

# PMEL Ocean Climate Station Program

Meghan Cronin, Chris Sabine, Chris Meinig  
NOAA Pacific Marine Environmental Laboratory

<http://www.pmel.noaa.gov/OCS/>

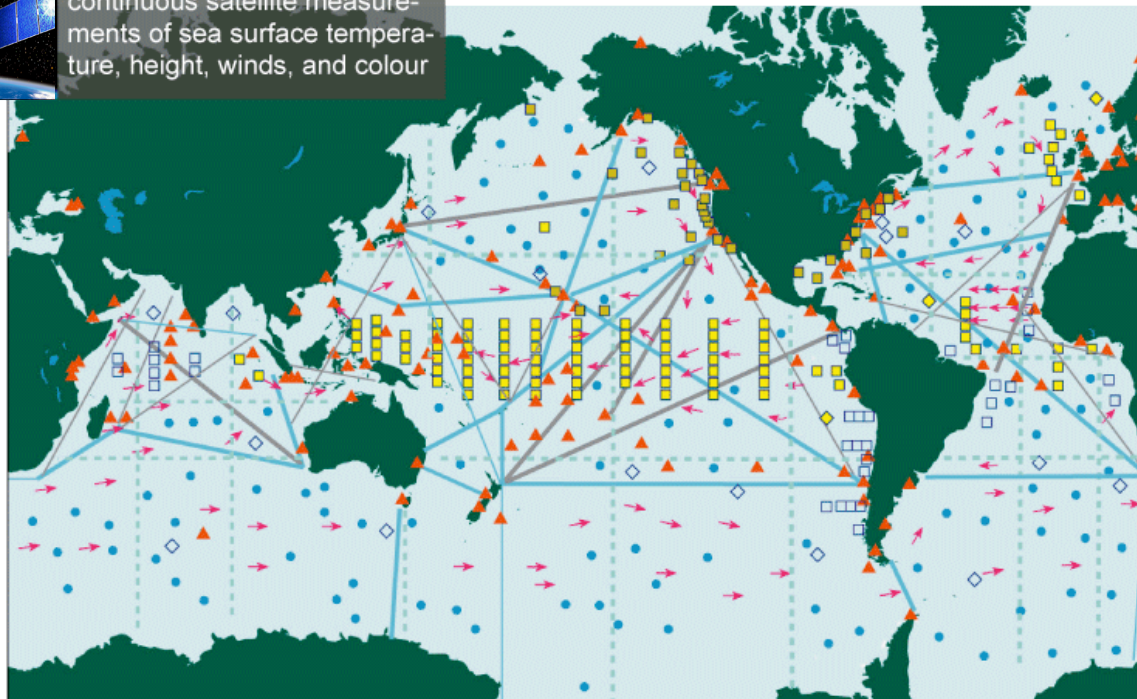


Total *in situ* networks (Feb 08)

60%



continuous satellite measurements of sea surface temperature, height, winds, and colour



