



River & Estuary Observation Network Rio Grande Valley

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Research, Applied Technology, Education & Services, Inc. New York, Texas

- Mission: *“Make knowledge-based policy and decision making possible with regards to water resource management.”*
 - Focus on addressing monitoring needs of under-served areas to ensure technology and monitoring solutions are available to all
 - Support and facilitate collaborative efforts between stakeholders such as municipalities, academic institutions, not-for-profits, conservancy & environmental groups as well as state and federal regulatory agencies

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- Tools for Knowledge-Based Decision Making
 - Working to make the tools needed for monitoring and knowledge-based decision making attainable by the smallest entity
 - Lower the cost of the equipment using in-house designs
 - Extend the duty cycle of instruments to make O & M costs more manageable
 - Make them modular and customizable to enable user-friendly sensor integrations and rapid deployment

Organizational Structure



River and Estuary Observatory Network (REON)



1974



1994



2002

2009

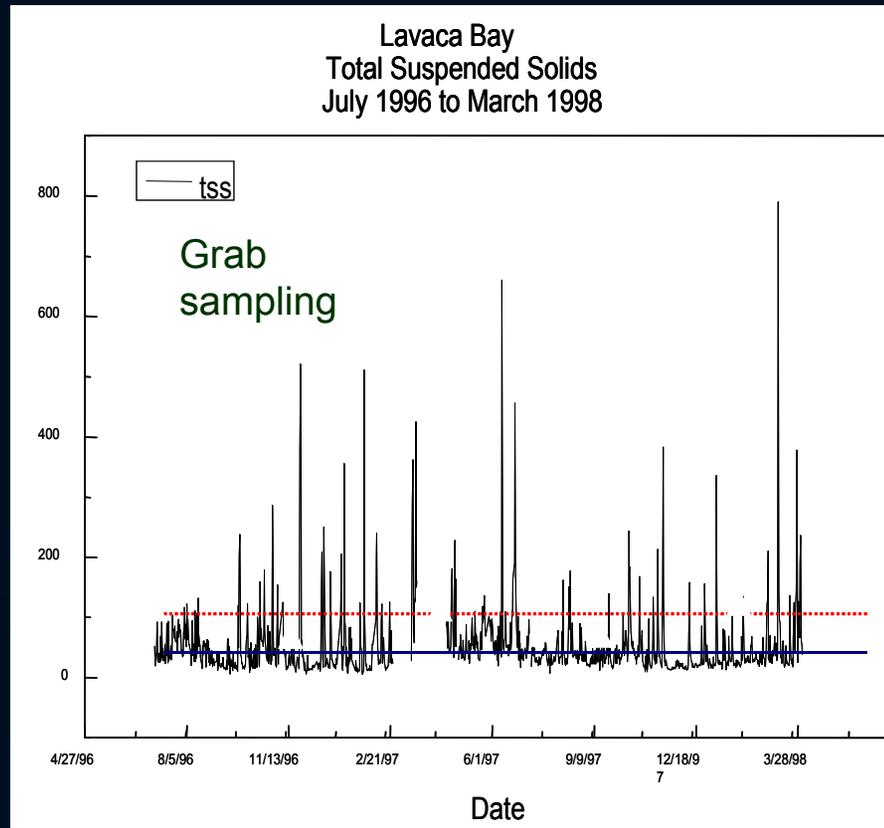


2009

2014

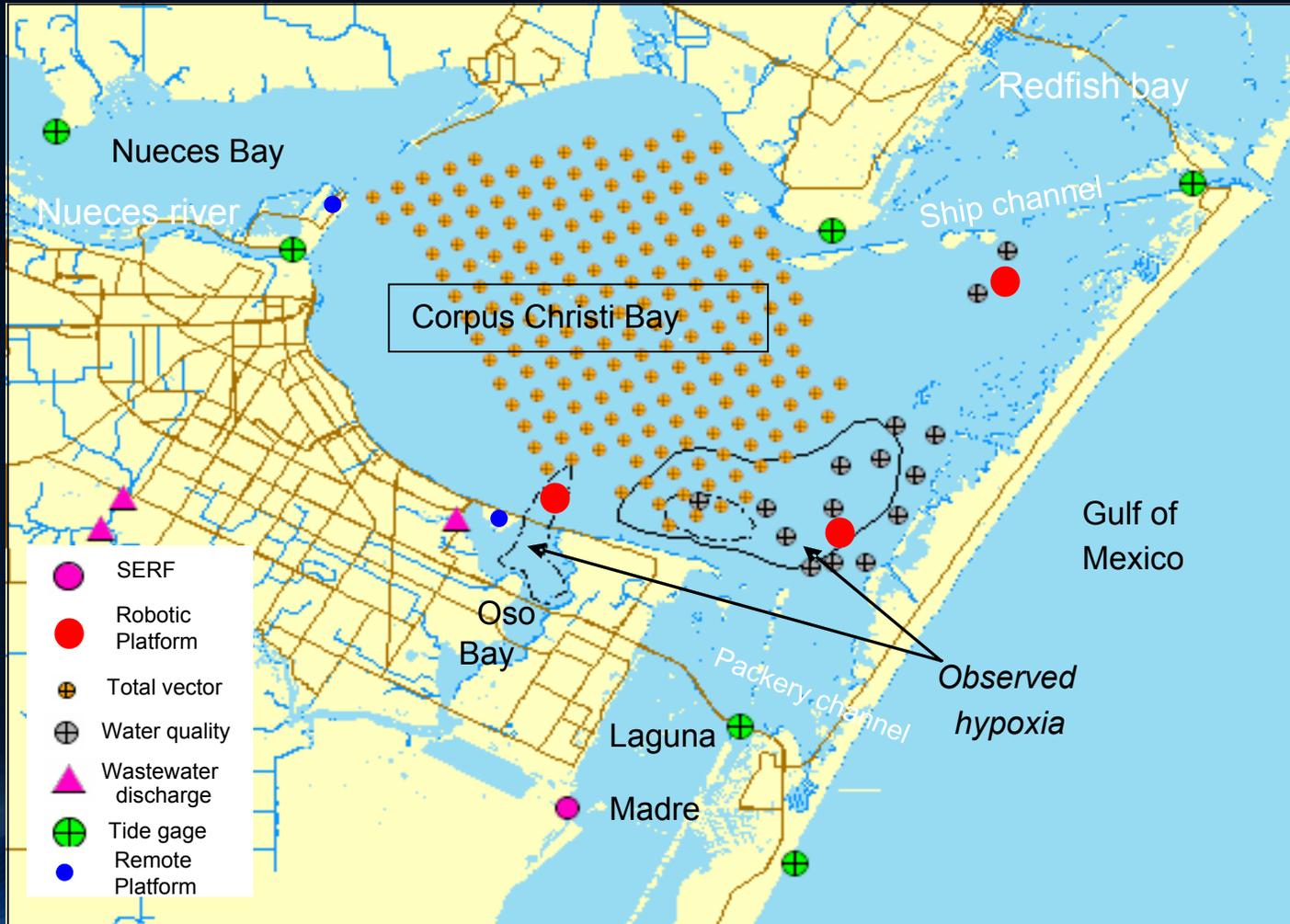


Paradigm shift in Monitoring

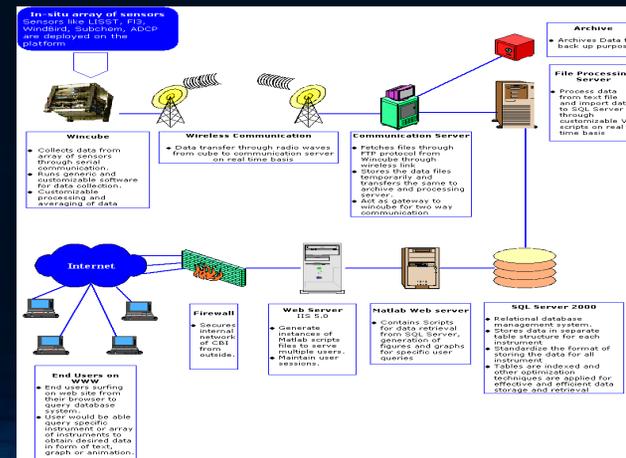
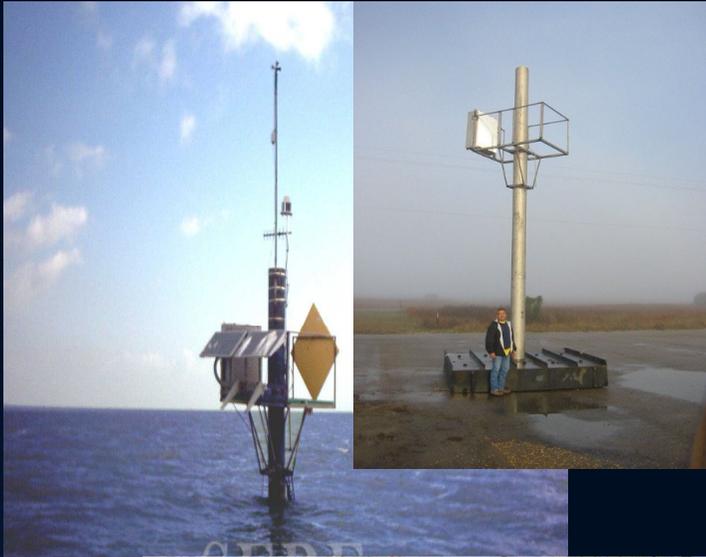


Blue line represents the mean. Red line represents 1 standard deviation

Platform Locations in CC Bay

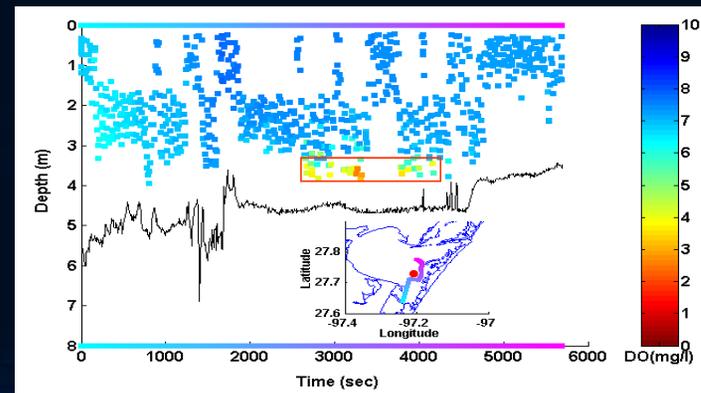
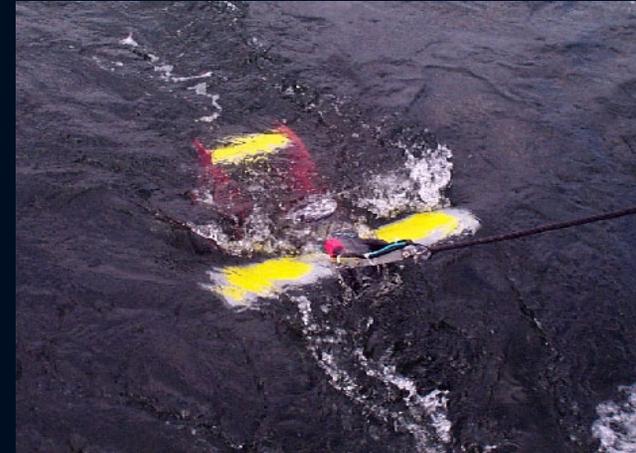
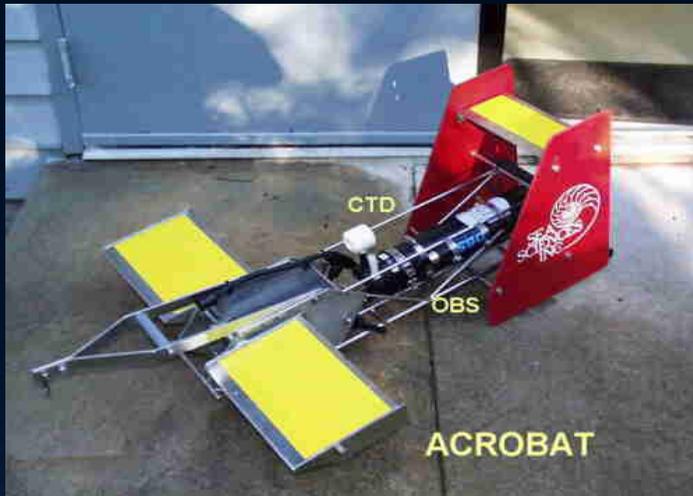


NSF Waters: Corpus Christi Bay Test Bed



Mobile Platform

- Multiple real-time instruments
- Undulating tow-body
- **Shallow-water operation**

