

Status of and Plans for the Wave Measurement Program at NOAA's National Data Buoy Center

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11th International Workshop on Wave Hindcasting and Forecasting

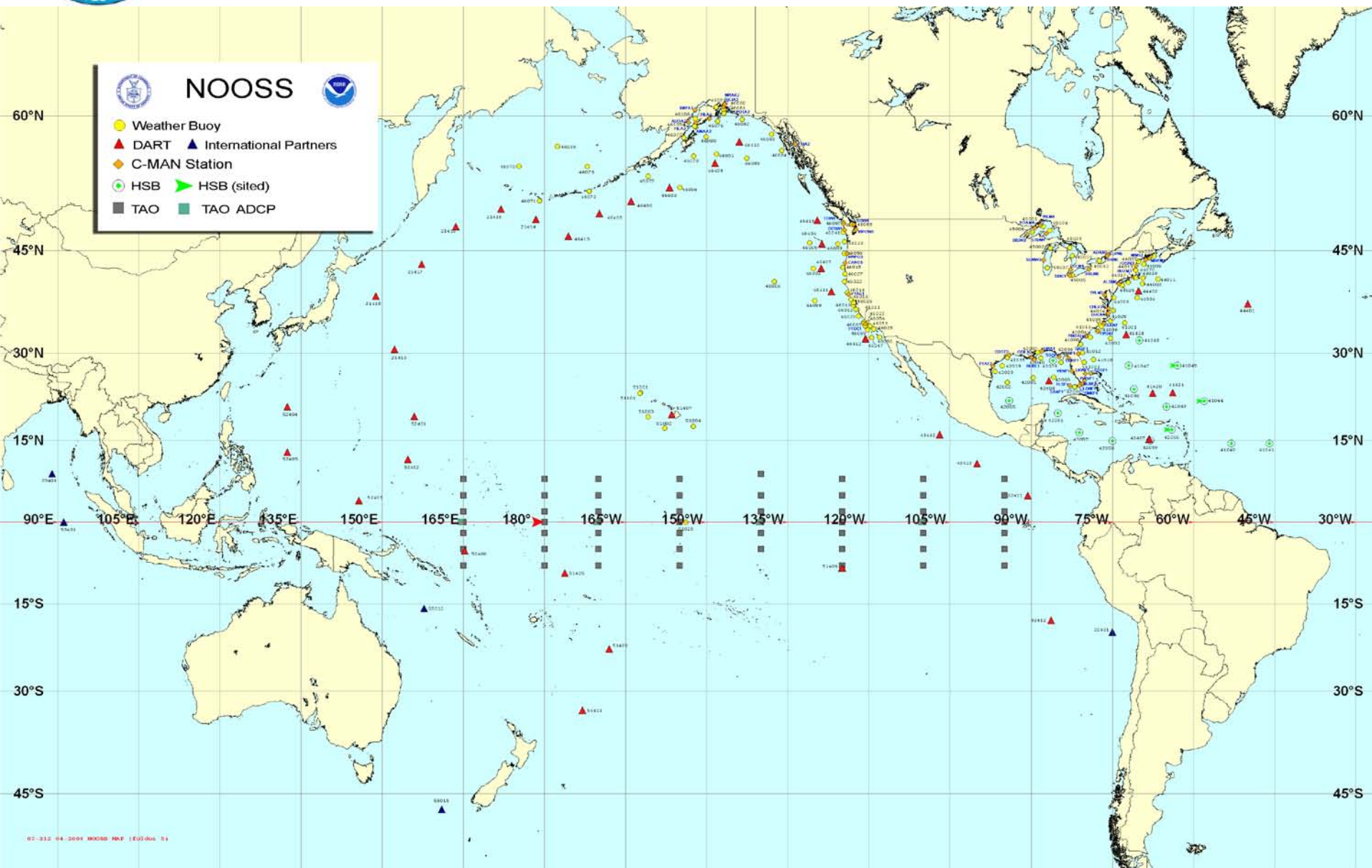
Halifax, Nova Scotia. Canada

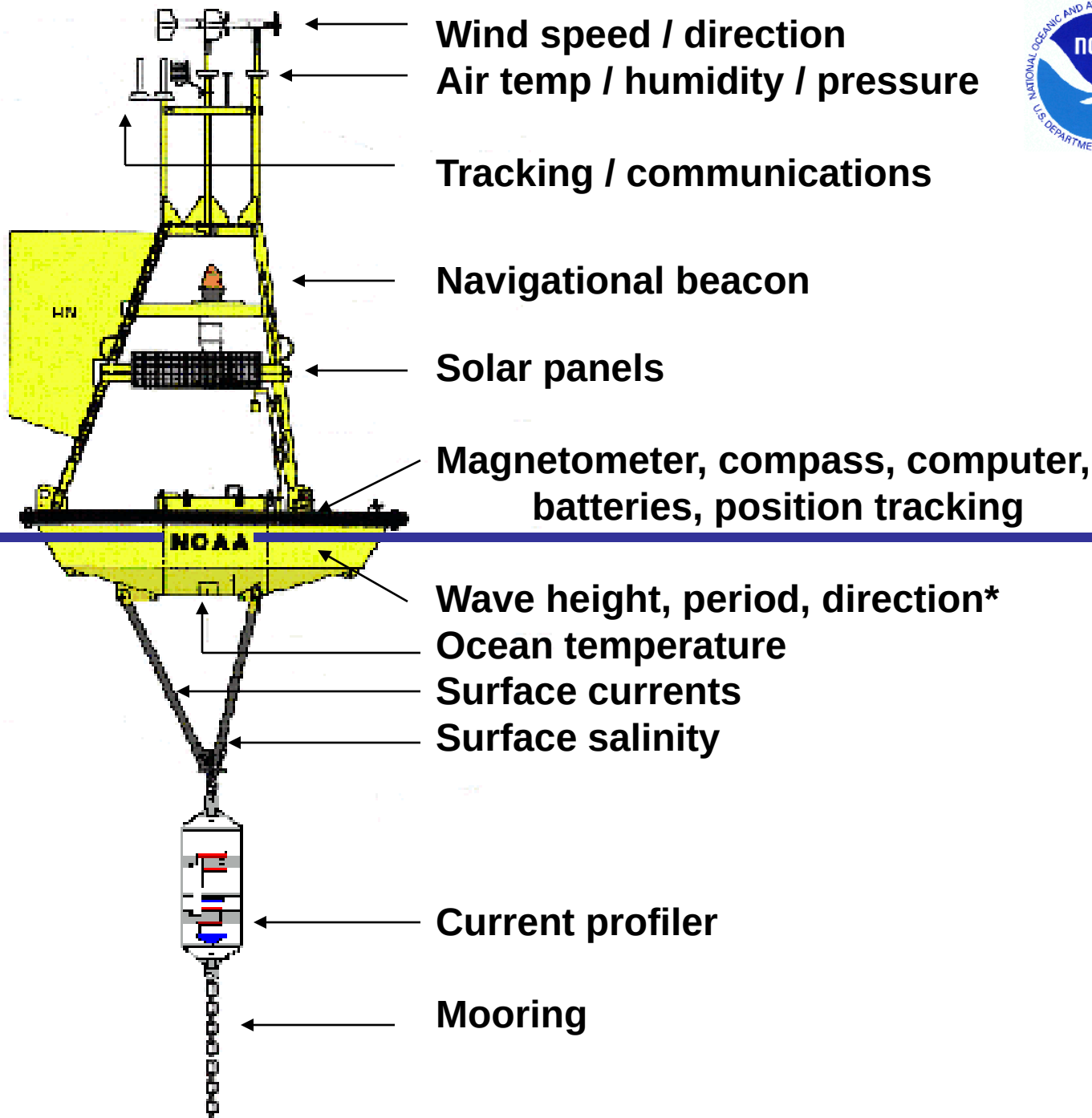
18-23 October 2009





NDBC Ocean Observing System of Systems







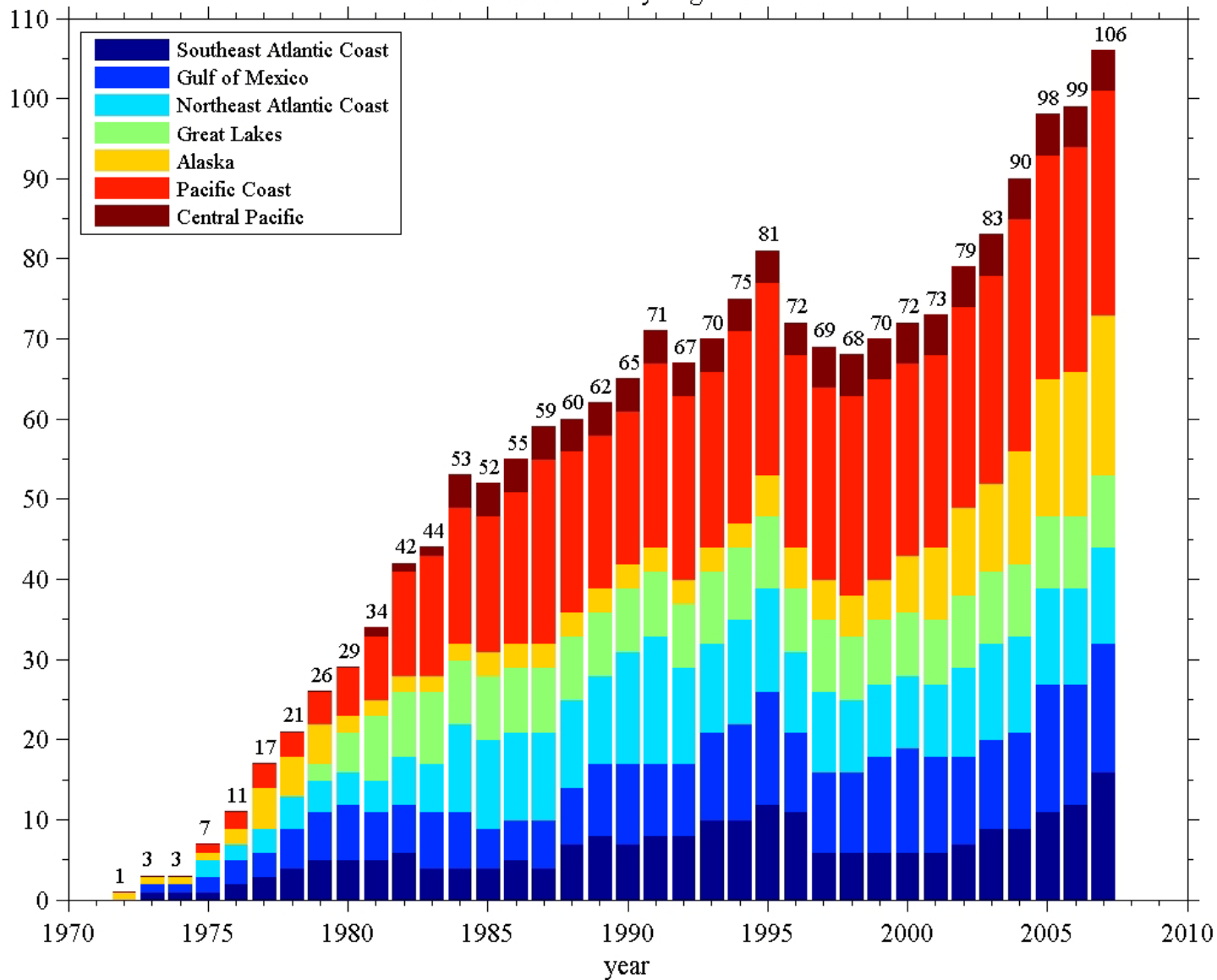




August 2009: 117

