

*SECOORA's Regional Comments on draft National Operational Waves Observation Plan (as distributed on 25 Nov 2008 by Zdenka Willis)*

**17 DEC 2008**

This document represents the aggregation of comments (8 reviewers) from the SECOORA region with respect to the draft National Operational Waves Observation Plan. Since there was no specific format requested, we have provided a summary of key viewpoints and then organized supporting material by (anonymous) reviewer – please read these additional comments for full explanation of general comments.

**SECOORA Points of Contact:**

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**Summary of Key Comments:**

1. The Waves Plan continues to represent a critical aspect of ocean observing that involves instrumentation, data management, modeling, and practical outcomes and applications (e.g., near shore safety prediction). Practitioners in the SECOORA region appreciated the opportunity to comment on this evolving document, and feel that the foundation built under SEACOOS and other sub-regional efforts places the region in a strong position to move forward with future ocean observing activities. Even after the final Plan is published, we strongly support soliciting advice from the relevant practitioners, data users, and system operators. The opportunity for providing input to operational plans and national strategy is something that the professionals in the region take very seriously, and local/regional needs can be clearly stated/addressed accordingly.

***REPLY:** The final report has included working with the regional associations and partners for operations, as well as local knowledge when the Waves Plan is implemented.*

2. The practitioners in the SECOORA region feel that the Waves Plan (in its current form) could be strengthened by further addressing new technologies and emerging Research & Development (R&D) components/systems that are relevant to operational wave forecasts and research. In particular, the high-frequency radar systems in the region need to be more clearly addressed in the Waves Plan. The opportunity to integrate high resolution (and mobile) radar systems and other technologies with buoy-based data should not be overlooked, as this presents a valuable opportunity to improve wave forecasting models/capability. See comments from Reviewers #1, #4, #6, and #8 (below)

***REPLY:** The report fully understands that HF radar systems have the potential to estimate wave conditions. We coordinated the final review process with Jack Harlan*

*(IOOS Program) to assure there would coordination between the Waves and HF Radar plans.*

3. SECOORA is very supportive of the testbed approach and also suggests that testbeds be located where existing technology arrays (and expertise of personnel) can be leveraged. For example, WERA radar systems are highly relevant to conducting wave validation and there are several such systems already operating in the Southeast. Including specific locations in the Waves Plan might preclude the consideration of other important or equally appropriate testbed sites where complementary data, systems, and expertise can be integrated for optimal results/applications. See comments from multiple Reviewers (below).

*REPLY: The report does identify two locations as Testing and Evaluation Centers. These were selected based on established infra-structures, areas that are maintained by specific organizations and have staff support maintaining 24/7 operations and on-going measurements. The report also identifies provisions to perform “in-place” evaluations.*

4. This version of the Waves Plan contains some significant changes (in both content and format) relative to the previous version. In particular, there now seems to be an imbalance between buoy based observations and other technologies (radar, remote sensing, other in situ platforms, AUVs, etc.) in terms of their relative importance within the Plan. A buoy-centric plan does not accommodate these other technologies well, and given the high current characteristics in the Gulf Stream and Loop Currents might be difficult to maintain (due to physical damage to the buoy platforms/instruments arrays). Please see comments from Reviewer #5 (below).

*REPLY: As previously mentioned the Waves Plan is mainly about point source measurements. This does not suggest that any other measurement device is not important, like satellite- or land based radar systems. We do acknowledge these systems are important however compliancy to First-5 standards to ground truth measurements need to be performed. The plan also acknowledges the Florida, Loop Currents as well as the Gulf Stream. The Waves Plan recommends no point-source measurements will be positioned in these areas because of the inherent Doppler shifting and contamination of the wave measurements, mooring problems etc where alternatives must be sought and something to pursue in an Implementation Plan.*

5. Reviewers in the SECOORA region also felt that maintenance issues (e.g., obtaining the ship time and the appropriate vessel/equipment) are not adequately addressed in the Plan. Another long-term operational aspect that may need additional consideration is the cost of/access to telemetry for data/command relay. See comments from Reviewers #3 and #7 (below).

*REPLY: The Waves Plan has identified estimated costs for ship time in Table 3. We will need the help of the RA's and RCOOS for O&M as the plan moves into Implementation. Data transmission and telemetry issues would also be part of the Implementation plan. We recognize this issue is an important factor requiring costs and will not ignore.*

6. We have also included (attached in PDF format) a recent manuscript (Voulgaris *et al.*, 2008) that is highly relevant to the issues of wave data acquisition and measurement techniques, and we strongly support referencing this publication in the final Waves Plan. We also suggest revising the use of the reference to Haus (2007) – see comment from Reviewer #5 (below).

