"We trained hard, but it seemed that every time we were beginning to form up in teams we would be reorganized. I was to learn later in life that we tend to meet any new situation by reorganizing.

And a wonderful method it can be for creating the illusion of progress while producing confusion, inefficiency, and demoralization."

-- Gaius Petronius Arbiter, 210 BC

Agenda: STAR CI Directors' Meeting

Tuesday, June 20 (Burt 193)

8:00 Coffee and Registration

8:30 Welcome (Strub/Freilich/Vandehey/Guch)

8:50 STAR Issues (Powell)

9:35 CoRP & CI Policy Update (Guch)

10:15 Break

10:30 Discussion: CI and NOAA Issues (all)

12:00 Lunch

1:00 CI Highlights (CIMSS, CIRA, CICS, CREST)

2:20 Break

2:30 CI Highlights (CIOSS)

2:50 IOOS Plans (operational ocean observing)

3:10 Plans for operational coastal modeling

3:30 Poster Session

5:00 Return to hotels

6:30 Dinner at Michael's Landing or on your own.

Wed, June 21 (COAS Admin)

8:00 Coffee

8:30 Separate Discussions (NOAA & CI Dirs)

9:30 Summary of Discussions (together)

10:15 Break

10:30 Summary and Action Items (Guch)

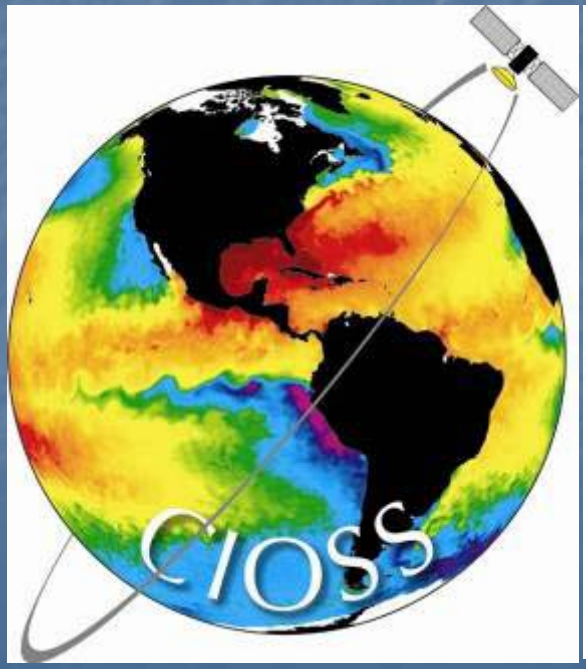
11:30 NOAA GMD Discussion (Nelson)

12:30 Lunch

1:30 Adjourn

Cooperative Institute for Oceanographic Satellite Studies
CIOSS

- Established within COAS at OSU to make use of the extensive expertise of the COAS Faculty in satellite remote sensing, data analysis, modeling and data assimilation.



Cooperative
Institute for
Oceanographic
Satellite
Studies

CIOSS – Years 1-3

- The approach in years 1-2 was to use the "core" research funds to hire post-doc and other early career reseachers to address basic research problems in CIOSS Research Theme Areas.
- In year 3 and later, we are emphasizing more traditional research projects that address CIOSS Themes and NOAA/NESDIS "Missions" and responsibilities, with support for all levels of staff (students to PI's).
- A focus remains (15 out of 23 projects) on large-scale continental margins, especially along the West coast of the US – the California Current System.
- In this focus region, many CIOSS/COAS Faculty are collaborating in national field programs, providing a wealth of field data with which to test remote sensing and model fields.
- A focus on the continental margins, is also aligned with the national effort to create an Integrated Ocean Observing System (IOOS) for both the "open" and "coastal" ocean. CIOSS Fellows are active leaders and participants in forming the regional IOOS consortia in the Pacific Northwest (NANOOS & PACOOS).

CIOSS - Years 3+

- Expand activities designed to evaluate present and future satellite sensors, algorithms and techniques to produce improved surface fields and fluxes (Themes 1 & 2). This also helps NOAA/NESDIS accomplish its mission within the IOOS System, where it is assigned the role of providing the "National Backbone" for the "coastal" system.

- **Look at what the IOOS system is** expected to become and think about what NOAA's role should be within this system (NESDIS, NCEP, NOS). **Look at CIOSS activities within the context of IOOS** and NOAA's role within the developing observational/modeling system.

A brief history of IOOS
Integrated Ocean Observing System

- NOPP established by law in 1997
- NORLC has oversight of NOPP
- NORLC recommends an IOOS in 1998-1999
- NOPP establishes Ocean.US in 2000 to implement a user-driven IOOS
  - Global IOOS and Coastal IOOS
  - Coastal IOOS to have two components:
    - National Backbone – NESDIS, NOS, OAR, NMFS, NWS (NCEP)
    - Regional Coastal Ocean Observing Systems managed by Regional Associations

System Elements

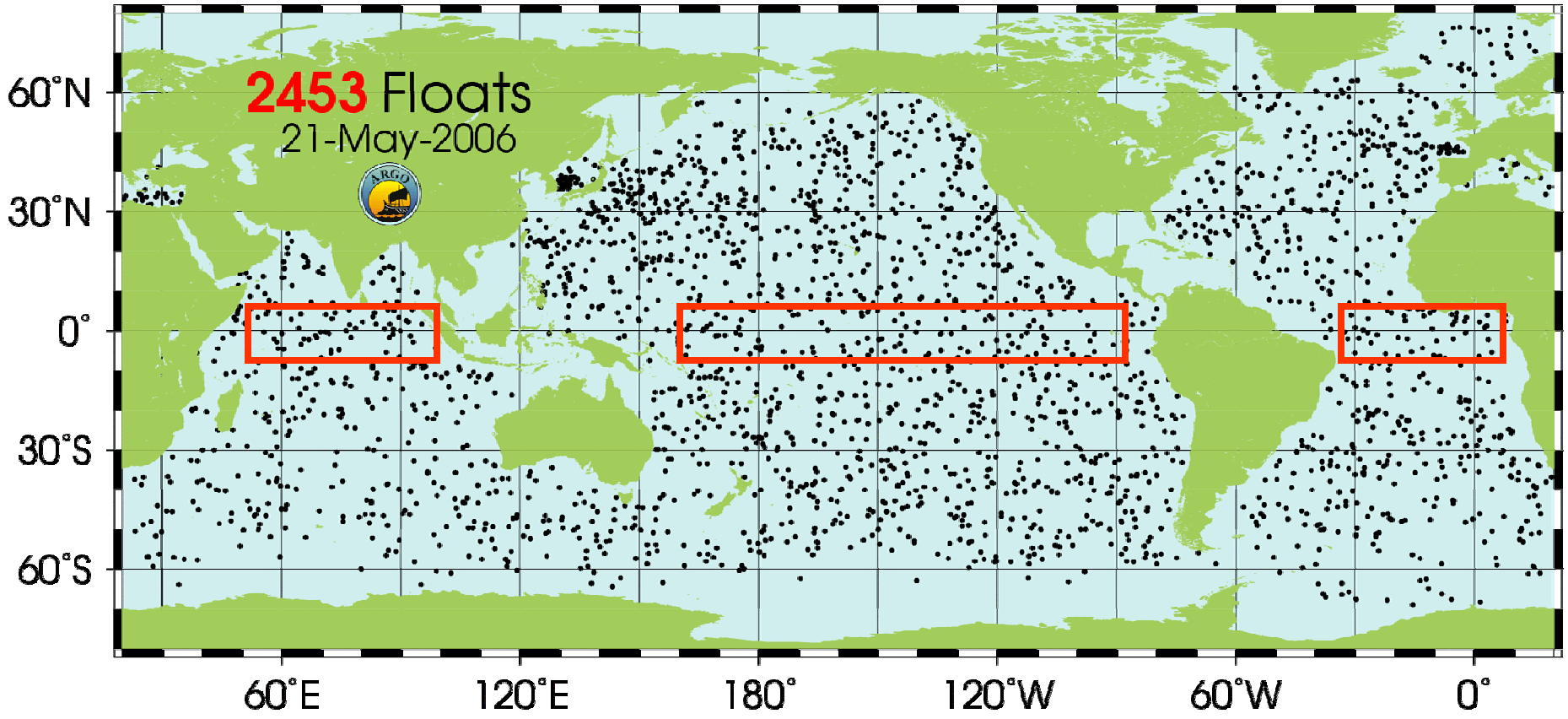
"The observing system shall consist of the following program elements:

1. A national program to fulfill national observation priorities, including the Nation's ocean contribution to the Global Earth Observation System of Systems and the Global Ocean Observing System.
2. A network of regional associations to manage the regional ocean and coastal observing and information programs that collect, measure, and disseminate data and information products to meet regional needs.
3. A data management and dissemination system for the timely integration and dissemination of data and information products from the national and regional systems.
4. A research and development program conducted under the guidance of the Council.
5. An outreach, education and training program that augments existing programs (e.g. Sea Grant, COSEE, NERRS) … for improving public education … and building the technical expertise required tooperate and improve the observing system.

