NASA's Earth Science Enterprise

Update from Physical Oceanography Program

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Ocean Color Science Team
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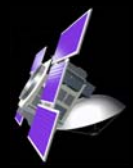
NASA Ocean Science Missions

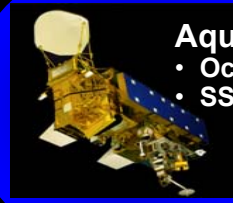
TRMM

GRACE:
- Dynamic topograhpy

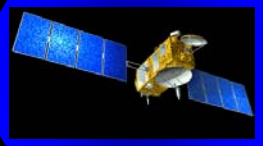


Cloudsat

CALIPSO

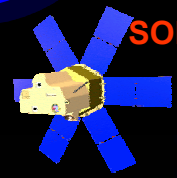


Aqua:
- Ocean Color
- SST



Jason:
- Altimetry

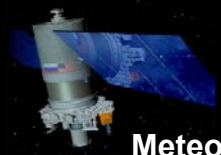
TOPEX:
- Altimetry



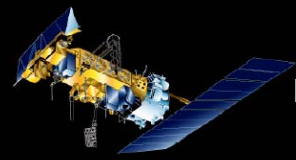
SORCE

GIFTS

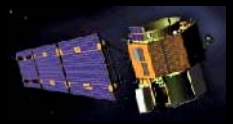
Landsat



Meteor/ SAGE



NOAA/ POES



EO-1

SeaWiFS:
- Ocean Color

Aura

QuikScat:
- Vector Winds

ICESat

Terra :
- Ocean Color
- SST

ADEOS-II :
- Vector Winds

Key:

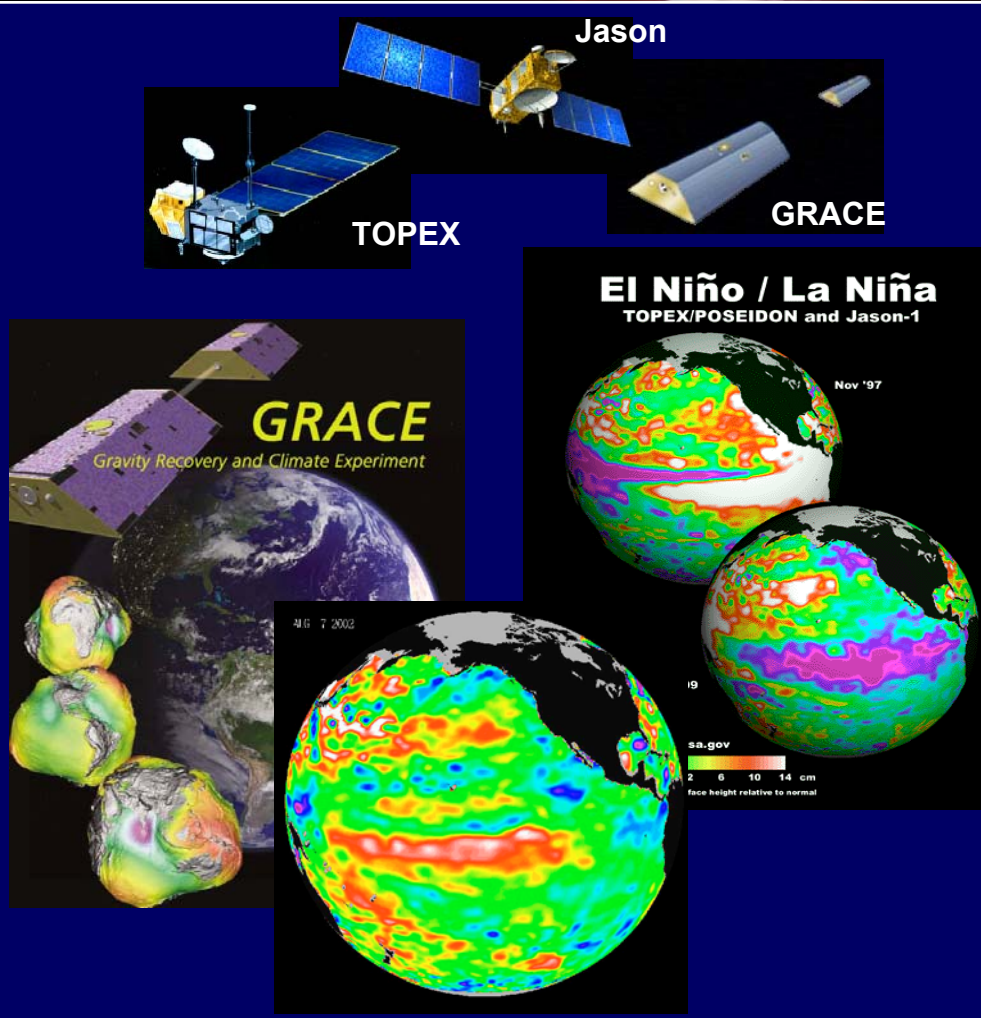
Operating

In Development

Ocean Science

Ocean Altimetry

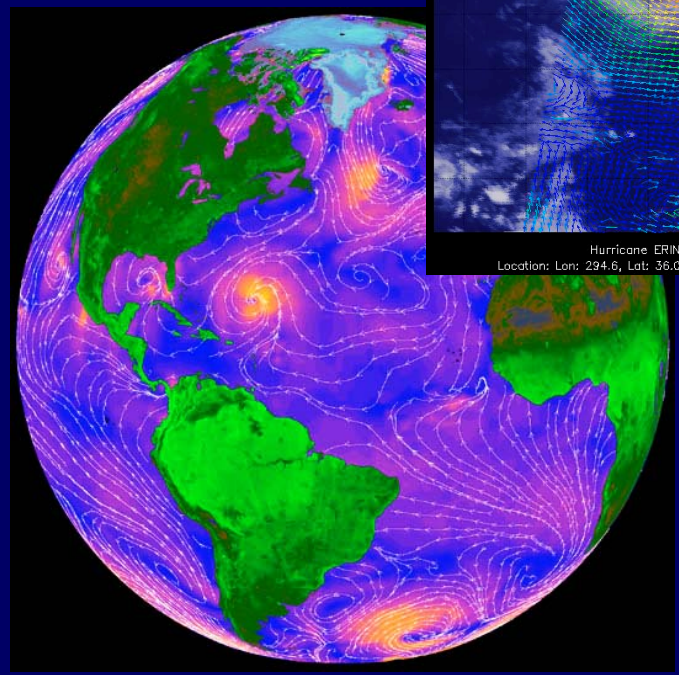
- Altimeter data provide monitoring of the El Niño/La Niña conditions in the Pacific ocean and have been used to provide input to short-term climate forecasts.
- Altimeter data products have been in growing use by the applications community in areas such as deep-sea cable laying, fisheries management, marine habitat assessment, and ship routing.
- The addition of precise geoid measurements from the GRACE mission enable the use of dynamic topography for studying surface and deep currents.
- CNES (France), NASA, NOAA, and EUMETSAT have agreed to work towards the joint implementation of an Oceanographic Surface Topography Mission (OSTM) to ensure the continuation of precise altimetry data to meet the needs of the user community.

