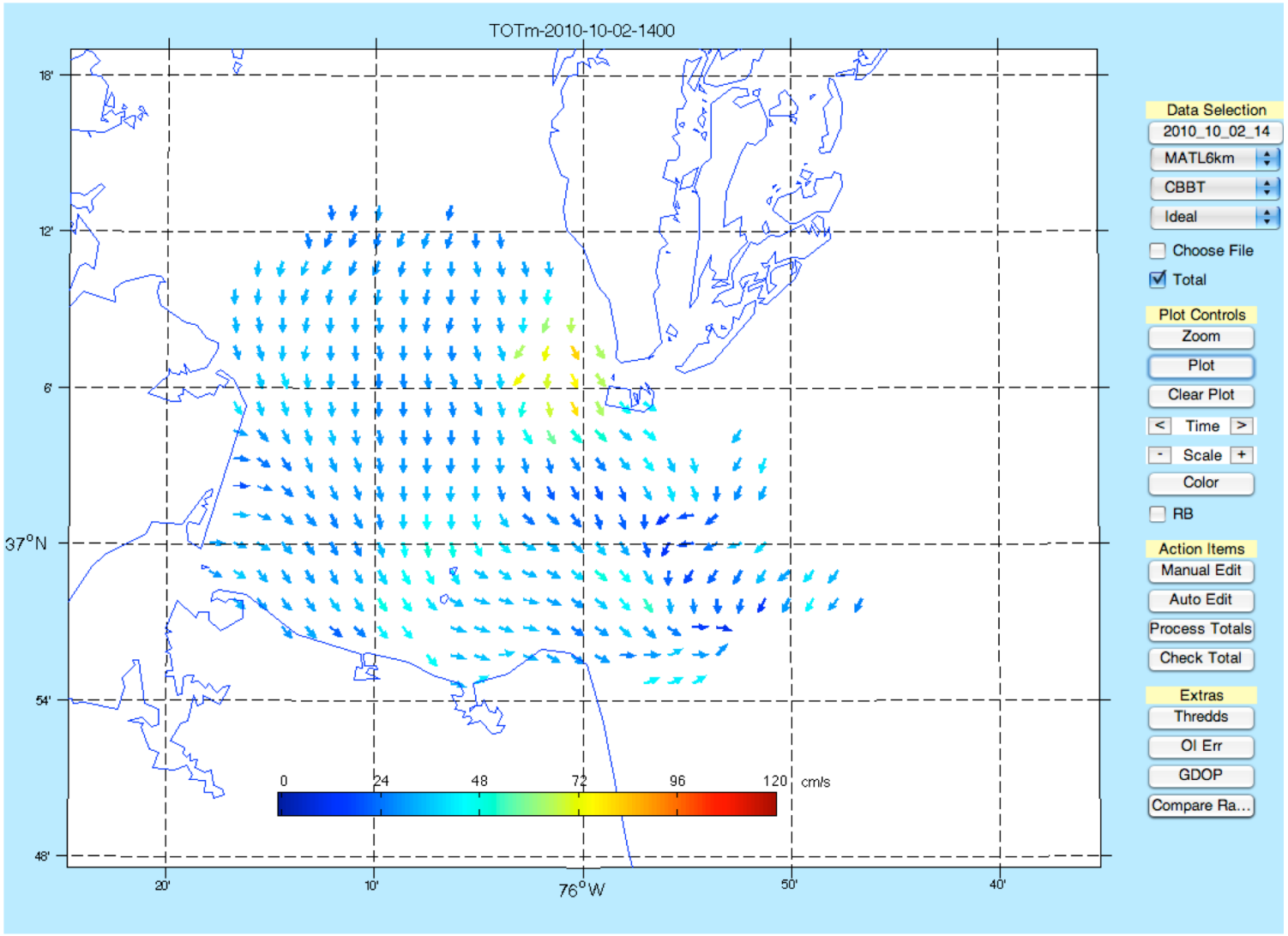
Bearing vs Speed Differences
for All Shared Radials



