Ongoing Ocean Station P Time Series

Meghan F Cronin (NOAA PMEL): surface & ADCP moorings, met&physical sensors

Steven R Emerson (UW): pH and GTD-CTD-O_2 sensors

Seth Bushinsky (UW): pH and GTD-CTD-O_2 sensors

Christopher L Sabine (NOAA PMEL): air-sea pCO_2 system

Marie Robert (IOS): Line P Program

Frank Whitney (IOS): Line P Program

Matthew H Alford (UW APL): ADCP mooring, narrowband ADCP

Jody Klymak (U. Victoria, BC.): ADCP mooring, longranger ADCP

Jeffrey A Nystuen (UW APL): passive aquatic listening device

Eric A D'Asaro (UW APL): waverider mooring

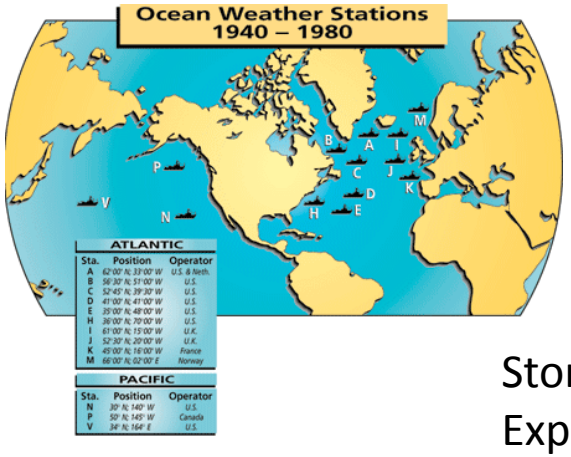
James M. Thomson (UW APL): waverider mooring

Ramsey R. Harcourt (UW APL): waverider mooring

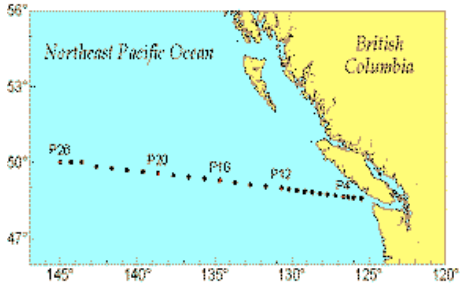
Charles C. Eriksen (UW): glider

60 years at Station P

Ocean Weather Ship Papa
Dec 1949 – Aug 1981



P-Line Program
Aug 1981 - ongoing



PMEL mooring
2007 - ongoing

Storm Response Experiment (STREX) 1980

Subarctic Pacific Ecosystem Research (SUPER) 1984

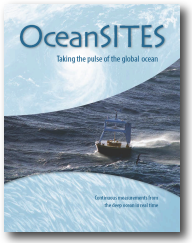
Mixed-Layer Experiment (MILE) 1972

Ocean Storms Fall 1987

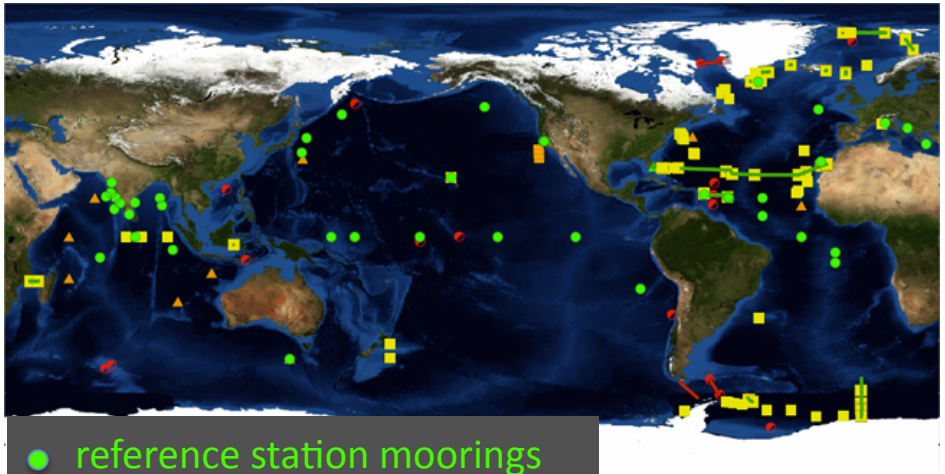
PMEL mooring 1997-1999

1950 1960 1970 1980 1990 2000 2010

Station P is part of the global network of OceanSITES time series reference sites



http://www.oceansites.org



- reference station moorings as of 2009

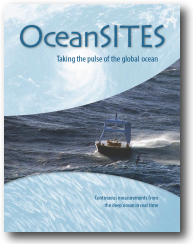
Station P is also a global node in the Ocean Observatory Initiative (OOI)