The GLOBAL System

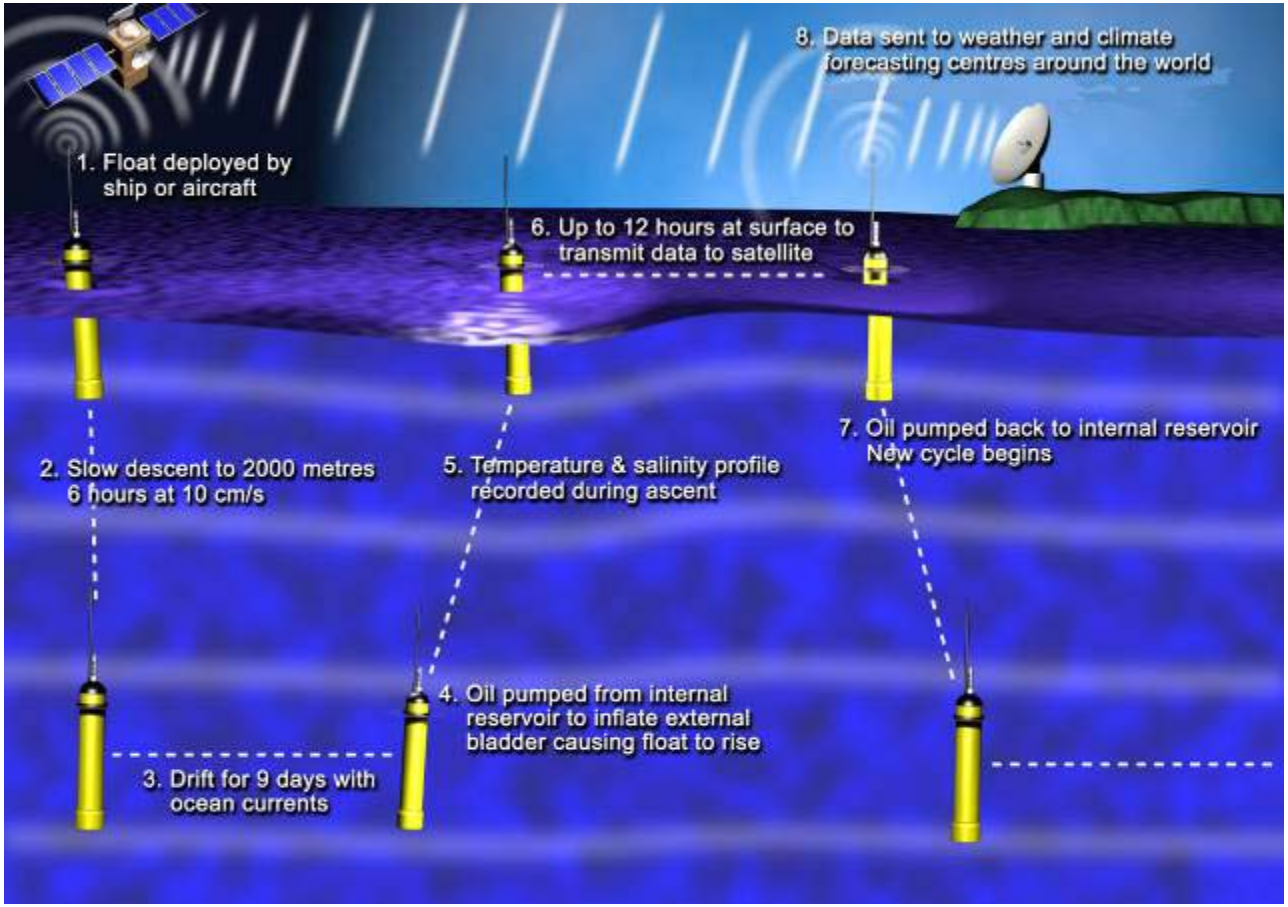
– ARGO Profiling Float System –

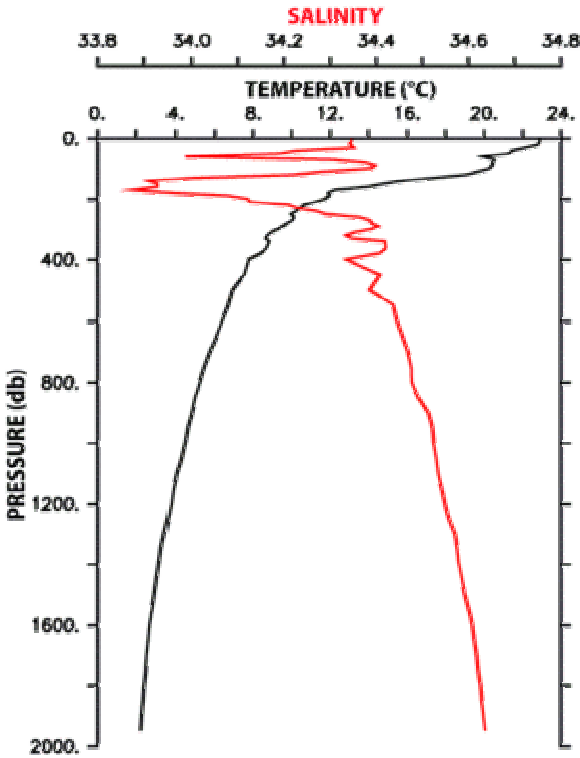
Part of the Global Integrated Ocean Observing System



** Also including the TAO Array and tropical mooring arrays in other basins, along with moorings at selected other locations.

ARGO: Deployment & Operation



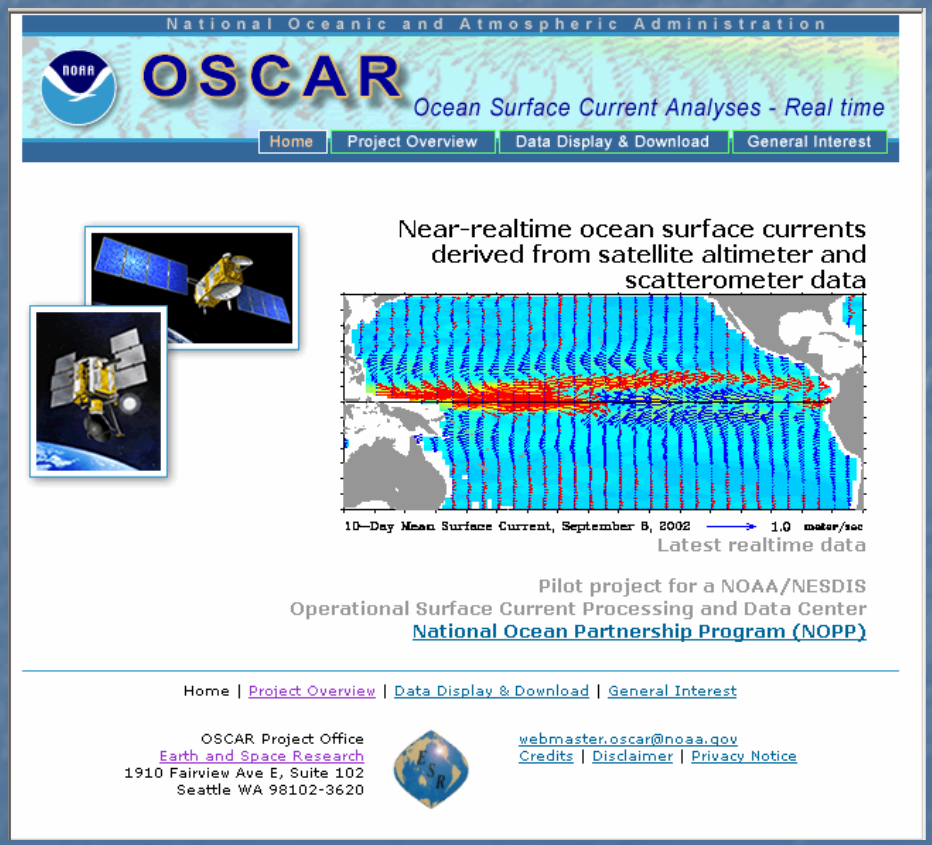


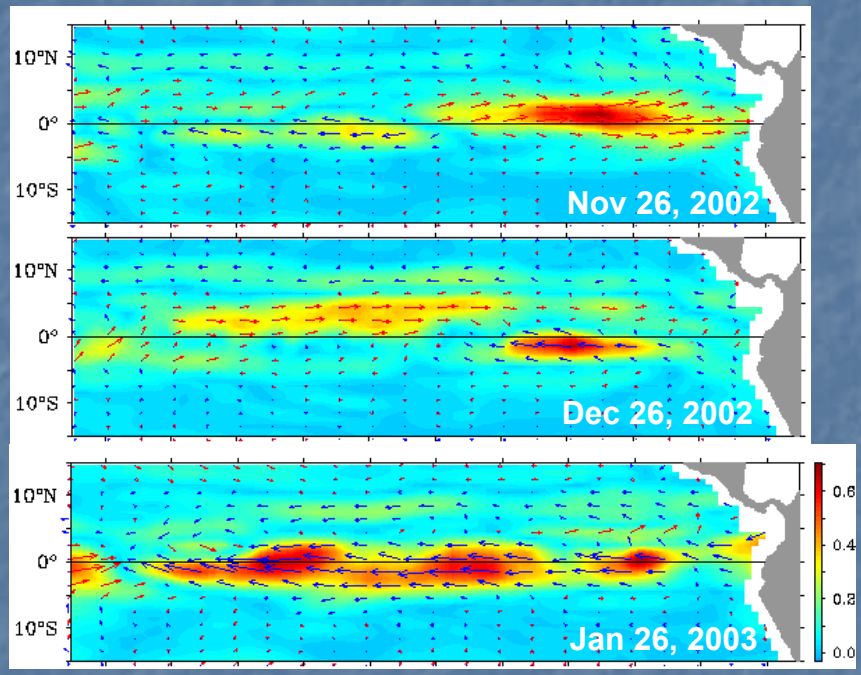
Altimetry + Scatterometry = SURFACE CURRENTS

Jason-1

QuikSCAT

Surface Current Anomalies





****** These all feeding into basin-scale, data-assimilating OGCM's, running at ?? NCEP ??**

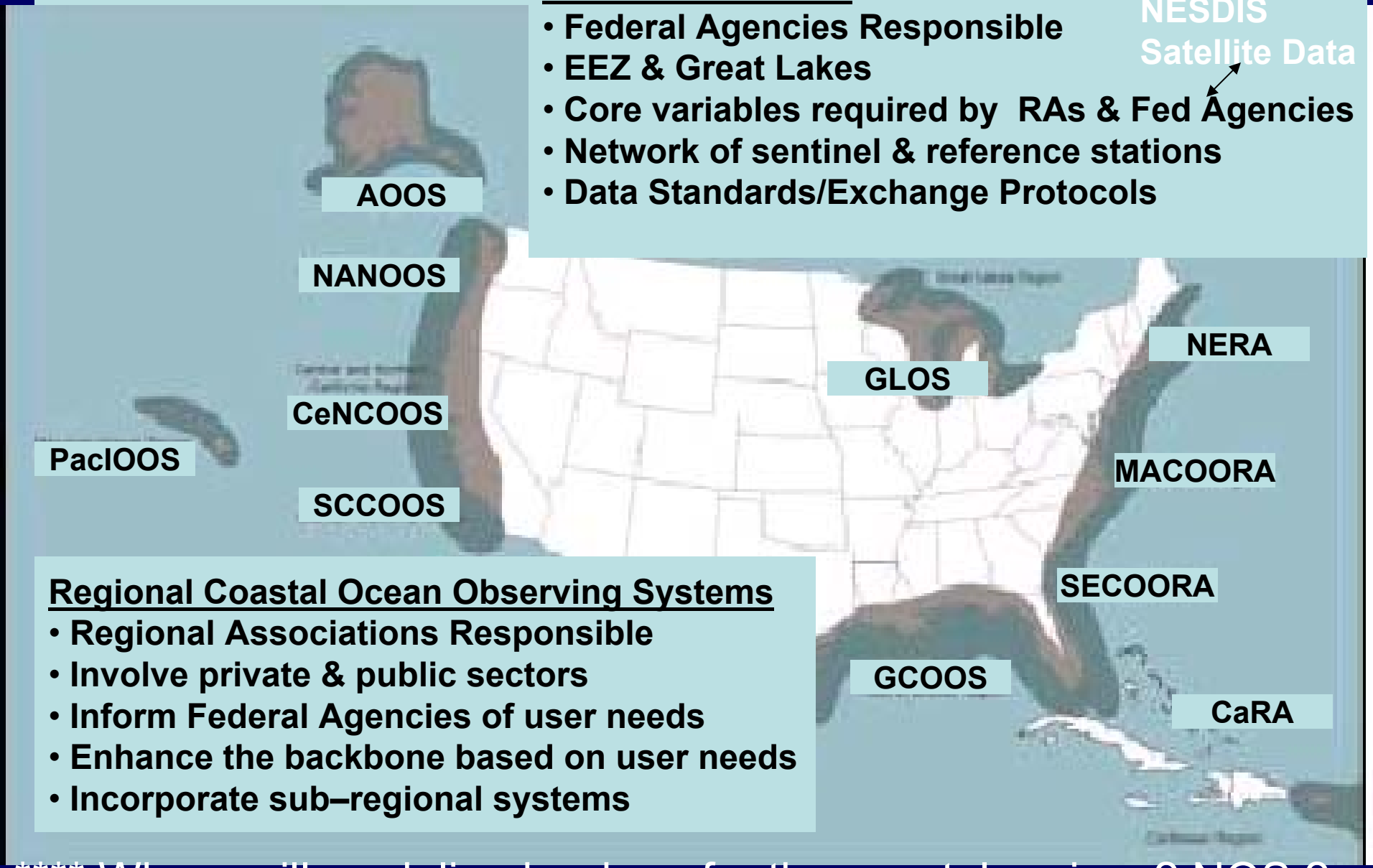
Coastal Component of IOOS

T. Malone, Ocean.US

National Backbone

- Federal Agencies Responsible
- EEZ & Great Lakes
- Core variables required by RAs & Fed Agencies
- Network of sentinel & reference stations
- Data Standards/Exchange Protocols

