NOAA WATER LEVEL PROGRAM UPDATE

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IHO TWCWG2

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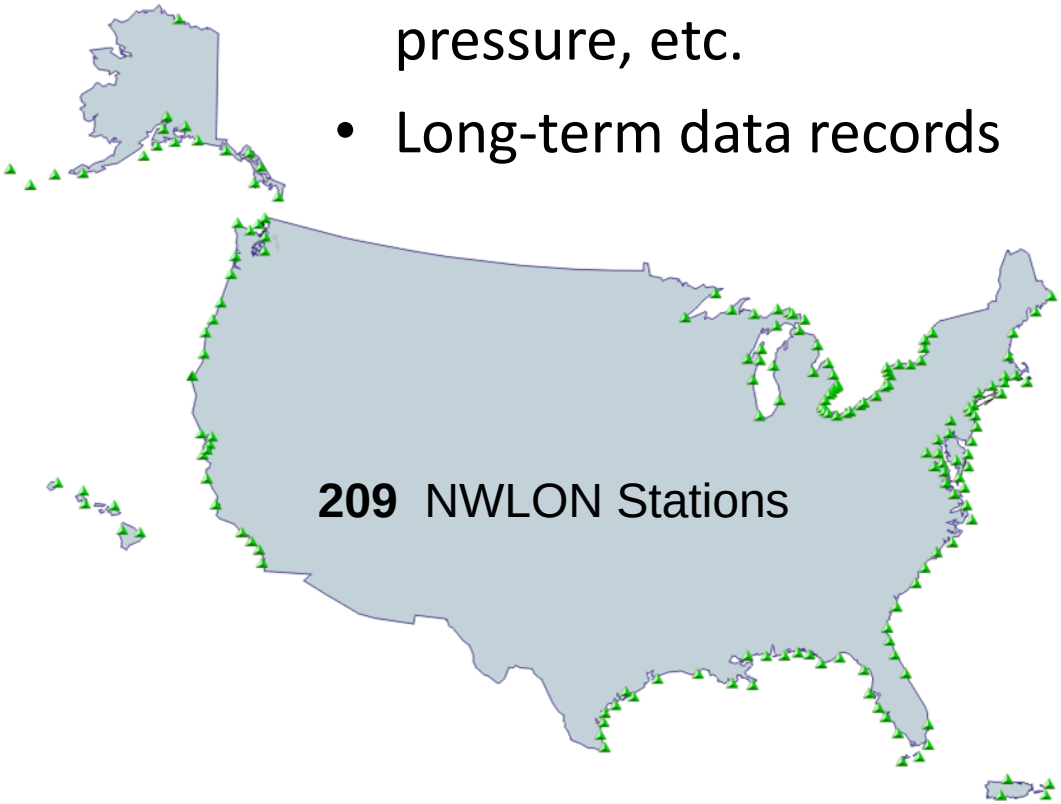
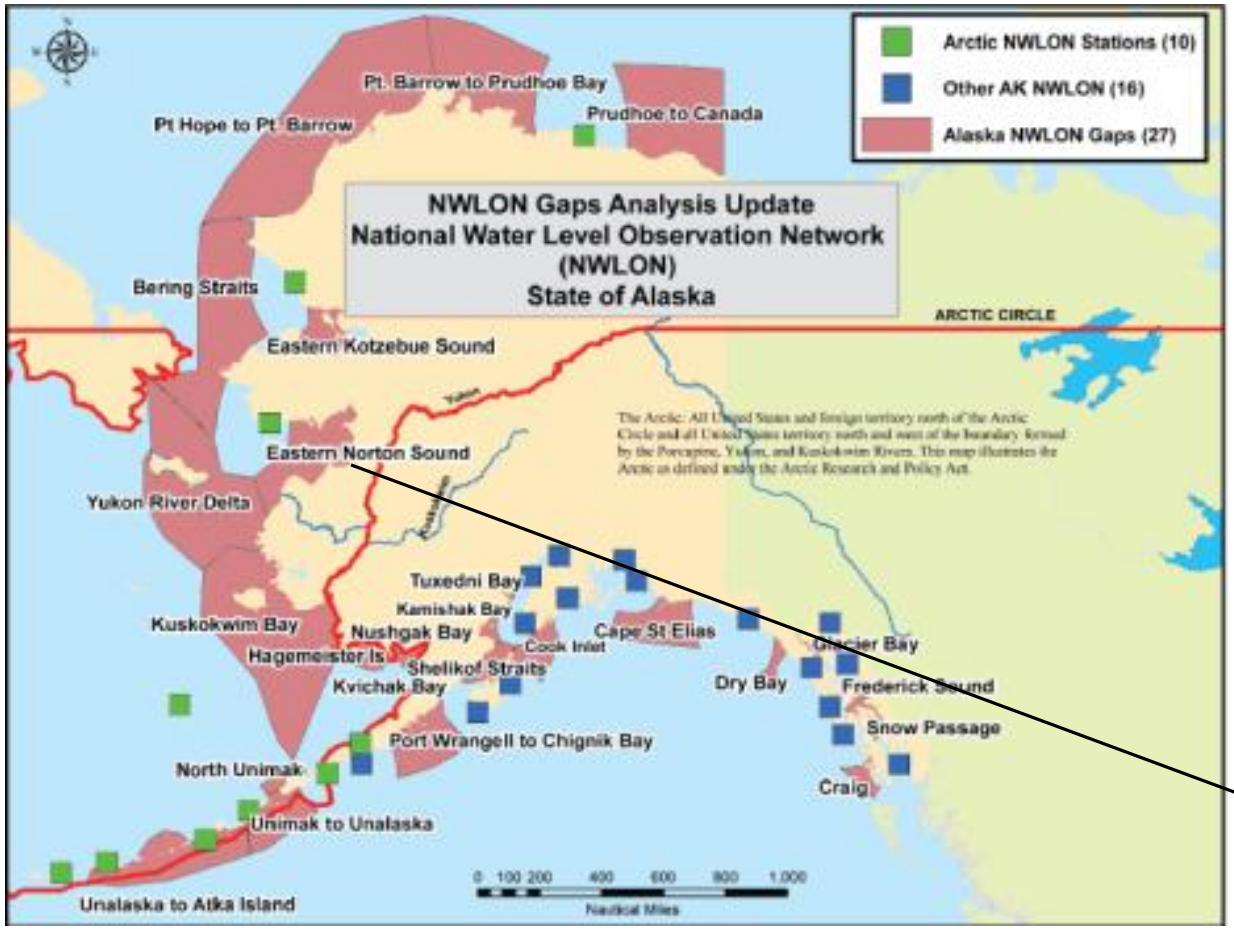
Water Level Observations