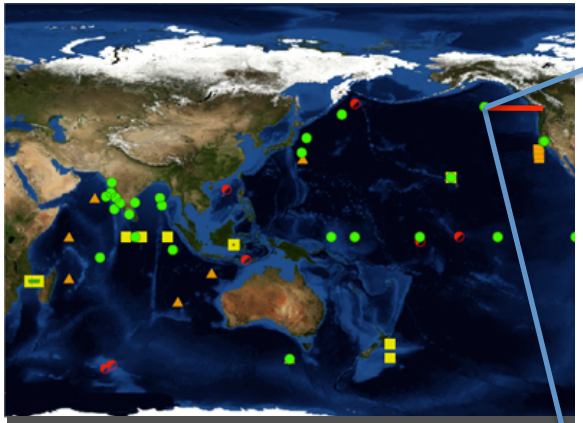
http://www.oceanobservatories.org/

CONSORTIUM FOR Ocean Leadership
DISCOVERY • UNDERSTANDING • ACTION

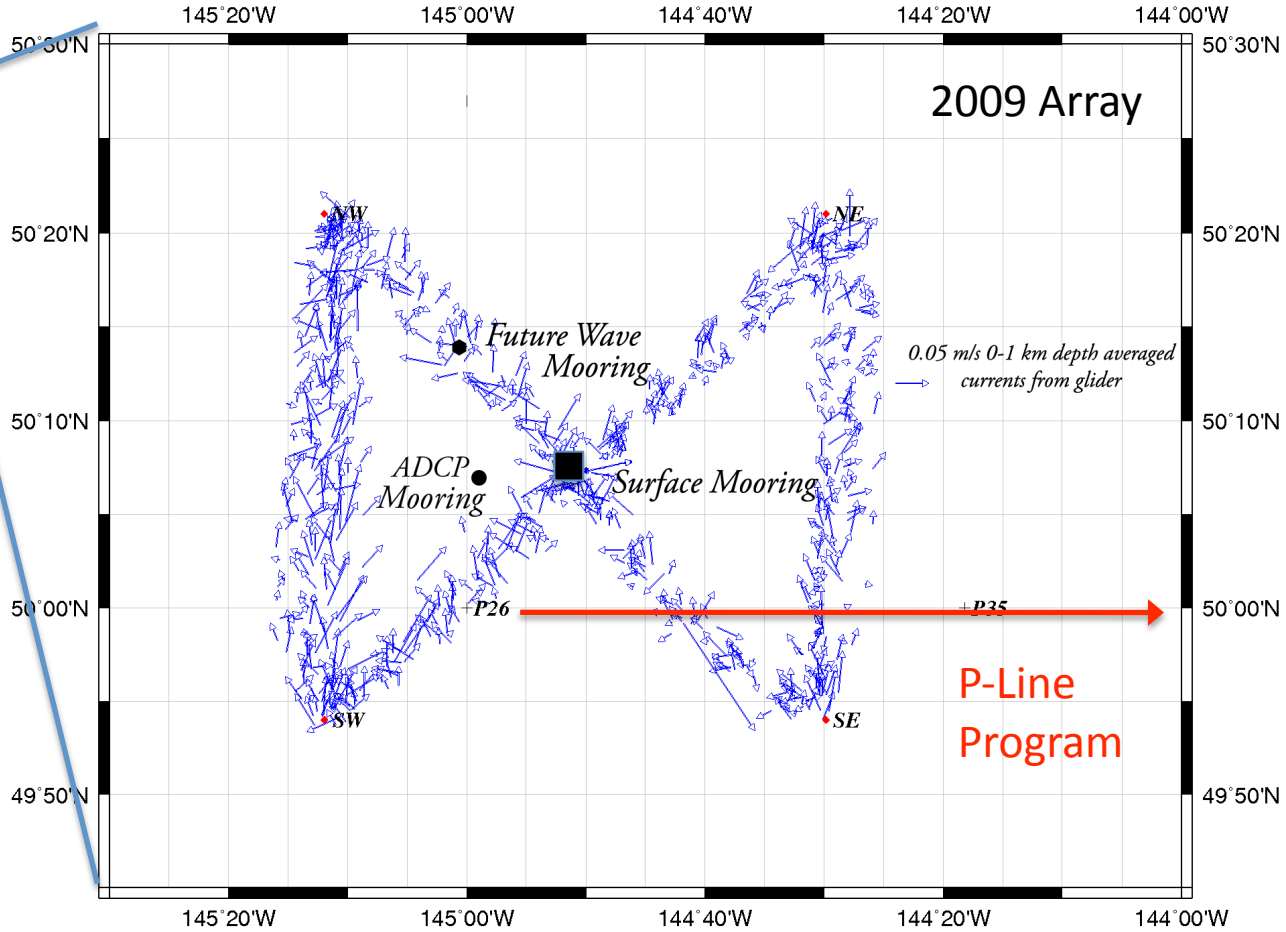
Station P is part of the global network of OceanSITES time series reference sites