48% Global **reference mooring** network

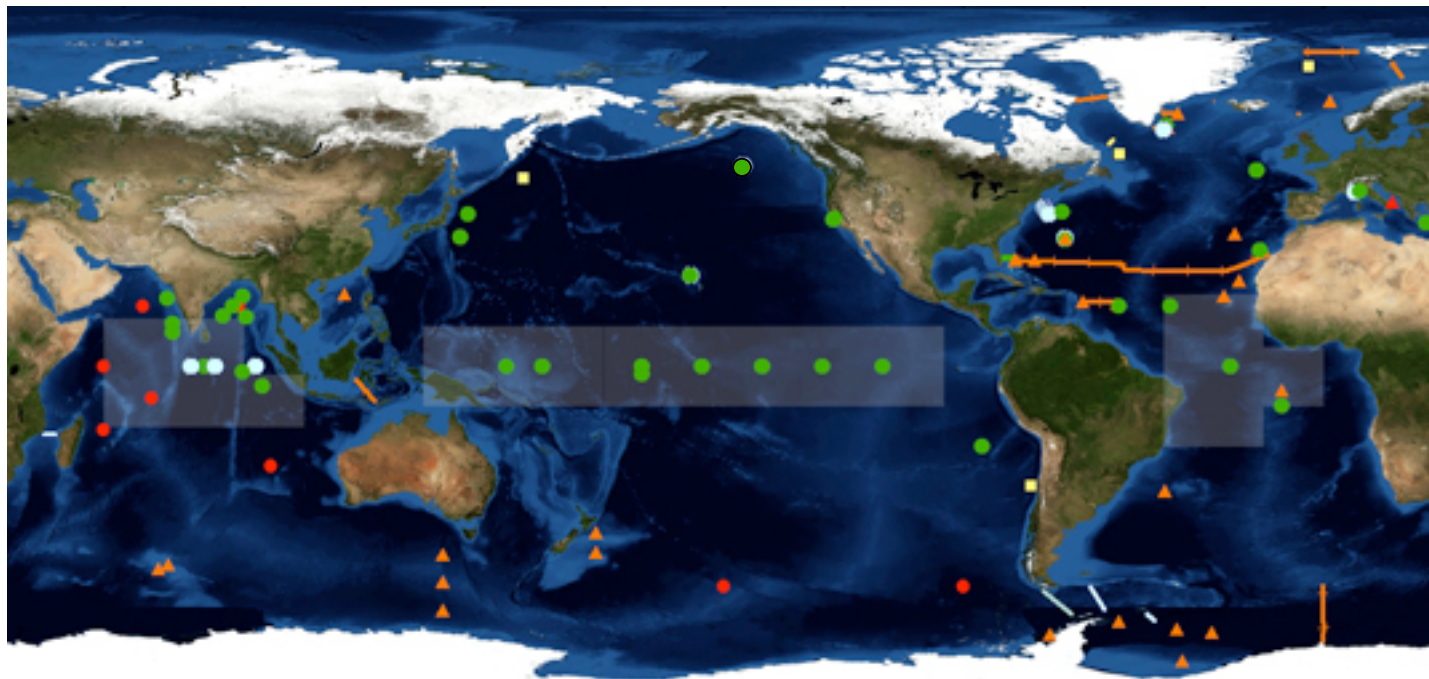


29 moorings planned

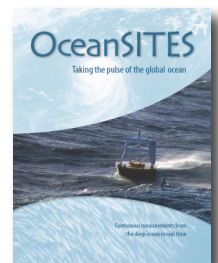


**PMEL Ocean Climate Stations are  
a contribution to the global network of  
OceanSITES timeseries reference sites**

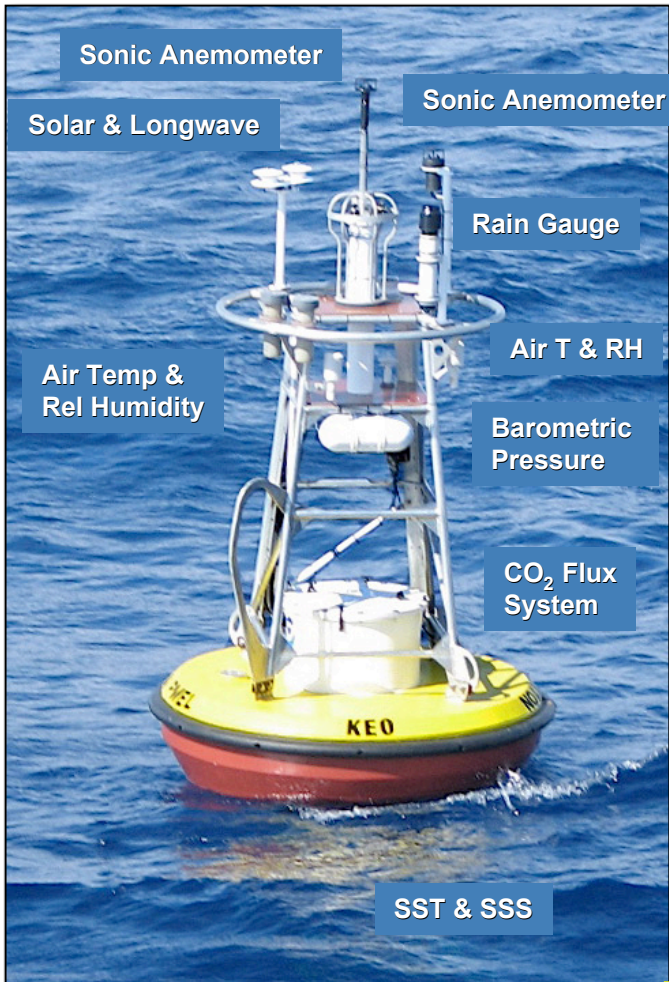
## **OceanSITES network**



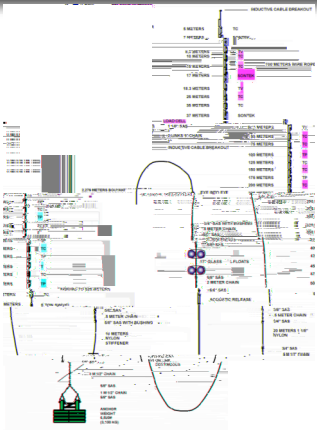
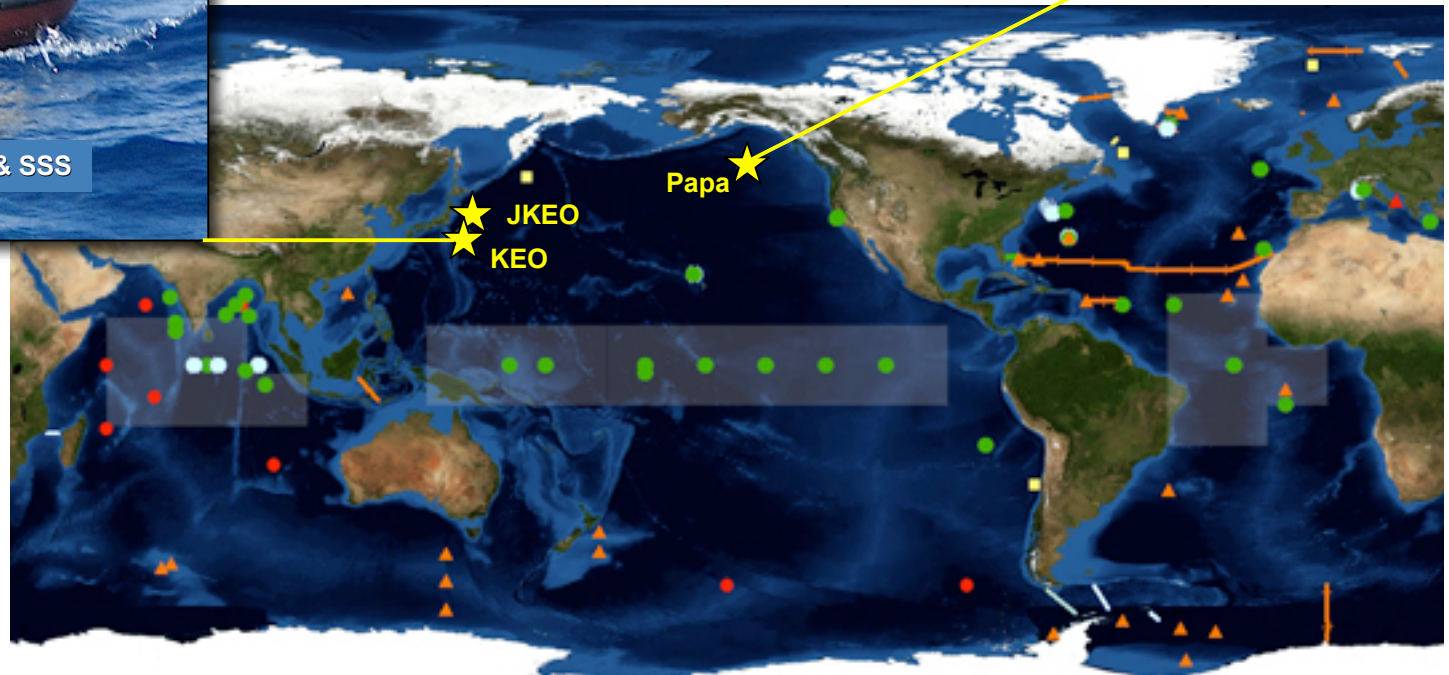
- Existing flux reference sites
- Planned flux reference sites



