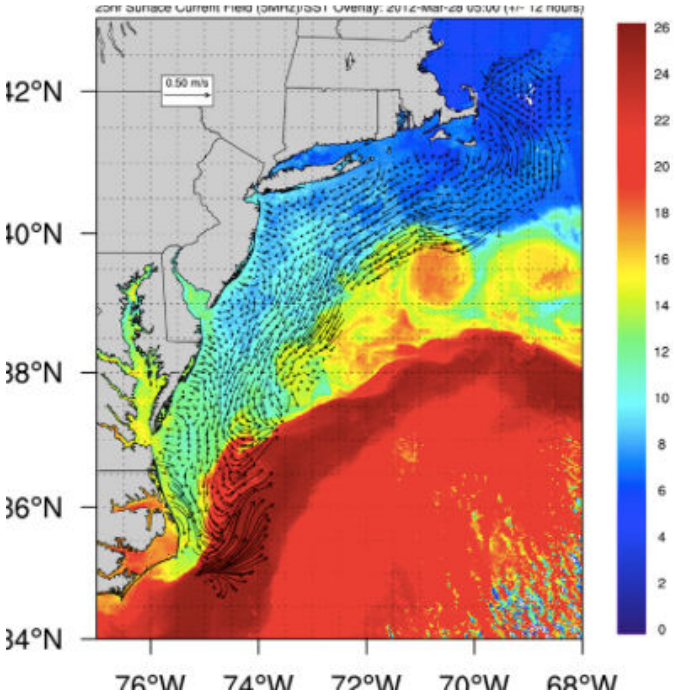
U.S. IOOS

Common Product Initiative
Summary Report



January, 2014

By Aric Bickel, IOOS Association and CeNCOOS on behalf of the Steering Committee

Table of Contents

SUMMARY 4

RECOMMENDATIONS: 5

NATIONAL IOOS PRODUCT (26 VOTES FROM THE DIRECTORS) 5
EXTREME EVENTS PRODUCT (14 VOTES FROM THE DIRECTORS) 5
REGIONAL CLIMATOLOGY PRODUCT (12) 6

IOOS COMMON PRODUCT INITIATIVE: PROJECT DESCRIPTION 7

WORKING SESSION #1 SUMMARY: SEPTEMBER 12, 2013 7
PRODUCT IDEA MATRIX 9

PRODUCT PROSPECTUSES 10

PROSPECTUS 1: NATIONAL IOOS PRODUCT 10
BACKGROUND 10
CURRENTLY BEING DONE 10
PRODUCT IDEAS 11
CONSIDERATIONS AND POSSIBILITIES 11
PROSPECTUS 2: CLIMATOLOGIES 12
BACKGROUND 12
CURRENTLY BEING DONE 12
PRODUCT IDEAS 13
CONSIDERATIONS AND POSSIBILITIES 13
PROSPECTUS 3: INDEX PRODUCT 15
BACKGROUND 15
CURRENTLY BEING DONE 15
PRODUCT IDEAS 16
CONSIDERATIONS AND POSSIBILITIES 16
PROSPECTUS 4: EXTREME EVENTS 17
BACKGROUND 17
CURRENTLY BEING DONE 17
PRODUCT IDEAS 18
CONSIDERATIONS AND POSSIBILITIES 19
PROSPECTUS 5: NATIONAL TRAJECTORY PRODUCT 19
BACKGROUND 19
CURRENTLY BEING DONE 20
PRODUCT IDEAS 20
CONSIDERATIONS AND POSSIBILITIES 20
PROSPECTUS 6: VIRTUAL OCEAN TOOL BOX 21
BACKGROUND 21

CURRENTLY BEING DONE 21
PRODUCT IDEAS 21
CONSIDERATIONS AND POSSIBILITIES 22
PROSPECTUS 7: SURFACE CURRENT VISUALIZATION **22**
BACKGROUND 22
CURRENTLY BEING DONE 22
PRODUCT IDEAS 23
CONSIDERATIONS AND POSSIBILITIES 23

Summary

The goals of the IOOS Common Product Initiative (CPI) are to explore product development efforts being made by the Regional Associations (RAs) and identify areas where common products could be developed that would meet regional and IOOS product development goals. The hope is that the development of products common to all of the regions (or groups of them) would be more efficient, allow for the sharing of resources to achieve similar goals, and demonstrate the national scope of IOOS. This Initiative follows the Product Development Workshop held in Ann Arbor, MI in 2010.

Over the summer of 2013, a Steering Committee for the CPI was assembled[1]. The committee worked to plan and facilitate Working Session #1 for September 2013 that scoped out potential products for the initiative to be held in conjunction with the annual Data Management And Communication (DMAC) meeting in Washington, D.C. Additionally, a product survey of the 11 RAs' websites was conducted prior to the working session with a focus on identifying products that were shared by many and any gaps that could be filled by the CPI. The initial survey of the RA websites was completed and was followed by phone interviews with the RA directors. The results of this survey and the subsequent interviews were used to frame the discussions at the September working session and can be found on the IOOS Association website (see http://www.ioosassociation.org).

Working Session #1 (Sept 2013) was the first step towards scoping out possible joint products that the IOOS RAs and the Program Office could develop. This initial conversation was held with the data managers so that the technical issues could be reviewed and some preliminary brainstorming could be done.

Working Session #2 (Nov 2013) was conducted with the RA directors to update them on the progress of the Initiative thus far, give them an opportunity to provide feedback, and get a general idea of their priorities for common product development. At this event, the directors were asked to rank the options according to their preferences.