http://www.oceansites.org





- reference station moorings as of 2009



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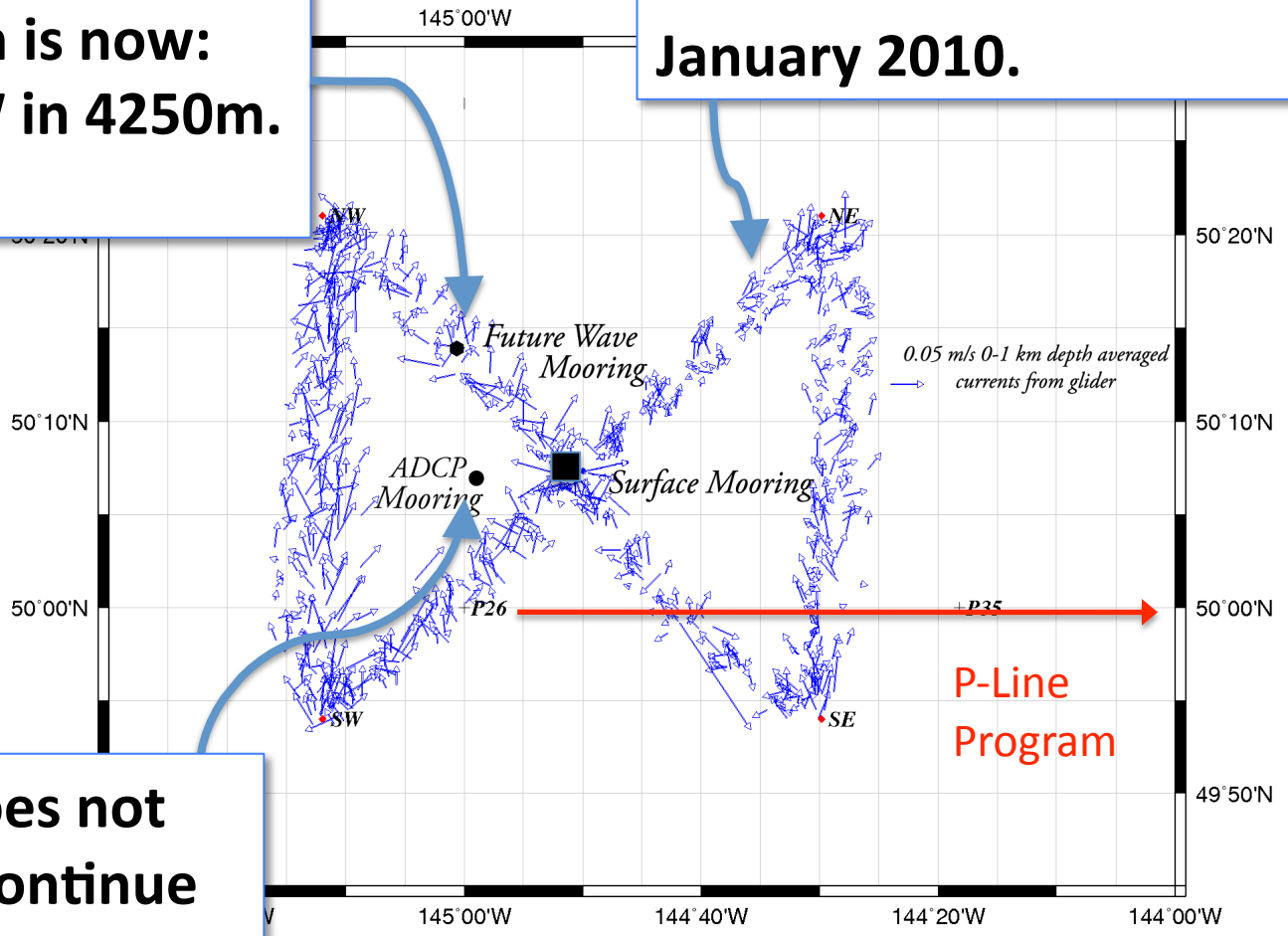
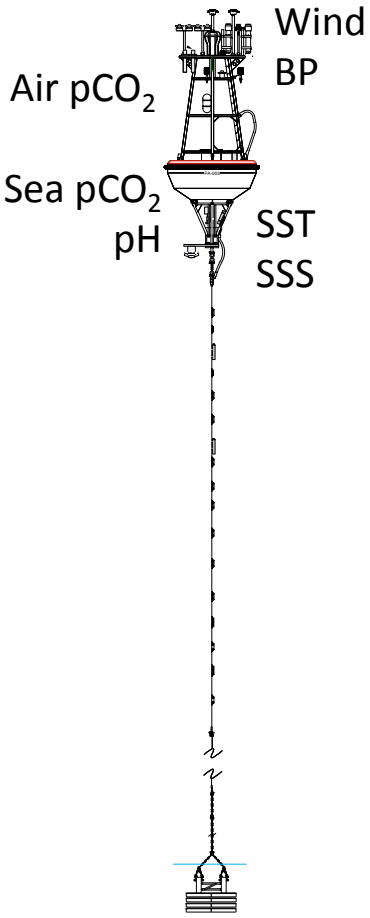
New wave rider mooring will be deployed in June 2010. Proposed location is now: 49˚ 59’N 145˚ 6’W in 4250m. OK?

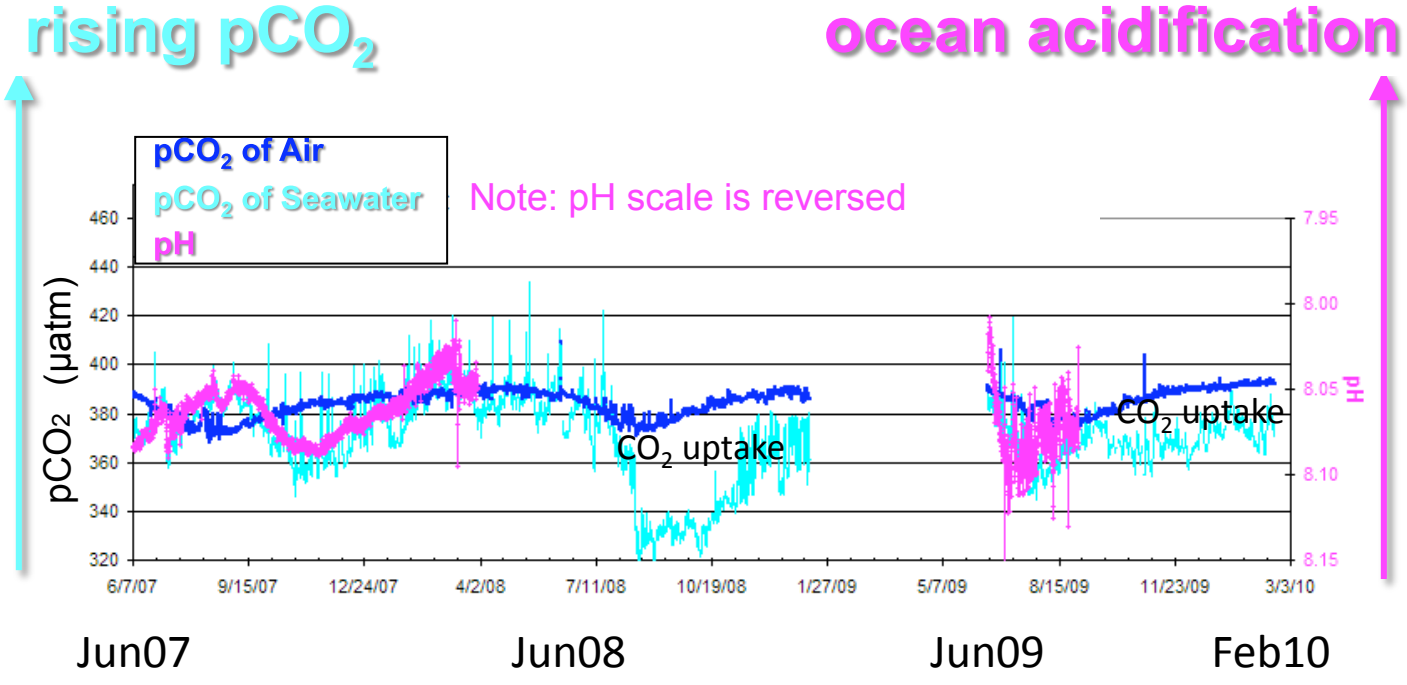
Glider mission ended in January 2010.