<http://www.oceansites.org/>



***NOAA PMEL Ocean Climate Stations have been engineered to survive and to continue monitoring air-sea interactions during extreme weather and ocean conditions.***



Total *in situ* networks (Feb 08) **60%**

### **NOAA Strategic Plan - Mission Goal (Climate):**

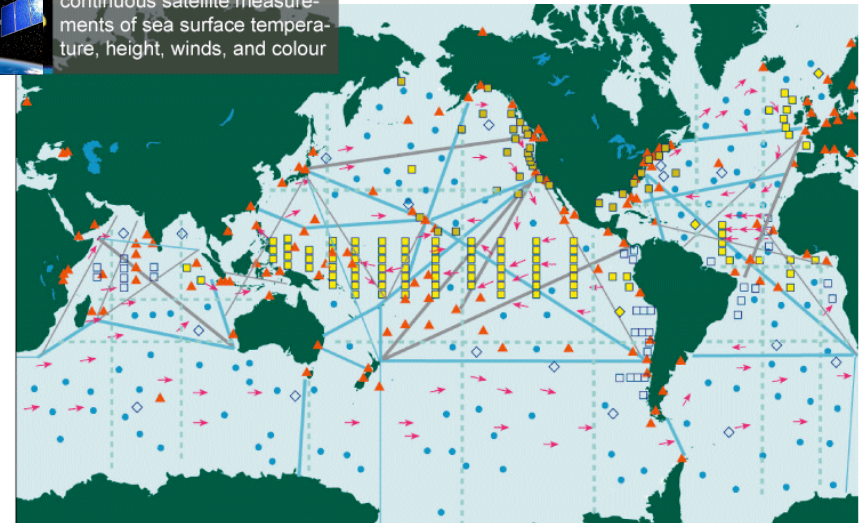
A predictive understanding of the global climate system on time scales of weeks to decades, with quantified uncertainties sufficient for making informed and reasoned decisions.

### **NOAA Research Plan - (Climate goal):**

Develop an integrated global observation and data management system for routine delivery of information, including attribution of the state of the climate.



continuous satellite measurements of sea surface temperature, height, winds, and colour



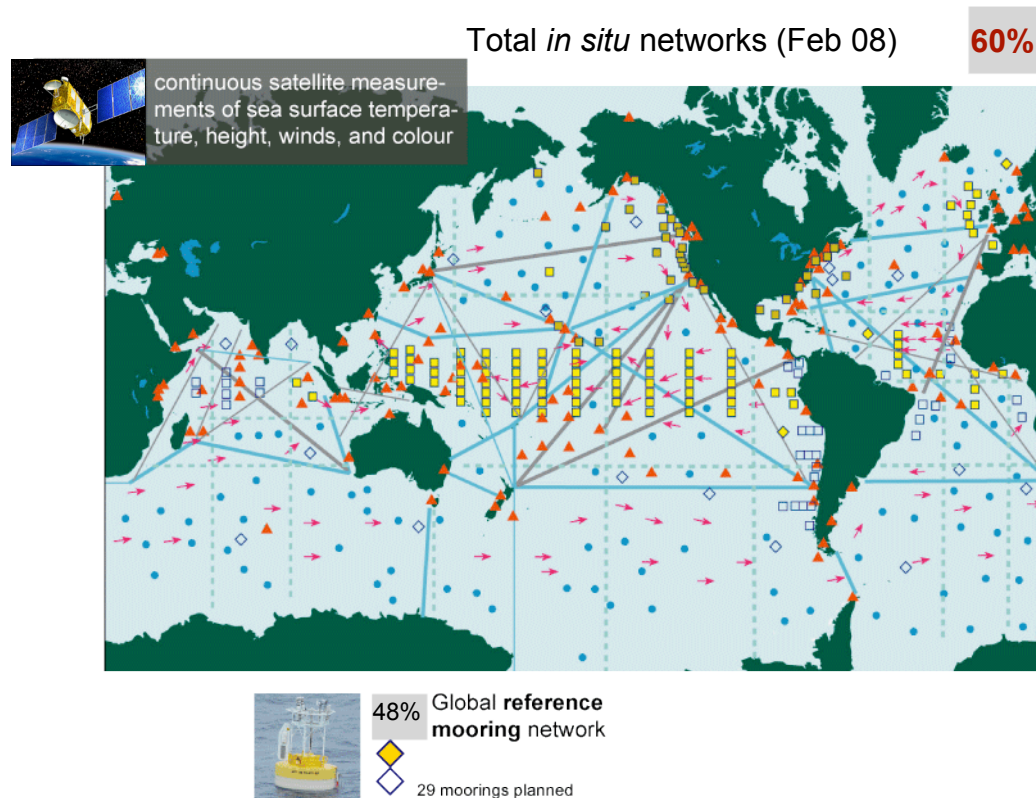
### **Priority Research Activities - (Climate goal):**

- Completing the ocean observing systems. (*OceanSITES time series reference site network*)
- Collecting and delivering regular, systematic, and reliable climate data and information
- Producing reference data sets that provide improved climate information
- Conducting observational, diagnostic, and modeling research to improve understanding of physical mechanisms and processes of climate variability and predictability.

### **PMEL Ocean Climate Station Project Goals:**

- Assess biases and uncertainties in the ocean “weather maps”,
- Detect rapid variations and episodic events, as well as long-term changes in climate system,
- Identify mechanisms and relationships within the climate system.

