Radiowave Operators Working Group (ROWG)
5th Workshop
26-28 April 2011
Marine Science Research Building
University of California - Santa Barbara
Santa Barbara, CA

Executive Summary

The workshop welcomed 40 attendees from five countries (USA, Taiwan, Korea, Canada, Italy). The vast majority of the attendees were veterans of previous IOOS-sponsored ROWG workshops although new attendees from the USA and other countries were active participants in the discussions.

The ROWG Steering Committee is made up of Jack Harlan (NOAA IOOS Program and Sponsor of ROWG), Brian Emery (University of California – Santa Barbara, and Local ROWG-5 Host), Josh Kohut (Rutgers University) and Brian Haus (University of Miami). The Steering Committee created an agenda well in advance of the workshop that intentionally provided enough time for networking among attendees, time for poster presentations and breakout sessions for discussion of topics of most importance for HF radar operations and maintenance. Traditionally, there have been two breakout sessions: Hardware and Software and this tradition was adhered to once again. The posters were available for both days of the meeting so that ample time was devoted to interaction with the poster authors.

On the final morning of the workshop, the entire group assembled to discuss the next ROWG workshop. It was decided that it should be held during the Fall 2012 and Cliff Merz (University of South Florida) volunteered to act as the local host in St. Petersburg, Florida.

The compiled notes from the two breakout sessions and a list of the poster titles follow. Additionally the participant list is appended.

Compilation of Recommendations:

Recommendations for QC:

1) Streamline the process to flag radial files going to the national network (still work to do on flagging individual vectors)
2) Inventory existing QA/QC software. What it does, who is using it, how to get it
3) Develop a ROWG best practices document building off existing CeNCOOS, QARTOD documents, and present packages
4) Identify gaps in available software
5) Generate a specific list of present practices for each group submitted to report.
6) Demonstrate software at future ROWG meetings, webinar?
7) Form QA/QC 'Tiger Team' as part of ROWG.
8) Critique others work. Work with Network operators to 'inspect' each others sites.
9) Most operators use a manual check on the data requiring human interaction requiring about 5 minutes per site per day.
10) Most operators use CODAR software's automated email warning application

Other recommendations and practices of specific operators from the software breakout group are embedded in the notes.

Recommendations from the Hardware Breakout Group:

These numerous recommendations are embedded in the notes below. They cover a wide range of detailed topics ranging from the type of shelter housing to tapes and tools.

Titles of the Poster Presentations

HF Radar: Mapping the Oregon Coast – Kosro, M. et al, Oregon State University.

Investigation of First Order Line Settings for MARACOOS High Frequency Radars – Rivera, E. et al, Rutgers University.

Quality Assurance Measures for High Frequency Radar Systems – Roarty, H. et al, Rutgers University.

Application of 13 MHz SeaSonde Systems for Vessel Detection – Smith, M. et al, Rutgers University.

MARACOOS High Frequency Radar Network Operations – Kohut, J. et al, Rutgers University.

Evolution of the USF/CMS CODAR and WERA HF Radar Network – Merz, C. et al, University of South Florida.

Forecasting Currents in San Francisco Bay with Model Forcing from High-Resolution SeaSondes – Zelenke et al, California Polytechnic University.

Improved Prediction of Surface Currents based on Historic HF radar observations – Frolov et al, Monterey Bay Research Institute and Naval Postgraduate School.

Operation of Standard and Long-Range SeaSonde in the East Coast of Korea – Young-Tae Son et al, Seoul National University.

The State of HFR Product Development at NOAA/CO-OPS - Paternostro, C. et al, NOAA National Ocean Service/CO-OPS

Antenna Patterns from AIS Ships of Opportunity – Emery, B. et al, University of California – Santa Barbara

HF Radar Activities at Old Dominion University – Garner, T. et al, Old Dominion University

Alaska Remote Power Module – Potter, R. et al, University of Alaska – Fairbanks

SFSU - Recreational Boating Applications – Pettigrew, J. et al, San Francisco State University.