ADCP mooring does not have funding to continue and will not be redeployed in June 2010.

The primary purpose of the surface mooring is to monitor the carbon cycle and ocean acidification



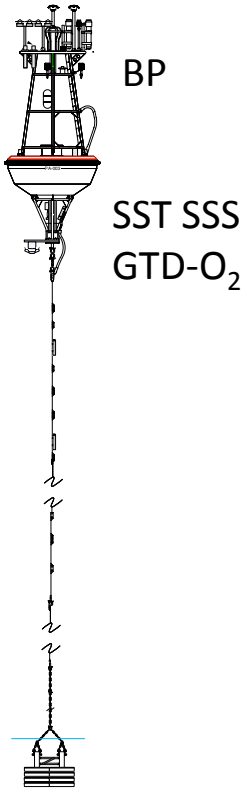


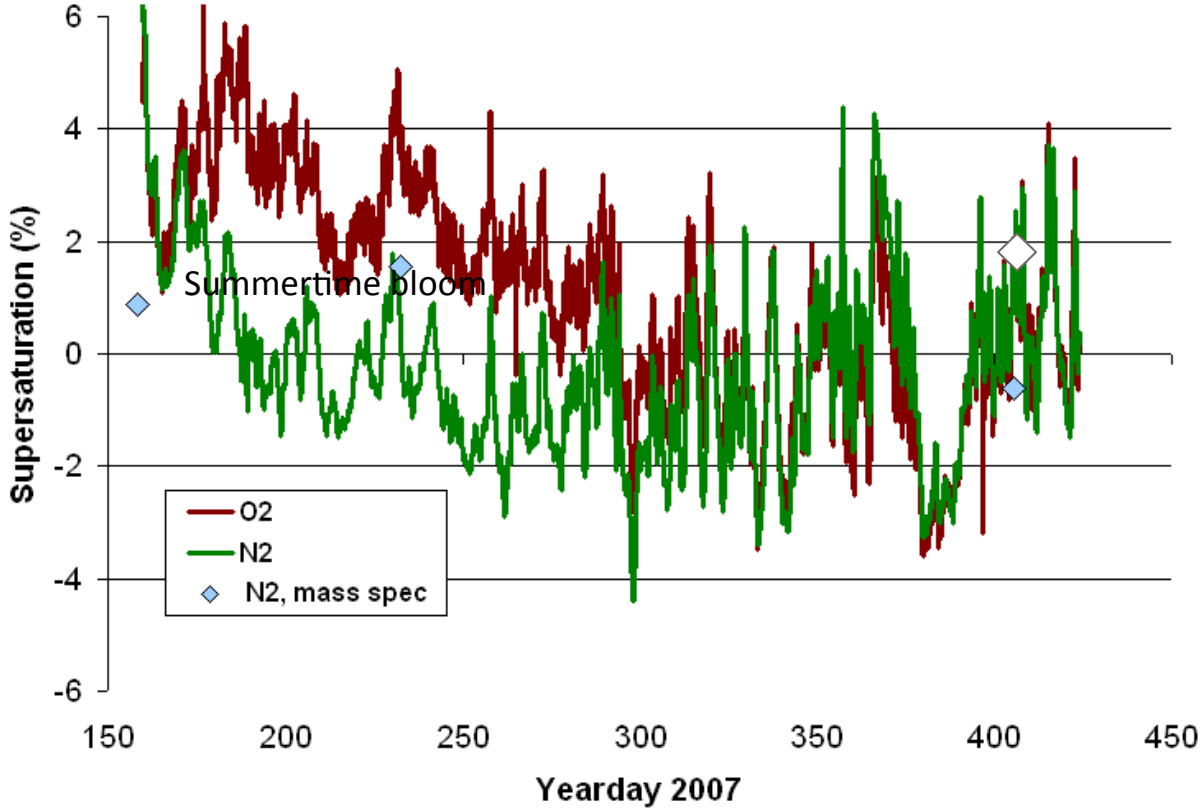
pCO_2 -- Chris Sabine

pH -- Steve Emerson and Mike deGranpre

Total gas pressure, O_2 and T&S data are used to compute N_2 and O_2 supersaturations.

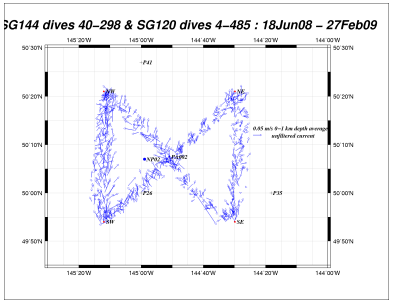
$\Delta O_2 - \Delta N_2$ is used to get net biological production of O_2 that draws down CO_2 during photosynthesis.

