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What Does "Transition" Mean? A Qualitative Analysis of Reported Transitions at OAR

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What Does "Transition" Mean?

A Qualitative Analysis of Reported Transitions at OAR

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Summary

OAR recently completed an inventory of all research and development (R&D) that had successfully transitioned to applications between January 2013 and July 2014. A wide variety of activities were submitted by OAR Laboratory and Program Directors as examples of transition, but, when examined closely, many did not seem to be transitions at all. It became clear that there is a lack of shared understanding about what qualifies as a bona fide "transition."

This analysis is intended to address the cultural challenge of transition by focusing on semantics: what we mean when we say "transition." It was conducted determine which reported transitions were consistent with the definition of transition in NOAA Administrative Order on Transitioning Research into Applications (NAO 216-105), and to describe in detail how that determination was made so that it can be reliably repeated, and so that OAR and NOAA leadership can manage transition activities with confidence.

Four criteria are proposed to qualify a transition. It is *the use of an R&D output:* (1) transition is focused on a specific product that is the result of research or development; and (2) is aimed at a particular and verifiable application of the R&D output in a non-R&D context. However, "transition" is not a label to be applied to every use of every R&D output. A more specific definition is that it is the *evolution of a new capability:* (3) transition activities are boundary-spanning work (translation and re-contextualization), different from the disciplinary work of science; and (4) is the building or moving of a service capability, not the running of an operational (or quasi-operational) service.

Per this interpretation, only 96 out of 245 submitted items (39%) were consistent with the understanding of transition per the updated NAO. The single most frequently identified type of activity was research to produce observations and data (35%) – not determined to be a type of transition. Of those that were considered transitions, 67 were examples of technologies transferred (27%) and 29 were examples of knowledge transferred through extension and outreach (12%).

Introduction

Research to application transition (R2A, or "transition") has been a perennial concern of NOAA since the SAB Research Review Team report was issued in 2004. It is a specific priority of Dr. Sullivan for OAR as noted by the language from the NOAA Annual Guidance Memorandum (AGM) "Strengthen the integration, alignment, and effectiveness of R&D that supports NOAA's operational missions, including accelerating the transition of research advances to applications (OAR)." In addition, NAO 216-105: Policy in Transition of Research and Development to Application has been updated and is being reviewed for approval by Dr. Spinrad and Dr. Sullivan.

As such, R2A has been a major topic of recent briefings that OAR leadership has delivered to Dr. Sullivan, NOAA Executive Council (NEC), Department of Commerce (DoC), Office of Management and Budget (OMB), Line Offices, and the new Chief Scientist. In preparing for these briefings and meetings, it became very clear to Assistant Administrator Craig McLean that OAR did not have sufficient data on completed R2A projects to be able to provide a robust or compelling message. It has also become clear that there is a lack of shared understanding (within OAR and across NOAA) about what qualifies as a bona fide "transition."

Methodology

On July 30, AA Craig McLean requested all OAR Senior Managers provide a complete inventory of all OAR research and development (R&D) that had successfully transitioned to applications (R2A) in the period from January 1, 2013 to July 31, 2014 (using the R2A NAO as the basis on which to include each item in the inventory). OAR's Office of Policy Planning and Evaluation (PPE) gathered the information to create an inventory, and used it to refine OAR's list of transitions.

A request to complete a spreadsheet template was sent each Laboratory and Program Office director to identify and describe R2A projects within their units that had successfully transitioned to application within the defined timeframe. Also provided was the 2013 draft revision of NAO 216-105, which defines transition in the NOAA context (see appendix). Each successful transition item was required to be discrete, discernible, and explainable. The template included the following information:

- Project Name
- Thing Transitioned
- Purpose of Transition
- From Where (Organization, Point of Contact, PoC email)
- To Where (Organization, Point of Contact, PoC email)
- Date Completed (Month and Year)
- Comments

PPE received 245 transition items. However, in many cases it was not clear what the "thing transitioned" was, or what the application of that thing was. To ensure a quality analysis, PPE made a short interpretation -- 10 words or fewer -- of the thing transitioned and its application for each submission (e.g. "atmospheric data" was provided for "The National Climate Assessment.") A second tasker requested confirmation or editing of these interpretations from the responsible Laboratory and Program Directors during September 24 - October 10, 2014.

With the validated information in hand, the analysis consisted of qualitative coding (i.e. labelling) of each reported transition with well-defined labels in order to create a typology. Coding was performed by three PPE Staff members working in series (Avery Sen, Andrea Badder, Mark Vincent), then validated by the PPE director (Gary Matlock). Coding disagreements across individuals were identified and resolved at multiple points in the analysis.

The result of coding was that each reported transition had a number of labels associated with it, thus standardizing the characteristics of all reported transitions. Some labels (e.g. activity types such as "research," "development," and "transition") were predefined by the OAR Strategic Plan and the Information Quality Guidelines issued by the NOAA CIO. Others labels (e.g., application types such as "environmental intelligence," "resource management," and "policy, legislation, law") emerged through the process of coding the data. (This approach to qualitative data analysis is known as *abductive* reasoning: the iterative process of comparing empirical data with existing theory.)

Labels were organized into categorical bins, listed here in the sequence of a logic model, starting first with type of activity and working forward along the value chain toward strategic goals. Different types of activities yield different types of outputs, different types of outputs are used by different types (and numbers) of recipients; different types of recipients have different types of applications, and different types of application satisfy different types of goals. In, each label and each bin is defined in Appendix 2, as are the various options within each category.

Type of **Activity** → Type of **Output** → Type, Number of **Recipients** → Type of **Application** → Strategic **Goal**

For each reported transition in the data set, only one option was chosen for each categorical bin (i.e. each item could only be labelled as one type of activity, one type of output, etc.). There were many cases where more than one option within each category (for instance, more than one application type) was identified by the submitter, but only the primary option was chosen. Most often, this was determined by what the submitter listed first.

It is important to note that – per NAO 216-105 as well as the OAR Strategic Plan – "transition" is defined as an activity type. As such, labeling an item with "transition" as activity type was at the

crux of this analysis; those items labelled with “transition” as an activity type were those items that the coders deemed to qualify as a transition (and those not labelled with “transition” represent cases where the coders disagreed with the submitters). In the process of analyzing the data, this determination was made last in order to factor in the all other coded characteristics of each item.

The primary reference for this determination, however, was the meaning of transition per the 2013 draft revision of NAO 216-105. (Prior to this revision, the NAO did not define transition.) The dictionary definition of transition is "the act of passing from one state or place to the next." The NAO revision adds specificity to this common understanding: transition is “the transfer of an R&D output to operations, commercialization, or other uses,” and, more particularly, the progression through Technical Readiness Levels (TRLs) 6 through 9 (see Appendix 1 for details).

Thus, as a starting point, we assume that *transition is the use of an R&D output*. This implies the passage of something to a recipient, i.e., that something moves from one situation to another and that, by definition, the thing transitioned is the thing that moved. Moreover, we assume that, for a transition to be complete, the thing must not only have moved, but must have been used in its new location. We further assumed that *transition is not the use of any R&D output*, and that the process of characterizing the items submitted as examples would help us draw those parameters more precisely. The conclusion section details what was and was not ultimately deemed to be a transition and why that determination was made.

Finally, after coding was complete, a tally of reported transitions was taken for all labels within their respective bins in order to understand their relative numbers. The pie charts in the results section below illustrate these quantities. For the subset of items deemed to be transitions, a separate tally was taken to quantify the number of transitions and the labels applied to them.

Results

This section describes how submissions were characterized and provides the rationale used in identifying which of the potential transitions should be considered actual transitions. (In the table and charts that follow, shades of orange indicate characteristics consistent with the definition of transition whereas shades of blue indicate categories that were not.) The codes (or “labels”) used to characterize each reported transition are given in the table below. Full definitions for each are provided in Appendix 2.

