HF Radar Network (HFRNet) Data Management and Applications

Lisa Hazard and Hugh Roarty

Scripps Institution of Oceanography and Rutgers University

Agenda

- Overview
- Data Acquisition
- Site Diagnostics
- Data Distribution

Overview



Years of Operation: 9 years Number of files: >7 million

Participating Organizations: 31 Number of Physical Sites: >130

Network Architecture



SIO:	SDPL	ACK	10/09	12:53	MA	0.0	100.0	0	SSH	172.23.42.42
SIO:	SDCI	ACK	10/09	12:54	MA	0.0	100.0	0	SSH	172.23.42.42
SIO:	SDBP	ACK	10/09	12:42	AM	0.0	0.0	0	SSH	166.140.38.139
SIO:	SDSL	ACK	10/09	12:56	AM	0.0	100.0	0	SSH	137.110.142.30
SIO:	SDSE	UP				99.7	0.1	167	SSH	75.32.81.89
SIO:	SDSC	ACK	10/09	12:59	MA	0.0	100.0	0	SSH	172.23.38.40
SIO:	SDWW	ACK	10/09	01:00	MA	0.0	100.0	0	SSH	198.180.31.29
UAF:	WAIN	UP				99.8	0.0	49	Ante	132.239.92.228
SIO	Portal	UP				99.7	0.0	0	Prob	132.239.92.228
								10		

SLO: PTC

SLO: RAGG

SLO: ESTR

Data Acquisition Example Node to Site Aggregator communications

Example Site Aggregator to Site communications

Site - the individual field installations of HF radar equipment Portal or Site Aggregator a local regional operations center which maintains multiple installations Node - Centralized locations which aggregate data from multiple regions

Scripps and NDBC West Coast Repository & Engine

RUTGERS East Coast Repository



Diagnostics Radial Diagnostics



Radial diagnostics are summarized in a balloon with a link to the most recent radial image, file information and time histories of latencies and radial solutions

Diagnostics Network Diagnostics

+	hfmet.ucsd.edu/	diagnos	tics/ne	etworkUp	time.php?	year=2012
---	-----------------	---------	---------	----------	-----------	-----------

0

😭 🛡 C 🔣 = Google

Pick a year: 2013 2012 2011 2010 2009 2008
West Coast Stations JUMP TO: East Coast & GOM Stations
Click on column to sort

	West Coast															
Station	Network	Latitude	Longitude	Frequency	2012-01	2012-02	2012-03	2012-04	2012-05	2012-06	2012-07	2012-08	2012-09	2012-10	2012-11	2012-12
3DDP Ideal	345	33-46940	-117.70883	25.20mi	10.11 No. 110.1 No.	10.01 %. 10.01 %	66.46 % 767.1766	86.10 N 711 - 700	10.44 %. 701/744	86.00 %. Ref. (700	46.33 N. 1967 144	Maria N. TROJ MAR	10.44%	March N. March Tear	10.44 %. 114.7 %	88.48 W 196.7 Mile
SDSR Ideal	100	30.024800	-117,380,00	34,79964	222.	100.00 M	100-00 % 3467-346	100.00 A	11.44 % 1037 %	No. of Street,	Address of the Design that	Second Second	11.04 N 3067 708	100-10-10 7467-246	动车	MACK PETTHE
SDIRW Ideal	m	arono.	-(1)/(a/a)/	25-40000	Local N.	100.01 M	and an ex-		Harris A.	100 1 TOT	44.47 % 8177.944	#74	100.00.00	SECOLAR PART NA	\$ 1 7.5	NUCL MICTH
SDR. Ideal	899	31.4403830	-017.29960	34,300000	1272		86,87-41 3627 New	10110	the second se	272	territer Netzine	10.14	10.00 Mg 10.7 200	1000 001-50 7646 7 7644	100.00	tani tan bi Naki 1 Mas
SDSC Ideal	111	31.6798	-118,488900	533488	a and a second	31.71 % 319.106	10.33 % 709 / 240	101.01.4	can de las Texas Sen	100 AN - 10 100 - 100	Marcal St. Sec.7 New	11.00.%. 102.1 Page	87.38 %. 4187.738		18.44 %. 1987/1988	10.75 % 78.75%
ISDC1 Ideal	50	31.414967	017,04020	34.799000	1272		1272	872	10.41%) 100.7349	1070	12732		42752	88.70 % 188.70 %	1000	86.35 % 276.7764
SDCP Ideal	80	312(047	-117,408217	25.800000	1000	100-101 %s 100-1100	The state No.	89.12 % 2342 700	in the second	100.00 M	40.32 m 1917 See	10 10 % 70 / 104	100-00 % 700 / 700	892,307 No. 1739 - 1944	10000	Section 4
SD8F Ideal	80	31.51112	-01/01009	25-799804	10.00	49.00 %. 199.1 199	NATES.	191-00-04 2716-700	10.41%	100-30 A.	101.23 mg	10.20 %. 105.7 %	40.31% 849 / 238	States.	10.0 % 10.7 %	61.42% 4377.744
SDGM Ideal	315	51,514,163	-111.00000	Beens	40.32 % 400 / 744	41.24 % 287.7 888	10.41 % 1077 104	34.00 N	HAN .	46.64 % - 4/8						
SDS), Ideal	100	11,12590	0123380	8.299955	The second		18.22 % 2827 544	10.01	10.42 W. 1007 Pee	94.72 %. MET 720	部為	100.00 N 144.0144	播除	翻論	1072	8047 N. 901 944