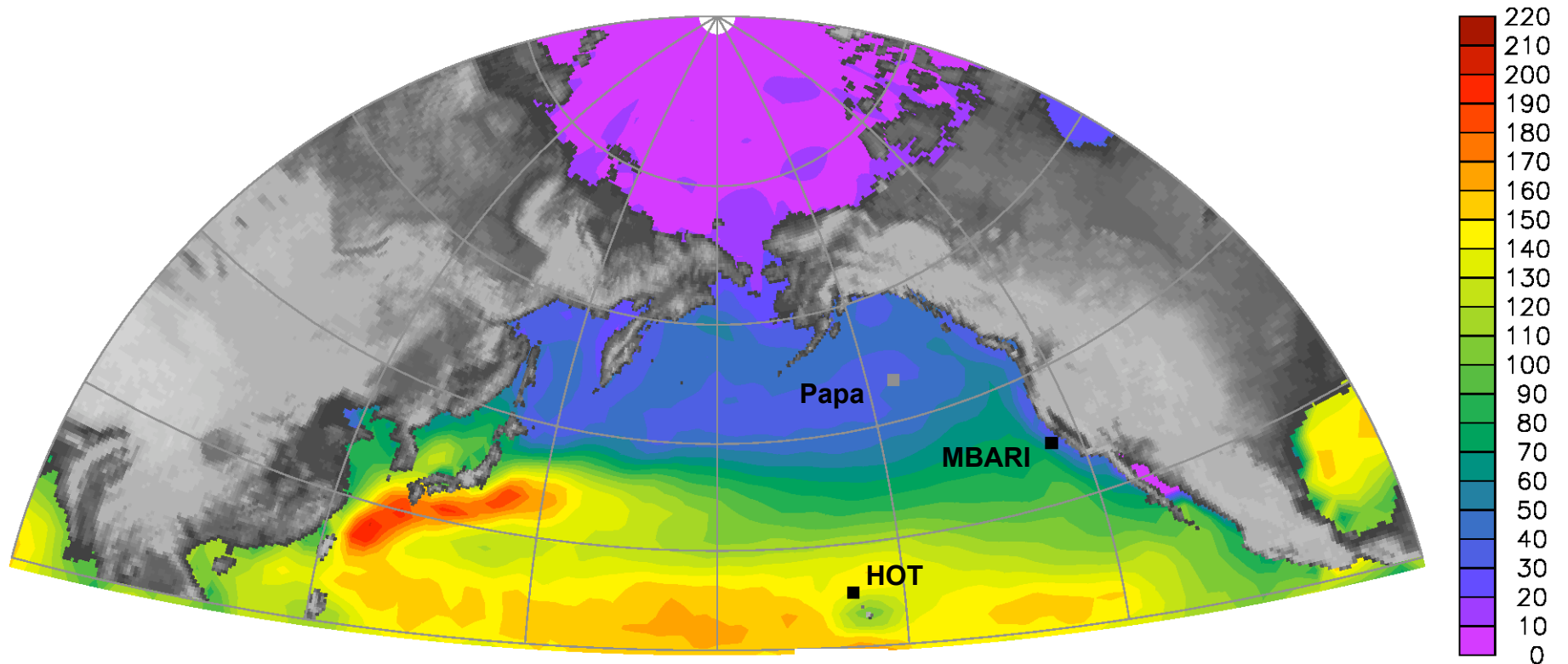
# How will the reference station network be completed?



## Critical factors for starting a new reference station:

- ***Scientific interest in the site***
- ***Feasibility***
- ***Endorsement by international OceanSITES steering panel***

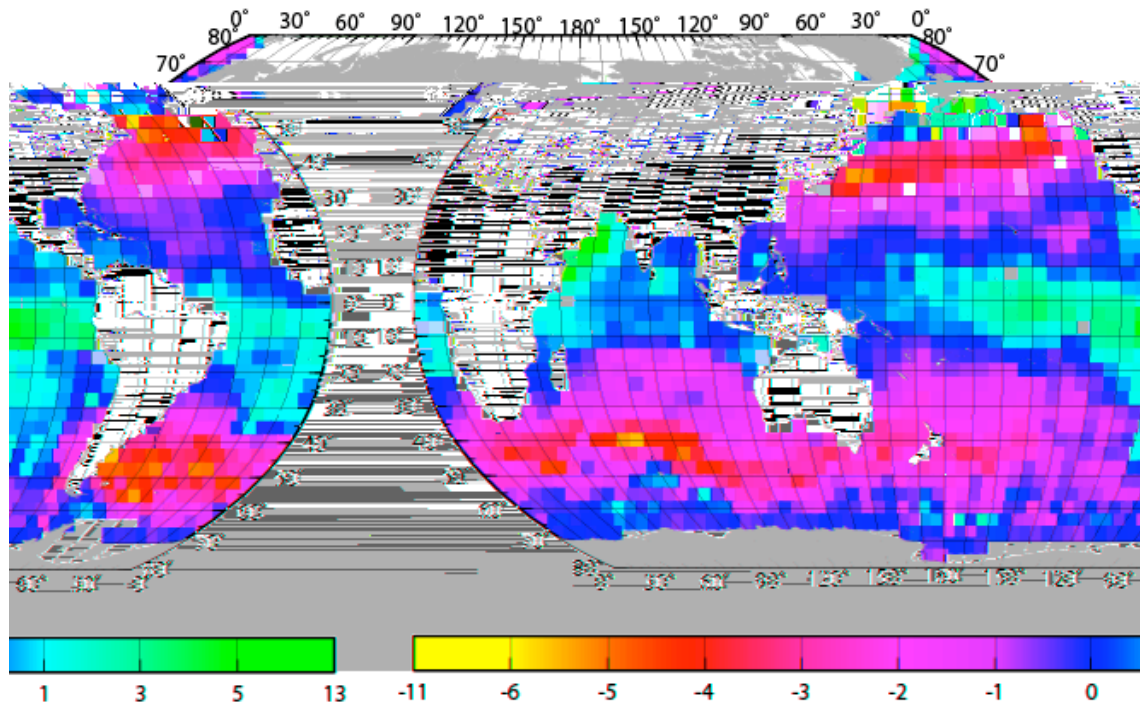
# Cold dry air blowing over warm Kuroshio Extension causes large sensible and latent heat loss



NCEP/NCAR reanalysis annual mean latent heat loss. Units are  $W/m^2$ . OceanSITES network circa 2003.

