

Global HF Radar – in the GEO Context



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Outline: Goals

- GEO/GEOSS
- GEO Work plan 2012-2015
- Global HF Radar Component



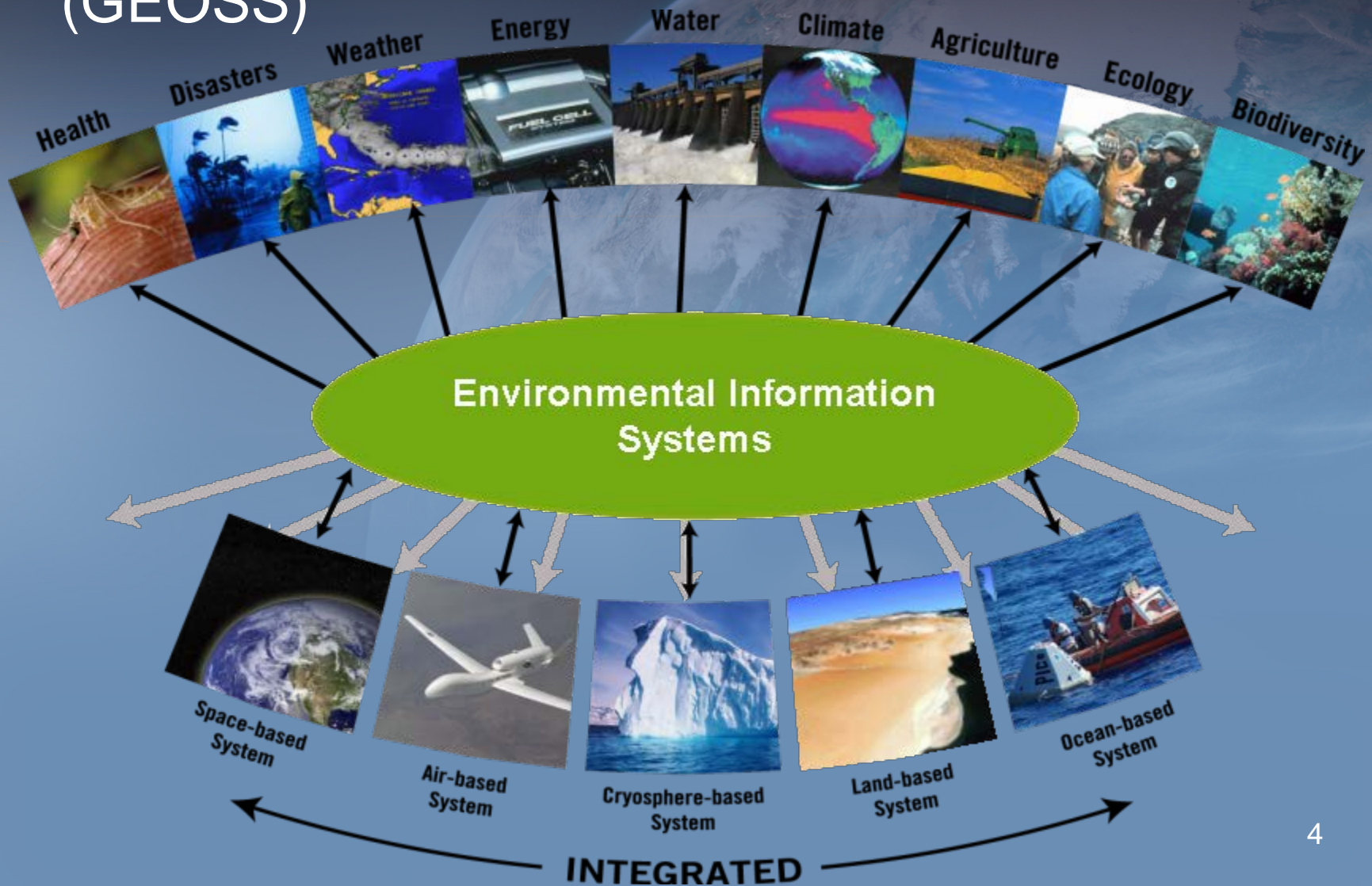
What is GEO?