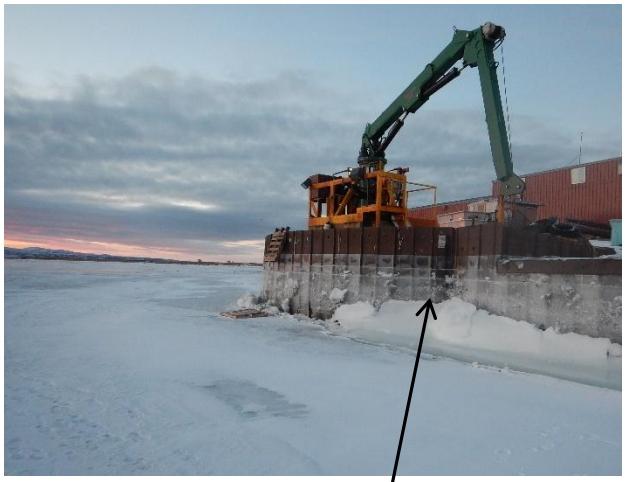
National Water Level Observation Network (NWLON)

- Collect real-time water level, air and water temperature, wind speed/direction, barometric pressure, etc.
- Long-term data records



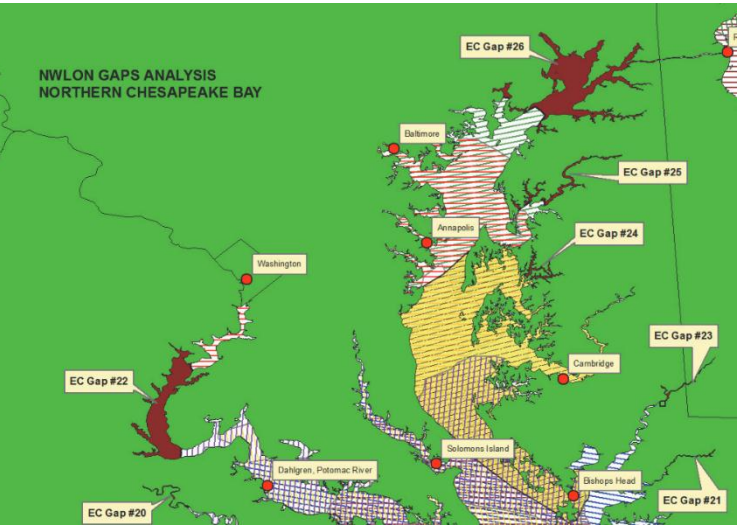
New NWLON Station in the Arctic





CO-OPS partnered with NWS in AK to install a water level gauge in Unalakleet – a key NWLON gap.

New NWLON Station – Dahlgren, Virginia

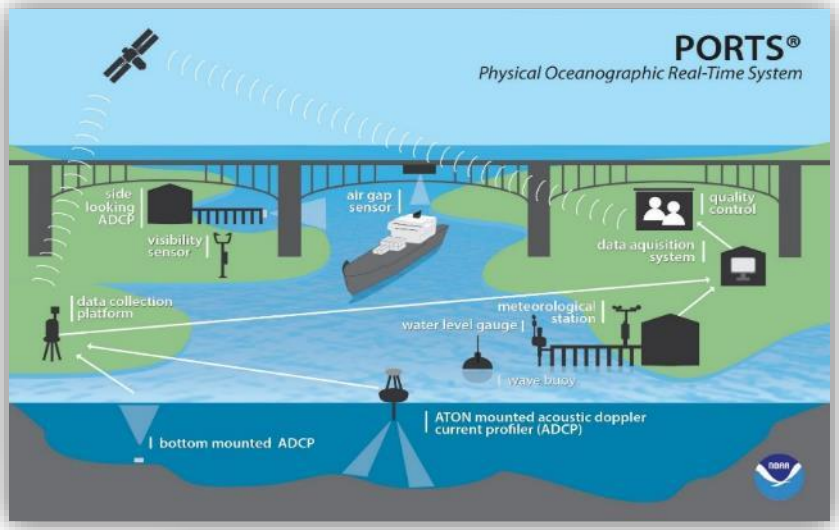


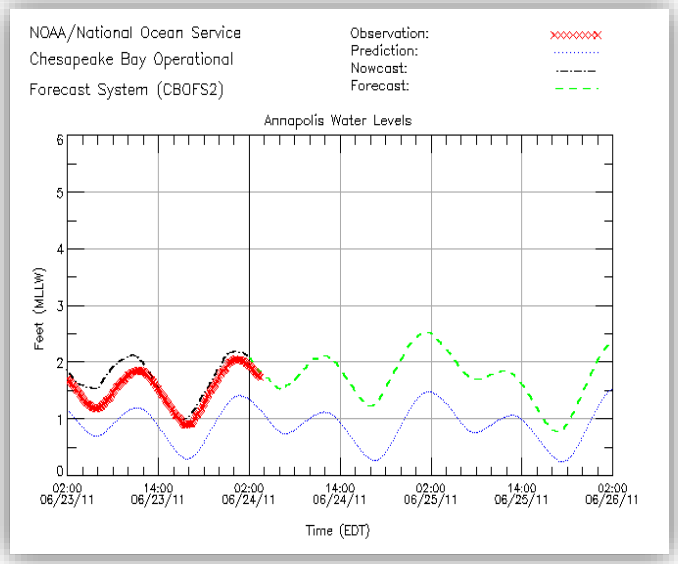
Installed in 2015 to replace station destroyed by hurricane

Fills NWLON in Potomac River due to Tidal nonlinearity

PORTS

Physical Oceanographic Real Time System





MWWL Transition at NWLON Stations

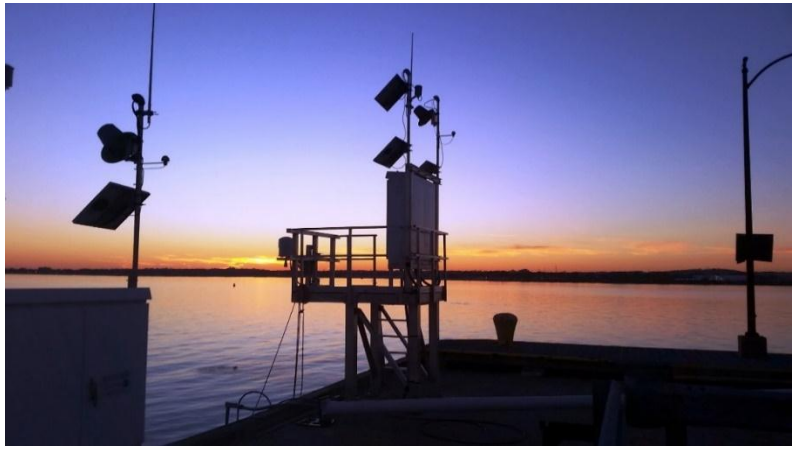
Since 2011…

- ***Installed*** MWWL at…
  - **42** NWLON Stations
  - **25** PORTS & Partner Stations
- ***Fully Transitioned*** at…
  - **14** NWLON Stations
  - **20** PORTS & Partner Stations

