Recent PMEL Climate Instrumentation Developments and Field Results

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DBCP Workshop
September 28, 2009

Outline

- Updates on Vandalism mitigation measures
- Field Results from Indian Ocean
- Low-cost self contained MET system
- ‘Easy-to-Deploy’ Surface Moorings
- Prototypes and field results

Indian Ocean Mooring Design Modifications
2007-2008

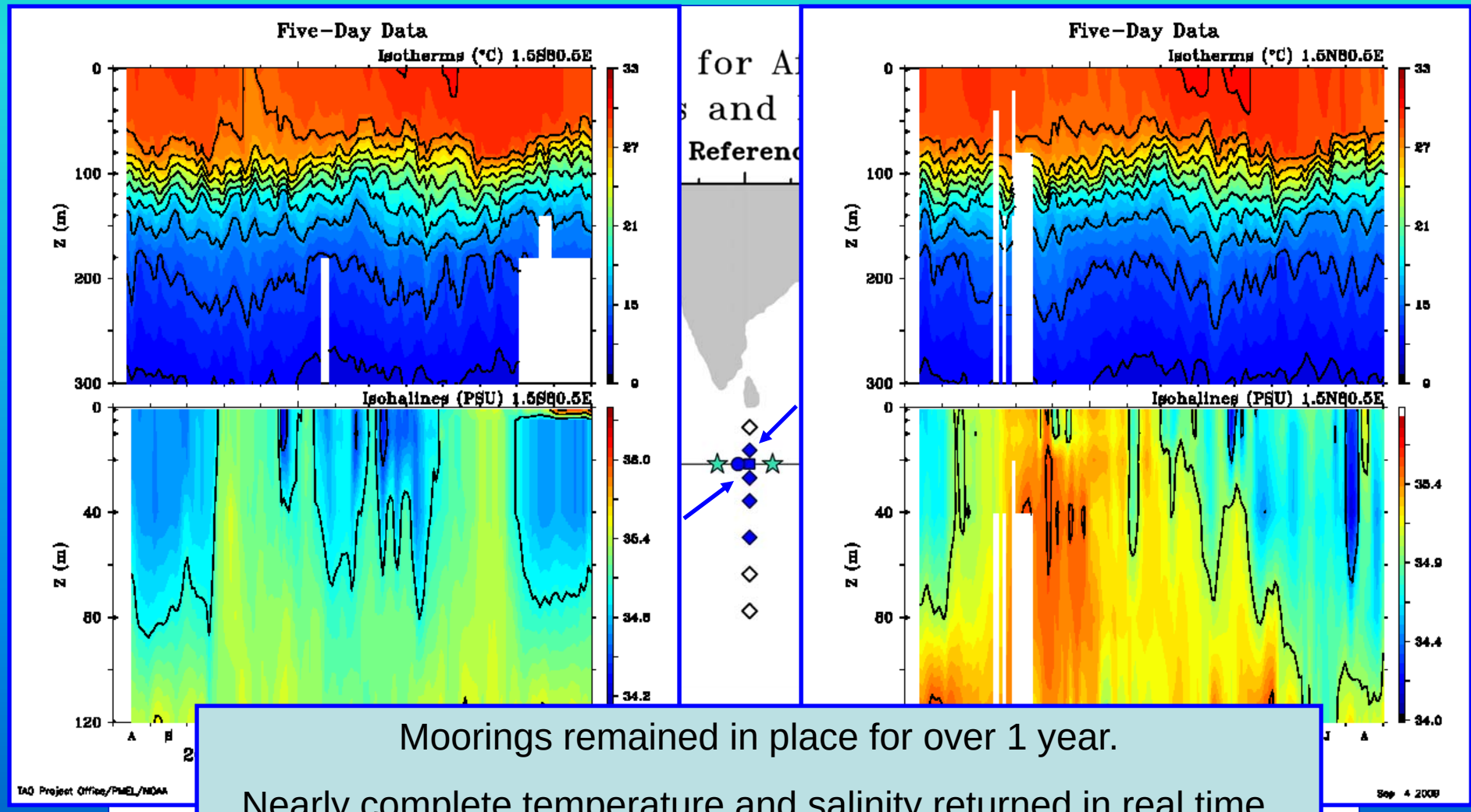
- Make sensors and equipment more difficult to remove
- Remove vulnerable sensors
- Make buoys harder to board
- Remove buoy attachment points
- Deploy more subsurface moorings

Short –term test:
Vandal Resistant Buoys

Surface sensors and tower removed. Buoy covered with cone to inhibit boarding or attachment to buoy. SST, SSS, subsurface T and S, and velocity measurements remain and telemetered via Argos.