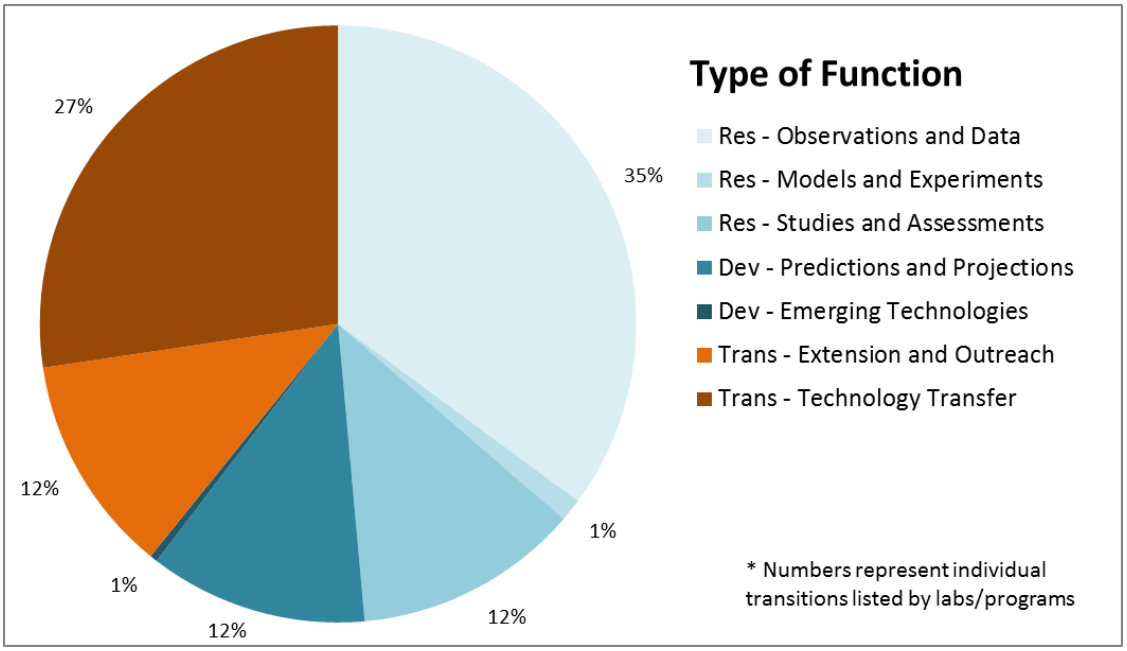
In many cases, there is a high degree of overlap between labels across bins (e.g. “research: observations and data” as an activity and “science: original data” as an output). This was by design. The purpose of this study was to characterize transitions with as much detail as necessary to bin them accurately – in other words, it was not to *lump*, but to *split*. Tallies of items at the intersections of adjacent bins (e.g. number of output types from each activity type) are provided in Appendix 3.

Table 1: The codes (or "labels") used to characterize each reported transition

Activity	Output	Recipient	Application	Goal
• Research – Observations and Data – Models and Experiments – Studies and Assessments • Development – Predictions and Projections – Emerging Technologies • Transition – Extension and Outreach – Technology Transfer	• Science – Original Data – Synthesized Product – Interpreted Product – Tacit Expertise • Technology – Model, Algorithm – Hardware, Equipment – System, Service – Standards, Protocols	• Academic • Public – Federal - OAR – Federal - NOAA (not OAR) – Federal (not NOAA) – State, Local, or Tribal – International • Private – For Profit – For Profit (Startup) – Not For Profit • Infinite • Several • Single	• Research • Application – Environ-mental Intelligence – Resource Management – Policy, Legislation, Law – Education, Learning – Emergency Management – Commerce	• Climate • Weather • Oceans • Coasts

Type of Activity

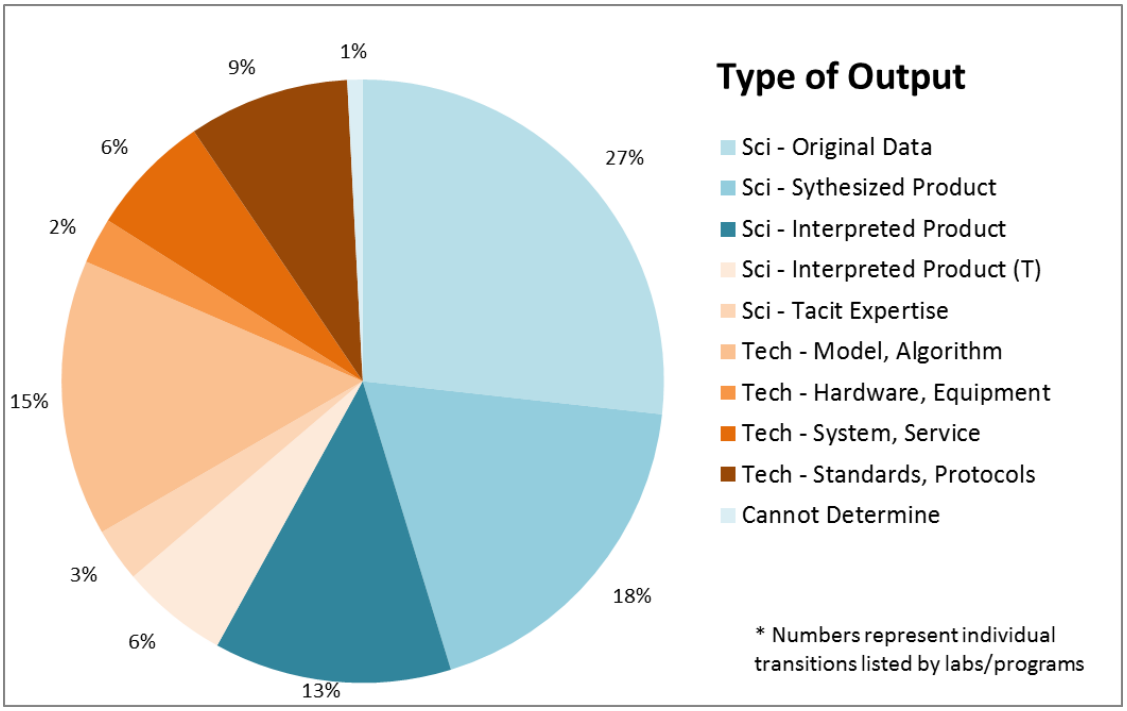
Based on the interpretations and categorizations below -- particularly output type, recipient number, and application type -- the final determination on whether a submission was or was not a transition was made here. Each submission was labelled with an activity from the OAR strategic plan, two of which fall under the heading of "transition" (extension and outreach, and technology transfer). If submissions are labelled as any other activity, they are not considered transitions.



Most proposed transitions (61%) were not determined to be transitions. The single most frequently identified type of activity was research to produce observations and data (35%). Of those that were considered actual transitions (39%), most were examples of technology transfer (27%) and fewer were examples of extension and outreach (12%).

Type of Output

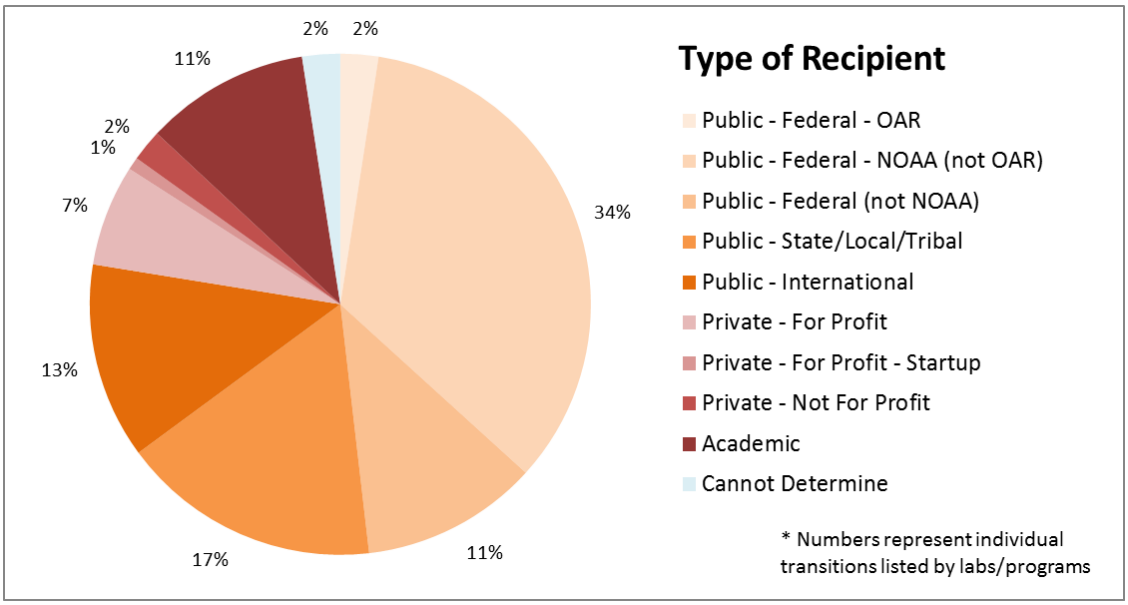
As detailed in the conclusion, "transition" seemed most appropriate when describing the provision of a capability to make something (via a *capital good*, in economic language), rather the provision of a final good or service (a *consumer good*). This largely excludes supplying original data, synthesized products, and many interpreted products, which are simply made available for anyone to use through publication. Some interpreted products, however, were counted as transitions because they seemed to be re-interpreted; that is, they function to translate discipline-specific knowledge into application-specific knowledge (particularly for education and resource management). In the chart below, this is the series labelled "Sci - Interpreted Product (T)."