NESDIS Satellite Data

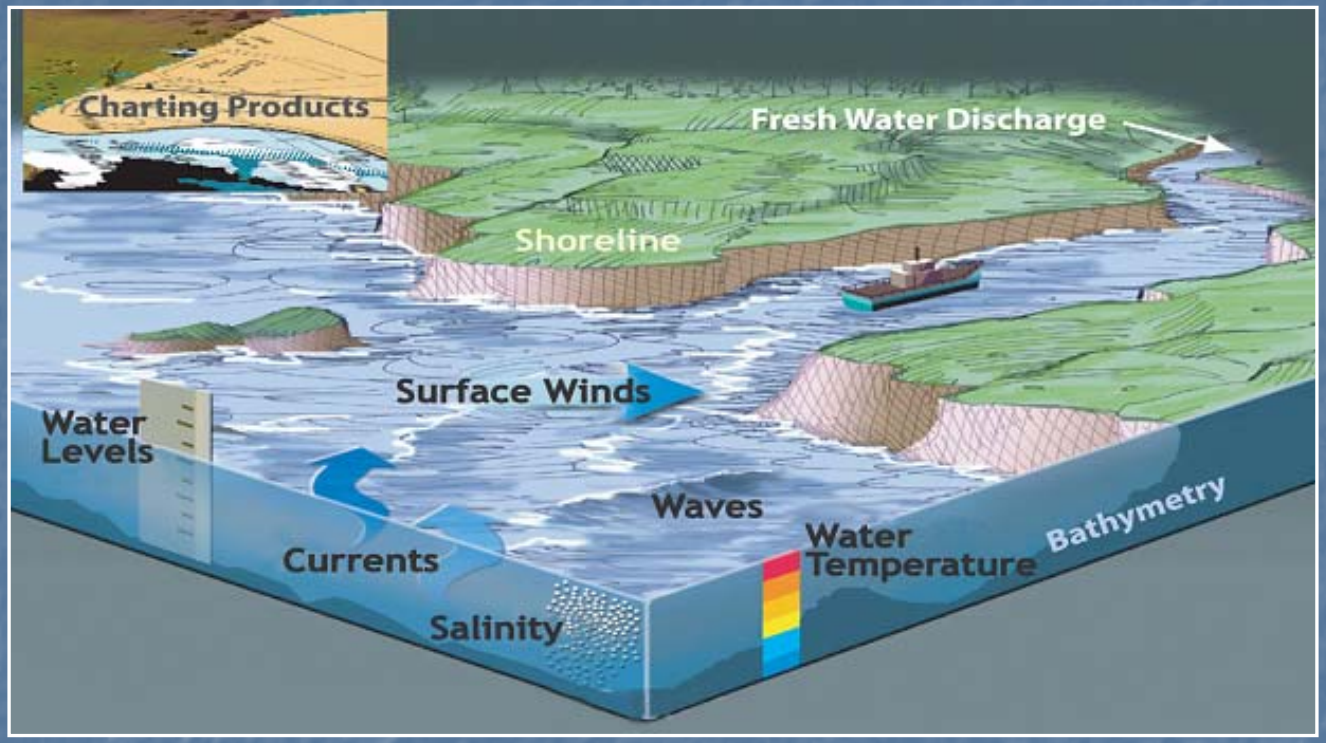


Regional Coastal Ocean Observing Systems

- Regional Associations Responsible
- Involve private & public sectors
- Inform Federal Agencies of user needs
- Enhance the backbone based on user needs
- Incorporate sub–regional systems

**** Where will modeling be done for the coastal regions? NOS ?

Fundamental Issue:



We are limited and poorly coordinated with respect to environmental data supporting fundamental societal needs

R. Spinrad, NOAA

Integrated Ocean Observing System

Northwest Association Of Networked Ocean Observing Systems (NANOOS)

http://www.nanoos.org

Who are we?

- **NANOOS Coordinator** (Executive Director per execution of MOA):
  - Jan Newton, University of Washington
- **Governing Council**:
  - David Martin, University of Washington (NANOOS PI)
  - Jonathan Allen, Oregon Dept. of Geology and Mineral Industries
  - Antonio Baptista, Oregon Health and Sciences University
  - **Jack Barth**, Oregon State University
  - Robert Bohlman, Marine Exchange of Puget Sound
  - Patrick Corcoran, Oregon Sea Grant Program
  - **Mike Kosro**, Oregon State University
  - Greg McMurray, Oregon Dept of Land Conservation & Development
  - Ian Miller, Surfrider Foundation
  - Jay Pearlman, The Boeing Company
  - Terry Wright, Northwest Indian Fisheries Commission

NANOOS Members *to date…*

1. Ocean Inquiry Project
2. Oregon Dept of Land Conservation & Development
3. Surfrider Foundation
4. The Boeing Company
5. ** **Oregon State University < CIOSS**
6. Puget Sound Action Team
7. University of Washington
8. WET Labs, Inc.
9. Oregon Health and Science University
10. Quileute Indian Tribe
11. Oregon Dept of Geology and Mineral Industries
12. Humboldt University
13. Marine Exchange of Puget Sound
14. Washington State Dept of Ecology
15. Pacific Northwest National Laboratory

- NGO
- State Gov't
- Industry
- Academia/Research
- Tribes

Ocean Observing System Elements in place in Pacific Northwest

Focus on 2 regions; there are others

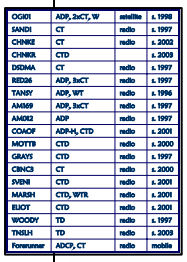
- Columbia River:
  - CORIE: modeling and observation program
  - NANOOS Pilot
- Newport region:
  - Long-term moorings and hydrography
  - Surface Current Mapping with HF
  - New measurement technology
    - Profiling moorings
    - Autonomous Gliders
  - Data Assimilative Modeling

Columbia River - CORIE

OHSU

Other key networks

- Lower CR
- NSF-RISE
- …



X-band radar

Baker Bay

Grays Bay

Youngs Bay

Cathlamet Bay

OGI02 (s)

OGI01

Coastal radar

Active

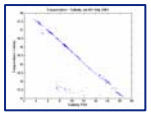
Inactive

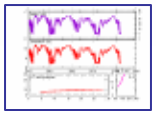
Collaborations

http://www.ccalmr.ogi.edu/CORIE/network

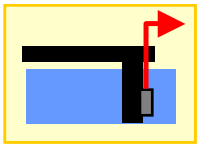
0 10 Kilometers

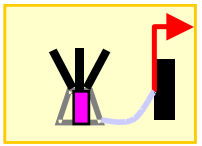
N

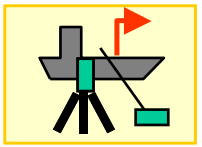




QA/QC

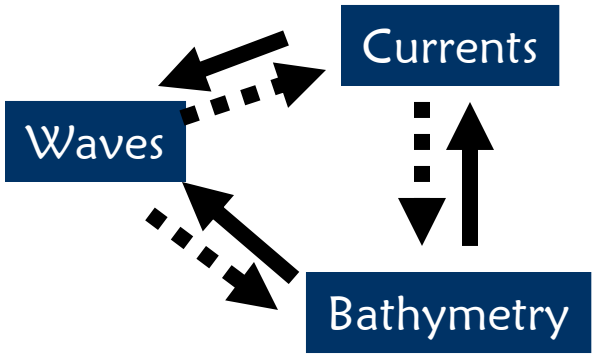


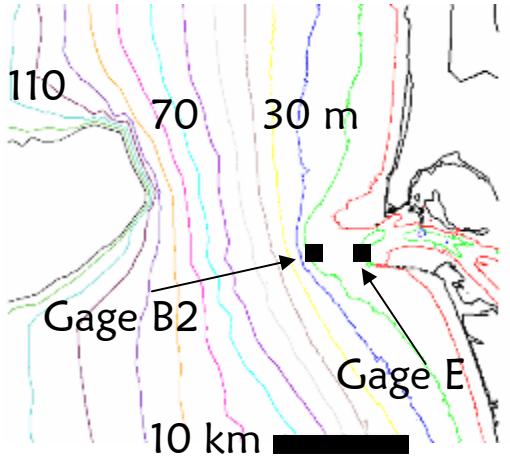




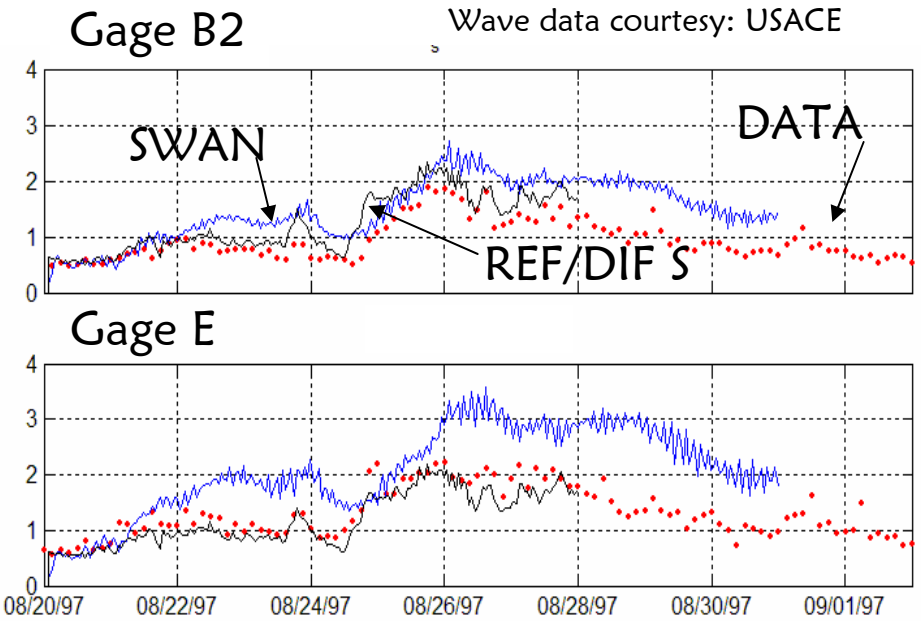
NANOOS short wave modeling at the mouth of the Columbia

