

High Frequency Coastal Ocean Radars:

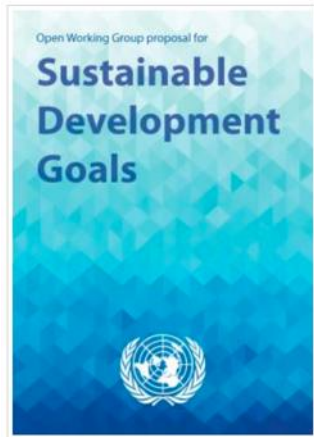
Promoting Partnerships for Research, Education, and Service to Society

Josh Kohut, Hugh Roarty, and Scott Glenn
Rutgers University

and MANY MANY MANY Others



Sustainable blue economy requires information



SUSTAINABLE DEVELOPMENT GOALS



Ocean Data, Predictions, and Analysis:

- Supports decision making
- Enables marine sector to
 - Operate efficiently
 - Maintain safety
 - Support the ecosystem
- Supported by many
- Usable by many more

Realized through:

- Scientific understanding
- Emerging technologies
- Optimize sustained observations
- Improved forecasts



27 Years of Ocean Observing at:

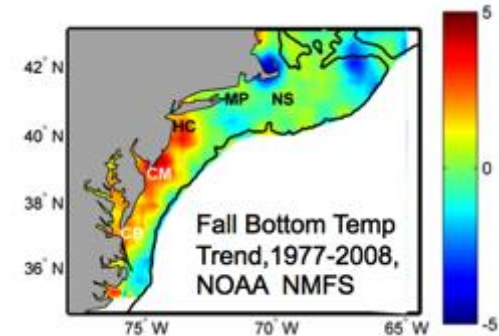
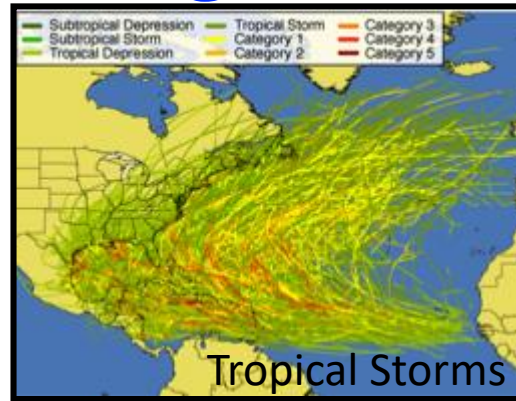
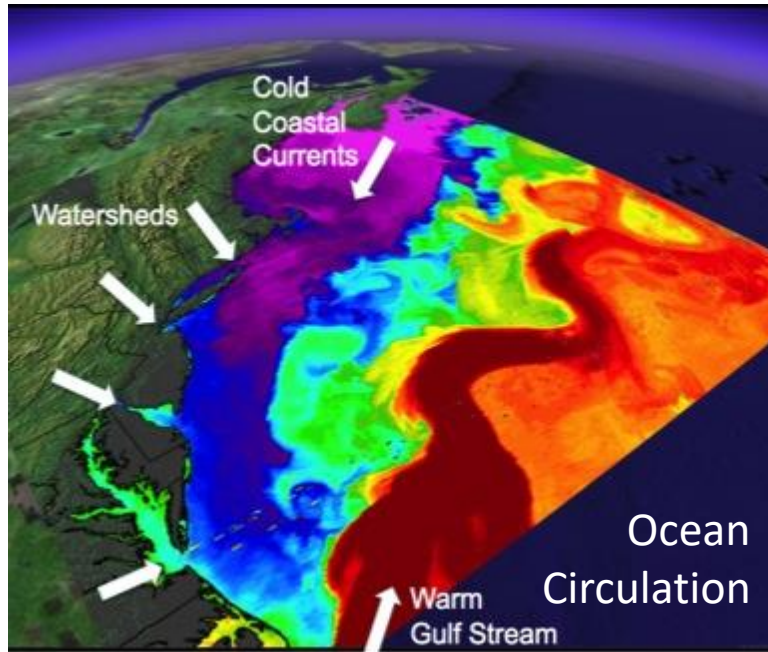


Rutgers University (RU) Center for Ocean Observing Leadership (COOL)

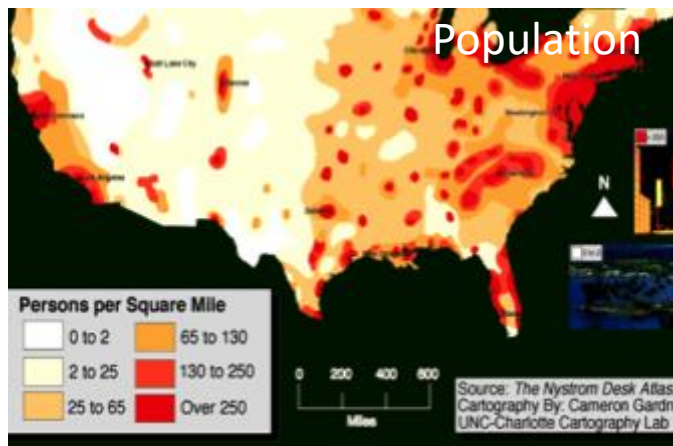
Department of Marine and Coastal Sciences (DMCS)
71 Dudley Road, New Brunswick, New Jersey, USA
<http://rucool.marine.rutgers.edu>