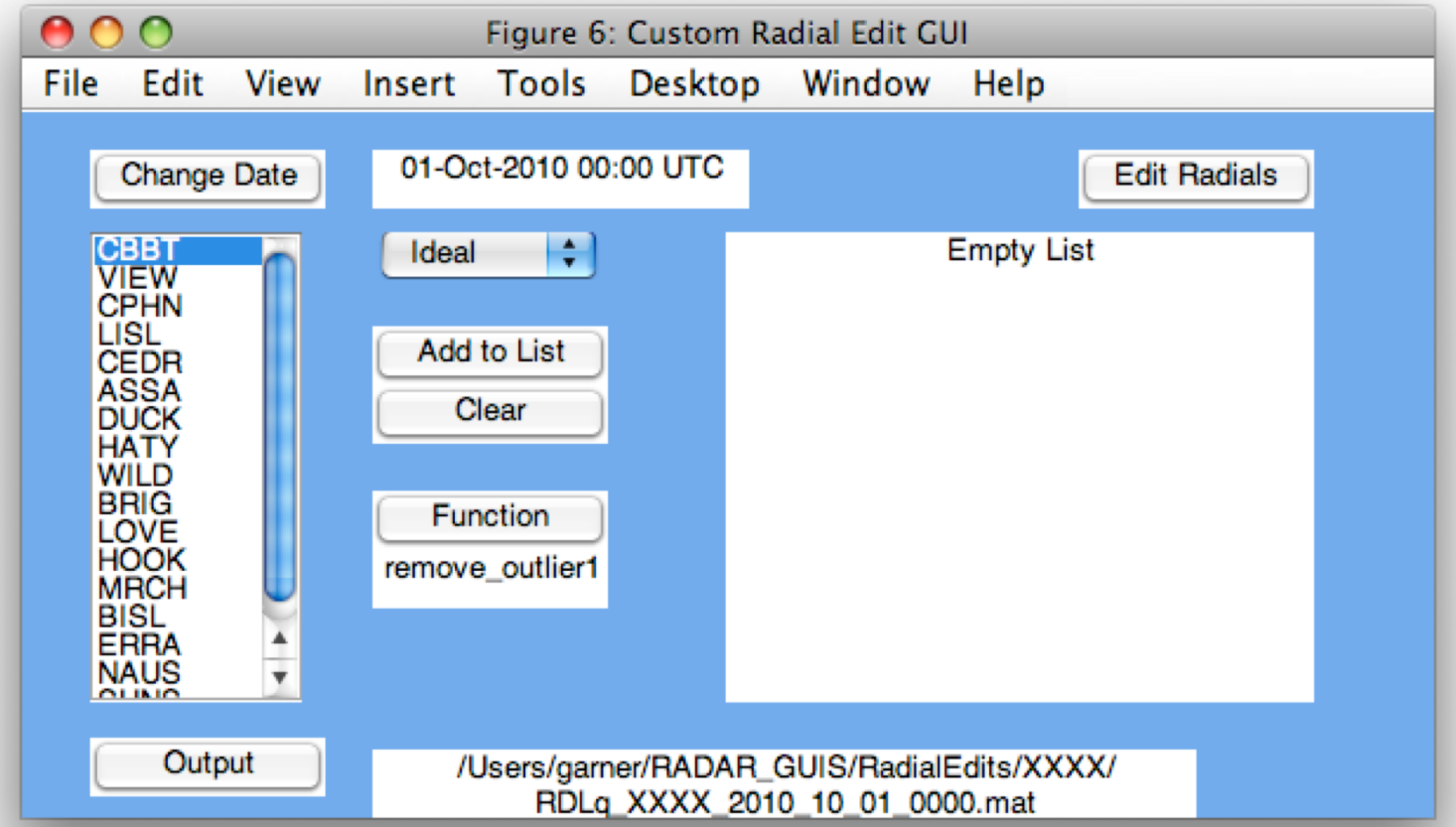
R1 = /Users/garner/RADAR_GUIS/RadialEdits/VIEW/VIEW smooth00/RDLm VIEW 2010 07 21 2100.ruv (386 count)
R2 = /Users/garner/RADAR_GUIS/RadialEdits/VIEW/VIEW smooth05/RDLm VIEW 2010 07 21 2100.ruv (399 count)

