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Coastal CUBEnet

http://oceancube.usm.edu/ or http://131.95.7.148/

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Jason McKenna
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Coastal CUBEnet

- The Northern Gulf of Mexico is fast becoming the go-to maritime test range for DARPA, DHS S&T, ERDC, NRL, and other Federal R&D agencies.
- To support the emerging requirements USM's has developed its Coastal CUBEnet Environment.
- The CUBEnet with its Environmental Intelligence (EI) infrastructure is a high-resolution, coastal ocean sensor, modeling, and data sharing network that provides the integrated infrastructure needed for collaborative ocean research products.
- This specifically includes high-resolution products needed for the testing and evaluate of UMS.
- The EI provides the networked Blue Economy stakeholders with the ability to access models, and high- resolution data for real-time or near-real Gulf coastal policy decisions with much greater accuracy and confidence.

Coastal CUBEnet

- USM's EI network is a platform for the ongoing development of hydrodynamic, machine learning, and other artificial intelligence models.

- The CUBEnet and its EI offers the opportunity to bring in expertise, insights, methods, and tools from multiple disciplines.

    - Oceanography
    - Climate science
    - Biology
    - Natural resource management
    - Coastal and ocean engineering
    - Computer/data science
    - Public policy
    - Economics

Coastal CUBEnet

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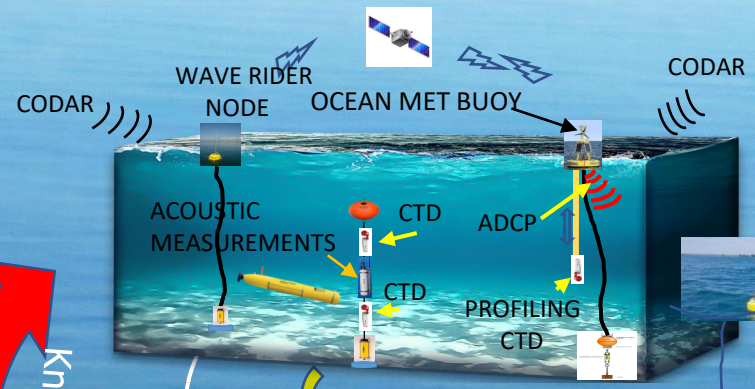
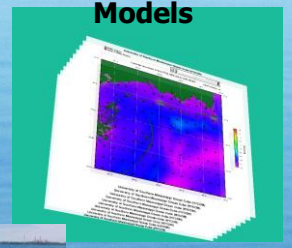
4-D Ocean Cube



High-Resolution Models



SUBCubes
Underwater Sensor Networks
AUV's

High-Resolution Data and Modeling Products

Environmental Intelligence

Knowledge Applications Decisions

Knowledge Applications Decisions

AQUACULTURE

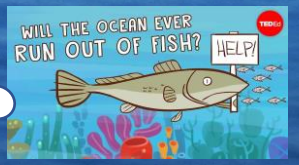
COASTAL PROTECTION

TOURISM

ENERGY EXPLORATION

EDUCATION and RESEARCH

RENEWABLE ENERGY



FISHERIES and MARINE BIODIVERSITY

TRAINING, TEST, and EVALUATIONS

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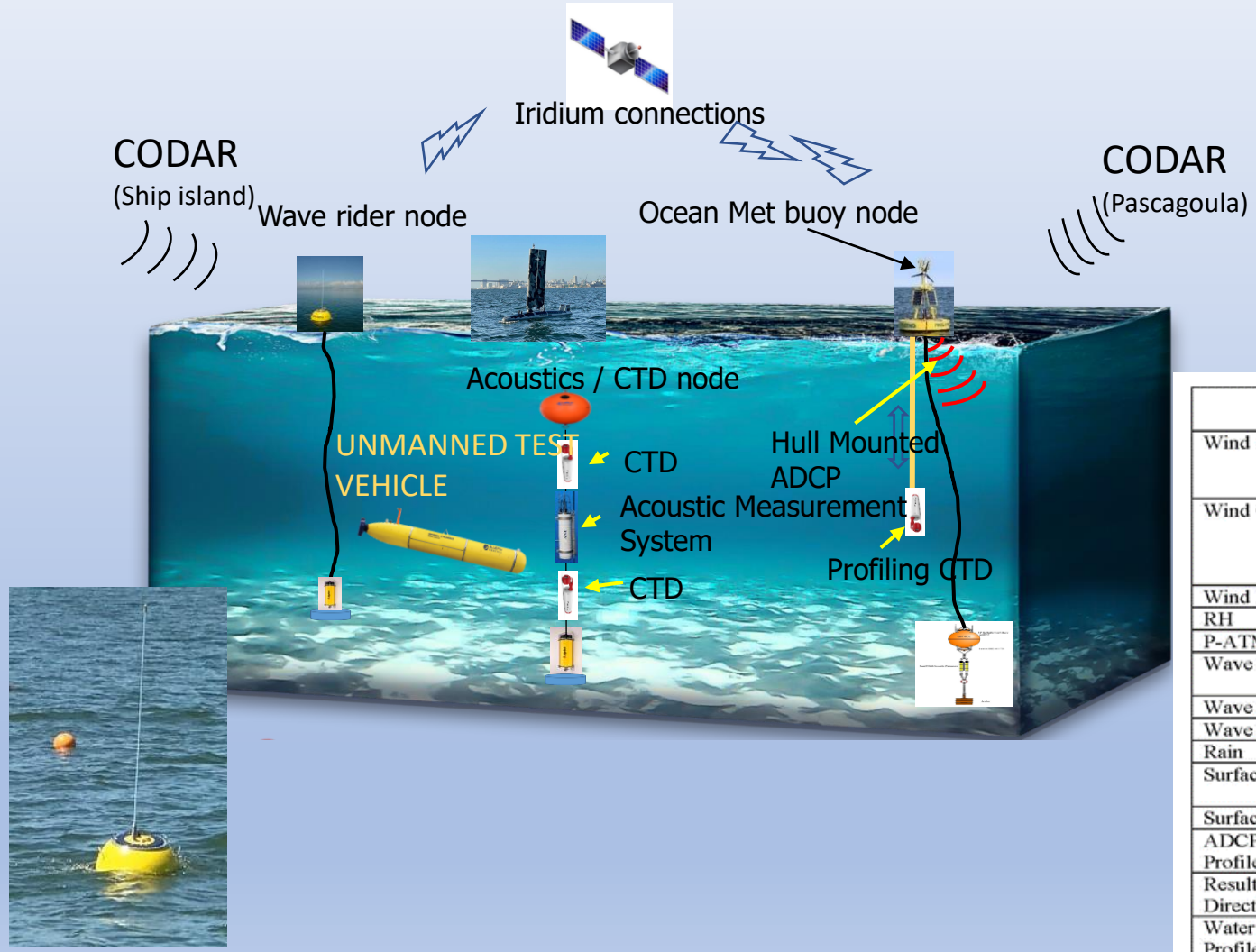
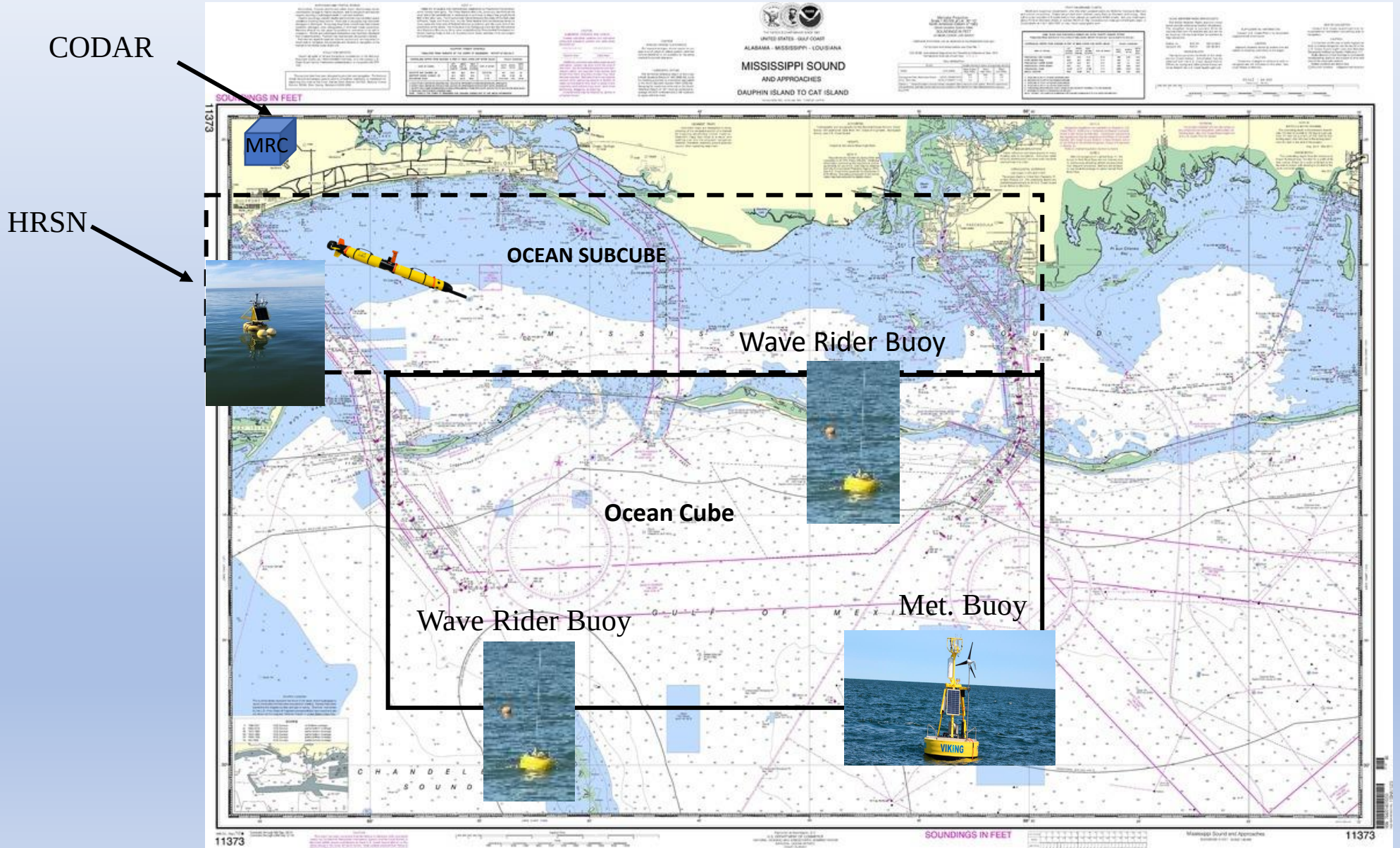
Environmental Intelligence
4-D Ocean Cube