Mid-Atlantic Regional Drivers



Climate Change



MIDDLE
ATLANTIC
REGIONAL
ASSOCIATION
COASTAL
OCEAN
OBSERVING
SYSTEM

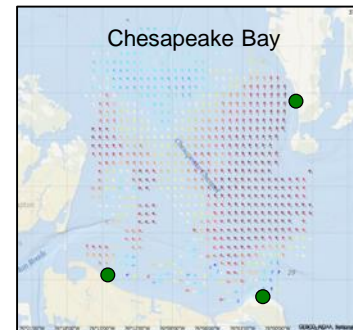
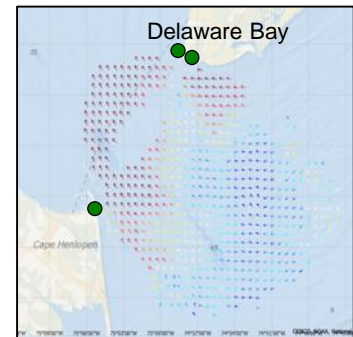
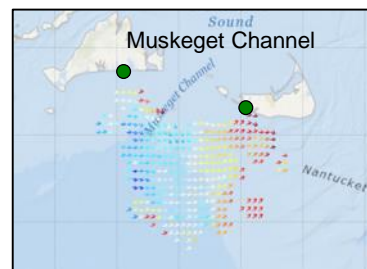
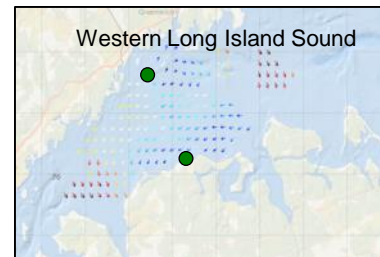
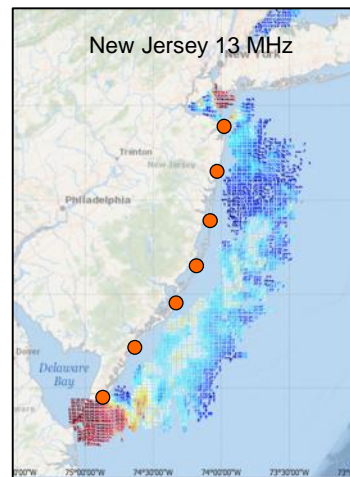
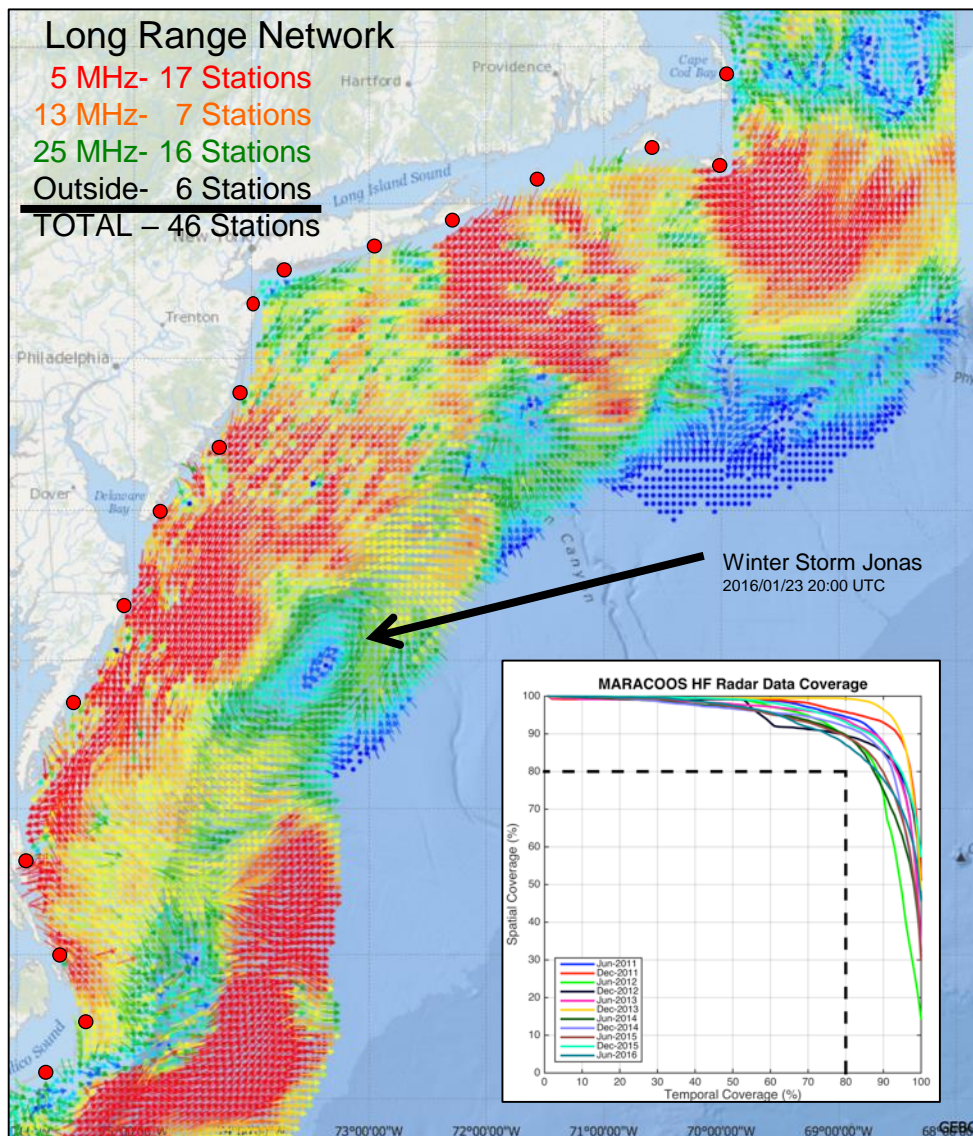
10 States - 76 Million People
 1000 km Cape to Cape

CT RI MA Cape Cod
 NY NJ DE MD VA NC Cape Hatteras

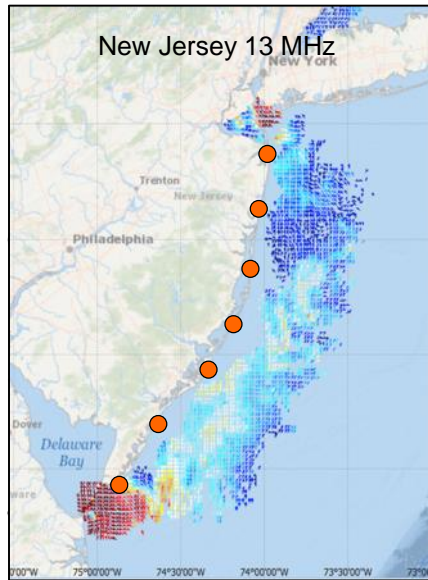
MARACOOS: An Integrated, Sustained & Certified Real-time Observation and Forecast System