For 2017…

- 11 NWLON Stations to be installed
- 14 stations reconned

Waterlog H-3612 Radar Water Level Sensor



Recent MWWL Installations…

Toke Point, WA

Springmaid Pier (Myrtle Beach, SC)

Recent MWWL Installations…

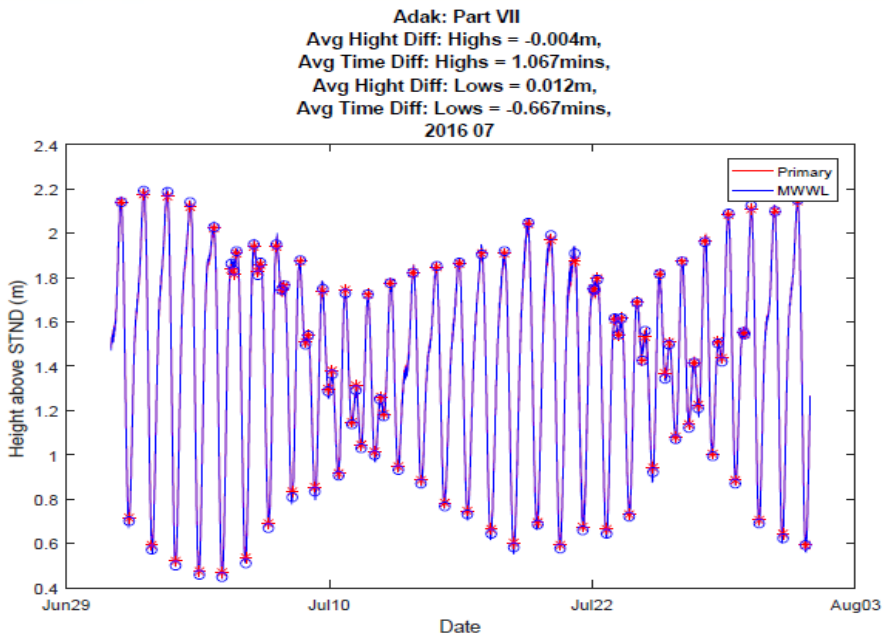
Duck, North Carolina

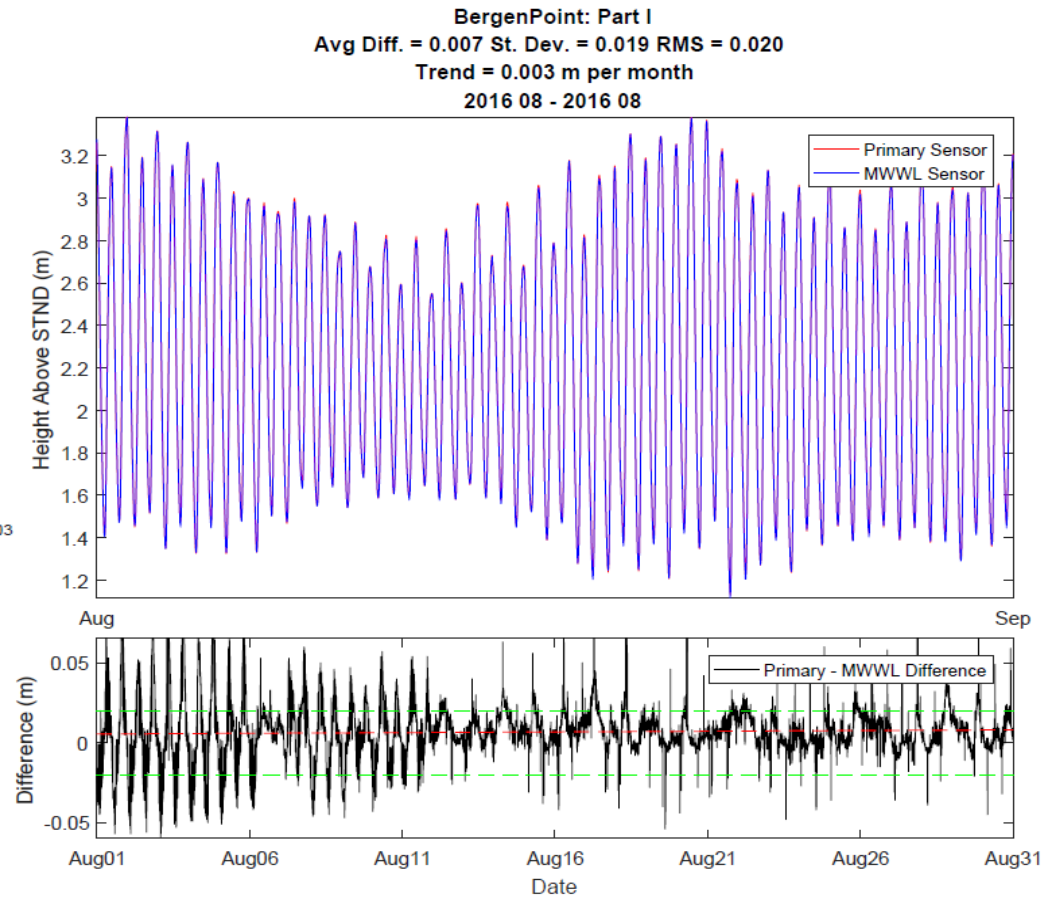
Trident Pier, Florida

Transition Process after installation of Sensor

- 1 year (minimum) comparison between MWWL and Acoustic sensor
- Mean Differences should not exceed 2cm
- Full review of:
  - Documentation
  - Leveling/Vertical Stability
  - Sensor Offsets
  - Tidal Datums between sensors