Sunset Beach

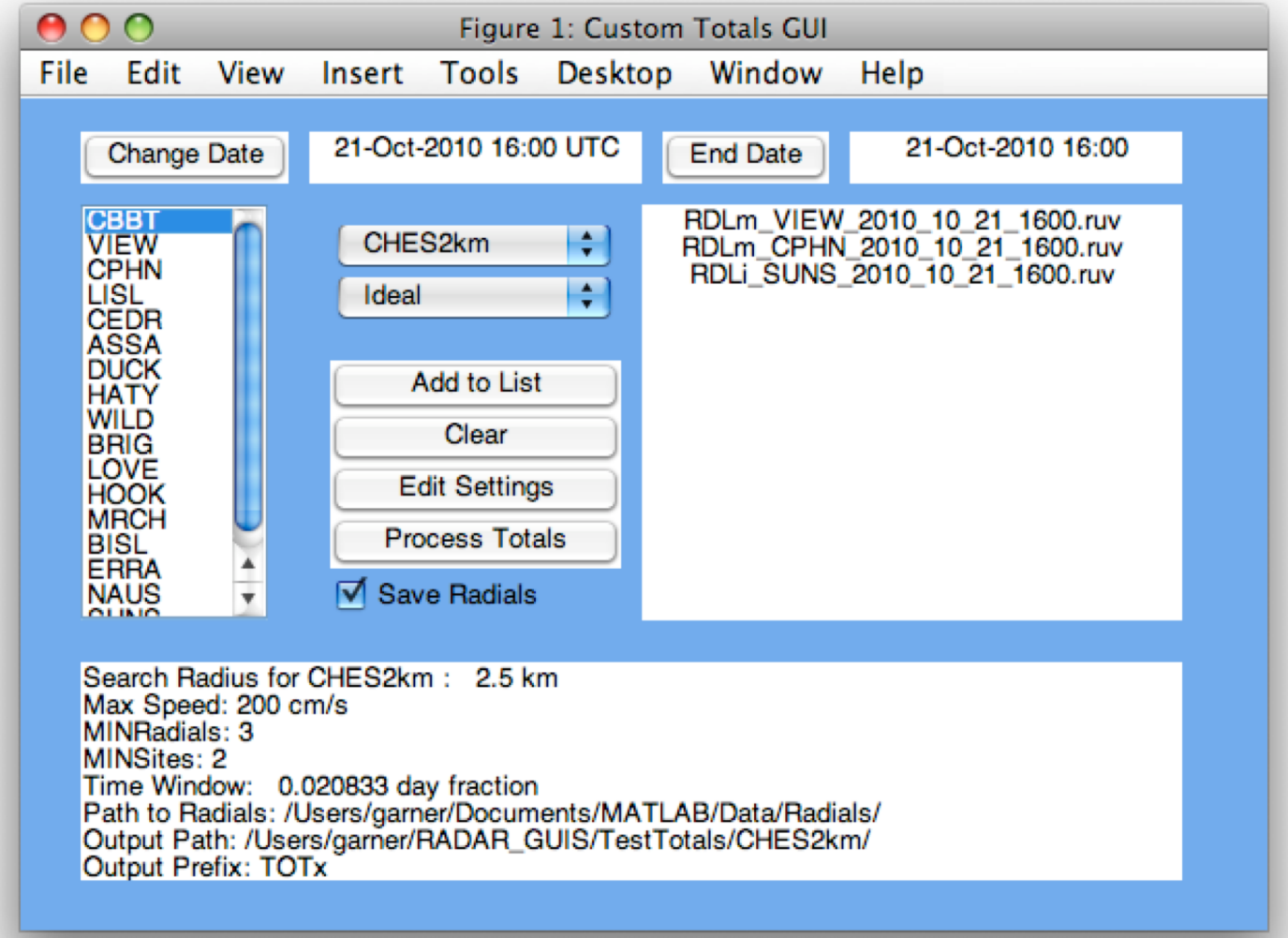
MATLAB Viewer



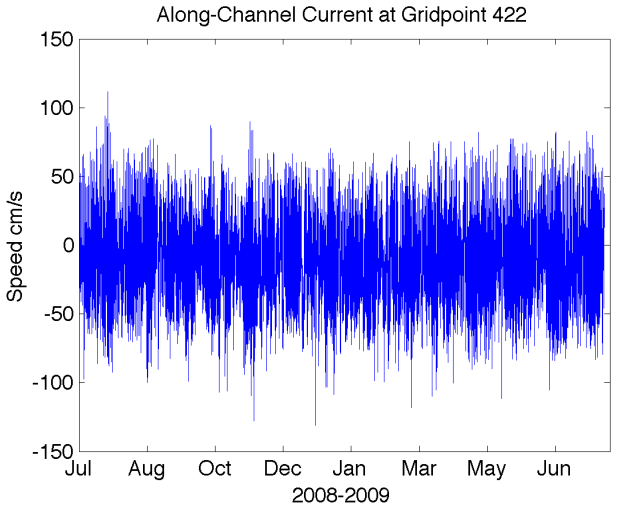
Radial Map Editor

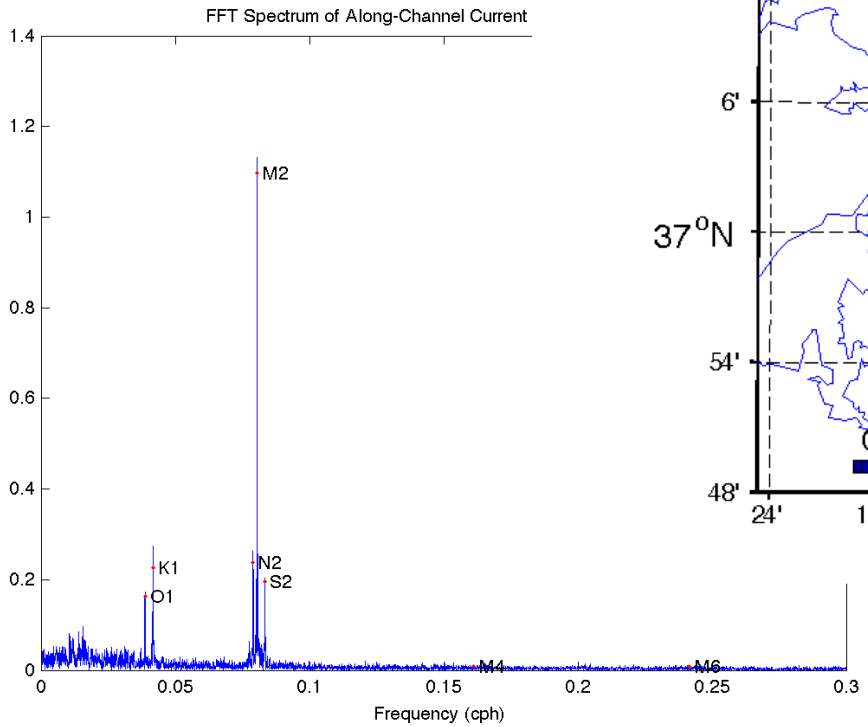


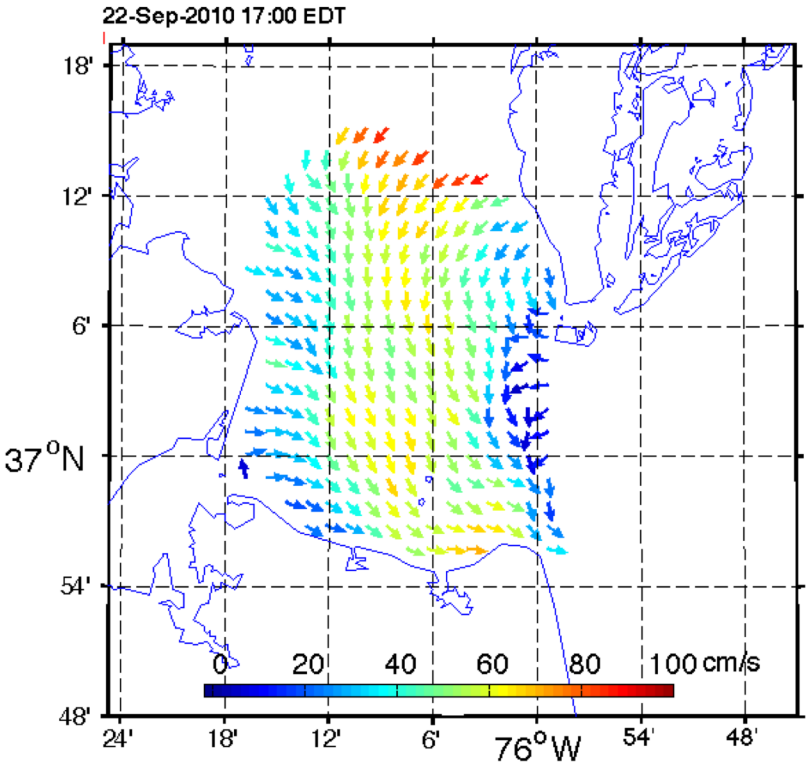
Compute Totals (LSQ)



Tides


Along-Channel Current at Gridpoint 422
Speed cm/s
150
100
50
0
-50
-100
-150
Jul
Aug
Oct
Dec
Jan
Mar
May
Jun
2008-2009


FFT Spectrum of Along-Channel Current
1.4
1.2
1
0.8
0.6
0.4
0.2
0
M2
K1
O1
N2
S2
M4
M6
0
0.05
0.1
0.15
0.2
0.25
0.3
Frequency (cph)


22-Sep-2010 17:00 EDT
18'
12'
6'
37°N
54'
48'
24'
18'
12'
6'
76°W
54'
48'
0
20
40
60
80
100 cm/s

