



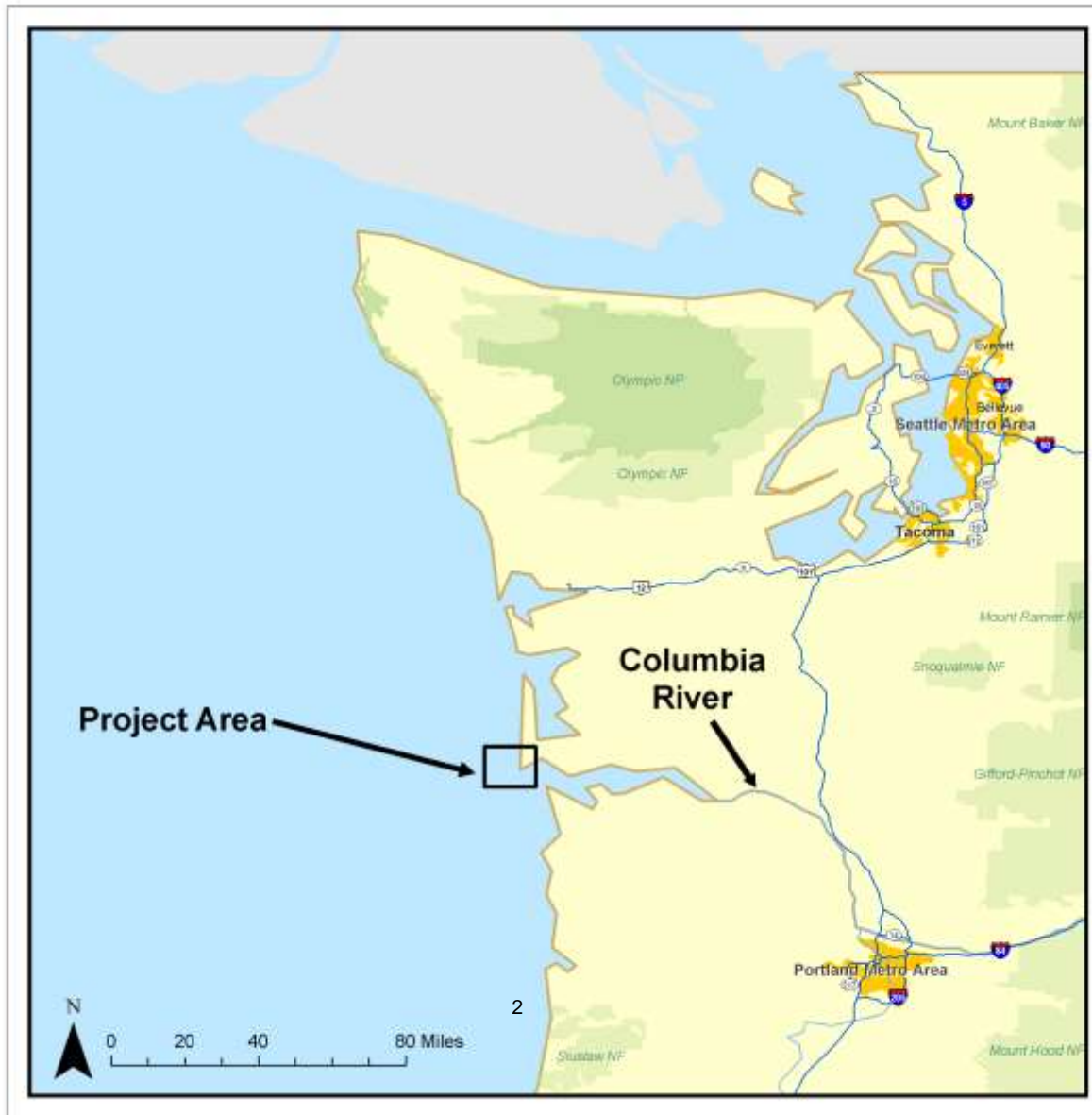
Nortek Users Symposium
March 16, 2011

**Southwest Washington
Littoral Drift Restoration
Project: LITTORAL
PROCESS MONITORING**





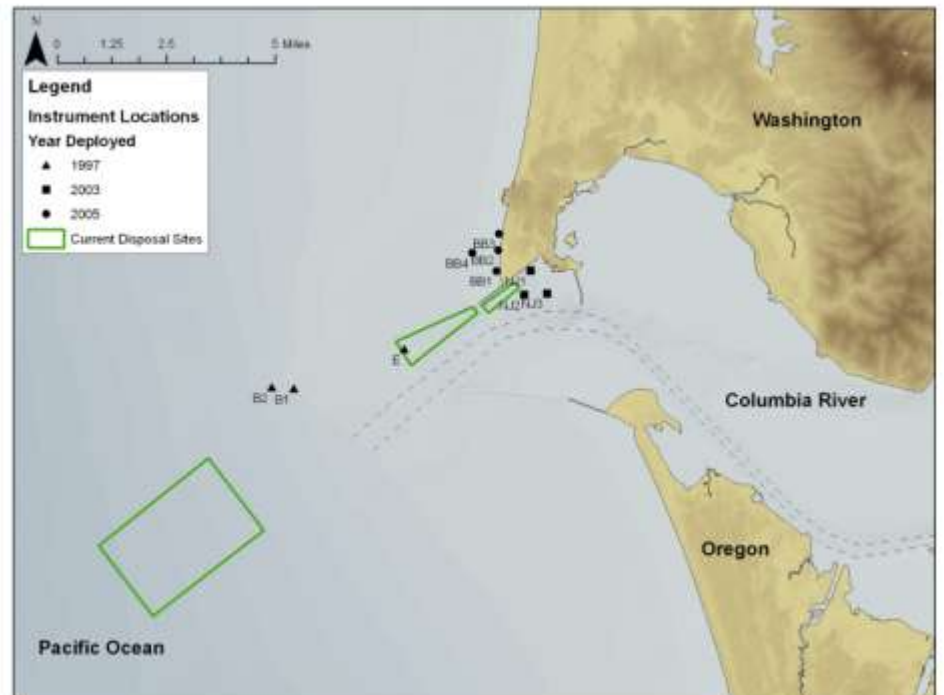
Project Site



March 16, 2011

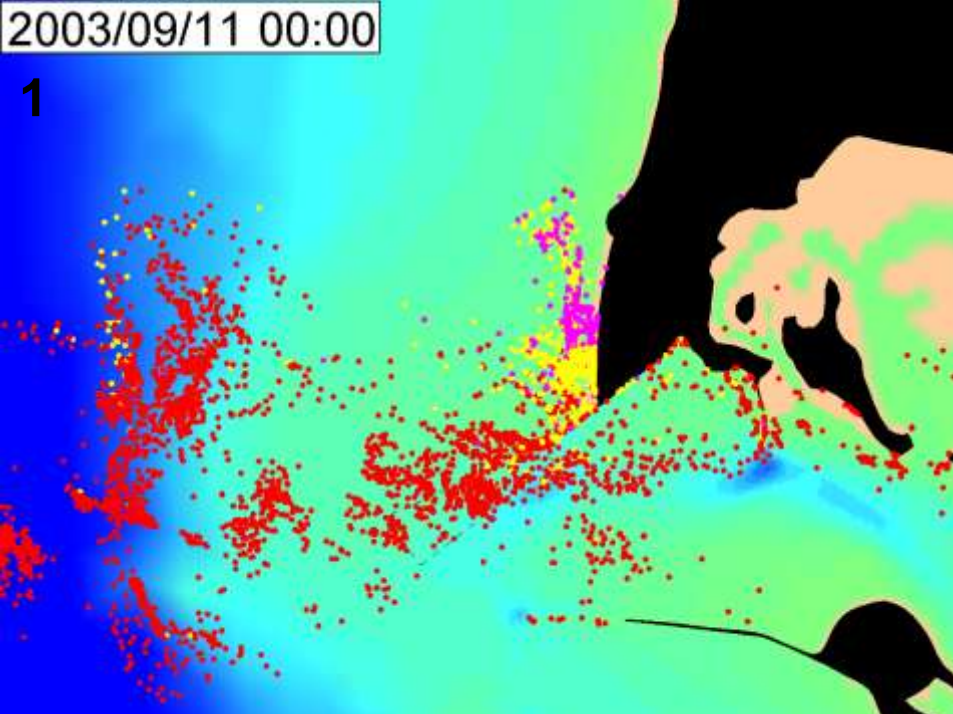
Background

- Maintenance dredging of approximately 4 M cu. yd. per year at Mouth of Columbia River
- Over last 5 years 1/3 of volume disposed in deep water sites (> 50 m water depth)
- Remainder disposed in shallow water sites (10 and 25 m)
- Much of sediment is lost from nearshore system
- SW Washington Littoral Drift Restoration Project find alternative nearshore disposal sites to retain sediment in littoral cell
- Field measurements (1997 to 2010) from ebb shoal, shoreface, and nearshore