- The intergovernmental Group on Earth Observations (GEO) is a voluntary partnership of 88 Member governments and the European Commission, working with 61 Participating Organizations
- GEO is coordinating efforts to build a Global Earth Observation System of Systems, or GEOSS
- A forum to develop new projects, coordinate strategies and investments

What is GEOSS?

- A distributed system of systems
 - Improves coordination of strategies & observation systems
 - Links all platforms: in situ, aircraft, & satellite networks
 - Identifies gaps in our global capacity
 - Facilitates exchange of data & information
 - Improves decision-makers' abilities to address pressing policy issues

A Global Earth Observation System of Systems (GEOSS)





GEONETCast

- GEONETCast is a low-cost, global environmental information delivery system by which remotely sensed and *in situ* data and services from GEOSS are transmitted to users through communications satellites offering near-global coverage.
- Using a multicast, broadband capability, GEONETCast provides information essential to protecting lives allowing for faster decision-making and policy response.



USGEO

GEONETCast Americas:
Near-Global Coverage to More Effectively Manage a World of Resources

In recent years, scores of satellites and thousands of sensors on land, in the seas, and in the atmosphere have been deployed to gather environmental information. As a milestone in the emerging Global Earth Observation System of Systems (GEOSS), GEONETCast is helping to make this vital information more available around the globe, transmitting information on climate, crops, water quality, air pollution and more.

The U.S. National Oceanic and Atmospheric Administration (NOAA) has awarded a commercial services contract to enable expansion of GEONETCast into the Americas. Having GEONETCast Americas in place will provide an alternative means of distributing data and other information about the Earth's changing environment to users, particularly those in developing countries.

As a low-cost, global environmental information delivery system by which satellite and *in situ* data and services from GEOSS are transmitted to users through communications satellites, GEONETCast offers near-global coverage. Using a multicast, broadband capability, GEONETCast provides information essential to protecting lives. It allows for faster decision-making and policy response.

Communication satellite providers broadcast using a standard protocol interface. Different data streams or products could be available on separate channels. The user determines which data are to be received, managed and saved locally. No Internet connection is required. The receiving station is simply a standard personal computer, an off-the-shelf satellite television dish, and a few computer cards.

The total cost... around 1500 euros or 2000 dollars. The result is expanded, worldwide dissemination of urgently needed environmental data to users located just about anywhere on the planet—automatically—24 hours a day.

The communication satellite for each sector of the globe is provided by one or more GEONETCast partners. Current coverage is based on contributions from the European Organisation for the Exploitation of Meteorological Satellites, the U.S. National Oceanic and Atmospheric Administration, and the Chinese Meteorological Administration. Russia has indicated interest in providing coverage in Eurasia. As a GEONETCast partner, the World Meteorological Organization contributes its experience in coordinating globally interoperable telecommunication systems for weather-related information.

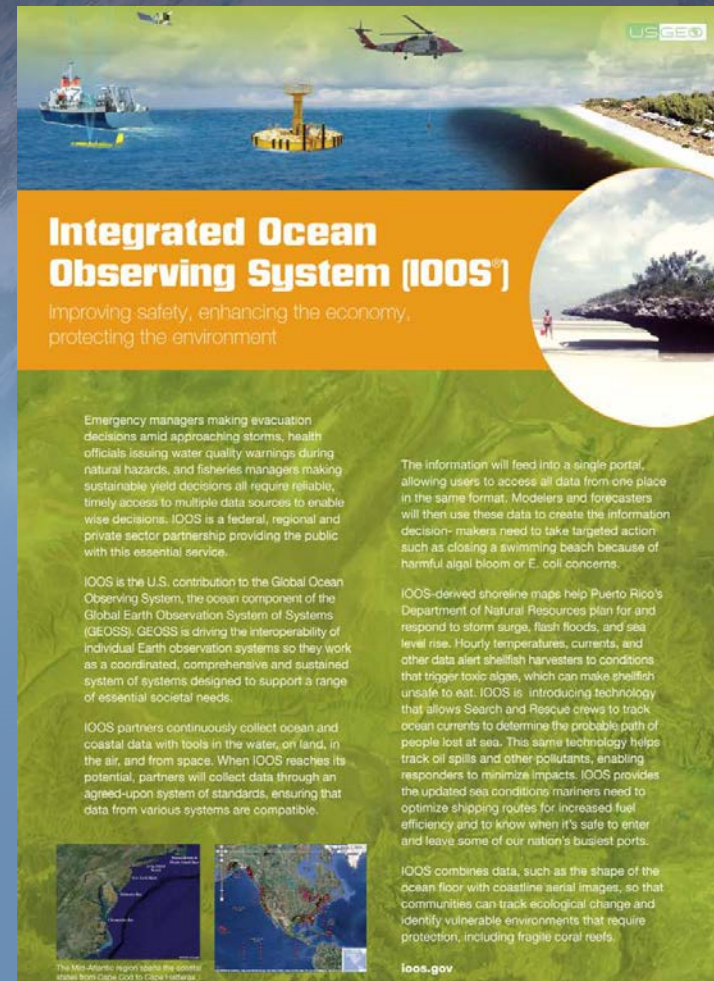
GEONETCast Americas Data Flow To and From the Americas