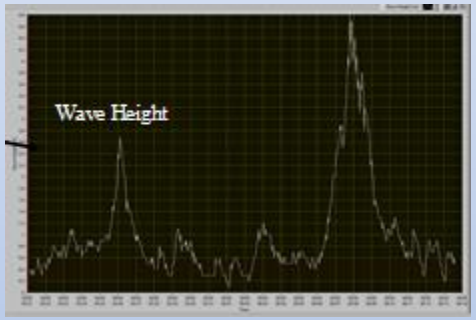


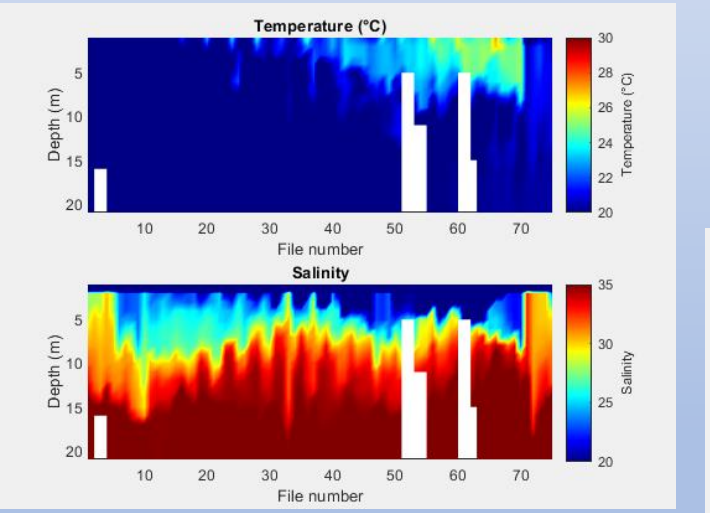
Viking Ocean Met Buoy		*Datawell Wave Rider Buoy*	
Wind speed	kts	Surface currents	m/sec
Wind Gusts	kts	GPS	deg
Wind Direction	deg	Displacements	m
RH	%	Spectral Statistics	m, date, sec
P-ATM	in HG	Wave height Statistics	m, date, sec
Wave Period	sec	MEM spectrums	deg, Hz, density
Wave Height	m	Current meter	m/sec
Wave Peak	m	Sea surface temps	
Rain	mm	Spectral Statistics	m, date, sec
Surface Current Speed	m/sec	Wave Spectrums	m^2/Hz, Hz, deg
Surface Current Direction	deg		
ADCP Water Volume Profiler	m/sec		
Resulting Current Directions	deg		
Water Column CTD Profile	ppt, °C, m		
GPS	decimal degrees		