The possible products that were considered by this effort include:

1. National IOOS Product (26 votes)
2. Extreme Events Product (14)
3. Regional Climatology Product (12)
4. Regional Trajectory Product (8)
5. Surface Current Visualization (5)
6. National Trajectory Product (1)
7. Index Product
8. Virtual Ocean Tool Box

Descriptions of the products, including background, examples of current efforts, and considerations on the impact, feasibility and level of effort required to make a national product can be found in the Product Prospectuses

[1] Debra Hernandez, Matt Howard, Jenn Patterson, Josie Quintrell, Rob Ragsdale, Derrick Snowden, Aric Bickel

Recommendations:

The following recommendations area based on the outcomes of the above discussions and the deliberations of the Steering Committee. They list the top 3 ideas that could be moved forward in the next 1-2 years.

National IOOS Product (26 votes from the Directors)

The strongest support was given to developing a national IOOS product that could demonstrate the power of IOOS at the national level, providing decision-makers and the general public a sense of why national coastal observations are important, how they vary in the different ecosystems and that IOOS has created the ability to integrate them on the national level.

The next step for this project is to define the stakeholders, assess what is technical achievable and scientific meaningful. The starting premise is that the main stakeholders would be members of Congress, decision makers, outreach coordinators, visitors to the IOOS website and the general public.

Ocean Currents: One "low hanging fruit" for a national IOOS product is the visualization of surface currents that Rich Signell and Charlton Galvarino mocked up to test the THREDDS services that have been employed by the regions. This is modeled after the wind currents. Their demonstration would need to be revised, expanded to cover all regions and enhanced with user-friendly information and graphics. The demonstration can be seen at: http://testbedwww.sura.org/ocean/

Next Steps: Convene a small team to scope out what it would take to transform this demonstration into a user-friendly, eye-capturing product suitable for posting on the IOOS website. This team should estimate the time, technical expertise (programming, web content, graphics, etc) and costs associated with this effort.

Extreme Events Product (14 votes from the Directors)

This category was favored by the Directors as a critical user need. At the time of the meeting, a specific product was not identified. Since then, Malcolm Spaulding has developed a storm tool that builds on the work done by the IOOS Coastal Modeling Testbed and the forecast system of NERACOOS that would provide web-based access to inundation modeling.

STORMTOOLS Overview:
The vision of this effort is to develop a system called STORMTOOLS that provides access to a suite of coastal planning tools (numerical models et al) available as a web service that allows wide spread accessible (at low cost) and applicability at high resolution to user selected coastal areas of interest. The system, with a focus on storm inundation and sea level, would assist federal and state government and regional organizations in coastal planning. The initial suite of tools would include those used in CSTORM to predict winds, waves, and currents. The models and associated data bases would reside on the web server site and run remotely via the web. The system could either be hosted by a government agency, a regional collaborative organization (one of the recently formed Regional Ocean Councils, IOOS Regional Association), or reside on the

cloud. The system would allow new high resolution study domains to be developed and pre-established, high resolution grids could be made available for areas of particular interest.

Next Step: A small group of Program Office staff and RA staff and others needs to review the STORMTOOLS idea in depth to determine its appropriateness for an IOOS Product and to scope out what would be involved to launch the product.

Regional Climatology Product (12)

The development of a regional climatology product that could be similar on all of the RA sites. The product would need to be adapted to suit the data available in each RA, as not all regions have access to long-term buoy data but the graphics could have a similar look, feel, and capability. It would be focused on identifying anomalies and viewing variance from historical means. The product could display available time-series data for water temperature (possibly from various depths where available), salinity, water density, air temperature, and/or other variables. For each of these variables, means and anomalies compared with current observations could be shown and be displayable over various averaging time periods (monthly, yearly, over decades, etc.).

Next Step: GLOS is exploring developing a product and has agreed to share the results of their experience with the other RAs. This could be discussed in the RA Modeling Group to determine feasibility.

IOOS Common Product Initiative: Project Description

The goals of the IOOS Common Product Initiative (CPI) are to explore product development efforts being made by the Regional Associations (RAs) and identify areas where common products could be developed that would meet regional and IOOS product development goals. The hope is that the development of products common to all of the regions (or groups of them) would be more efficient, allow for the sharing of resources to achieve similar goals, and demonstrate the national scope of IOOS. This Initiative follows the Product Development Workshop held in Ann Arbor, MI in 2010.

Over the summer of 2013, a Steering Committee for the CPI was assembled[2]. The committee worked to plan and facilitate Working Session #1 for September 2013 that scoped out potential products for the initiative to be held in conjunction with the annual Data Management And Communication (DMAC) meeting in Washington, D.C. Additionally, a product survey of the 11 RAs' websites was conducted prior to the working session with a focus on identifying products that were shared by many and any gaps that could be filled by the CPI. The initial survey of the RA websites was completed and was followed by phone interviews with the RA directors. The results of this survey and the subsequent interviews were used to frame the discussions at the September working session and can be found on the IOOS Association website (see http://www.ioosassociation.org).

Working Session #1 Summary: September 12, 2013

The Working Session #1 was held on September 12, 2013 immediately following the IOOS Regional Data Management Meeting. The first item on the working session agenda was to come to a consensus on the definition of "products" that would be used for the CPI. Following some discussion, the group accepted using the definition of "products" from the IOOS build-out plans[3].