GEONETCast Americas

Global High-Lat Coverage

US IOOS®

- Integrated Ocean Observing System (IOOS) provides new tools and forecasts to improve safety, enhance the economy, and protect our environment.
 - Has a coastal and global component
 - Is a National and Regional framework
 - Provides observations, data management, modeling and analysis, education and outreach and research and development
- Supports 7 goals with one integrated system



Integrated Ocean Observing System (IOOS®)
Improving safety, enhancing the economy, protecting the environment

Emergency managers making evacuation decisions amid approaching storms, health officials issuing water quality warnings during natural hazards, and fisheries managers making sustainable yield decisions all require reliable, timely access to multiple data sources to enable wise decisions. IOOS is a federal, regional and private sector partnership providing the public with this essential service.

IOOS is the U.S. contribution to the Global Ocean Observing System, the ocean component of the Global Earth Observation System of Systems (GEOSS). GEOSS is driving the interoperability of individual Earth observation systems so they work as a coordinated, comprehensive and sustained system of systems designed to support a range of essential societal needs.

IOOS partners continuously collect ocean and coastal data with tools in the water, on land, in the air, and from space. When IOOS reaches its potential, partners will collect data through an agreed-upon system of standards, ensuring that data from various systems are compatible.

The information will feed into a single portal, allowing users to access all data from one place in the same format. Modelers and forecasters will then use these data to create the information decision-makers need to take targeted action such as closing a swimming beach because of harmful algal bloom or E. coli concerns.