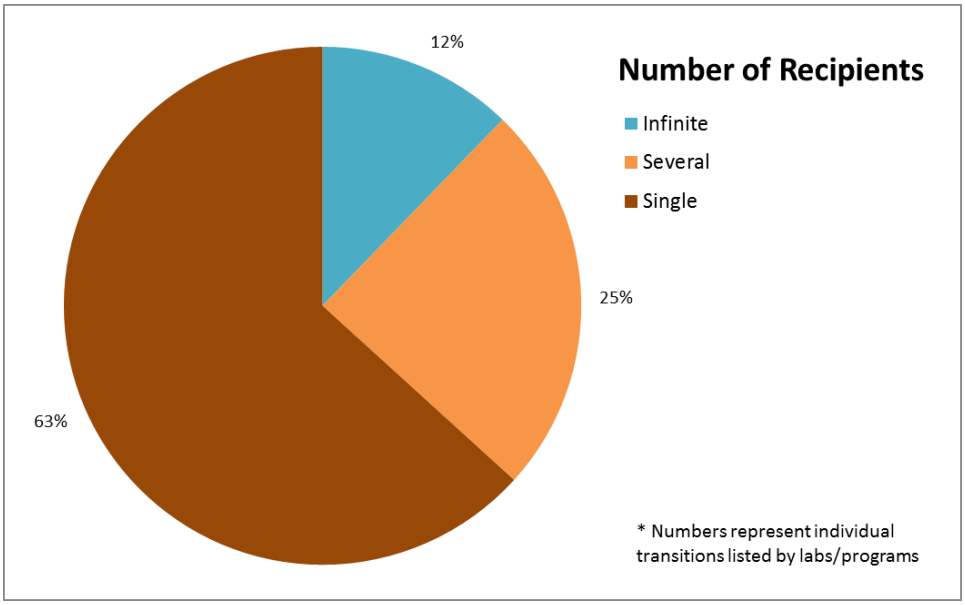


Most proposed transitions could be associated with a discrete output; fewer than 1% of submissions could not. 66% identified outputs of science and 34% identified outputs of technology (per definitions above). However, most submissions (58%) identified outputs that were not indicative of a transition: original data, synthesized products, and many interpreted products. The single largest type of output transitioned was model or algorithm (15%).

Number and Type of Recipient

The particular recipient of the transition item should not a determine whether or not something is a transition. That is, the party receiving the output can be from any societal or economic sector or any location. There should, however, be clearly identifiable, specific recipients who have specific requirements for specific applications. (Ideally, recipients would be a party to an agreement formalizing the transition activity.) Transition does not apply to outputs intended for an infinite number of recipients (i.e., “the public” or “the scientific community”).

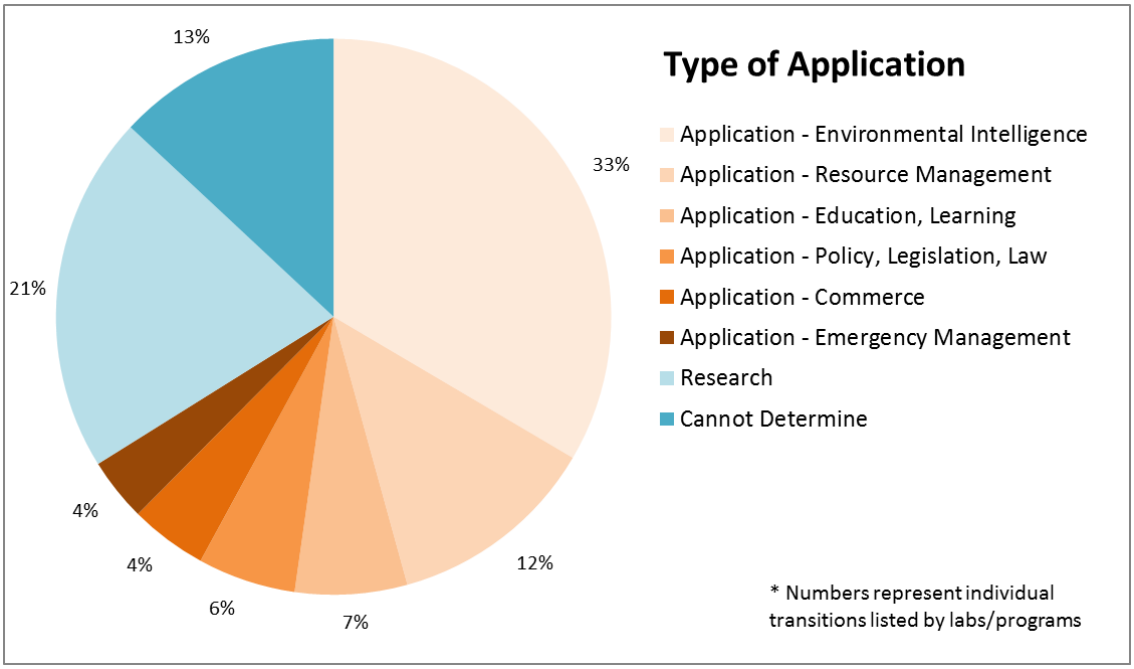




Most proposed transitions could be associated with a single or several recipients; however, 12% of submissions identified an infinite number of recipients, and for only 2% could a specific recipient not be identified. The majority of submissions (63%) identified a single party as the recipient. 78% of the recipients identified were in the public sector (with 34% at NOAA beyond OAR), 9% were in the private sector, and 9% in the academic sector.

Type of Application

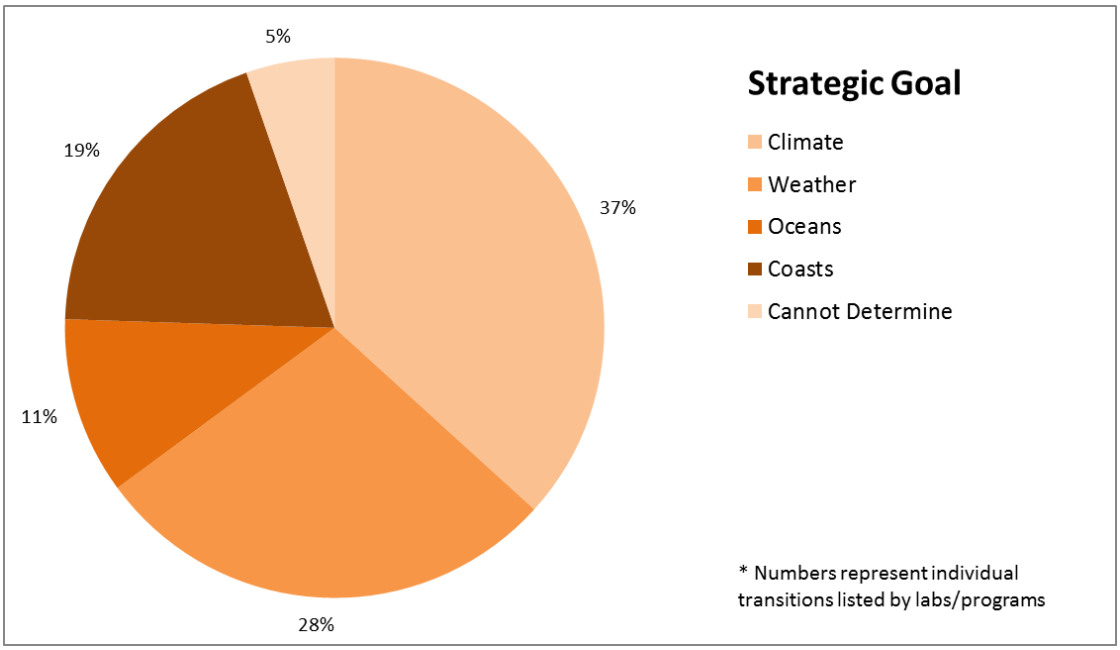
The particular application has no bearing on the activity's definition as a transition. However, there must be an application. For a planned transition activity, the application has to be very specific and, for a completed transition, the application must have actually happened (using the thing transitioned). Moreover, research is not an application. The application must create social, economic value beyond improved scientific understanding. Thus, if follow-on research (excluding quasi-operational services) is the immediate use, then the activity is not transition. This distinction does not, in any way, diminish the importance or the value of research that is not transitioned.