The majority of the working session was dedicated to the discussion of product ideas for the CPI. Prior to the CPI working session, the CPI Steering Committee created a short list of 4(5?) potential areas in which national or super regional common products could be developed. These short-listed areas were presented to the group and followed by a facilitated discussion that built consensus around the breakout topics that would be focused on for the remainder of the working session. Through RA Director comments collected during the products survey and discussion by the group on hand, the following topics were identified:

1) Climatologies
2) Extreme Events

---

[2] Debra Hernandez, Matt Howard, Jenn Patterson, Josie Quintrell, Rob Ragsdale, Derrick Snowden, Aric Bickel

[3] Build out Plan product levels:

1. Level 1: Raw data – delivery of minimally processed data or model output to "super" users. (e.g., HFR data for SAR; data sent to NDBC; data used by agencies for model input for fisheries, etc).
2. Level 2: Processed information or data - display of real-time data, posting of information with minimal processing (e.g., posting of real-time data from buoys).
3. Level 3: Data Visualizations (charts, graphs, graphic displays, phone apps, etc.)
4. Level 4: Decision-support tools (DST)- information tools developed to fulfill specific decision-making needs (e.g., alerts, Huron/Erie modeling output of public health officials, harbor warning systems)
5. Level 5: Other

3) Inundation
4) Model visualization/comparison
5) A single/limited variable national display

It was stressed during the discussion that the initial product(s) developed through this initiative should be simple, build off the existent IOOS services, and have a specific audience in mind. It was this latter point that led to the discussion of Washington, D.C. decision makers being an important potential audience for the CPI, and it was with this in mind that the 5th area (a single/limited variable national display) was added to the list. The concept would be to have a national display, potentially hosted on the IOOS website, which would be focused on serving, in a very user friendly way, all the observations being made on a particular variable (i.e. surface water temperature). This product would be used to showcase the power and usefulness of IOOS across the nation.

The five topics identified in the previous discussion were nested into three break-out groups; attendees self-selected which of three groups to attend. The groups spent an hour scoping out potential common products that could be developed within these areas. Detailed descriptions of those product ideas are provided in the prospectuses, however a brief summary of the ideas generated is below:

Group 1: National IOOS Product/Climatologies (Prospectuses 1-3)

- National IOOS product focused on a single variable (i.e. surface water temperature)
- Regional climatology product
- National climatology product
- National index product, potentially focusing on water quality

Group 2: Extreme Events/Inundation (Prospectus 4)

- Standardized regional inundation and/or storm surge tool
- Hurricane tracking product for the East Coast
- RA data layer product that could be fed to Google Crisis Maps
- Statistical national map to display climatology or other statistics
- Model and observation comparison product for extreme events
- Watershed regional event monitoring product which incorporates rain/stream gages, water level, coastal water quality, and waves
- Datum conversion tool to allow water level data sets to be served in the user's choice of vertical datum

Group 3: Modeling and Trajectories (Prospectus 5-7)

- National trajectory product
- Regional trajectory product
- Virtual ocean toolbox, making a number of data analysis tools available on users' personal work stations
- Surface current visualization product

Product Idea Matrix

Below is a matrix summarizing the ideas generated during the break-out discussions of the working session. The CPI Steering Committee assigned broad rankings of each product's impact, feasibility, and level of effort required to develop. The rankings are qualitative and are initial assessments based on the limited discussions at the working session and Steering Committee meetings following it. A thorough scoping would be necessary for any of these ideas to more accurately assess these values.

For the purposes of this matrix (and the prospectuses that follow), the product ideas from the "Extreme Events/Inundation" group are lumped into a single product line due to limited scoping that was able to be done on the large number of generated ideas. Further discussion is needed to identify what products make sense for regions to develop in conjunction with what Federal agencies are doing and recent developments in inundation modeling. The notes briefly explaining the rankings are provided; please see the full prospectuses for more detail.

None of the products listed in the table and discussed later in this report are fully scoped. Discussions during Working Session #1 were conducted within a limited amount of time and some topics required input from technical experts not represented at the meeting. The results of these discussions only constitute a sense of the products that could be developed through this initiative; there is still significant room for additionally ideas and honing of those products proposed. All of the listed ideas would require scientific, DMAC, and design scoping to evaluate their technical needs, impact, and level of effort and resources to complete.

Additionally, it should be strongly noted that the majority of these products require the continued development of the IOOS SOS services in the regions. This has been and continues to be a DMAC priority, and the CPI is not intended to replace or otherwise impinge on the fulfillment of those DMAC goals. The completion of these data management objectives is integral to many of the common products discussed herein.

Product	Impact	Feasibility	Level of Effort	Notes
National IOOS Product				High impact; seems technically feasible; builds on common services and the ability to adequately display all regions data
Regional Climatology Product				Possible duplication of effort for RAs that have similar product; technically feasible; needs commitment to common displays
National Climatology Product				High impact; difficult to develop due to diverse sets of parameters. Common services are integral to technical feasibility
Index Product				High impact; would need significant scientific input for index and thresholds.

Product Prospectuses

Prospectus 1: National IOOS Product

Background

Two possible audiences for products resulting from the Common Products Initiative (CPI) are Washington decision makers and the general public. A national IOOS product would target both of these groups and demonstrate the power of IOOS, show data on a national scale collected by the regional systems, build awareness about the coastal environment, and show a clear way(s) that the American people are benefiting from it.

A product in this area would be simple enough for a wide audience of people to use, visually impressive, and clear in the type(s) of information that can be derived from it. It would likely be hosted on the IOOS main site.

Currently Being Done

By definition, a product such as this does not yet exist. However, there are a number of products external to the IOOS program that could be used as examples and some IOOS technology in development that relates well to this effort.

- NASA's State of the Ocean product: Provides near real-time data that gets displayed on a virtual globe and is annotated to give context descriptions of the ocean's features and events). It also provides data layers for Sea Surface Temperature (SST), wind vectors, and ocean color. This product integrates many data sources and acts more like a data portal than we would want for our purposes. However, it is a good example of the type of displays we could use and has done some interesting work with visualizing data. An IOOS national product would likely focus more on a select number of variables.