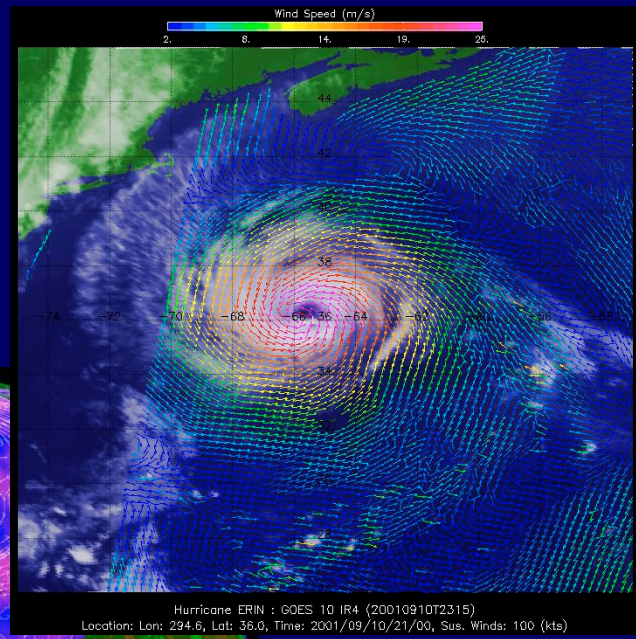


TOPEX/Poseidon tracked the 1997-1998 El Niño/ La Niña (right), and is exploring longer-term changes such as the Pacific Decadal Oscillation. In February 2002, TOPEX data prompted NOAA to forecast a mild El Niño. The center image shows a large pool of warm water in the tropical Pacific in August 2002.

Vector Winds

- On February 22, 2002, the QuikSCAT satellite turned operational as the United States and Europe began incorporating wind speed and direction in their global weather analysis and forecast systems.
- Forecasters can now predict hazardous weather events over the oceans as much as six to 12 hours earlier.
- ADEOS-II with Seawinds failed in Oct 2003 after only 9 months on orbit.





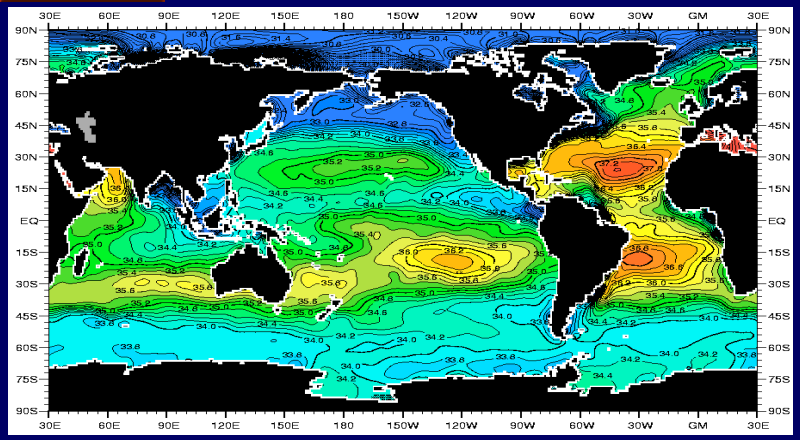
Above: QuikSCAT wind data overlaid on GOES-10 IR cloud imagery of hurricane Erin, September 10, 2001

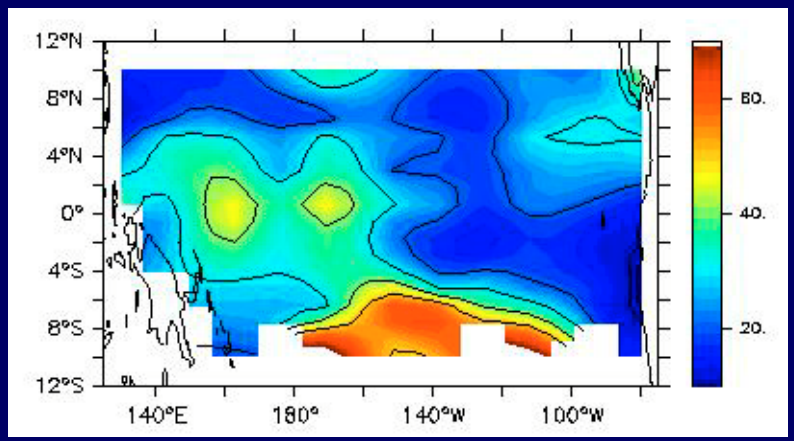
Ocean Salinity Mission Selected for ESSP-3