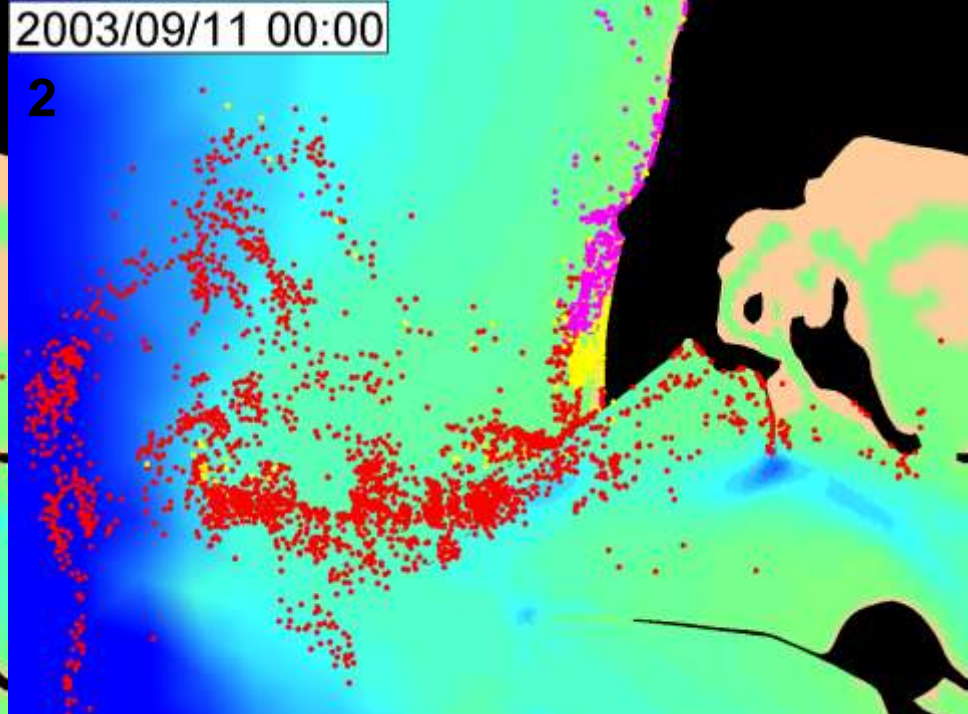
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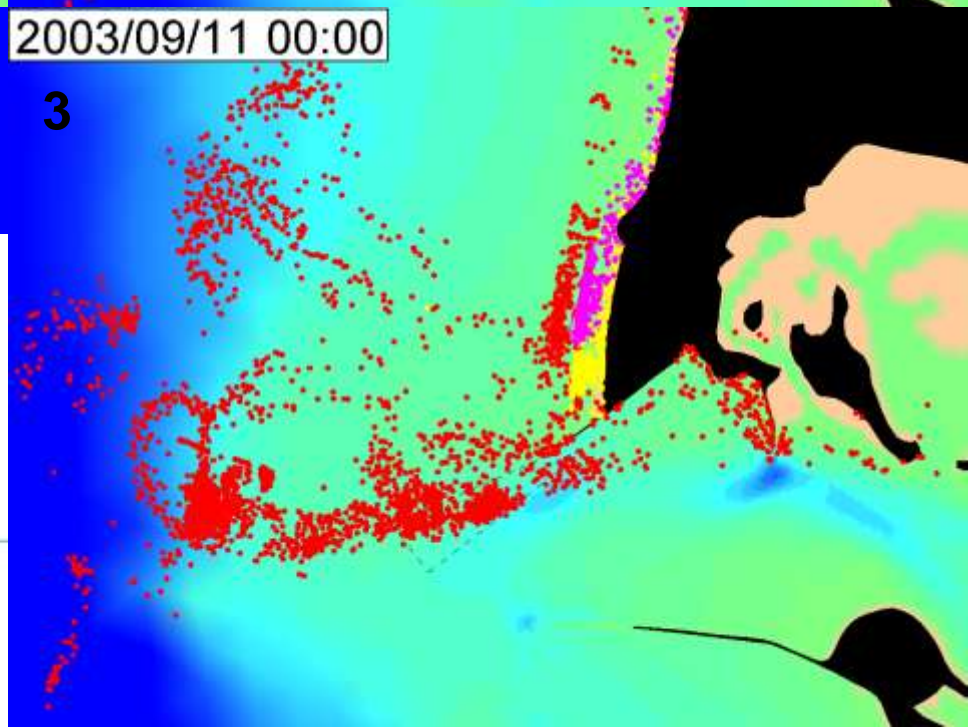
2



- Spring tides
- 3 x 5-day events
- D50 = 0.19 mm.

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3

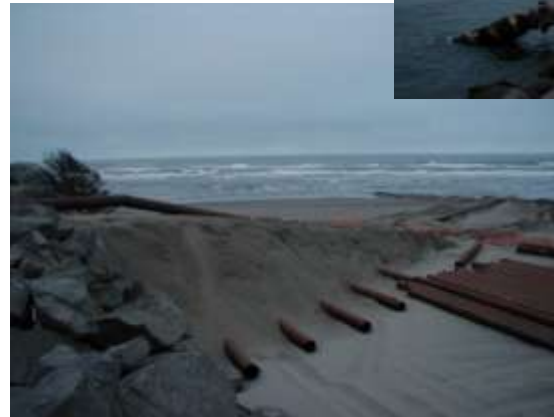
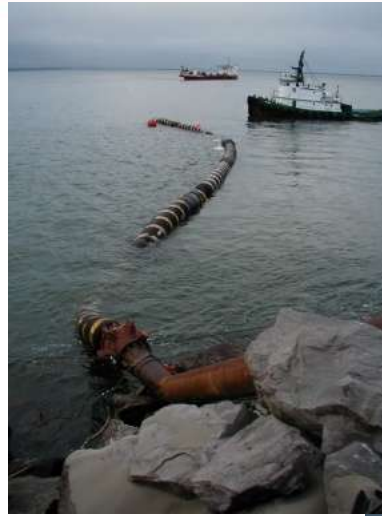


