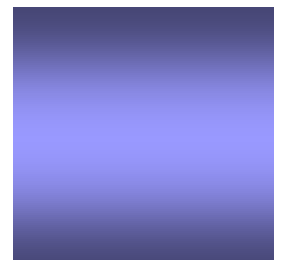
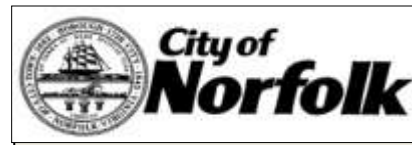


*Long-Term Wave Data
Measurements with an
AWAC in Support of
Coastal Studies for the
City of Norfolk, VA.*

Presented by Trap Puckette



RPS Evans-Hamilton

City of Norfolk looking to revitalize sections of its shoreline along the Chesapeake Bay



- Long term beach management and protection required
- Local waves and currents key drivers of the coastal processes
- Storm events can result in significant erosion
- Previous numerical modeling studies for coastal projects had relied on numerical modeling of offshore measured waves and wave data from the USACE FRF on the Atlantic Coast in Duck, NC

- Decision made to conduct long-term measurements to obtain more accurate data on wave climate using a Nortek AWAC
- Long-term performance of the system was a concern
- City of Norfolk purchased the equipment
- RPS Evans-Hamilton installed and serviced instruments and analyzed data
- Data provided to Moffatt Nichol