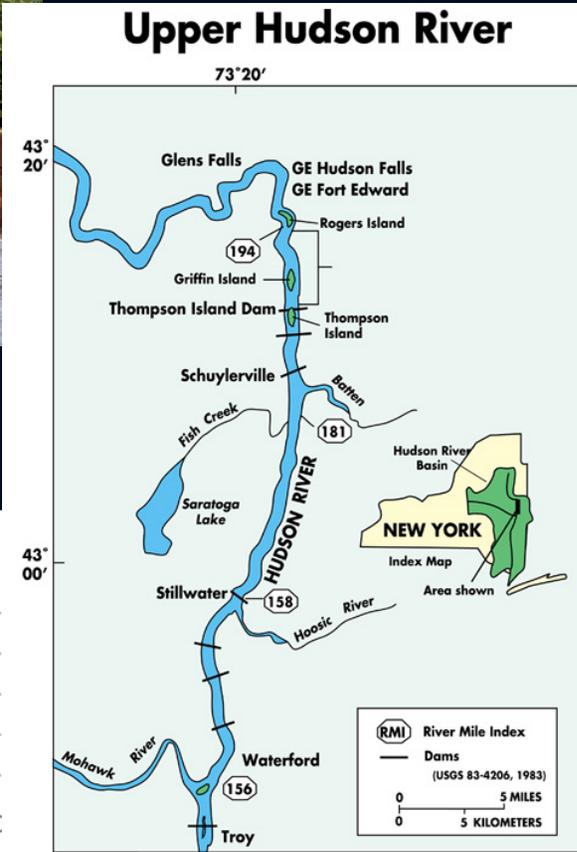
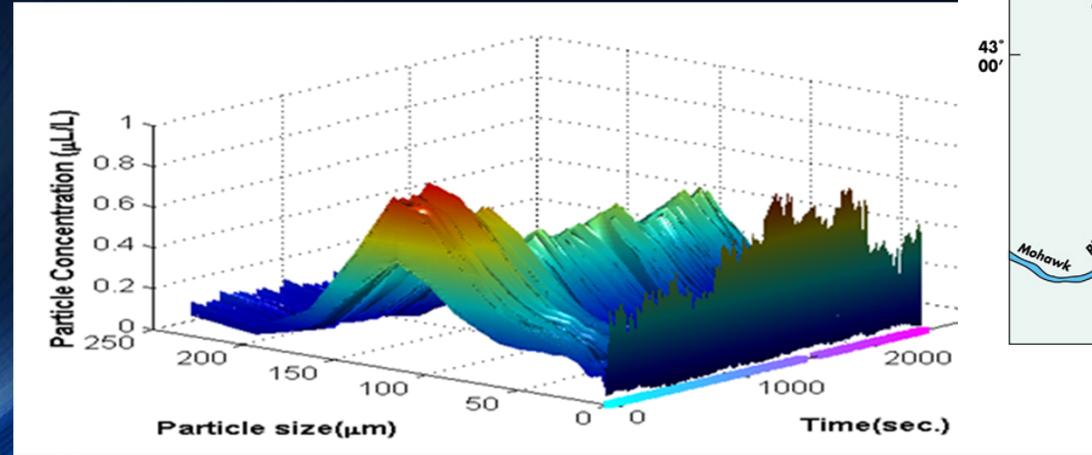


Rivers and Estuaries Observatory Network (REON)





Compliance/Enforcement, Resource Management of contaminated sediments removal at the Superfund site



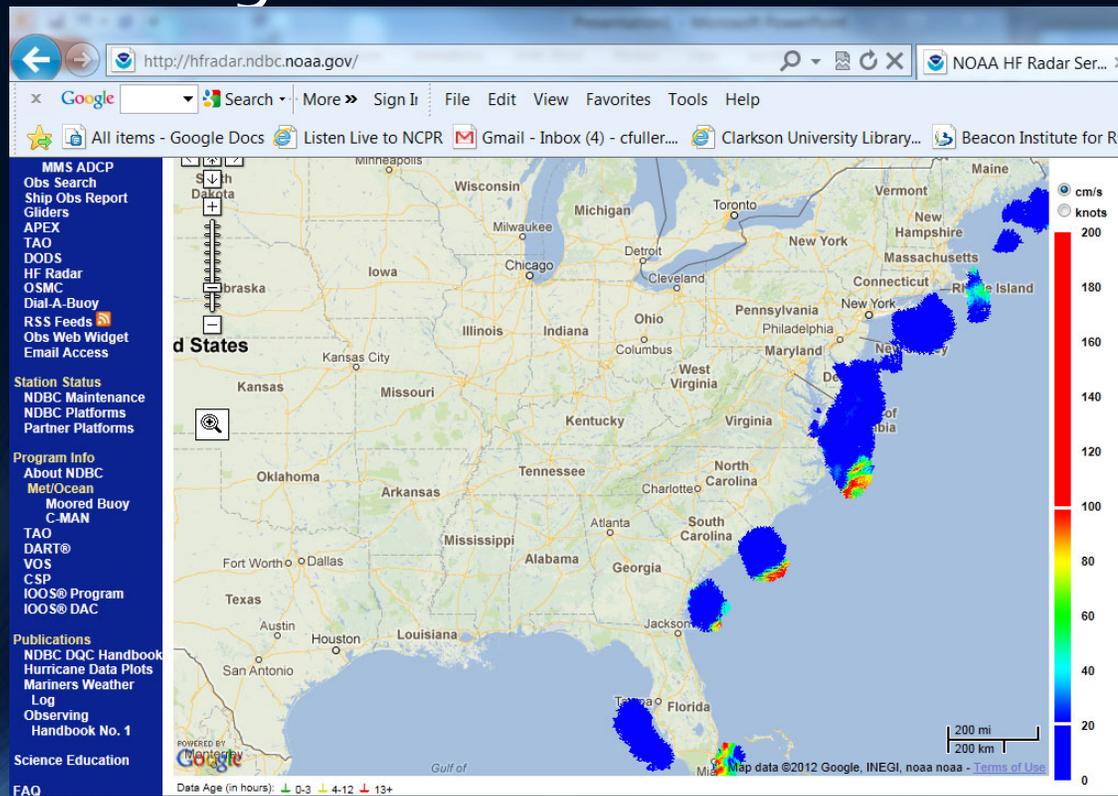
HF Radar

- Remotely measures ocean surface currents using High Frequency (HF) radio spanning 3-30 MHz
- Radio signal is propagated over electrically conductive ocean surface beyond line of light.
- Technology relies on Bragg scattering
 - Return radar signal scatters off water waves with wavelength = $\frac{1}{2}$ HF radio wave length
 - In absence of ocean currents, there is no Doppler frequency shift.
 - Actual wave speed is shifted plus or minus the surface currents, resulting in Doppler frequency shift. Allows determination of surface currents.