Storm	Direction	Hm0 (m)	Tp (sec)
1	290	4.5	15.0
2	270	3.5	14.0
3	250	3.8	14.0



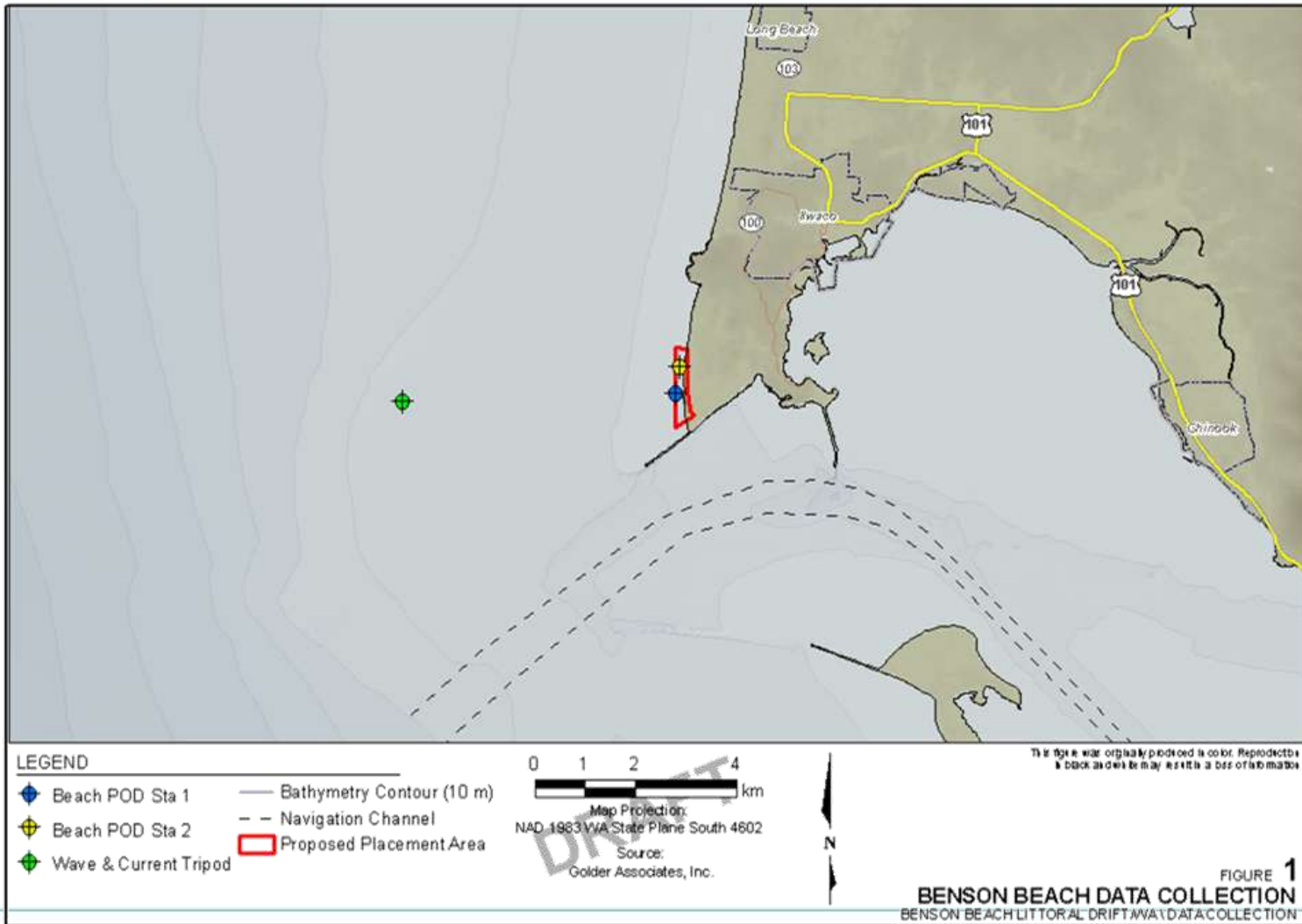
2010 Benson Beach project

- Dredged sediment placement demonstration project
- Partnership between Coastal Communities, State of Washington, USACE – Portland District
- Initial demonstration project (2002) – 40,000 cy pump-ashore
- 2010 demonstration project – 350,000 cy pump-ashore
- Monitoring program elements:
 - waves, currents, suspended sediment transport,
 - nearshore bathymetry and beach topography surveys
 - Sediment tracer study
 - Delft 3D modeling





2010 Placement Site

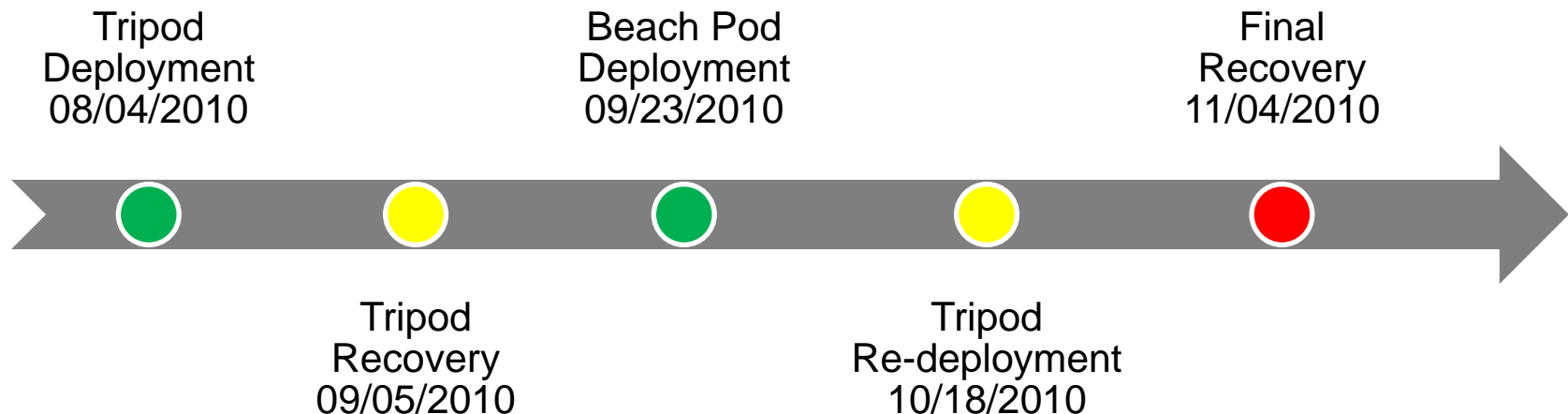


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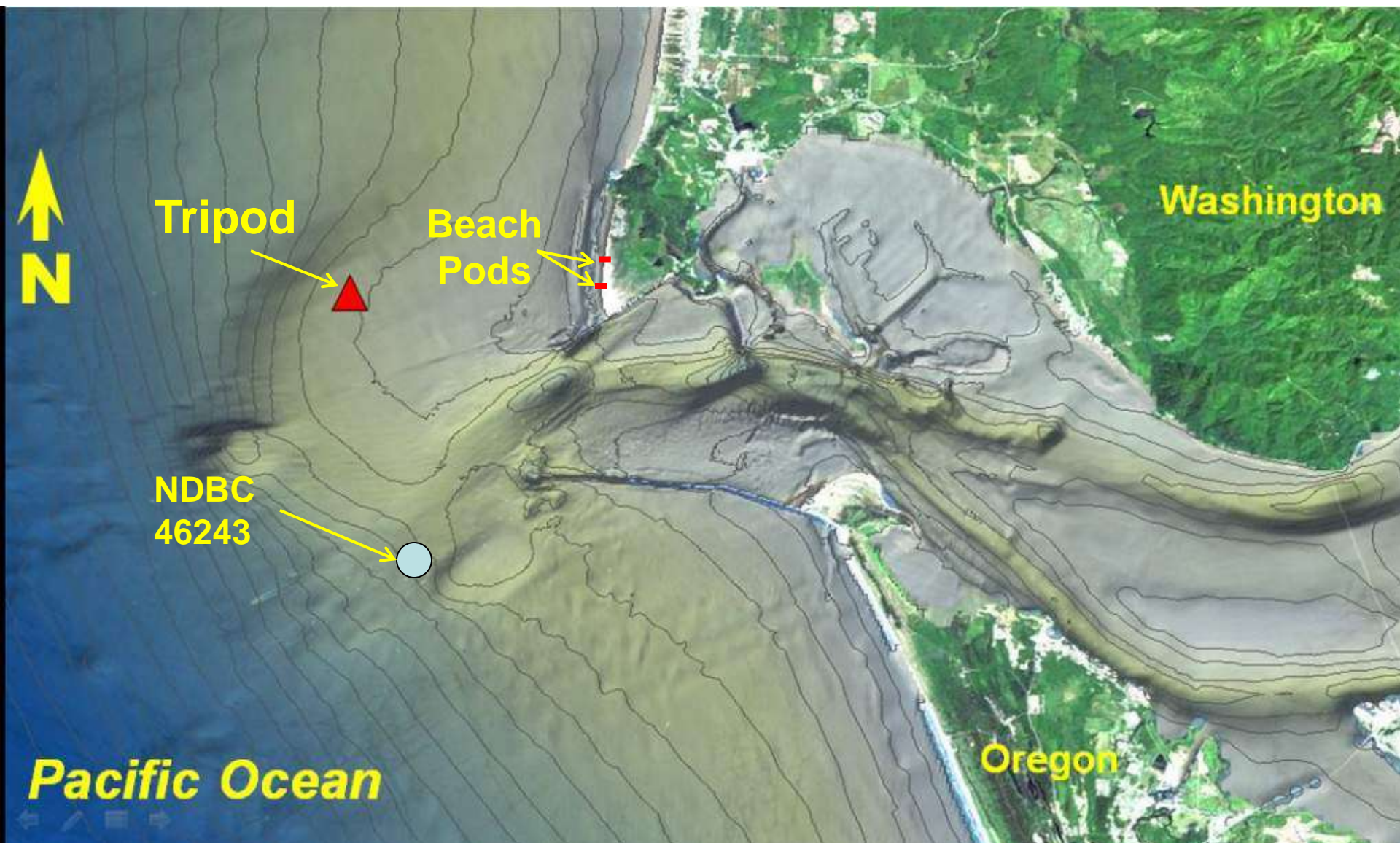
2010 Instrument Deployments

- Wave, Current, Sediment Load Tripod station
 - Nortek 1 MHz AWAC with Acoustic Surface Tracking (AST)
 - Sontek 5 MHz ADV Ocean Hydra with Paros pressure sensor, 2 Optical BackScatterance (OBS) sensors, sediment trap;
 - ORE CART release, buoy, and groundline;
- Two Beach Pod stations
 - Sontek 5 MHz ADVO Hydra with Paros pressure sensor, 2 Optical Back Scatter (OBS) sensors