CODAR Sites in Taiwan – Taiwan Ocean Research Institute

CODAR Observation During Typhoon Fanapi – Jan, J-C et al, Taiwan Ocean Research Institute

CORDC HF-Radar Research and Applications – Cook, T. et al, Coastal Observing Research and Development Center, Scripps Institution of Oceanography, University of California – San Diego

SOFTWARE BREAKOUT GROUP

This group's chosen topics were:

1. The State of Data Quality Control (by a large margin, the highest priority topic)
2. Upcoming Codar software releases
3. Data Archiving
4. Radial Processing
5. Version Control and HFR_Progs

Day 1

Some general comments:

The ROWG-4 report (http://www.ioos.gov/library/rowg428_sep_2009.pdf) is a good reference for all topics as many efforts mentioned there continue to be works in progress

The topic of data quality control (QC) has so much importance and so many facets that the group spent the entire first day on QC. These notes are composed of recommendations by individual operators as well as specific procedures used by the operators. The overall recommendations by the group as a whole are also embedded. We note that the discussions refer extensively to Codar SeaSonde®-specific applications and programs since all attendees were Codar users.

1. The State of Data Quality Control

QC was considered at the radial level and at the total vector level and each attendee was polled for his/her current QC activities. Those results follow below and have also been captured in a Google document: https://spreadsheets.google.com/ccc?key=0AiQGzbMafH40dE5lRDQxM3BMcDU5WTUwY2VaMVJLYXc&hl=en&authkey=COyz6vEM

UCSB-

- Website for diagnostic tracking
- Realtime stat file updates (temperature, rad coverage, hardware voltages), checked a couple times a week
- Warning emails (Chad's perl scripts, and CODAR software)

University of Alaska-Fairbanks –

- Daily checks in the morning to ensure data is coming from each site.
- Check diagnostics (daily) for shifts
- Once a week check spectra to check first-order-lines to make sure first order is properly identified

Naval Postgraduate School

- Website to check file latency
- Number of radials from each site over one week visualized on a plot (in time and space)
- Manual checks of diagnostic files.
- Check national network diagnositcs (CORDC)

WHOI –

- Daily emails with all site warnings enabled.
- Check individual site websites daily or every other day (CODAR software)
- Re-run spectra with updated software

UVictoria –

- Long term average super-imposed on the data to reference the real-time data.

Umass - Dartmouth –

- Daily email status (red/green).
- Daily checks of radials from the sites.
- Look at radial file size as a diagnostic for further checks (150 KB is 'normal')
- Use Timbuktu to log into the sites to check

Rutgers –

- Daily email status
- Attempt once a week site checks (Teresa is doing it)
- Chris Haley (BML) suite of matlab scripts that will do QC checks, based on standard Deviation in time.
- Trying to implement NDBC guide to real-time QA/QC ' Handbook of automated QA/QC procedures'.
- Inventoried first-order-line settings to explore site specific modifications.
- Explored use of AngSeg.txt

CODAR Ocean Sensors Ltd. (Bill Rector)

- Current version of software does 110 checks on QC
- Be careful forcing vectors over water if your angseg is composed of multiple sectors.
- They tend to mask problems by masking over-land vectors
- Separate angseg program is under development so that a system will automatically flag data that is overland rather than just eliminate them.

Ocean

- Using CODAR software warnings (110 checks).
- Sends notification if setting is tripped
- Configured in the radial webserver configuration (radial web configs)
- All checking is done by a radial site reporter.

Oregon State Univ.

- Marcel Loosekoot (Bodega Marine Lab) monitoring table for frequent updates of radial and power variables.
- Daily plots from stat files that get emailed
- Once a day total radials per bin for each site by email
- Check CORDC National network site
- Radial webserver (CODAR)

Scripps

- Custom website for each site (coverage plots, etc.. check with Tom).
- National Network diagnostics are focused on num radials (time and space).
- More metadata can be incorporated into the diagnostics
- Provide access to the MySQL database.
- As a network we have to make sure that we are providing quality data to the national server.
- If site is not working properly, operators can email hfrnetadm@ucsd.edu to notify
- Stop radial transfer at our end.
- Other ways (web form, etc..) need feedback.
- Leave it to the regions via a webpage so that they can toggle sites on and off.

Old Dominion Univ –

- Daily warning emails from release 6 software
- Filtering emails (organized by site)
- Monday morning site checks (frequency, GPS alignment, for/ref power, temperature, available disk space, bragg peaks visible, time)
- Look more carefully at the radials (To be done)

CODAR Ocean Sensors Ltd. –

- New support packages available (remote site checks)
- Weekly report on system status
- Daily check-up of the systems (connectivity, radial production, radial quality visual inspection, first order lines).
- First-order lines can be just as important as antenna pattern measurements
- Loiter on the site for 10-15 minutes
- Use the server software
- Look for warnings being tripped
- Weekly plots of diagnostics
- Monitors in common areas to visualize the data as an indicator for system QC.