Photo courtesy: http://www.ecy.wa.gov





Wave data courtesy: USACE



Attributes	SWAN	REF/DIF S
Wave-current interactions	Yes	Yes
Local wind waves	Yes	No
Diffraction effects	No	Yes

Ocean Observing System Elements in place in Pacific Northwest

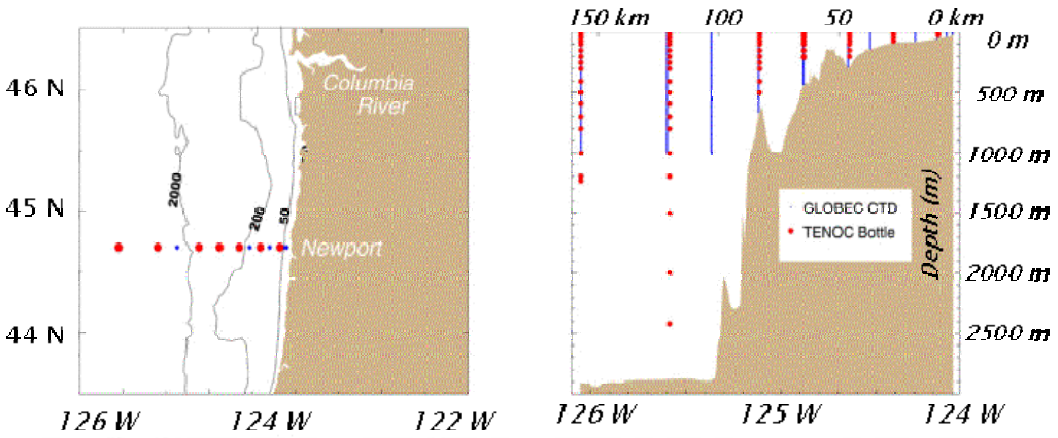
- Columbia River:
  - CORIE: modeling and observation program
  - NANOOS Pilot
- Newport region: ←
  - Long-term hydrography and mooring
  - Surface Current Mapping with HF
  - New measurement technology
    - Profiling moorings
    - Autonomous Gliders
  - Data Assimilative Modeling

Long History of Sampling along the Newport Hydrographic Line

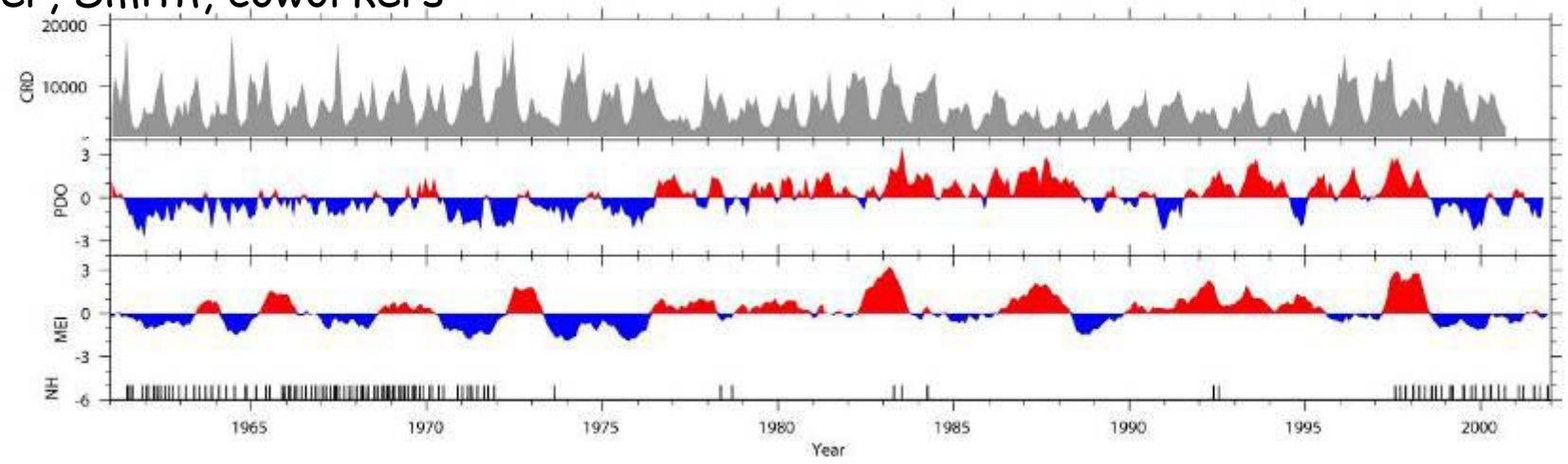
Typical Sampling of the Newport Line

1961–1971 & *1997–2003*

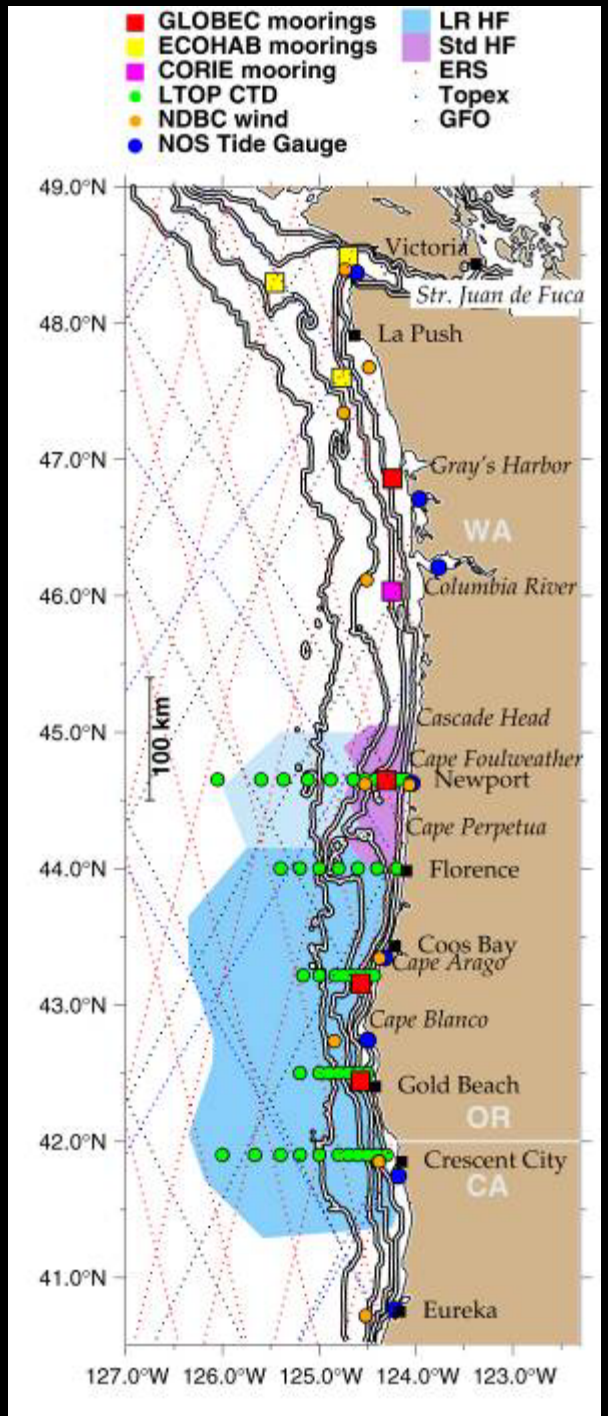
TENOC (bottles) & *GLOBEC (CTD)*



Huyer, Smith, coworkers



Long-Term sampling provides baseline for detecting anomalies: ENSO effects, cold halocline, shelf anoxia.

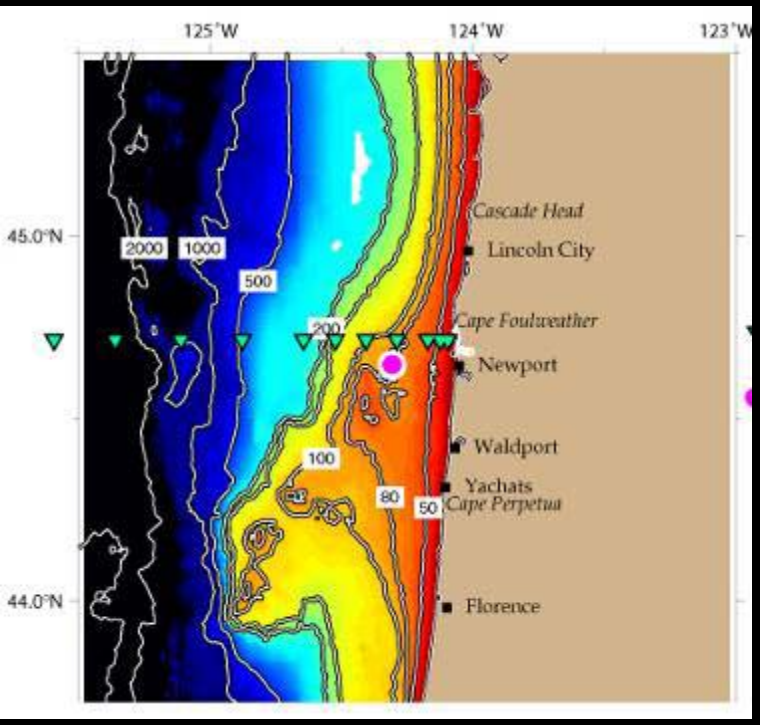


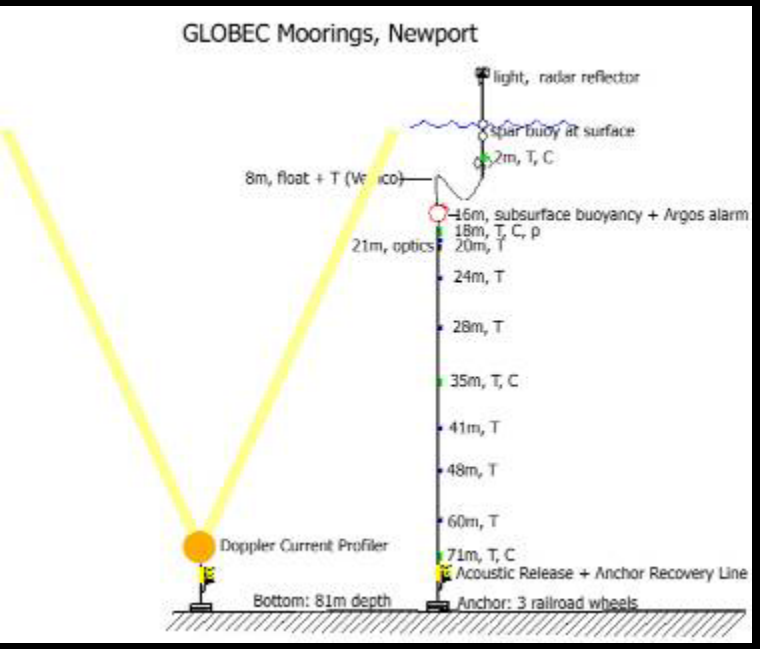
Time-Series Measurements

Kosro, Hickey, Ramp, Letelier, Paduan, Abbott

- 4 GLOBEC Mooring Sites:
  - Newport (44.65 N, 81m depth)
  - Coos Bay (43.16 N, 97m)
  - Rogue River (42.44 N, 76m)
  - Gray's Harbor (46.86 N, 25m)