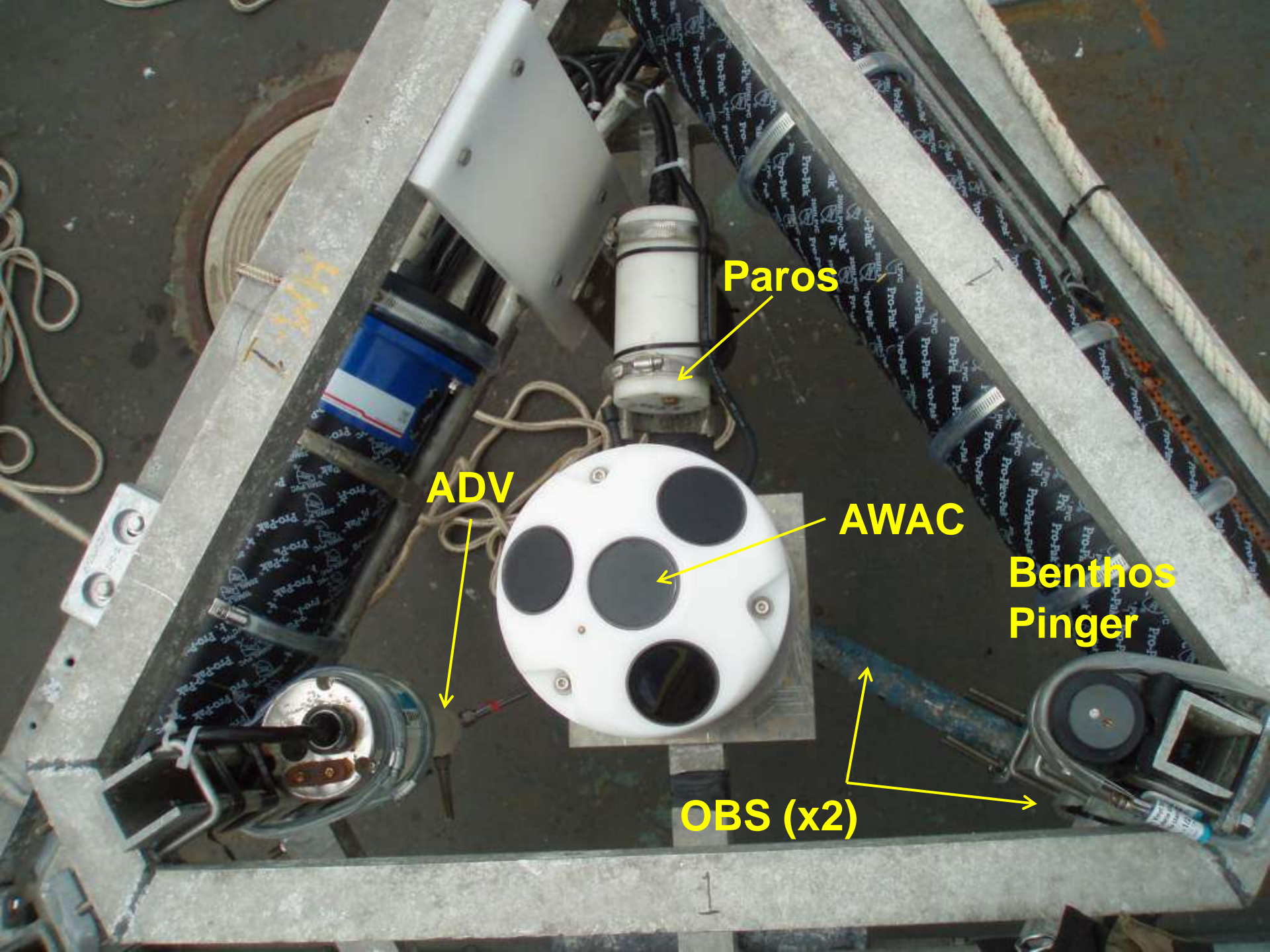




2010 Location of Instruments







Paros

ADV

AWAC

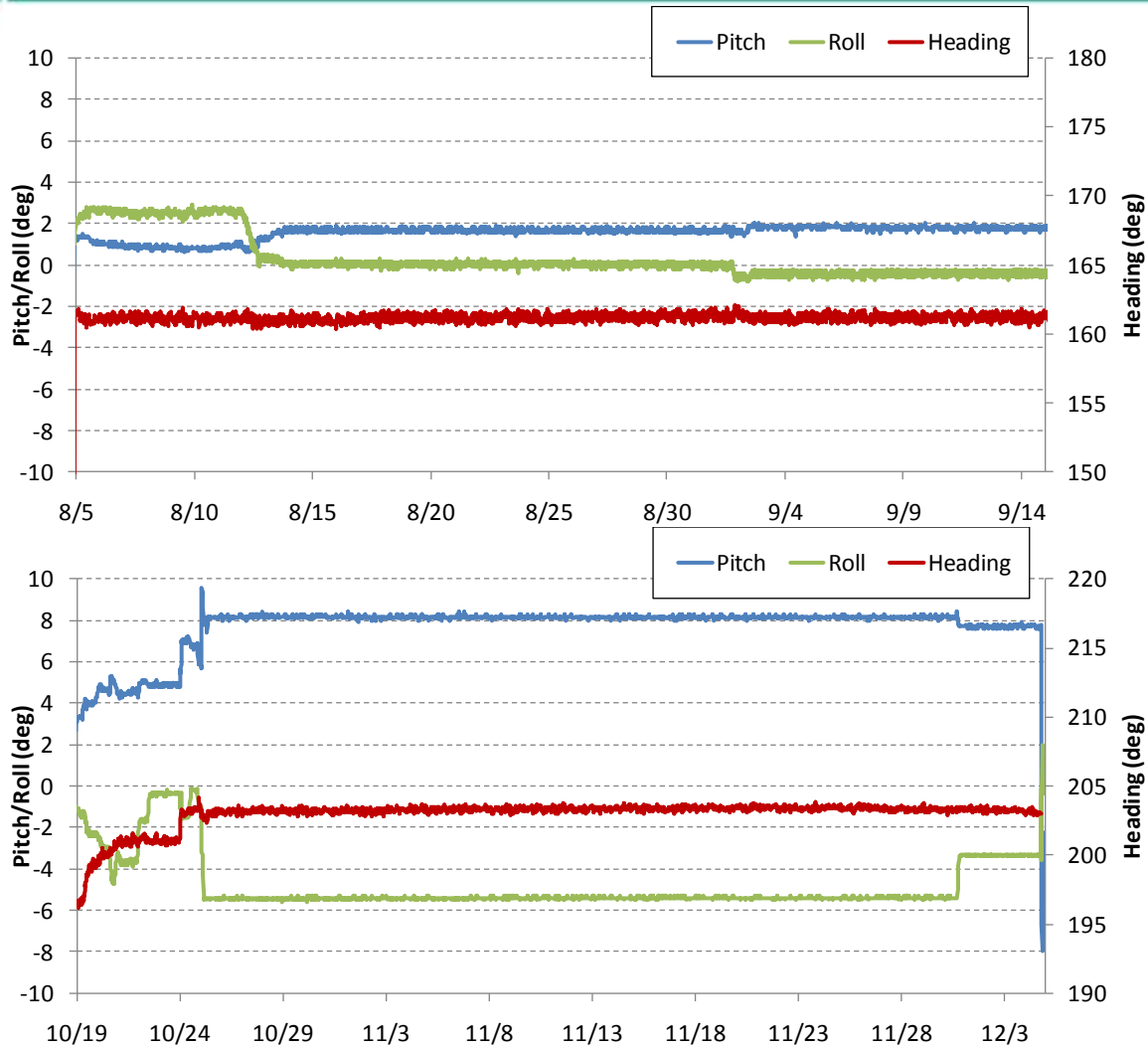
**Benthos
Pinger**

OBS (x2)