- WunderMap: A Weather Underground prototype (please don't share the link) interactive map that allows users to turn on/off a number of weather related layers such as radar images, sea surface temperature, storm tracks, satellite images, severe weather warnings, etc. Similar to the "State of the Ocean" product, WunderMap integrates a large number of data sources and acts more like a data portal than we would want for an IOOS national product. What it does do is set the bar high for user friendliness and ease of display for a number of data types and sources. We should be aware of products like this out in the private sector and work to compliment them or equal their level of design.

- Axiom's Hexagonal Binning: Axiom, the DMAC lead for AOOS and CeNCOOS, has been developing a map-based display that may be useful for a national IOOS product. The display summarizes individual data feeds into bins with a collection of measurements (i.e. A hexagon shaped bin statistically summarizes all of the sea surface temperature measurements within its

area). As a user zooms into the map the statistics within each bin are recomputed based on the new map coverage area for that zoom level. Once zoomed in far enough for all the points to be displayed at the same time without overlapping, the bins are no longer necessary and the individual data points are displayed instead. A demo of the display (that is still very much in development) with a marine debris dataset can be found here. This technology could provide a snap shot of what is going on nation-wide for a select variable (i.e. Water temperature); data layers could be toggled to show multiple variables.

- Derrick Snowden (IOOS) and Kyle Wilcox (ASA) have been redesigning the IOOS Asset map. They are close to an operational version of it and will be looking for feedback on the re-design in the near future. It is possible that the work done for this could somehow be leveraged or otherwise taken advantage of for this product. (For example, incorporating Axiom's binning display with the new asset map.)

Product Ideas

The following ideas were discussed during the September working session of the CPI:

- The development of an aggregated national product such as "Our Oceans Now" (the name is only a recommendation) that would provide information on a few variables (e.g. temperature, salinity, dissolved oxygen) and link the observations to overall trends. The overall target of this product would be to show the power of IOOS and demonstrate the usefulness of the ocean observing system. It could be something similar to NASA's "State of the Ocean" product with a limited number of variables that focuses on in situ observations. Depending on how these observations are linked to overall trends, a climatology product could be incorporated into it at some point. This product could also incorporate the hexagonal binning display that is being developed by Axiom.

Considerations and Possibilities

The following are the considerations and possibilities for a national IOOS product such as that outlined above.

- Impact: Properly developed, this product would show how IOOS as an integrated system benefits the American people. It could start with just a few variables and then be expanded upon. Additionally, this product would be something all of the RAs could point to and a product folks from both the federal and regional level could stand in front of a room with to explain what IOOS/the RA do and how they benefit stakeholders.

- Feasibility: The data we would want to use for this product are already available. The readiness of this project depends greatly on whether or not all regions have set up their regional SOS servers. If this is completed, it may take minimal effort for code to be written that integrates the necessary data feeds into a display. Additionally, Axiom's binned display work is nearing a live debut (likely with the CeNCOOS and/or AOOS data portals). With the examples of existent products mentioned above and Axiom's work, the pieces for this product are fairly well in line. Decisions to be made and work to be done would be more in the area of the kinds of observations/measurements we would want to display through the first iteration of this product, and how they would be linked to overarching trends.

- Level of Effort: We would need to form a working group of technical experts (e.g., : data architects, data integration programmers, product designers , requirements: (RA Directors and IOOS Office Staff), and others to determine which parameters make the most sense to start with, the visual design, and the data management processes needed to support the visualization.

  Some funding and time would need to be put toward the development of the product. The interface would need to be designed and a contractor hired to implement the design. The time of some personal would also need to be dedicated to scoping out the variables we will incorporate for the first iteration of this product and to decide how those measurements/observations will be linked to overarching trends. Time and money will be necessary to organize the data and aggregate it into the product. If the RA's comply with an SOS service (custom, NcSOS or 52N) these data will be accessible, but realistically there will still be hurdles to overcome with vocabulary differences before the data can be presented.

  If determined to be a high priority, a prototype of this project for at least one variable could be completed within a year, with a more robust product completed by the end of a second year.

Prospectus 2: Climatologies

Background

The idea of a national climatologies product was identified by the Common Products Initiative (CPI) Steering Committee, supported in RA director surveys, and discussed during the breakout period of the September working session. There are example products from a few of the RAs that could be built on or scaled up to the national level (or adapted to other regions).

The ability to create a product such as this has been displayed. It seems to be a common product that many RAs are interesting in developing in response to user requests.

Currently Being Done

Many of the RAs have created products along these lines. Those listed are included to give an idea of the breadth of work being done in this area.

- Jobos Bay Climatologies: Provides climatology graphs for temperature, salinity, DO, and pH in Jobos Bay, Puerto Rico. Each graph shows historical mean (time frame un-specified), standard deviation, and the current year's daily mean. It is specifically designed to assess the deviations from expected values and assist in warning of anomalous events affecting water quality.

- Oasis Mooring Temperature: A series of graphs displaying ocean temperature at 0m, 60m, and 100m over the past year. Included in the graphs is the mean temperature for each depth from 1990 to 2012, the min and max temp for the current year, and grayed-out lines of the previous 22 years of measurements. A fourth graph shows SST anomalies from 1989 to 2013. Archived graphs for each depth are available for each year dating back to 1992.

