Station ALOHA: Time-series Science and Status

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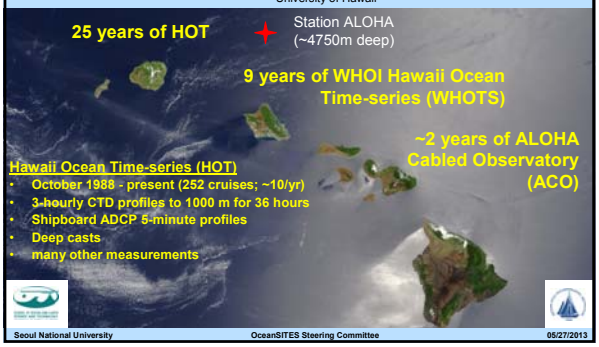
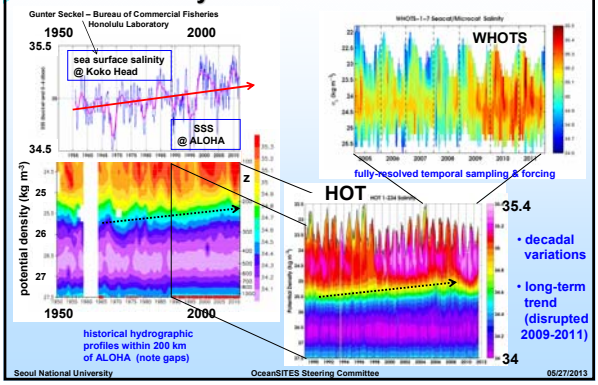


Hawaii Ocean Time-series (HOT)

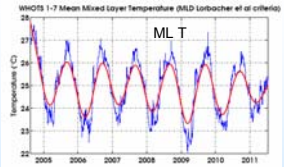
- October 1988 - present (252 cruises; ~10/yr)
- 3-hourly CTD profiles to 1000 m for 36 hours
- Shipboard ADCP 5-minute profiles
- Deep casts
- many other measurements

Local and Remotely-Forced Salinity Trends and Variations



- decadal variations
- long-term trend (disrupted 2009-2011)

WHOTS Mixed Layer and 1-D Model



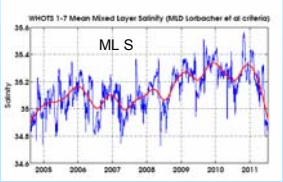
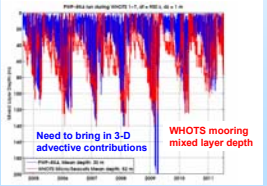
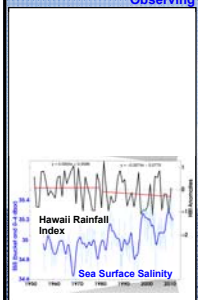


Photo Credit: Sean Whelan (WHOI)

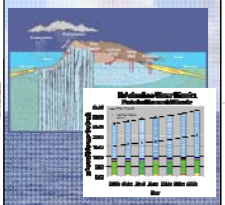


Ocean Reference Station: WHOTS

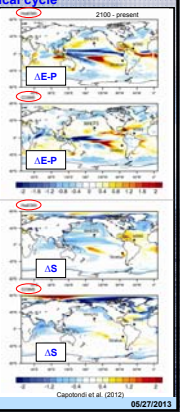
Observing and helping to model the hydrological cycle



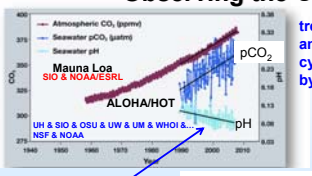
Growing populations require better management of water resources, including effects of climate variation and change



Sustained open ocean measurements (L) provide the foundations for testing models. Two IPCC class models (R) show different E-P and salinity projections.

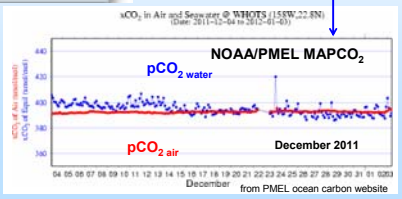


Observing the Carbon Cycle



trends, ENSO and annual cycle resolved by HOT

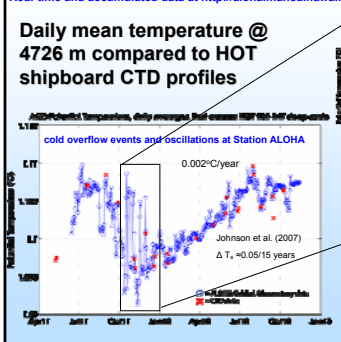
effects of eddies and storms are not resolved by HOT but are resolved by WHOTS (NOAA&NSF)