***What is the fidelity of the heat flux products? How does extremely large heat flux in Kuroshio Extension region affect SST? Mode water formation? Rainfall? Clouds? Storms?***

# The largest sink of carbon in the North Pacific is in the Kuroshio Extension region

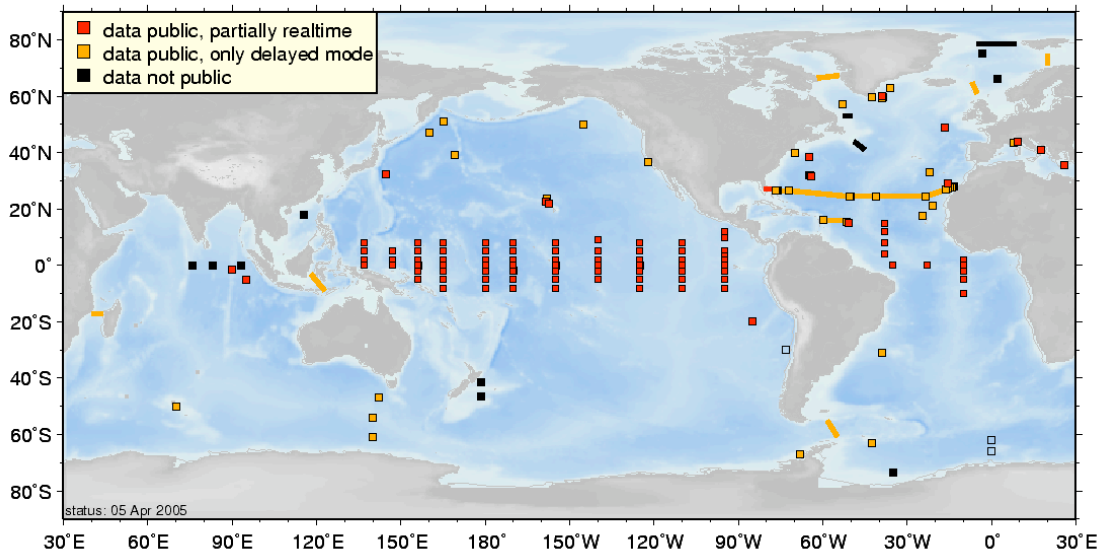


Net Flux (moles CO<sub>2</sub> m<sup>-2</sup> year<sup>-1</sup>) Takahashi et al. DSR 2002

***How is Carbon Flux affected by Kuroshio Extension variations? Mode water formation? What are the roles of physical and biological pumps?***

***What is the influence of these processes on ocean acidification?***

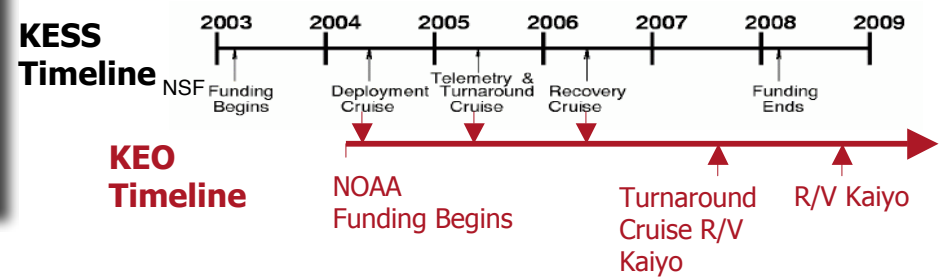
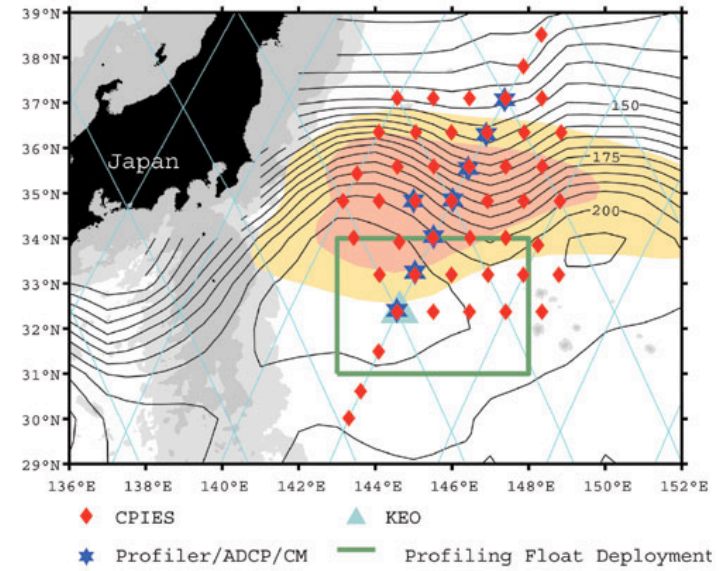
## OceanSITES – near-term (circa 2004)



**KEO is both an element of the global network of OceanSITES time series reference sites...**

**...and an element of the Kuroshio Extension System Study (KESS).  
Moving forward: In 2006, a partnership between PMEL and JAMSTEC was formed to improve the capacity to monitor air-sea interaction in eastern North Pacific.**