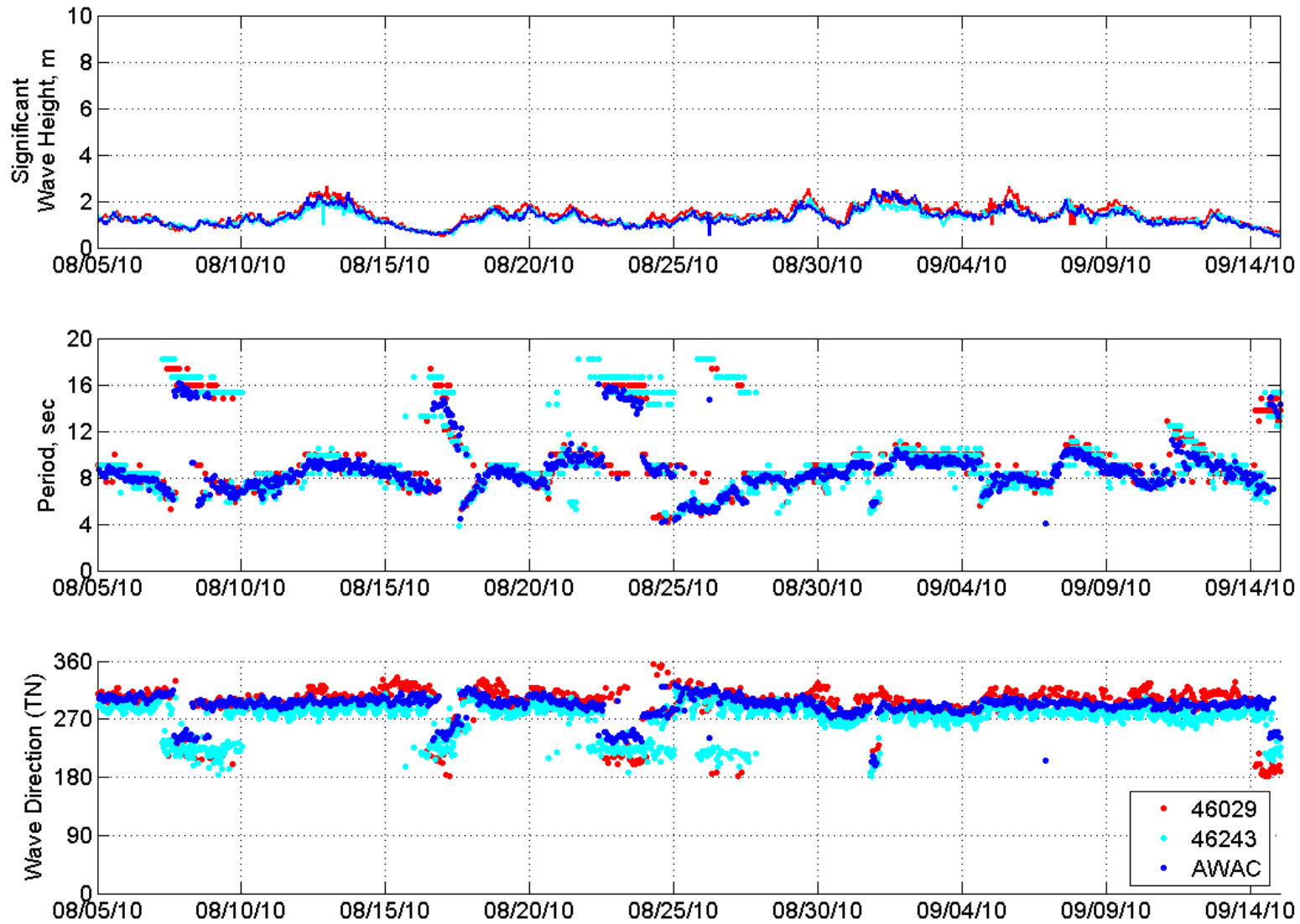


Data Quality – AWAC compass



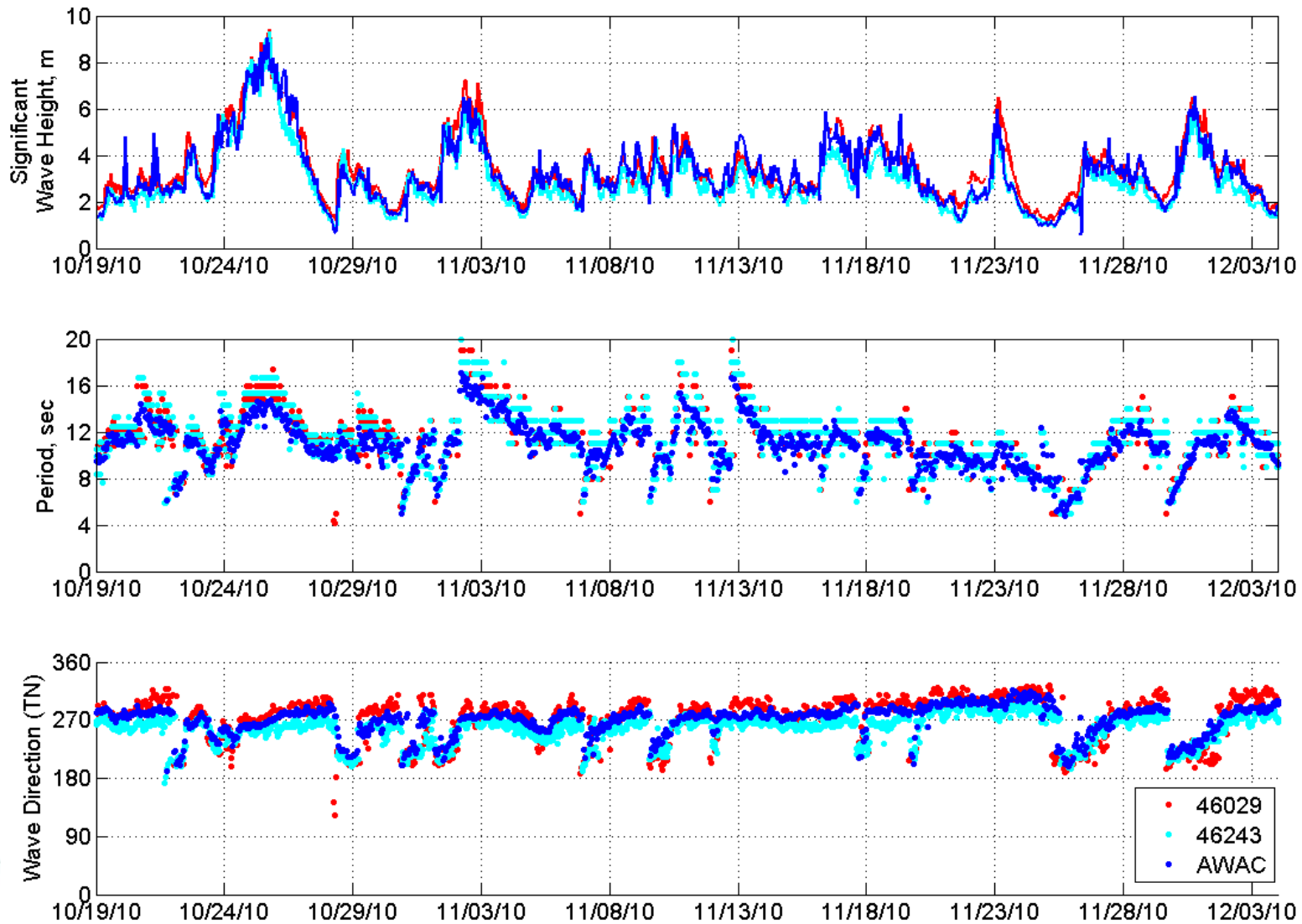


Wave Station Comparison



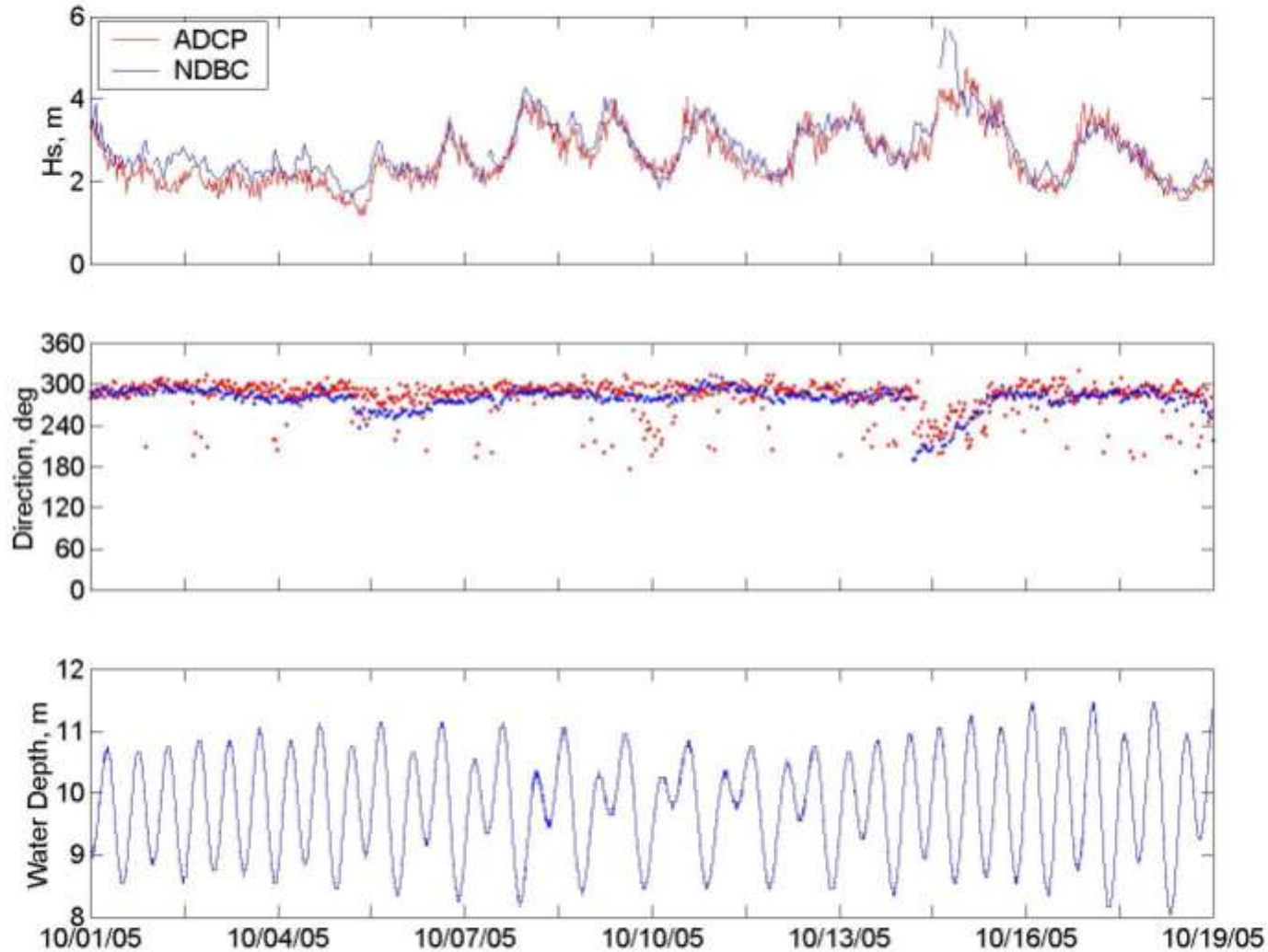


Wave Station Comparison

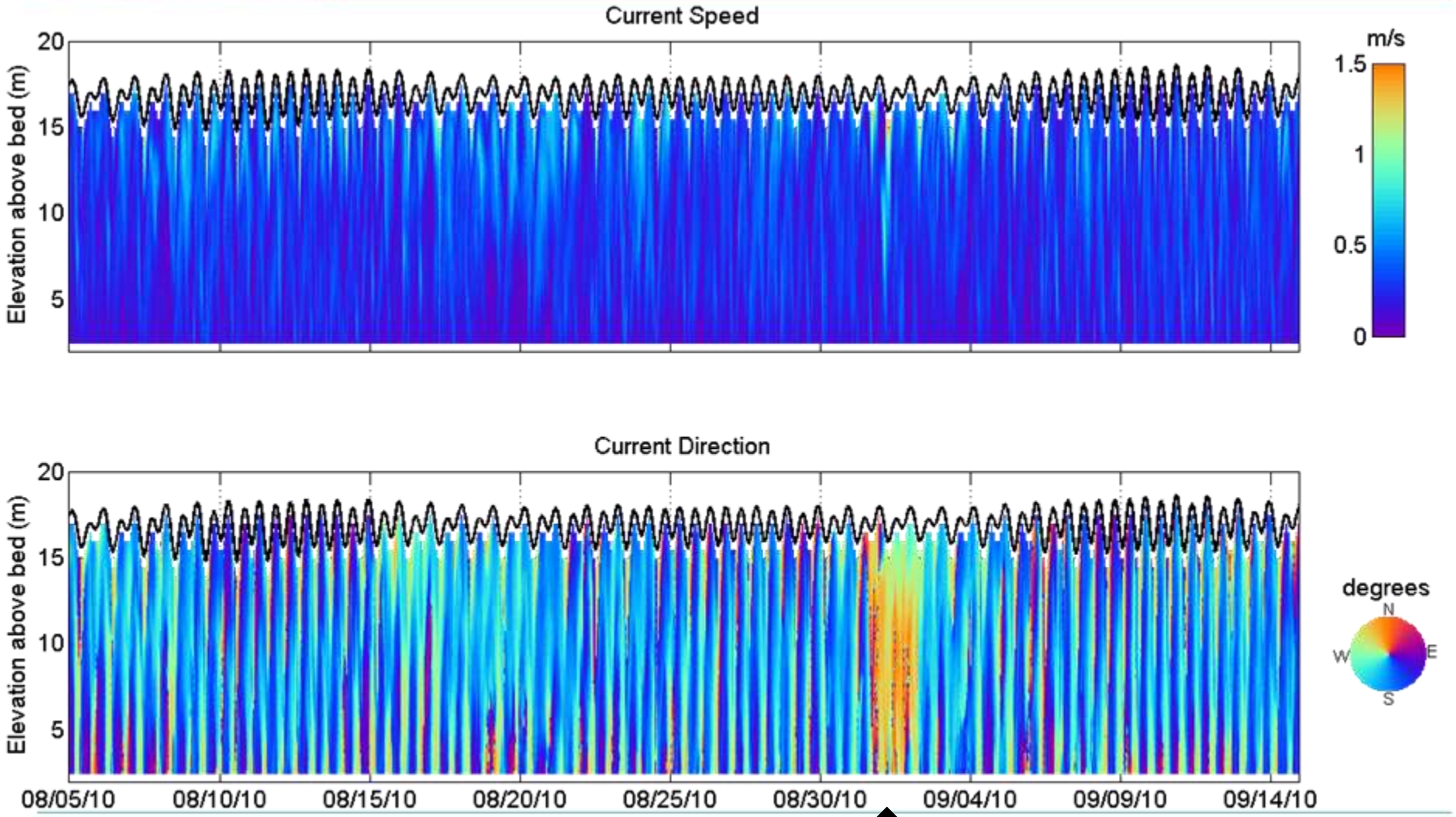