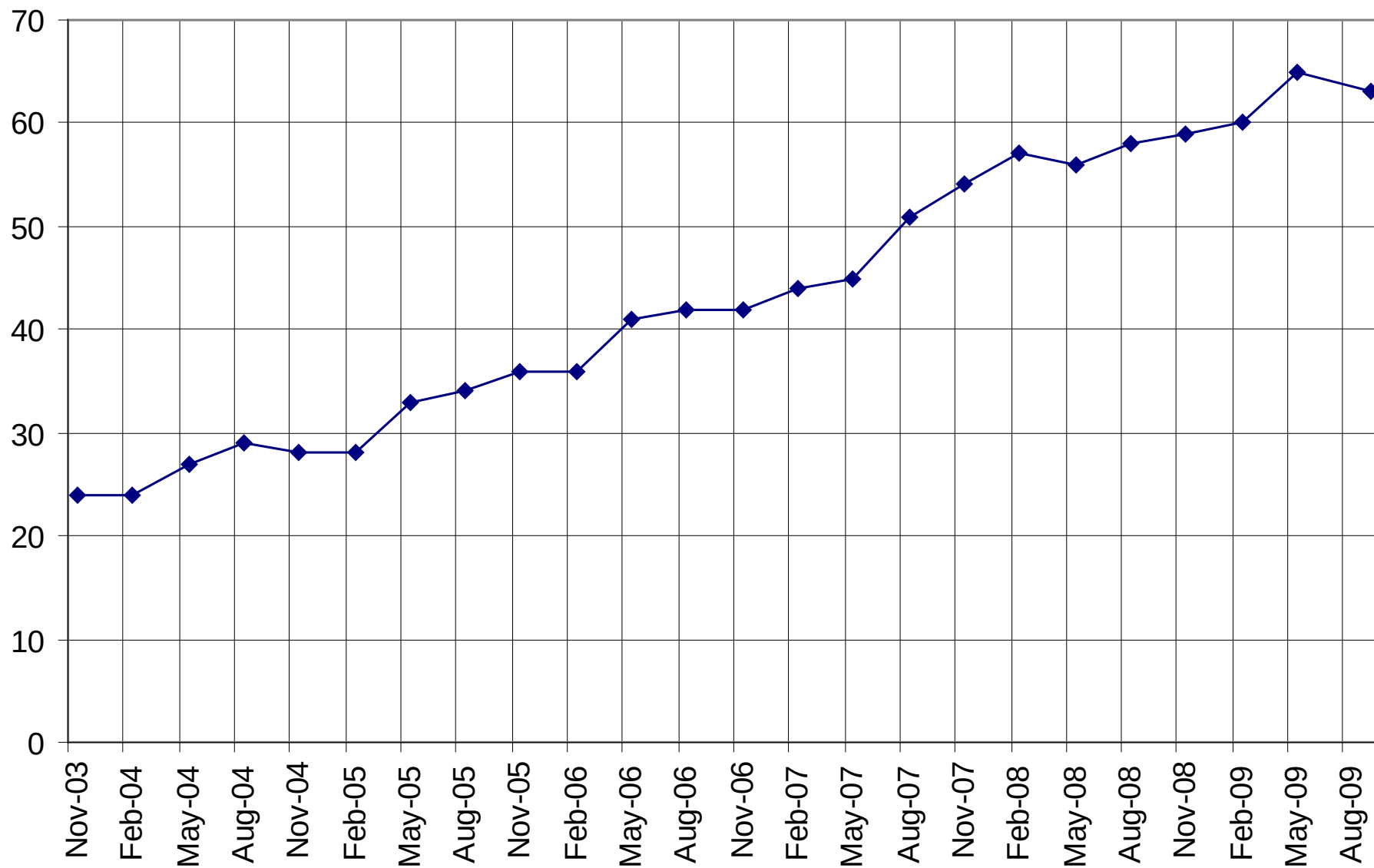


NDBC Station Count by Region 1972-2007





Increase In Directional Wave Platforms





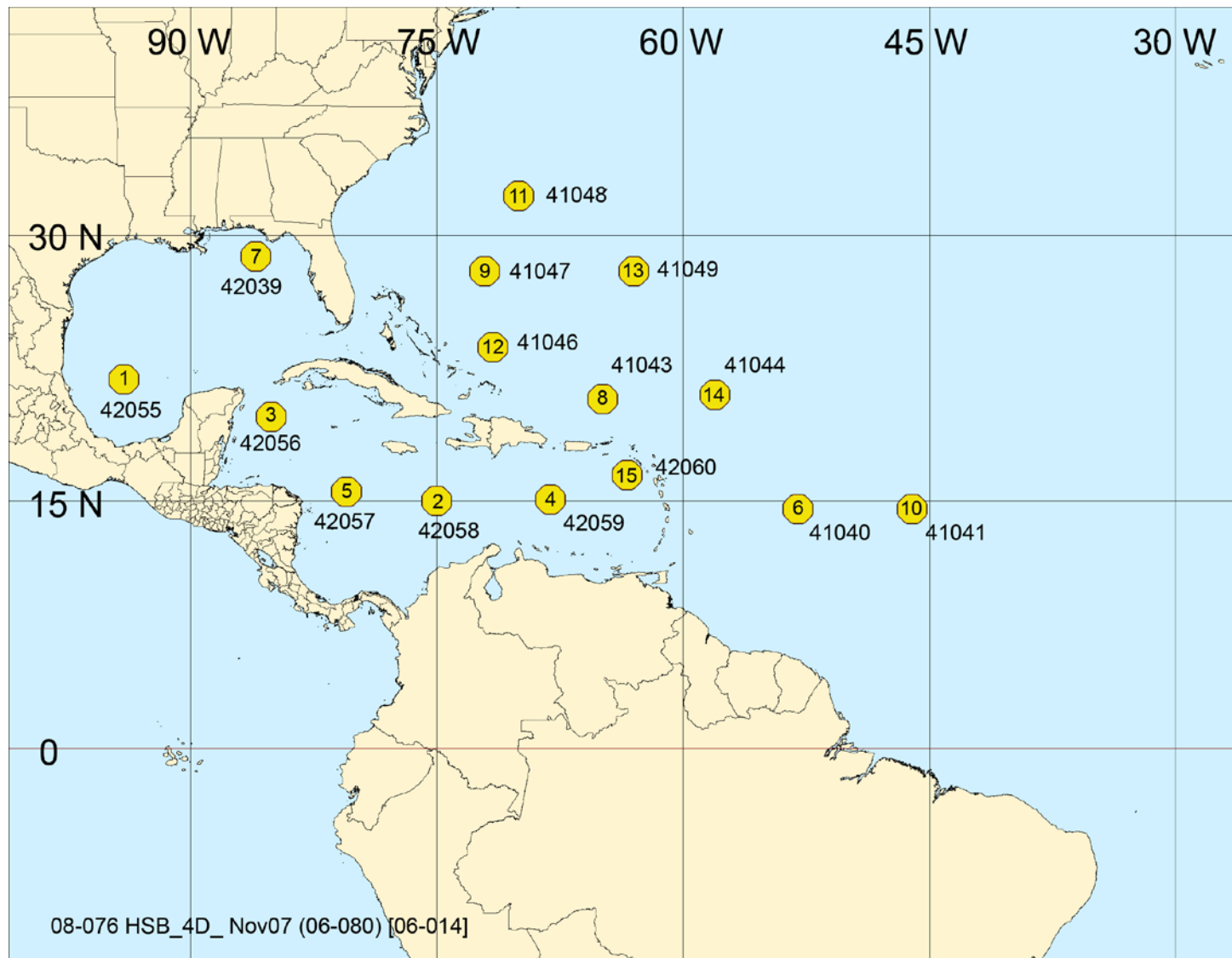
Growth Drivers

- Requirements
 - New Geographic Areas: Alaska and Tropics
- Technology, Lower-costs
 - Lower-Cost Systems
 - Microstrain 3DMG-X1
 - Digital Directional Wave Module (DDWM)
 - 1.8-m Waves-Only Buoy
 - Wave measurements offshore of existing land-stations