MATLAB & Traditional Analysis





Intercomparison Analysis

	8722670 Lake Worth		8518750 The Battery		8519483 Bergen Point		8467150 Bridgeport		9755371 San Juan		9751401 Lime Tree Bay		8443970 Boston		
	difference	stdev	difference	stdev	difference	stdev	difference	stdev	difference	stdev	difference	stdev	difference	stdev	
October-14			0.030	0.021											October-14
November-14			0.031	0.021											November-14
December-14			0.028	0.022											December-14
January-15			0.028	0.022											January-15
February-15			0.024	0.022											February-15
March-15			0.027	0.022											March-15
April-15			0.027	0.022											April-15
May-15			0.032	0.022											May-15
June-15			0.034	0.021											June-15
July-15	*back july 27*		0.038		-0.015	0.008									July-15
August-15	0.034	0.011	0.038	0.021	-0.018	0.009									August-15
September-15	0.035	0.012	0.038	0.020	0.009	0.008	0.008	0.009							September-15
October-15	0.029	0.017			0.008	0.010	0.006	0.004							October-15
November-15	0.021	0.022			0.002	0.009	0.004	0.005							November-15
December-15	0.031	0.016	0.020	0.022	0.000	0.009	0.000	0.006							December-15
January-16	0.037	0.014	0.020	0.022	0.001	0.011	-0.002	0.006							January-16
February-16	0.038	0.015	0.015	0.022	-0.002	0.010	-0.004	0.008							February-16
March-16	0.038	0.014	0.017	0.022	-0.001	0.018	-0.001	0.008	0.012	0.006					March-16
April-16	0.038	0.013	0.018	0.022	-0.002	0.029	-0.002	0.006	0.011	0.006	0.012	0.005			April-16
May-16	0.039	0.012	0.017	0.022	0.001	0.032	-0.001	0.006	0.012	0.005	0.014	0.005			May-16
June-16	0.038	0.011	0.017	0.022	0.006	0.034	0.006	0.007	0.011	0.005	0.014	0.004			June-16
July-16	0.041	0.011	0.020	0.022	0.007	0.027	0.008	0.006	0.011	0.005	0.012	0.004			July-16
August-16	0.042	0.013	0.022	0.022	0.007	0.019	0.011	0.006	0.011	0.006	0.012	0.004			August-16
September-16	0.039	0.012	0.021	0.021	0.006	0.020	0.011	0.006	0.011	0.007	0.011	0.005	0.016	0.012	September-16
October-16	0.025	0.019	0.021	0.021	Completed		0.006	0.005	0.010	0.006	0.014	0.005	0.007	0.012	October-16
November-16	0.038	0.014	0.019	0.022			0.002	0.006	0.008	0.006	0.013	0.004	-0.003	0.009	November-16
December-16	0.039	0.013	0.020	0.022			Completed						-0.008	0.009	
	CHRIS		BOB		CHRIS/BOB		ASHLEY		KAT		SURAFEL		ASHLEY		

*This highlighed color indicates a period of bracketed levels

Tracking average height differences and standard deviations month to month

Station Transition Approvals

CO-OPS MICROWAVE WATER LEVEL TRANSITION TO OPERATIONS ACCEPTANCE CHECKLIST AND GUIDELINES FOR DATA COMPARISON

Station ID: **9461380** Station Name: **Adak Island, AK**

Data Comparison Period: **Jul 15, 2015 - Sep 19, 2016**

Checklist Section	CO-OPS Team Lead Sig. & Date
1. Configuration Documentation	JOHNSON.ARTARA.C.1383928628 (COET)
2. Data Comparison Analysis	CULP.JANET.F.1365824157 (DPT)
3. Bracketing Levels	MEYER.ROLIN.SHAWN.1280867698 (FOD TL)
4. Sensor Offset Checks	JOHNSON.ARTARA.C.1383928628 (COET)
5. Vertical Stability Confirmation o Benchmark Stability Checks o Datum of Tabulation Checks	JOHNSON.ARTARA.C.1383928628 (COET)
6. Datum Recovery	MICHALSKI.MICHAEL.PAUL.1280465174 (DT)

7. Transition Review and Approval

Reviewed By: SAMANT.MANOJ.R.1365854420 Date: December 22, 2016
(Engineering & Development Branch Chief)

Reviewed By: HOVIS.GERALD.THOMAS.JR.1365860250 Date:
(Products & Services Branch Chief)

Reviewed By: MEYER.ROLIN.SHAWN.1280867698 Date:
(Applicable FOD Branch Chief)

Signatures below indicate approval to:

- Connect MWWL to DCP1 (if applicable)
- Switch primary sensor dissemination to MWWL
- Cease processing of former primary water level data
- Remove comparison period DCP, former primary sensor and mounting

Approved By: DUSEK.GREGORY.PAUL.1242862402 Date:
(CO-OPS Chief Scientist)

Approved By: BOSLEY.KATHRYN.THOMPSON.DR.1365827539 Date:
(MWWL TOP Steering Committee Chair)

Short Term Infrastructure Free Water Level Measurement Requirements

Deployment duration: real-time data telemetry for 90 days, internal recording for 12-18 months.

