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Status of U.S. HF Radar National Network (HFRNet)

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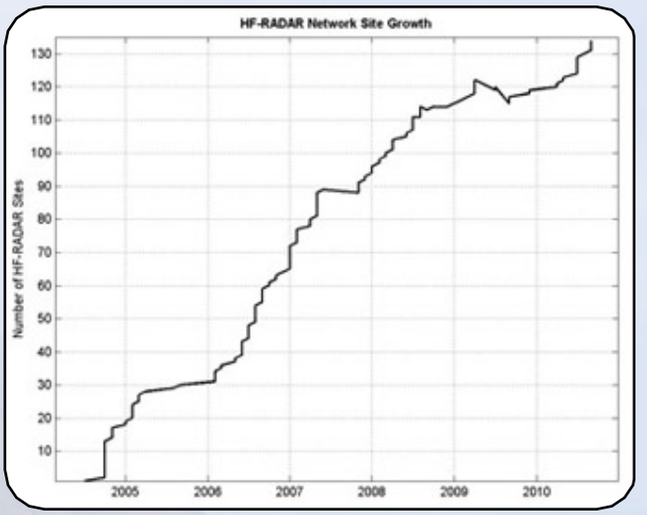
The success and continued expansion of a high frequency (HF) radar national network for the distribution of coastal surface currents has become possible through the dedication and partnerships of multiple institutions, federal and non-federal agencies, local and state governments, and private companies. The U.S. Integrated Ocean Observing System (U.S. IOOS®) is dedicated to maintaining the U.S. network and beginning to reach out to global partners as these data are used in universal applications for the health and safety of human and marine populations.



HF Radar site growth in U.S. from 2003 - present.

The Coastal Observing Research and Development Center (CORDC) at Scripps Institution of Oceanography (SIO) leads the development and administration of the HF Radar National Network (HFRNet) for distribution of HF radar derived surface currents. The HF-Radar Network started as a prototype with a single portal and node and 4 sites in December 2003 and has since grown to an operational status with over 4 million radial files produced by 133 sites from 29 participating institutions as of September 2012 as shown in adjacent figure. Central repository nodes have been deployed at the National Data Buoy Center (NDBC), on the west coast at Scripps Institution of Oceanography (SIO), and east coast at Rutgers University, to demonstrate an end to end distributed data. Site aggregators are currently deployed at eleven partnering institutions including Oregon State University; San Francisco State University; Monterey Bay Aquarium Research Institute; California Polytechnic State University; University of California, Santa Barbara; University of Southern California; Scripps Institution of Oceanography; University of Maine; Rutgers University; University of Southern Mississippi; and University of Miami. The U.S. IOOS program has supported the standards-based ingest and delivery of HF radar data. Standardized data formats and access methods enable surface-current data to be ingested by national tactical decision aids, such as those used by the U.S. Coast Guard for search-and-rescue, and NOAA for oil spill tracking and abatement. Coastal applications utilizing HF radar derived surface currents transcend all coasts. The first Group on Earth Observation (GEO) Global High Frequency Radar meeting was held in London, England in March, 2012. A pilot project to extend the distributed data management system to global partners will begin next year initially with the Republic of Korea. U.S. and Korean partners will collaborate in all aspects of HF radar operations including system deployment, maintenance, data distribution, and products.

HFRNet Data Integration into Search and Rescue Optimal Planning (SAROPS)