HF Radar Applications

- Oil Spill Response
- Navigation/Port Management
- Database for Bay Modeling
 - Hydrodynamic modeling
 - Dredge analysis
 - Storm events
 - Ecological modeling (salinity)

Atlantic and Gulf of Mexico HF Radar Coverage



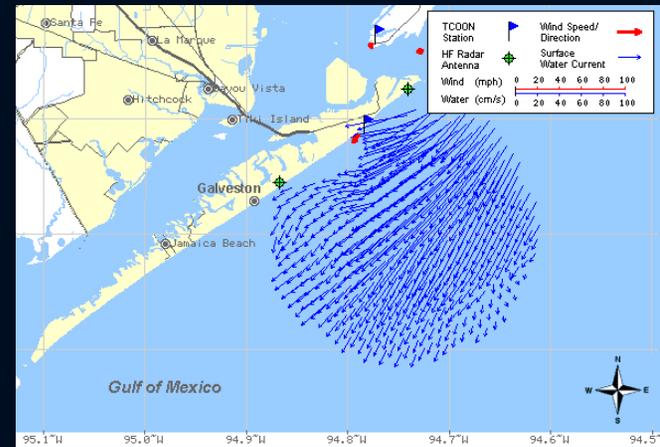
- Codar current data is provided to NOAA
- Applications include:
 - Modeling, Spill Response, Search and Rescue, Navigation Safety
- Northern and Western GoM is lacking coverage

HF Radar unit in action



RATES HF Radar Experience

- Previously operated 8 stations along the Texas Coast.
 - 2000-2009
 - ~250 miles of coast line coverage
 - ~20,000 square miles
 - 8 remote stations between Corpus Christi and Bolivar Peninsula
 - Corpus Christi Bay (25 MHz)
 - GoM 12 and 5 MHz

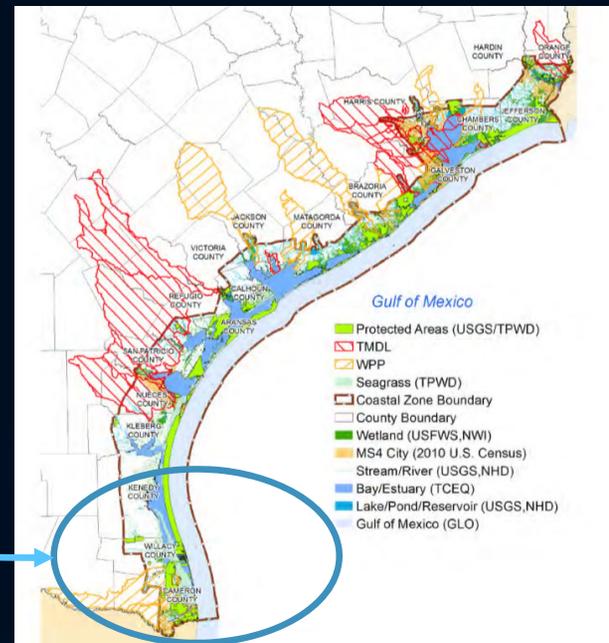
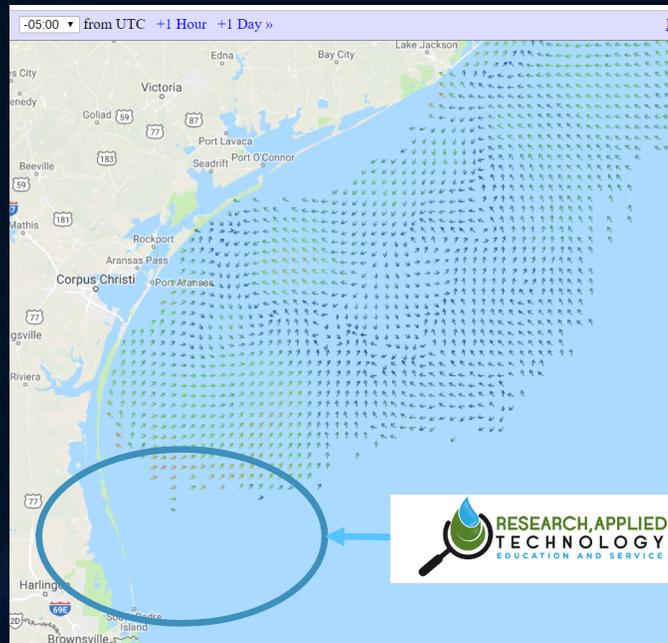


Total velocity vectors generated during mobile radar deployment used in U.S. Coast Guard Spill Exercises



Mobile Radar Unit on Galveston Seawall

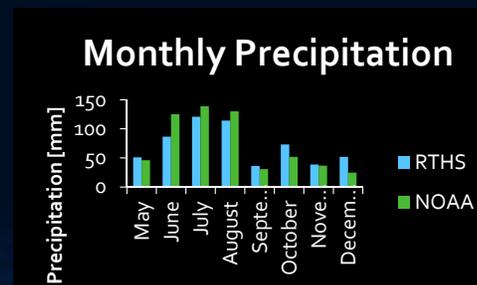
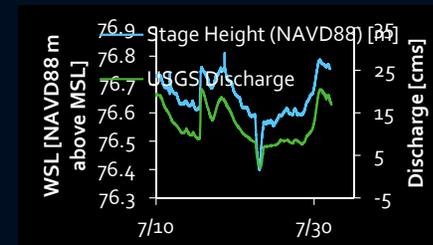
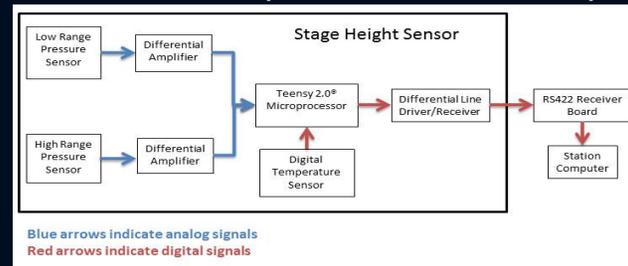
RGV-Observatory Opportunities



Reduce Capital Cost

- Sensor technology.
 - Enabling technology borne through low-cost microprocessors (Teensy)
 - Incorporated into sensor designs.
 - Stage height
 - Precipitation
 - Water quality
 - Integrated network
 - Standardized/modular designs
 - Integrated systems

Developed water quality sonde can be built for approximately \$2,000. Comparable commercially available sonde ~\$20-25K with sufficient performance to characterize parameter variability and range.