Operating depth: 5-40 m

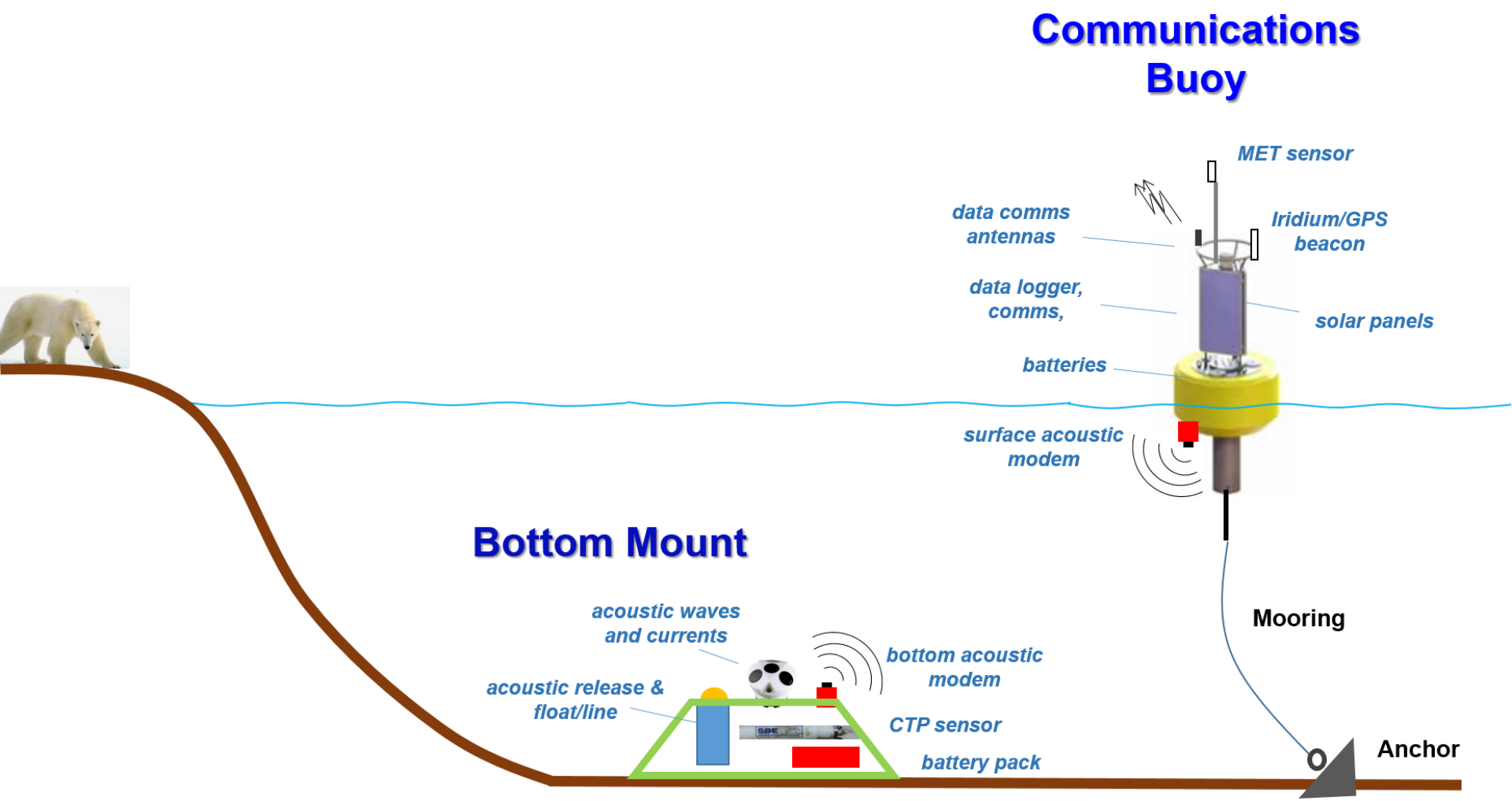
Parameters and sampling/recording rates

- bottom conductivity, temperature, pressure - 6 min (10/hr).
- vertical current profile – 30 min (2/hr).
- waves - 30 min (1/hr).
- wind, air temperature, baro pressure - 6 min (10/hr)

Non Real Time or
Real-time data telemetry every 6 minutes

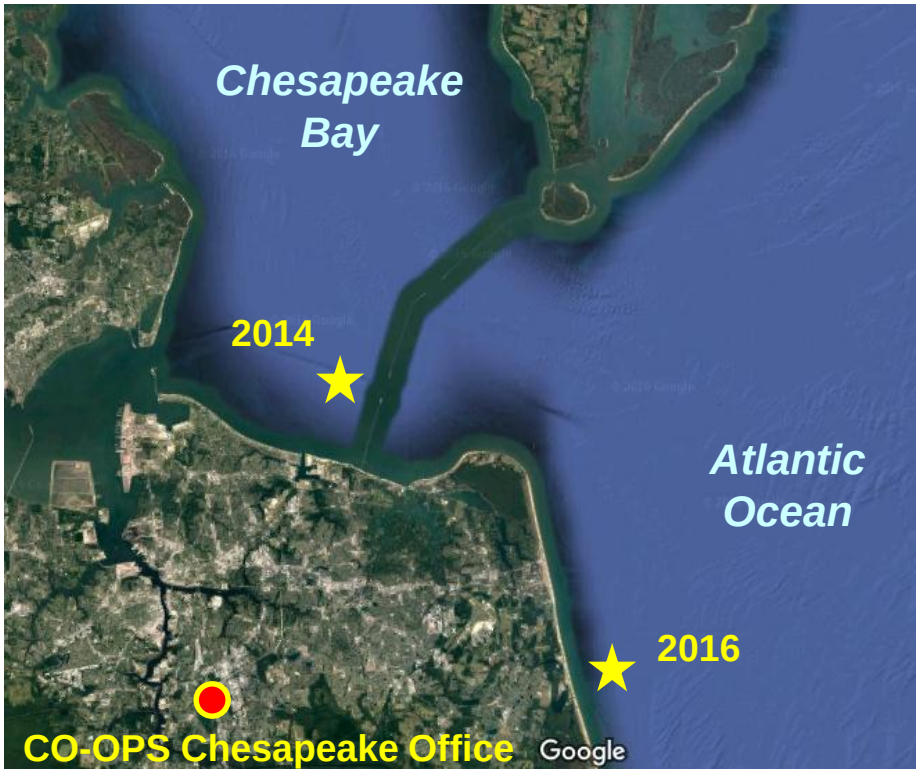
Pressure readings must be vertically references to land based benchmark network and/or geoid model (NAVD88)