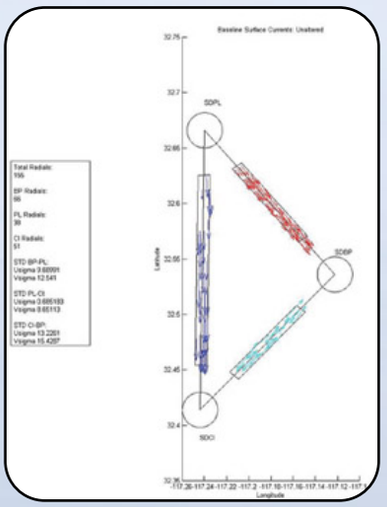
Full HFRNet integration into the U.S. Coast Guard Search and Rescue Optimal Planning System (SAROPS) has occurred in a phased approach in partnership with the United States Coast Guard (USCG), CORDC, Applied Science Associates (ASA), NDBC, the University of Connecticut (UCONN), and Rutgers University with funding from the U.S. IOOS. The CONUS total vectors are made available in near real-time via both graphical display tools, and machine services Thematic Real-time Environmental Distributed Data Services (THREDDS) to USCG Environmental Data Server (EDS). A graphical representation of the network is showing in adjacent figure.

Graphical representation of data path from site to SAROPS tool.

Direction of Arrival (DOA) Metrics

Detailed analysis into Quality Assurance (QA) metrics is an ongoing research area at CORDC and SIO. Analysis of the compact antenna patterns and the internal signal processing within the MUSIC algorithm leads to a goodness-of-fit quality metric for the output radial current velocities and bearings produced by the HF radar system. Quality of measured antenna patterns is paramount to the accuracy of the MUSIC algorithm bearing output. Ongoing research and development between CORDC and CODAR Ocean Sensors aims to provide HF radar users with a practical quality metric for the radial current velocities and their associated bearings produced by the HF radar system.

Our current effort focuses on the three CODAR SeaSonde sites in the San Diego Bight: Point Loma (SDPL), Border Park (SDBP), and Coronado Island (SDCI). Using the Radial Metric files that CODAR Ocean Sensors developed, we can collect the statistical distributions of various QA metrics for each site. In this analysis, we are using the maximum of the Direction of Arrival (DOA) function, the half power width of the DOA function, and the Doppler cell Signal to Noise Ratio (SNR). All of these metrics are used in determining the bearing angle of each radial velocity vector. See references [5] and [6] for complete details.



San Diego Bight SeaSonde system baseline analysis.

The data set currently being analyzed is show in adjacent Figure, which lays out the baseline areas between SIO SeaSonde sites. If one looks closely, especially on the baseline between SDBP and SDCI, there are inconsistencies in the radial vectors. Radial velocity vectors are pointing in both directions, to the northeast, and to the southwest. Physically, this in unlikely to be a realistic situation. By eliminating the vectors with low quality metrics, according to the distributions above, it is expected that the baseline data will become more consistent. As a measure of consistency, the standard deviation of the two components of the radial velocity vectors (U, V) should decrease after QA analysis. Many days of baseline data are being analyzed at this time, and formal results will follow.

HF Radar Oil Platform Deployments in Gulf of Mexico

CORDC staff continue HF radar operations at the Atlantis Platform in the Gulf of Mexico and an additional radar has just recently been installed on Thunderhorse Platform in August 2012. Processing efforts continue to focus on Loop Current detection using radial currents from a single radar, and altimeter-derived currents to constrain the single site solutions. Analysis efforts are prioritized to a time frame when Loop Current passes within close proximity of the Atlantis radar system. In support of these efforts an array of 14 CORDC miniature wave buoys were deployed along a transect in the Gulf of Mexico on October 21-22, 2011. The transect extended from the shelf break (~800m depth) to a deep water location (~2800m depth) that was predicted to be the location of the Loop Current as estimated from satellite imagery and the EddyWatch product. Within the first 2 weeks of the deployment, 8 of the buoys were entrained in a warm core eddy that was forming along the Loop Current, while the remaining buoys drifted along the shelf, and exhibited flow patterns consistent with wind generated and inertial motions (figure at right). The buoys were unique in that they captured the warm core eddy during its formation, and continued to be entrained in the eddy, some making 3 or 4 transits around the eddy. The buoys that made it on to the shelf provided wave and current observations in the vicinity of many of BP's offshore leases. Analysis efforts are continuing on platform based HF Radar deployments.

Track of all buoys over entire deployment (Oct 2011 - Jan 2012).

References:

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