- Ocean and Weather Climate Display: A climatology product for the buoys in the NERACOOS region. Users can select one of 14 buoys in the region to see a climatology graph of one of its variables. Variables and data varies by buoy, but most allow users to see data from 2001 to 2013 on air temperature, barometric pressure, salinity (at 1m, 20m or 50m), water density (at 1m, 20m or 50m), water temperature (at 1m, 20m or 50m), wind gust, and wind speed. Users can select to view either monthly or daily averaging periods. The graphs show a mean line for the full time period available, the range of means over that period, and the monthly or daily mean for the year selected, allowing users to compare the current year (or any other year selected) to the mean over the full period.

- Virtual Columbia River Climatological Atlas: A product that provides climatologies for the Columbia River and its plume area. Many variables can be viewed, including river water temperature, estuary salinity, upwelling indices, river flow, etc. For most variables, data is available from 1999 to the present. For each variable, an overview, climatology, histogram, and an anomaly graph are available. Users have the option of viewing all of the years on the same graph or looking at each year available individually.

Product Ideas

The following ideas were discussed during the September working session of the CPI:

- The development of a regional product that would be identical (or very similar) on all of the RA sites. The product would need to be slightly adapted to suit the data available in each RA, but it would have a similar look, feel, and capability. It would be focused on identifying anomalies and viewing variance from historical means. The product could display available time-series data for water temperature (possibly from various depths where available), salinity, water density, air temperature, and/or other variables. For each of these variables, means and anomalies compared with current observations could be shown and be displayable over various averaging time periods (monthly, yearly, over decades, etc.).

- The creation of a national climatology product, similar to one described above, that would be hosted on the IOOS site. The product would pull in data from the RAs to give users a national/super-regional look at climatologies for a number of variables and how they compare to historical means. This could relate to the previous product describe in Prospectus 1.

Considerations and Possibilities

The following are the considerations and possibilities for a climatology product such as that outlined above.

- Impact: Properly developed, a standardized regional climatology product would allow users to get climatology information clearly from any of the RA sites. The products would be very similar across all of the RAs, making it easy for a user to visit multiple regions' sites and access/view equivalent data. This would particularly assist RAs that have not had the time or resources to develop a climatology product that their stakeholders/users have been requesting. It would, however, be a duplication of effort for some RAs that have already developed a similar product for their region.

A national climatology product would provide a singular resource for users to access nation-wide climatology information. Depending on how it was developed, it could be a product all of the RAs could point their stakeholder/users towards to get information they are requesting. Additionally, the product could be used to demonstrate the power of IOOS as an integrated system and be an example used to display the benefits of program to the nation.

- Feasibility: The feasibility of this product would depend on how different it is from the products some of the RAs have developed. For example, if the end result was a product very similar to NERACOOS's Ocean and Weather Climate Display, it may be relatively simple to create a template based off the NERACOOS product that the RAs could incorporate into their region. However, the NERACOOS product (and several of the other RA products that have been developed) is centered on a network of buoys with a fairly long time series; not every RA has similar sets of historical data or observing platforms. The largest hurdle with a regional product of this nature may be adapting it to the specific observing and data sets of each RA.

  For a national climatology product, the same hurdle likely exists. Not every RA has a 10+ year data set for 10 different variables at 14 locations. Creating a system that harmonizes these differences in observations/capacities between each of the RAs and still presents a clear national/super-regional picture for users may prove to be difficult. The question of what a "national" climatology product actually looks like also exists. The product may have to be super regional, as pulling data in from both coasts, Alaska, Pacific and Caribbean Islands, and the Great Lakes may not lend itself well to a clear national overview.

- Level of Effort: For either a national or regional product, A working group would need to be assembled that included DMAC leads and/or product developers for each of the RAs, RA directors, subject matter experts in each RA (to define thresholds) and IOOS technical staff. Some funding would need to be put toward the development of the product. Significant staff time would need to put toward integrating the product into each region or each regions data into the national product. If the product was to be very similar to an existing RA product, less may need to be put towards development. Regional RA subject matter experts would likely be needed to invest time/resources to define algorithms for determining thresholds (seasonal variability, etc).

  Regional product: It is feasible that a prototype for one of the regions could be completed within a year, with the goal of incorporating it into all of the regions sites by the end of second year.

  National/super regional product: this may be a longer-term endeavor. It is possible that a prototype could be completed within 2 years, with a full product completed after a third.

- Other Considerations: GLOS has already designated the development of a climatology product as a priority. Tad Slaweck, from GLOS, has agreed to spear-head the near-term research into developing something along these lines, as he had already planned to do so prior to the working session. He is going to contact RAs and other groups that have developed these kinds of products and report back to this group what he finds and what his recommendations are for moving forward.

This discussion group also cautioned that the information we display through a climatology product needs to be scientifically meaningful. The computing of means is not as straight forward as it may seem and we should proceed with scientific caution in developing a product such as this.

Prospectus 3: Index product

Background

The idea for a national index product has come up over the past several years and came up again during discussions at the September working session, partly sparked by comments made by RA directors and product developers during the products survey. The discussions began with the idea of creating a common water quality product at either the national or regional level. This evolved into talk of creating a national water quality index product (likely an interactive map) that could summarize water quality data at different scales, providing users the ability to see water quality both at a national level (when zoomed out) and at a local level (when zoomed in). This idea received generally good reception during the working session; however it was pointed out that a group of experts in the water quality field would need to be included in the discussions to fully scope out the product, ensure that the index developed was accurate and meaningful, and answer a number of technical questions that this group could not. This background work would be required before the data and product experts could fully scope out the product.

The water quality index idea also sparked conversation on other indexes that could be developed on a similar type of framework, such as a drought index, an ocean acidification index, etc.