- Long Range HF Current Mapping
- Std. Range HF Current Mapping





Long-Term Mooring, NH10

Kosro, Letelier, Abbott

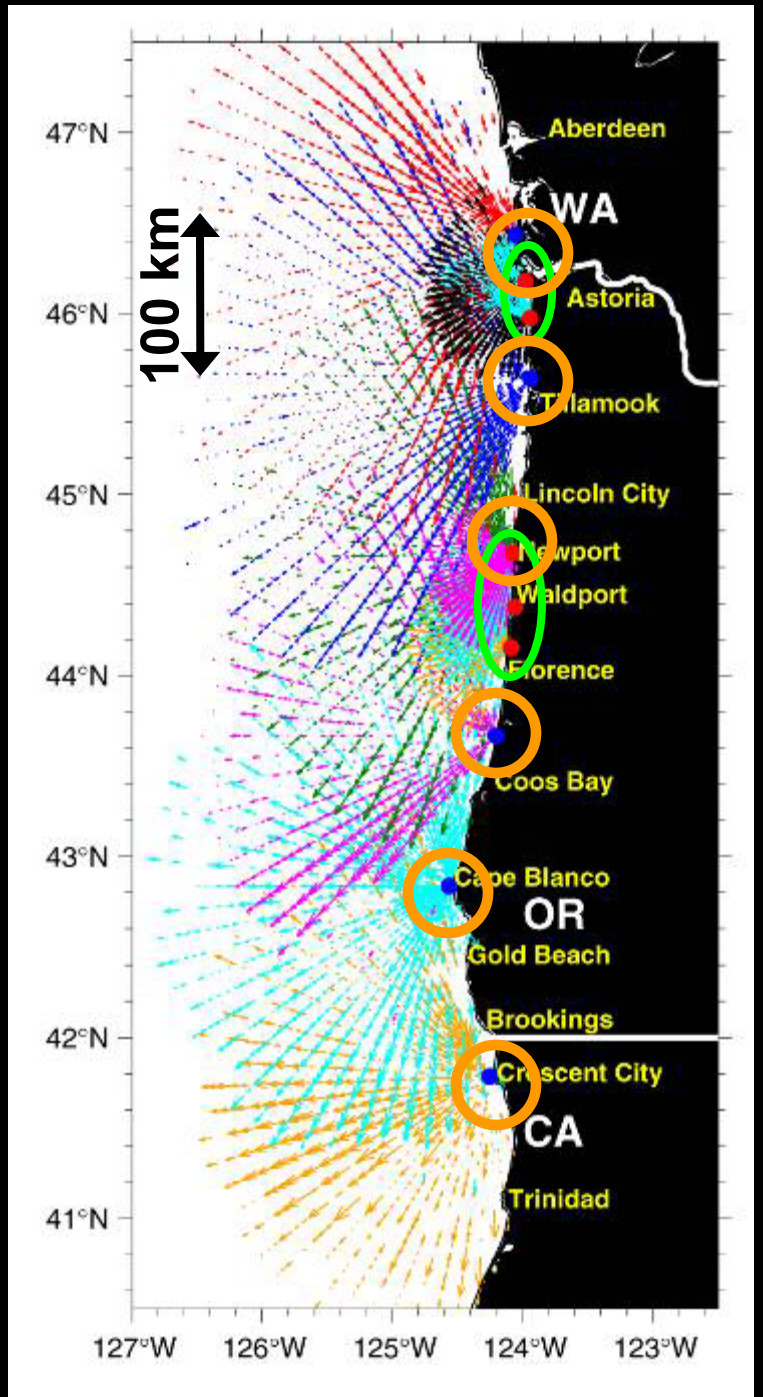
- On Newport Line, in 81m water

  Duration: 4.5 (T/S) to 7 yrs (u,v)

  Sampling Δt: most at 3 minutes

Continuously recorded measurements:

- ADCP current profiles
- T and S at fixed depths
- chlorophyll fluorescence near 20m



Time-Series Mapping of Surface Currents from Land

Mike Kosro, Walt Waldorf, Anne Dorkins

Long-term timeseries maps of NW surface currents in near real-time.
http://bragg.coas.oregonstate.edu

- 5 std.-range (12MHz) sites: data to 45 km
  - Columbia River
  - Heceta Bank
- 6 long-range (5MHz) sites: data to 180 km
  - Crescent City, CA through Southern WA.

Data retrieved by wireless, DSL and phone.

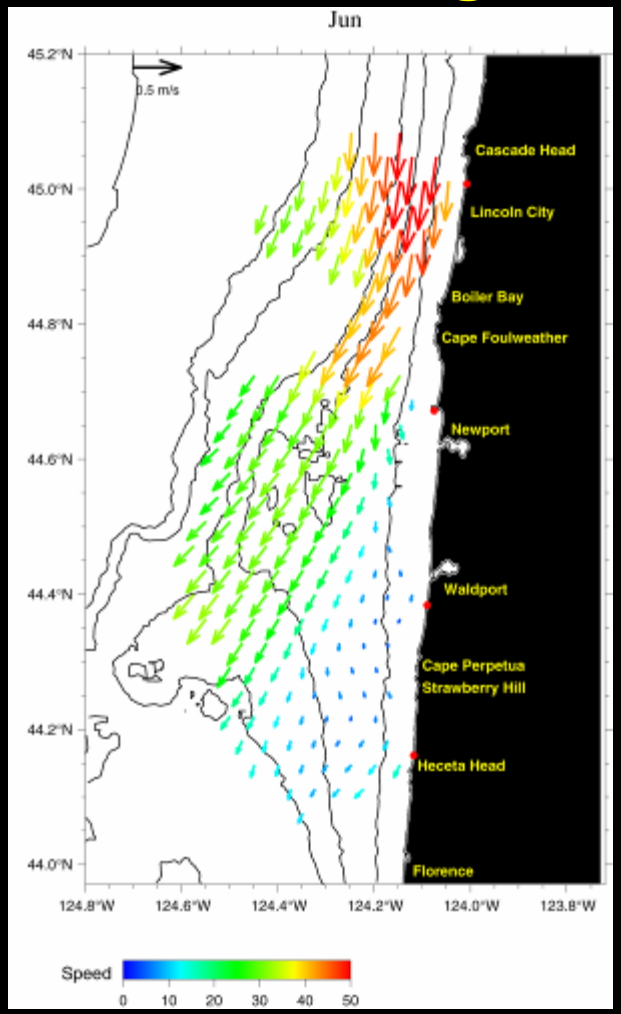
Alerts and remote restarts when sites fail

Each site visited every one or two months.

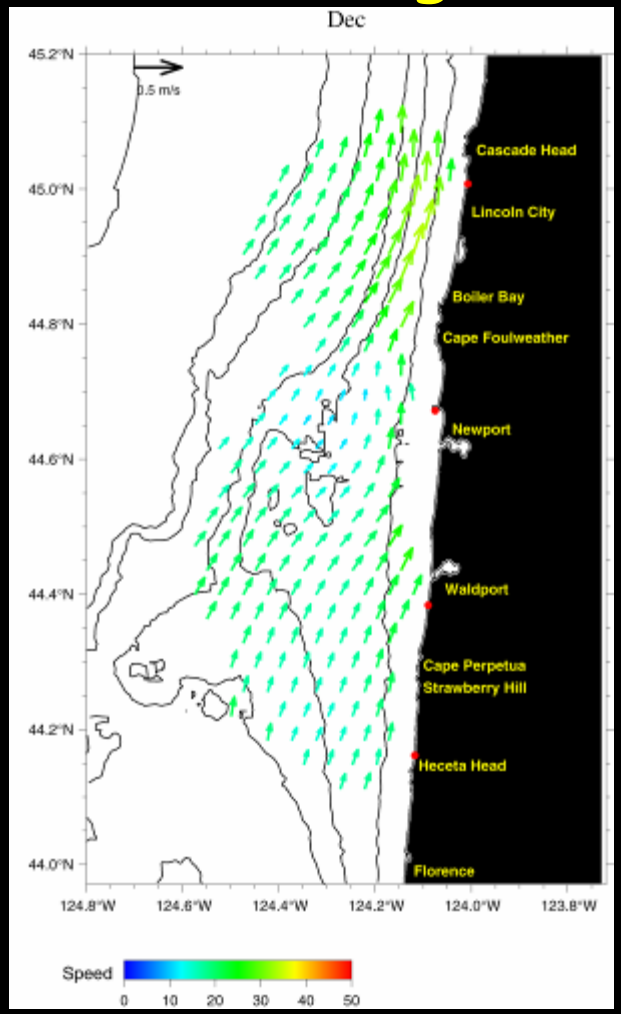
OSU Oregon State University
Ocean Currents Mapping Lab

Wind-Driven Shelf Currents

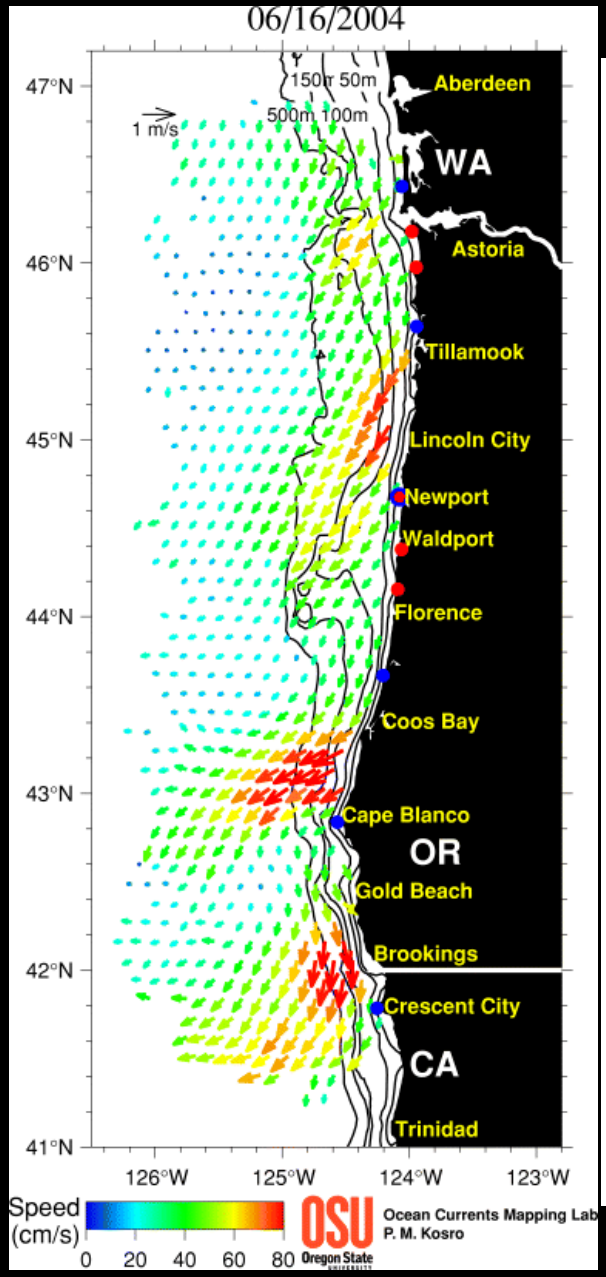
June avg.