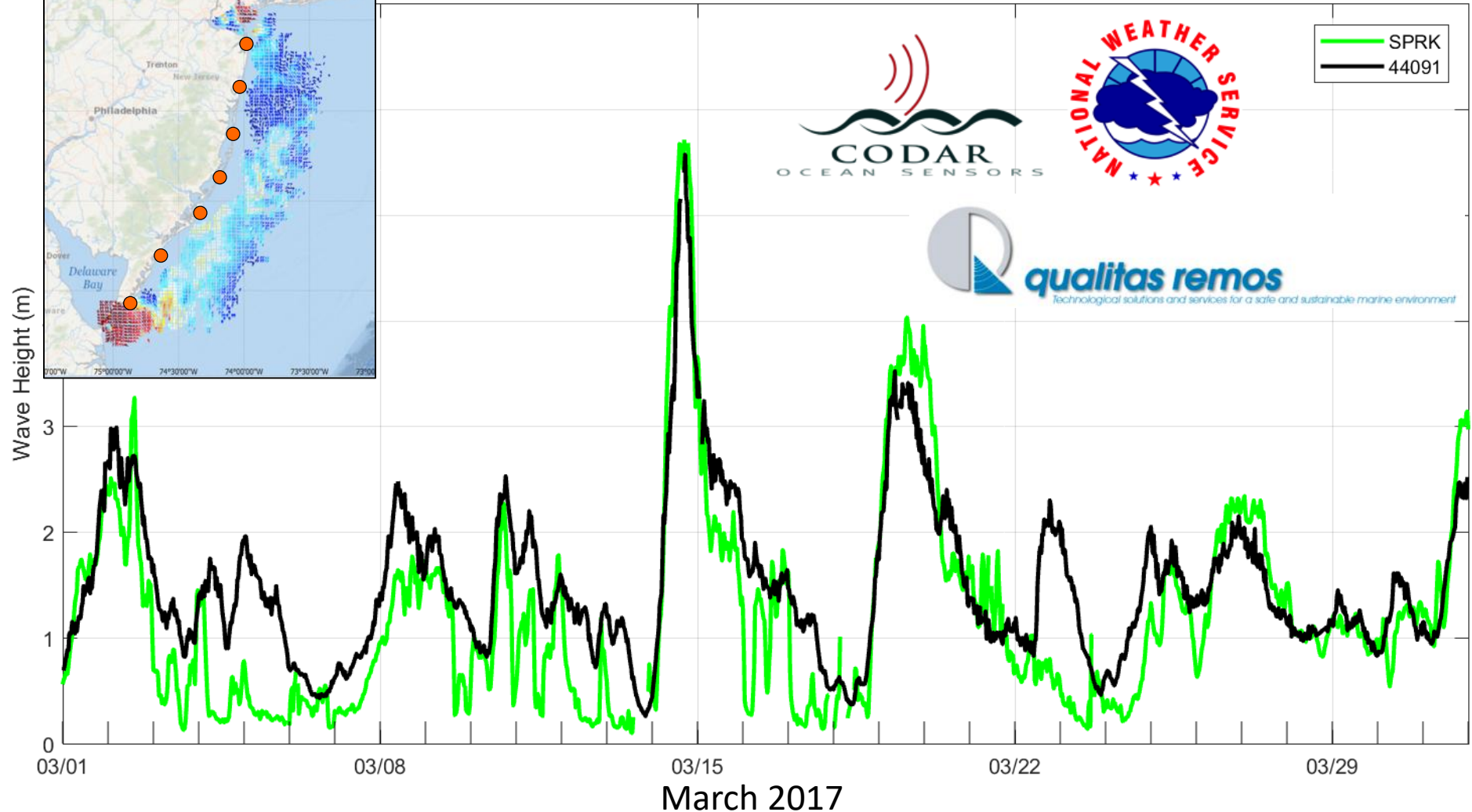
MARACOOS HF Radar Network



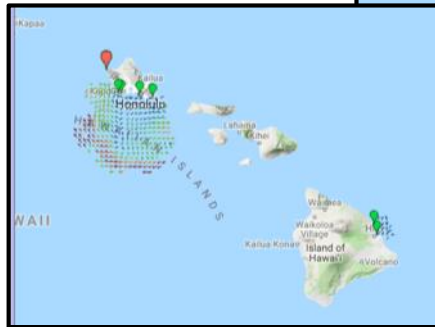
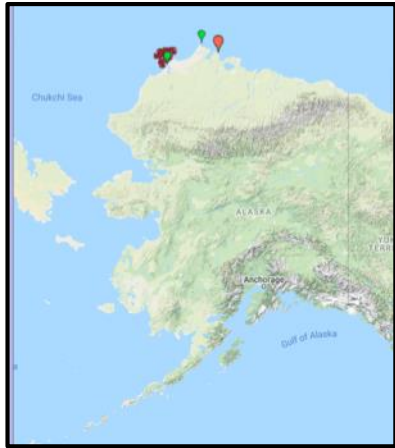
Wave Measurements from a Single Station



R8 Comparison of Buoy and CODAR Wave Height (m)