RPS Evans-Hamilton



RPS Evans-Hamilton



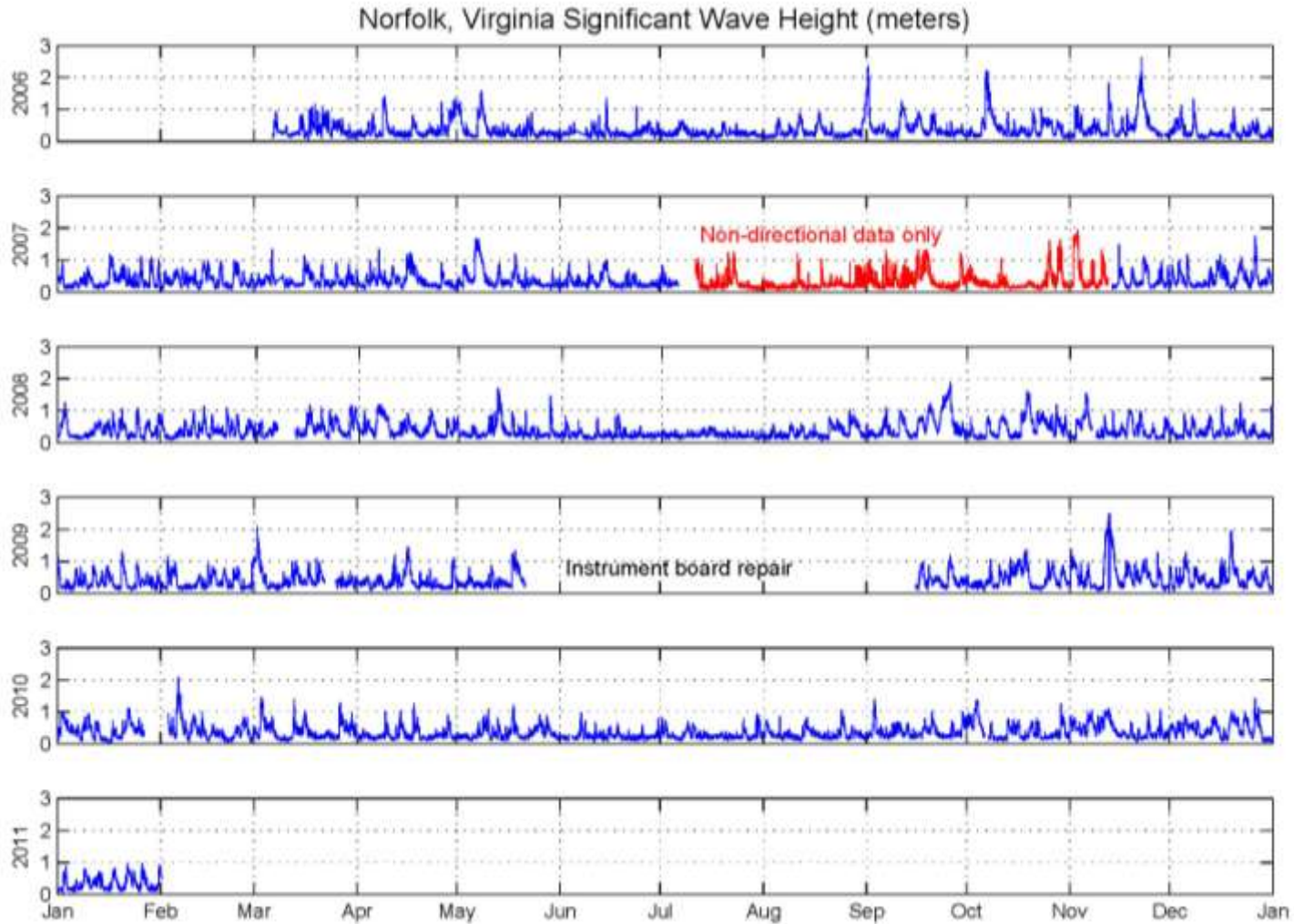
RPS Evans-Hamilton

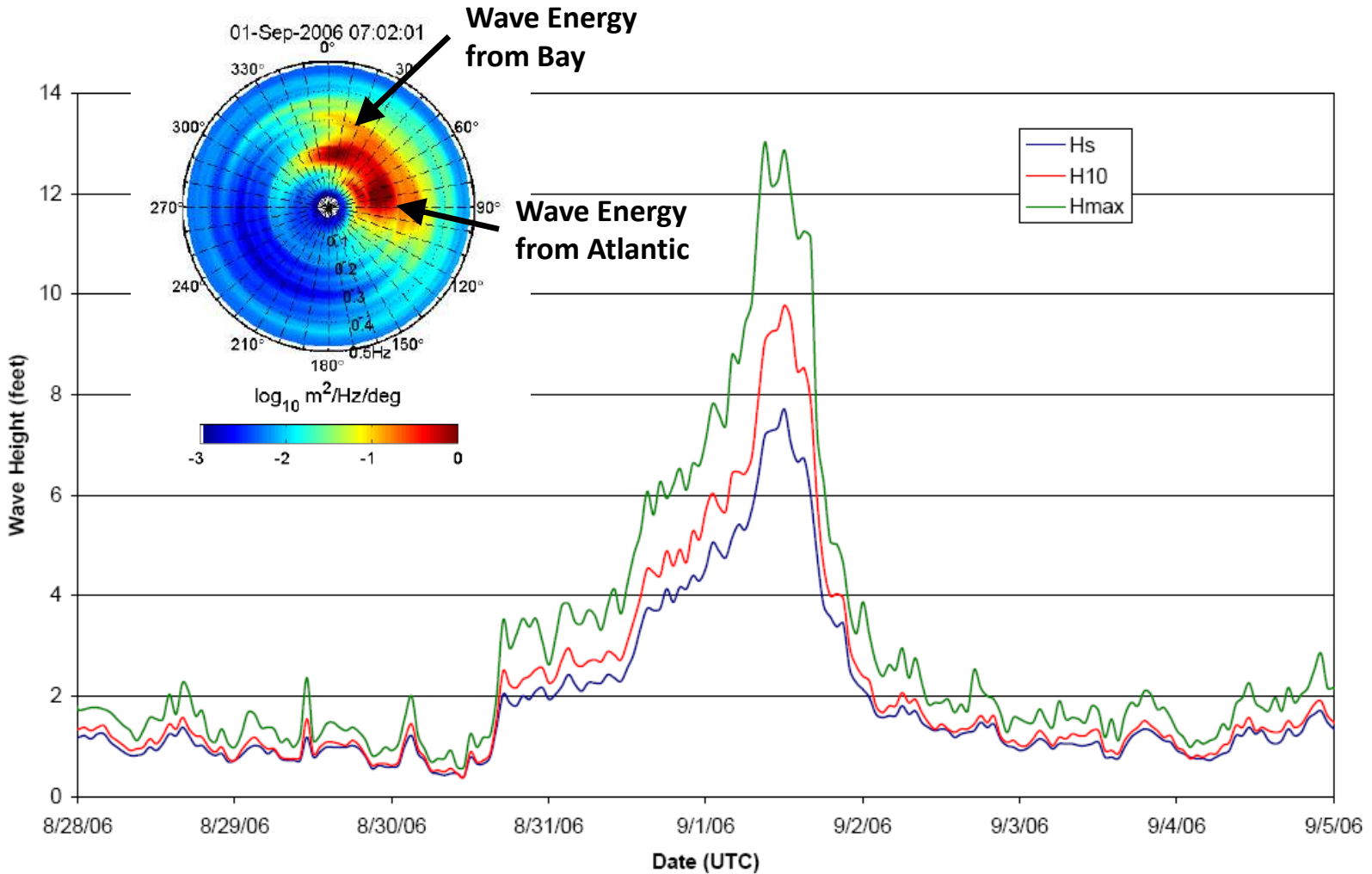


RPS Evans-Hamilton



RPS Evans-Hamilton

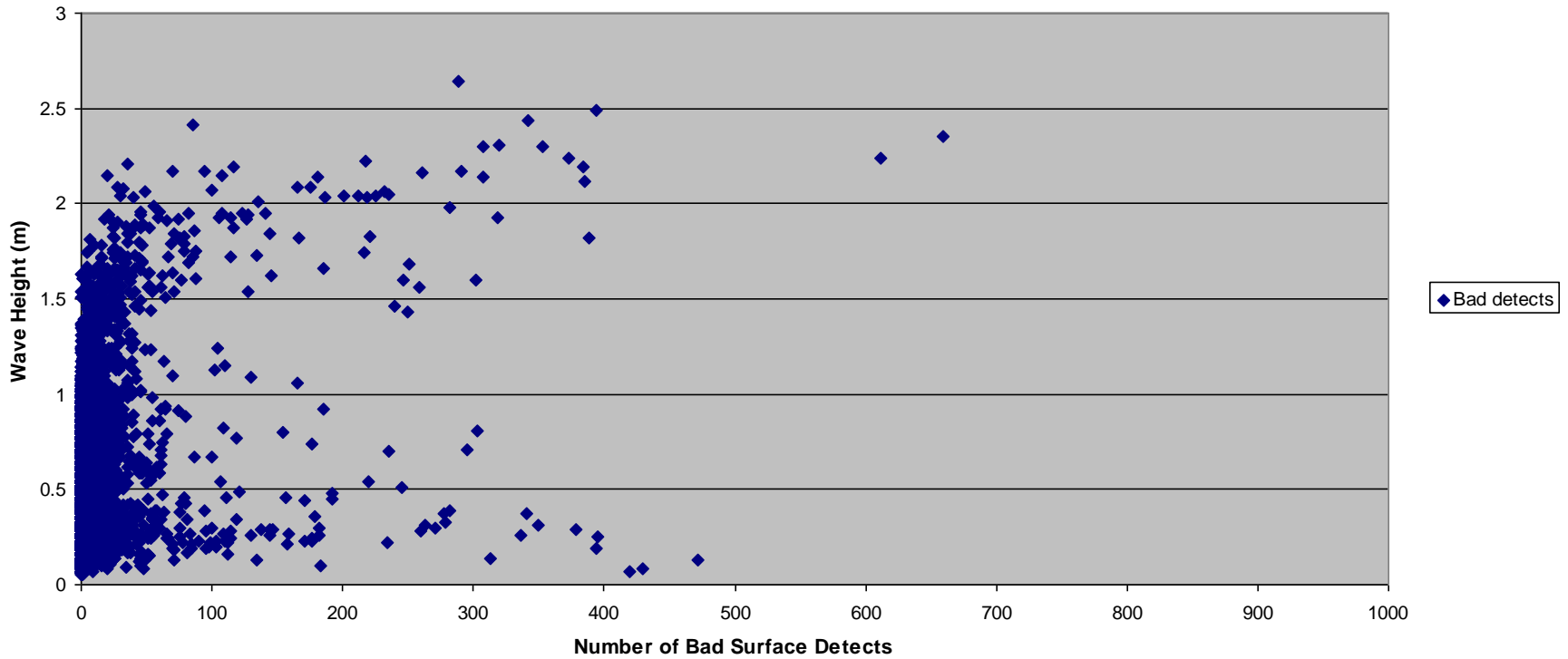




RPS Evans-Hamilton

Error Code	Number of Occurrences	% of total errors	Errors					
			Low Pressure	Low Amplitude	Unreasonable Estimate	AST Out of Bounds	Dir. for Peak Period Out of Bounds	High AST Data Loss
4	51	1.6		X				
16	36	1.1			X			
66	8	0.2	X			X		
82	4	0.1	X		X	X		
128	3140	96.6					X	
132	3	0.1		X			X	
1024	7	0.2						X
1030	1	0.0	X	X				X
Total:	3250							
Total # of Samples: 36448			(Directional only)					
Percentage of bursts with error codes: 8.9								