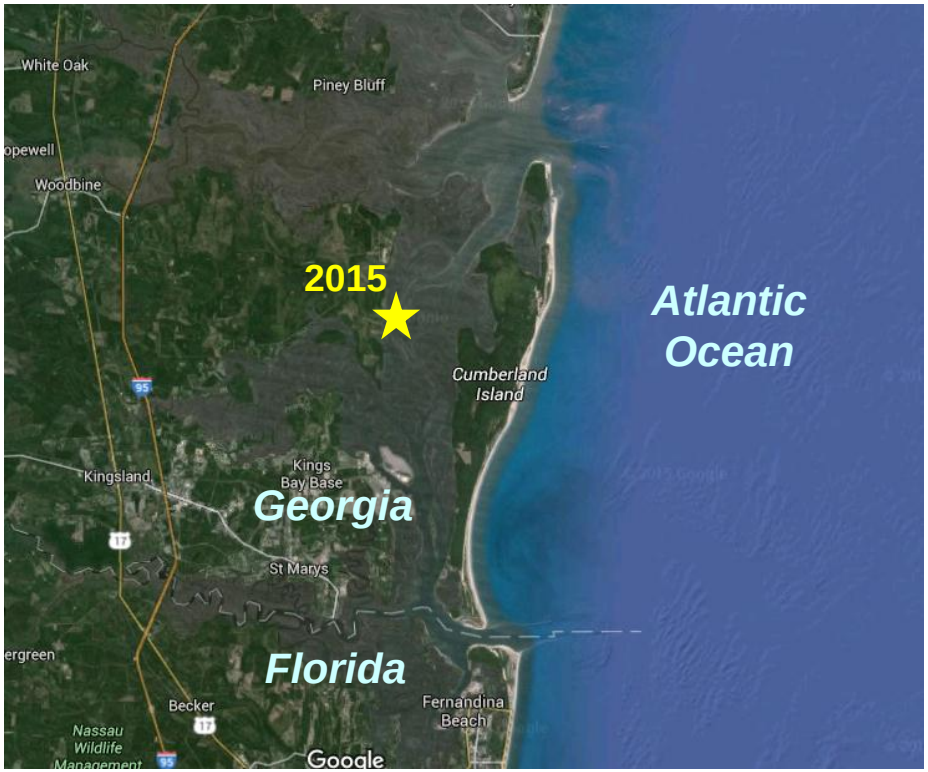
HERMIT - Real-Time System Design



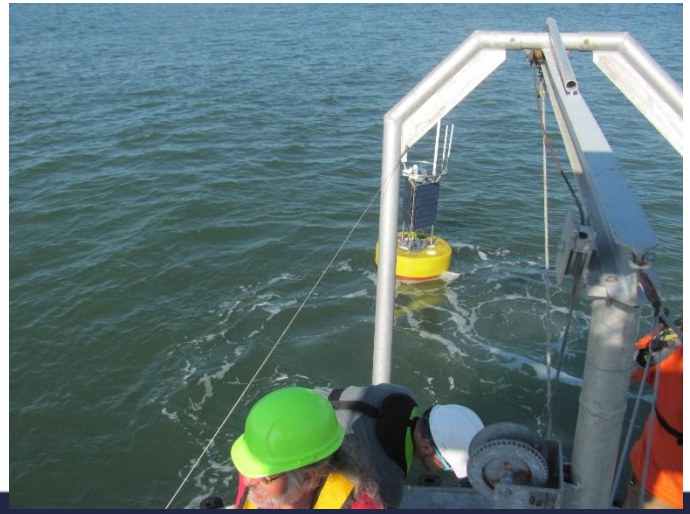
Recent Field Testing

- **Sep – Dec 2014**, South Chesapeake Bay, Virginia
- **Sep – Dec 2015,** St. Andrews Sound, Georgia
- **Sep – Oct 2016**, Virginia Beach, VA, Oceanfront

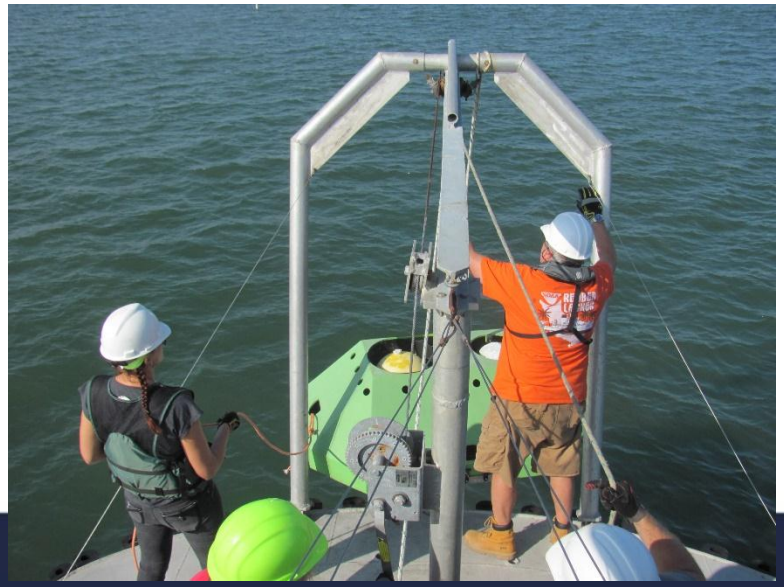




Recent Field Testing – Surface Buoy



Recent Field Testing – Bottom Platform



Defining NWLON Requirements

Purpose: To Define and Document the minimum requirements for NWLON

Why: CO-OPS operates many different types of water level stations to meet multiple applications. Some applications do not need highest level of accuracy.

All stations were being labeled as NWLON when only the long term permanent stations should be considered as NWLON

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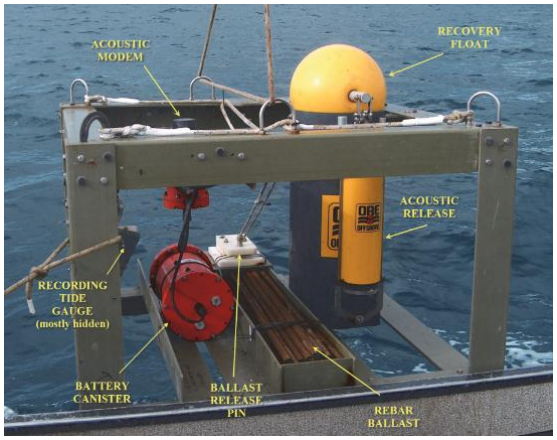


NWLON Requirements – Approach

Differentiate between Requirements and Standards

Define Accuracy and Uncertainty

- Vertical Position Error: Sensor (1.2cm)
- Vertical Position Error: Reference System (0.9cm)
- Measurement Error (0.9cm)
- Data Processing Error (1.0cm)

Station and Data Continuity – Stations must operate for a minimum of 19 years for Tidal Datum control. Station design must minimize data loss during extreme events

Data Collection, Transmission and Access

- Near real time data transmission and quality control
- Internally data storage as backup

NWLON Requirements – Approach

Documentation

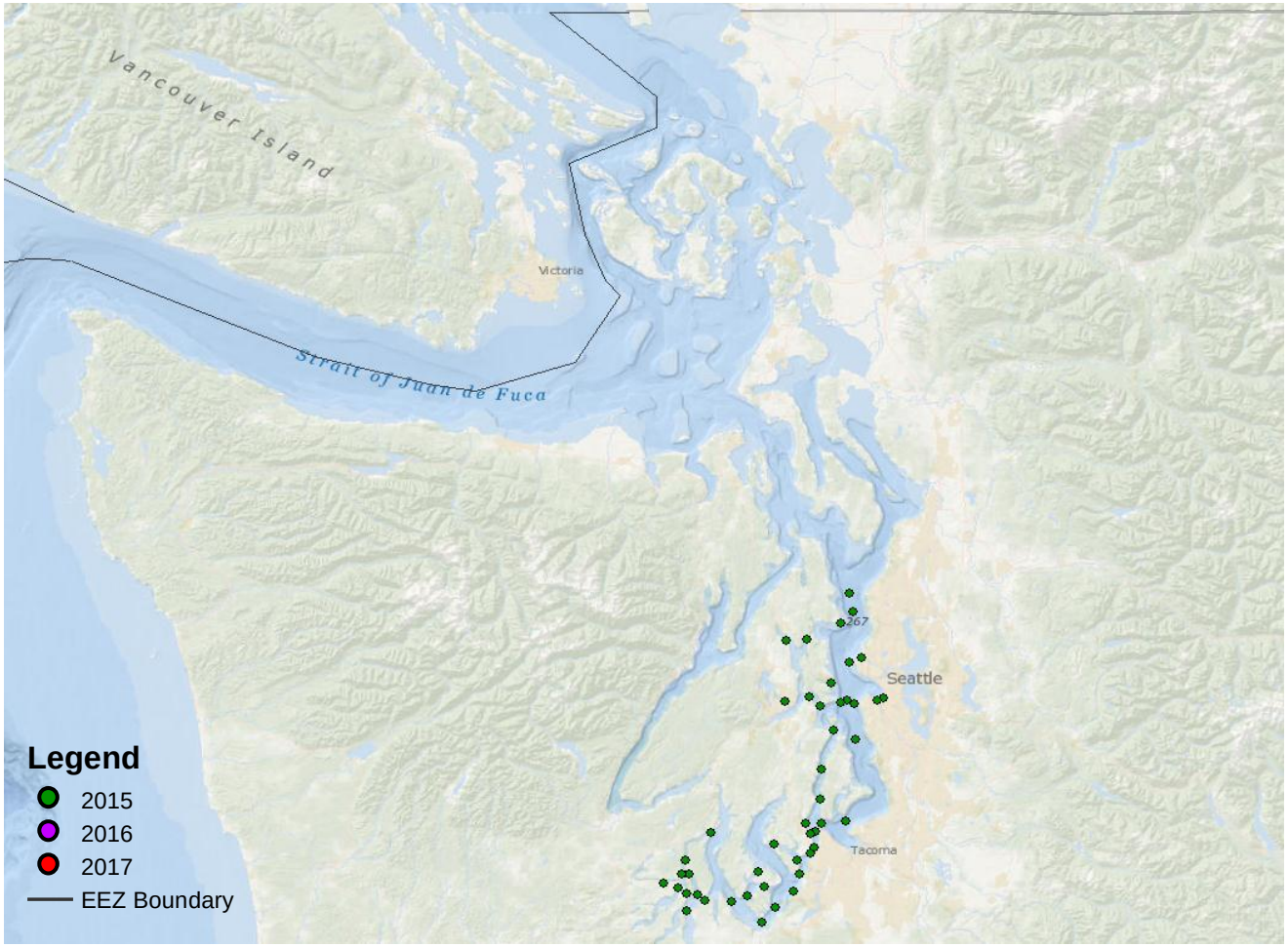
- System Metadata
- Standard Operating Procedures
- Standard Data Analysis Procedures