U.S. National HF Radar Network

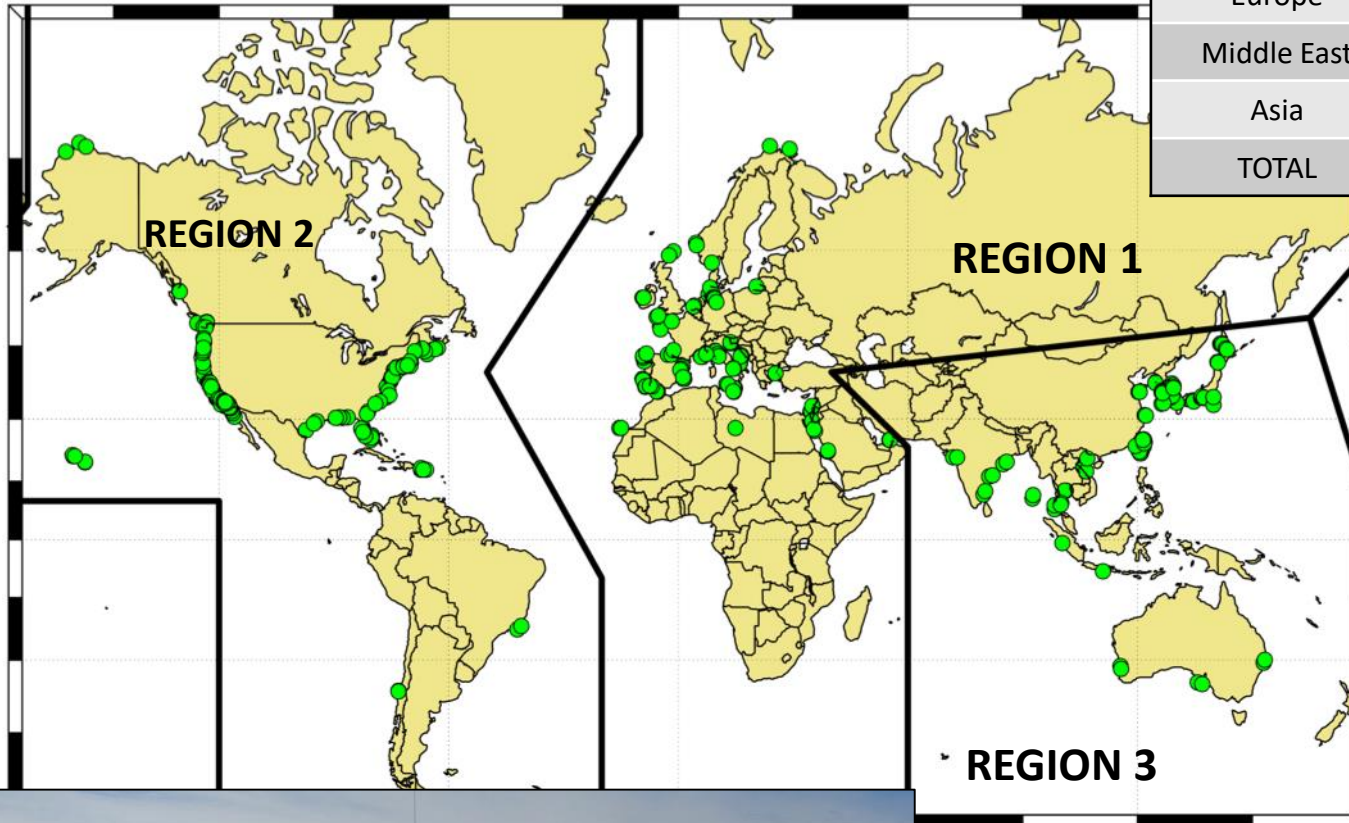


Coverage for 29 NOV 2018
150 HF Radars Registered
121 HF Radars Reporting



HF Radar Globally

Region	Number	Percentage
Americas	162	43%
Europe	75	20%
Middle East	10	3%
Asia	130	34%
TOTAL	377	100%