Most proposed transitions could be associated with a use of some sort; however, for 13% of submissions no specific application could be determined, and for 21% the immediate use was additional research, not an application (either operational or quasi-operational). Among applications, the provision of "environmental intelligence" was associated with the highest number of submissions (33%).

Strategic Goal

As with an activity's application, the particular strategic goal (or goals) of an activity have no bearing on whether or not it is a transition activity. A transition can be made in the interest of achieving any goal. Of course, while all NOAA and OAR activities should be clearly directed to at least one strategic goal, an activity may be accurately labelled a transition even if it has no alignment to any goal.



Most proposed transitions could be associated with an OAR strategic goal; only about 5% could not. Most were identified as related to the climate goal (37%), fewer for the weather goal (28%), still fewer for the coast goal (19%) and least for the ocean goal (11%).

Conclusions

A wide variety of different activities and outputs were submitted as examples of transition. The purpose of this report is to interpret the information provided to determine which of these were transitions based on NAO 216-105 and provide further interpretation. From the basic definitions provided in the methods section, transition is the use of an R&D output. However, per the analysis of all reported items, "transition" is not a catch-all label to be applied to *every* kind of R&D activity that is conducted. Transition is one way that R&D delivers value, but not the only way -- and not even the primary way.

Transition is the use of an R&D output

Transition refers to the passage of something to a recipient, i.e., that something moves from one situation to another and that, by definition, the thing transitioned is the thing that moved. Moreover, for a transition to be complete, the thing must not only have moved, but must have been used in its new location.

Criterion 1: A Discrete Output of R&D

Transition is focused on a specific product that is the result of research or development.

This criterion almost goes without saying. An output of transition is the result of an R&D activity -- perhaps not even the primary or intended result of that activity as originally conceived. It must be a single thing -- not several things, or several types of things. Furthermore, for the result to be an output, it must be "put out." That is to say, the result of the R&D cannot remain with the originating Laboratory, the Program, or the principal investigator. It must be a discrete thing that moves out of one context and into another.

Criterion 2: An Application Beyond R&D

Transition is aimed at a particular and verifiable application of the R&D output in a non-R&D context.

The application of an R&D output may certainly be subsequent R&D; this is the normal course of research. The assumption underlying this analysis is that transition is something different: the application must create social, economic value beyond improved scientific understanding. Moreover, evidence of a non-R&D application must support every claim of transition. For claims of transition in the past, there must be evidence that the output was applied in a new context. For transitions planned for the future, there must be evidence of a recipient and a codification of their specific needs. Indeed, requirements cannot be specified until after the recipient is identified. (In the submissions used for this analysis, contact information was requested for each transition listed. Time did not allow for the verification of each, so, for the purposes of this study, the uses for each item submitted was assumed to be real.) Publication is not evidence of use, per se, and therefore not evidence of transition.

Transition is the evolution of a new capability

We understand transition to be more than merely *availing* the public of an R&D output, but rather the incorporation of those outputs into specific applications, including our efforts to facilitate or improve the application of our outputs. It requires a human touch and active dialog, not simply "throwing it over the transom" by publishing a manuscript or a data set.

Criterion 3: Maturation, Not Delivery

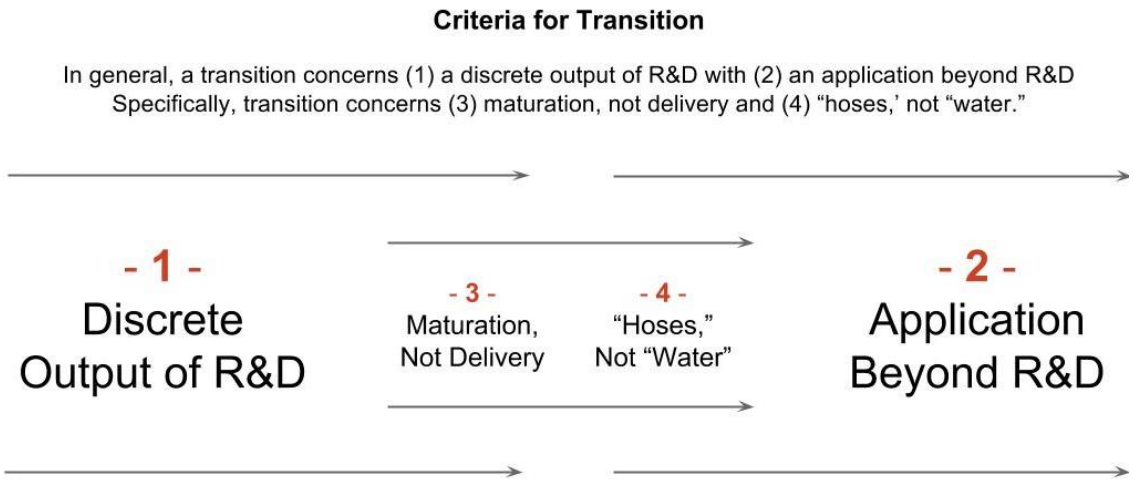
Transition activities are boundary-spanning work (translation and re-contextualization) different from the disciplinary work of science.

The thing at the end of the transition is different than the thing at the beginning of the transition. Per NAO 216-105, the thing at TRL 9 is not what it was at TRL 6, and that the maturation to TRL 9 from earlier stages is what qualifies as a transition. Transitions involve iteratively changing the output from its initial form to meet requirements of an application, and thus navigating the unexpected complexities of applying new capabilities to unique circumstances. In contrast to published deliverables, transitions are *excludable*; each is unique and requires a level of attention and resources that prevent an infinite number of customers. The publication of data, information, and knowledge is typically automated to provide the same product to a large (potentially infinite) number of people. Publication does not involve extensive "hand holding," nor the tailoring of products to the needs of each user.

Criterion 4: "Hoses," Not "Water"

Transition is the building or moving of a service capability, not the running of an operational (or quasi-operational) service.

In sharing model code, application particulars must be known intimately to drive the maturation process; in publishing existing data sets, applications are known more generally, if at all, and further tailoring does not occur. In economic terms, this is the distinction between products that are *capital goods* and *consumer goods*. Transition is the integration of a new capital good within a system of production, or the establishment of new system of production; it is not the making of a consumer good widely available. Transition and publication are like a hose and water. Transition describes the displacement of "hoses" from one context to another, not the displacement of "water" via a hose. This criterion adds additional specificity to the NAO definition that this study began with; it makes explicit an assumption underlying the use of a scale of technical maturity: that which is maturing is a technical capability.



Transitions are not the typical "services" of a research institution, i.e. the production and publication of scientific findings. Rather, transitions constitute a different, value-added function of active support for and transformation of a recipient's capabilities.

From this perspective, less than half of what OAR Laboratories and Program offices reported as transitions actually were transitions; the rest were considered scientific or pre-operational service delivery. Nearly half were examples of the delivery of data products or information products synthesized from data, and for nearly a third the "application" was additional research or could not be determined at all.

This study confirms that managing transition is a cultural challenge. The first hurdle to surmount in managing transitions more effectively is to develop a shared understanding of what transition is (and what it is not). The criteria in the conclusions above are offered to do just this.

Illustrative Examples

A few examples (most taken from the submissions, but generalized) can serve to illustrate the difference between transition and publication more tangibly:

- The citation of a scientific journal article in a patent, in public law, or in a policy document is a transition, but publishing the paper is not; publication, per se, is not evidence of any specific application.

- Licensing the use of a patented technology is a transition, but filing an invention disclosure and receiving a patent on a new technology is not; patenting is not even evidence of production, let alone use.

- Extension and outreach to help communities appropriately use OAR-collected data (and to learn from them what data and formats are needed) is transition, but posting that data for public use is not.

- Model code (and associated instructions for use) given from OAR to NWS and used in an operational model to improve forecasts is a transition, but predictions generated with that same code and published on an OAR website is not.

- Building a web-based GIS to deliver information and taking the site live (either at OAR or partner institution) is a transition, but, once the site is live, use of the site to routinely provide information is not.