Survivability

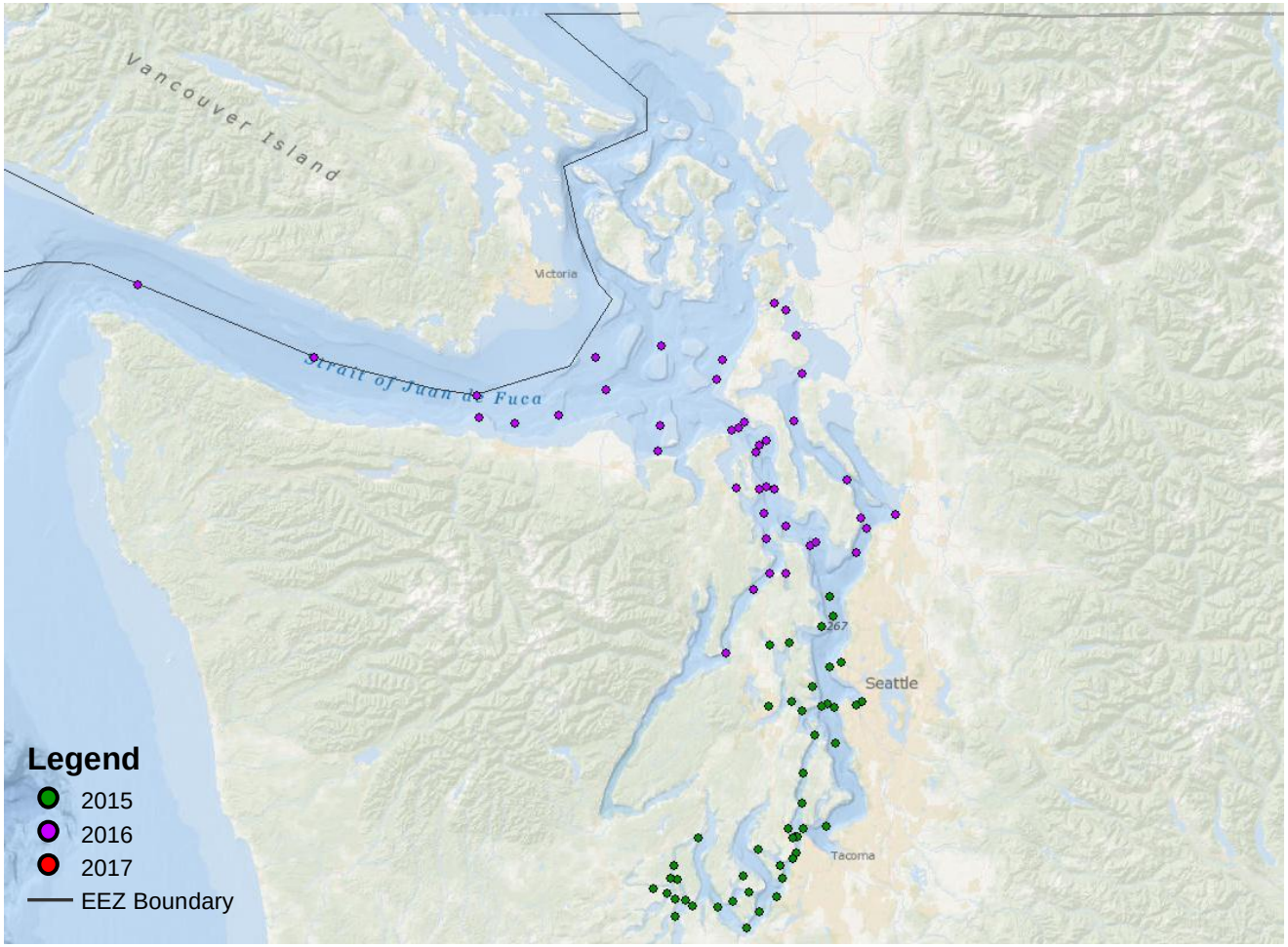
- Station infrastructure must last at least 20 years
- Follow all state, local and applicable building codes