JPL

GSFC

AQUARIUS



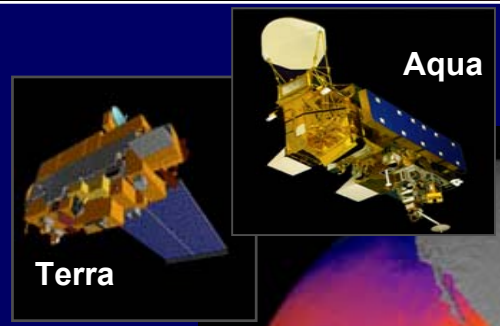


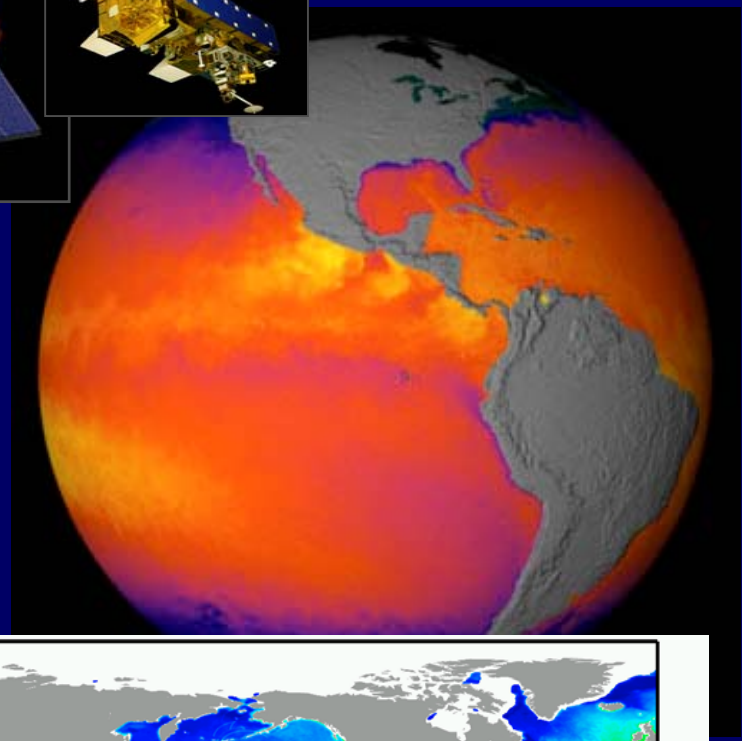
Percentage of dynamic height variability due to salinity (Maes and Behringer, 2000).

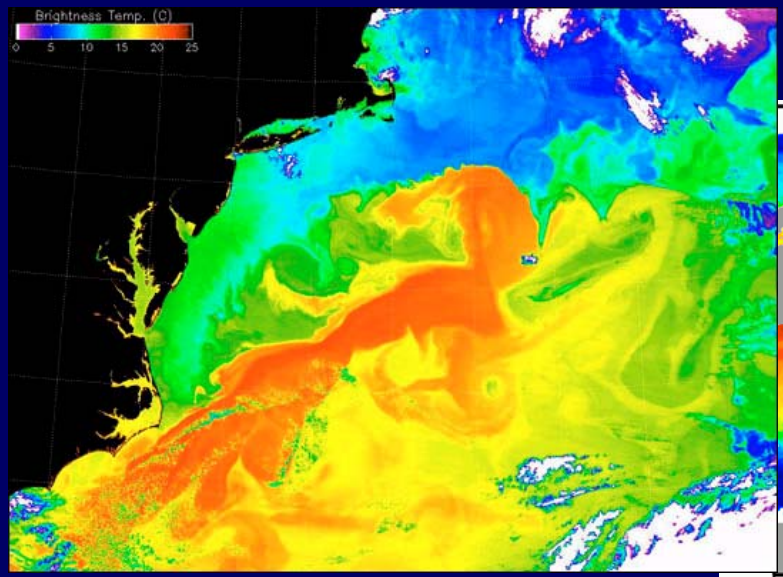
- The effect of salinity on surface height is comparable to the effect of temperature.
- Salinity is a key variable in density which drives circulation. It is therefore a critical area of scientific uncertainty in the oceans' capacity to store and transport heat, which in turn affects the Earth's water cycle and climate.
- Conventional *in situ* Sea Surface Salinity (SSS) sampling is too sparse to give a global view of salinity variability.
- Aquarius will provide the first-ever global maps of salt concentration on the ocean surface.
- Aquarius will measure global SSS synoptically every month for 3 years, resolving missing physical processes that link the water cycle, the climate, and the ocean.