Vandal Resistant Moorings

Deployed August 2008-August 2009

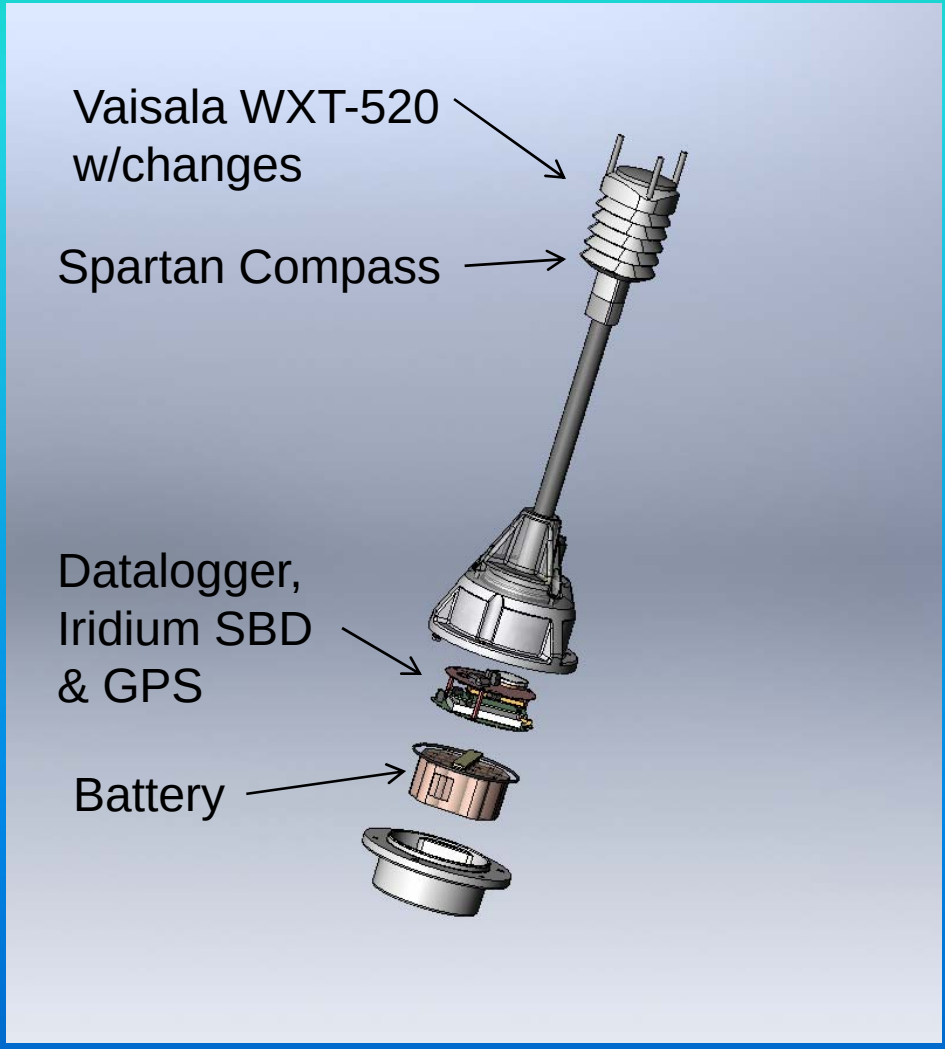


Moorings remained in place for over 1 year.

Nearly complete temperature and salinity returned in real time.

Vaisala WXT520 Testing

- Calibration checks at PMEL.
- Laboratory side-by-side testing.
- Deployed on moorings with standard PMEL met sensors.



Stand Alone Vaisala

- 400 Day Endurance
- Hourly Transmissions
- Iridium SBD 9601-D Modem
- Sparton SP3004D Compass
- Alkaline Batteries

Wind Direction
±3.0°

Wind Speed
± 3% at 0 to 35 m/s, ±5% at 36 to 60 m/s

Rain
Better than 5%, weather dependent

Barometric Pressure
± 1 hPa at -52 to +60 °C

Air Temperature
±0.3 °C at -52 to +60 °C

Relative Humidity
±3% at 0 to 90% RH, ±5% at 90 to 100% RH

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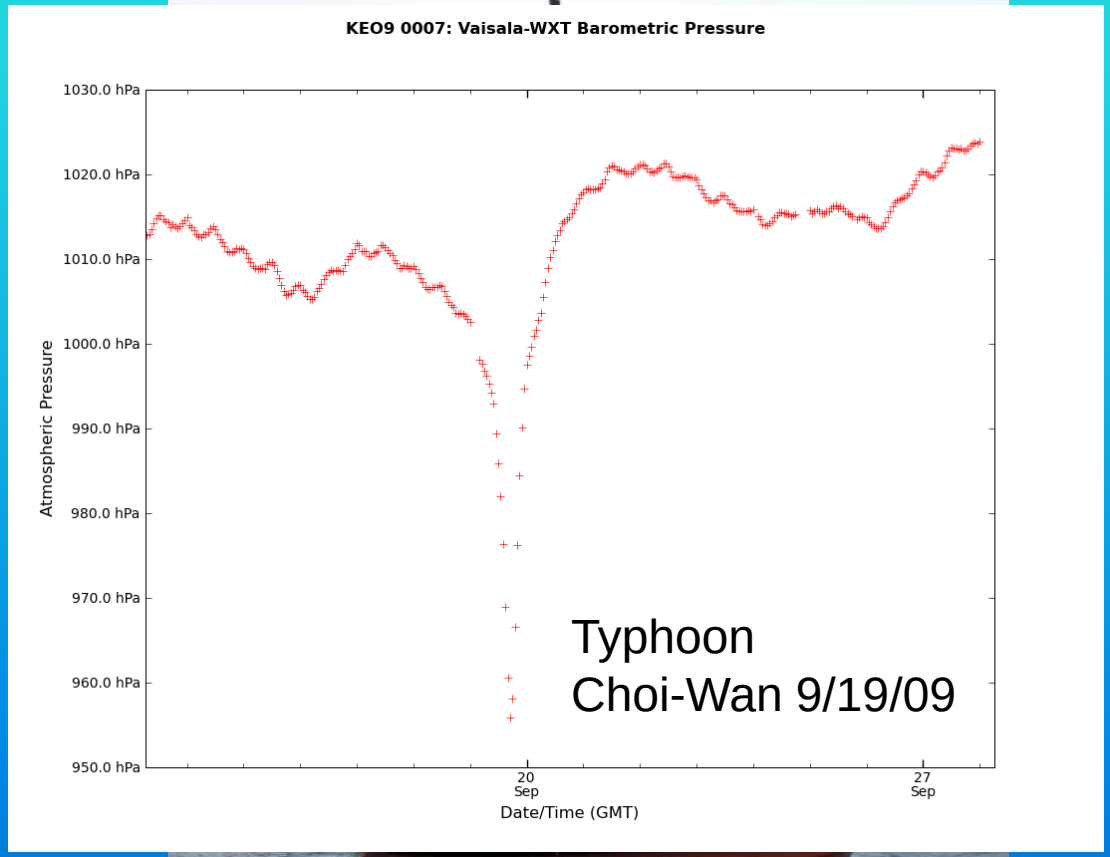
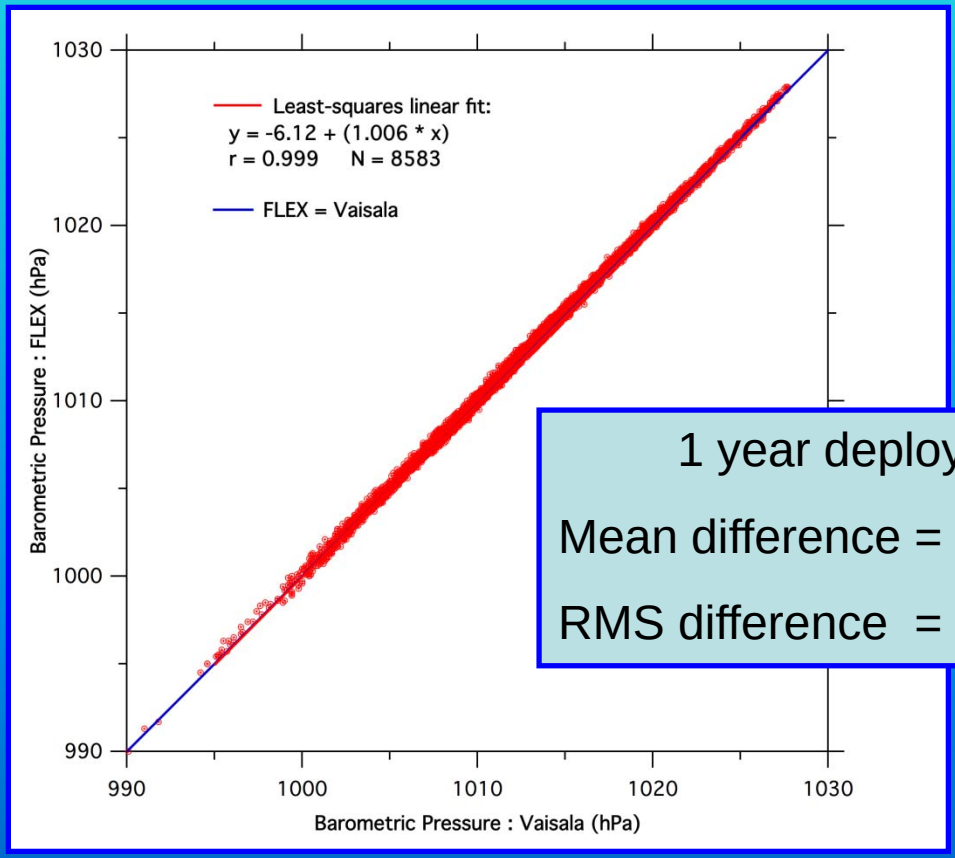