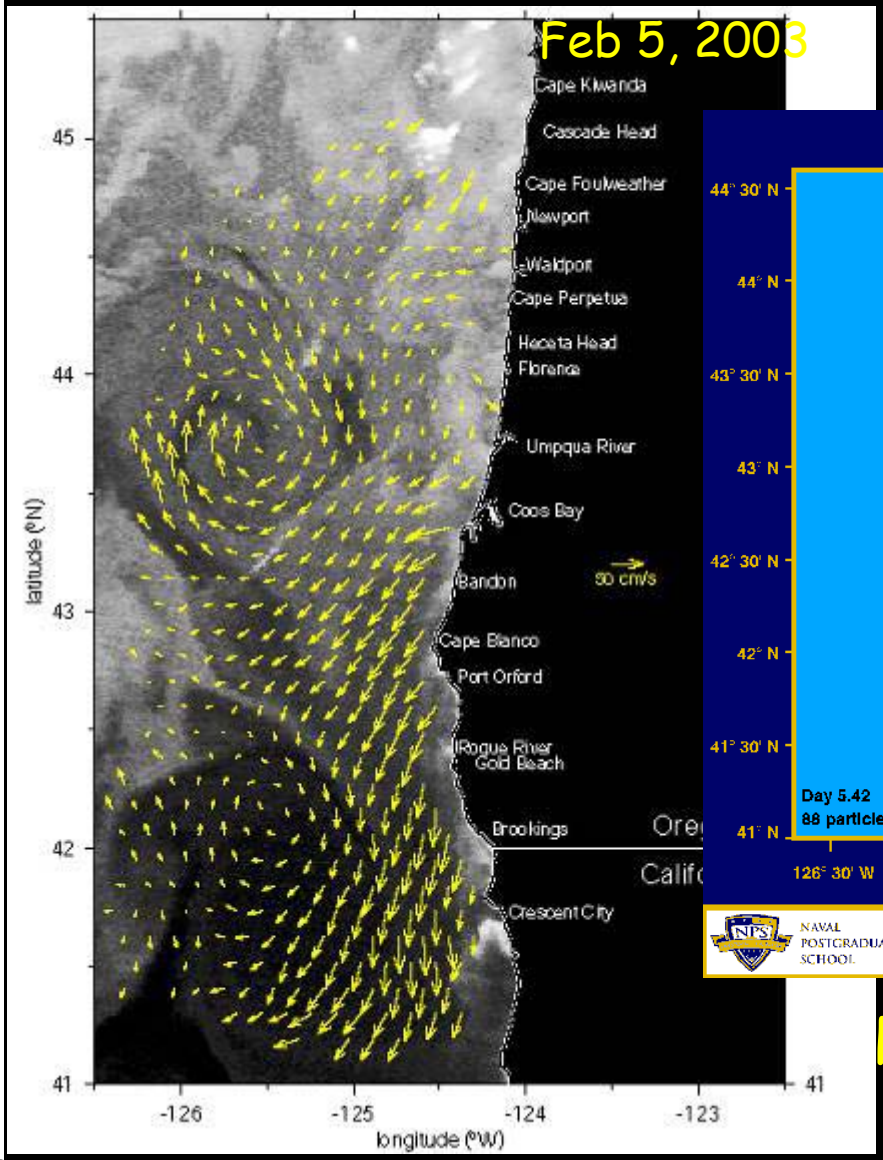
Dec. avg.



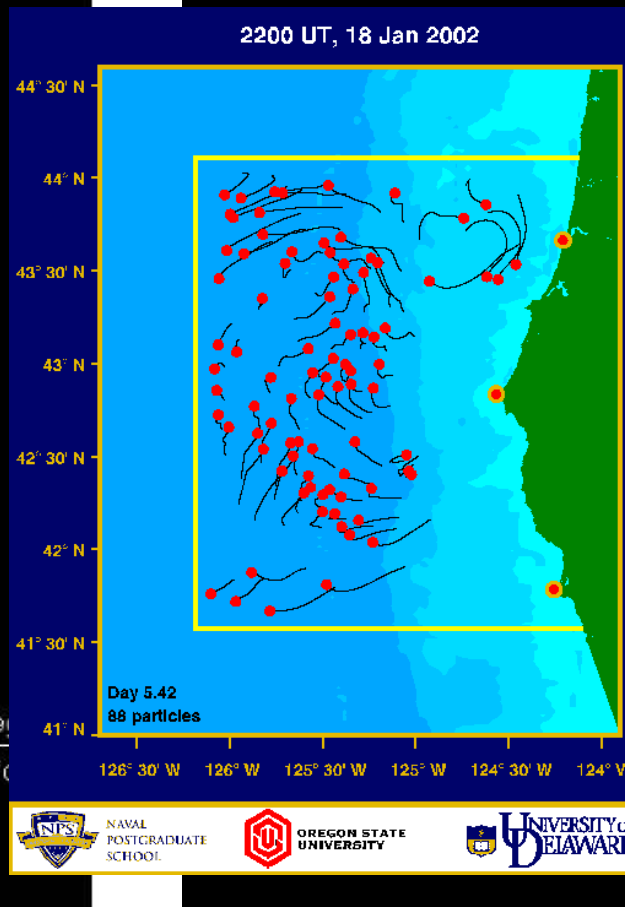
Long-Range HF current mapping



Separating Jets

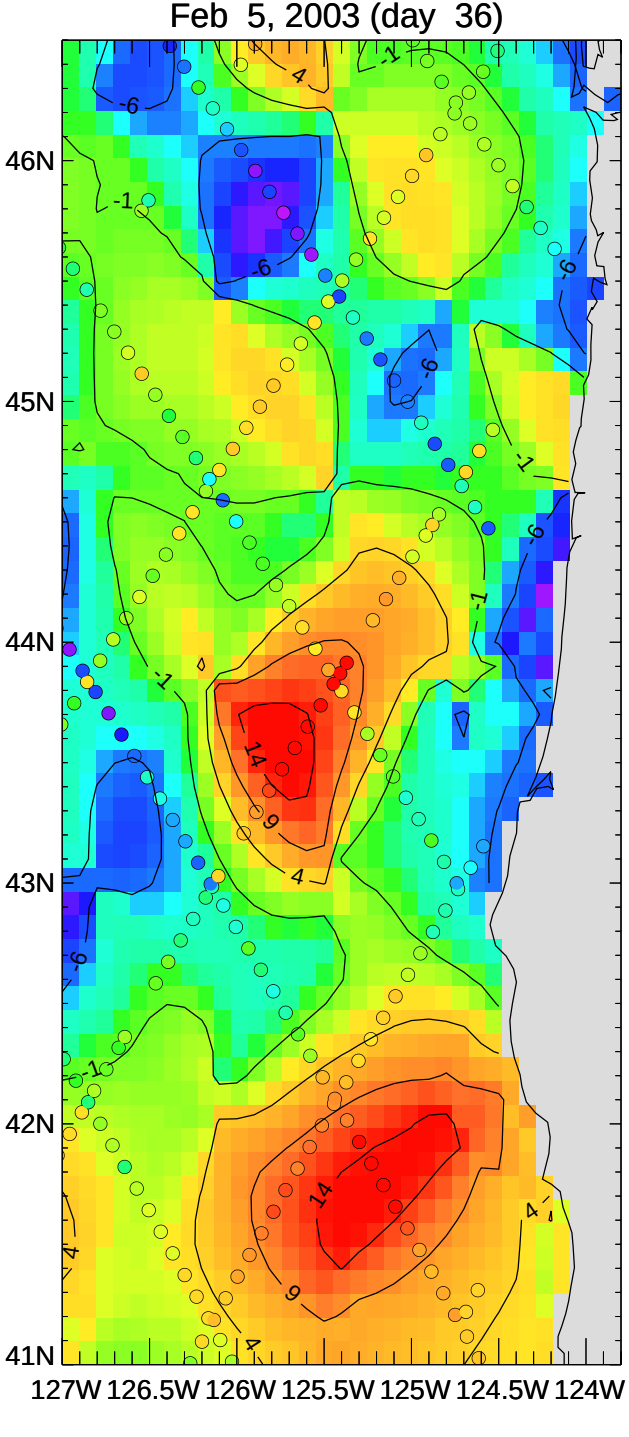


Eddy, winter upwelling



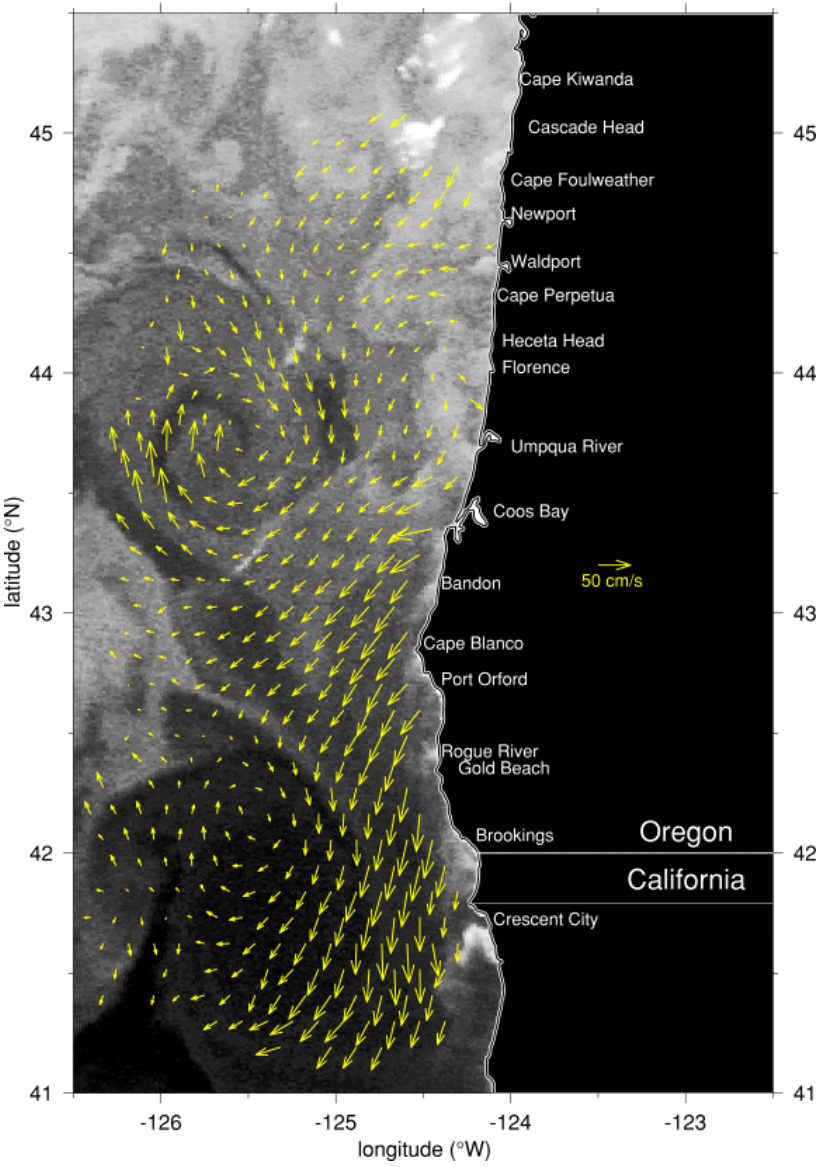
Pseudo-drifter
w/ Lipphardt, Kirwan, UDel