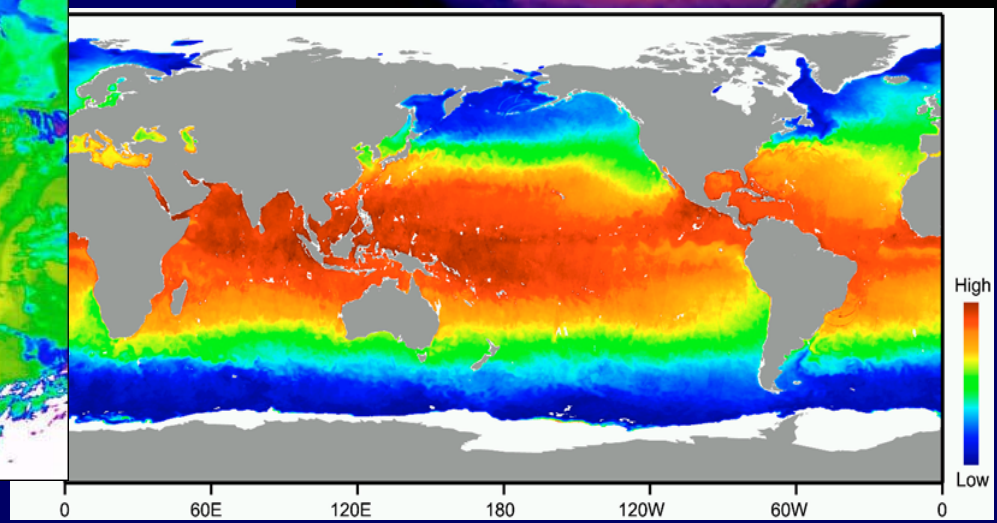
Sea Surface Temperature

- The MODIS instruments on Terra and Aqua provide day and nighttime SST globally on a daily basis to an accuracy more than twice that of previous satellite sensors.
- This data is particularly helpful in forecasting events like El Niño and La Niña, and predicting how temperature anomalies will affect weather patterns around the world.
- SST maps are also helpful for locating gamefish.