Data Environment

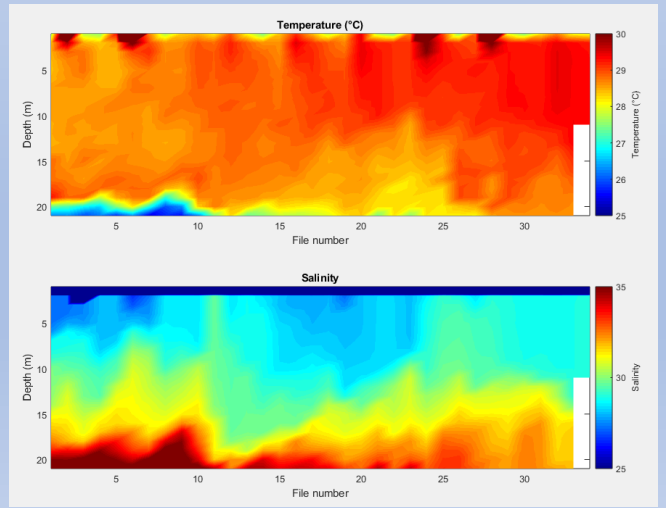


Data Environment

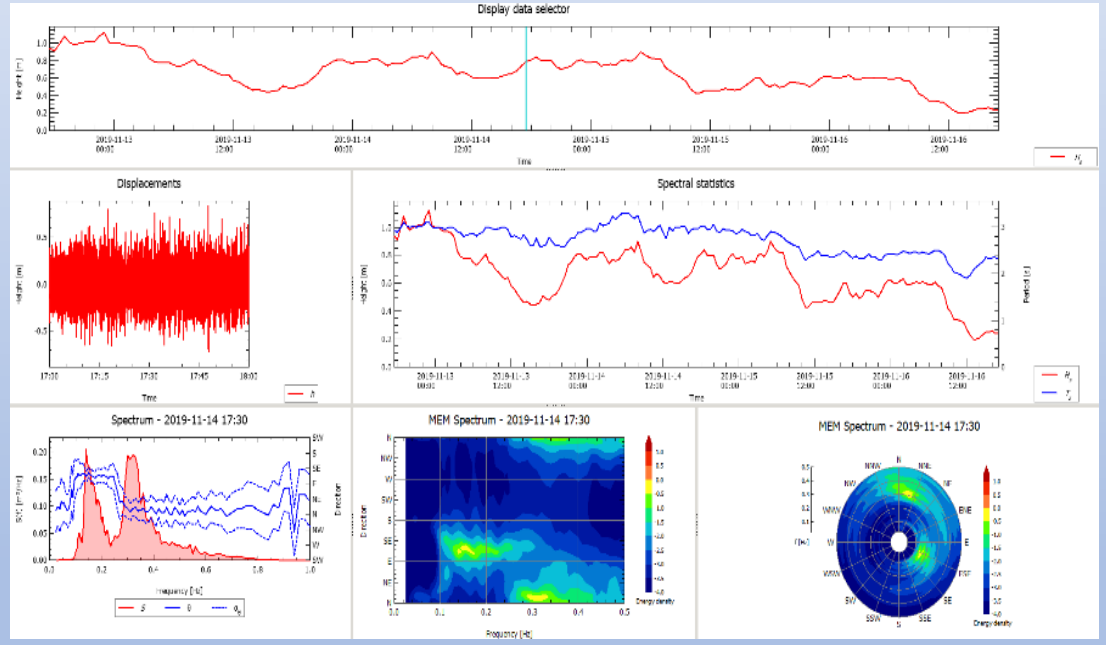




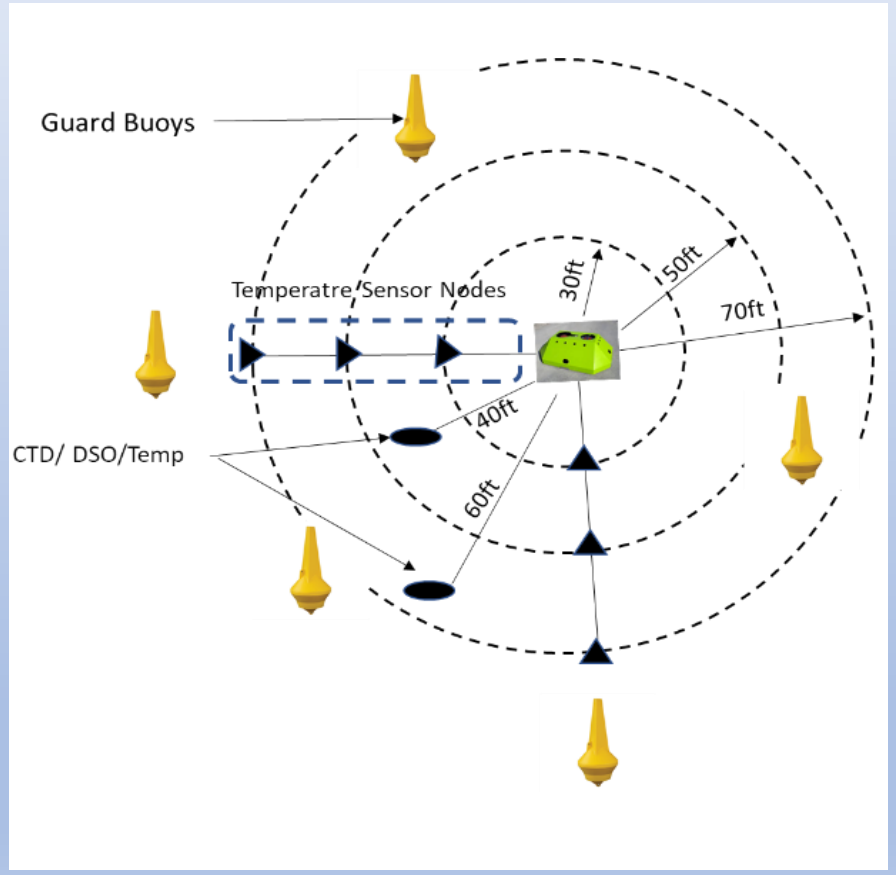
Profiling Data

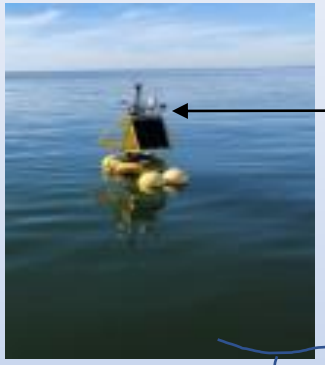


Sea Surface Wave Data

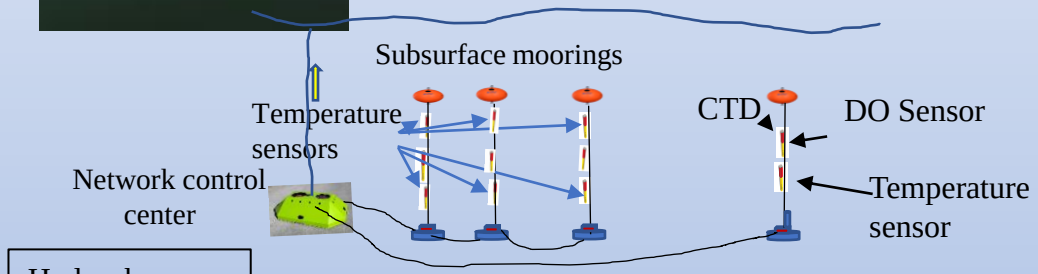


Data Environment
High-Resolution Sensor Network





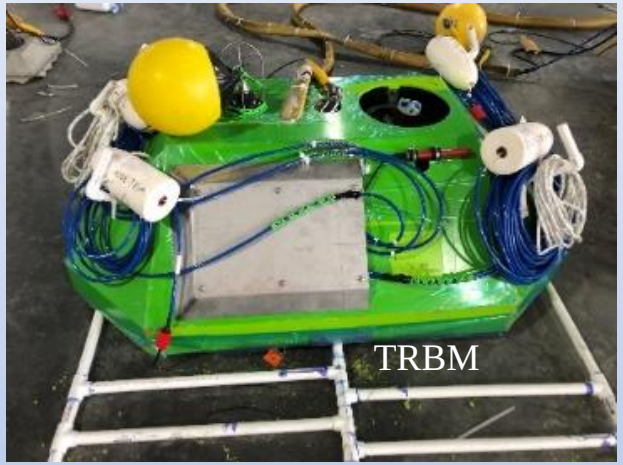
Weather station/ Wave sensor
Cellular Data transmitter/ Batteries

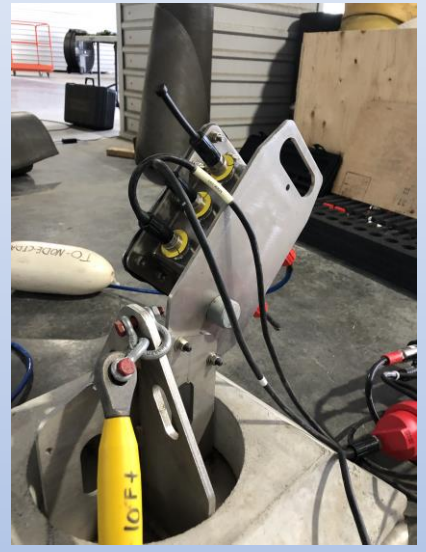


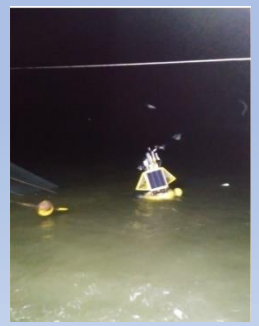
Hydrophone
Hi-Freq ADCP
Tide sensor

System Sensor Types
18 Temperature Sensors
2 CTDs
2 DO
1 ADCP
1 Hydrophone
1 Tide Sensors
1 Weather Station
1 Wave Sensor