2005 TRDI ADCP Deployment

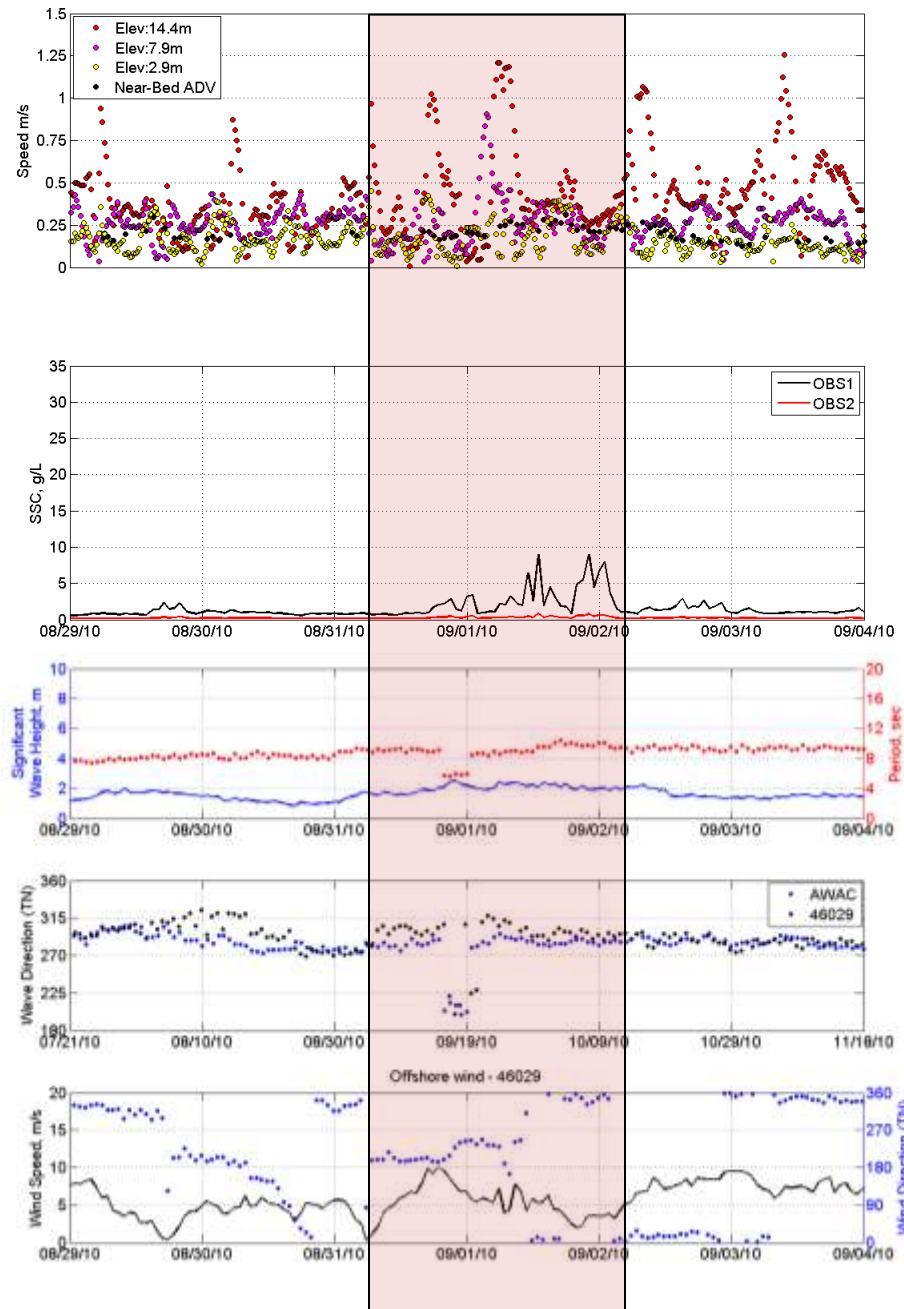


Current Magnitude and Direction



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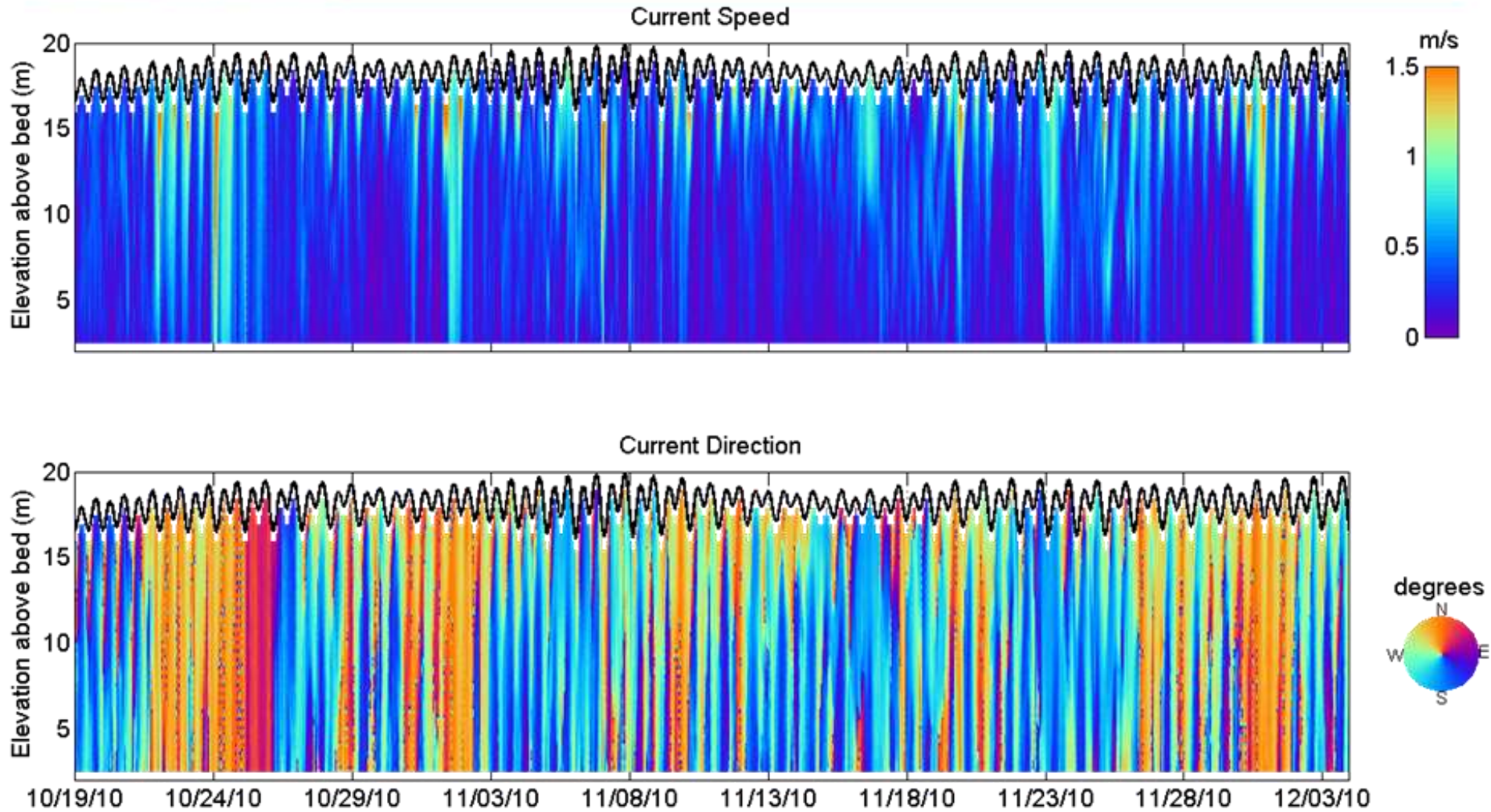
16