Network diagnostics are summarized monthly based on file acquisition

Data Distribution HFRNet Data Availability



1. Online Visualization –

http://cordc.ucsd.edu/projects/mapping/maps/fullpage.php Online visualization of HF radar surface currents with ability to change date, resolution, colorbar, and station information

2. Web Overlays -

http://cordc.ucsd.edu/projects/mapping/api/ Application programming interface (api) that allows programmers to overlay the currents into any website

- 3. THREDDS Data Server (TDS) access -<u>http://sdf.ndbc.noaa.gov:8080/thredds/catalog.html</u> <u>http://hfrnet.ucsd.edu/thredds/catalog.html</u> TDS service that allows folks to acquire or used the data via thredds for processing and/or visualization.
- 4. Data Archiving HFRNet (NDBC): Totals and Radials
 - Operators: Range Series and beam pattern
 - Future: All above through

Data Distribution Google Maps Visualization

Features include:

- 12 zoom levels
- Coordinate Locator
- Site Diagnostics
- Total Vectors at 500m, 1km, 2km & 6km
- Hourly and 25 Hour Averaged Data



http://www.cordc.ucsd.edu/projects/

COASTAL OBSERVING RESEARCH AND DEVELOPMENT CENTER

HERADAR Maps API

Data DistributionGoogle Maps API

PROJECTS

Incomentational State Control of State C

PUBLICATIONS

DEVELOPERS & TECH.

Press Paraget

SCOOS WERA Remains Communications

Do you want HRADAR vectors on your map app.1 We thought you might, so we built an API that allows you to access and query our file base

ar your den.

With the inclusion of just a script tag and the Google Maps APL, you can add your own vector overfays. Keep reading to see how.

Updated for Google Maps v3

The API documentation on this page works for the new GNv3-compatible API. Hethods have not changed, only the main object!

Higrating from GMv2 to GMv3?

- The following highlights the "major" changes between versions.
- The API unlichenged.
- The object, RTVT/leLayer, was renemed to RTVMapType
- There is no longer a need to unap the KTVTMcLaver/KTVMcPtype object in an eventer. This means, no more calls to rtu getTileLaverOverlav() to change state. This need was elleviated by Occeptrix upgrade. use caution
- There is no longer a need to bind the 'statechange' event with overlay, refresh.
- · When creating a new RTvMapType object, you must provide the map object as a parameter to the constructor.

The basics

First, you'll need a page, a map, and our APL

Google Maps API v2 Google Maps API v3 Description

Simple Demo v2	Simple Demu x3	therebones may utilizing the API
Consiste Demo v2	Complete Demo v3	A typical map that uses most of the map features.
Kittpine Sink v2	Kitomen sink vä	A complete tour of the APD
v2.0.a watures v2.	v2.0.6 features v3	Demonstration of how to use getLatestTimestampAtLat



are*http://seede.arad.ass/ar/2000/ tantips.type*tast/javanitips*t

/in . Initialize the boogle map.

Function Initialize !! |

· builer-plate Google Sape code.

*/
*** sepignions * |
 center: nev google.seps.lating(3)

accu: 0. mapTypeId: prople.maps.MapTypeId

ex.condx.uccid.edu/projects/mapping/api/preview.php/beamplex.es/



B www.cordc.ucsd.edu/projects/mapping/api/preview.php?examples.ed7

Averaged O Hourly Resolution: 6km Color Scheme: Default Colorbar range: min 0 50 max (cm/s) Current Strength (cm/s) 0 10 20 30 40 50 2013-04-23 08 00 00 UTC -1 Hour Update