Reduce Unit Data Costs

- Application of surrogate measurements

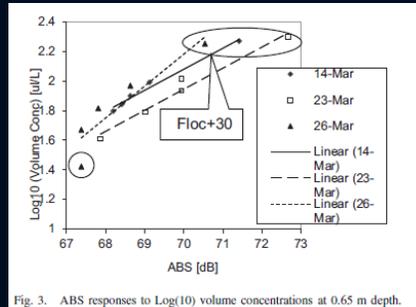
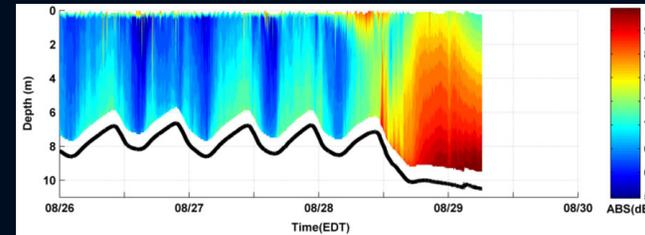
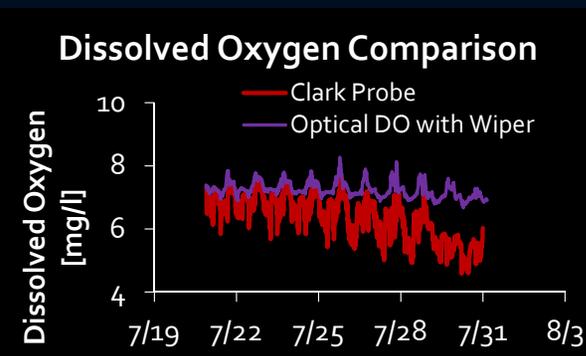


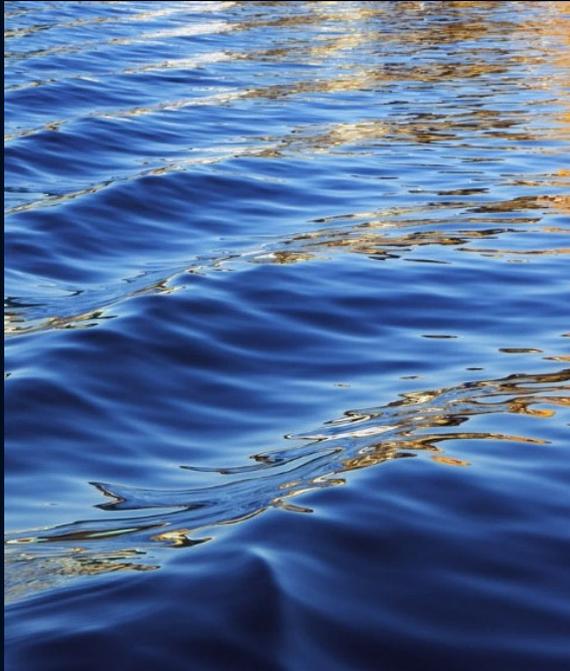
Fig. 3. ABS responses to Log(10) volume concentrations at 0.65 m depth.



- Minimize service requirements through maximizing service intervals.



- Maximize parameter counts of developed sensors and sensor nodes (pH, DO, salinity, turbidity, chlorophyll, CDOM, atmospheric conditions, water level, water temp, etc.)



Sensors

In-House Design

Stage Height/Water Temp

- Low Power
- Easily deployed and maintained
- Small size makes them easily adaptable
- Durable
- Low Cost (~\$200.00)
- Real-Time
- Large Range/High Accuracy



Stage Height/Water Temp

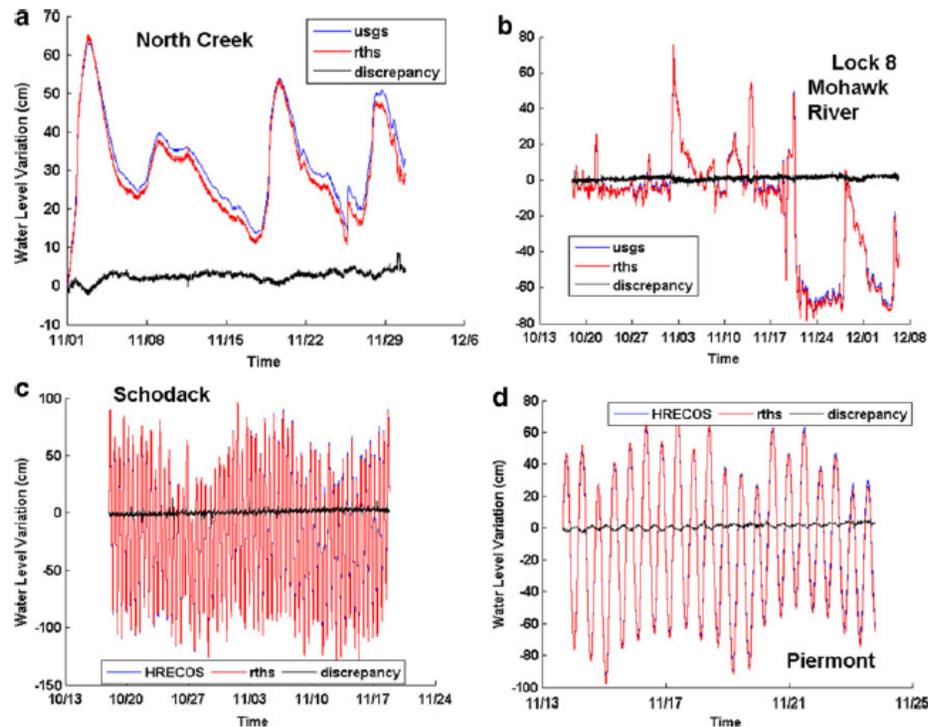


FIG. 6. RTHS and reference sensor-measured water level variation and their discrepancies at four sites: (a) North Creek, (b) Lock 8 Mohawk River, (c) Schodack Island, and (d) Piermont. Note: blue, red, and black lines represent RTHS measurements, reference sensor measurements, and their discrepancies, respectively.