Vaisala WXT520 Wind

- Vaisala (and Gill) wind speed are typically 2% - 6% higher than PMEL wind tunnel standard
- When deployed, Vaisala and Gill wind speed data track well, but some unexplained speed bias is evident.
- Sonic anemometers perform better than mechanical sensors in light wind conditions and in extreme high wind conditions.

Vaisala WXT520 Pressure

• Calibration checks at PMEL and at sea intercomparison indicate Vaisala is equal to Paroscientific.



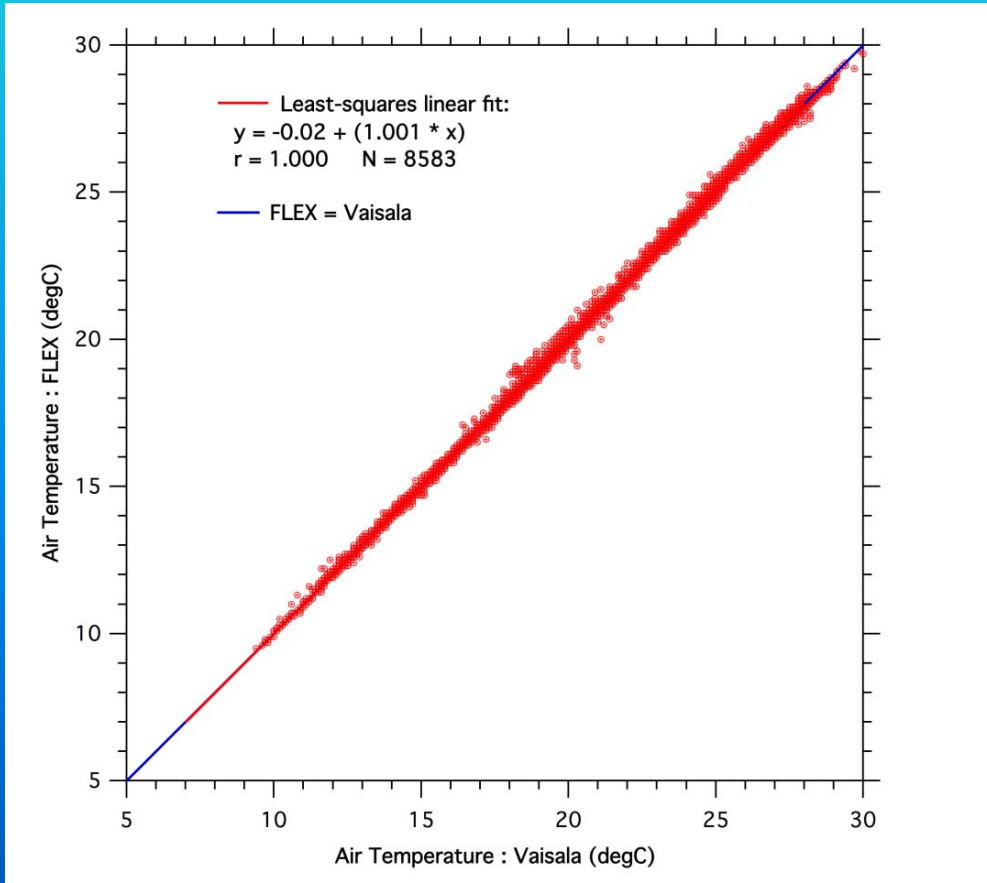
1 year deployment

Mean difference = 0.04 hPa

RMS difference = 0.21 hPa

Vaisala WXT520 Air Temp

- Calibration checks at PMEL not yet performed.
- Vaisala and ATLAS standard (Rotronic) compare well at sea.