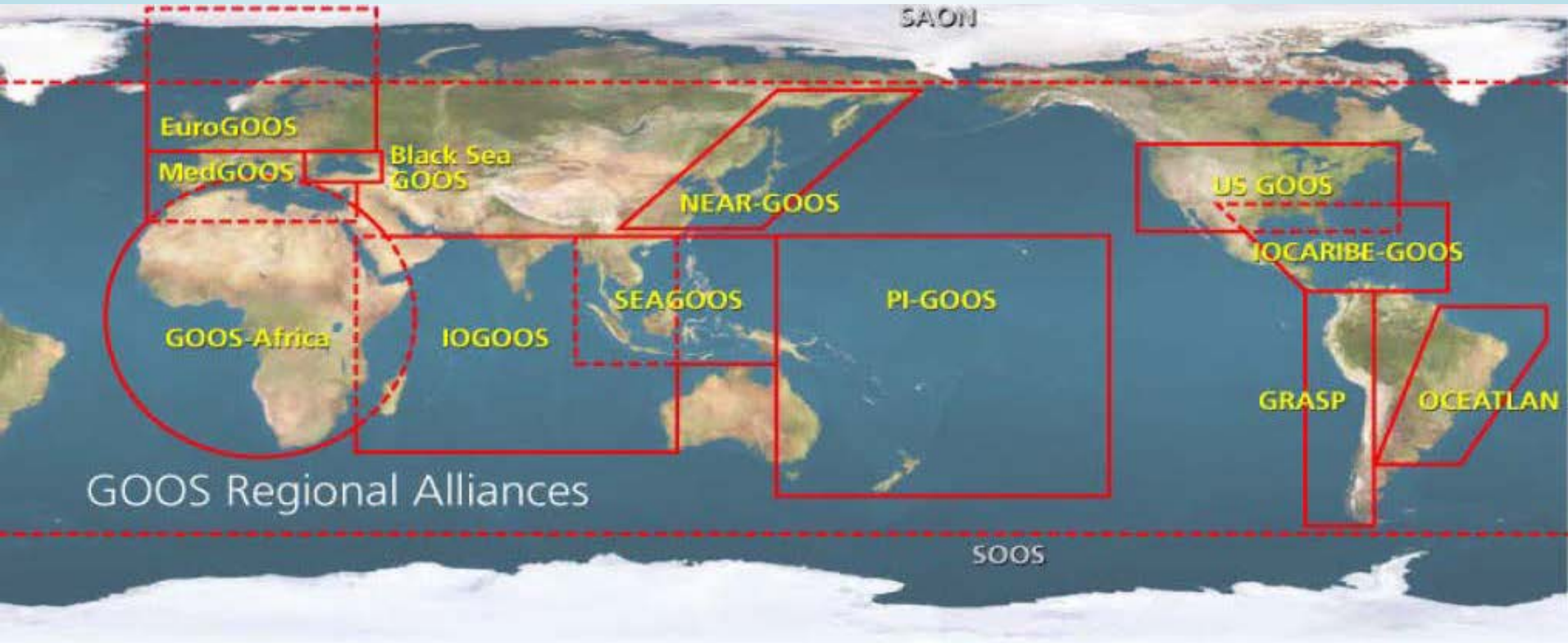
IOOS-derived shoreline maps help Puerto Rico's Department of Natural Resources plan for and respond to storm surge, flash floods, and sea level rise. Hourly temperatures, currents, and other data alert shellfish harvesters to conditions that trigger toxic algae, which can make shellfish unsafe to eat. IOOS is introducing technology that allows Search and Rescue crews to track ocean currents to determine the probable path of people lost at sea. The same technology helps track oil spills and other pollutants, enabling responders to minimize impacts. IOOS provides the updated sea conditions mariners need to optimize shipping routes for increased fuel efficiency and to know when it's safe to enter and leave some of our nation's busiest ports.

IOOS combines data, such as the shape of the ocean floor with coastline aerial images, so that communities can track ecological change and identify vulnerable environments that require protection, including fragile coral reefs.

ioos.gov

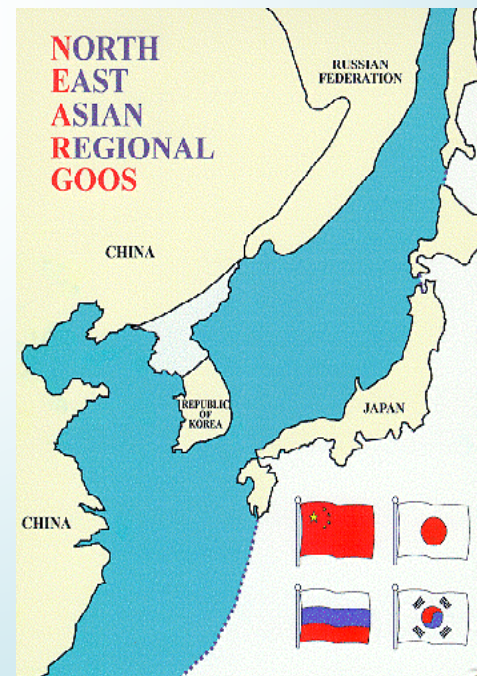
The West Atlantic Region shows the general trend from Cape Cod to Cape Hatteras.