HURRICANE EXPANSION

15 New Buoys



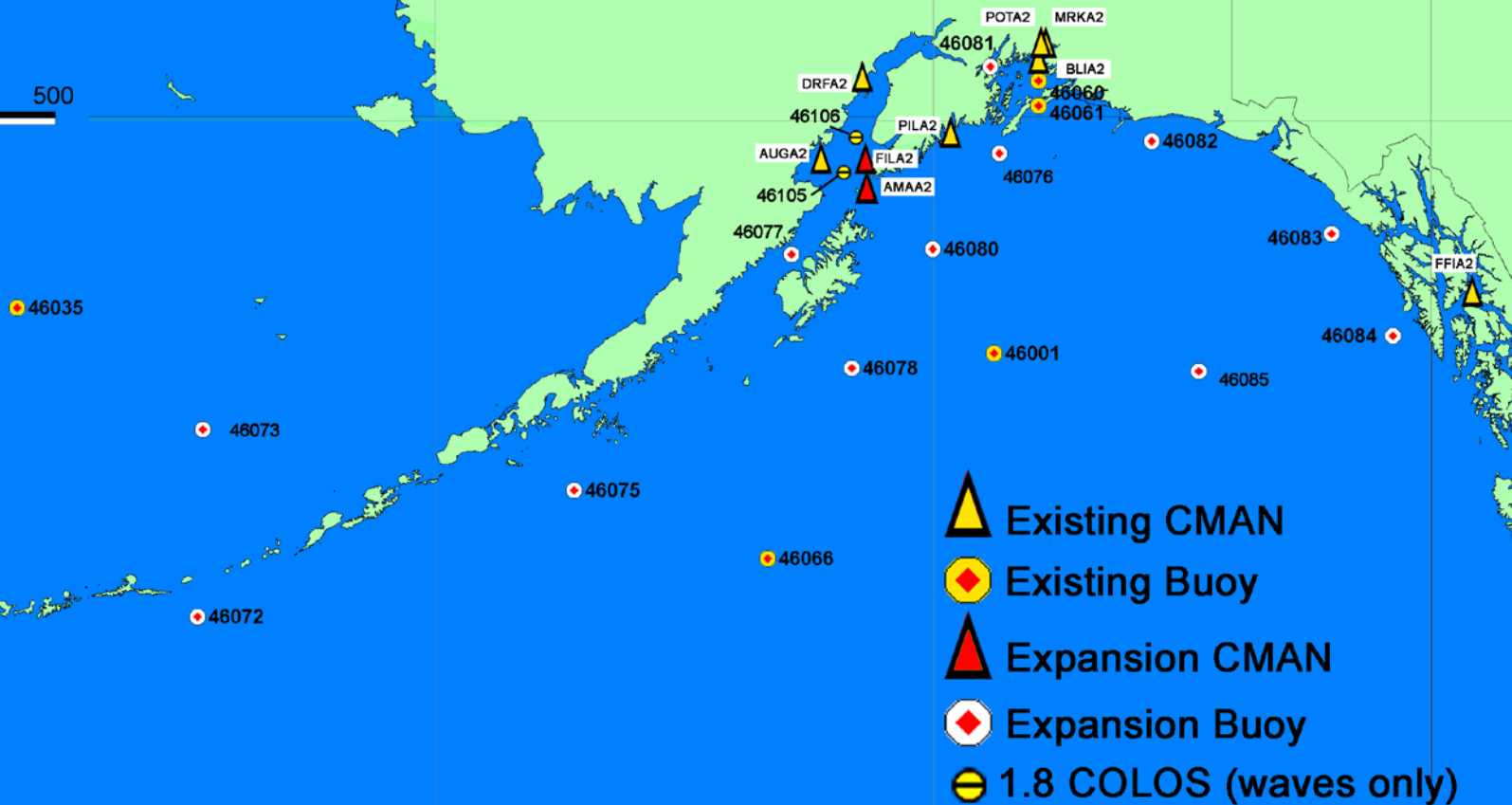


Added 14 Weather and three 1.8-m Buoys



Alaska Network Expansion

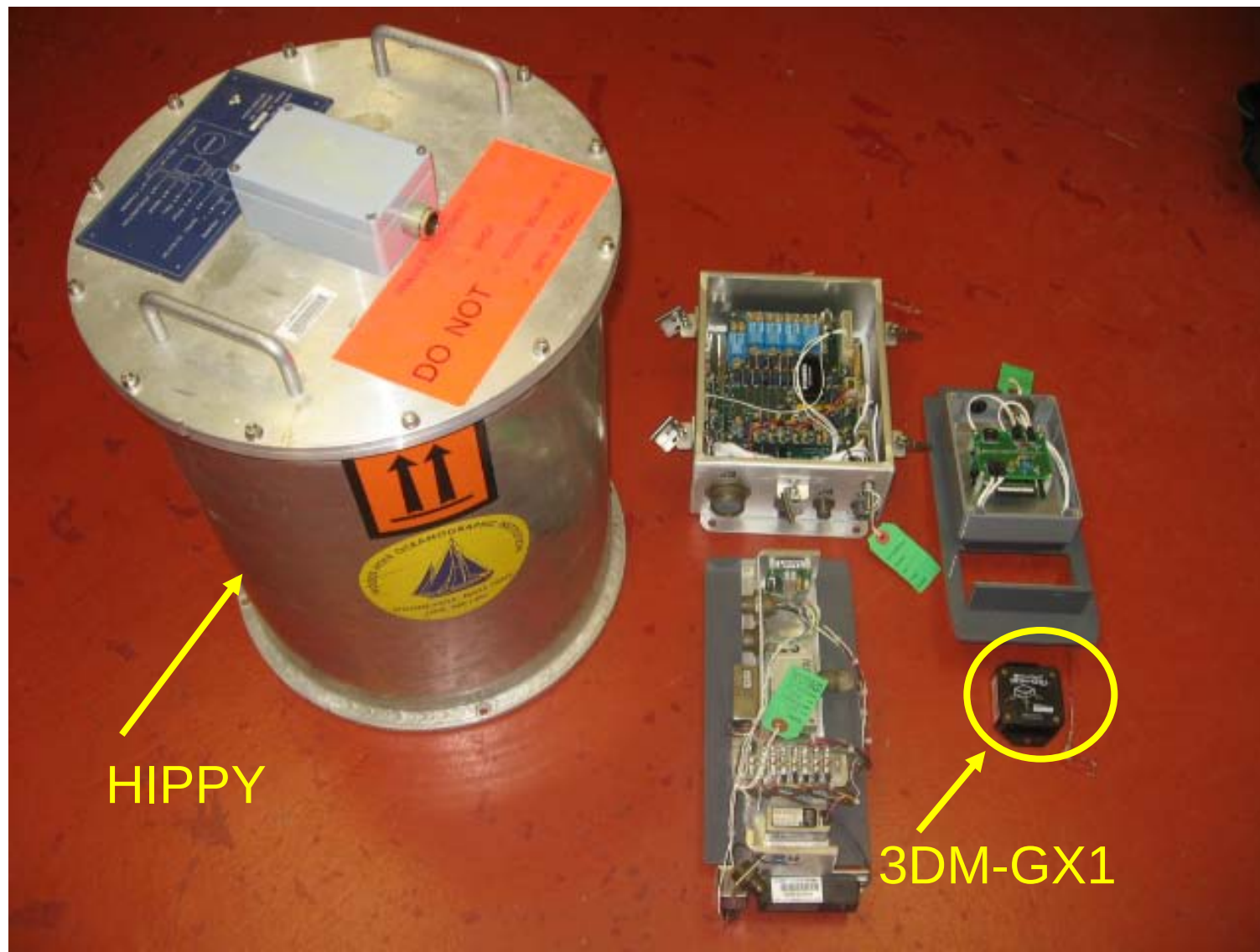
0 250 500
nautical miles





HIPPY: 66,000 cm³, 36 kg, US\$30,500

3DMG: 145 cm³, 0.075 kg, US\$ 1,300





NDBC Buoy Wave Measurements

No Longer Use Non-Buoy Systems

- Heave/Pitch/Roll (Slope Following)
- Heave
 - Hippy 40, or
 - Strapped-Down Accelerometer
- Pitch and Roll
 - Hippy 40, or
 - Integrate 3-D Angular Rate (ARS)
- Buoy Orientation
 - Magnetometers, and
 - Magnetic Declination



DDWM

- WPM (Wave Processing Module)-based
 - Samples at 1.7066 Hz
 - Sampling Duration:
 - 20 minutes for 0.020 to 0.350 Hz, and