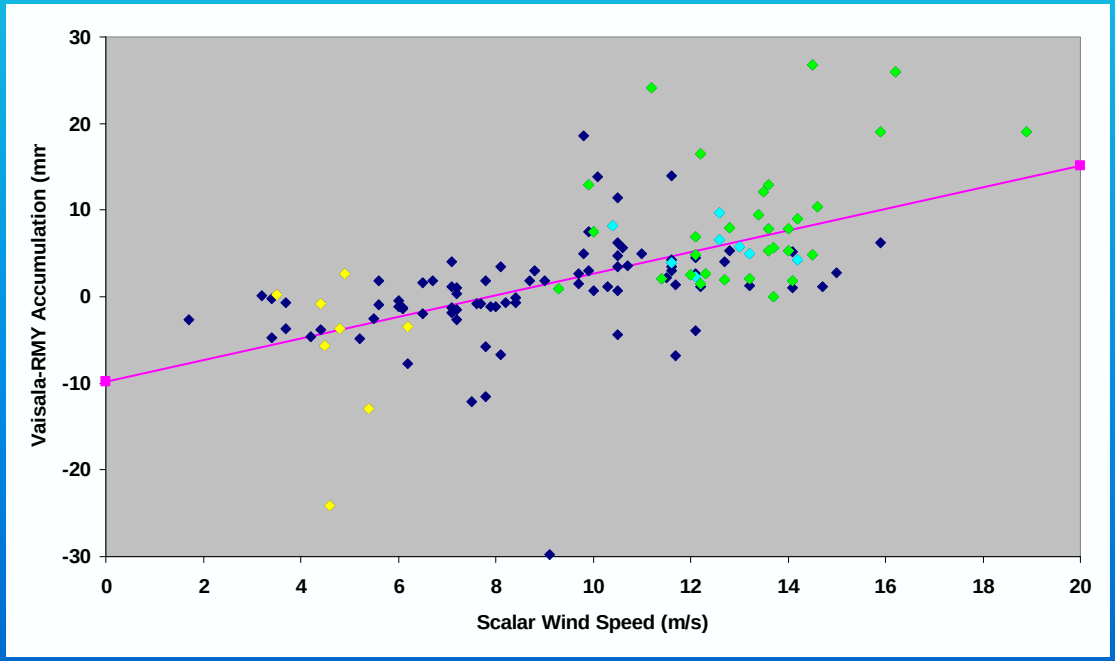


Vaisala WXT520 Precipitation

- Laboratory calibrations not possible at PMEL
- ATLAS standard sensor (RM Young) has performance issues (mainly noise).
- At-sea intercomparison recently completed. Analysis of high-temporal resolution data planned.

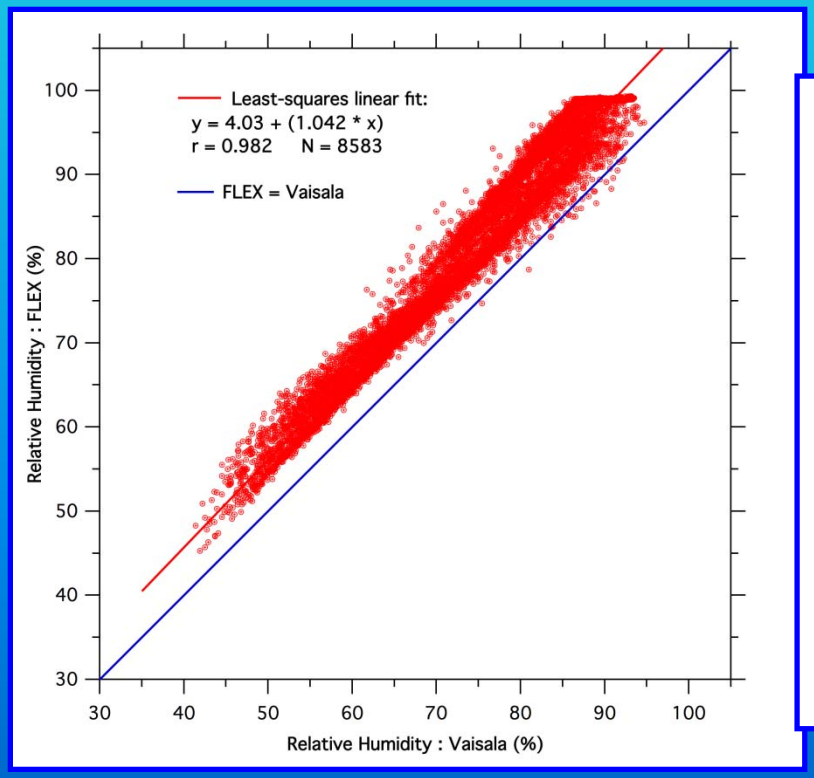
Preliminary analysis of real time data suggests:

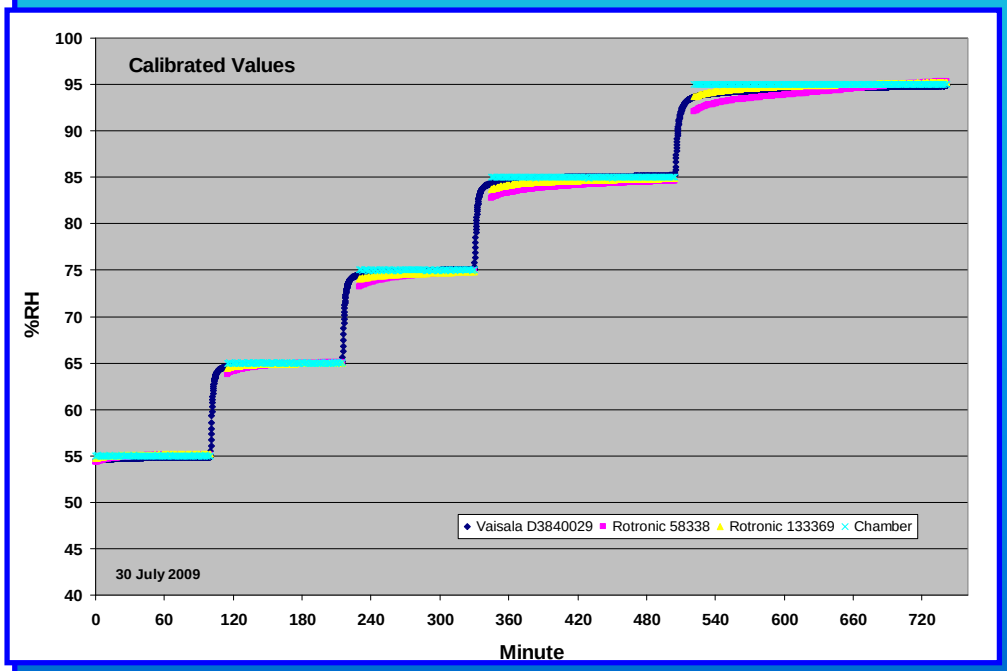
1) Vaisala is more sensitive at low rain rates
2) Accumulation differences may be related to wind speed.