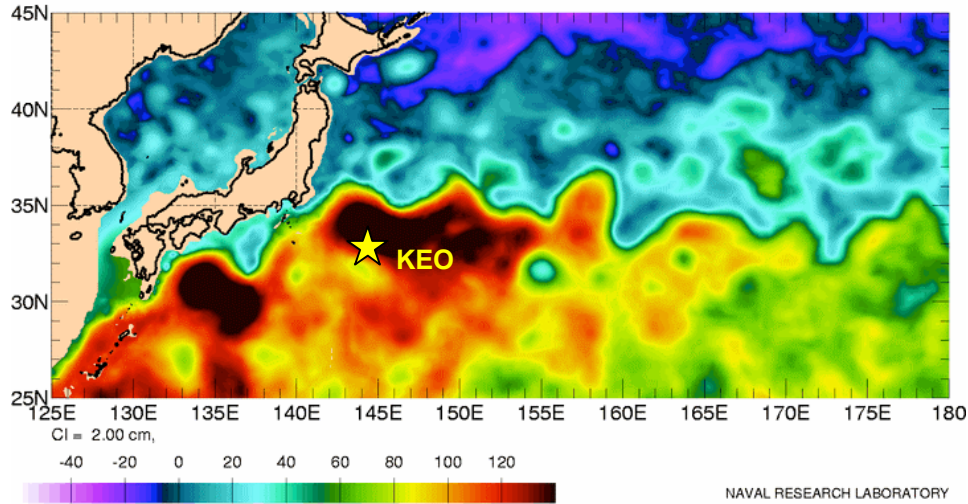
## KESS Observing Array





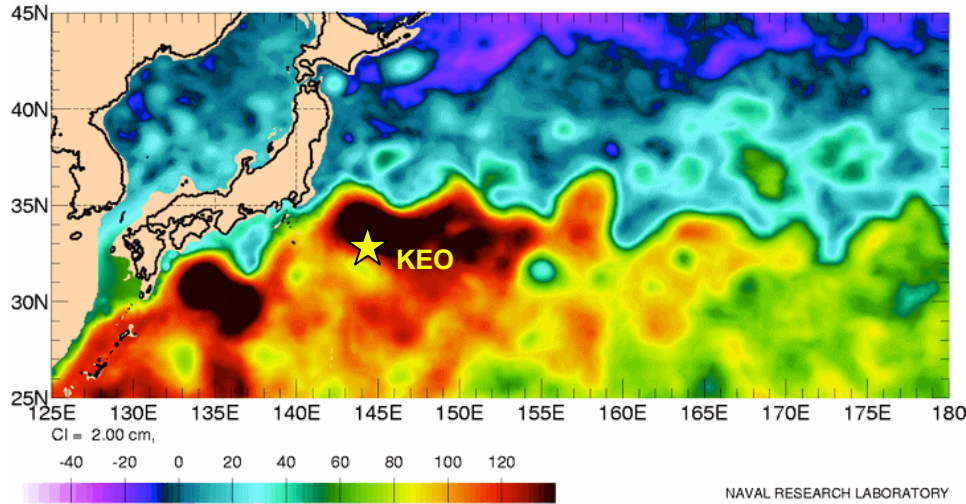
# What is influence of Kuroshio Extension front?

1/32° Global NLOM  
SSH ANALYSIS: 20040806



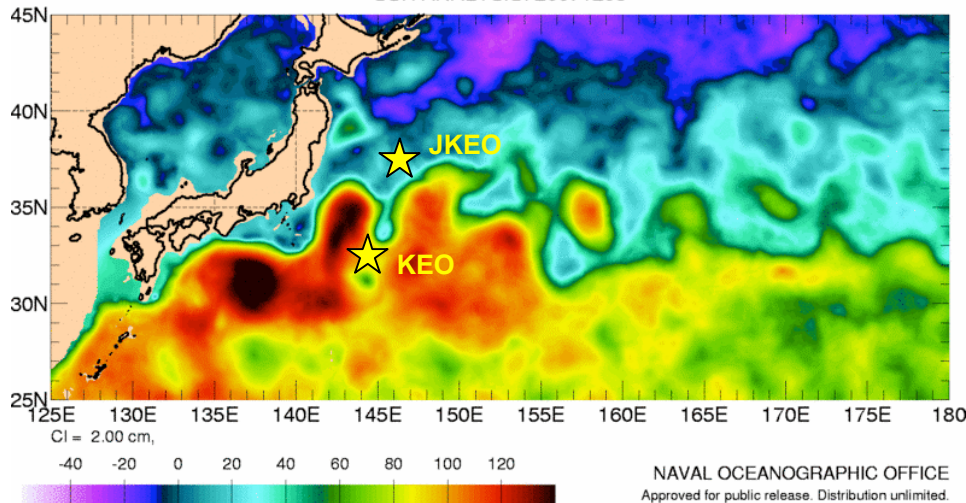
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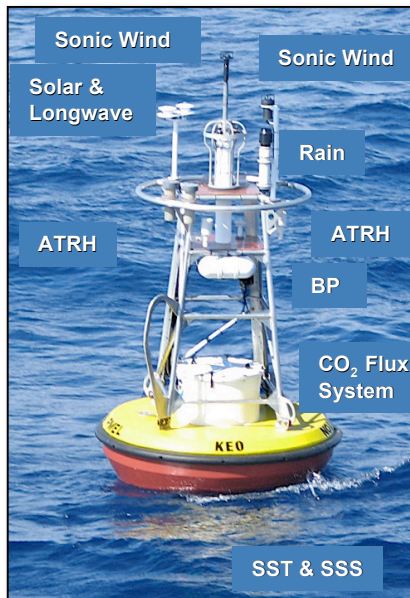
*The Kuroshio Extension jet was in its stable mode in 1993-1994 & 2002-2004.*