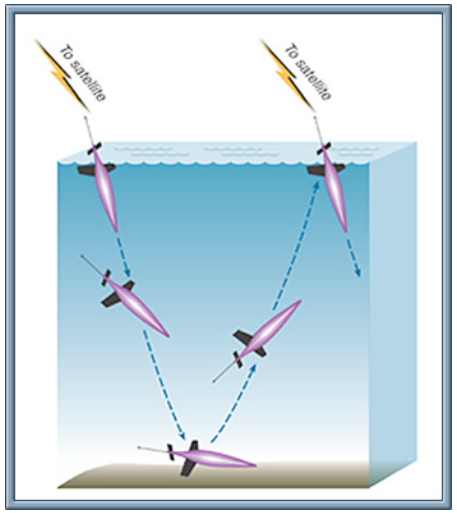




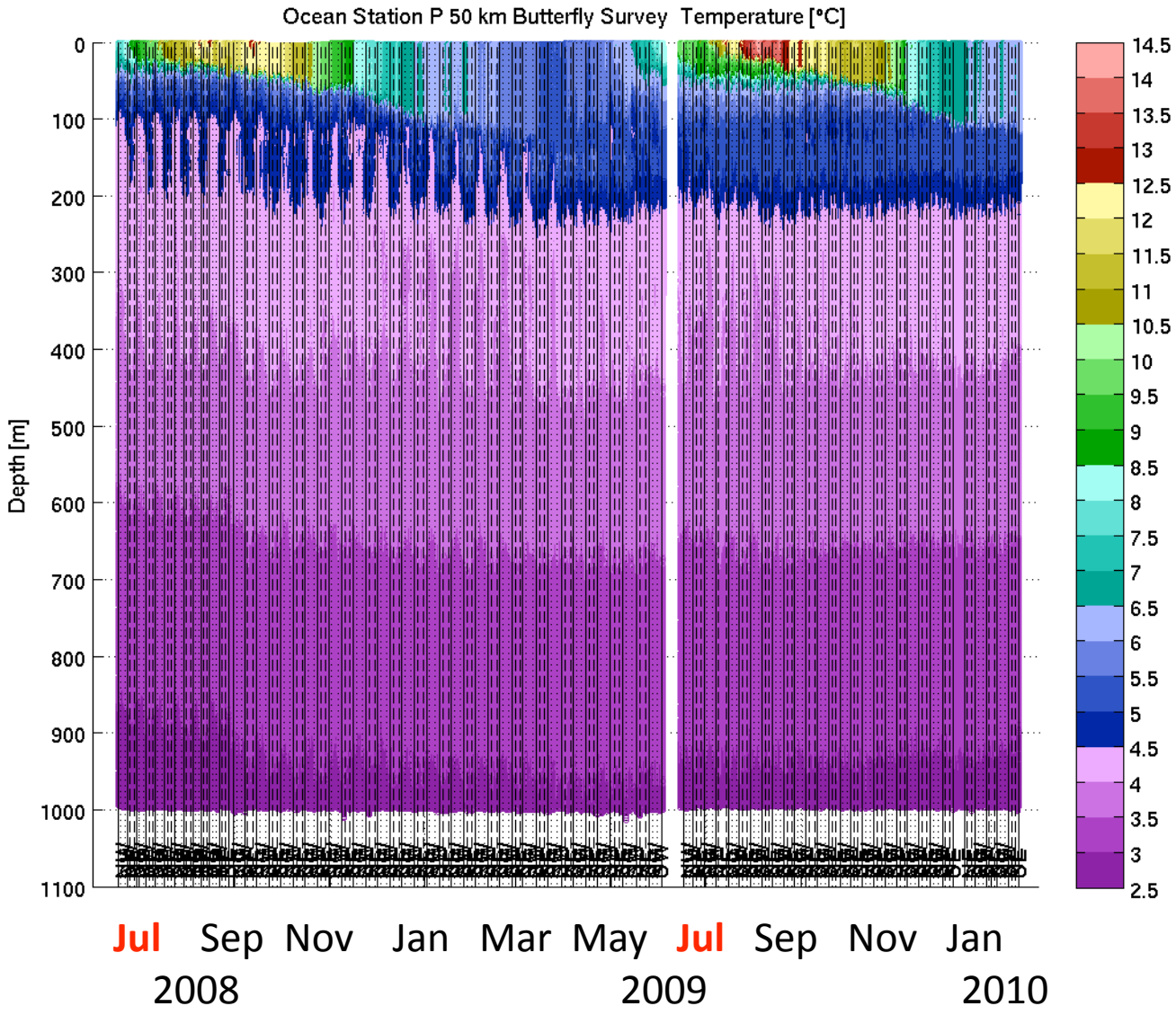
Gas Tension Device-O_2-CTD – Emerson

Spatial variations are monitored by glider, P-Line cruises, satellites and Argo floats

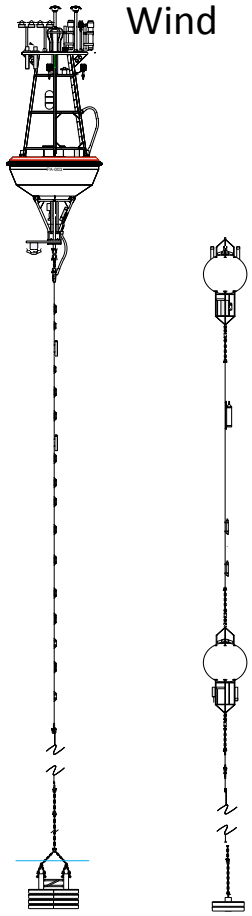




Seaglider -- Eriksen



Use currents to estimate advection.
Currents are strongly forced by winds and show deep penetration of wind-generated near-inertial waves