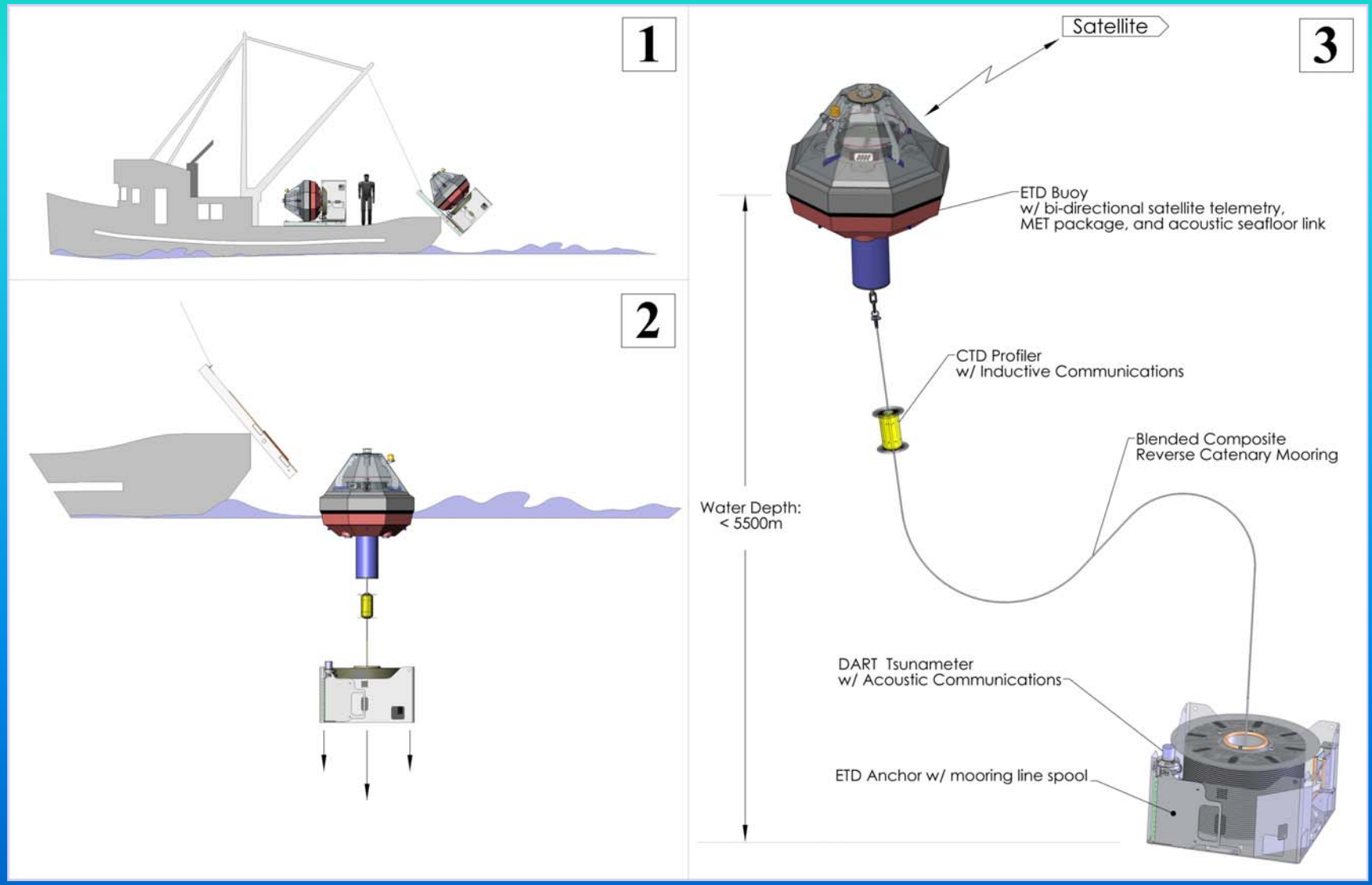
Vaisala WXT520 Humidity

- Calibration checks at PMEL and at-sea intercomparison indicate Vaisala humidity is biased low 4-8 %RH.
- Vaisala response time is equal to or faster than Rotronic