PUGET SOUND CURRENT SURVEY

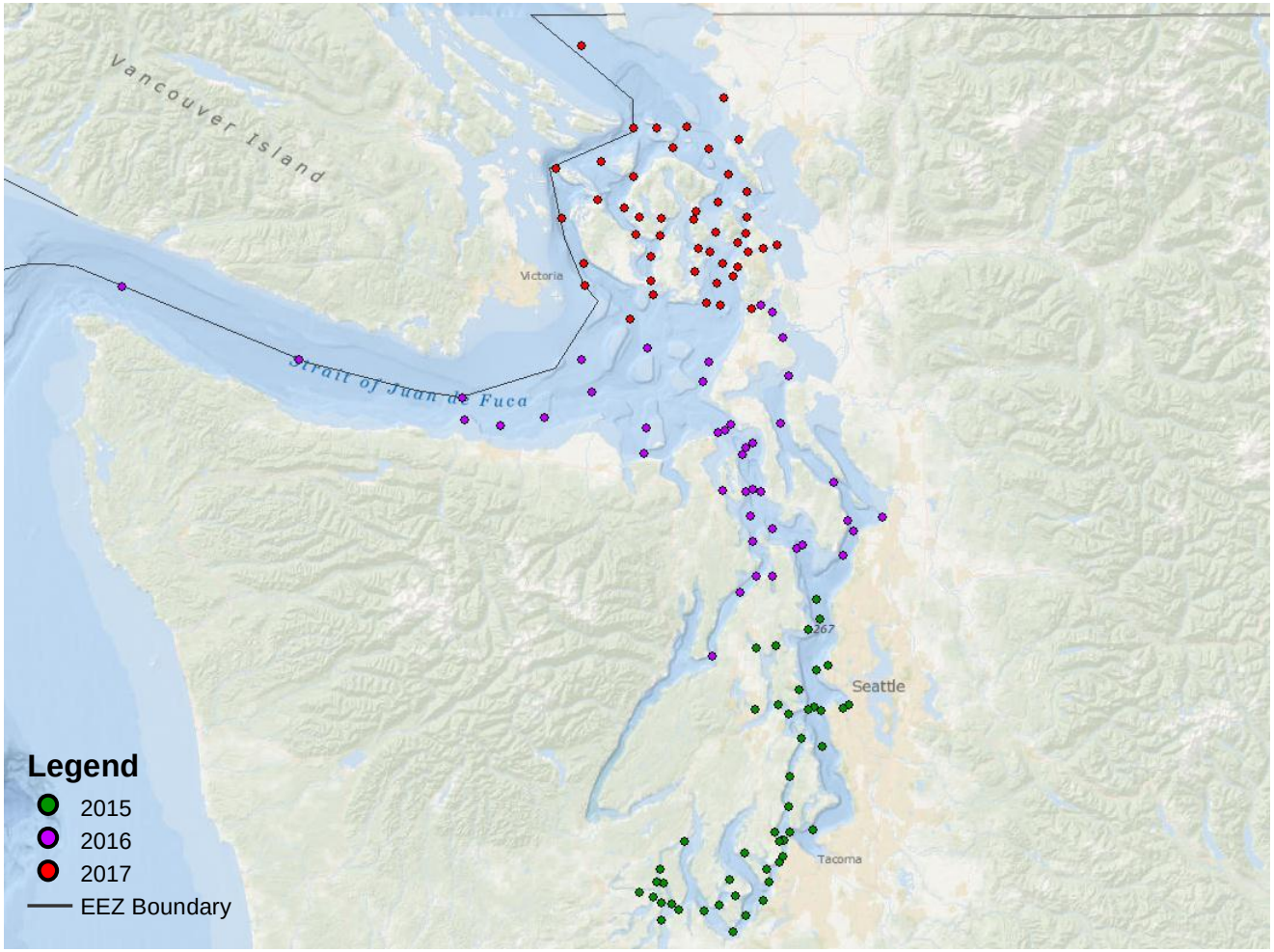
NOAA Puget Sound Current Survey 2015-2017



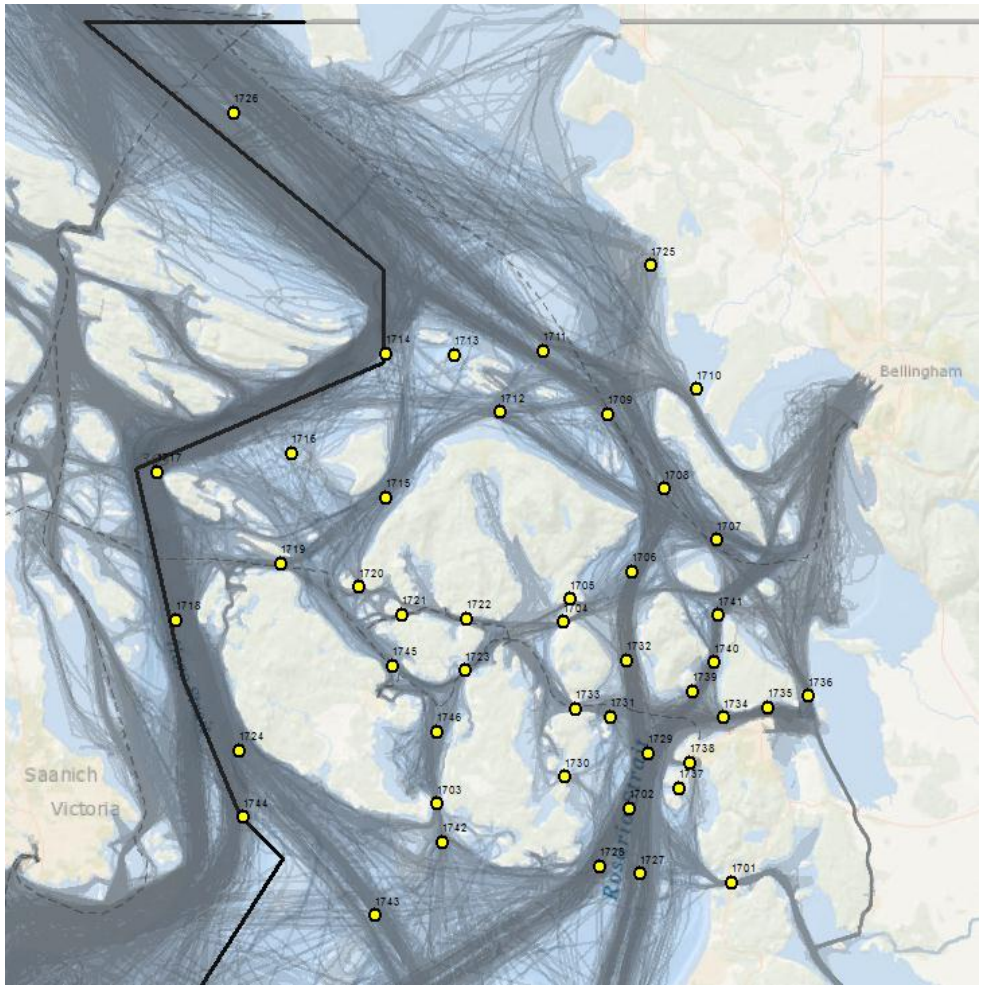
NOAA Puget Sound Current Survey 2015-2017



NOAA Puget Sound Current Survey 2015-2017



NOAA Puget Sound Current Survey 2017



Methods

- All survey stations are occupied with Teledyne RD Instruments Workhorse ADCP's for at least a lunar month.
- ADCP's are mounted in either bottom mounts or taut-line moorings.
- CTD Casts are taken at deployment and recoveries.
- Some taut-line stations have CTD's attached collecting time-series.
- Stations are recovered using acoustic releases.