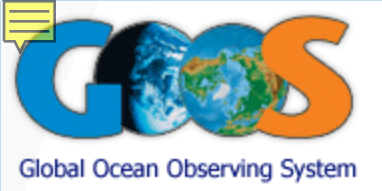
GOOS – Regional Alliance



Program Overview: NEAR-GOOS

- Partnership between China, Japan, the Republic of Korea and the Russian Federation
- The primary aim of the project in its first phase was to facilitate the sharing of oceanographic data in order to improve the availability of information and ocean services in the region





Data/Product Availability

- NEAR-GOOS Data Management
- Each country establishes a National Real Time Data Base (RTDB) and a National Delayed Mode Data Base (DMDB) to collect all the available oceanographic data in the country, and to make them available to users.
- The Regional [Real Time Database](http://goos.kishou.go.jp/) , <http://goos.kishou.go.jp/> collects the real time data in the region from the national RTDBs or directly from the data producers. The Regional RTDB is maintained by the Japan Meteorological Agency (JMA) for on-line access by NEAR-GOOS users via the Internet. Data in the data base are kept for 30 days and then transferred to the Regional Delayed Mode Data Base.
- The Regional [Delayed Mode Database](http://near-goos1.jodc.go.jp/) , <http://near-goos1.jodc.go.jp/>, also exists for archiving data. The Regional DMDB is maintained by the Japan Oceanographic Data Center (JODC).

GEO Work Plan 2012-2015

- Adopted at GEO Plenary VIII in Istanbul Turkey, Nov 2011
- Includes component for a Global HF Radar Network for data sharing and delivery and to promote the proliferation of HF radar surface current velocity measurements in two tasks:
- **IN-01 Earth Observing Systems**
 - C1 Development, Maintenance and Coordination of Surface-based Observing Networks (in-situ and airborne)
 - Promote rapid development of a global high frequency radar network to measure coastal surface currents (see also SB-01)
- **SB-01 Oceans and Society: Blue Planet**
 - C2 Operational Systems for Monitoring of Marine and Coastal Ecosystems
 - Promote rapid development of a global high frequency radar network to measure coastal surface currents. High frequency radar is recognized as a cost-effective solution to augment *in situ* measurements and provide increased spatial and temporal resolution

Global HF Radar Component

- **Who:** Co-Chairs: Enrique Alvarez-Fanjul (Spain), Jack Harlan (USA), Lucy Wyatt (Australia)
 - More are welcome
- **What:** HF radar data available in a single standardized format in near real time; Worldwide QA/QC standard; Easy-to-use standard products; HF radar data assimilated in ocean and ecosystem modelling; Develop emerging uses of HF radar in the areas of ecosystem, tsunami, and climate
- **Why:**
 - We have individually begun to move from individual radars, to clusters of radars to a comprehensive national networked tied together through a common data architecture and set of practices
 - Informal coordination and collaboration can be accelerated under GEO
 - IT infrastructure is scalable

Kick off Meeting in London

- Oceanology 2012 – London, England: Australia, Brazil, Belgium, France, Germany, Japan, Malta, Norway, Spain, Sweden, United Kingdom, United States
- Discussed forming the following working groups:
 - Information Management: Data Management; Products and Modeling
 - Capacity building: Building new networks
 - Radio Frequency management
- Near term activities:
 - Form working groups
 - Create template for each country to fill in with details of their Radars e.g. site identifier, geographic name, latitude, longitude, transmit frequency, bandwidth, land owner, Radar owner, Radar operator.
 - Create template for each country to fill in with details of successful applications of HF Radar data

Global High Frequency Radar Sites

Frequency	Number
Long Range	86
Standard Range	83
High Resolution	69
VHF	20

Australia	12
Brazil	2
China	4
India	10
Indonesia	2
Ireland	2
Israel	2
Italy	3
Japan	22
Jordan	1
Mexico	1
Norway	2
Portugal	2
Russia	1
South Korea	25
Spain	16
Taiwan	15
Thailand	6
USA	125
United Arab Emirates	2
Vietnam	3
TOTAL	258