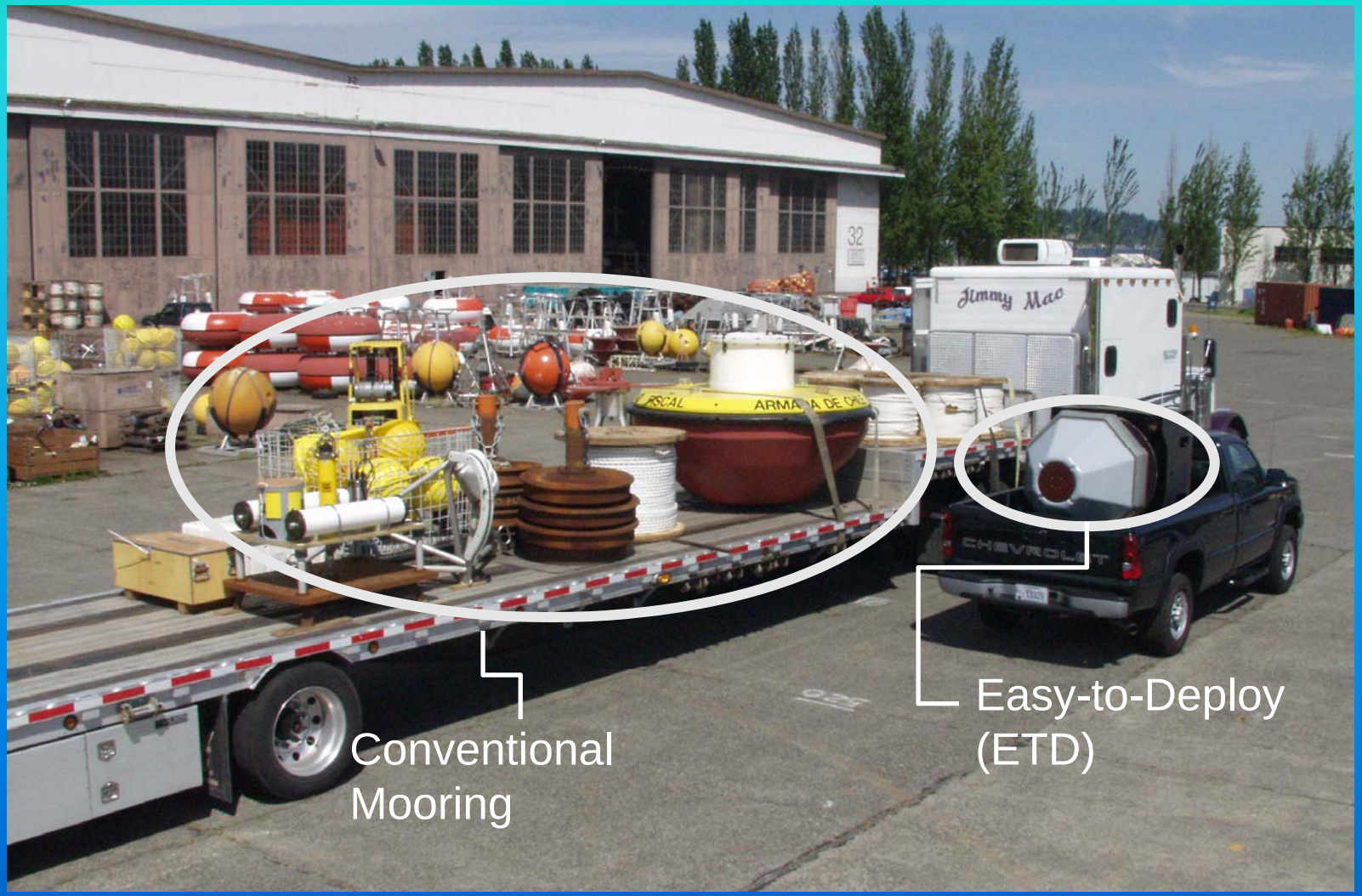




Easy-to-deploy (ETD) Mooring

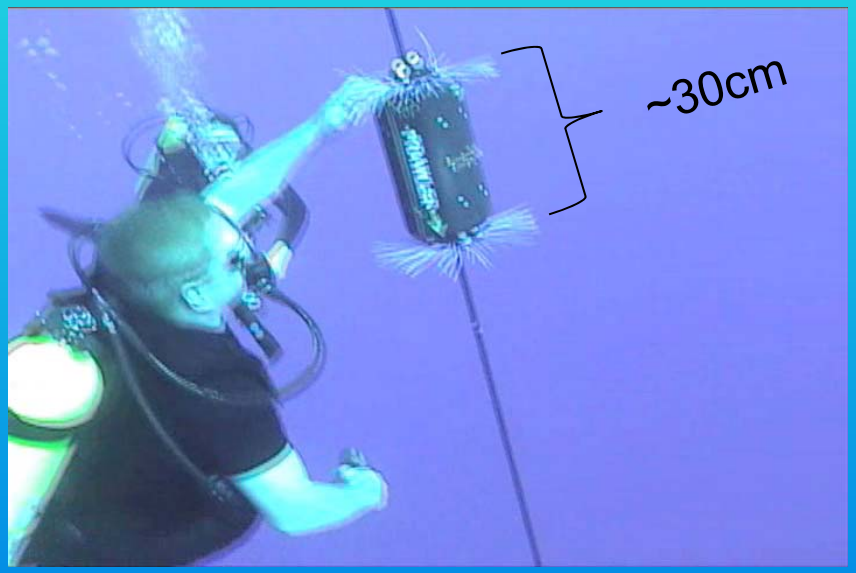


Logistics


Jimmy Mac
CHEVROLET
Conventional Mooring
Easy-to-Deploy (ETD)

Profiling-Crawler (‘Prawler’)

- Uses wave-driven motion of buoy line to climb. Samples on decent
- Bi-directional control via Seabird Inductive Modem Module (IMM)
- Stores all data on board.



PRAWLER:
HAWAII 2008 DEPLOYMENT RESULTS

TIME DEPLOYED AT SEA:

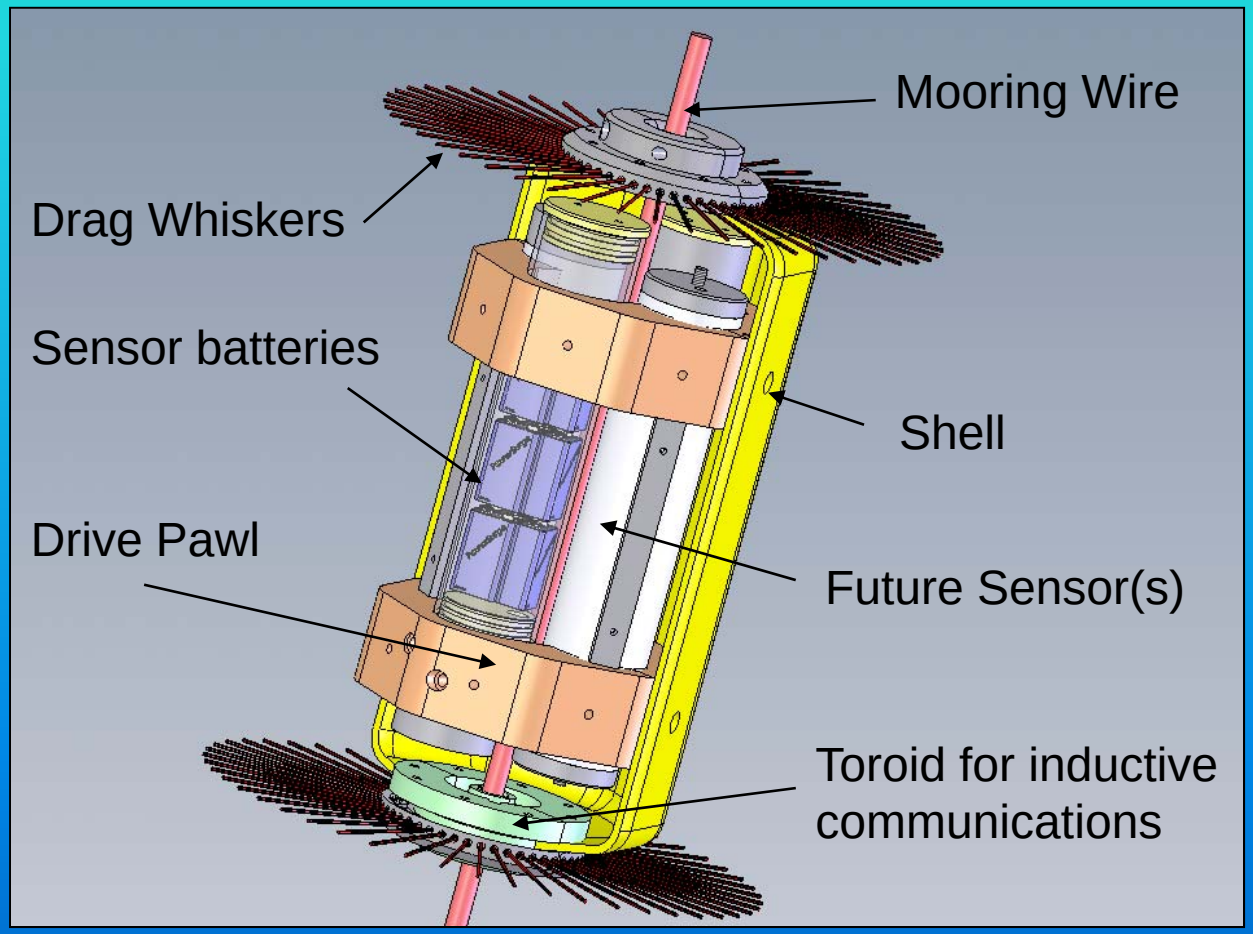
38 days

NUMBER OF PROFILES:

1050

TOTAL DISTANCE CLIMBED:

367 km



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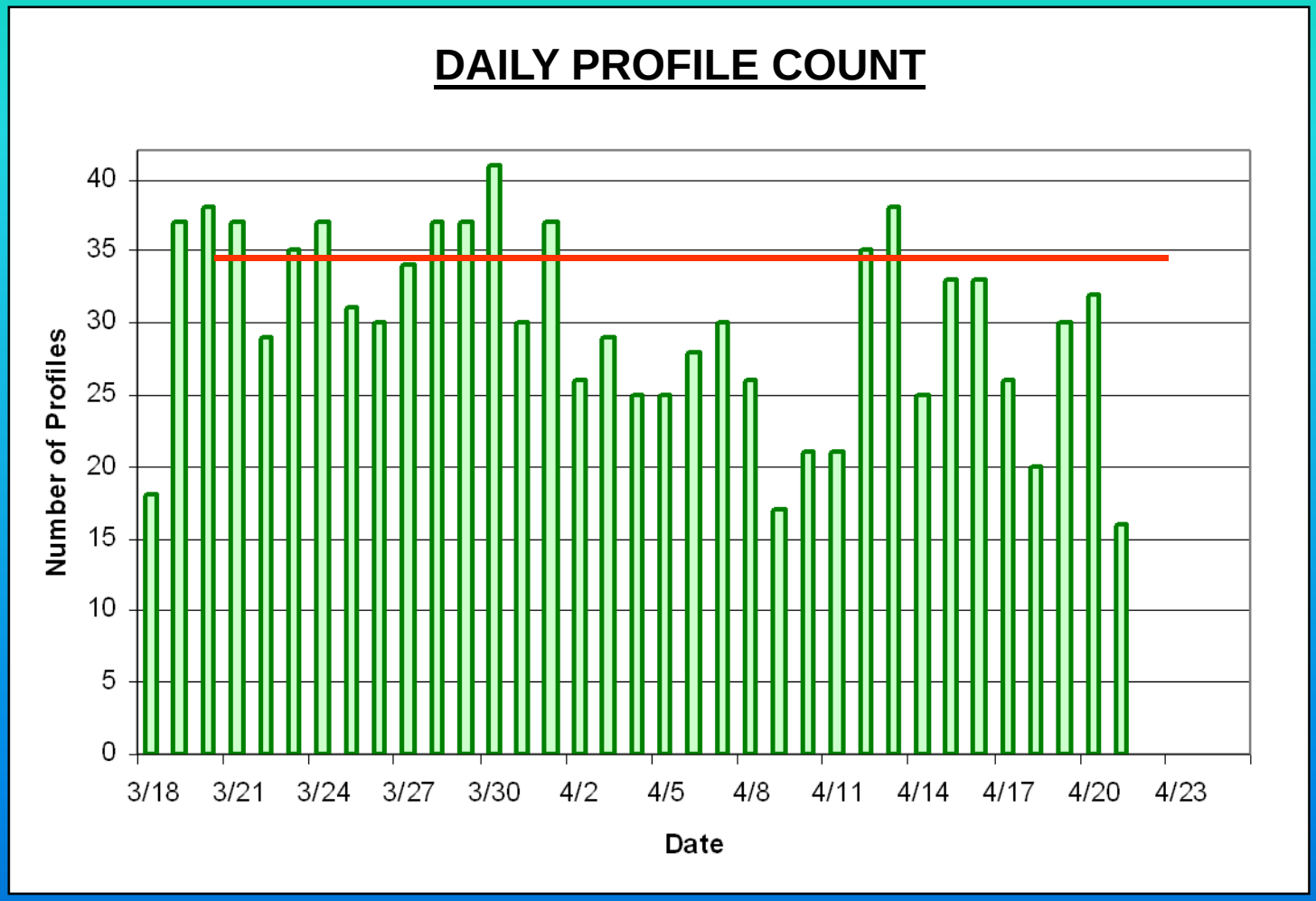
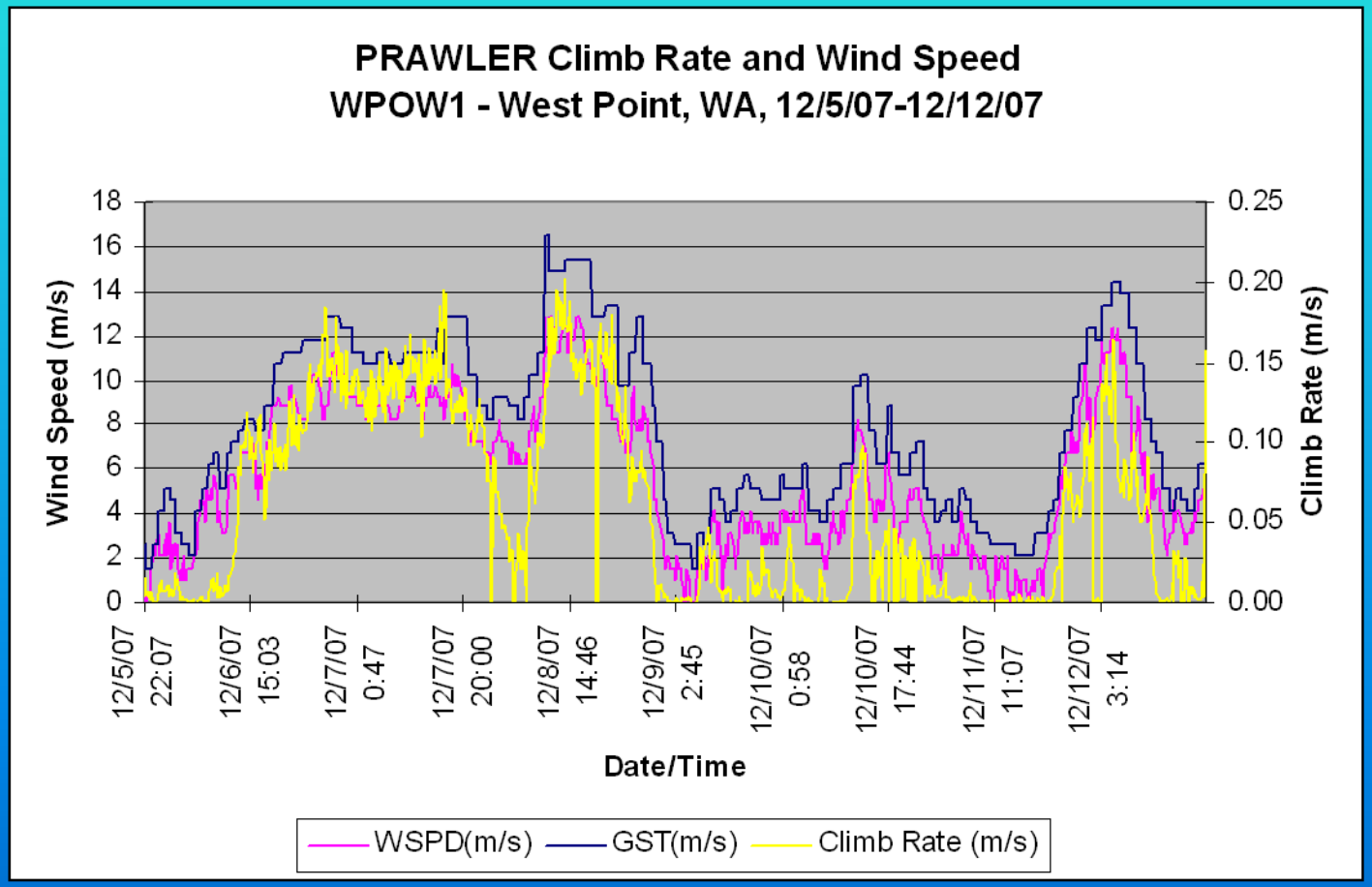