High-Resolution Sensor Network







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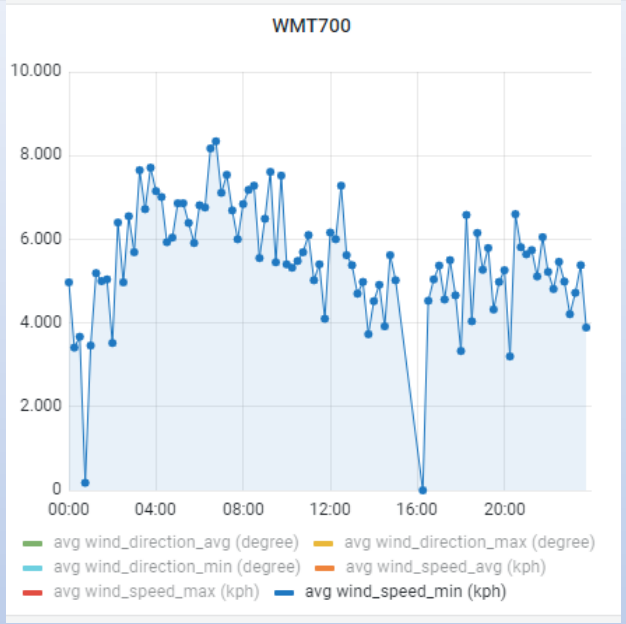
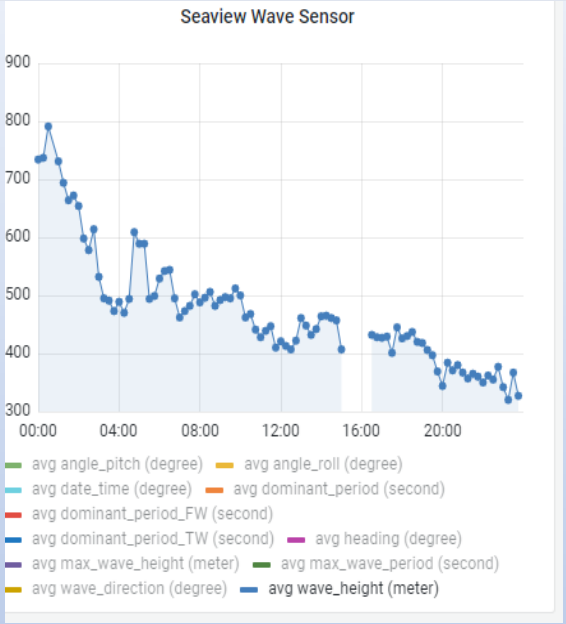
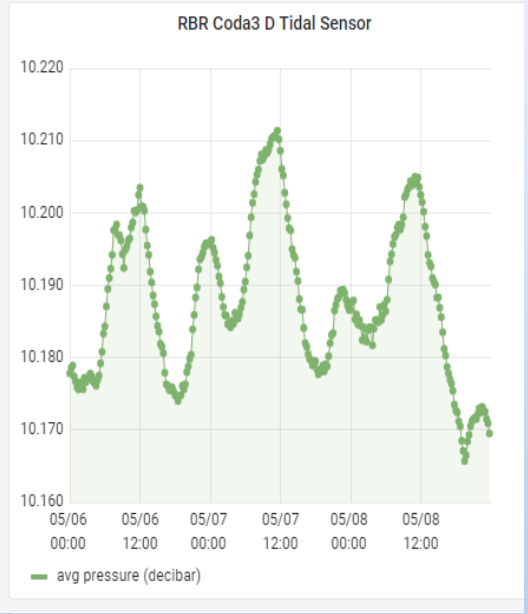
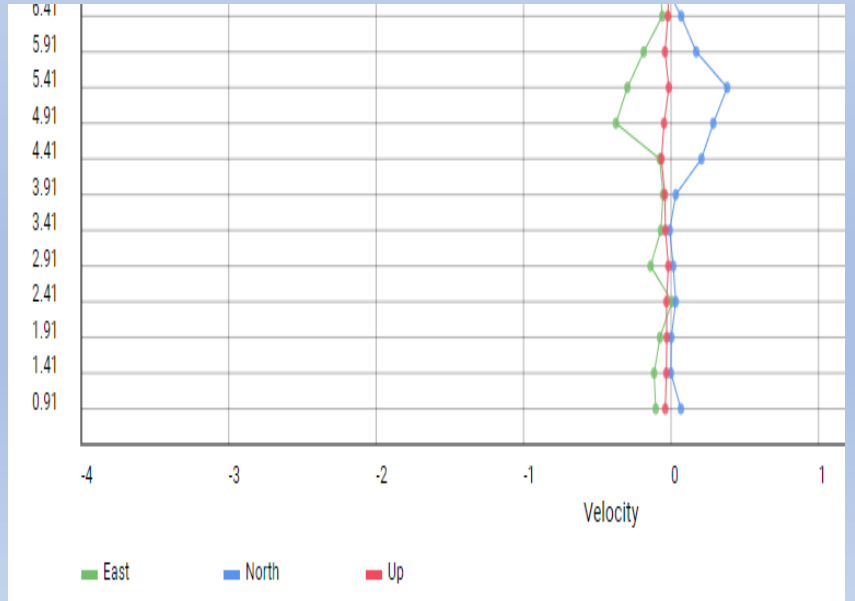
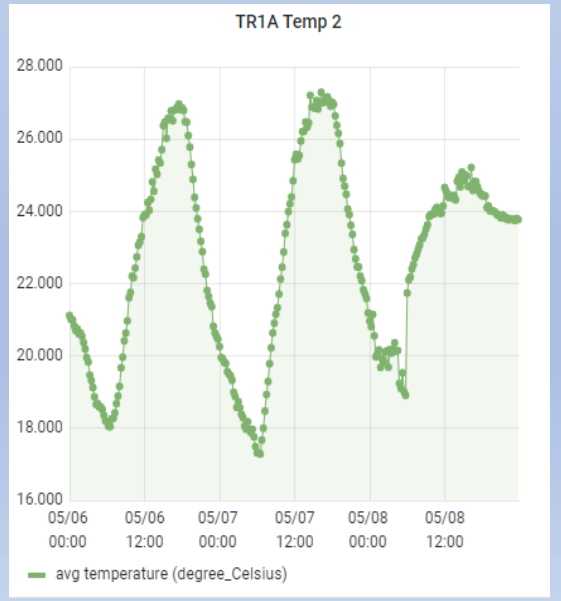
Data Environment
High-Resolution Sensor Network











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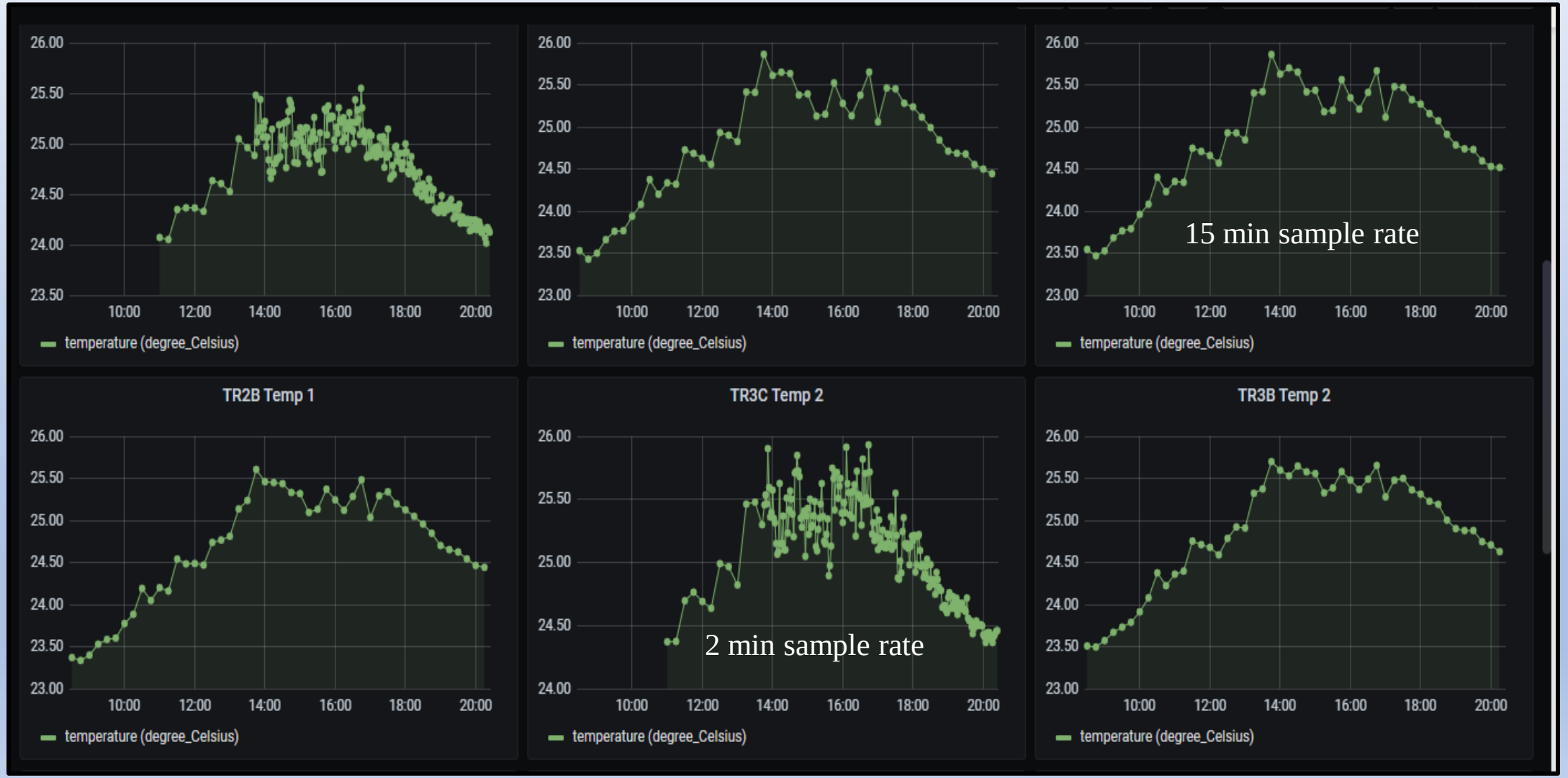
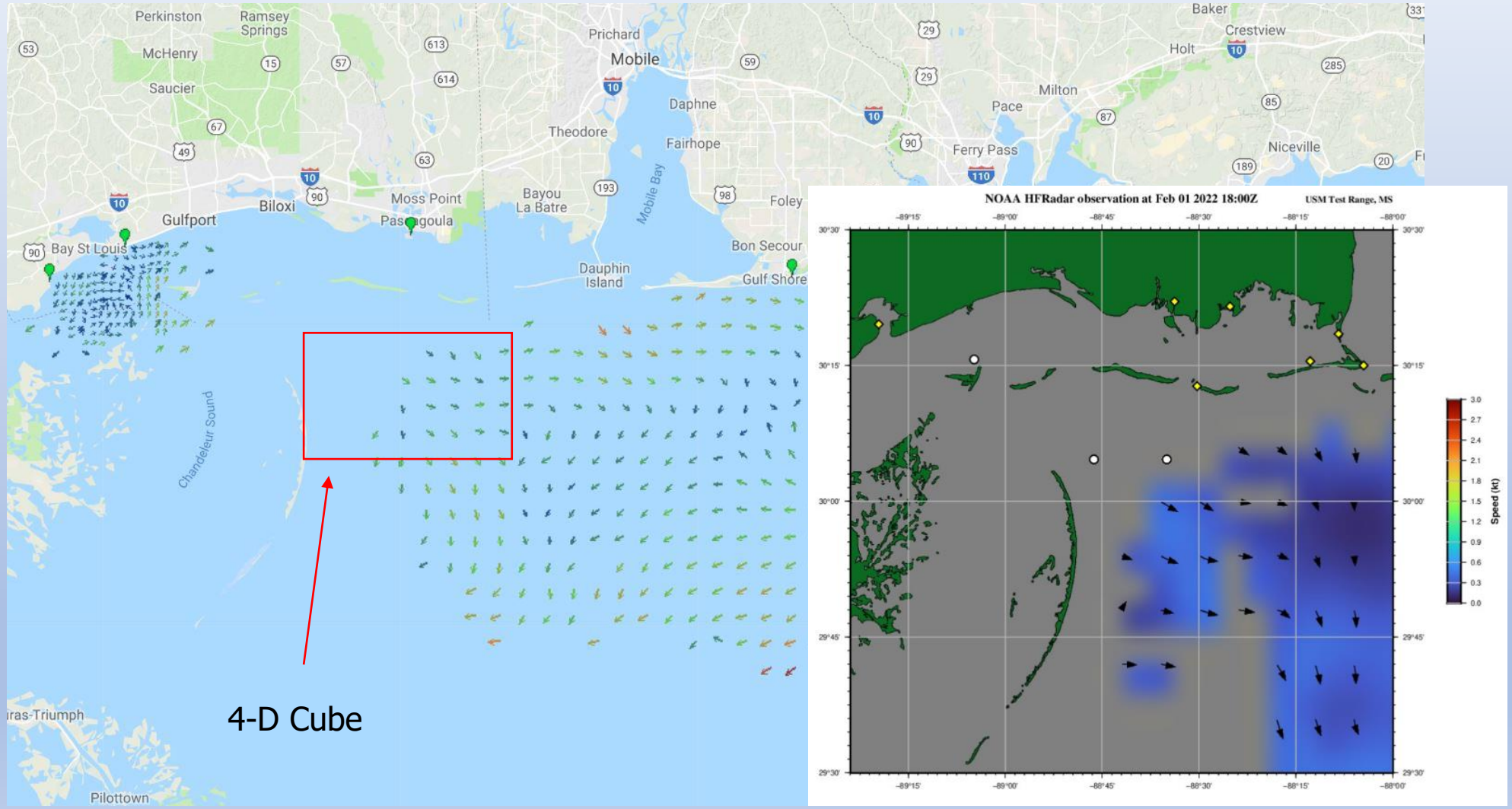
Data Environment
High-Resolution Sensor Network