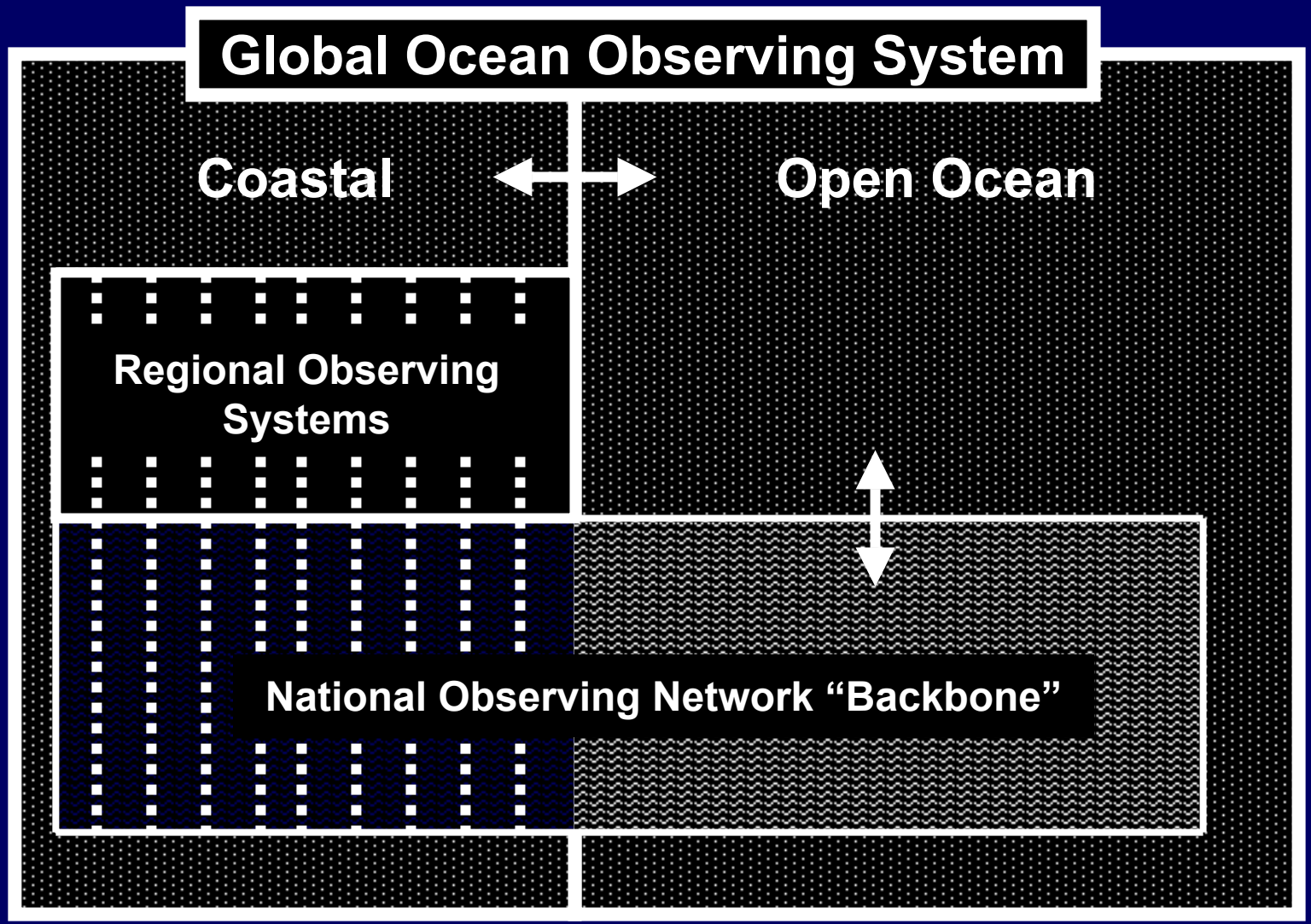




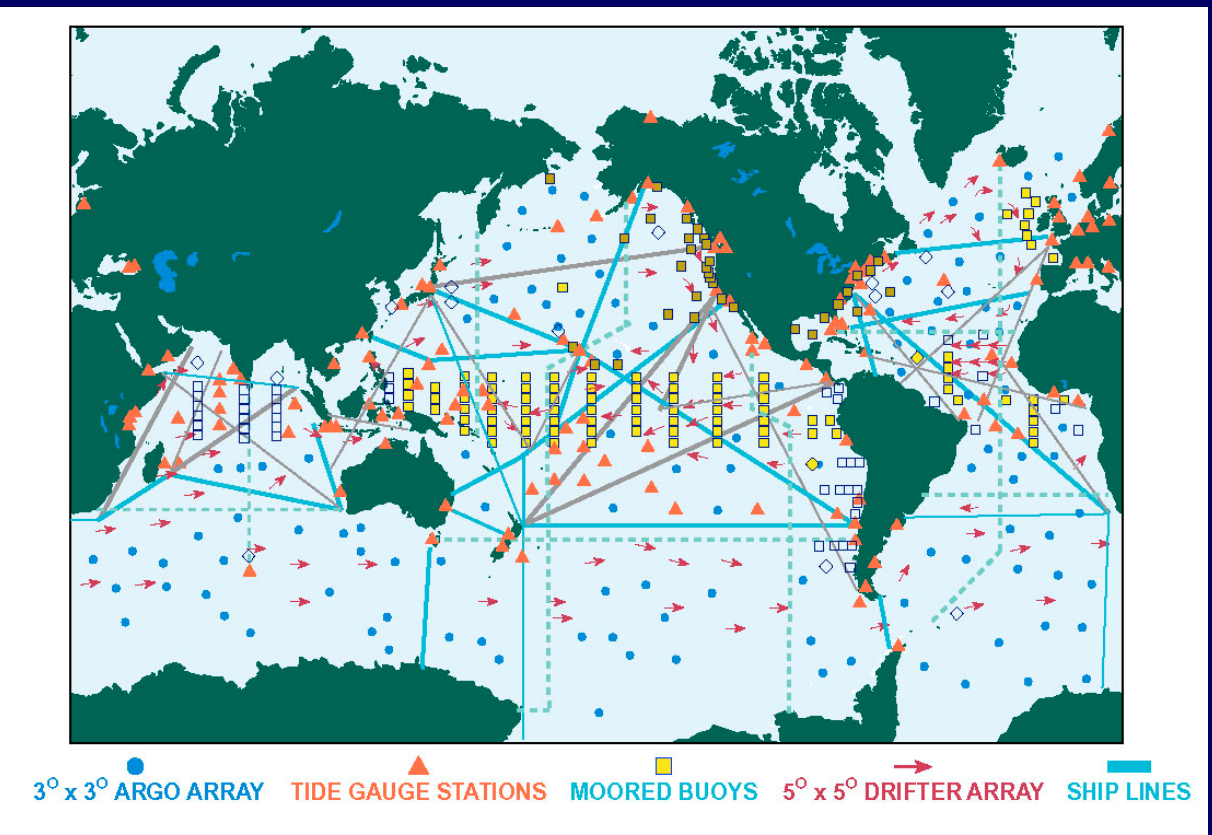
Sea Surface Temperature

- Research development of new SST products in proceeding (e.g. GHRSST-PP)
- Validated MODIS SST products continue to be produced through MODAPS.
- Near-real-time MODIS SST product now available through ocean color processing team. Data set utility and product accuracy under discussion.
- Currently in “fact-finding” mode on how to better organize SST research, product production, and requirement evaluation.
- “Missions to Measurements” - SST Science Team?

U.S. Integrated Ocean Observing System



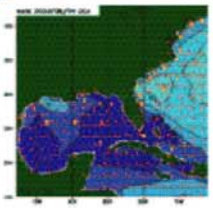
IOOS Global System



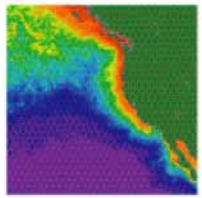
- Full implementation of Argo and the global ocean time series observatories.
- Successful completion of the Global Ocean Data Assimilation Experiment (GODAE).
- Optimizing the global network of observations, and
- Enhancing the ocean time series observatories with key biological and chemical sensors.

Possible Components of the IOOS National Backbone

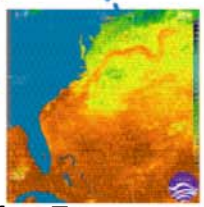
- Measure and process variables needed by all regional systems
- Satellite remote sensing
- Reference, sentinel stations
- Link to global system
- Data standards & exchange protocols
- Capacity building