Currently Being Done

There is not an existing IOOS product that meets the exact specifications of what is described above. Other organizations at the national, state, and local levels are monitoring water quality and have a variety of products available. There have been discussions in the past between these groups and many RAs concerning the creation of a water quality index, the structure of which would allow a number of other products to be developed. The construction of this index, however, is integral to these efforts. Examples of current water quality products provided by regional associations are provided here for reference, they are not an exhaustive list. Other RAs have water quality products similar to these.

- Water Quality Platforms: A set of interactive maps that display the locations of PacIOOS water quality platforms in their region. Selecting a platform brings up the most recent water quality readings (parameters vary by platform; they include salinity, temperature, chlorophyll florescence, turbidity, and dissolved oxygen) and allows users to download data from the platform. The product additionally links the users to the Sate of Hawaii Department of Health's clean water warning and advisories. The interactive maps are an example of how an indices product could look.

- Beach Water Quality Model: This product does predictive modeling to aid in the beach swimming advisories for an area of Myrtle Beach, South Carolina. It is an automated ensemble of models that utilize various near real time data sources from buoys to rainfall radar. The interface for this product may be an example of what could be done with an indices product.

- Hawaii Beach Safety Product: An interactive map product that allows users to view any safety warnings or messages concerning beaches in the Hawaiian Islands. While it does not relate specifically to water quality, it is a further example of what the interface for an indices product could look like.

Product Ideas

The following ideas were discussed during the September working session of the CPI:

- The development of a national index product centered on water quality. This would be something akin to an interactive map that would display various levels of water quality nation-wide. The structure and thresholds for the index would need to be decided by a technical team. The construction of a team made up of IOOS, Federal, State, and local entities would need to be the initial focus of this effort. There are a number of design/display ideas that could be used as for this product. The main hurdle seems to be the creation of the index and thresholds.

- Building on the structure of a water quality index, any number of other indexes could be created focusing on other issues. These could include a drought index, an ocean acidification index, and others. This is contingent on the hurdles that plague the creation of an index as described above.

Considerations and Possibilities

The following are the considerations and possibilities for an indices product such as that outlined above.

- Impact: The IOOS national water quality index or other index would provide a singular resource for users to access nation-wide information. Depending on how it was developed, it could be a product all of the RAs could point their stakeholder/users towards to get information they are requesting/searching for. Additionally, the product could be used to demonstrate the power of IOOS as an integrated system and be an example used to display the benefits of the program to the nation. The creation of the water quality index could potentially lead to the creation of other indexes that would meet stakeholder and program needs.

- Feasibility: An initial small working group should review what is possible for developing such indexes, including identifying Federal agencies that should be involved (such as the National Water Quality Monitoring Council and the Ocean Acidification Program). This product would also require a scientific team to review existing IOOS data and to develop meaningful indices. It is difficult to estimate the readiness of a display without first creating this index structure and answering these technical questions. Following this, a team could begin working on the creation of a product that would sit on top of the structure. The creation of the index and coming to a consensus on how it should be done would seem be the largest hurdles

- Level of Effort: The first step would be for IOOS to dedicate staff time and other resources to creating a panel of experts that includes IOOS, Federal, State, and local entities to develop the index structure. The initial scoping project could be done by volunteers from the RAs, IOOS Office, and other agencies. Their work would result in a description of what product(s) could be developed and an estimate of the time. It may be possible to assemble a team, hammer out the

details of the display, and create a prototype within a two year period.

- Other Considerations: It was difficult for the group to be confident that they were asking the right questions concerning a product of this nature. It seems necessary to discuss the idea with water quality experts before decided on a plan to move forward with this idea.

Prospectus 4: Extreme events

Background

Extreme events – hurricanes, typhoons, storm surge, flooding, etc. - affect all IOOS regions and for which all regions are engaged. Hurricane Katrina, Sandy and other events have highlighted the role IOOS can play in providing real-time data such as water temperatures to early notification of potential hazards. The idea of a common product to address extreme events came out of director comments during the product survey and discussions during the working session. A number of ideas were discussed in the break-out group for this topic, all of which likely need to be scoped further. Further direction as to what would be most valuable for the RAs and what would be attainable within the CPI's timeline. As such, the product ideas generated in this topic area are presented as a whole.

Currently Being Done

Below are examples of products developed by the RAs that relate to this topic. They are listed here not necessarily as examples of products that could be scaled up to a national level, but rather to give an idea of the breadth of work being done in this area.

- Shoreline Profile Database and Website: a database storing shoreline profile data for the entire Alaskan coast, including a significant amount of historical data. The final product will include a user interface that allows for the visualization of this data.

- Hurricane Tracker: An interactive map displaying current weather, inundation/flooding risk, and hurricane tracks/info when available. Users can also choose to over lay water gauge locations (that show their current measurements if selected), precipitation and other forecasts, and FEMA emergency information (evacuation routes, power outage areas, etc.). The product allows users to explore the tracks of previous storms.

- Tsunami Evacuation Zones: A data portal that shows Tsunami evacuation zones in the Pacific Northwest and links to other relevant information about planning for a tsunami. The system has the capacity to display warnings of possible tsunamis.

- Coastal Flooding and Erosion Forecast: A tool that gives a 48-hour forecast of coastal flooding and erosion risk. The forecast is available for Portland, ME and Scituate, MA Users can view the forecast animated for specifically defined times over the 48hrs.

- Sea Level Visualization Tool: A tool that allows for improved visualization of sea level information as well as provide area specific forecasts (in development by NERACOOS).

- High Sea Level and Wave Run-up Forecasts: Provides observed and forecasted sea level graphics for select locations across the Pacific. Provides links to the specific methodology for deriving the forecasts.

- Hawai'i Beach Safety: A site that provides beach safety alerts for 4 of the Hawaiian Islands (Oahu, Maui, Hawaii, and Kauai). The site also provides surf and weather forecasts.