Islam et al. (2016) Environmental Engineering Science, 33, DOI: 10.1089/ees.2016.0106

Water Quality Sonde

- Measured parameters
 - pH
 - Dissolved Oxygen
 - Conductivity/Salinity
 - Chlorophyll
 - Turbidity
- Low cost
- Good Field performance, comparable to YSI Multi-Parameter sonde
- Ambient light reduction
- Tested to 100 psi submersible depth



Precipitation Gauge

- Low power
- Extended duty life
- All season performance
- Results comparable to NOAA observations





RTHS

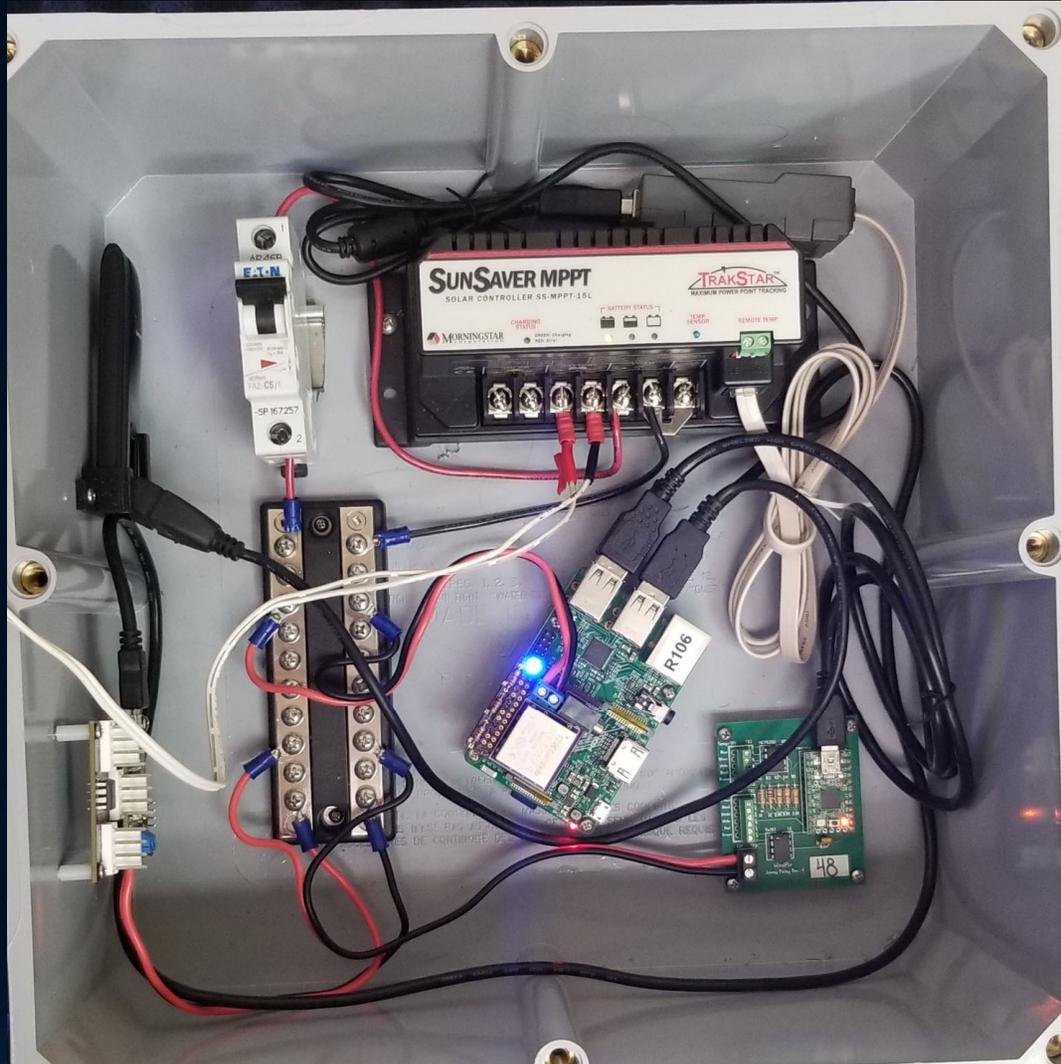
Real-Time Hydrologic Station



Real-Time Hydrologic Station (RTHS)

- COTS Meteorological Pole
 - Wind Speed/Direction
 - Relative Humidity
 - Air Temperature
 - Barometric Pressure
- Can be solar powered or grid tied
- Master control box
 - Raspberry Pi Microcomputer
 - Sensor Circuit Boards
 - Solar Controller
 - Cell Stick





Real-Time Hydrologic Station (RTHS)

- In-House designed sensors operate “plug and play” with RTHS
- Modular customization allows for use of COTS sensors
- Stage height, precipitation and sonde all tie back to base station with buried conduit and cable



Real-Time Hydrologic Station (RTHS)

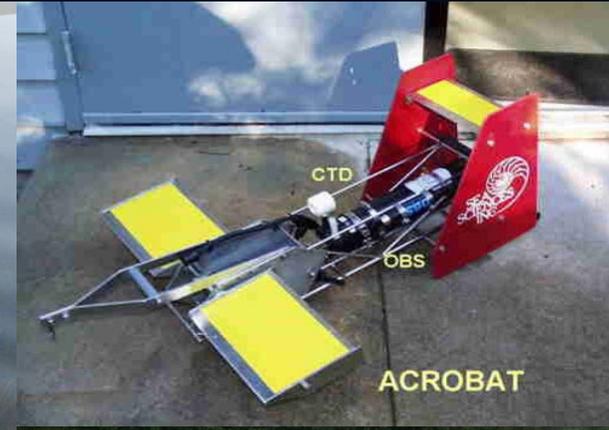


- Customizable sensor mounts all for installation in many different environments or conditions



Instruments

- Ecomapper AUV
- Acoustic Doppler Current Profiler
- Acrobat Undulating Towbody
- StreamPro Shallow Water ADCP
- YSI Handheld Multi-Parameter Sondes
- YSI EXO Series Sondes
- Robotic Platforms
- Oxygen Optodes
- Fluorometers
- Conductivity/Temp/Depth
- pH/Redox
- Flow Probes
- Optical Backscatter Sensors





