# Surface current mapping in the lower Chesapeake Bay

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



# **RADAR Site Locations**



# **Chesapeake Bay Data Coverage**





90% Coverage shown in green.

# Sunset Beach Test Site













### Tides



0.3

#### Current Reversals Apr 10 2007 – Aug 31 2010



### Mean Sub-tidal Surface Circulation



### Comparisons with NOAA PORTS Doppler Current Profilers



York Spit (YS)

Cape Henry (CH)

#### Thimble Shoals (TS)



### **ADCP Along-Channel Comparisons**

Aug 21 2010 0:00 - Sep 21 2010 23:00 UTC



	Cape Henry	Thimble Shoals		
R <sup>2</sup>	0.74	0.79		
RADAR - CODAR Standard Deviation	13.4	14.4		

## **Antenna Pattern Smoothing**



What difference does it make?

Velocity Differences (R1-R2) for All Shared Radials: 783 count R1 Only: 96 count (red) R1 slower (pink/red) R2 slower (cyan/blue) Darker shades > 30 cm/s R2 Only: 66 count (blue) Average Speed Difference = 10.3 cm/s 18' 18' 12' 12' 6' 6' 37°N 37<sup>0</sup>N 54' 54' 48' 48 20' 10' 50' 40' 20' 10' 50' 40  $76^{\circ}W$  $76^{\circ}W$ Direction Changes (Subset of Shared Radials: 82 count) **Bearing vs Speed Differences** Average Speed Difference = 38.2 cm/s for All Shared Radials 140 18' 120 Speed Differences (cm/s) 12' 100 6' 80 60 37°N 54' 20 48' 50 10' 40' 20' 76<sup>0</sup>W 400 50 350 Bearing (deg CCWE)

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)

Velocity Differences (R1-R2) for All Shared Radials: 368 count R1 Only: 18 count (red) R1 slower (pink/red) R2 slower (cyan/blue) Darker shades > 30 cm/s R2 Only: 31 count (blue) Average Speed Difference = 3.4 cm/s 18' 18' 12' 12' 6' 6' 37°N 37°N 54' 54' 48' 48' 20' 10' 50' 40' 20' 10' 50' 40  $76^{\circ}W$  $76^{\circ}W$ Direction Changes (Subset of Shared Radials: 15 count) **Bearing vs Speed Differences** Average Speed Difference = 8.0 cm/s for All Shared Radials ô0 18' Speed Differences (cm/s) 50 12' 40 6' 30 37°N 20 54' 48' 50 20' 10' 40' 200 250 76<sup>°</sup>W 150 300 350 400 Bearing (deg CCWE)

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)

### Antenna Patterns at CBBT



# Matlab GUI Scripts for QA/QC

- Works with HFRADAR community toolbox HFR Progs
- Display radial and/or total maps (can overlay plots)
- Compute totals for a list of specifically chosen radials (LSQ method)
- Edit a radial map by clicking on vectors to remove
- Run a custom script that will edit radial files
- Plot only the radials that contributed to a specific total vector
- Compare two radial maps





# **Radial Map Editor**

00	Figure 6: Custom Radial Edit GUI
File Edit View	Insert Tools Desktop Window Help
Change Date	01-Oct-2010 00:00 UTC Edit Radials
CBBT VIEW CPHN LISL CEDR ASSA DUCK HATY WILD BRIG LOVE HOOK MRCH BISL ERRA NAUS	Ideal Empty List     Add to List   Clear     Function   remove_outlier1
Output	/Users/garner/RADAR_GUIS/RadialEdits/XXXX/ RDLq_XXXX_2010_10_01_0000.mat

# Compute Totals (LSQ)

🖻 🔿 🔿 Figure 1: Custom Totals GUI							
le Edit	View	Insert	Tools	Deskto	p Window	Help	
Change	Date	21-Oct-	2010 16:0	OUTC	End Date	21-Oct-2010 16:00	
CBBT VIEW CPHN LISL CEDR ASSA DUCK HATY WILD BRIG LOVE HOOK MRCH BISL ERRA NAUS		CHE: Ideal	S2km Add to Lis Clear dit Setting cess Tot e Radials	t s als	RDLm_VIEW RDLm_CPHN RDLi_SUNS	2010_10_21_1600.ruv 2010_10_21_1600.ruv 2010_10_21_1600.ruv	
Search R Max Spe MINRadia MINSites Time Win Path to R Output P Output P	adius for ed: 200 c als: 3 : 2 dow: 0.0 adials: /U ath: /User refix: TOT	CHES2kn m/s 020833 da Jsers/garn rs/garner/f Гx	n : 2.5 k y fraction er/Docum RADAR_C	m hents/MAT àUIS/Test	'LAB/Data/Radia Totals/CHES2ki	als/ m/	

### Data Access

#### **HFRADAR** @ Old Dominion University

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

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

# Acknowledgements

- CIT, MACOORA, NOAA
- CODAR support
- HFRADAR operators









#### **Radial Current Velocities**



+ Grid



#### Around each grid point... Combine Radial Vectors (Least Squares Average)



#### **Total Current Velocities**



# **Baseline Comparisons**

### Mean Sub-tidal Surface Circulation