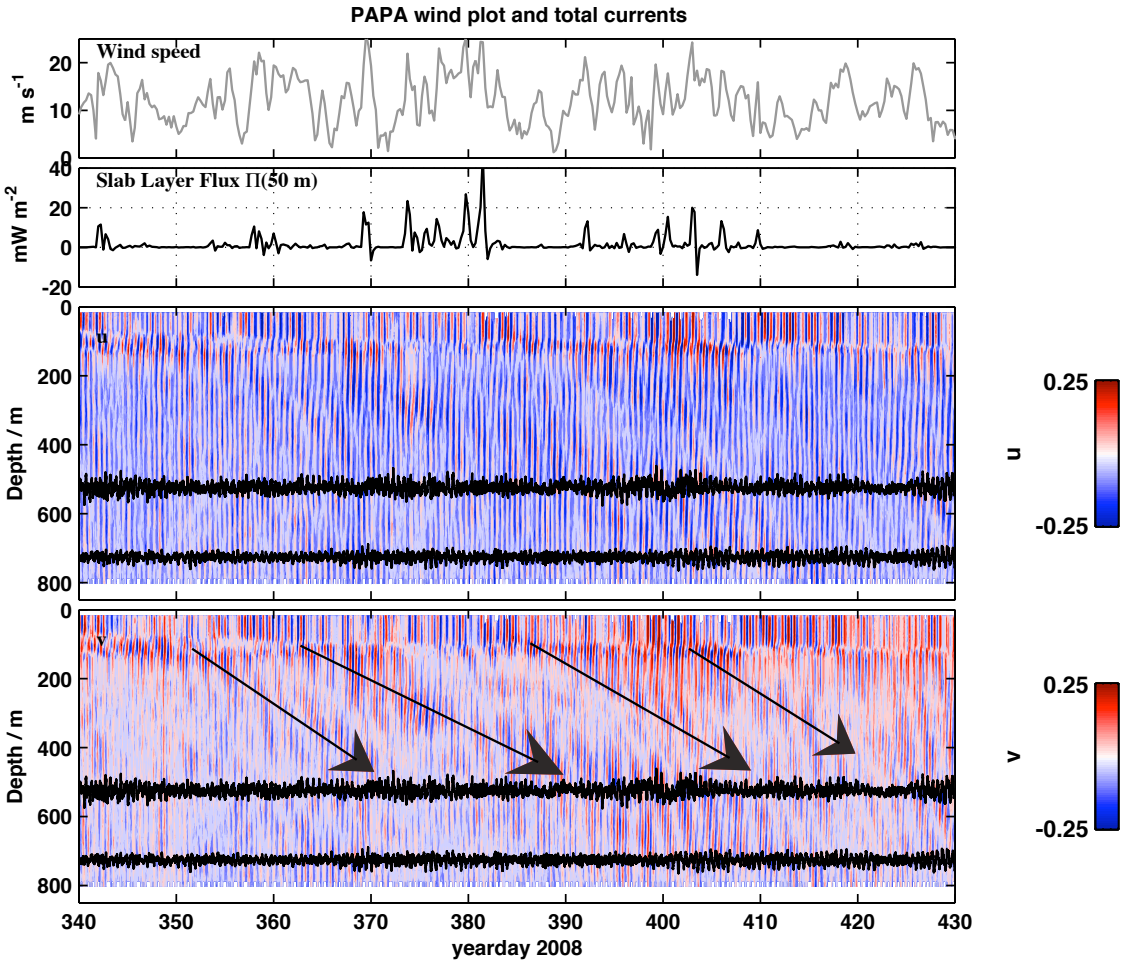


Wind

Narrowband
ADCP at 154m

TCP at 519m
TCP at 719m

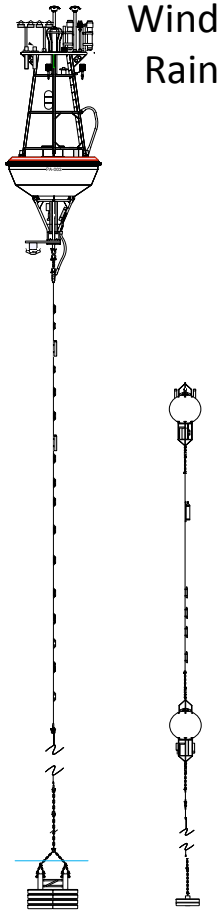
Longranger
ADCP at 835m



Currents – Alford, Cronin, Klymak

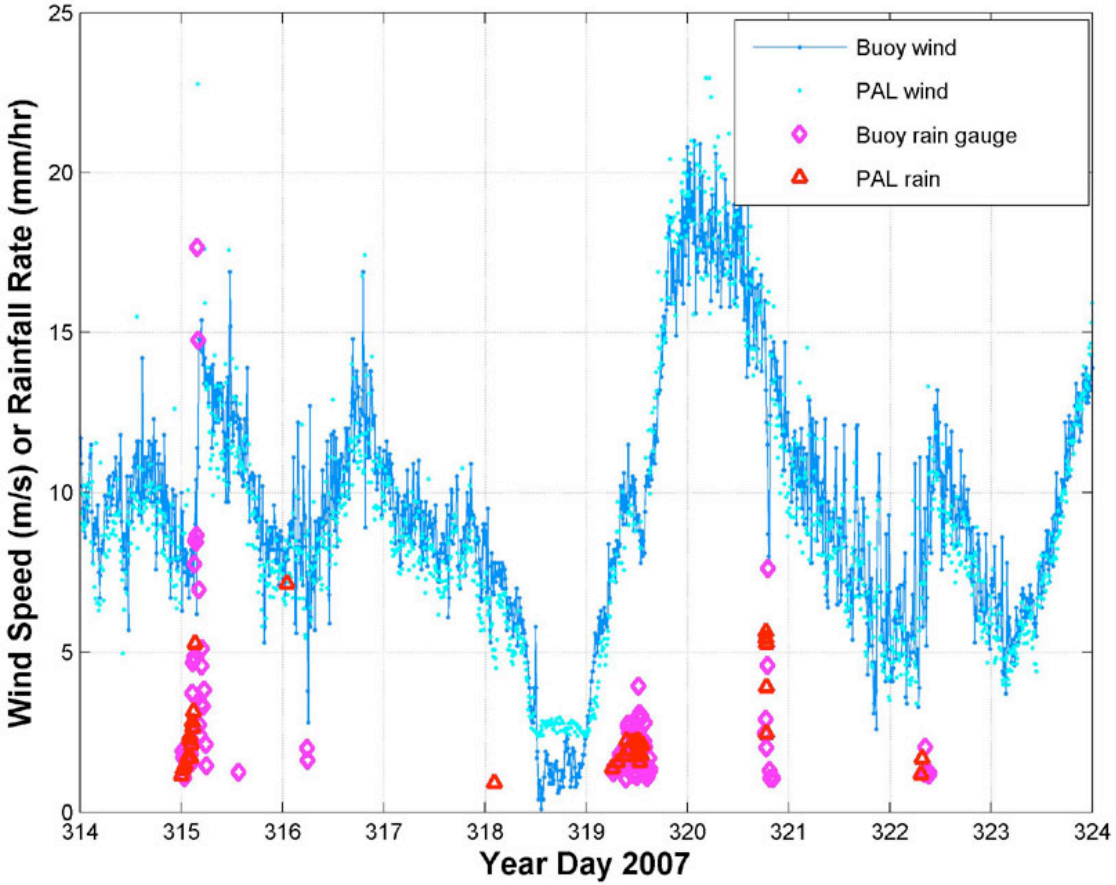
December – January – February

The moorings provide a testbed for new sensors, such as the Passive Aquatic Listening device that uses sound to measure rain, wind, bubbles, marine life and ship traffic.