CalPoly –

- Keeping current software running on the machines (CODAR, Apple, etc..)

- Use the CORDC diagnostics with custom additions (Tom Cook can enable it, maybe)
- Radial webserver interface using tabs to organize the site information (automatically set as home configuration so that each time the web application starts you see it).

Taiwan –

- Radial webserver (CODAR)
- use a remote power management systems to check power status (voltage to each chassis as well as control, smartpower, Taiwanese company)

NPS – automated radial interpolation, threshold based on speed (outliers), look at radial geometry, Automated: Totals tossed based on speed threshold.

CalPoly – National Network settings based on geometry, number of radials, speed thresholds. Only data that passes these criteria are published in the NetCDF files.

UCONN – All data greater than 3 SD are taken out. If less than 5 days (over a month) of data at a gridpoint, it is eliminated. If less than 5 datapoints in last 24 hours, that is thrown out.

Bodega (Chris Halle) has an add-on to HFR-Progs (mentioned above) with automated QA/QC.

Recommendations for QC:

11) Streamline the process to flag radial files going to the national network (still work to do on flagging individual vectors)
12) Inventory existing QA/QC software. What it does, who is using it, how to get it
13) Develop a ROWG best practices document building off existing CENCOOS, QARTOD documents, and present packages
14) Identify gaps in available software
15) Generate a specific list of present practices for each group submitted to report.
16) Demonstrate software at future ROWG meetings, webinar?
17) Form QA/QC 'Tiger Team' as part of ROWG.
18) Critique others work – Brian Z. Work with Network operators to 'inspect' each others sites.
19) Most operators use a manual check on the data requiring human interaction requiring about 5 minutes per site per day.
20) Most operators use CODAR software's automated email warning application

<u>Day 2</u>

2. Update on CODAR SeaSonde® Release 7 (Bill Rector)

- Will contain short radial metrics based on Tony DePaolo's work on MUSIC simulations. A beta-version of this release is currently being assessed for near-real time application by Tom Cook and Tony DePaolo at Scripps.

- New radial interpolation methods as well as filtering can be done to short radials or hourly radials. based on nearest neighbor

- SpectraPlotterMap - 1st order settings dialogue has been improved

- "Combine" program will allow for combination of radials over multiple grids

- Archivalist will now be multithreaded, so archiving will be quicker

- Two new radial tools: one to create short time (typically 10-minute) radials, and another to merge short-time radials into the merged (typically hourly) radials.

Topics Continued:

3. Data Archiving

UCSB –

- Using Archivalist Range Files and at some sites CSS and CSQ files and radials
- not tracking config settings.
- archive of antenna patterns
- Brian emery has an rsync

UAF-

- keeping range, CSS, diagnostics, and radials.

Codar

- Bill recommends to use SeaSondeReports to zip up all the configs including versions and log file information. Saves stat, data, and configs together.
- Hector: Archive the files without considering a data budget. Bill says there is a new archivalist will help manage these issues.

- SeaSonde® software has a compression tool, called SpectraShortener, that will compress CSS file by about 1/3.

Taiwan –

- Archive time series and range files, diagnostics, radial configs, with an onsite RAID-5.

WHOI –

- Developing an archiving plan that builds on the use of archivalist on the sites.
- Necessary to ensure that archivalist is not filling the remote site hard drive.

NEPTUNE –

- Plan for immediate transfer of data to servers in their facility.

NPS –

- Runs a perl script off the cron that puts three copies on the local, external and lab drives. CSS, radials.
- Looking for advice on archiving configs. Also document site activity with a log file that grows.

Possibility of using version control software to track changes to the config files on a monthly basis.

UMass-Dartmouth

- Uses archivalist then periodically transfer data back to a 1 TB server back on campus.
- Has questions on appropriate way to organize these data once back on campus/facility drives.

OSU-

- Dates config file changes and creates folders on a two-three month time frame. Runs daily change tracking on each site.