- Adapting a UAS developed at DoD for use at OAR (or at another NOAA LO) is a transition, but using it to collect and report data is not. Being on the receiving end of a transition is still a transition.

Still, many questions remain where examples and hypotheticals are not so clear:

- Are technology upgrades (including software updates) transitions in the same way that the original technology was? If version 1.0 was a transition, is version 1.1 also a transition?

- Similarly, is the update to a web-based service a transition the same way that the launch of that web-based service was? A new website vs a new page on that site?

- Regular data provision is not a transition (because it is “broadcast”), but what if there is a help desk that provides individual assistance to users? Is that extension? Is it therefore transition?

- When the R&D source is not NOAA, where does contracting for non-COTS technology end and technology transfer begin? Are GOES and JPSS transitions?

Final Tally of Transitions

Per the conclusions above, 96 of the 245 reported transitions were determined to be actual transitions; 29 were of the type “education and outreach” and 67 were of the type “technology transfer.” The table below breaks the numbers for each type down by the other categories used in this analysis.

Table 2: Final tally of transitions

		Extension, Outreach (#)	Technology Transfer (#)	Extension, Outreach (%)	Technology Transfer (%)
Output Type	Sci - Original Data	0	0	0%	0%
	Sci - Sythesized Product	0	0	0%	0%
	Sci - Interpreted Product	14	0	15%	0%
	Sci - Tacit Expertise	3	3	3%	3%
	Tech - Model, Algorithm	0	34	0%	35%
	Tech - Hardware, Equipment	0	6	0%	6%
	Tech - System, Service	3	12	3%	13%
	Tech - Standards, Protocols	8	12	8%	13%
	Cannot Determine	1	0	1%	0%
Recipient Type	Public - Federal - OAR	2	3	2%	3%
	Public - Federal - NOAA (not OAR)	2	27	2%	28%
	Public - Federal (not NOAA)	3	3	3%	3%
	Public - State/Local/Tribal	14	5	15%	5%
	Public - International	2	8	2%	8%
	Private - For Profit	2	6	2%	6%
	Private - For Profit - Startup	0	2	0%	2%
	Private - Not For Profit	0	2	0%	2%
	Academic	4	8	4%	8%
	Cannot Determine	0	3	0%	3%
Application Type	Application - Environmental Intelligence	2	25	2%	26%
	Application - Resource Management	9	4	9%	4%
	Application - Policy, Legislation, Law	4	3	4%	3%
	Application - Education, Learning	10	2	10%	2%
	Application - Emergency Management	3	2	3%	2%
	Application - Commerce	0	6	0%	6%
	Research	0	16	0%	17%
	Cannot Determine	1	9	1%	9%
Strategic Goal	Climate	3	18	3%	19%
	Weather	1	27	1%	28%
	Oceans	4	11	4%	11%
	Coasts	21	9	22%	9%
	Cannot Determine	0	2	0%	2%

Recommendations

Per the findings and conclusions above, the following recommendations are offered to improve the management and reporting of successful transitions and on-going transition activities.

Use the Four Criteria to Identify Transitions

For reporting in annual operating plans, and in the soon-to-be-implemented Project Portfolio Management System, the four criteria detailed above should be used to identify which outputs and activities should be labelled as transition. To reiterate: (1) the output is the product of research or development, (2) the application is particular and verifiable, (3) the activity is focused on translation and adaptation, and (4) the output is a productive system or a component thereof. All four criteria should be met for bona fide transition.

Use Transition Plans

For prospective transitions, and per the draft update to NAO 216-105, all transition projects must have a transition plan. This document would serve to codify much of the information needed for future analysis along the lines of the one presented here, without the need for a lengthy data call. The submissions collected for this study were not required to include a reference to (or a copy of) a transition plan, but, as enforcement of NAO 216-105 has been lax, it is suspected that most do not. Transition plans would enable more consistent information about transition activities for improved monitoring and evaluation. Of course, as with any activity, a plan would also increase the likelihood of success.

Use Technical Readiness Levels

In both planning and reporting documentation, transition activities should be associated with sequential levels of maturity. The draft update to NAO 216-105 requires the use of Technical Readiness Levels (TRLs), as used by the Defense Department and NASA. TRLs offer a higher level of resolution index of maturity of transition projects as they evolve. They would enable analysis of how quickly or slowly different projects progress, as well as analysis of the overall maturity (and, inversely, riskiness) of R&D portfolios. Careful attention and guidance will likely be required to ensure accurate and consistent labelling of projects with TRLs.

Use a Technology Scale Index

Most of the remaining uncertainties in how to identify a transition are associated with the scale of the output relative to the scale of the application into which it is incorporated. While the operational deployment of a predictive model and a later update to that same model, for example, are both considered a transition, the former is at a larger scale than the latter. It may be useful for future analyses to account for transitions at different scales in order to answer questions such as “is OAR realizing more radical improvements by transitioning new systems/services, or more incremental improvements by transitioning components of existing systems/services?” The systems engineering and systems architecture literature may already reference existing technology scale indices that OAR could adopt.

Appendix 1: Transition Definitions

Transition definition, per the 2013 draft revision of NAO 216-105

Transition is the transfer of knowledge or technology from a research or development setting to an operational setting.

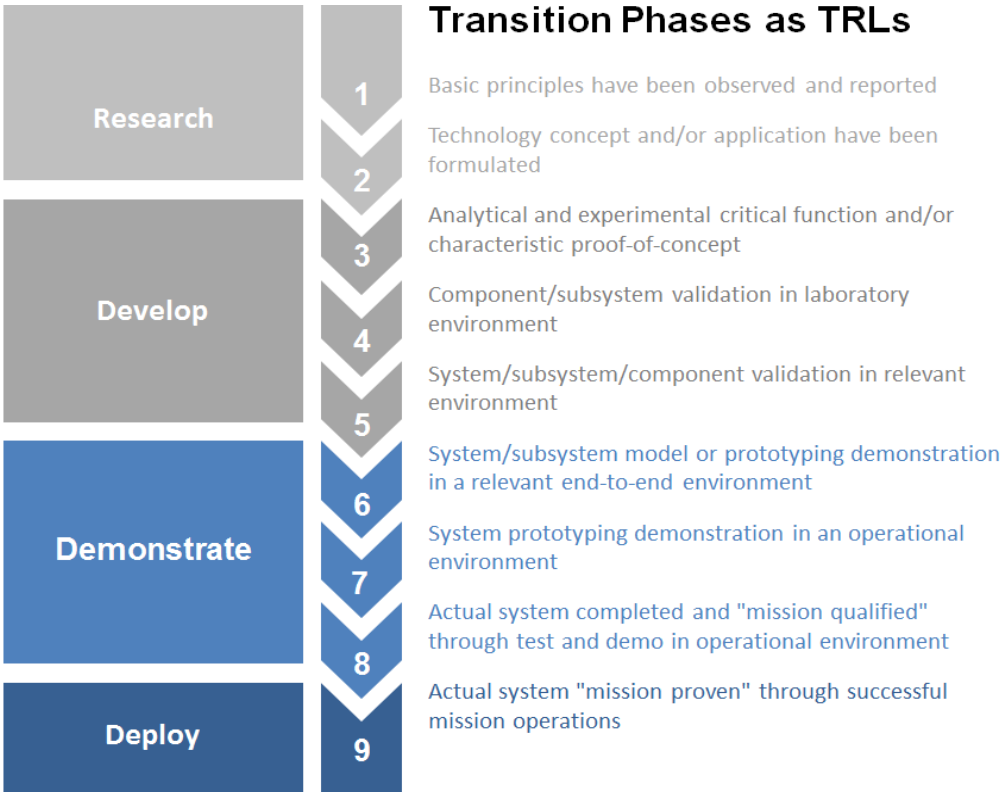
Transition occurs in two phases:

1. Demonstration (e.g., the use of test-beds to confirm operational usability or demonstration using rapid prototyping), which is part of R&D
2. Deployment (e.g., the integration of new people, equipment, or techniques into an operational environment), which is part of operations.