GEO GROUP ON
EARTH OBSERVATIONS



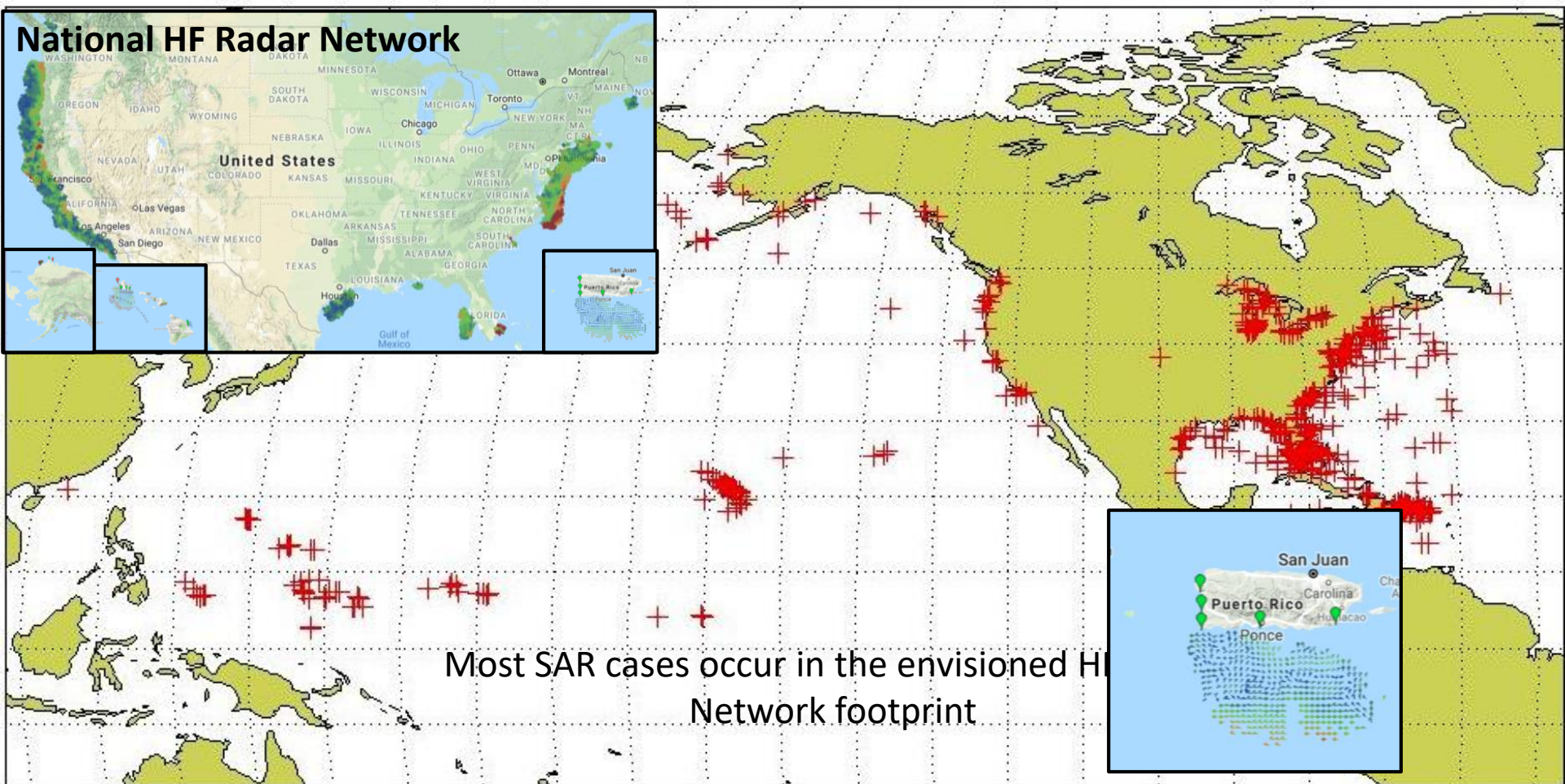
USCG Drifter Deployments

Self Locating Data Marker Buoys (SLDMB)
for Search And Rescue (SAR)

January 2006 – December 2007 (2 years)