OSU Oregon State Ocean Currents Mapping Lab



T/P + Jason-1: Feb 5, 2003 ±5 days

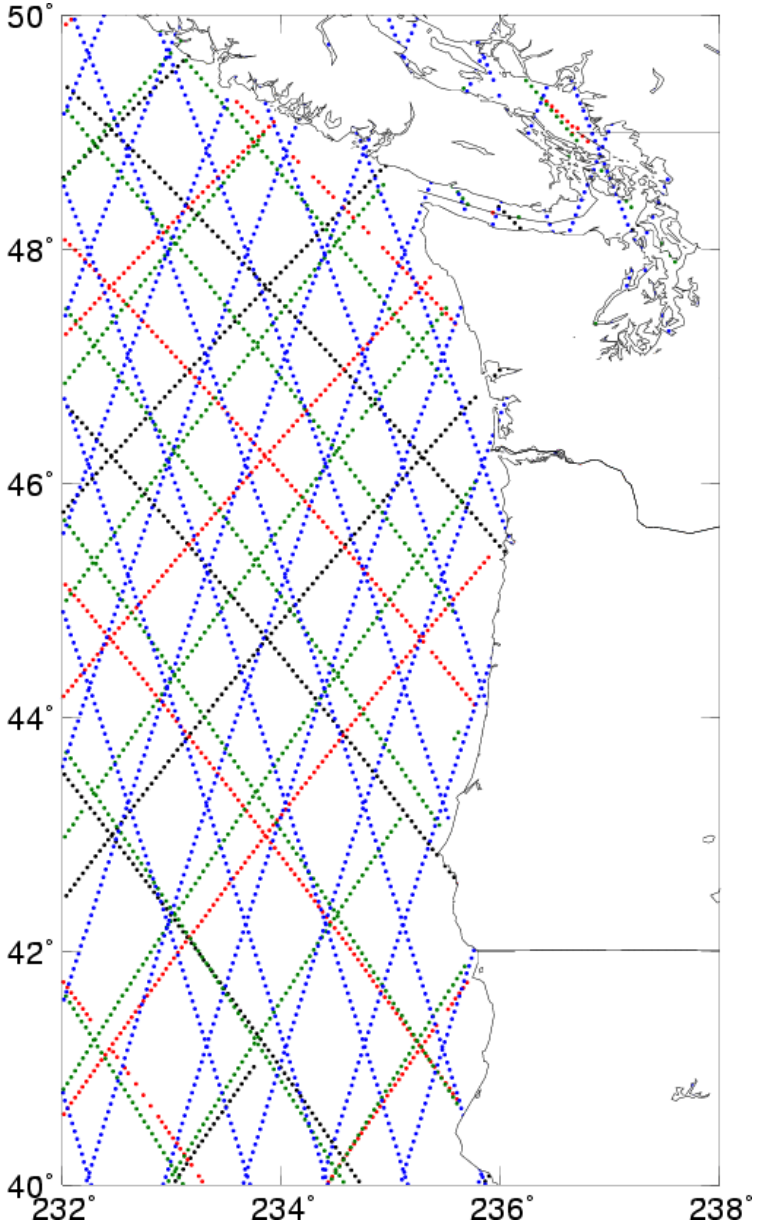
Long Range Radar Surface **V**, Feb 5, 2003



Long-Range HF current mapping

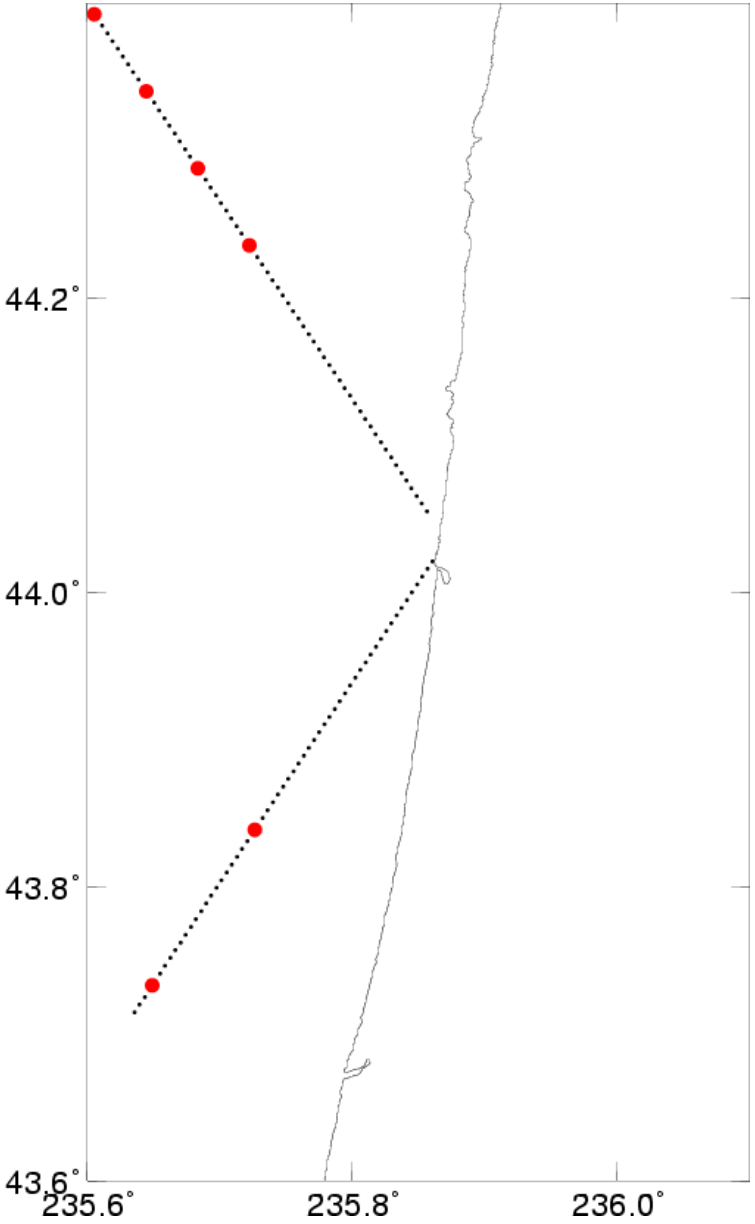
- We provide daily maps of surface currents off the entire coast of Oregon in near real-time, with detailed maps for Columbia River and Newport.
- Systems are in place or being installed at other locations around the country. California is beginning a program to complete a mapping array for their coast over the next 2-3 years.
- Data archival is handled locally for now. We plan to form regional data centers (California, PNW on West Coast) in the IOOS era.
- **Merged data products (SST, Alt, Scatt, HF currents) are a CIOSS research topic.**

Multi-Mission Altimetric Coverage



- Four concurrent altimeters
  - Topex (black) : 10 day repeat
  - Jason-1 (red) : 10 day repeat
  - GFO (green) : 17 day repeat
  - Envisat (blue) : 35 day repeat
- Radar Altimeter Database System
  - All data & corrections within RADS
  - Normally data provided at 1 Hz (7 km)
  - Capable of handling 10 Hz high-rate data
  - Does NOT account for radial orbit errors
- Coarse sampling near shore
  - Assimilation into coastal models
  - Will only get worse as we lose Topex, GFO…

Proximity to the Coastline

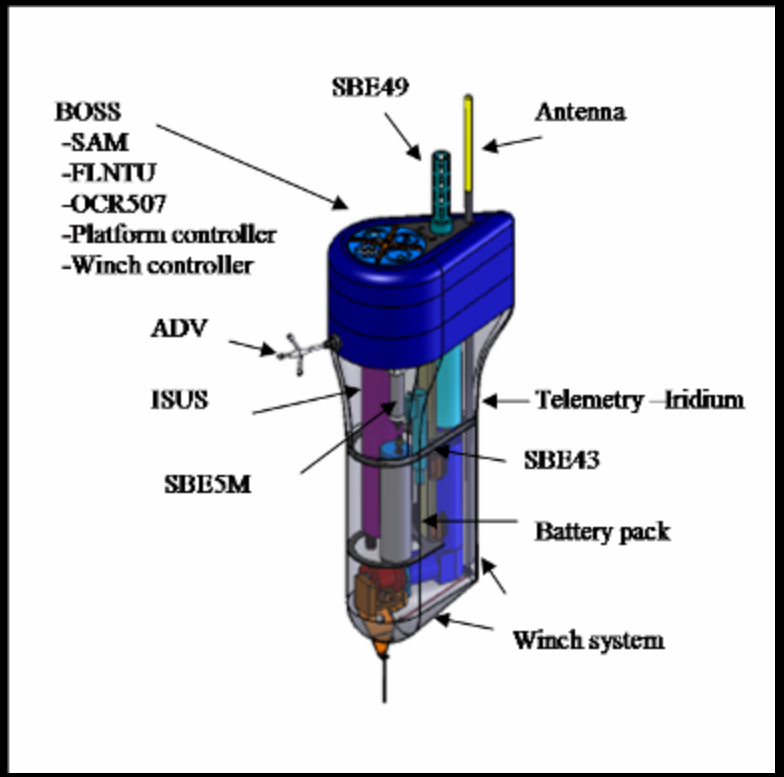


- 1 Hz averaged data (red)
  - 7 km spacing too coarse
  - Data gaps due to editing or radiometer contamination
- 10 Hz high-rate data (black)
  - 700 m spacing - sufficient?
  - Careful near shore editing
  - Agility of altimeter acquiring sea surface after land/sea transition
  - Waveform retracking