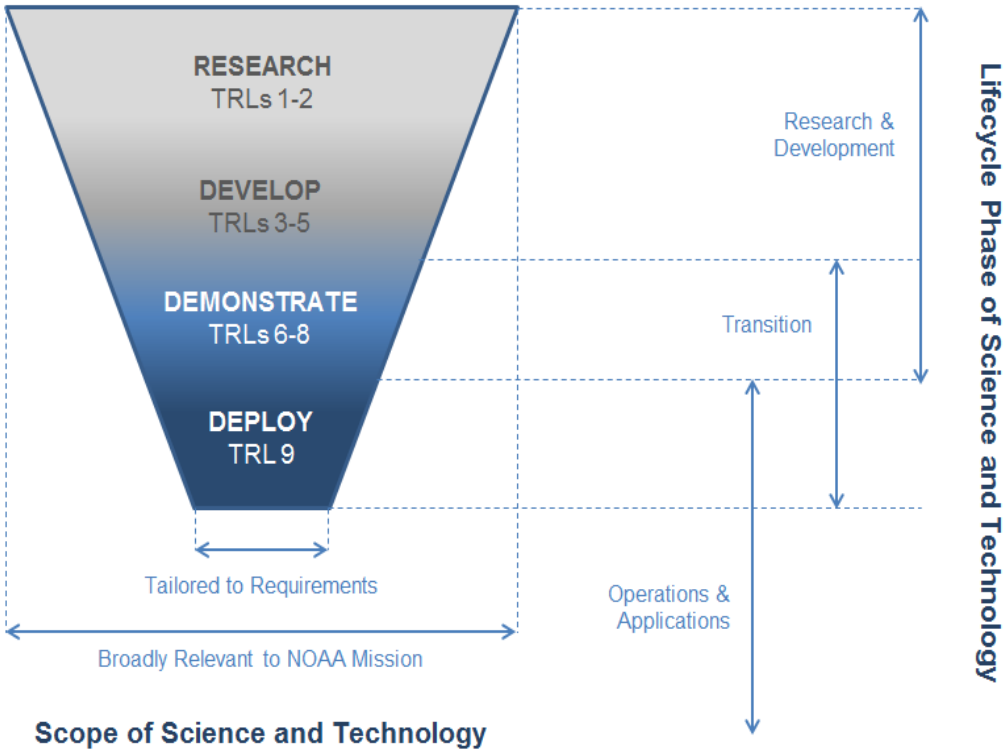
Transition may occur:

- From NOAA-conducted R&D to NOAA operations
- From NOAA-conducted R&D to an external partner's application
- From external partner-conducted R&D to NOAA operations

Transition Phases as Technical Readiness Levels



The NOAA R&D "Funnel"



Appendix 2: Definition of Codes

Type of Activity

Activity types were taken directly from the "Activities" section of the OAR Strategic Plan. The three primary activity types, per the OAR mission, are research, development, and transition.

Research. "Systematic study directed toward fuller scientific knowledge or understanding of the subject studied" (NSF/OMB definition). Per the OAR Strategic Plan, the following are products of research activities:

Research: Observations and Data. Collecting data on the Earth system for use in models and studies. This includes analyzing observations and developing insights based on those observations, as well as procuring and maintaining observing systems, quality control of data, and archive and access.

Research: Models and Experiments. Models codify our understanding of a system in terms of the relationships among its elements, both qualitatively and quantitatively. Scientific experiments test hypotheses about these relationships as the basis for creating, refining, and rethinking models. This combines lab and field work with coding experimental algorithms and running simulations.

Research: Studies and Assessments. Synthesizing scientific knowledge of Earth systems into tools for decision making and future research, often using observational data, model output, experimental results, and other research as source material.

Development: "Systematic use of the knowledge or understanding gained from research, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes. It excludes quality control, routine product testing, and production" (NSF/OMB definition). Per the OAR Strategic Plan, the following are products of development activities:

Development: Predictions and Projections. Applying advanced models of Earth systems to make predictions about the future (using present-day conditions) or projections (using plausible economic development scenarios). They are pre-operational products intended for use in regular services. They require models, data, advanced computing architectures and techniques, and the publication and interpretation of information.

Development: Emerging Technologies. Creating new or significantly improved technology for observation and modeling systems, as well as tools for information delivery and stakeholder engagement. Typically, this involves the development or application of new hardware or software, or the integration of technologies into systems.

Transition. "Transition is the transfer of knowledge or technology from a research or development setting to an operational setting. Transition occurs in two phases: 1) Demonstration (e.g., the use of test-beds to confirm operational usability or demonstration using rapid prototyping), which is part of R&D; and 2) Deployment (e.g., the integration of new people, equipment, or techniques into an operational environment), which is part of operations" (draft update to NAO 216-105). Per the OAR Strategic Plan, the following are products of transition activities:

Transition: Extension and Outreach. Working directly with stakeholders on the ground to understand their needs, conduct research that meets those needs, and translate results so that they are meaningful and actionable. Ensuring that the results of R&D are accessible to and understood by stakeholders that might use them.

Transition: Technology Transfer. Working with end-users to integrate mature technologies (and associated expertise) into larger systems, either in NOAA operations or partner applications, via testbeds, patents, etc.

Type of Output

The "things transitioned" were understood as outputs and fell into the broad categories of either *science* or *technology*. Within these categories, definitions of specific output types are below. The first three (original data, synthesized product, and interpreted product) are taken from NOAA Information Quality Act Guidelines, maintained by the NOAA CIO. The other definitions were constructed per web searches of relevant terms, which was deemed to be accurate enough for these general concepts.

Science Outputs. These are defined as data, information, or knowledge (either codified or tacit) -- they allow us to understand things we would not have otherwise understood.

Science: Original Data. Original Data are data in their most basic useful form. These are data from individual times and locations that have not been summarized or processed to higher levels of analysis. While these data are often derived from other direct measurements (e.g., spectral

signatures from a chemical analyzer, electronic signals from current meters), they represent properties of the environment. These data can be disseminated in both real time and retrospectively. Examples of original data include buoy data, survey data (e.g., living marine resource and hydrographic surveys), biological and chemical properties, weather observations, and satellite data.

Science: Synthesized Product. Synthesized Products are those that have been developed through analysis of original data. This includes analysis through statistical methods; model interpolations, extrapolations, and simulations; and combinations of multiple sets of original data. While some scientific evaluation and judgment is needed, the methods of analysis are well documented and relatively routine. Examples of synthesized products include summaries of fisheries landings statistics, weather statistics, model outputs, data display through Geographical Information System techniques, and satellite-derived maps.

Science: Interpreted Product. Interpreted Products are those that have been developed through interpretation of original data and synthesized products. In many cases, this information incorporates additional contextual and/or normative data, standards, or information that puts original data and synthesized products into larger spatial, temporal, or issue contexts. This information is subject to scientific interpretation, evaluation, and judgment. Examples of interpreted products include journal articles, scientific papers, technical reports, and production of and contributions to integrated assessments.

Science: Tacit Expertise. Tacit knowledge (as opposed to formal, codified or explicit knowledge) is the kind of knowledge that is difficult to transfer to another person by means of writing it down or verbalizing it. For example, stating to someone that London is in the United Kingdom is a piece of explicit knowledge that can be written down, transmitted, and understood by a recipient. However, the ability to speak a language, use algebra, or design and use complex equipment requires all sorts of knowledge that is not always known explicitly, even by expert practitioners, and which is difficult or impossible to explicitly transfer to other users.

Technology Outputs. These are defined as automated processes or artifacts (hardware or software) -- they allow us to do things we would not have otherwise done.

Technology: Model, Algorithm. A mathematical model is a description of a system using mathematical concepts and language. A model may

help to explain a system and to study the effects of different components, and to make predictions about behavior. Mathematical models include dynamical systems, statistical models, differential equations, or game theoretic models. An algorithm is a step-by-step procedure for calculations. Algorithms are used for calculation, data processing, and automated reasoning.

Technology: Hardware, Equipment. The artifacts of technology. Material objects designed, engineered, and built to serve a purpose. Any physical item -- i.e., a tool or device -- that can be used to achieve a goal, especially if the item is not consumed in the process. In NOAA's case, this includes computers, sensors, observation platforms. It does not include software, data, or information. A piece of hardware or equipment is a discrete item, and may be incorporated as a component within a larger system or service.

Technology: System, Service. A system is a set of interacting or interdependent components forming an integrated whole or a set of elements (often called 'components') and relationships which are different from relationships of the set or its elements to other elements or sets. A Service is a set of actions or solutions that are put in place or are performed to provide a repeatable and consistent set of outcomes, deliverables, and performance for people, organizations, and systems that represent consumers or beneficiaries of such results.

Technology: Standards, Protocols. A technical standard is an established norm or requirement in regard to technical systems. It is usually a formal document that establishes uniform engineering or technical criteria, methods, processes and practices. A technical standard can also be a controlled artifact or similar formal means used for calibration. In the natural sciences a protocol is a predefined written procedural method in the design and implementation of experiments. Protocols are written whenever it is desirable to standardize a laboratory method to ensure successful replication of results by others in the same laboratory or by other laboratories.