REON

River & Estuary Observatory Network

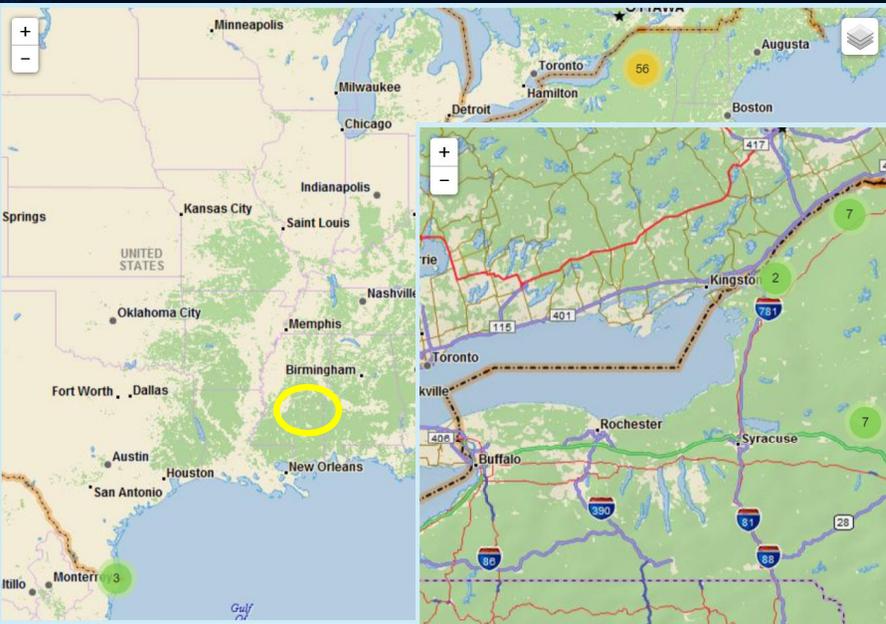


River & Estuary Observatory Network (REON)

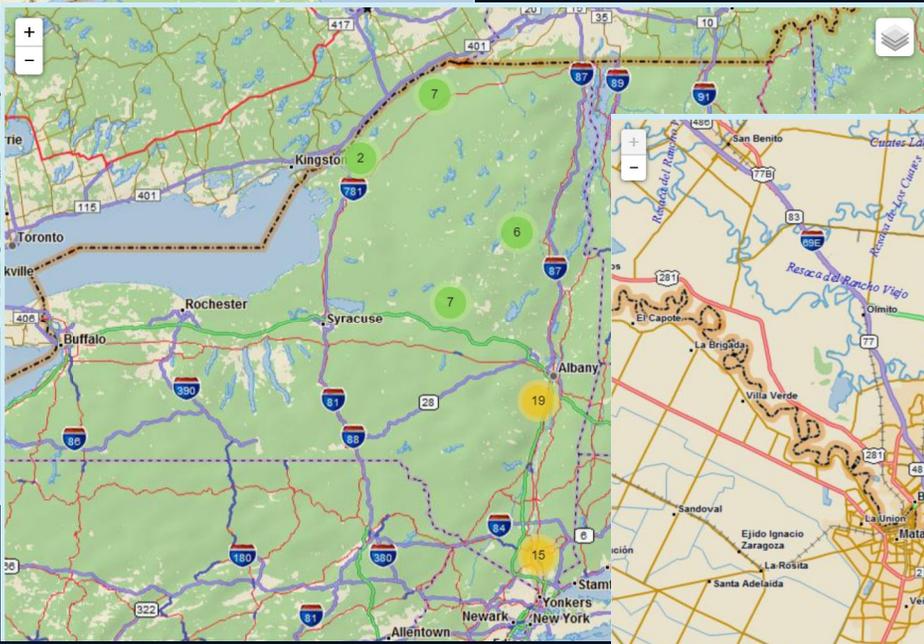
- Series of ~60 land-based sensor nodes coupled with deployable floating profiling platforms
 - Address “paradigm shift” in term of monitoring needs
 - Make sensor systems more cost effective
 - Develop and implement an effective cyber infrastructure
 - Field test to validate and improve



National (59...And Counting)



New York (56+10)



South Texas (3+?)



Alabama



The Growing REON Network

REON-RGV: An Affordable Real-Time Sensor Network for Regional Water Resource Management in Lower-RGV



- Proposed commissioning of 15-RTHS at strategic locations
 - Promote inter-jurisdictional engagement and collaborative decision making
 - 3-demonstration deployments were commissioned Fall 2019 to support LLMEP-Phase 1
 - Stream gauging for discharge rating curves by SWTF