THEREMISTOR DATA

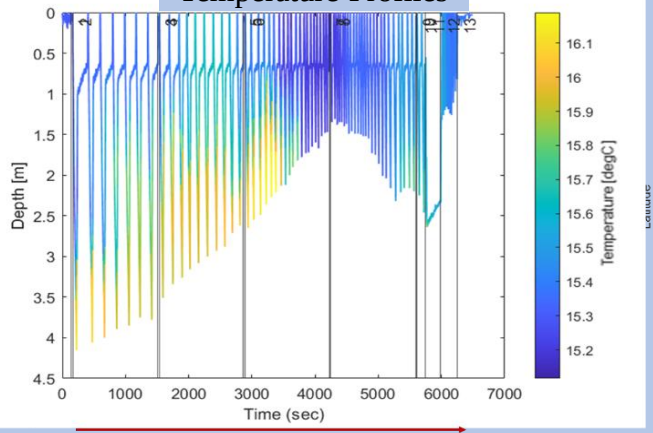


CODAR Surface Current Measurement Node (1km resolution)

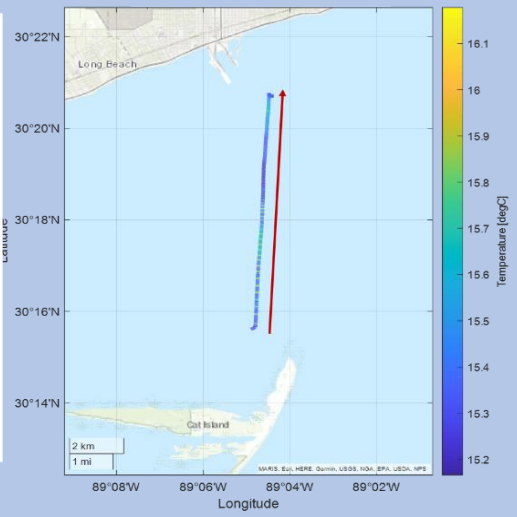


Data Environment
Iver3

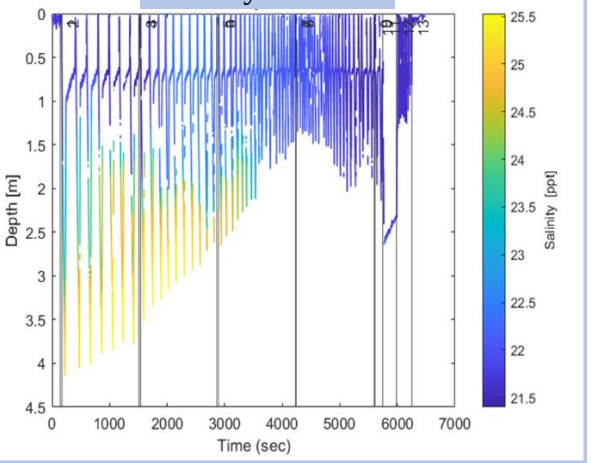
Temperature Profiles



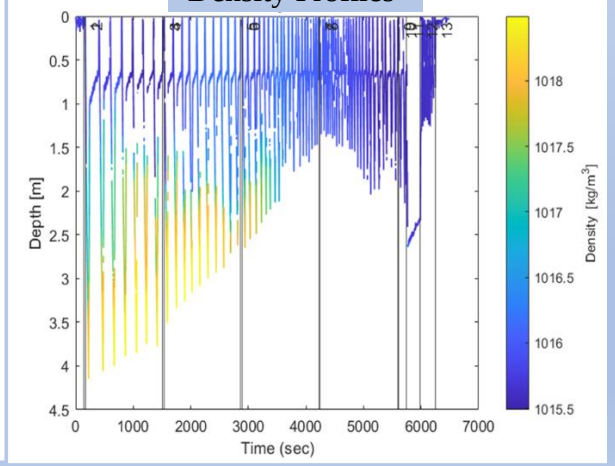
Iver3 Data Track



Salinity Profiles



Density Profiles



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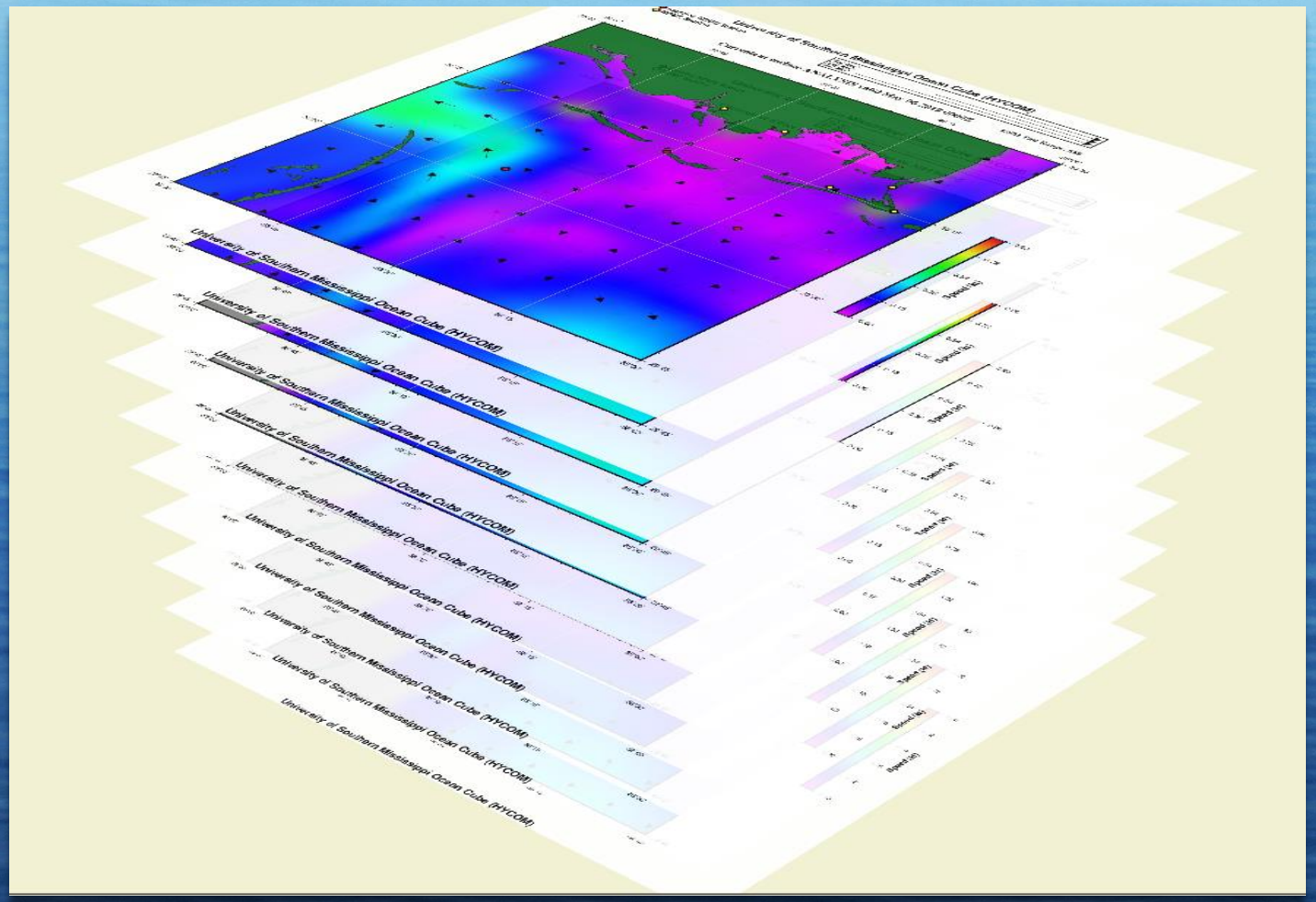
Model Environment

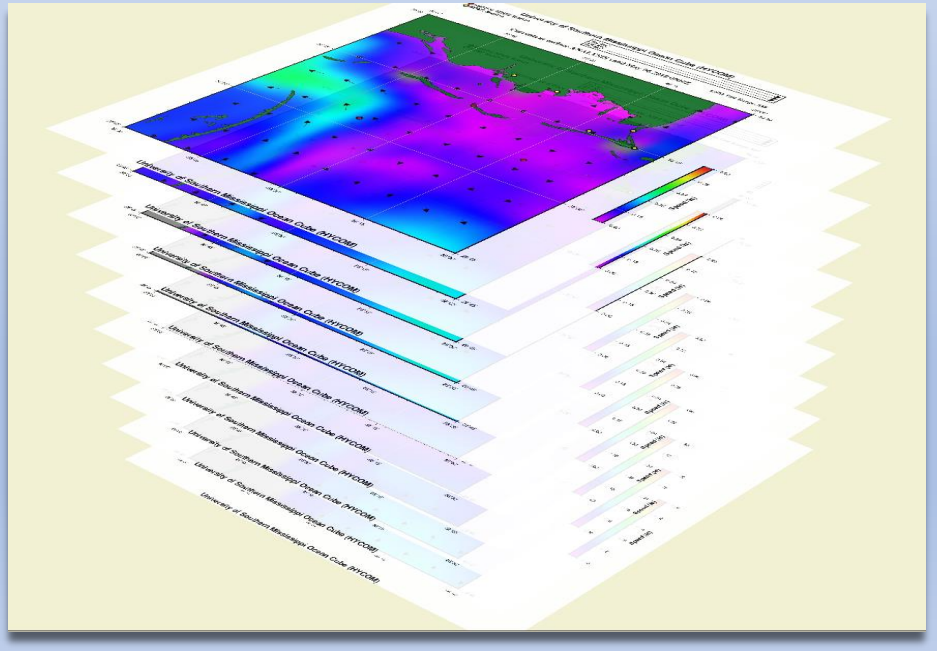