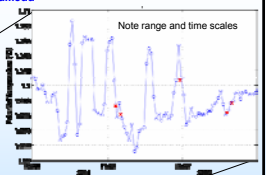


ALOHA CABLED OBSERVATORY

Real-time and accumulated data at http://aloha.manoa.hawaii.edu

Daily mean temperature @ 4726 m compared to HOT shipboard CTD profiles





Lukas et al. (2001, DSR), Alford et al. (2011, GRL)

Data Management

Principal Investigators

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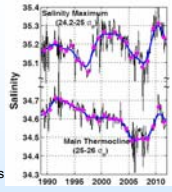
Bruce Howe (UH)
Christopher Sabine (NOAA/PMEL)
Robert Bidigare (UH)
John Dore (MSU)
Michael Landry (SIO)
Ricardo Letelier (OSU)

Data are available via:
http://aloha.manoa.hawaii.edu
http://uop.whoi.edu
http://www.soest.hawaii.edu/WHOTS
http://www.oceansites.org
ftp://ftp.ifremer.fr/ifremer/oceansites/
ftp://data.ndbc.noaa.gov/data/oceansites/

Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

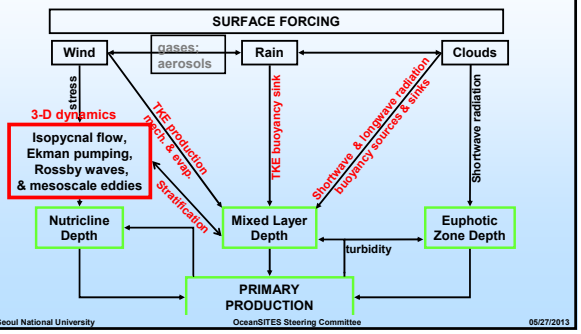
Station ALOHA

- **Sustained, consistent, collaborative, interdisciplinary science**
  - Creating a long, accurate, and high-resolution surface and upper ocean climatology including atmospheric forcing and carbon variables
  - Air-sea fluxes, ocean-truthing atmospheric reanalyses, and benchmarking ocean models
  - Providing essential information on climate change, eddy fluxes and ecosystem dynamics
- **Impacts as part of a global observational network**
  - Assessing ocean changes (incl. C) and enabling climate predictions
  - Atmosphere and ocean modeling – Ocean Reference Stations
- **Institutions & agencies needed to sustain infrastructure**
  - Sustained multi-institutional collaboration (WHOI, UH/SOEST, PMEL)
  - Collaborative funding, NOAA, NSF and SOEST
  - OceanSITES data management (setting metadata standards)
  - JCOMM OPS



- **Confidence in changes**
- **Connections among processes**
- **Strong tests of models**

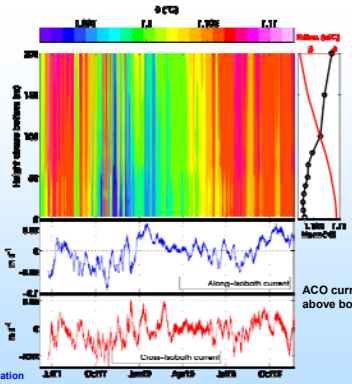
Upper ocean stratification variations in NPSG are important for nutrient fluxes, primary productivity and community structure (Corno et al., 2007; Bidigare et al., 2009; Church et al., 2009).



Price-Weller-Pinkel (1986) 1-dimensional mixed layer model

- diagnostic ML model – Ri #-based vertical diffusive mixing
- Model code improved with 4th order Runge-Kutta integration. Errors in previous public Matlab™ version corrected.
- dt = 900 s, dz = 1 m
- **forced with WHOTS 1-minute heat, moisture and momentum fluxes**
- **T and S initialized with a 36-hr mean of HOT cruise 3-hr interval CTD profiles – removes internal tides influence**
- **u and v initialized with a 36-hr mean of 5-min HOT ADCP profiles – reduces initial influence of inertial motion**

Potential temperature and currents from the ALOHA Cabled Observatory reveal cold overflow event dynamics



Thermistor string plus ACO Microcat

Symbols indicate heights of sensors above bottom

ACO currents 27-58 m above bottom

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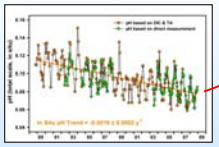
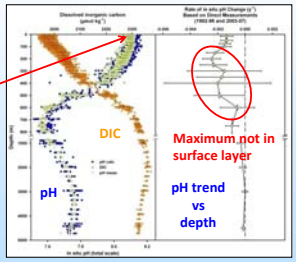
Acidification @ ALOHA

Updated and adapted from Dore et al. (2009, *Proc Natl Acad Sci USA* 106:12235)



pH of surface ocean



Annual, interannual, decadal and longer term changes in surface forcing, mixing, and advection

Local and remote physics are crucial, not just pCO_2, temperature and biology

← This point was made in the paper