 - 10 minutes for 0.365 to 0.485 Hz
 - 47 Frequency Bands Sent Shoreside
 - Longuet-Higgins *et al.* (1963), FFT
- Advances
 - Digital
 - 3DMG-X1
 - Integrated acceleration, angular rate, magnetic flux in 3 orthogonal axes (9 measurements)
 - No need for independent tilt sensor for ARS integration



DDWM



No change to shoreside processing

- Apply empirical low-frequency noise correction to strapped-down accelerometers
- Apply Response Amplitude Operators
- Integrate Acceleration -> Displacement
- Compute Moments, Find Peaks, Sea-Swell
- Compute and Determine Bulk Parameters
- Same Quality Control Procedures
- Real-time Distribution Using WMO Alphanumeric Messages: FM13 (bulk) and FM65 (bulk and spectra) and NDBC Website



DDWM Compared to Hippy, HI, May 2009, Sample Size 744

Measurement	Bias	Root Mean Square Difference	NDBC Goal
Significant Wave Height	-0.02 m	0.03 m	0.2 m or 10%
Average Period	0.19 s	0.08 s	1.0 s
Peak Period	0.13 s	1.01 s	1.0 s
EW Direction	-0.53	5.34	10

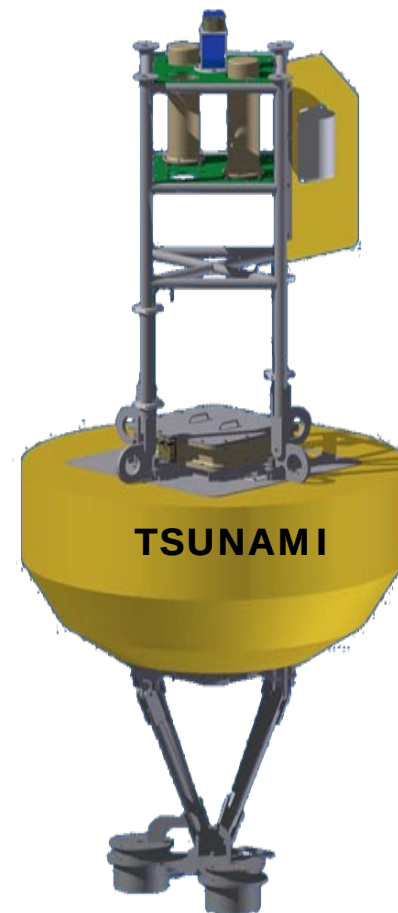


Plans

- Retire Magnetometer-Only Directional Waves
- Evaluate True Tilt Correction for Heave
- Hybrid Measurements:
 - Particle (orbital velocities) at low-frequencies
 - Slope following at higher frequencies
- Evaluating Non-buoy Instruments
- Return Time Series to Shore
- Standard, Multi-purpose Buoy
 - Expand Geographic Coverage with Possible Wave Measurements from Climate (TAO) or Tsunami Stations