http://oceancube.usm.edu/ and http://131.95.7.148/

Model Environment

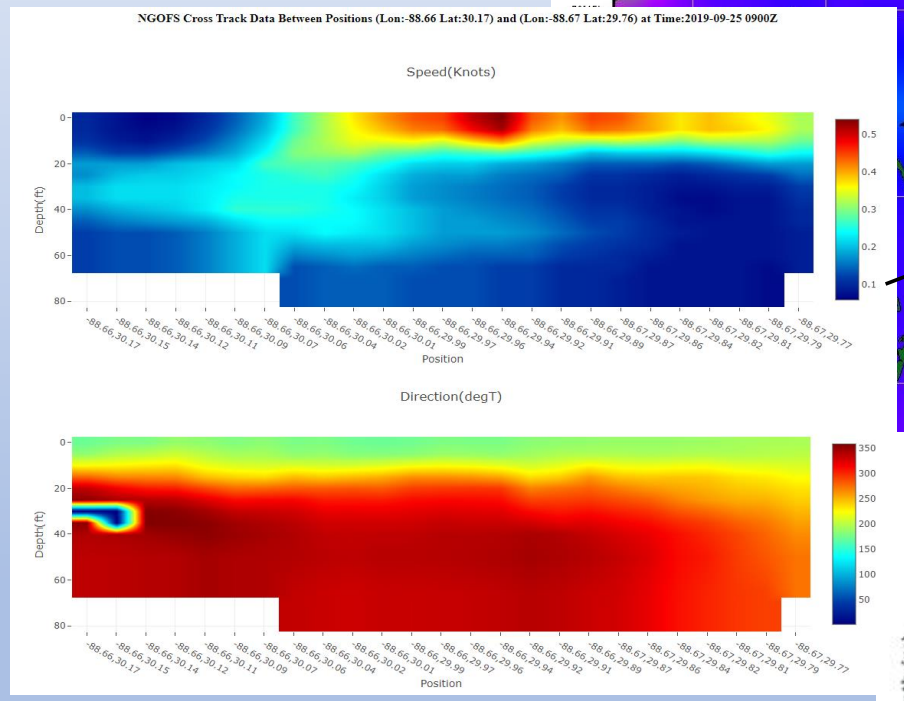
Model Summary

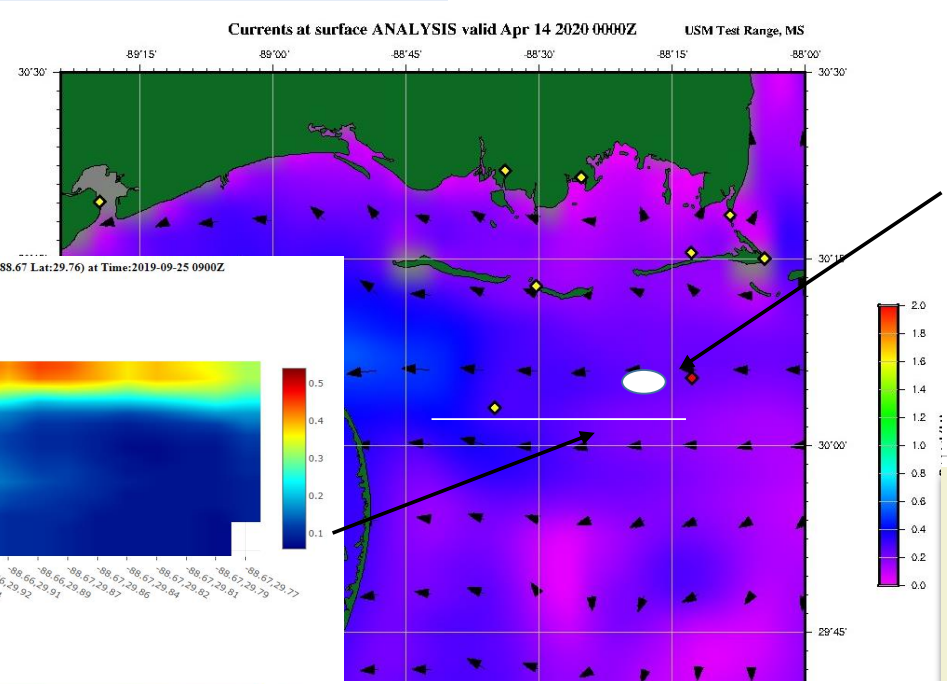
Name	Source	Horizontal Resolution	Vertical Resolution	Time Step	Forecast
HYCOM	hycom.org experiment 90.1m000	3.5 km	36 z, sigma and isopycnal layers	3-hour	120 hours
AMSEAS	ncdc.noaa.gov	3 km	40 z and sigma layers	3-hour	96 hours
NGOFS2	tidesandcurrents.noaa.gov	1 km calculated at 45 m – 11 km	41 sigma layers	3-hour	54 hours
BellHop	Michael B. Porter	Variable	Variable	NA	NA