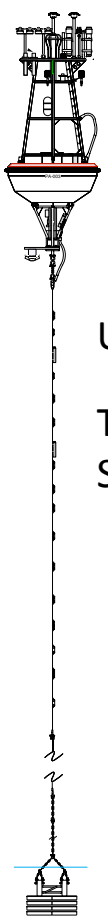
Wind
Rain

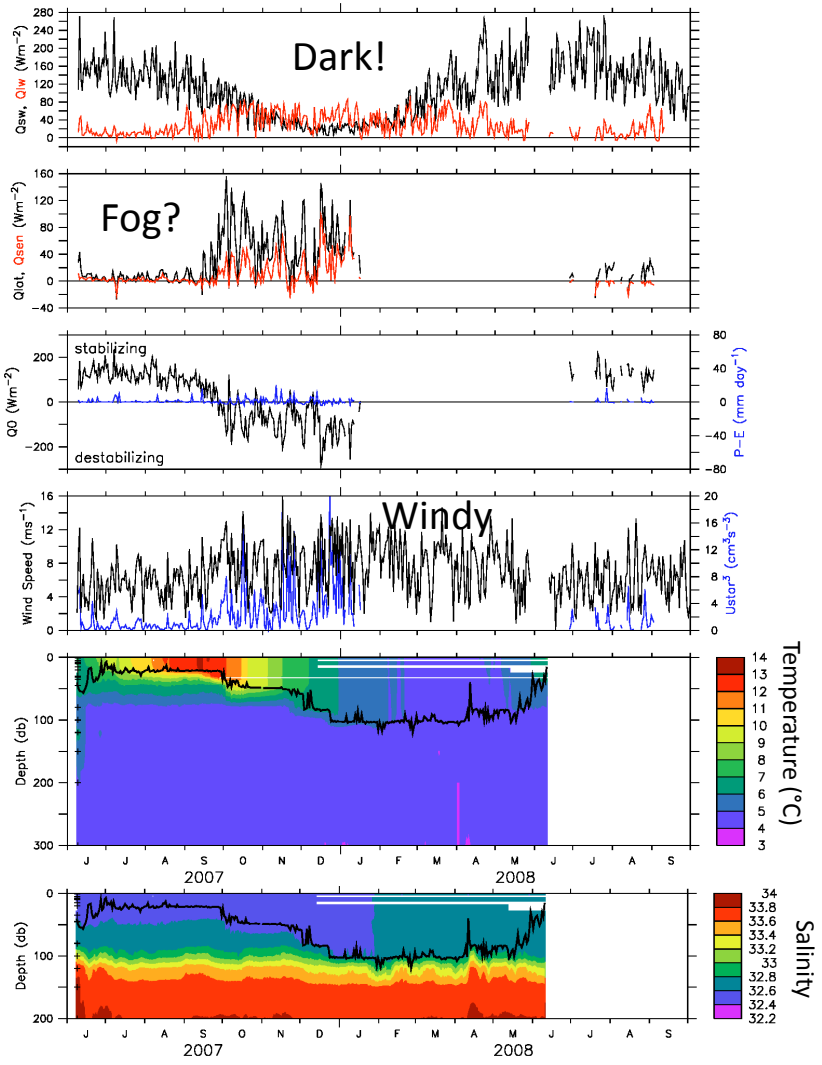
PAL (at present) nb. in 2010, PAL will be deployed on waverider mooring.



Passive Aquatic Listening Device – Nystuen

Meteorological data are used to compute air-sea heat, moisture and momentum fluxes, for analysis of the mixed layer heat and freshwater budgets.