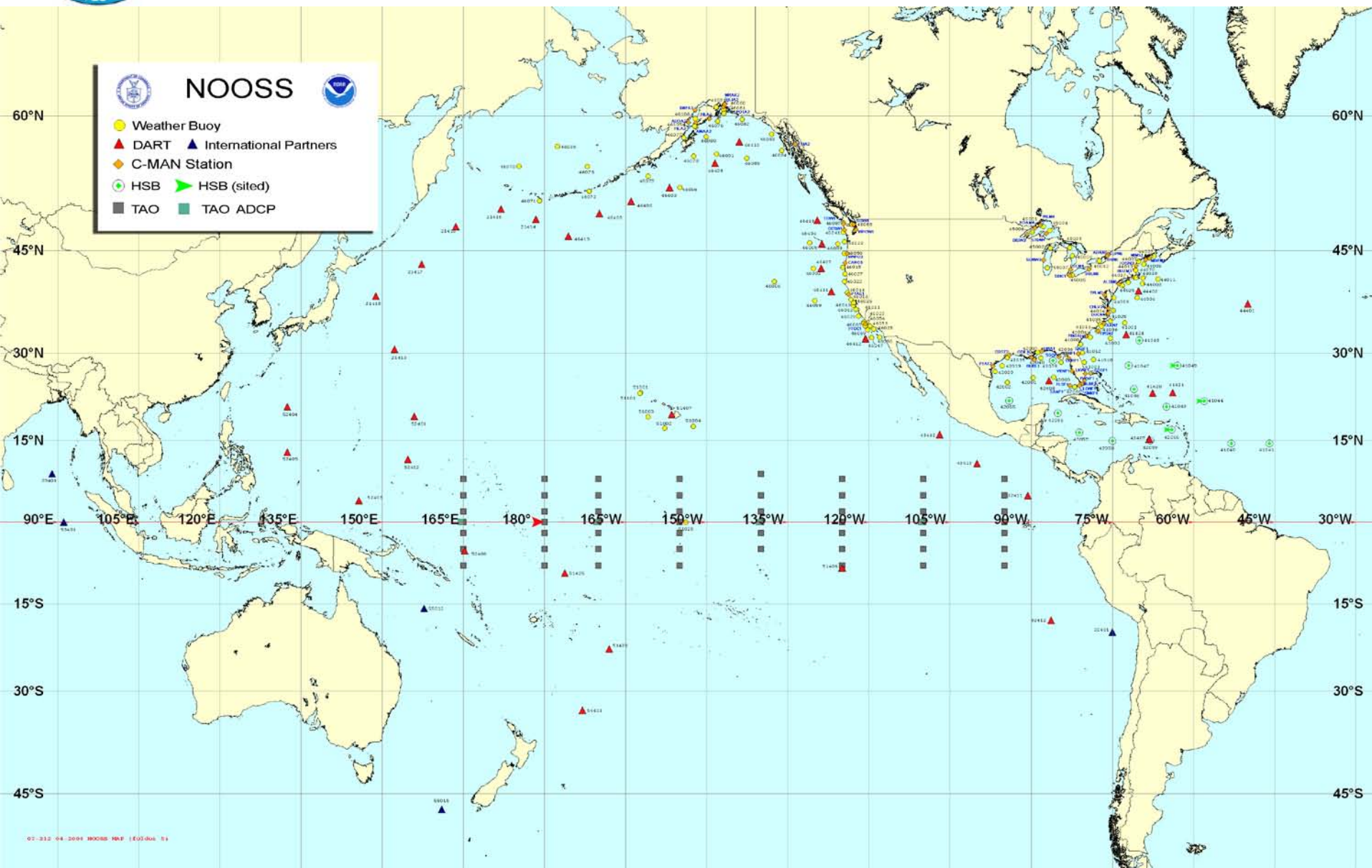


NDBC Standard Buoys





NDBC Ocean Observing System of Systems





NOAA's National Data Buoy Center

Information



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Waves: <http://www.ndbc.noaa.gov/wavemeas.pdf>