Rutgers –

- Archiving spectra, radials, writing data t external hard-drives.
- 30 GB per year for spectra, 60 GB for range files per year.
- Writing spectra to file server and range files on external drives.
- When we swap out a computer, there is a burn of all diagnostics, configs, etc.
- there are a few that know where and how the data is organized.
- We are tracking changes using a blog.
- Recommendation to make sure that the site log file is transferred off the site hard drive to protect against drive failure.

ODU –

- Archivalist using external drives. Uses Lacie 1TB drives. Burning some data to DVD and storing for each site. Optical disks have a lifetime of around 20 years.

CalPoly –

- Came up with a consistent archivalist settings

General Notes

- 2 areas of consistency: What needs to be saved to be part of the national network? What tools are available to better organize data once back from the site for easy access to reprocessing steps.
- National network is looking for guidance on what is needed to reprocess data.
- There is a need to maintain the archive by moving it from one media to the next greatest media.
- Can use spectra shortner to compress the spectra 3-1.
- Development area to potentially apply a database structure to organize the data once back on facility servers.
- Codar can distribute document on what can be done with each level of data in terms of reprocessing.

4. Radial Processing

- It was brought up that there is a bug in SeaSonde® software Release 6 Update 3 and early versions of Release 6 Update 4 where not all of the short time radials are being merged into the hourly radial files. Also some users complained about cspro hanging up. Bill Rector says Release 6 Update 5 will fix these problems and will be available "soon."

5. Version control, HFR_Progs

- Brian Emery says he has programs for APM visualization and manipulation that would benefit everyone, but wonders how to make it available to everyone.
- Chris Paternostro makes a presentation on his effort to port HFR_Progs from matlab to octave. The motivation was that the matlab web server code didn't work well, and octave's did. Octave is free, but it lags behind matlab in its development. As a result, the particle tracking and OMA parts of HFR_Progs haven't been ported yet.
- Mike Cook will place the current version of HFR_Progs into sourceforge. Chris will put the octave version in sourceforge as well. Mike and/or Chris will look into making an area in sourceforge for ROWG so anyone can contribute code they want to share.
- John Kerfoot showed examples of NCL (NCAR command language), which is nice for netcdf formatted files, has curly vector capability, and has opendap capability.

- Jim Pettigrew shows the group his iphone/ipad map app called BayCurrents. His is trying to complete the app before the America's Cup to be held in San Francisco Bay in 2013. Jim notes that this app can be applied to any area easily, not just the San Francisco Bay.
- Anthony Kirincich says he is a beta tester for SeaSonde® Release 7 - and uses HFR_Progs to work with the radial metric formatted radial files.
- Teresa Garner has built add-on programs to HFR_Progs to do radial currents visualization and editing.
- Mark Otero is using HFR_Progs and has made modifications to deal with very large regions and grids, with can be slow in HFR_Progs. There was some discussion about merging his modifications with the main HFR_Progs version, but Mark has investigated this and his conclusion is that the modifications won't work well in the main HFR_Progs because of diverging methods each toolbox uses to implement the grids.
- Jack Harlan notes that THREDDS is becoming a very common data transfer protocol. John Kerfoot says that the data transferred is usually in netcdf format, but it doesn't have to be. Metadata that isn't in the netcdf file can be added to the data during the transfer process. Josh Kohut pointed out how much time THREDDS saves when people request data from their group. Josh and John note that there are some cons, such as cache corruption issues, but THREDDS seems to fix itself eventually. THREDDS is open source, and developed by UNIDATA.
- John and Mark point out that matlab version 2010 had added opendap support and netcdf is now native.

HARDWARE BREAKOUT GROUP

The topics selected by the entire ROWG group for discussion at the Hardware Breakout Group session were:

1. Power & Uninterruptible Power Supply (UPS)
2. Common hardware failures
    - front panel & blanking boards
    - Trimble antennas
    - cable connectors
    - TX feed wires
    - frequency of maintenance
3. Transponder and super transponders, pattern measurement
4. Auto-restart options/recommendations
    - watchdog
5. Replacement time for key components
    - guidance for spares
6. Site configuration and components
    - cabling
    - environmental impacts
7. Lightning protection
8. A/C and other cooling methods
9. GPS sync – Frequency sharing
10. Receiver bandpass filter
11. Communications (wireless, cellular modems, satellite)
12. Security (impact of fences on system operation)
13. Antenna design and placement
14. Antenna tuning