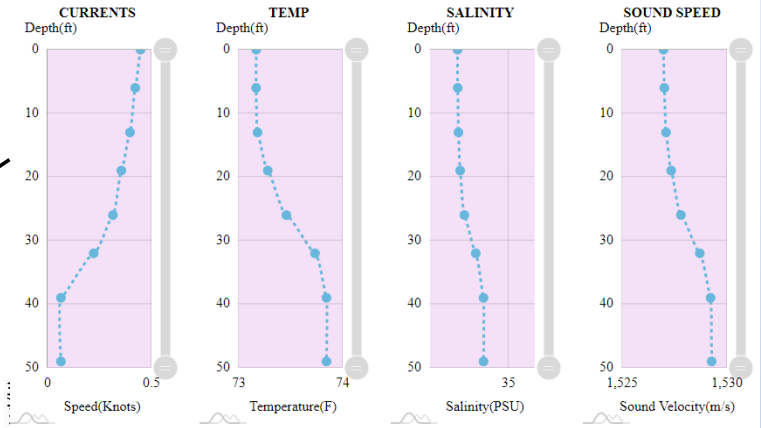
Model Environment

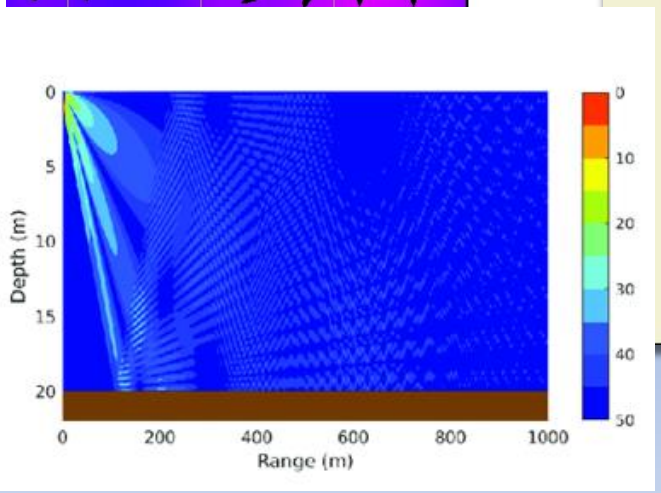
Track Calculations

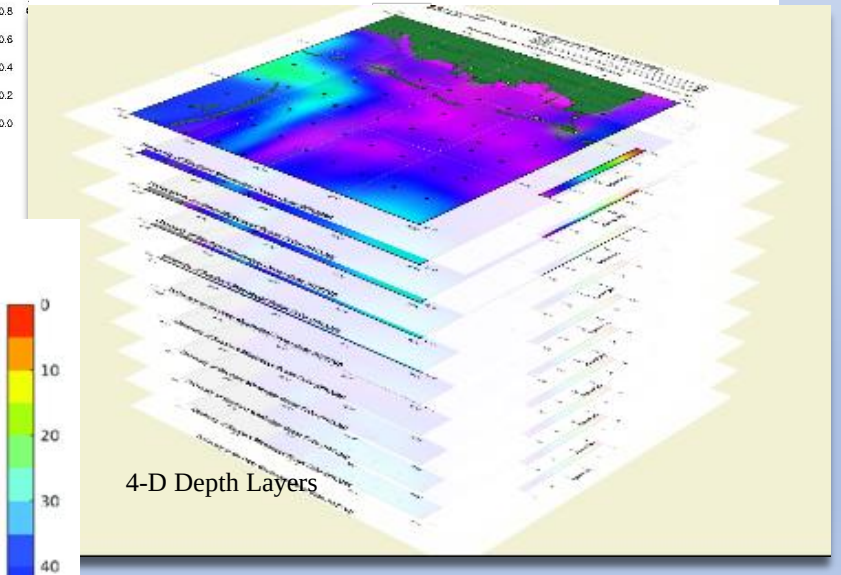




Parameter Profiles

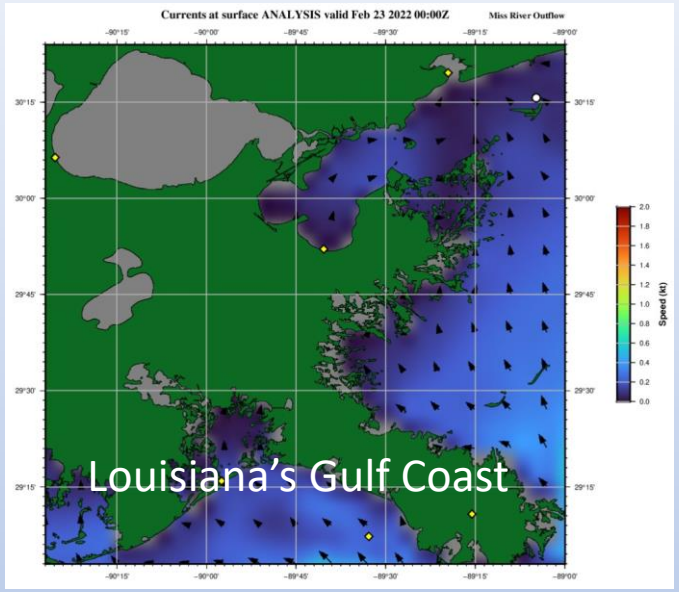


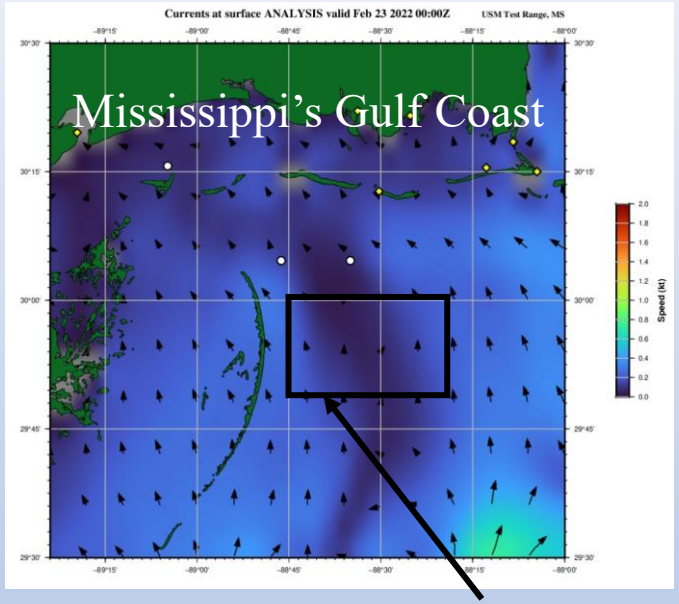


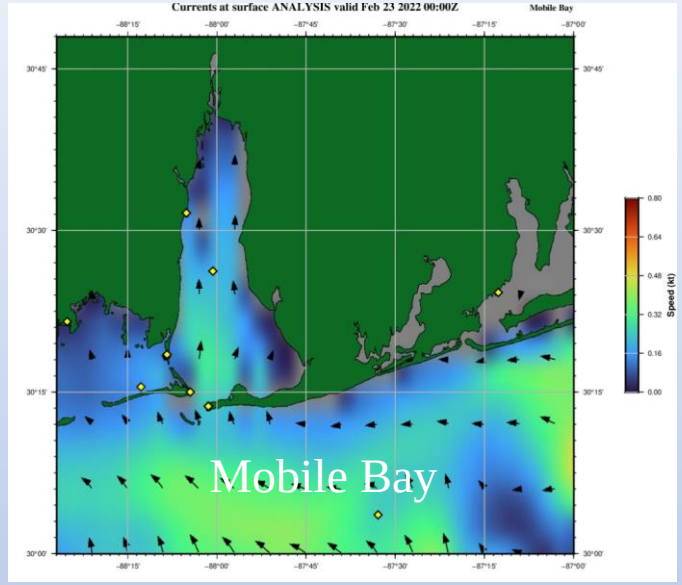


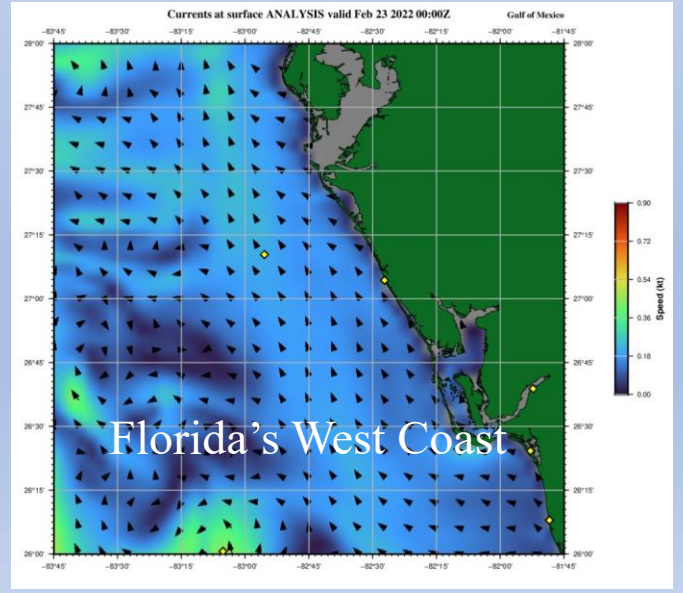
4-D Depth Layers

Model Environment (Surface Currents)





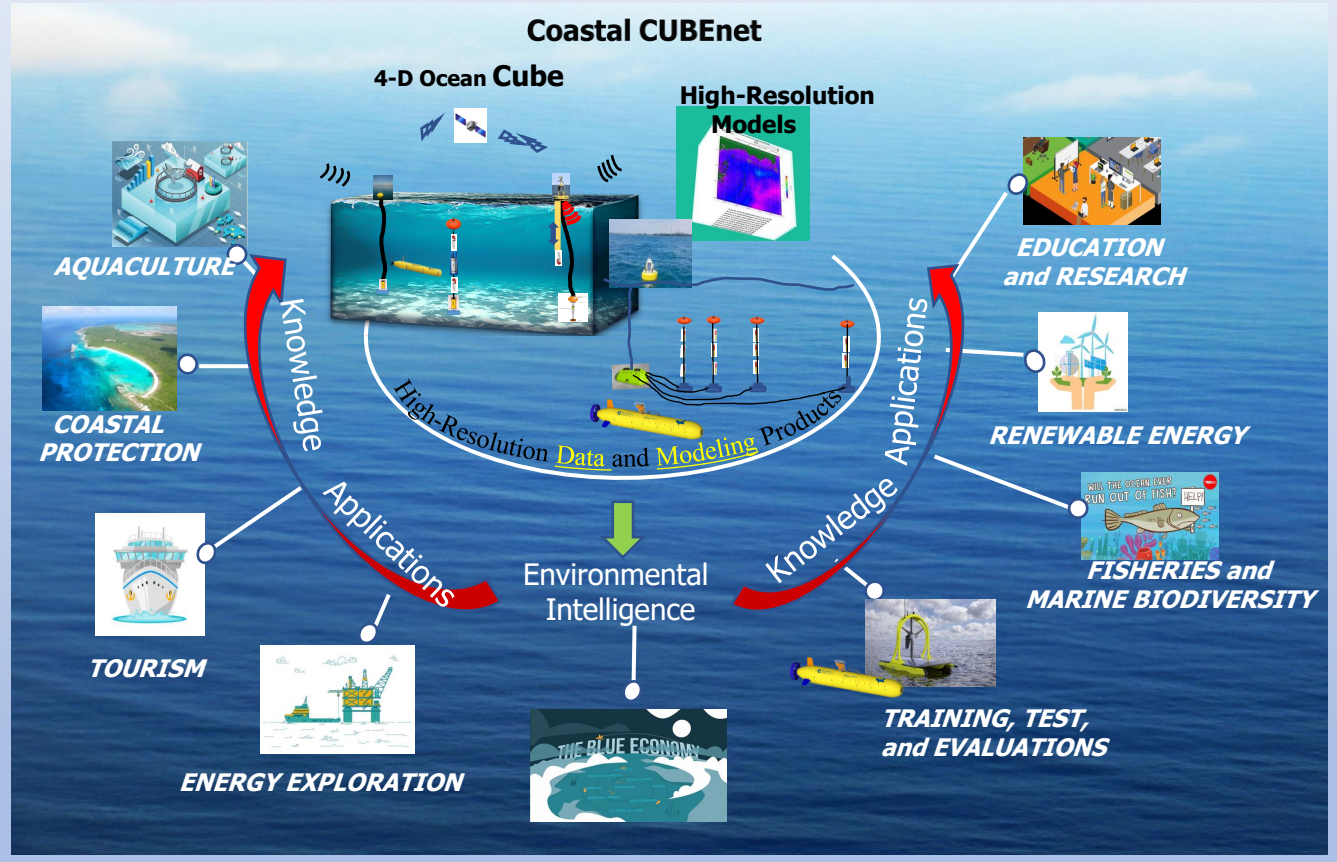




HYCOM Data for Rectangle Bounded By West-88.55, South:29.75, East:-88.36, and North:29.92 at Time:2022-02-23

Longitude	Latitude	Depth(m)	Speed(m/s)	Direction(degT)	Temperature(F)	Salinity(PSU)	Sound Velocity(m/s
-88.553	29.7538	0	0.0529	352.9263	66.7291	35.8767	1520.4756
-88.553	29.7538	2	0.0354	357.3963	66.7251	35.8764	1520.5027
-88.553	29.7538	4	0.0194	15.5663	66.7116	35.8757	1520.5143
-88.553	29.7538	6	0.0098	53.6085	66.6823	35.8746	1520.5007
-88.553	29.7538	8	0.0164	163.1792	66.6253	35.8729	1520.4431
-88.553	29.7538	10	0.0381	182.4249	66.5252	35.8707	1520.3174
-88.553	29.7538	12	0.0662	190.2756	66.3424	35.8656	1520.0581
-88.553	29.7538	15	0.0943	196.6984	66.0660	35.8618	1519.6687
-88.553	29.7538	20	0.0808	179.3256	65.2195	35.9215	1518.4756
-88.553	29.7538	25	0.0704	179.1907	65.0803	35.9476	1518.3662
-88.553	29.7701	0	0.0518	354.3876	66.5842	35.8493	1520.2182
-88.553	29.7701	2	0.0347	0.3982	66.5803	35.8492	1520.2454
-88.553	29.7701	4	0.0190	24.2139	66.5670	35.8484	1520.2571