New Mooring Technology
Levine/Barth/WET Labs

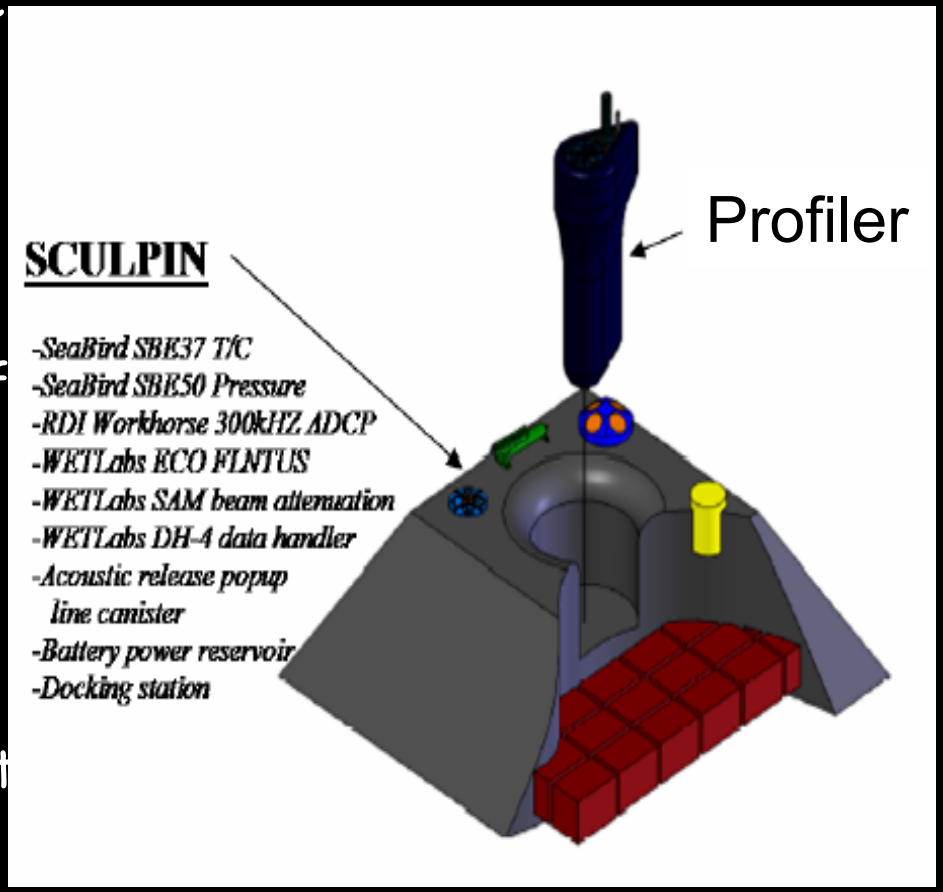
CAPABLE

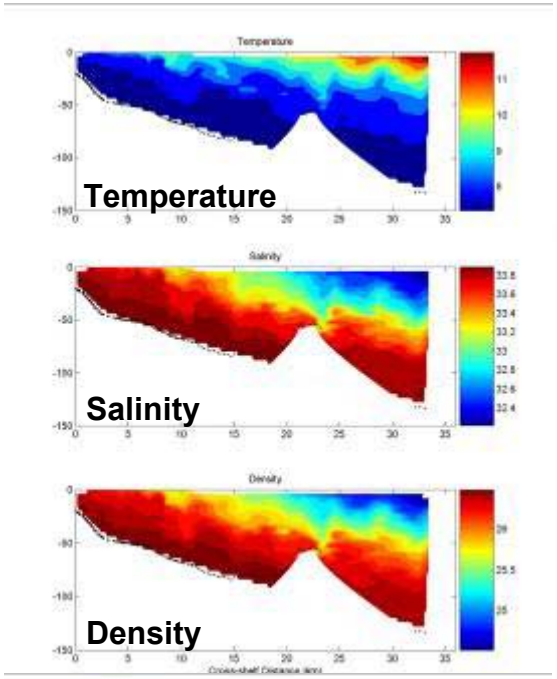
- Collaboration between WET Labs and OSU (Jack Barth and Murray Levine, Oregon State University)
- Environment: Coastal Water Column Profiling to 200 m depth
- Power: On board batteries, rechargeable when docked on the bottom docking station (SCULPIN).
- Data Transfer possibilities: Internally recording, inductive modem, acoustic telemetry system, spread spectrum radio frequency (FreeWave), Iridium satellite, cabled observatory.
- Instruments: Sea-Bird 49 CTD, WET Labs SAM, WET Labs ECO Fluorescence and backscatter, Satlantic OCR507 Radiometer, Satlantic ISUS nitrate sensor, acoustic Doppler velocimeter, dissolved oxygen sensor. Expansion bay to accommodate additional sensors.
- Profiling: 0.2 – 1 m/s, in currents up to 1 m/s
- Deployment: 180 Days

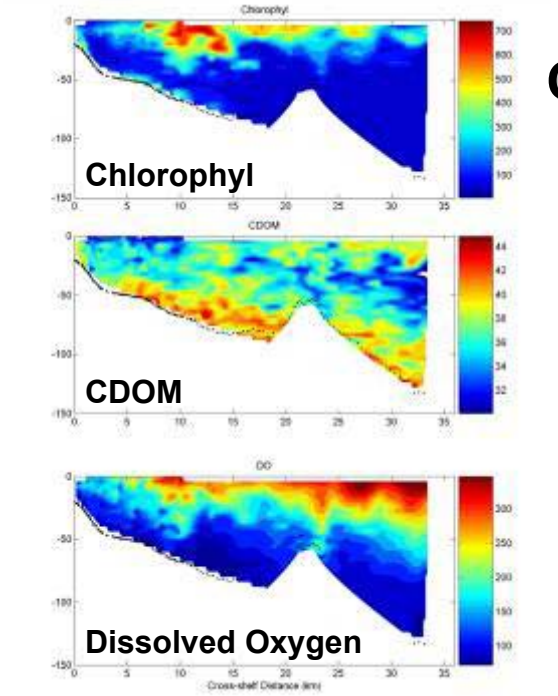


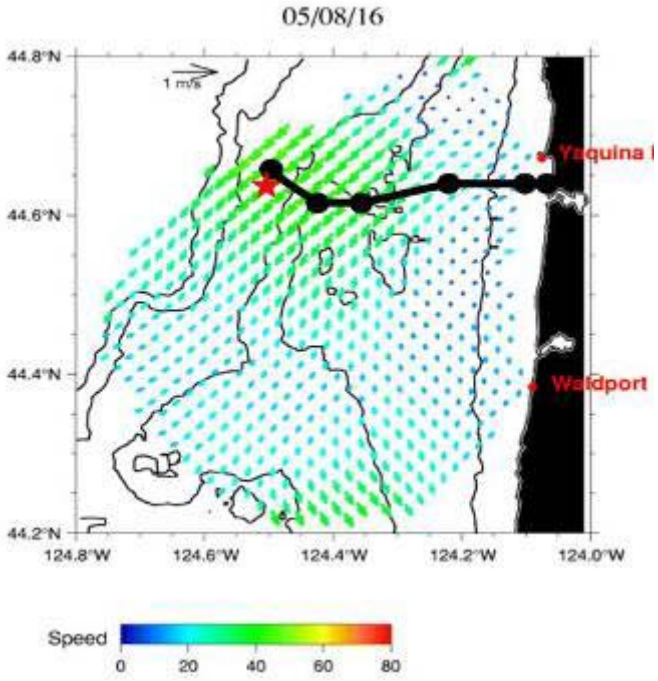
Sculpin

- A stable docking station for the Profiler
- Platform for the profiler battery to be inductively recharged from a large battery power reservoir.
- A suite of sensors to measure variables within a few meters of the bottom
- An acoustically released recovery line
- All the sensors will be plugged into the data handler module (WET Labs, model DH-4) that will merge the data and transmit it inductively to the Profiler









OSU Glider Lab

2 Slocum electric, 200 m gliders

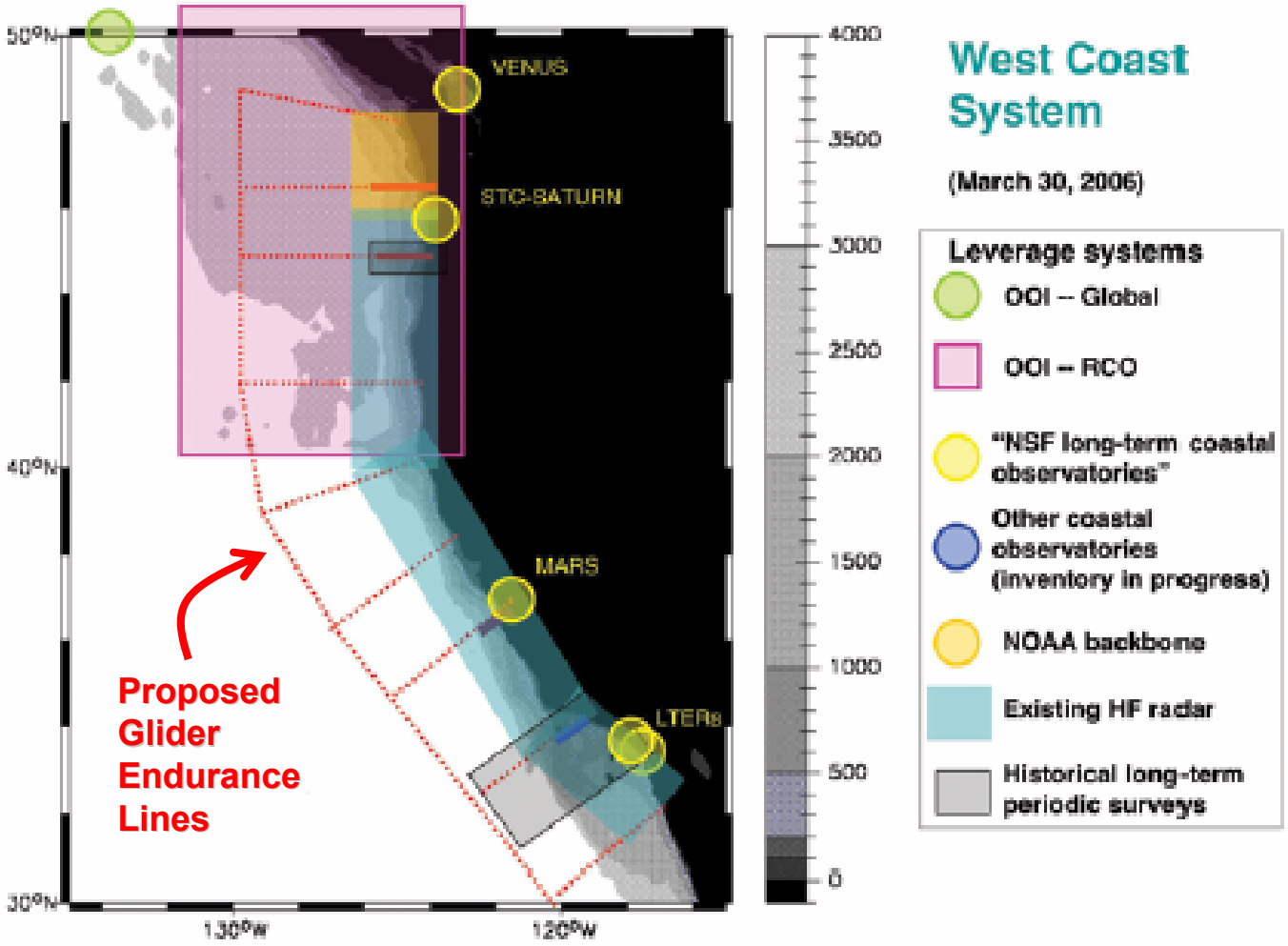
New 1000 m glider (spring 2007)

Endurance Line off Newport, OR

- **began April 2006**
- **100 km offshore**
- **7 day repeat cycle (out+back)**

Gliders will play a major role in planned ocean observing systems …

Figure 6.1. West Coast plan recommended by coastal breakout groups.



ORION D&I Workshop Report, 2006