Current Reversals
Apr 10 2007 – Aug 31 2010

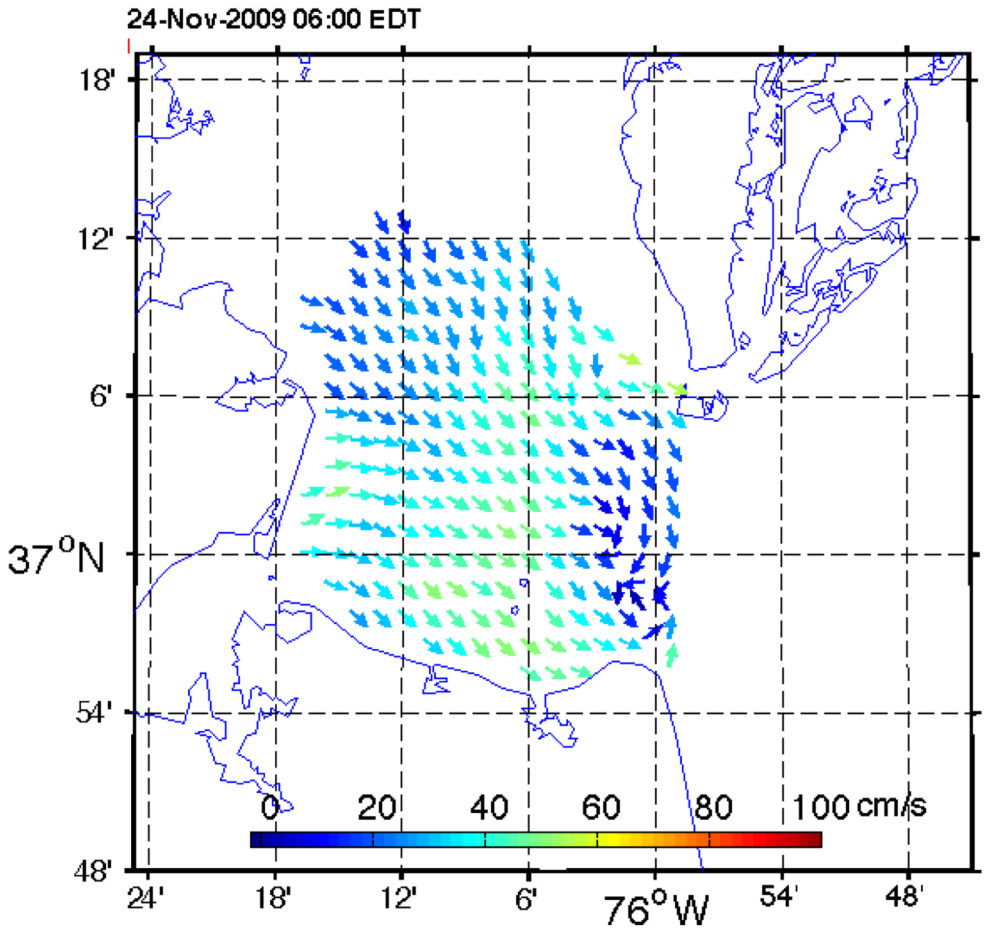
2 hours: 153

3 hours: 111

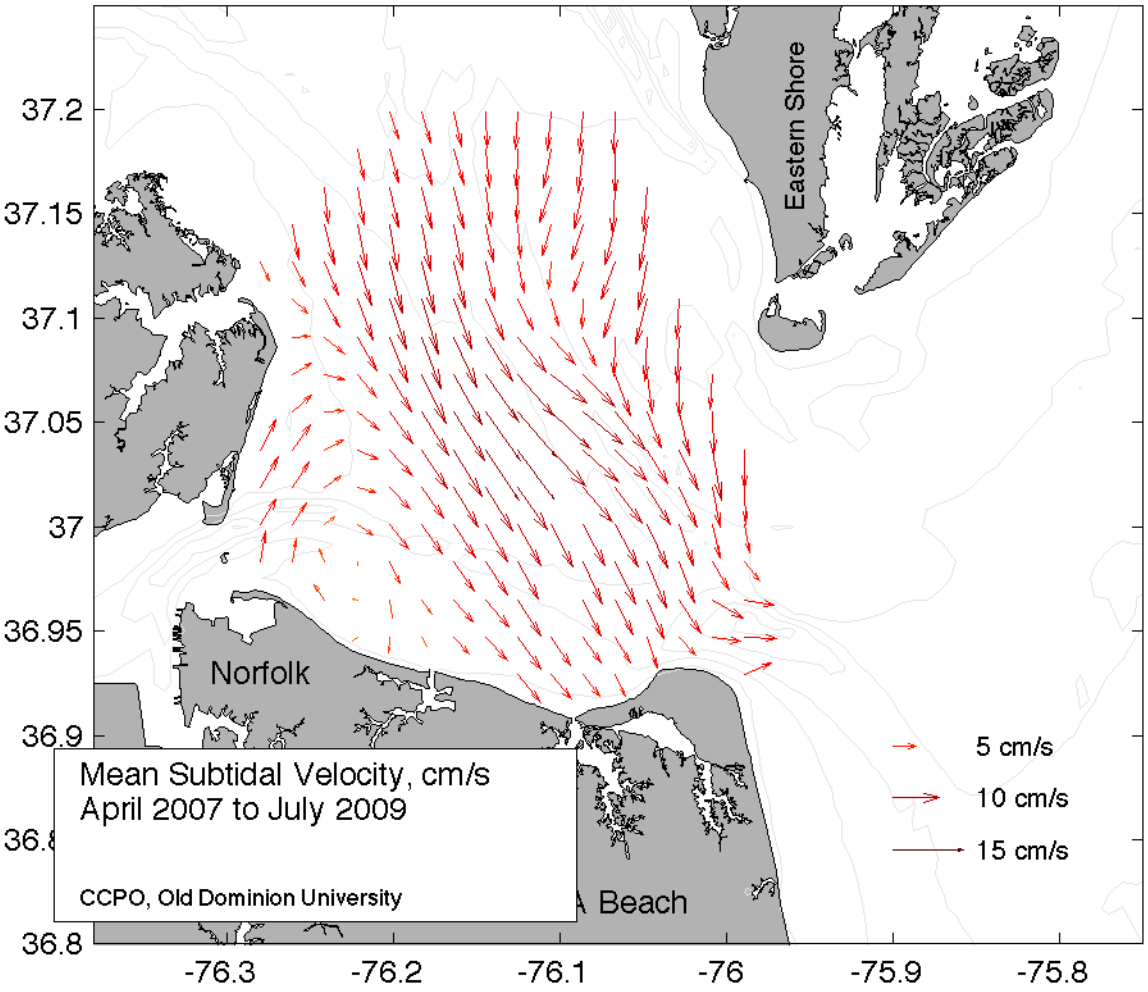
4 hours: 67

5 hours: 38

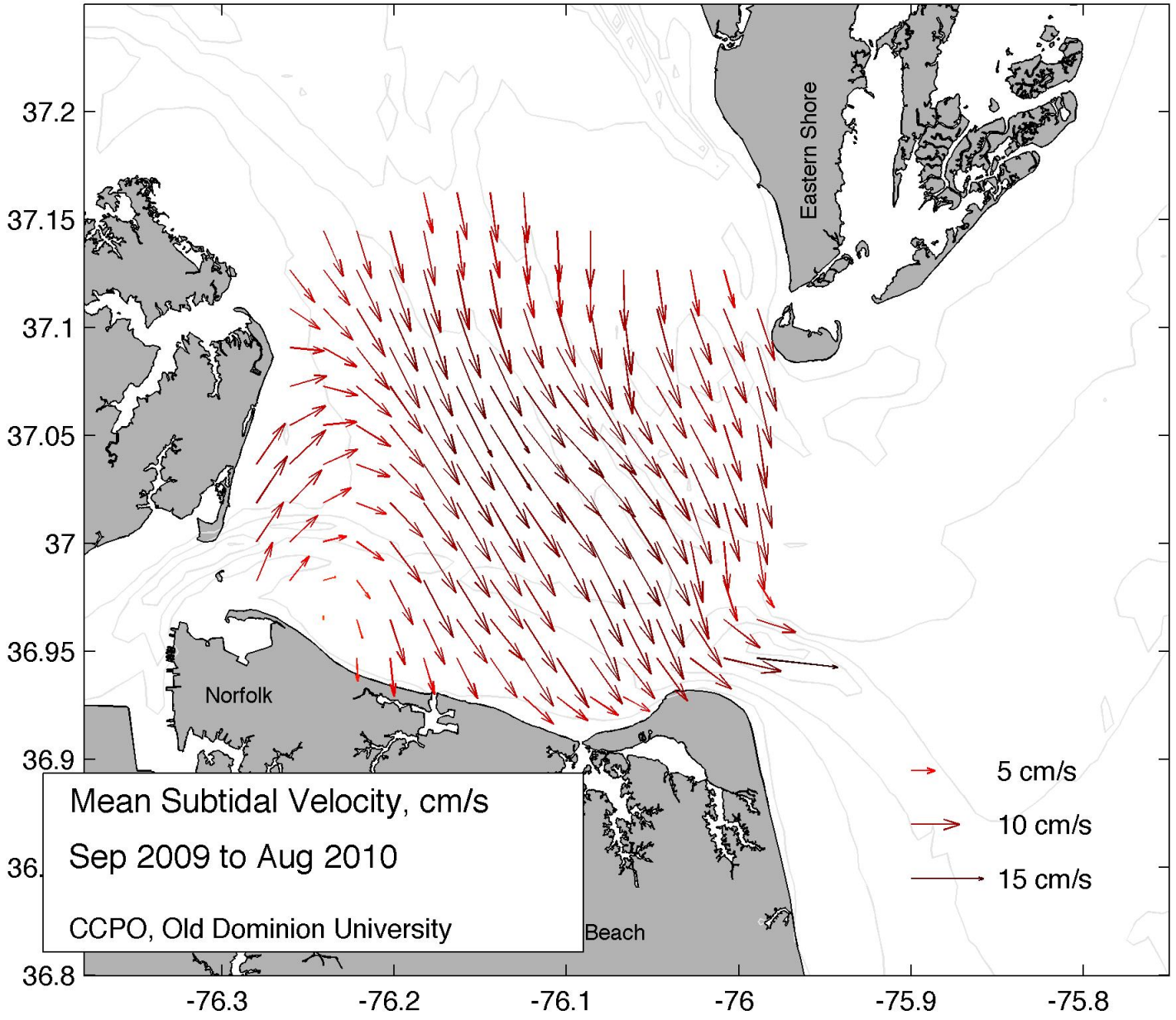
6 hours: 11



Mean Surface Circulation



Mean Surface Circulation



HFRADAR @ Old Dominion University

http://www.ccpo.odu.edu/currentmapping

Home
Old Website

About
- Latest News
- Contact us
- Project Overview
- Photos
- Documents

Data Products
- Latest Velocity Map
- Movie
- Alongshore Currents
- Subtidal Map
- Sample Trajectories
- Sample Time Series
- Download Data

Diagnostics
- Radials
- 50 Hr Total Coverage
- 50 Hr Radial Coverage
- ADCP Comparisons
- Baselines

External Links
- NOAA Winds & Tides
- NOAA Marine Forecast
- Wunderground Forecast