Global HF Radar Assets

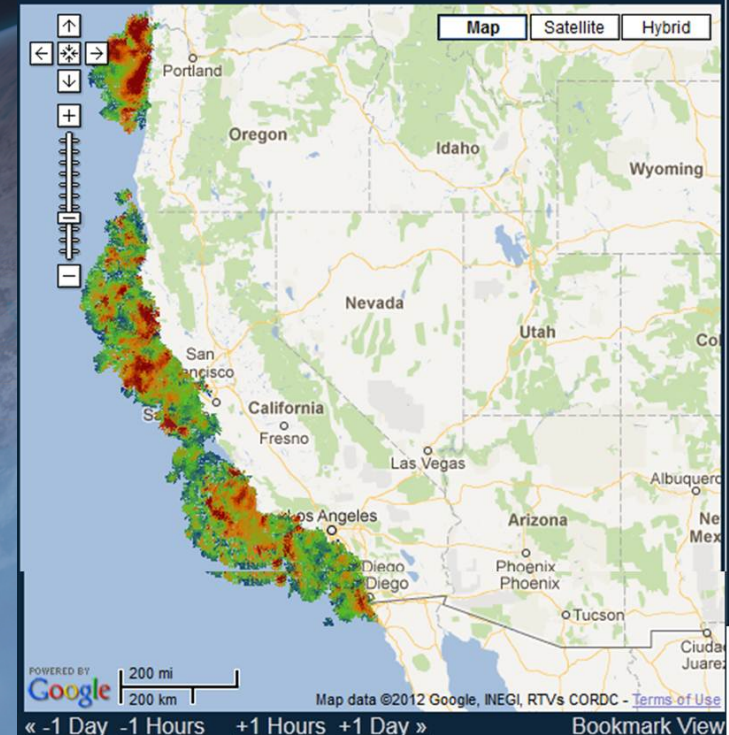
The screenshot displays the MARACOOS Assets Explorer interface. On the left, there are two main panels: 'Point Observations' and 'Models'. The 'Point Observations' panel includes a list of asset types such as NDBC buoys, CO-OPS stations, HRECOs stations, Maryland DNR stations, NERRS stations, USGS stations, Gliders, Drifters, Ships & drifting buoys, and Satellite ground stations. The 'HF radar ground stations' option is checked. The 'Models' panel lists various oceanographic models like Chesapeake currents, STPS currents, Stevens NYHOPS currents, ROMS ESPRESSO currents, MARACOOS HOPS currents, NCOM currents, HYCOM currents, NAM winds, WWIII waves, and NCOM water temperature. Below these panels are 'Spatial Observations' and 'Time-Series Query Results' sections. The main map area shows a world map with numerous green dots representing HF radar ground stations. A legend on the right indicates 'HF radar ground station 256 site(s) fetched'. At the bottom, a time-series graph shows 'HYCOM currents : Water Velocity (Knots)' over a period from Nov 16 0:00 to Nov 18 12:00. The graph shows a fluctuating blue line with a peak around 1.0 knot. A small inset map shows a hand cursor clicking on a dot on the map to trigger the graph.

HF Radar Data management

- Standard interoperable self-describing netCDF format
- Standard metadata ISO 19115 format
- Quality control
 - Radar level
 - Radial velocity level
 - Total vector velocity level
- 1,2, 6 KM data
- Optimal Interpolation

Surface Current Mapping

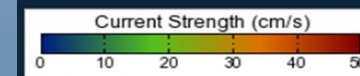
Interface to HFRADAR Derived Surface Currents



2012-05-16 05:00:00 UTC | SET

2012-05-16 05:00:00 UTC

Surface Currents



Units: cm/s

Auxiliary Layers



Units: m²/s

Layers

- OI 6km, Hourly
- OI Stream Function
- OI Velocity Potential
- OI Error Ellipses
- Raw 6km, Hourly
- Raw 6km, 25-hr Avg
- HF RADAR Sites

Auxiliary Layers Colorbar Description

- **Stream function:** Red indicates counter-clock wise rotation, blue indicates clockwise rotation.
- **Velocity potential:** Red indicates upwelling, blue indicates downwelling.

Radio Frequencies

- World Radiocommunications Conference Feb 2012
- Provide HF Radar (oceanographic) with Primary Frequencies but with a caveat for future systems.
- Simultaneous sharing (synchronization) of frequency use
- Call sign during transmission
- Important that we as oceanography community work together to provide a strong position.

Why Care About GEOSS?



**The goal is to access the right information,
in the right format, at the right time,
for the right people, to make the right decisions.**