-88.553	29.7701	6	0.0098	61.2135	66.5380	35.8474	1520.2441
-88.553	29.7701	8	0.0173	161.0911	66.4787	35.8455	1520.1825
-88.553	29.7701	10	0.0388	181.5823	66.3750	35.8433	1520.0506
-88.553	29.7701	12	0.0670	189.3089	66.1821	35.8382	1519.7750
-88.553	29.7701	15	0.0917	196.8588	65.9198	35.8355	1519.4079
-88.553	29.7701	20	0.0783	177.9436	65.0663	35.9126	1518.2204
-88.553	29.7701	25	0.0652	178.4734	64.9734	35.9487	1518.1961
-88.553	29.7863	0	0.0495	355.6954	66.4731	35.8232	1520.0146
-88.553	29.7863	2	0.0329	2.9527	66.4692	35.8231	1520.0419
-88.553	29.7863	4	0.0181	26.0729	66.4558	35.8223	1520.0534
-88.553	29.7863	6	0.0093	73.7772	66.4271	35.8213	1520.0408
-88.553	29.7863	8	0.0195	160.8161	66.3650	35.8193	1519.9745
-88.553	29.7863	10	0.0409	180.7238	66.2553	35.8168	1519.8327
-88.553	29.7863	12	0.0688	188.3367	66.0506	35.8120	1519.5380
-88.553	29.7863	15	0.0902	197.1185	65.7999	35.8104	1519.1898

Coastal CUBEnet Summary



- To support emerging unmanned vehicle testing requirements USM's has developed its Coastal CUBEnet Environment.
- Coastal CUBEnet's EI mission is to provide comprehensive Nowcasts and Forecasts in support of unmanned vehicle testing.
- Coastal CUBEnet displays high-frequency radar observations, bathymetry, acoustic noise, current, temperature, salinity, and density profiles along, meteorological information.
- Coastal CUBEnet extracts and displays the data from these widely used ocean and acoustic models, HYCOM, AMSEAS, NGOFS2, and BellHop.