*REPLY: This new reference has been added to the revised Waves Plan. The Haus, (2007) did indicate some analysis of the WERA wave results in a general form and that was why it was used in the original document. We appreciate the Voulgaris *et al.*, 2008 reference where additional information is provided.*

## Full Comments from (8) Regional Reviewers:

### Reviewer #1:

My major concern is that the plan fails to contribute significantly on the R&D area of waves. Some of the emerging technologies in wave measurements are with the surface radar systems. The plan recognizes this but it calls for the validation (and correctly so) of those systems prior to adoption. This is a well-known issue and during the last RCOOS proposal process, we submitted a proposal (through SECOORA) for validation of surface radars for wave measurements but it was not selected due to limited funds. The new plan calls for the development of new test-beds (as we called for in our 2005 meeting and the attached paper). Without being too specific, I think that such a testbed should be in an area with Radar coverage. The plan proposes that the testbeds should be the FRF facility at Duck, NC (Atlantic coast) and Scripps on the Pacific coast. My concern is that such a focused selection of sites at this point (via this document) is too narrow and will lead to repeating mistakes we identified in the Waves Plan. (Example: UNF and NWS created a wave forecasting model in the Jacksonville, FL region, while others were performing similar measurements in SC, and we missed each other by only a few hundred KMs). The creation of testbeds should be conducted while utilizing as many assets available. The specific selection of FRF is justified by the existence of a pressure array (at 10m) that can create high resolution wave directional spectra and an offshore buoy. The plan adopts the use of the "first five" (i.e., use of the first five Fourier coefficients for describing directional spectra) thus there is a mismatch in the desired resolution (first five) and the capabilities of the pressure array (the latter provides much higher resolution). Significant progress can be achieved if the test bed includes a WERA radar system(s). There is a justification for doing it with different frequencies - but this is something to discuss at a later point. This approach will at least provide the data for the evaluation of the radars even if no money is provided to the radars from this program. My view is that the testbed locations should not be named at this document at this time. The site selection should be based on sound criteria that include both past technologies and infrastructure but also emerging technologies.

### Reviewer #2:

After reading your email and (albeit briefly) reading the attachment (i.e., revised Waves Plan), I fully agree with **Reviewer #1**, that SECOORA adopt the position that testbed locations should not be presently named in this document. However, I fully support the concept of using testbed approach.

### Reviewer #3:

I just finished reviewing the waves plan. I don't have much to offer scientifically, but I do have a few observations/comments:

- 1) The document under-emphasizes the potential issues associated with ship time for maintenance. Finding the appropriate vessel (which will depend on the type of platform) when needed for unscheduled maintenance is a major issue. As it is,

NDBC can't rely on USCG vessels for even scheduled maintenance. We have been "offering rides" to NDBC for several years. I think the available ship issues should be highlighted more prominently. Also, on a related note, does the plan thoroughly assess telemetry costs and issues?

- 2) I strongly support establishing a test-bed on the Atlantic side of the SECOORA region. Many SECOORA investigators already work with the folks at FRF and this could be advantageous. There also is a big push for the development of regional sediment management plans. We have already talked quite a bit with the Wilmington District Corps office about this, so this is another area for engagement – especially in NC and SC (and potentially throughout the region in the future). Also, this may tie into some USGS efforts which are using sand resources/erosion to justify many of their large coastal research programs in the Atlantic.
- 3) I am curious as to what the dots on their maps refer to – hard to tell which systems are which. Nonetheless, it will be an opportunity for the RCOOS to maintain existing platforms resources and leverage existing regional infrastructure and expertise to support ongoing ocean observing activities (e.g., radar wave validation, model validation, rips, sediment management).

**Reviewer #4:**

Once again, thanks for sharing this document with us. It was also briefly discussed at the National Radar Plan meeting in Colorado this past year, but with few details on the waves. Hopefully we will be seeing the revised plan for HF Radar Gap analysis soon for the nation. Whenever I receive that, I will send it to the SECOORA/GCOOS-RA practitioners for commentary. I quickly read over this document and a few things jumped out at me:

- 1) This is essentially a federal document, so I am surprised that there are references in it. I have been on writing teams for other federal documents and was told that such references should not be included as it will appear as a conflict of interest. Of course, references can be valuable (if they are approved for inclusion).
- 2) The document is buoy-centric. Chapter 3 discusses subnets and gives some examples. There was no discussion about how we solve the wave problem in strong current regimes such as the Gulf Stream, Loop Current, etc. - the ribbon of high currents surrounding the GCOOA-RA and SECOORA domains. These regimes do not necessarily allow buoys to survive too long. Suggest that the Plan include a greater balance between buoys, radar, and remote sensing (and/or other in-situ instruments that can be mounted on AUVs).
- 3) With respect to point #2, new and emerging technologies bring in remote sensing tools but only lightly. Highly recommend adding more substance to this section.

Given the scale and access issues for these environments, remote sensing (satellite imaging or ground-based radar) is the optimal platform (or tool) for such regimes.

- 4) Hurricanes are mentioned throughout the document, however airborne remote sensing is not mentioned to provide spatial evolution of the directional wave field. I suspect that within the next five-year time horizon, the new Scanning Radar Altimeter will become part of the payload for the NOAA and Air Force missions. We have used such measurements to study wave current interactions under strong winds from aircraft during Isidore and Lili. While buoy measurements provide the temporal evolution, hurricane encounters with buoy measurements are simply fortuitous. One may get lucky (or not) depending on your point of view. This is why remote sensing (#3) is so important to this problem. I agree with others from the region, in that what we started in SEACOOS is a good springboard for both SECOORA and GCOOS-RA especially within the HF radar footprints and buoys such as the Tri-Axys that Paul Work (Georgia Tech) and Brian Haus (University of Miami) deployed in the Mini-Waves Experiment. Since we now have the Seaview Remote Sensing Software, the time is ripe for such an approach to be explored in the existing WERA domain(s).