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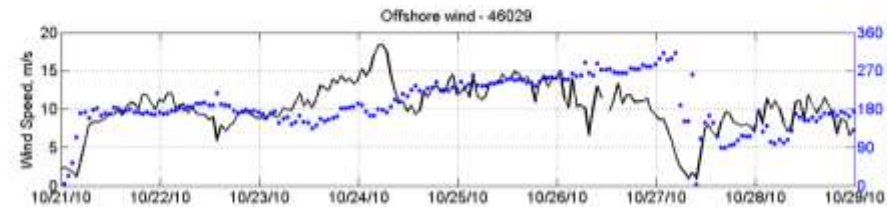
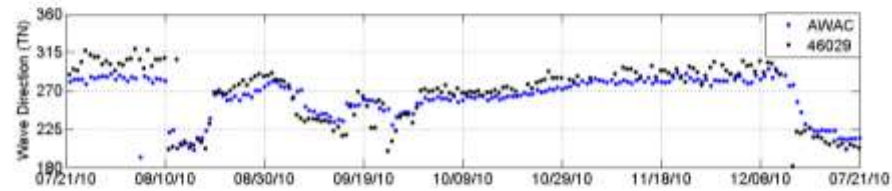
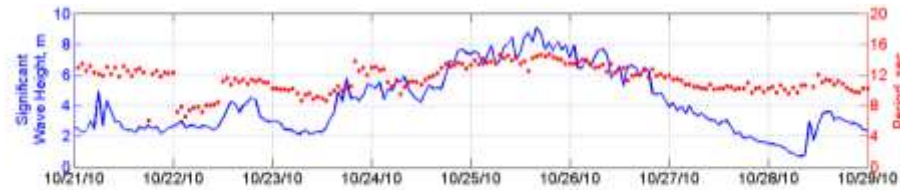
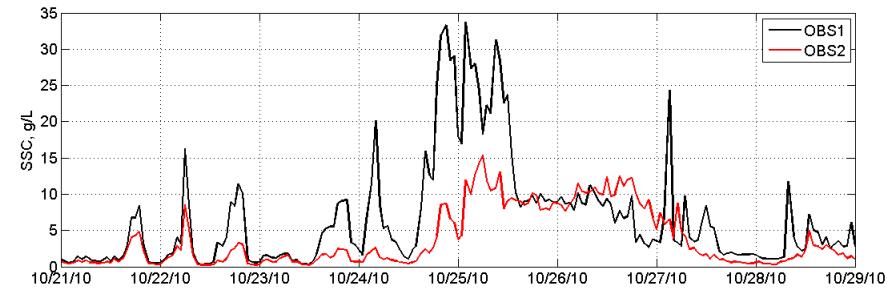
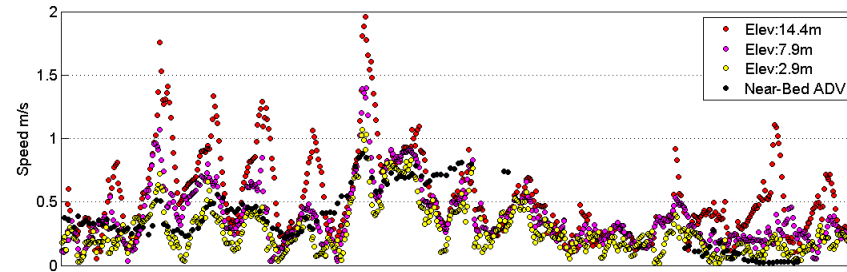