Met and upper ocean T,S, UV – Cronin

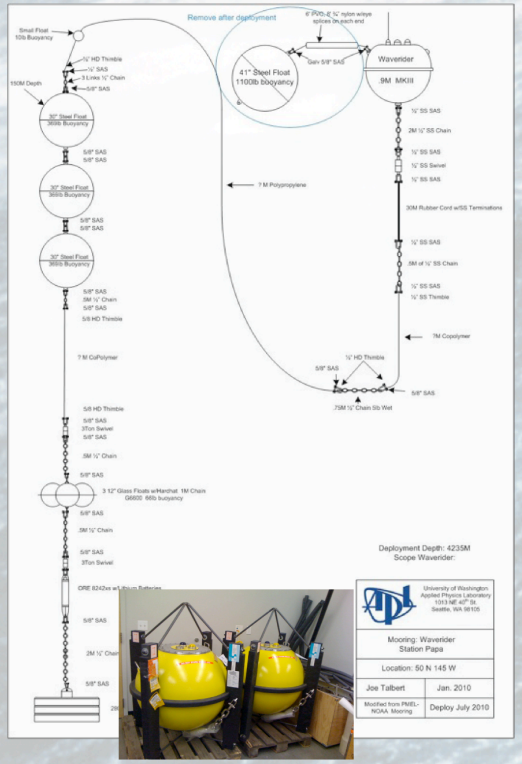
Wave Impacts Project at OWS Papa

Eric D'Asaro, Jim Thomson, Ramsey Harcourt, Andrey Shcherbina

Can we improve mixed layer models by including waves?

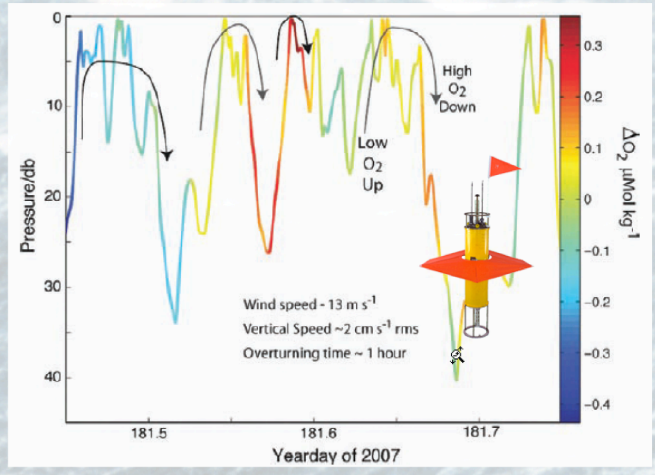
WAVES

High quality directional wave spectra at OWS-P
June 2010 - June 2013



TURBULENCE

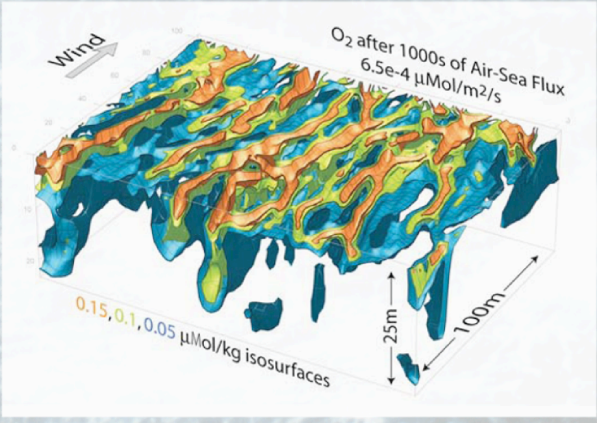
Lagrangian Float Deployments
Detailed Wave Measurements
October 2012



Proposed Gas flux Measurements
Winters 2011 2012

THEORY

Large Eddy Simulations



Improved
Boundary Layer Models

$$\frac{\mathrm{D}}{\mathrm{D}t}(q^2) - \frac{\partial}{\partial z}\left[q\ell S_q \frac{\partial}{\partial z}(q^2)\right] = -2\overline{uw}\left(\frac{\partial U}{\partial z} + \frac{\partial u_S}{\partial z}\right) - 2\overline{vw}\left(\frac{\partial V}{\partial z} + \frac{\partial v_S}{\partial z}\right) + 2\beta g\overline{w\theta} - 2\frac{q^3}{B_1\ell}$$

$$\frac{\mathrm{D}}{\mathrm{D}t}(q^2\ell) - \frac{\partial}{\partial z}\left[q\ell S_1 \frac{\partial}{\partial z}(q^2\ell)\right] = E_1\ell\left(-\overline{uw}\frac{\partial U}{\partial z} - \overline{vw}\frac{\partial V}{\partial z}\right) + E_6\ell\left(-\overline{uw}\frac{\partial u_S}{\partial z} - \overline{vw}\frac{\partial v_S}{\partial z}\right) + E_3\ell_*(\beta g\overline{w\theta}) - E_2\frac{q^3}{B_1}\left[1 + E_4\left(\frac{\ell}{\kappa\ell_w}\right)^2\right] + E_5(2\Omega)q^2\ell$$

Summary

Station P surface mooring carries a suite of sensors to monitor the bulk air-sea, heat, moisture, momentum and carbon dioxide, and key variables in the upper ocean budgets.

The mooring is part of the network of OceanSITES time series reference stations. Some instruments and components are funded through research grants and are not necessarily part of the sustained observing system. All data are publicly available and collaborations are welcome. http://www.pmel.noaa.gov/stnP/

Hourly subsurface data are telemetered. Instruments are mounted on the line and MUST BE relatively small and aerodynamic.

Tully June 2010 Summary

Station P surface mooring needs to be turned around: Deploy Papa-2010 and Recover Papa-2009.

ADCP mooring needs to be recovered. It will not be redeployed.

Waverider mooring will need to be deployed.

Keith Ronnholm and Michael Craig (both from PMEL) will participate in the Tully June 2010 cruise to perform these mooring operations.

Thank you !!!