**Reviewer #5:**

I quickly read through the document and the way that it addresses HF Radar is quite a bit different than the original version. In the panel-approved version HF Radar assets were woven throughout the plan, not segregated into a separate (but unequal) section. I think this reflects the fact that this was a buoy-driven plan – for example, ADCP's and other technologies (like remote sensing) also got short shrift. Suggested changes that need to be made include:

- 1) Figure 2 is new and should definitely mention HF radar in the mid- and inner-shelf.
- 2) In the original version HF radar was in the "PRE-OPERATIONAL" section, it was put there after much discussion. Now it is in a gray area that doesn't clearly identify what it is considered and the emerging and pre-operational are lumped together. I strongly believe HF radar should be clearly identified as a preoperational component.
- 3) Also the citation of the Haus (2007) paper in this section is strange as it doesn't cover what is suggested (i.e., doesn't do any comparisons with buoys, doesn't include directional spectra and isn't using a nautical radar). The Voulgaris et al. (2008) MTS paper (attached) should be cited instead, or one of many other papers by Wyatt, Hisaki, etc. The Haus (2007) manuscript could be included as an example of an application.

- 4) I also agree with the comments of **Reviewer #1** (above). As a member of the plan review panel, it was a struggle to get the emerging technologies included at all. There was a group that felt it should only include buoys (and that it in fact was a National wave buoy plan). I completely agree that there should be explicit funding for testbeds to advance measurement technologies.

***References:***

Haus, B.K., (2007). Surface current effects on the fetch-limited growth of wave energy. *Journal of Geophysical Research*, Vol. 112, C03003, 15pp.

Voulgaris, G., B. K. Haus, P. Work, L. K. Shay, H. Seim, R. H. Weisberg, and J. R. Nelson. 2008. Waves initiative within SEACOOS. *Marine Technology Society Journal*, Volume 42(3), 68-80.

**Reviewer # 6 :**

I am attaching a copy of the "Waves Manuscript" (Voulgaris *et al.*, 2008) which has just been published in MTS and includes a lot of discussion about the issues addressed in the Waves Plan. I suggest you forward this to the NOAA and USACE representatives coordinating the document edits. This manuscript talks a lot about the wave plan discussions that were initiated in 2005 and also about the different wave measurements techniques (including radar systems). As some other Reviewers have suggested, I highly recommend inclusion of this reference in the plan. A general comment is that the plan is strong in maintaining and expanding old technology (older than 20 years) and very shy in the area of R&D for new technologies. As it is indicated in lines 986-988 of the Plan: "Once comprehensive validation of these systems' wave observation capabilities, through comparison with in-situ observations, is complete, they will complement and expand, but not replace the in-situ wave network proposed here." The plan recognizes the emerging technologies but it does not really offer its support for this. I believe the plan should be stronger in supporting the new technologies in conjunction with the more established ones. For example, the WERA systems have the potential to offer spatial resolution in wave measurements compatible of those of numerical models, which will have significant impact on data assimilation in wave propagation modeling efforts. On the Atlantic coast we already have two WERA installations (Miami and SC/GA) and any serious effort of R&D should make sure that testbeds with "traditional" methods are carried out in areas with existing (or future) HF Radar coverage.

Reference:

Voulgaris, G., B. K. Haus, P. Work, L. K. Shay, H. Seim, R. H. Weisberg, and J. R. Nelson. 2008. Waves initiative within SEACOOS. *Marine Technology Society Journal*, Volume 42(3), 68-80.

**Reviewer #7:**

I want to echo the comments from **Reviewer # 3** (above). Ship time CAN NOT be under emphasized. We have had issues with NOAA ships in the past (for buoy and non-buoy projects) and with USCG ships that seem to be broken more than they run. This issue of maintenance is critical for any operational system.

**Reviewer #8:**

I strongly suggest that Testbed Experiments (as noted in the Plan) should be inclusive of old (arrays, buoys), current (acoustic systems) and emerging technologies (i.e., remote sensing; and WERA radars - the only radar system that can give waves information at various locations). I agree with some of the other **Reviewers** that this document should not specify the location of the testbed apart from general comments, like one on the east coast and another on the west coast (already mentioned in the document). Rather it should emphasize the need of including all available technologies and the site location should be a matter of asset concentration (which site has most of the technologies available so that addition of new ones is cost-effective) and science input by the RA associations. The main concern is that FRF does not have an existing WERA system in place - of course someone might argue they get one and then that is the site. However, that is another issue that I do not think can be resolved in the give frame time, but at a later stage all parties can decide what is the best action (i.e., move the WERA radar installations within the SECOORA region, and/or deploy buoys, etc. within the area of the existing Radar Installations