Data Distribution

http://hfrnet.ucsd.edu/thredds/catalog.html

Catalog http://hfrnet.ucsd.edu/thredds/catalog.html

C more statistic front has many here

٠

Dataset	Size Last #	Modified				
C of Anthe Strve		-				
 Mr. Malaki, Markai, Marth Mickel Mr. Malaki, Di. Humi Courti Mr. Malaki, Di. Humi Courti Mr. Malaki, Di. Humi Courti Mr. Malaki, Di. Humi Courti, Annual Mr. Malaki, Francis Annu and the Di Yoraka, Islanda/ Mr. Malaki, Francis Annu, and the Di Yoraka, Islanda/ Mr. Malaki, Tok Humi, Sorth, Hone, (BUDH, Franki)/ Mr. Malaki, Di. Humi, Courti, (BUDH, Franki)/ 						
In Acos, of America Market (1998), Family In Acos, of America Market (1998), Family Inter, 644 Inter, 644	Summary: HPRADAR, US Hawaii State, Zm Resolution. Howly Combined Total Vectors (RTV) HFINet Documentation Rights: This is a research project and may contain errors. Please contact the providers of this data to ensure accurate values before making any critical judgements. Access: OPENDAP: htmsdds/dodsChffRiet/USH2/2m/howly/RTV WCS: fitnedds/uschfFRiet/USH2/2m/howly/RTV WGS: fitnedds/uschfFRiet/USH2/2m/howly/RTV WMS: fitnedds/month/FRiet/USH2/2m/howly/RTV WMS: fitnedds/month/FRiet/USH2/2m/howly/RTV WMS: fitnedds/month/FRiet/USH2/2m/howly/RTV WMS: fitnedds/month/FRiet/USH2/2m/howly/RTV Success:					

- Mark Otero
 - o email motero@ucsd.edu

http://www.ucsd.edu/drectory/search?jinkevent=Redirect&entry=otero%2C+mark&dimfaculty_staff

Viewers:

- · Integrated Data Viewer (IDV) (webstart)
- NetCDF-Java ToolsUI (webstart)
- · Godva2 (browser-based)

Data Distribution Total Velocities



APPLICATION: SEARCH AND RESCUE



Application to Search and Rescue United States Coast Guard Office of Search and Rescue

Point measurement vs. Field of measurements: Hurricane Floyd Simulation



Search area reduced by factor of 4 (>10)

Courtesy Art Allen, USCG Office of SAR







25 MHz Status 2002



IOOS INTEGRATED OCEAN OBSERVING SYSTEM



25 MHz Status 2002







5 MHz Status 2004





Status 2004



U.S. Coast Guard Research and Development Center 1082 Shennecossett Road, Groton, CT 06340-6048

Report No.

INTEGRATION OF COASTAL OCEAN DYNAMICS APPLICATION RADAR (CODAR) AND SHORT-TERM PREDICTIVE SYSTEM (STPS) SURFACE CURRENT ESTIMATES INTO THE SEARCH AND RESCUE OPTIMAL PLANNING SYSTEM (SAROPS)



FINAL REPORT November 2005



IOOS INTEGRATED OCEAN OBSERVING SYSTEM





Ocean Information for a Changing World

U.S. Integrated Ocean Observing System



MA

Ocean Information for a Changing World



Global Ocean Observing System



18 U.S. Federal Agencies



Ocean Information for a Changing World

MARACOOS REGIONAL THEMES & SUCCESS STORIES

1) Maritime Operations – Safety at Sea



3) Water Quality – a) Floatables, b) Hypoxia, c) Nutrients



2) Ecosystem Decision Support - Fisheries





5) Energy – Offshore Wind



IOOS INTEGRATED OCEAN OBSERVING SYSTEM





Themes and Capabilities

(1	MARCOOS Capabilities								
MACOORA Themes	Weather Mesonet	HF Radar Network	Statistical STPS Forecast	Satellite Imagery	Glider Surveys	Dynamical Ocean Forecasts			
1. Maritime Safety	Operational input to USCG SAROPS	Operational input to USCG SAROPS	Operational input to USCG SAROPS						
2. Ecological Decision Support		Circulation and divergence maps for habitat		SST & Color for habitat	Subsurface T & S for habitat	3-D Fields of T, S, circulation for habitat			
3. Water Quality	Winds for transport, river plumes, & upwelling	Surface currents for floatables, bacteria, spill response	Surface currents for floatables, bacteria, spill response	Ocean color for river plumes	Nearshore dissolved oxygen surveys	Surface currents for floatables, bacteria, spill response			
4. Coastal Inundation	Weather forecast ensemble validation	Current forecast model validation				Nested forecast ensembles			
5. Offshore Energy	Historical analysis & wind model validation	Historical current analysis & wind model validation		Historical analysis surface fronts & plumes for siting	Historical analysis subsurface fronts & plumes	Coupled ocean- atmosphere models for resource estimates			

IOOS INTEGRATED OCEAN OBSERVING SYSTEM





Optimizing HF Radar for SAR using USCG Surface Drifters



Scott Glenn Rutgers University

and the Mid-Atlantic Regional Coastal Ocean Observing System





NORA

Search Area After 96 Hours





HYCOM

36,000 km²

IOOS INTEGRATED OCEAN OBSERVING SYSTEM



12,000 km²

CODAR

May 4, 2009: After a year of testing, NOAA Announces on U.S. Department of Commerce Website that MARACOOS CODAR is Operational in SAROPS



U.S. IOOS Goal for 2010-2011: Bring all sustained regional-scale HFR networks up to operational status in USCG SAROPS

3 West Coast Regions for California & Oregon

Questions regarding this section may be directed to the Department of Commerce Webmaster



HFR Current Mapping Product Development Road Map for Search and Rescue























Thank You