- Hawai'i Flash Flood Response Tool: The Experimental Hawai'i Flood Response Tool is a Web-based geographic information system that provides emergency managers access to real-time precipitation and stream flow data, radar, weather satellite imagery, and alerts and warnings in a central location.

- Interactive Regional Map: An interactive map that displays the real-time observation stations of the RA. In addition to a number of other capabilities, the map integrates predictive storm data.

- Google Crisis Maps: GIS layers from ocean observation data are fed to this central location (SECORA contributes), this information is then used to plan for and monitor storms and other extreme events.

Product Ideas

Several ideas were offered during the September working session of the CPI:

1) Standardized Inundation and/or storm surge tool. There are examples of local inundation products from several regions (e.g., PacIOOS, SCCOOS, NERACOOS) that could be tailored to apply to other locales. Some of the tools require specific models, and in situ measurements from buoys or ADCPs to develop the local model. All tools would require a regional inundation or storm surge SME.

2) Hurricane tracking product for the East Coast. This would track tropical storms along the east coast, providing seamless coverage from one region to the next, showing wind, temperature, and other relevant ocean data.

3) Google Crisis Maps: The group discussed the possibility of all of the RAs putting their relevant observation data into formats (likely kml files) that could be fed to these kinds of online mapping products. This would not be a product hosted within the RAs, but rather a service that increases the use of IOOS data.

4) Statistical national map. A national map to display climatology or other statistics. This product could provide the ability to look at a US map and quickly see where there is something "unusual" happening. This product could potentially include Axiom's binned display method.

5) Model and observation comparison for extreme events: This product would allow users to determine the reliability of model forecasts. Many RAs have such a tool for water level and ocean model forecasts that could be used as a guide in developing a larger scale product.

6) Watershed event monitoring product: It would be a localized product that could be replicated throughout the RAs, which incorporates rain/stream gages, water level, coastal water quality,

and waves. It would allow for a regional view of what is happening in your watershed and the coastal areas closely associated with that watershed. All the RAs are collecting this kind of data, but there hasn't been a product developed that integrates it.

7) Datum conversion tool to allow water level data sets to be served in the users choice of vertical datum. During Sandy, IOOS water level data wasn't easily integrating into response maps because of this issue. NOAA/CO-OPS has a tool (VDATUM) that could potentially be adapted for IOOS requirements. It may be an easy product to develop that would have significant benefits to RAs and their users.

Recommendation
This area deserves more discussion. Many of the ideas were offered in a brainstorming mode and not discussed in any detail about their impact, feasibility, or level of effort. If a common product in this area is made a priority, we recommend that a small working group be convened to define what role IOOS can play in extreme events, review the existing examples of inundation/extreme event products to see how they compare, what features work for different locations and users and how transferable the code for the tools are and what it would take to transfer the tool. The group should also review the pros and cons of the recommended national products as super regional products may be more appropriate.

Considerations and Possibilities

The following are the considerations and possibilities for an extreme event or inundation product such as that outlined above.

- Impact: A common product or series of products related to inundation/extreme events could have a significant impact on a local or national level, and could demonstration the national scope and importance of IOOS.

- Feasibility: A review of the inundation/extreme events products should assess their readiness and technical feasibility. There seem to be a number of regional products that could be scaled to a national level or duplicated across the RAs (or a subset of them).

- Level of Effort: A working group of technical experts would need to be formed that included: NOAA, RAs, software and product developers, and other experts. This group would need to evaluate the product idea and what would be feasible/a priority for this initiative. Part of the effort must include an estimation of staff time and other resources necessary to complete one of these products. Including an evaluation period, we are likely a couple years away from a working prototype of a common inundation or extreme event product.

Prospectus 5: National Trajectory Product

Background

The idea of a trajectory product was put forward by the CPI steering committee and discussed in this breakout group. The group envisioned a national trajectory product that would be powered by RA modeling assets. The goal is a single clean interface to a national map supported by the 11 RAs. The idea of providing a national IOOS trajectory service (utilizing regional scale models) for each RA to use in developing their own products was also discussed (in this scenario a national product would be built on

top of these services). A product of this nature would appeal to a broad spectrum of users including search and rescue, HABS researchers, larval transport researchers, the shipping industry, disaster response, etc.

Currently Being Done

Several of the RAs have trajectory products, although the product discussed above would be more than a drop-a-drifter type tool. Three examples of RA trajectory tools are linked below, as they could potentially be examples of which features the above product could include or how the interface could look.

California ROMS Drop-a-Drifter

JPL Trajectory Tracking Tool

Ocean Model Trajectory

Product Ideas

The following ideas were discussed during the September working session of the CPI:

- The development of a "clean" national trajectory product that is supported by the 11 RAs (as described in the background section). The product could be based around the ASA larval transport product and/or the HF Radar data. There would be a single national map (website) where initial positions would be inputted and where resulting trajectories would be displayed. Business logic at the national level would distribute initial locations to the appropriate RA models. RA trajectory models would compute the trajectories and return results to the national level map for display.
- The creation of a national IOOS trajectory service (utilizing regional scale models for each RA to use when developing their own products.

Considerations and Possibilities

The following are the considerations and possibilities for a national or regional trajectory product such as that outlined above.

- Impact: Properly developed, this product would meet the needs of several different user groups, including those working in disaster response, search and rescue, shipping, HABs, larval transport, and others.