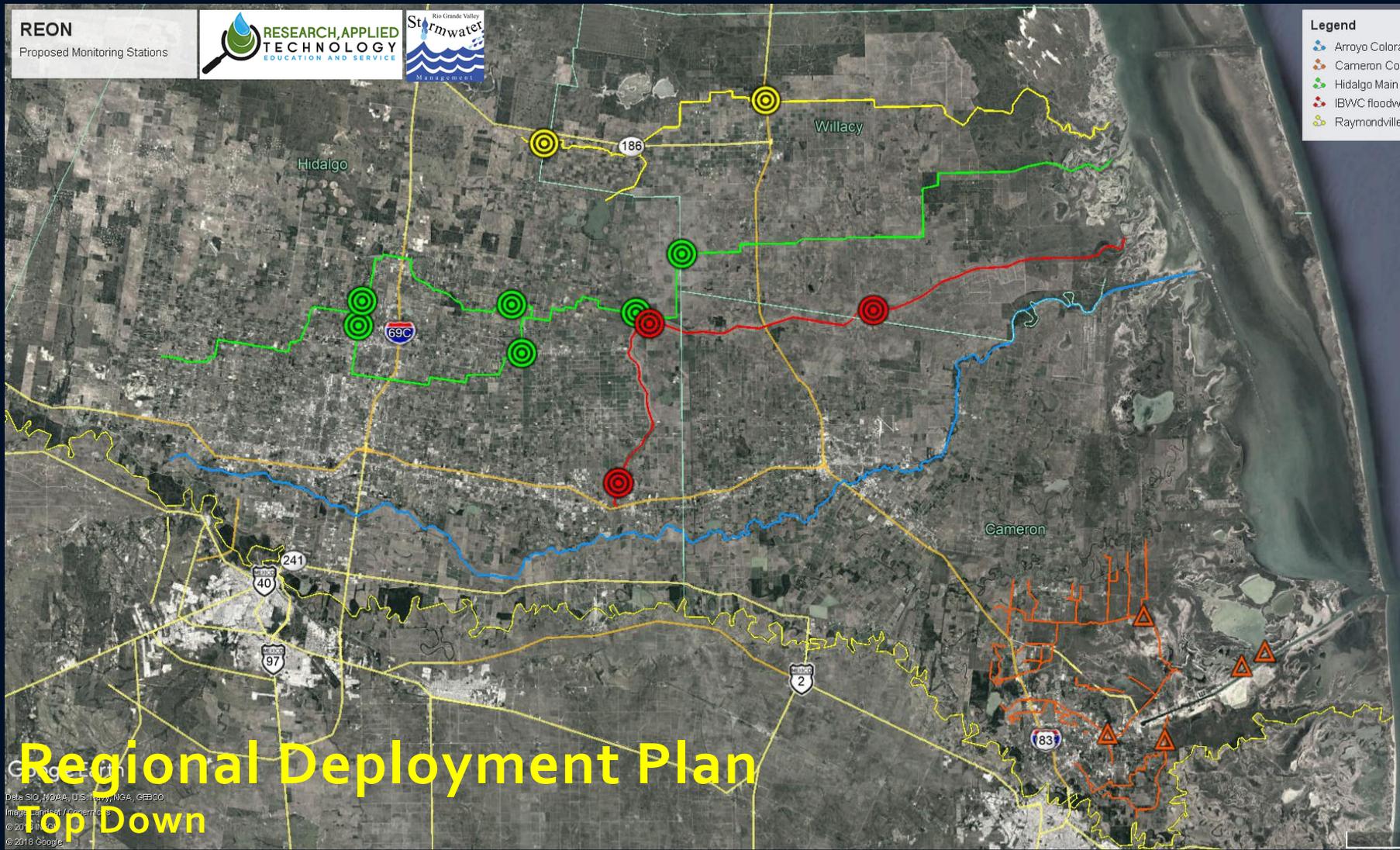
Andrew Ernest, Ph.D., P.E., BCEE, D.WRE | RATES/RGV

September 17, 2019

REON
Proposed Monitoring Stations



- Legend**
- Arroyo Colorado
 - Cameron Co. Drainage Dct. 1
 - Hidalgo Main Drain
 - IBWC floodway
 - Raymondville Drain

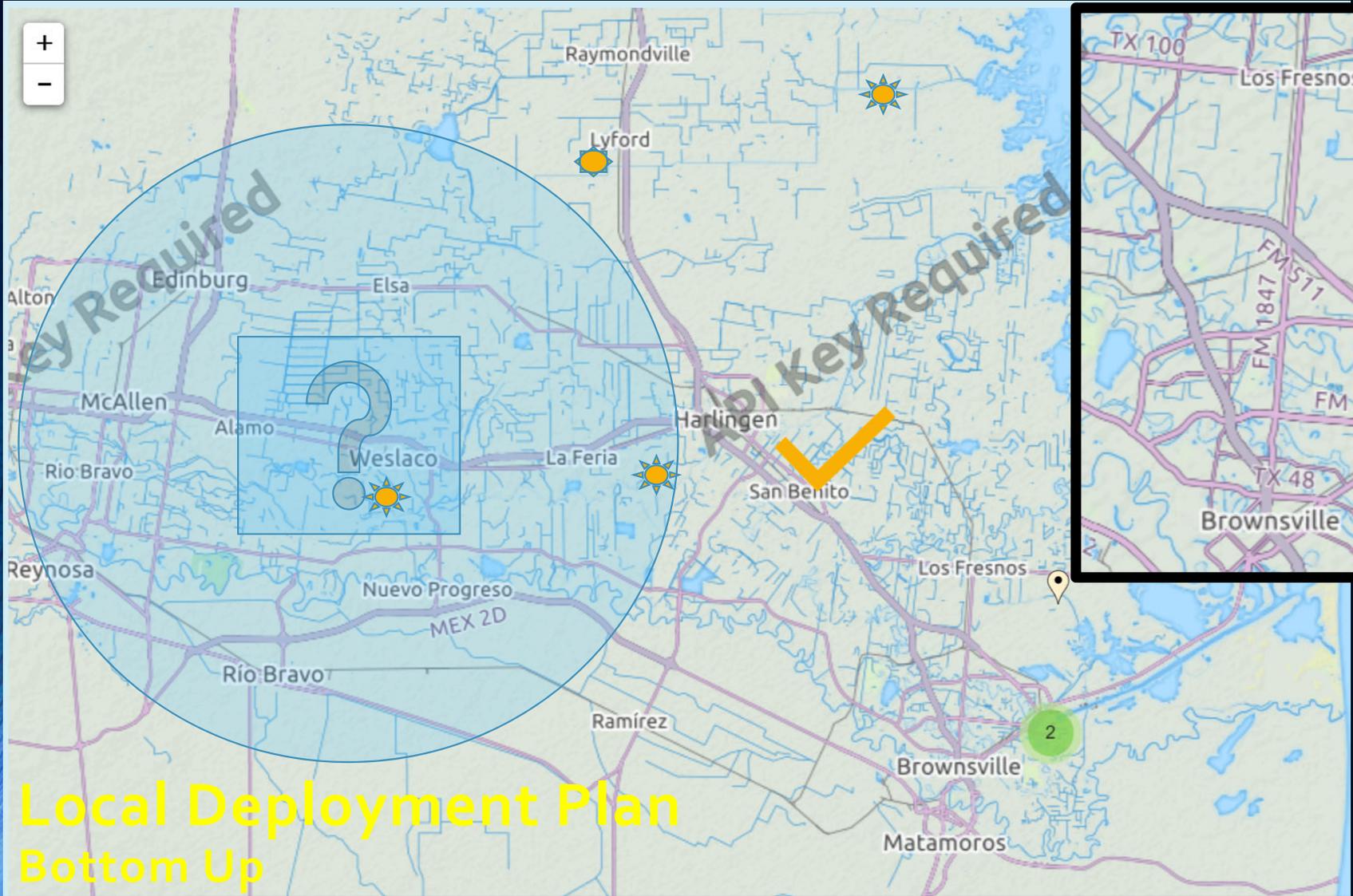


Regional Deployment Plan

Top Down

Google Earth
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image copyright / Contributor(s)
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Local Deployment Plan
Bottom Up