UNCLASSIFIED: 1/32° Global NLOM  
SSH ANALYSIS: 20071208

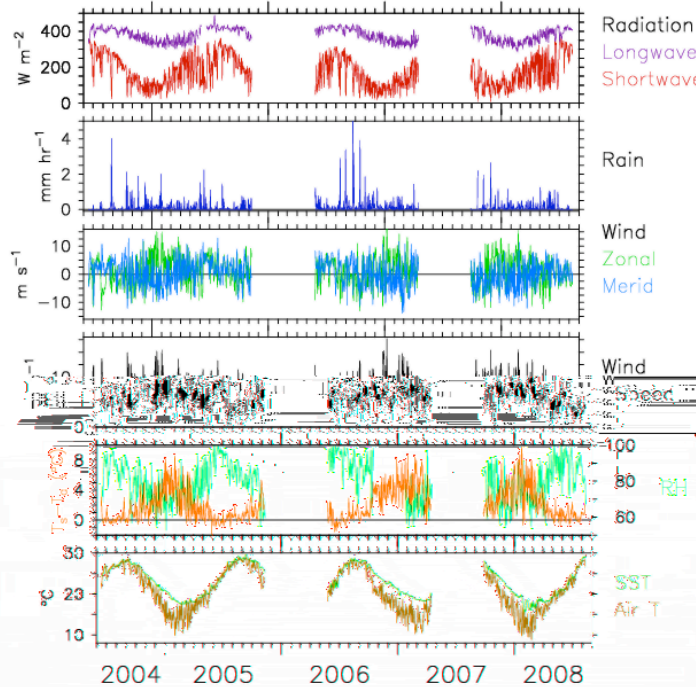


*The jet reverted back to its unstable mode in 2005. (1995-2001 & 2005-present)*

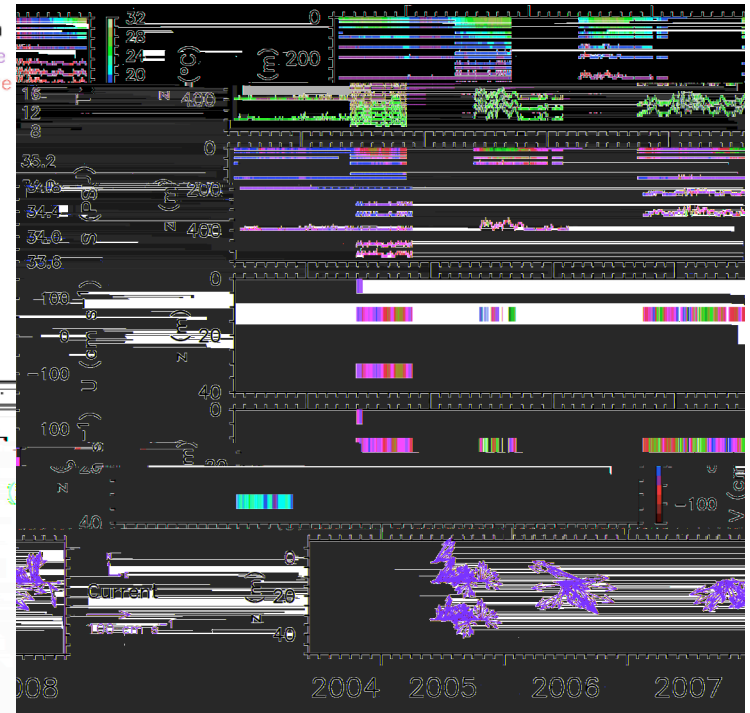
# Kuroshio Extension Observatory (KEO) data



## KEO Surface Data



## KEO Subsurface Data

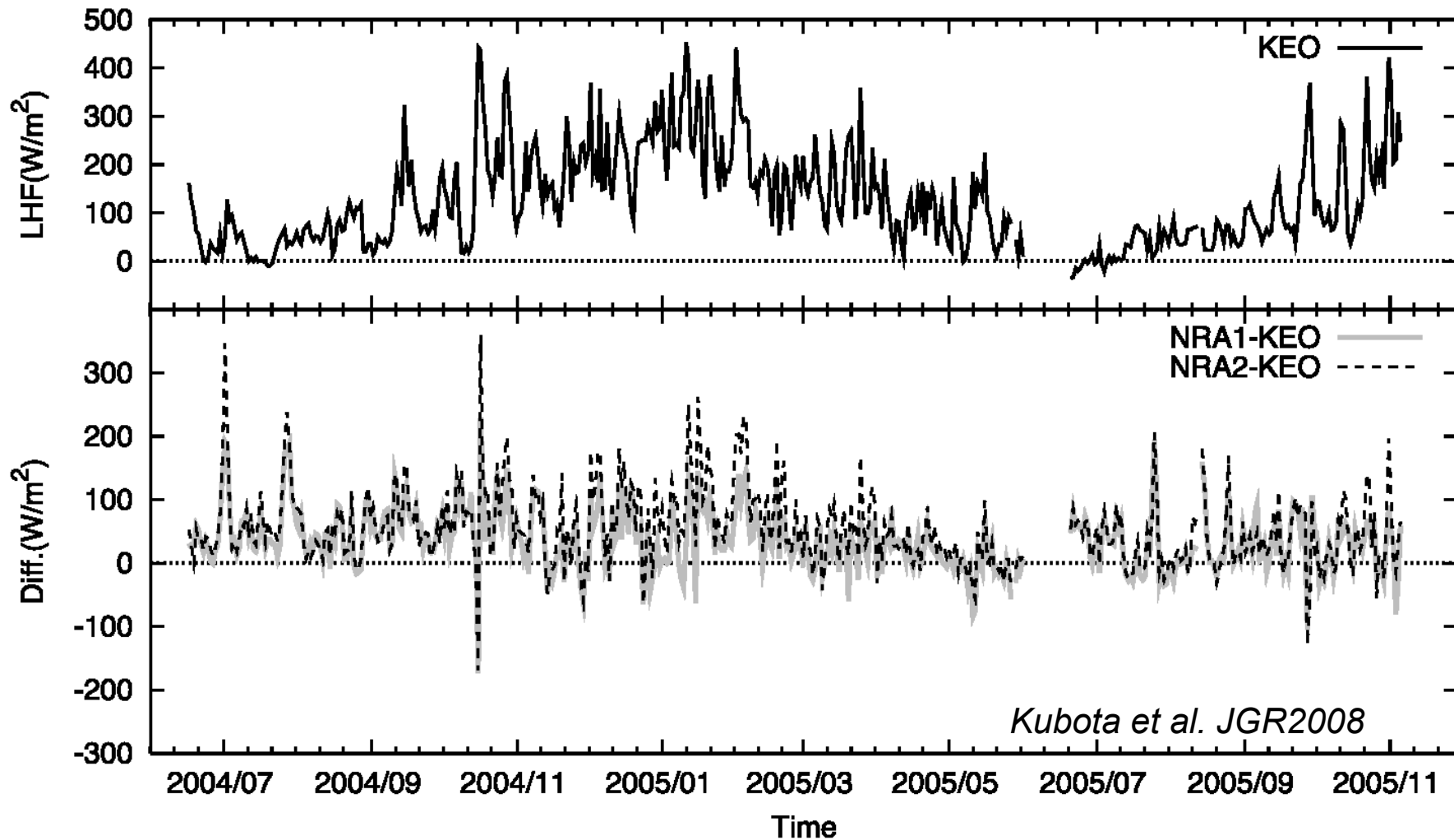


***Radiative Heat Flux = net solar radiation + net longwave radiation***

***Turbulent (latent and sensible) heat fluxes computed from state variables using bulk algorithm. Uncertainty ~ 10-15 W/m<sup>2</sup> (target for climate reference)***