Number of Recipients

Recipient number for the thing transitioned were captured in rough orders of magnitude: a single recipient, several recipients, or a very large (essentially infinite) number of recipients. This categorization was necessary to understand how widely or narrowly applicable the output is relative to applications.

Single. One party named in submission.

Several. A discrete number of parties named in submission.

Infinite. Recipient is understood as "the public" or "the scientific community"

Type of Recipient

Recipient type was bundled within three sectors: public, private and academic. The former two sectors were sub-divided into more particular categories (e.g. within the public sector, OAR vs NOAA beyond OAR vs other federal agencies). While recipient type and the application type (see below) are related, in the course of the analysis, it became necessary to distinguish between them.

Public - Federal - OAR. Any organization within Oceanic and Atmospheric Research (i.e. Laboratories or Program Offices).

Public - Federal - NOAA (not OAR). Any Line (or Staff) Office at the National Oceanic and Atmospheric Administration besides Oceanic and Atmospheric Research.

Public - Federal (not NOAA). Any Federal agency or body besides the National Oceanic and Atmospheric Administration.

Public - State/Local/Tribal. An organization of a state, regional, municipal, or tribal government (e.g., a local port authority).

Public - International. An organization of a foreign government or multinational organization (e.g. the United Nations).

Private - For Profit. Organizations that operate for profit, including corporations that are either privately held or publicly traded.

Private - For Profit - Startup. Small, recently founded organizations that operate for profit (only a few of these were identified, but they seemed to warrant a new category).

Private - Not For Profit. Non-governmental organizations that aim for public welfare outcomes, not profits.

Academic. Colleges, universities, and other institutions focused on research and education.

Type of Application

Applications were the immediate application of the output, rather than downstream or ultimate application. "Research" was used to label those instances where the immediate use of the output was follow-on research, but is not understood to be an application, per se, as it does not create social or economic value beyond improved scientific understanding.

Application: Environmental Intelligence. Information measured, gathered, compiled, exploited, analyzed and disseminated to characterize the current state and/or predict the future state of the environment at a given location and time.

Application: Resource Management. Environmental resource management is the management of the interaction and impact of human societies on the environment. It aims to ensure that ecosystem services are protected and maintained for future human generations, and also maintain ecosystem integrity through considering ethical, economic, and scientific (ecological) variables.

Application: Policy, Legislation, Law. This includes the crafting and influencing of policy at the local, state, tribal, federal, or international levels. Policy can be the proceedings and directives of legislatures or executives or judiciaries. Applications may be the creation, implementation or the debate over public law.

Application: Education, Learning. This is the imparting of knowledge and understanding. Education and learning applications include, but are not limited to K-12 education. They can also include higher education or "lifelong learning" of adults. This may be lecturing, activity based learning, or the production of educational materials.

Application: Emergency Management. Disaster management (or emergency management) is the managerial function charged with creating the framework within which communities reduce vulnerability to hazards and cope with disasters. Disaster management does not avert or eliminate the threats, instead it focuses on creating plans to decrease the impact of disasters.

Application: Commerce. Commerce is the whole system of an economy that constitutes an environment for business. It can also be defined as a component of business which includes all activities, functions and institutions involved in transferring goods from producers to consumers.

Research. "Systematic study directed toward fuller scientific knowledge or understanding of the subject studied" (NSF/OMB definition). Note that, research

is included as an “application” for ease of binning only; follow-on research may be the use of a NOAA research output, but it is not an application in the sense of a mature capability that provides social/economic value beyond that of improved understanding.

Strategic Goal

OAR focuses on NOAA’s outcome-oriented goals (per the Next Generation Strategic Plan) for climate, weather, oceans and coasts, which are themselves derived from the NOAA vision. Those goals, per the NOAA 5-Year Research and Development Plan and the OAR Strategic Plan, are listed below.

Climate Adaptation and Mitigation: An informed society anticipating and responding to climate and its impacts.

Weather-Ready Nation: Society is prepared for and responds to weather-related events.

Healthy Oceans: Marine fisheries, habitats, and biodiversity are sustained within healthy and productive ecosystems.

Resilient Coastal Communities and Economies: Coastal and Great Lakes communities are environmentally and economically sustainable.

Appendix 3: Counts Across Categories

Table 1: Activities and their Outputs

	Sci - Original Data	Sci – Synthe-sized Product	Sci – Inter-preted Product	Sci - Tacit Expertise	Tech - Model, Algorithm	Tech – Hard-ware, Equip-ment	Tech - System, Service	Tech – Stan-dards, Protocols	Cannot Deter-mine	Total
Res - Observations and Data	65	19	1						1	**86**
Res - Models and Experiments		2						1		**3**
Res - Studies and Assessments		1	27	1	1					**30**

Dev - Predictions and Projections		23	3		2		1			**29**
Dev - Emerging Technologies								1		**1**
Trans - Extension and Outreach			14	3			3	8	1	**29**
Trans - Technology Transfer				3	34	6	12	12		**67**

Table 2: Outputs and their Recipients

	Public - Federal - OAR	Public - Federal - NOAA (not OAR)	Public - Federal (not NOAA)	Public - State/ Local/ Tribal	Public – Inter-national	Private - For Profit	Private - For Profit - Startup	Private - Not For Profit	Aca-demic	Cannot Deter-mine	Total
Sci - Original Data	1	25	8	6	10	2		3	9	1	**65**
Sci - Sythesized Product		20	9	7	1	2			4	2	**45**
Sci - Interpreted Product	2	8	4	14	9	4			4		**45**
Sci - Tacit Expertise	1	1	1	2		2					**7**
Tech - Model, Algorithm	1	24	3	2	2		1		3	1	**37**
Tech - Hardware, Equipment		3			2					1	**6**
Tech - System, Service	1	3	1	5	1	1		1	2	1	**16**
Tech - Standards, Protocols			2	5	5	5	1	1	3		**22**
Cannot Determine					1				1		**2**

Table 3: Recipients and their Applications

	Application - Environmental Intelligence	Application - Resource Management	Application - Policy, Legislation, Law	Application - Education, Learning	Application – Emergency Management	Application - Commerce	Research	Cannot Determine	Total
Public - Federal - OAR	2			2			1	1	**6**
Public - Federal - NOAA (not OAR)	55		1	3	3		8	14	**84**
Public - Federal (not NOAA)	10	3	2	1	1		7	4	**28**
Public - State/ Local/ Tribal	2	23	8	1	3	1		3	**41**
Public - International	9		2	2			14	4	**31**
Private - For Profit	1	1		1	2	9		2	**16**
Private - For Profit - Startup	1					1			**2**
Private - Not For Profit				1			4		**5**
Academic	2	3	1	4			16		**26**
Cannot Determine				1			1	4	**6**

Table 4: Applications and their Goals

	Climate	Weather	Oceans	Coasts	Cannot Determine	Total
Application - Environmental Intelligence	35	42	2	2	1	**82**

Application - Resource Management	4	3	8	14	1	**30**
Application - Policy, Legislation, Law	6	2	1	5		**14**
Application - Education, Learning	3	2	2	9		**16**
Application - Emergency Management		3		6		**9**
Application - Commerce		2	6	3		**11**
Research	27	9	3	5	7	**51**
Cannot Determine	15	6	4	3	4	**32**

Table 5: Goals and Activities

	Res – Observa-tions and Data	**Res - Models and Experiments**	**Res - Studies and Assess-ments**	**Dev - Predictions and Projections**	**Dev - Emerging Tech-nologies**	**Trans - Extension and Outreach**	**Trans - Technology Transfer**	**Total**
Climate	48		14	7		3	18	**90**
Weather	20		6	15		1	27	**69**
Oceans	4	1	4	1	1	4	11	**26**
Coasts	8		4	5		21	9	**47**
Cannot Determine	6	2	2	1			2	**13**