AVG of 30 PROFILES of 350m PER DAY

PRAWLER Climb Rate VS. Wind Speed



Summary

- The vandal resistant moorings, survived the initial year-long deployments and have been re-deployed with a low-cost stand-alone Vaisala WTX-520 surface MET sensor.
- Prototype ‘Easy-to-Deploy’ moorings have been outfitted with wave-powered mooring crawlers that deliver water column data in realtime.
- Future steps include expanding the endurance and sensors options for climate research.
- Oct ‘09 tests will include measurements of waves & MET to quantify performance

National Oceanic & Atmospheric Administration

For more information: (206) 526-6239 // pico@noaa.gov

PICO Platform and Instrumentation for Continuous Observations

Home Vision Technology Field Experience

A smaller, safer, greener, and more cost-effective ocean observation system.

The PICO concept is the product of 30 years of PMEL experience with the logistical and financial challenges inherent in conventional oceanographic mooring systems. Recently, we've successfully deployed prototypes of this promising new technology throughout the Pacific.

In the years ahead—with the resources necessary to further enhance research and development efforts—the enabling possibilities of this streamlined and more energy efficient approach are rich indeed.

The PICO concept is not necessarily intended to replace all conventional moorings, such as those used as reference stations with heavy and redundant instrument loads. However, the low cost and ease of deployment will complement some observing systems and completely enable other time series measurements.

Comparison Chart

	PICO Concept	Conventional Moorings (CM)
Size	20 pre-packaged PICO units can fit into a single 40 ft. shipping container.	1-2 CMs fit into a 40 ft. container in ~15 pieces each (anchors, buoy, bridle, tower, wire rope, nylon line, barrels of chain, hardware, and tools).
Sea Transport	Can be sent aboard smaller vessels of opportunity, i.e. a fishing craft on its regular route. Able to deploy in higher sea states than CM.	Large research ships with specialized personnel and equipment.
Building & Assembly	Pre-built, factory assembled, and deployment-ready when shipped.	Deployments are sea state limited. Shipped in many parts and assembled on ship deck with skilled technicians in the field.
Manpower	Can be deployed by 1-3 people with basic seagoing skills. Buoy/mooring experience is unnecessary.	Requires 6-12 specialized crew and technicians.
Cost	TBD	TBD
Operational Life	Estimated 3-5 years.	1 year.

Watch the PICO advantage in action

click to start

Click for larger movie

NOAA's Strategic Plan for 2005-2010 calls for "development of ...an integrated global-to-local environmental and ecological observation ... system that will continually monitor the ... ocean, atmosphere and land."

www.pmel.noaa.gov/pico