Significant Wave Height vs Number of Bad Surface Detects



Physical performance:

Components have generally held up well

Failed board – May 2009

Loose wiring harness

Heavy fouling during summer

Oyster behind connector dislodged dummy plug
– replaced endcap

Pressure orifice became plugged

No pitting or damage to transducers

Electronics performance:

All system tests passed

Signal strength during comparable
time periods showed minimal variation

Bio-fouling did not impact signal
strength



DATA USES:

- Evaluation of wave and current climate along shoreline
- Input to numerical modeling for assessment of erosion, shore stabilization solutions, storm protection, and beach nourishment and better design decisions
- Provided measured field data to evaluate storm event impacts
- Used to aid in the development of Bay Oaks Beach protection and extension to East Ocean View breakwater field
- Study and modeling of West Ocean View and Willoughby Spit regions of the shoreline

RPS Evans-Hamilton

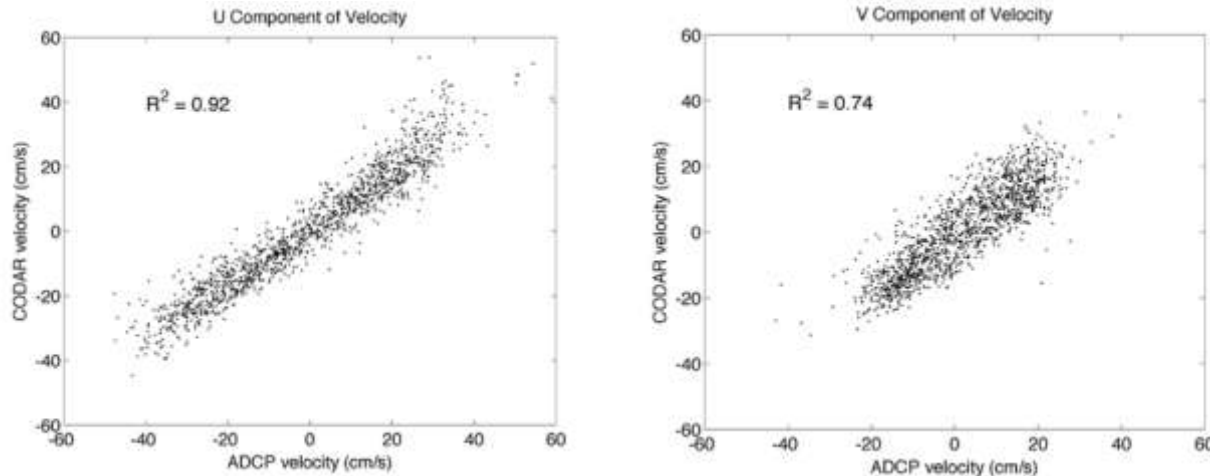


One of America's Top Restored Beaches in 2007
American Shore and Beach Preservation Association (ASBPA)



Other Uses (sharing the data):

- Data has been used in research efforts by ODU to validate CODAR measurements



Scatter plots of ADCP data vs. CODAR data for U and V velocity components during AWAC deployment 7 (Nov. 13, 2007 – Mar. 7, 2008)



USACE using data to support the General Reevaluation Report (GRR) for the Willoughby Spit and Vicinity Hurricane Damage Reduction Project. GRR will study and analyze the effects of coastal storms on the shoreline south of Willoughby Spit to Little Creek Inlet.

- AWAC has physically held up well over what is now almost a 5 year deployment.
- Electrical components have experienced some issues but are still serviceable.
- Data quality has not decreased.
- Relatively few data quality issues encountered over the deployment period.

RPS Evans-Hamilton

- System has provided reliable means of acquiring critical design data at a reasonable price.
- Data has led to improved coastal management and optimized design of coastal structures. Supported ~\$4M in construction to date for City of Norfolk.
- Data is an investment that will be will continue to be used on future coastal management and construction projects.
- Project serves as an example for other coastal communities.