1. & 4. POWER AND UNINTERRUPTIBLE POWER SUPPLY & Auto-restart options/recommendations

Recommendations:

- Codar recommends UPS usage as the AWG is sensitive to power fluctuations. The APC model number is SUM1500RMXL2U, 1500 V, 2400 W UPS.
- Use power line conditioners also if having problems with UPS.
- Use APC Smart-UPS to control the UPS from computer
- WakeOnLAN to restart computer.
- Netbooters can be used to get your computer back online after power to the computer or modem is lost. Recommended for its ease of operation and reliability, but especially for the support provided by the manufacturer http://www.synaccess-net.com. Work hourly.

Other Notes:

- Codar is developing a low-power SeaSonde® that will require only ~100W power. Presently, power draw is ~350-400W.
- See Brian Zelenke's poster on solar power for more information or contact him at bzelenke@calpoly.edu

2. Common hardware failures

Front panel & blanking boards

Recommendations:

- Ensure shelter has air conditioning and/or dehumidifying as necessary
- Internal fans can be ordered directly from the fan manufacturer

Other Notes:

- Codar front panel boards have one of the highest failure rates. Codar now using conformal coating on smaller components to reduce failure rate. "Blanking" board has higher failure rate because of its proximity to fan bringing in outside air. This is another reason to have a well-conditioned shelter.

Trimble GPS Antennas

Recommendations:

- Seal antenna to prolong its life
- Antenna can be located within enclosure but check signal strength
- Do not position within a stainless steel enclosure

Other Notes:

- If antenna does need replacement, there are numerous manufacturers that supply identical antennas.

Cable Connectors

Recommendations:

- Cable quality DOES VARY with company.
- Codar recommends Beldin 8214; Codar's website has other recommendations.
- Stranded cable is less prone to kinking than having solid core cable.
- Acquire and use a good crimper tool e.g. Allied electronics, TESCO, Amphinol, Beldin, Elimar. Relatively expensive but worth it.
- 3M Scotch 130C rubber tape to cover connections

Transmit Feed Cables

No Issues

Frequency of Maintenance

Recommendations:

- Once per year, at least, check cables, connections, bearing of RX antenna, helicoils on RX antenna

Other Notes:

- Old style SeaSonde RX antenna box's top fitting can corrode and allow water to enter the box

Transponder and super transponders, pattern measurement

Recommendations:

- After a receiver filter or entire receiver is replaced, an antenna pattern is recommended even if receiver appears to be identical.
- When doing antenna pattern measurement, no boat grounding for 42 and 25 MHz is needed. However, for 13 and 5 MHz systems, need to make sure that the grounding stays in the water. You can also use jumper cables to an engine mount.
- Set way points on a GPS before you get on the boat for difficult pattern measurements
- Or use a range feature on the GPS for nearshore patterns

Filters

Recommendations:

- High and low filter bands: need to ensure that they are set correctly. Otherwise, power will not be transmitted. Also, note that antenna is tuned to a frequency. So, be sure that filter is compatible.

Site configuration and components

Recommendations:

- Spend extra money during initial deployment to use quality materials and robust techniques
- Aluminum enclosures are light and easy to manage
- Two enclosure manufacturers mentioned: EIC (http://www.eicsolutions.com/) and DDB unlimited (http://www.ddbunlimited.com/).
- Place enclosures on north side of building in high temperature regions
- White paint for aluminum
- Jim Bonner (Clarkson Univ.) and his group are good resource for designing and building enclosures in hot, hurricane-prone climates

- Anthony Kirincich (Univ. of Rhode Island) has a sand mount for the new single-pole dome-style SeaSonde antennas.
- Jim Pettigrew (San Francisco State Univ.) also has a good sand anchor
- Use Kevlar, Phillystran or Dacron Stayset rope for guy wires; use redundant ropes. Useful website: http://www.radioworks.com/nrope.html
- Non-penetrative roof mounts are a good option for some situations.
- Connelly Oklahoma is the manufacturer of good fiberglas masts
- Protect cables with rigid PVC pipe
- To get an accurate measurement on forward power, take transmit power of sweep and pulse, set it to continuous wave (CW), measure the power at the antenna with a Bird watt meter and divide it by two.
- Cabling: to waterproof, use hot glue under connecting sealing tape; never use solder and crimper technique.

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