- Feasibility: This is not a simple task and is much more technically sophisticated than any previous effort in this area. It also presumes that each region has an operational model. There would be issues with handing trajectories off that cross regional or model domain boundaries. It was suggested that the larval transport product written by ASA could be ported to all regions so the same trajectory engine was employed. It has been suggested that HF Radar could be the basis of the current fields that drive the psuedo-particles, but HF Radar coverage is not available everywhere and is more prone to outages. It seems to be feasible, but would take a significant amount of work to bring the product to fruition.

- Level of Effort: We would need to form a working group of technical experts, RA Directors and IOOS Office Staff, design personnel, and others to determine the best approach to this project. Through these initial discussions, it seems like a significant amount of effort would be required to address all of the issues raised above. It is difficult to estimate a time frame for completing a prototype of the product, but initial scoping suggests it would be a longer-term project. However, the creation of a regional trajectory product, while still dealing with some significant hurdles, would be an easier task.

- Other Considerations: Prior to even considering a visualization tool like this we would need to have a good understanding of the underlying velocity fields that will be used for the trajectory integrations. Considerations include: horizontal, vertical and temporal resolution of the underlying velocities. If model generated, we need to know the configuration of the model computational grid (curvilinear, Arakawa C, B) as well as the temporal and spatial extent of the model grid.

Prospectus 6: Virtual Ocean Tool Box

Background

The idea for the virtual ocean toolbox was generated during the breakout group discussions at the September Working session. The tool box would be a set of tools that a user could have on their personal work stations that would allow them to explore IOOS and RA data further. This product could have the effect of making the data produced by IOOS more used/usable. The toolbox could also continuously be updated as new tools/products are created, allowing IOOS and the RAs to push new products to users.

There was also significant discussion about tools that are web deployable and could be used by each RA. These are typically distinct tools, or would at least require additional software to enable desktop tools to be deployed on the web or vice versa.

Currently Being Done

Below are examples of tools available through the RAs that could be aggregated into this kind of product.

- Virtual Mooring: A virtual mooring tool run by SCCOOS that has placed a number or virtual sensors in their ROMS output. The tool could likely be developed to allow users to place their own moorings.
- Virtual Sensor: AOOS has a virtual sensor tool associated with all of their model data that allows users to drop a “sensor“ into the layer they are viewing to get a value at that point.

Product Ideas

The following ideas were discussed during the September working session of the CPI:

- The development of a virtual ocean toolbox that would package a number of tools and products for users to have at their personal workstations. The toolbox could include tools like virtual

buoys, virtual sensors, time varying trajectory tools, etc. This idea has the potential to create a framework by which a number of products could be aggregated and fed to users. In general, many different efforts in the community could be characterized as a downloadable toolbox. These tools are typically written in a language that is commonly used in scientific analyses (Python, Matlab, IDL etc). It likely not worthwhile to build a toolbox from scratch. Rather, we could think about the specific tools that are needed, assess the toolboxes that exist, and supplement where necessary. There was also discussion about tools that are web deployable and could be used by each RA. These are typically distinct tools, or would at least require additional software to enable desktop tools to be deployed on the web or vice versa.

Considerations and Possibilities

The following are the considerations and possibilities for a virtual ocean toolbox.

- Impact: This product would create a way for IOOS and the RAs to push a set of tools to their users. This would ideally result in the data/model outputs being used more often and more effectively. It would also be a way in which IOOS could push new products/tools out to users. However, by definition this product would only target a limited audience and there is some duplication of effort as many of these tools are already available through the RAs.

- Feasibility: A technical working group would need to more fully answer this question, but through initial discussions it seems that a number of these tools already exist and it would be technically feasible with a reasonable amount of effort to aggregate them into an encompassing package made available to users.

- Level of Effort: We would need to form a working group of technical experts, RA Directors and IOOS Office Staff, design personnel and others to determine the best approach to this project. This group would need to more fully scope out this product and make a better estimate of level of effort and time necessary to create it. With the number of tools already developed and some examples of this programing already having been done, it is believed that it could be completed in a reasonable amount of time.

Prospectus 7: Surface Current Visualization

Background

The idea of a national surface current visualization product was generated during the breakout group discussions at the September working session. The idea would be to create a surface current visualization product that could be viewed from a national level and is standard for all of the regions.

Currently Being Done

Below are examples of surface current visualizations used by the RAs:

- ROMS Surface Current Trajectory: A particle trajectory tool for the California ROMS output; it could be an example of how to visualize current movements in a national product.

- Surface Current Mapping: The Southern California example of the surface current display that is currently available to all of the RAs.

- MARACOOS Currents: A surface current visualization tool that allows users to view current and historical HFR data.

Product Ideas

The following ideas were discussed during the September working session of the CPI:

- The development of a standard national surface current visualization product, the technology from which could be used at the regional level. One or two global or US specific data sets could be chosen and used to create a national map of surface currents. The underlying technology used to create the national maps could also be used in the regions to support their visualizations.

Considerations and Possibilities

The following are the considerations and possibilities for surface current visualization product.

- Impact: Properly developed, a national current visualization product could provide a a singular resource for users to access nation-wide information. Depending on how it was developed, it could be a product all of the RAs could point their stakeholder/users towards to get information they are requesting/searching for. Additionally, the product could be used to demonstrate the power of IOOS as an integrated system and be an example used to display the benefits of the program to the nation. The underlying technology to create the national map could also be used by the RAs to support their own visualizations.

- Feasibility: There are a number of examples for visualizing surface currents that developers could build from. There are some hurdles to overcome, but though initial discussions it is thought to be reasonably feasible to create this product.

- Level of Effort: We would need to form a working group of technical experts, RA Directors, and IOOS Office Staff, design personnel, and others to determine the best approach to this project. The working group would need to make a better assessment of time and effort needed to develop the product, but it is thought that it could be completed within a reasonable timeframe if made a priority.