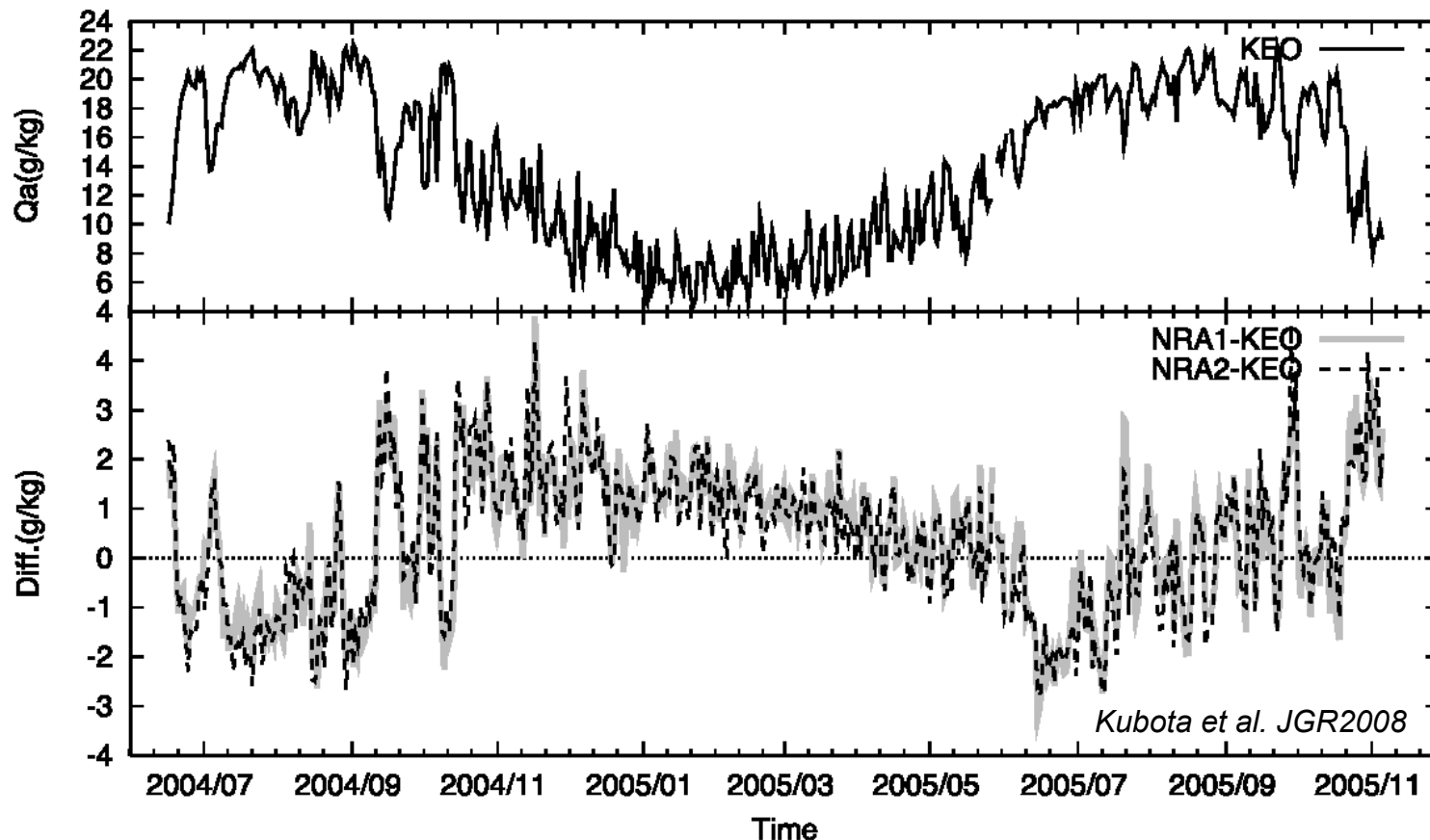
***Net Surface Heat Flux = Turbulent Heat Fluxes + Radiative Heat Fluxes***

# KEO, a Time Series Reference Site



- Mean bias in NRA1 latent heat loss is 38 W/m<sup>2</sup>
- Mean bias in NRA2 latent heat loss is 60 W/m<sup>2</sup> (yikes!)

# KEO, a Time Series Reference Site



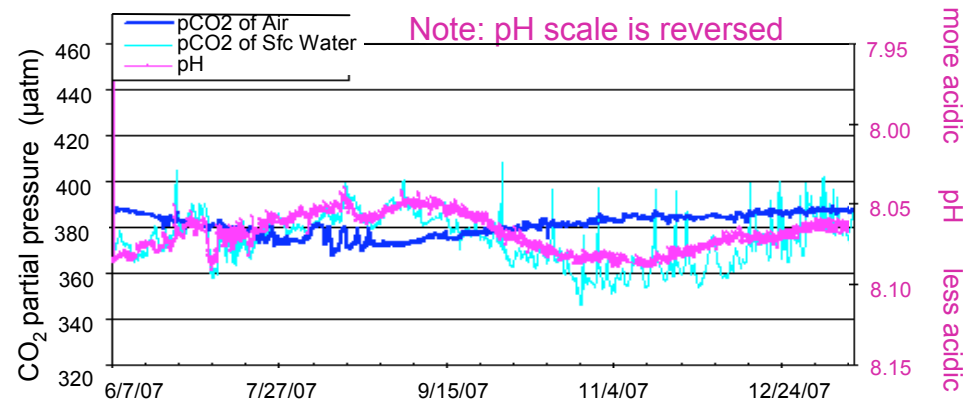
- ***Of all the state variables, NRA specific humidity contributes the largest error and biases to the latent heat flux.***
- ***During wintertime, when prevailing winds are northerly, NRA specific humidity is too large. During summertime, when prevailing winds are southerly, humidity is too low. This suggests improper boundary layer modification.***

# First ocean acidification mooring in the Gulf of Alaska at Station Papa

<http://www.pmel.noaa.gov/stnP/>



Sabine \* Cronin \* Emerson \* Meinig



# Summary Vision

**Ocean Climate Stations provide high quality *in situ* data to:**

- *assess biases and uncertainties in the ocean “weather maps”,*
- *detect rapid variations and episodic events, as well as long-term changes in the climate system, and*
- *identify mechanisms and relationships within the climate system.*

**The NOAA PMEL Ocean Climate Station program has two stations at present (KEO and Papa) and has helped initiate JKEO. These stations are OceanSITES time series reference sites, a network within the Global Ocean Observing System.**

**The NOAA PMEL Ocean Climate Station program is a new and growing program. We are prepared to expand into the global oceans to help complete the network of reference sites.**

**The NOAA PMEL Ocean Climate Station program encourages broad use of the data and welcomes collaboration.**