National HF Radar Network

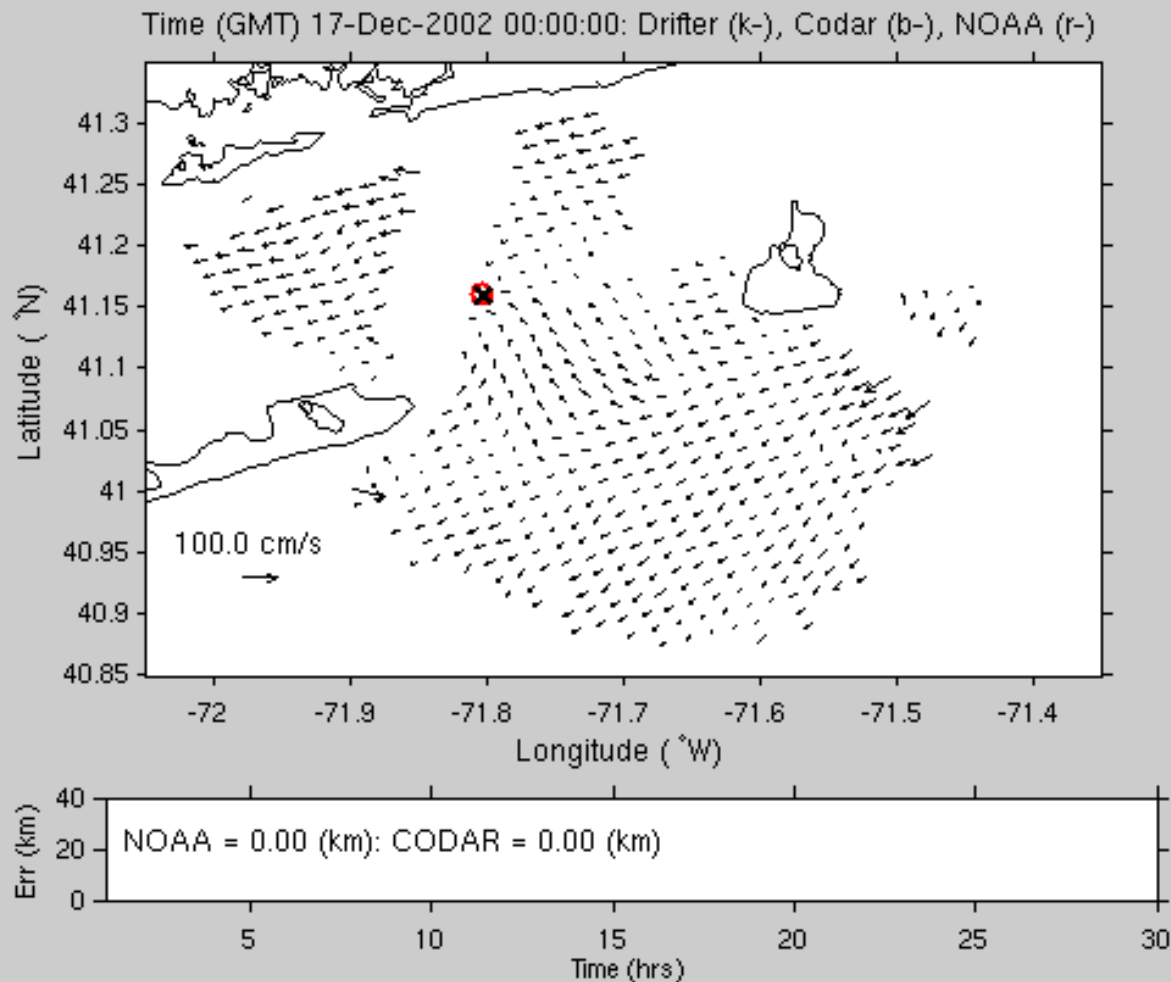


Most SAR cases occur in the envisioned HF
Network footprint



Standard Range 25 MHz

Year 2003



Drifter

HF Radar

**Existing
Model**

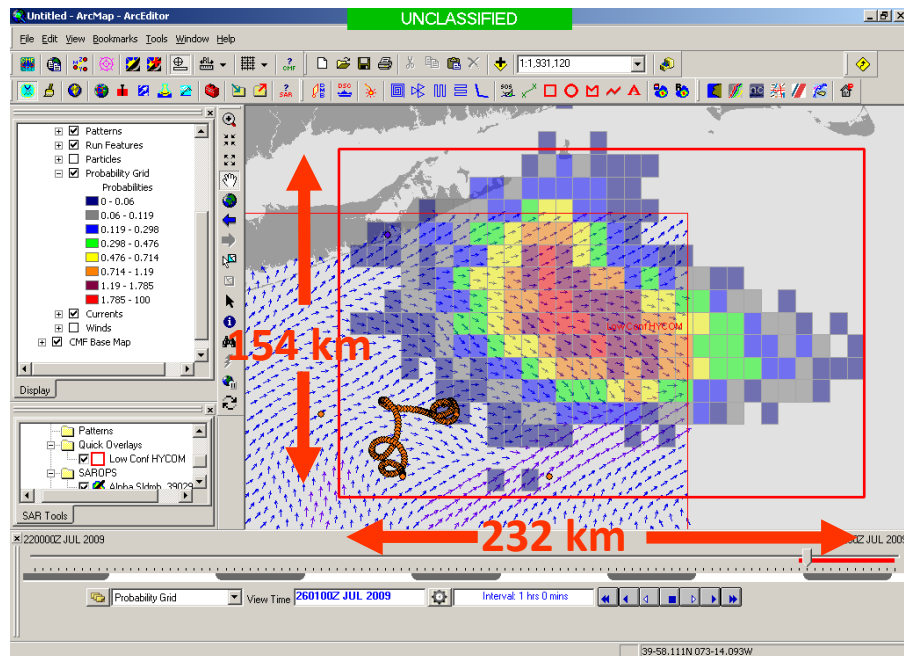
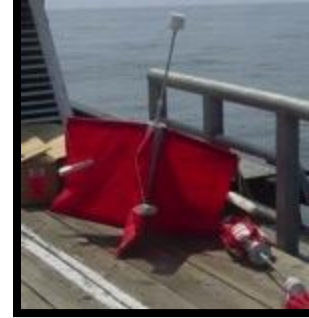




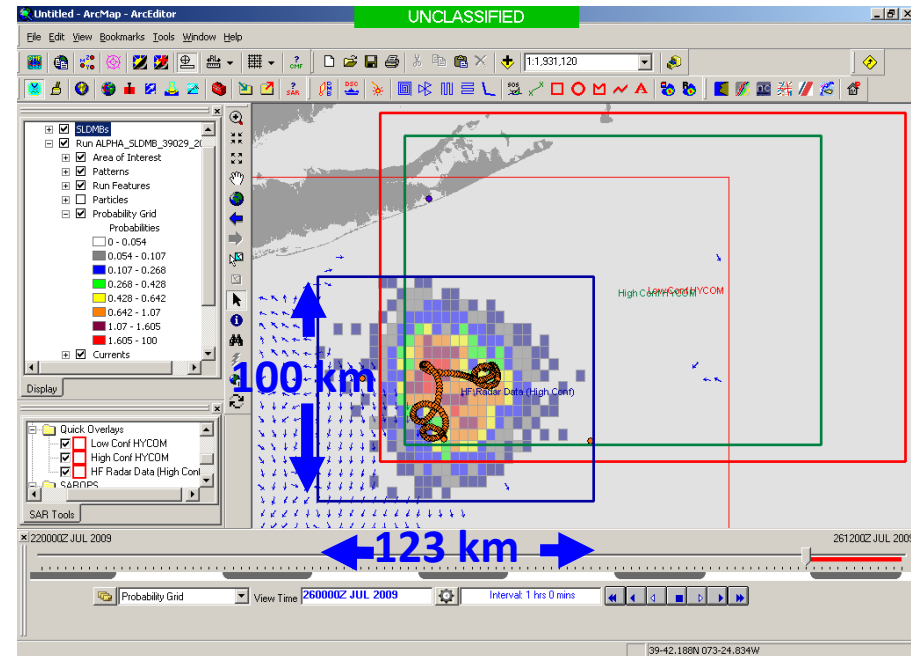
USCG Current Validation

Results of a 1-year blind validation study -
For every real drifter deployed at sea:

- 5000 Virtual Drifters Deployed in SAROPS
- Search Areas compared to real drifters every 12 hours



HYCOM 96 hour Search Area
36,000 km²



HF Radar 96 hour Search Area
12,000 km²

May 4, 2009:

NOAA Announces that MARACOOS CODAR is Operational in SAROPS

United States of America
DEPARTMENT OF COMMERCE

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Top News

NOAA, U.S. Coast Guard: New Ocean Current data to Improve Search and Rescue Activities
Washington (May 4)—A new set of ocean observing data that enhances the ability to track probable paths of victims and drifting survivor craft should improve search and rescue efforts along the U.S. coast. The data comes from the Integrated Ocean Observing System (IOOS), the Mid-Atlantic Coast Coast Guard, and the Department of Commerce.

Secretary Locke Sworn in by Vice President Biden
Washington (May 1)—U.S. Secretary of Commerce and Human Services Secretary Joe Biden in ceremony also attended the ceremony is now full of energetic innovation have them by my side as we and laying a new foundation for American people asked for, President Obama said. Locke is the department's 36th Secretary, leading its 12 agencies and bureaus.

Secretary Locke Disagrees with Colombia
Washington (May 1)—U.S. Secretary of Commerce and Human Services Secretary Joe Biden in ceremony also attended the ceremony is now full of energetic innovation have them by my side as we and laying a new foundation for American people asked for, President Obama said. Locke is the department's 36th Secretary, leading its 12 agencies and bureaus.

U.S. Coast Guard Photo

File Photo

Recovery.gov
For information about Commerce agencies' efforts, visit Commerce.gov/Recovery.