Current Magnitude and Direction



March 16, 2011







Pre-Storm: August 25, Benson Beach



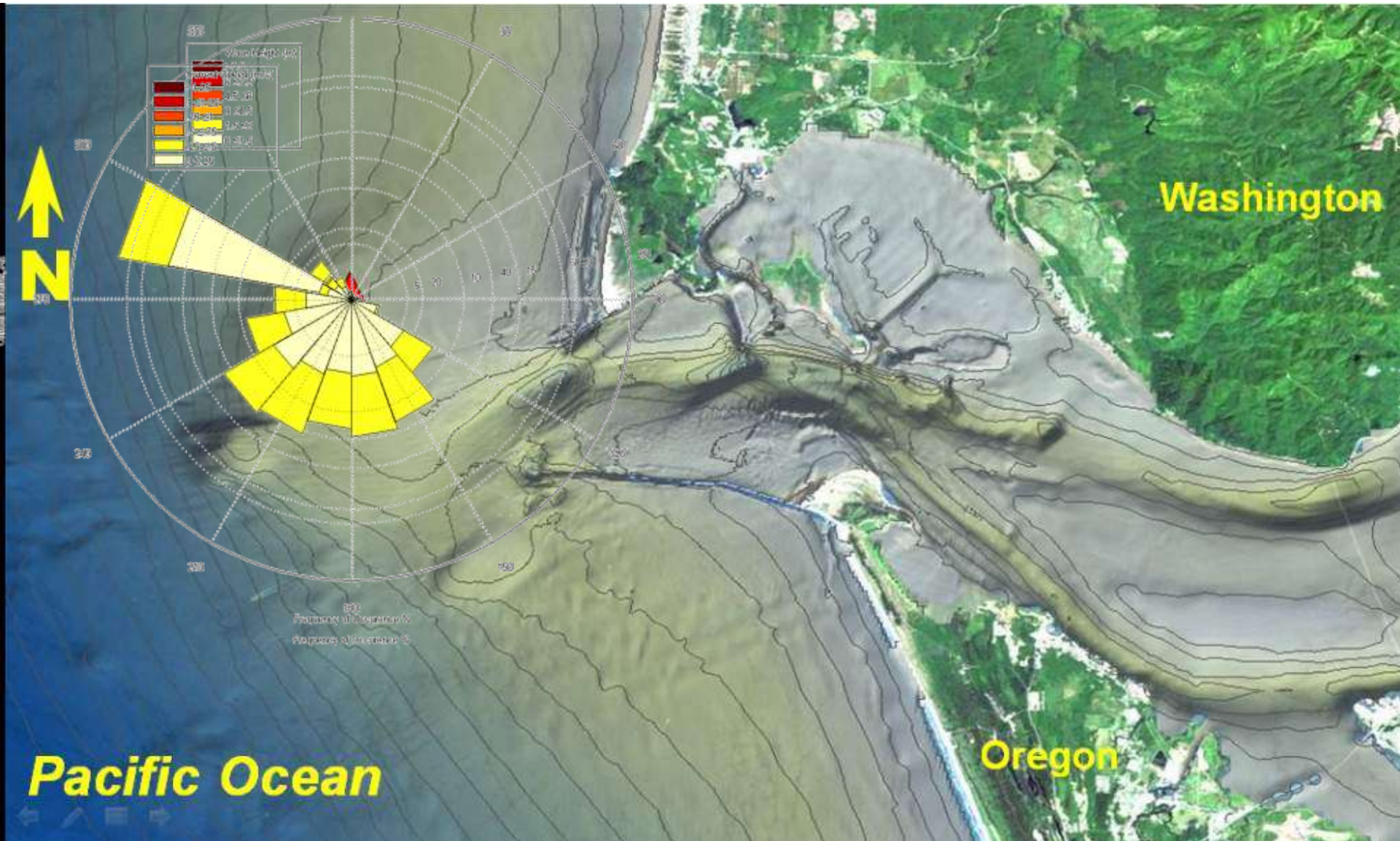


Post-storm: October 26, Benson Beach



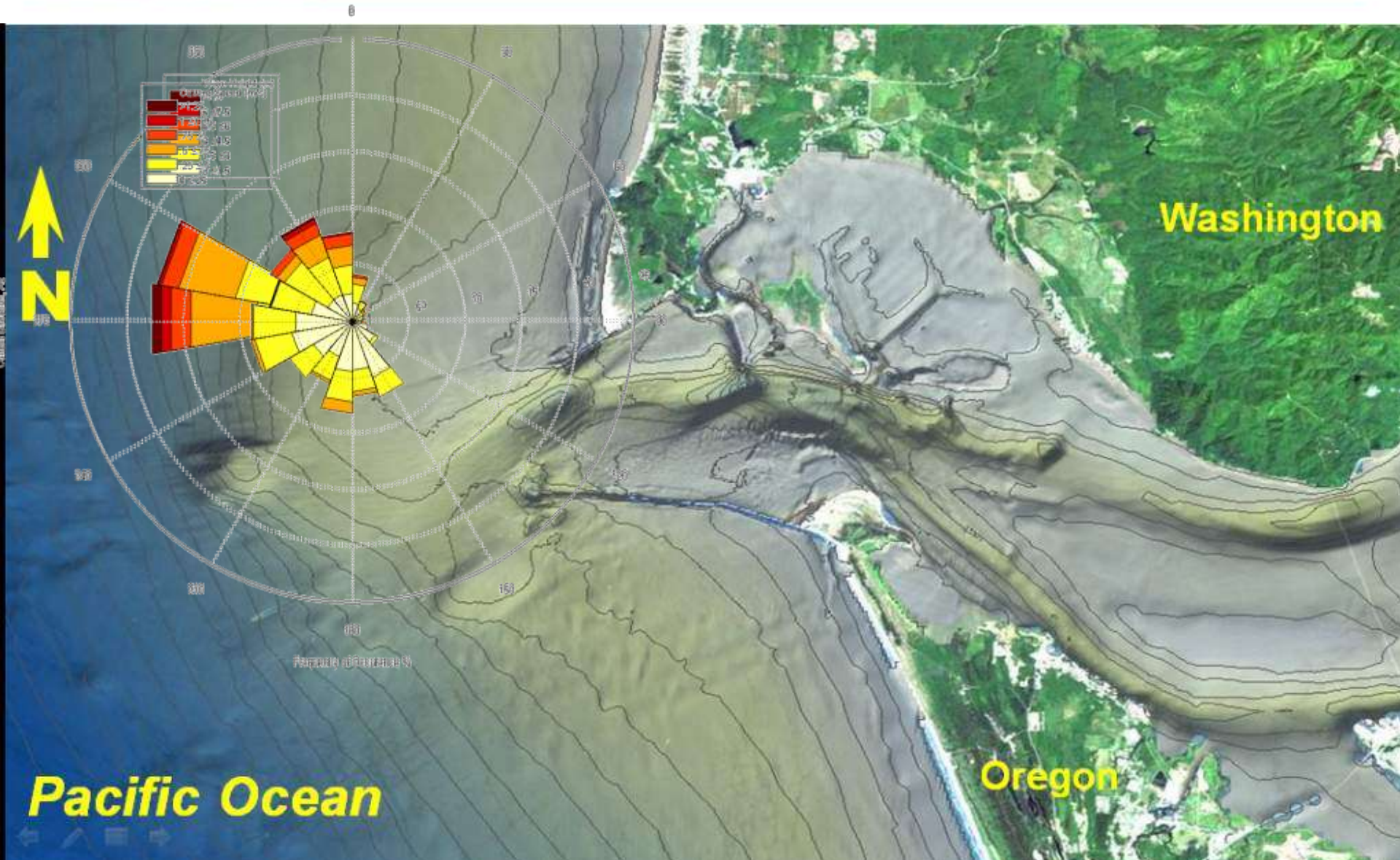


Waves & Currents Aug.-Sept.





Waves & Currents Oct.-Dec.





Summary

- Non-storm conditions (August-September)
 - West-northwest waves $H < 2$ m
 - Tide-dominated southeast-northwest currents
 - Vertically stratified currents as tide changes from ebb to flood
- Storm conditions
 - West and southwest waves $H > 9$ m
 - Current directions modified by wave direction and prevail throughout water column (no stratification) and drive sediment transport even when wave height increase is relatively small (< 3 m)
 - South-southwest wave direction coincides with current and sediment transport to the north-northwest aligned with local bathymetric contours

AWAC performance

- Wave heights measured by AWAC as compared to offshore buoys compare much better than waves measured by ADCP as compared to offshore buoys
- Previously used TRDI ADCP with waves, which showed sporadic directional changes up to 60 degrees relative to offshore buoys
- AWAC shows the same pattern in direction and fewer outliers as compared to the ADCP
- Incident wave direction is a key factor in controlling wave height and current circulation due to sheltering effects of jetties and shoals at MCR
- Important to be as accurate as possible

Thank You!



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