Wave Height



Ocean Color



Surface Temperature

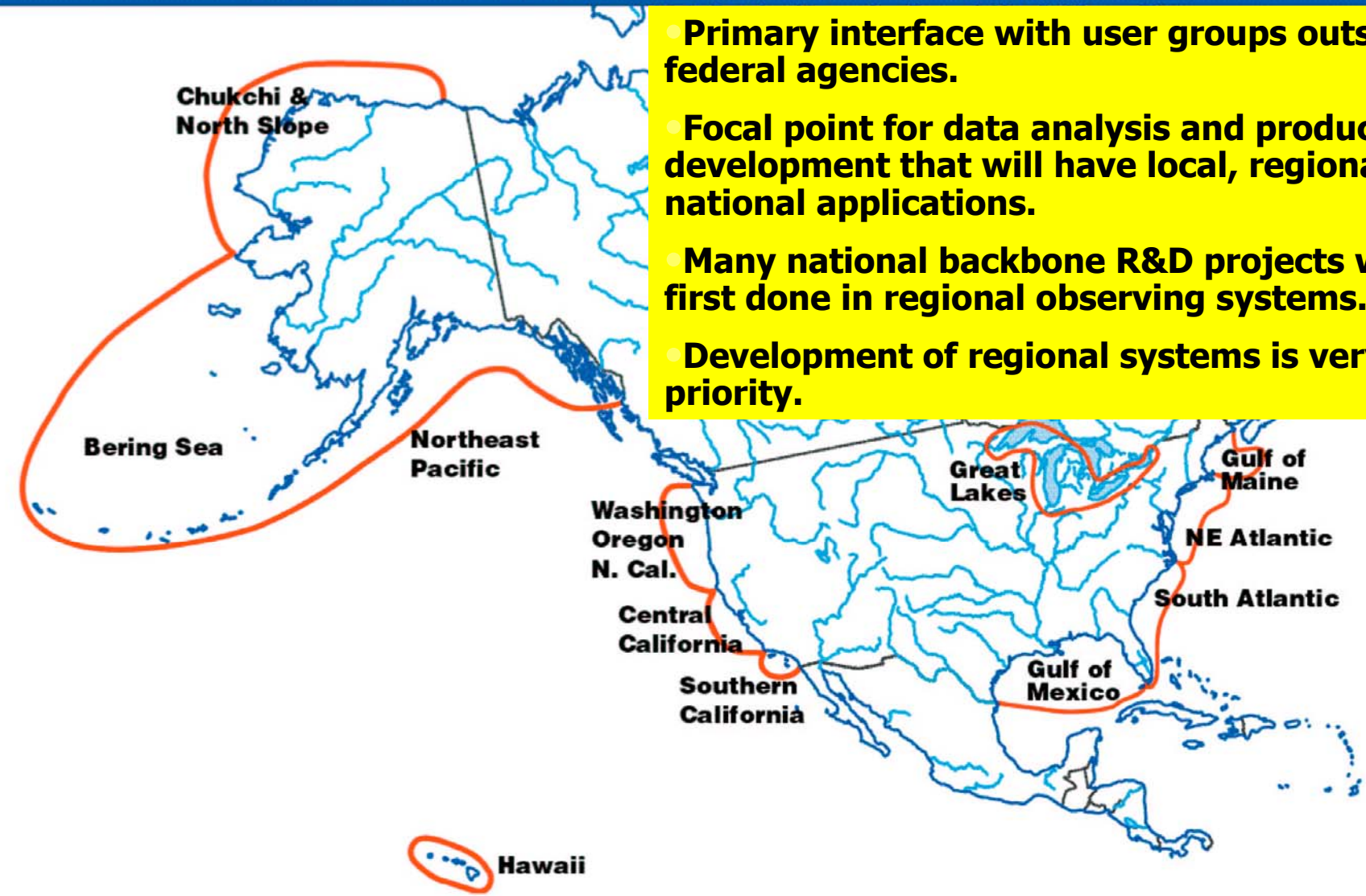
Physical Oceanography Real Time System (PORTS)

National Water Level Observation Network (NWLON)

National Data Buoy Center marine buoy network

CMAN stations

Possible Regional Observing Systems



- Primary interface with user groups outside federal agencies.
- Focal point for data analysis and product development that will have local, regional and national applications.
- Many national backbone R&D projects will be first done in regional observing systems.
- Development of regional systems is very high priority.