UNCLASSIFIED

Untitled - ArcMap - ArcEditor

SAROPS: Alpha MARCOOS_HF_radar : Surface Currents

Get EDS Data

Info

00.000

201300Z APR 09
201400Z APR 09
201500Z APR 09
201600Z APR 09
201700Z APR 09
201800Z APR 09
201900Z APR 09
202000Z APR 09
202100Z APR 09
202200Z APR 09

Confidence High

Reset Exit

Next >

Dis < Back

201300Z APR 2009

201400Z APR 2009

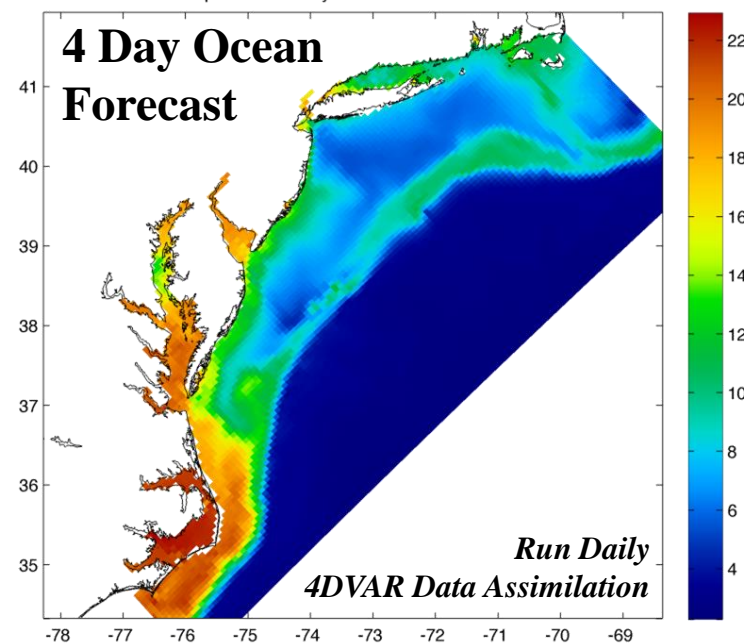
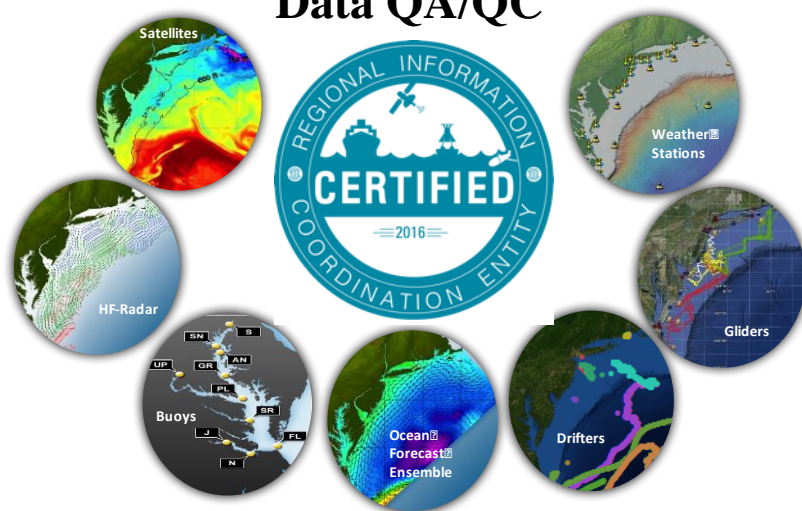
Interval: 1 hrs 0 mins