- CODAR
- National Network
- MARCOOS
- ROWG
- Rutgers
- Southern California

Surface Current Mapping in the Lower Chesapeake Bay

Quick Links to Most Recent Data

CBBT 1st Island 2nd Island 3rd Island 4th Island

A project of the Center for Coastal Physical Oceanography, Department of Ocean, Earth and Atmospheric Sciences, Old Dominion University.

Funding by the National Oceanic & Atmospheric Administration through the Center for Innovative Technology and MARCOOS (Mid-Atlantic Regional Coastal Ocean Observing System). Special thanks to the City of Norfolk, the Chesapeake Bay Bridge Tunnel Authority, Fort Story and Sunset Beach Resort for providing sites for the antennas.

Data Access

Teresa Garner
garner@ccpo.odu.edu
757-683-4816

HFRADAR surface current data in the lower Chesapeake Bay (April 2007-present) are available through ODU and the data may be transferred in a variety of formats (i.e. text, MAT files, NetCDF).

http://www.ccpo.odu.edu/currentmapping

National data including the lower Chesapeake Bay 2km grid are available via Thredds server (OPENDAP,WCS,NetcdfSubset,WMS) :

http://hfrnet.ucsd.edu:8080/thredds/catalog.html

Mid-Atlantic regional offshore OI (optimal interpolated) data are also available via Thredds server (OPENDAP) :

http://tashtego.marine.rutgers.edu:8080/thredds/cool/codar/cat_totals.html?dataset=macoora6km_codar

Acknowledgements

- CIT, MACOORA, NOAA
- CODAR support
- Advice and assistance from numerous other HF RADAR operators

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