38-22.446N 075-36.113W

Operations Center



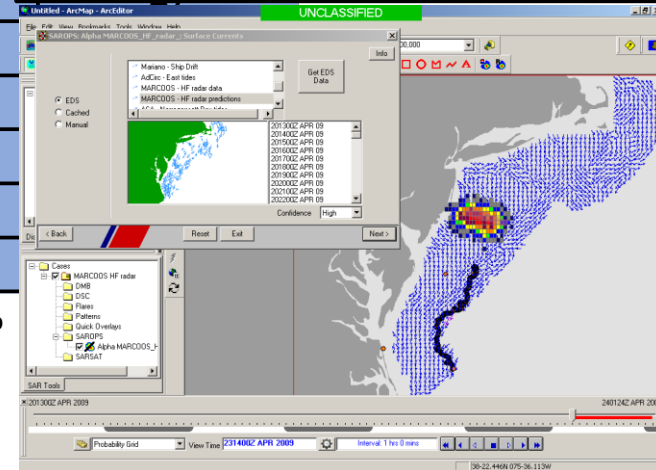
Data QA/QC



Coast Guard Surface Current Data Requests

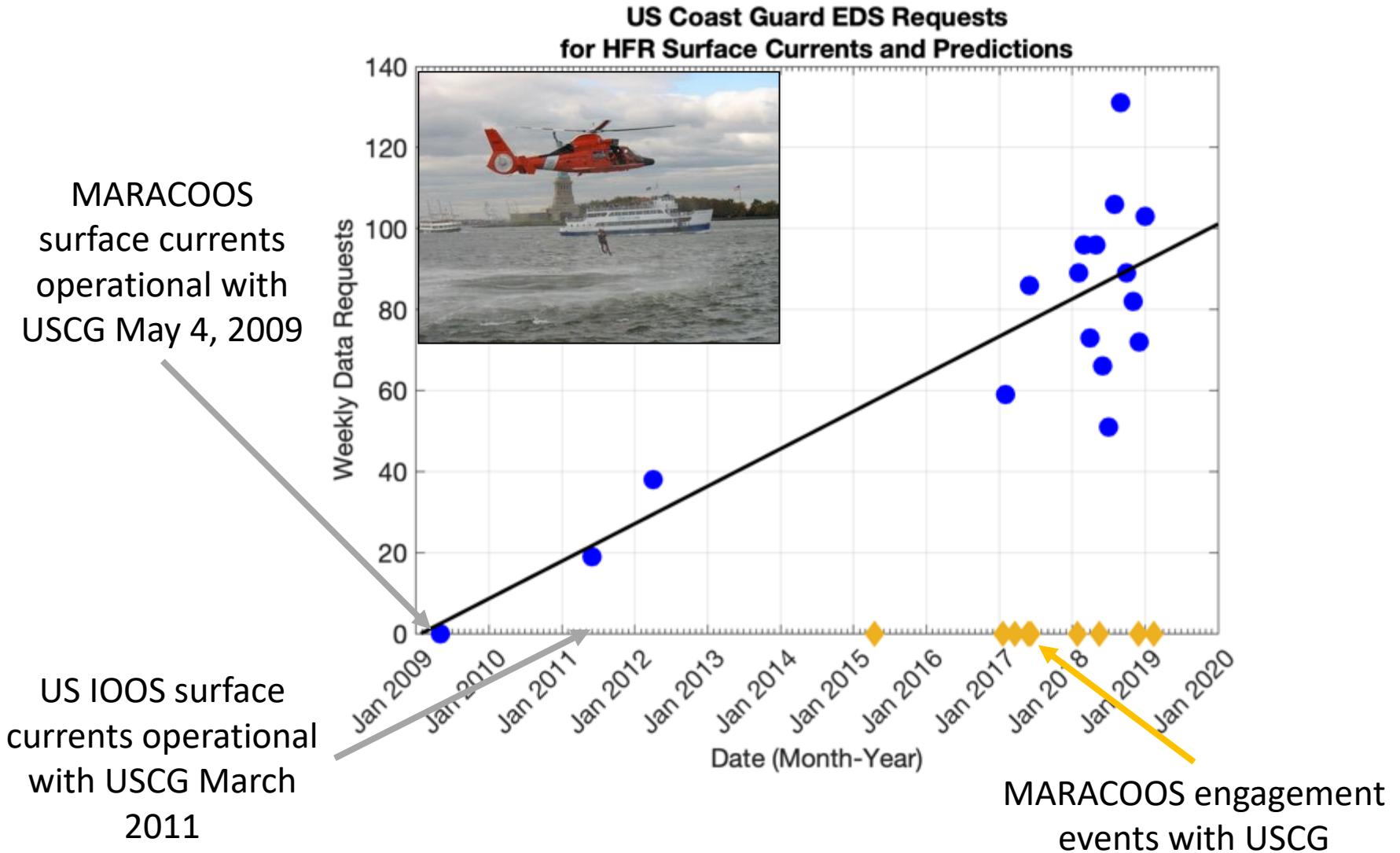
January 1 to December 31, 2017

Rank	USCG Product Key	Number of Orders	Percent	Orders/Week
1	Espresso_Rutgers_C	11,441	24%	220
2	AGG_ADCIRC_GHycom_C	6,860	14%	132
3	HFRData&STPS_C	4,451	9%	86
4	Global_HYCOM_NCEP_C	3,927	8%	76
5	Global_HYCOM_Navy_C	3,754	8%	
6	Maine_FVCOM_UMass_C	3,516	7%	
7	NoAtl_HYCOM_NCEP_C	2,975	6%	
8	ChesBay_NOS_C	2,804	6%	
9	NW_AtI_NCSU_C	2,086	4%	
10	Hawaii_UHI_C	1,380	3%	
11	CA_3KM_UCLA_C	1,166	2%	
12	ColumbiaR_NOS_C	1,026	2%	
13	MassBay_FVCOM_UMass_C	886	2%	
14	No_GoMex_FVCOM_NOS_C	886	2%	
15	L_Erie_FVCOM_NOS_C	767	2%	
		47,925	100%	



Email from Eoin Howlett March 20, 2018

National Use of HFR Data and Predictions



The Opportunity



Our Classrooms



Our Students

**In 2050,
they all
will be in
their 50's
to 60's.**

Rutgers Masters in Integrated Ocean Observing

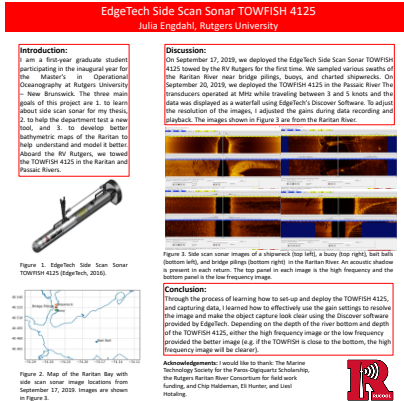
Key concept: Hands-on experience through total immersion in a working ocean observatory.

Students will:

Develop skills to use cutting-edge technology

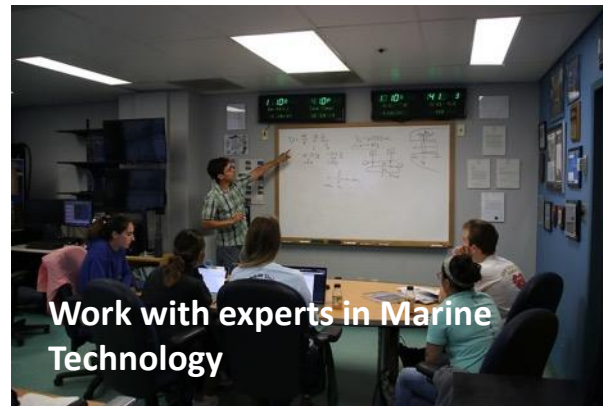


Present their work at marine technology meetings



Interact with leaders in the field from academia, government, and industry

Lead field teams



Work with experts in Marine Technology

Be immersed in ocean observatory operations every day



Application Deadline: 1 January, 2020!!!



Summary

- **Integrated Approach**
- **Enabled by New Technologies**
- **Requires Partnerships**
- **Supports scientific and societal goals**
- **We aim to train an experienced and inspired workforce**