Appendix 4: Reported Items, Interpetation, and Categorization

ID	LAB/ PGM	Project Name	Thing Transitioned	Purpose of Transition	From Organization	To Organization	Date Year	Lab / Pgm Confirmation: Thing	Lab / Pgm Confirmation: Application	Categorization for Analysis: TYPE OF THING	Categorization for Analysis: NUMBER OF RECIPIENTS	Categorization for Analysis: TYPE OF RECIPIENT	Categorization for Analysis: TYPE OF APPLICATION	High Level Conclusion: PRIMARY FUNCTION	High Level Conclusion: PRIMARY GOAL
1	AOML	HWRF V8.0.7	HWRF is upgraded every year before Hurricane seasons start. The 2013 upgrade includes implementation of one-way hybrid EnKF-3DVAR Data Assimilation System with real-time NOAA-P3 TDR inner core data assimilation. The 2014 upgrade includes upgrade to physics, ocean model, vertical resolution, and products.	2013 HWRF upgrade improved intensity and track forecasts by about 15% based on retrospective testing for 2010~2012. As a result, NHC strongly recomeended this implementaion. The 2014 HWRF upgrade improved track and intensity forecasts by ~10% in Atlantic basin based ob 2008~2013 retrospective testing. This upgrade was also strongly recommended by NHC. New simulated satellite products allow forecasters to make direct comparisons between satellite observations and model output. After testing and evaluation real-time airborne Doppler radar and inner core dropsonde thermodynamic observations were assimilated into the operational model this year.	AOML/HRD	NWS/NCEP/EMC and Developmental Testbed Center (DTC)	2013/2014	Hurricane model code	improved hurricane forecasts	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
2	AOML	HWRF V8.0.7 Idealized configuration	HWRF idealized is an essential tool in the HWRF model development enabling evaluation of different aspects of the model by the operational and research community.	The idealized capability allows researchers to test different configurations of the model in the basic model framework without the impacts of the large scale stmospheric and ocean environment of the evaluation. It includes the full operational atmospheric model with numerous physics packages and ocean coupling. A number of research grouops are now utilizing the HWRF idealized configuration to test and evaluate new physics configurations, the impact of the ocean, shear, and land surface on the forecast guidance using HWRF.	AOML/HRD	NWS/NCEP/EMC, Developmental Testbed Center (DTC), and India Meteorological Department	2014	Hurricane model code	improved hurricane forecasts	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
3	AOML	HWRF V8.0.7 Basin configuration	HWRF basin configuration enables a very large "basin-scale" outer nest with movable nests for multiple storms at once.	The basin scale version of the model with multiple moving nexts enables researchers to evaluate storm-storm interactions at the highest resolution, develop native HWRF data assimilation systems, and to evaluate land surface physics impacts in a non-moving outer domain reference. A number of research groups are utilizing the HWRF basi scale configuration to test and evaluate storm-storm interactions, land-radiation physics biases, and new data assimilation techniques.	AOML/HRD	NWS/NCEP/EMC and Developmental Testbed Center (DTC)	7/6/1905	Hurricane model code	improved hurricane forecasts	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather

4	AOML	NOAA G-IV Tail Doppler radar (TDR)	NOAA procured the TDR on the G-IV in 2011 and AOML/HRD provided the meteorological expertise needed for the acceptance testing and transition into operational use at EMC	NWS/EMC provided a mission requirement for a TDR on the NOAA G-IV aircraft to provide 3-D winds in support of hurricane forecasts in 2009. AOML/HRD worked with NWS and AOC to develop the requirements and instrument specifications. AOC was responsible for the technical acceptance and AOML/HRD the scientific specifications. AOML/HRD is now working with EMC to complete the transfer of the TDR observations to EMC for operational use in the hurricane forecast system.	AOML/HRD	NWS/NCEP/EMC	2014	Tail Doppler Radar (hardware)	improved hurricane forecasts	Tech - Hardware, Equipment	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
5	AOML	H*WIND	AOML/HRD H*WIND tropical cyclone surface wind analysis application was successfully transitioned to a commercial entity	To utilize NOAA/OAR-developed technology that was never transitioned into operations to provide products for industry and the private sector. The commercial venture saw an opportunity to take that technology and develop a commercially viable product to provide mission-critical hurricane data to industry, businesses and government for situational awareness, decision-support, impact assessment, emergency management, response / recovery, and forensic reconstruction.	AOML/HRD	Hwind Scientific	2014	tropical cyclone surface wind analysis application	hurricane data to industry, businesses and government	Tech - Model, Algorithm	Single	Private - For Profit - Startup	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
6	AOML	Joint Hurricane Testbed (JHT)	Development of a Probabilistic Tropical Cyclone Genesis Prediction Scheme	Develop a storm-centric TC Genesis Index -an objective tool for identifying the probability of TC genesis (0-48 hr and 0- 120 hr) in the North Atlantic basin. Incorporate two new predictors: total precipitable water (TPW) and Dvorak T-numbers. These and other top TC genesis predictors will be used to develop an objective genesis index (GI) that can be employed to provide estimates of the probability of TC genesis over a period of 0-48 and 0-120 h utilizing linear discriminant analysis.	AOML/HRD	NWS/NCEP/NHC	2013	Tropical Cyclone Forecasting model	improved hurricane forecasts	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
7	AOML	Joint Hurricane Testbed (JHT)	Improvement to the SHIPS Rapid Intensification Index	Develop additional versions of the RII for lead times out to 48-h, as well as an ensemble RII and an RII-based consensus aid that can be used to make intensity forecasts out to 48-h in each basin. Automate the evaluation of new structural predictors (i.e. microwave imagery) for inclusion in new versions of RII will be completed.	AOML/HRD	NWS/NCEP/NHC	2013	model enhancement	improved hurricane forecasts	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
8	AOML	Joint Hurricane Testbed (JHT)	Improved SFMR surface wind measurements in intense rain conditions	Deliver improved SFMR surface winds in such conditions incrementally in two steps: (1) Utilize the expanded SFMR and GPS dropwindsonde database to compute a statistically-based correction to real-time SFMR surface wind speeds.; (2) Use new corrected values to provide a basis for evaluating a new coupled wind and rain geophysical model function.	AOML/HRD	NWS/NCEP/NHC	2013	Weather data	improved hurricane forecasts	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather

9	AOML	Joint Hurricane Testbed (JHT)	Validation of HWRF forecasts with satellite observations and potential use in vortex initialization	Develop new capabilities for the operational HWRF (Hurricane Weather Research and Forecast) system such as: (1) Satellite data simulator: Develop new software within the post-processing component of HWRF operational forecast system for simulating a wide range of satellite observations using an operational version of CRTM (Community Radiative Transfer Model).; (2) Satellite data simulator: Develop new software within the post-processing component of HWRF operational forecast system for simulating a wide range of satellite observations using an operational version of CRTM (Community Radiative Transfer Model).; and (3) Initialization diagnostics: Using ensemble of forecasts, correlation statistics between thermodynamical and hydrologic variables and the simulated satellite observations will be evaluated.	AOML/HRD	NWS/NCEP/NHC	2013	Algorithm to validate forecasts	improved hurricane forecasts	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Studies and Assessments	Weather
10	AOML	R2C: CRADA; 3RR3HWSP14. Research to Aid Management of Coastal Water and Watershed Quality.	Microbial Source Tracking Assays (MST)	Activities of the CRADA technology transfer of NOAA-AOML MST assays as well as general knowledge on establishment of a molecular biology laboratory. The specific aim is to aid management of coastal water quality by investigating the sources and magnitude of microbial contamination to coastal waters and watersheds. Goals are to apply research results to the development of Quantitative Microbial Risk Assessments (QMRA), implementation of Total Maximum Daily Loads (TMDL), and assessment of non-fecal indicators and pathogens to support risk assessment. A primary motivator of this collaborative research is to understand the factors affecting chronically elevated indicator bacteria concentrations in recreational waters. Activities will include assessment of fecal pollution from humans and animals (e.g., birds, dogs, cattle, horses) and assessment of non-fecal contributions to the load of indicator bacteria (e.g., from	AOML/OCED	Weston Solutions	2014	microbial assay	assessment of fecal pollution from humans and animals and of non-fecal contributions to the load of indicator bacteria	Tech - Standards, Protocols	Single	Private - For Profit	Application - Commerce	Trans - Technology Transfer	Coasts

11	ARL	HYSPLIT v7.0.1	HYSPLIT operations at NWS NCEP Central Operations (NCO) include the HYSPLIT dispersion and trajectory models, and associated pre- and post-processing programs for the wildfire smoke, dust, volcanic ash, radiological and HAZMAT-type applications, including conversion of NCO forecast and analyses meteorology model output to HYSPLIT-format. Upgrades to the dispersion code included changes in the wet deposition processes, changes to the horizontal puff dispersion rate for more consistency with the 3-d particle dispersion, and changing the plume rise limits. Other upgrades in this transition included adding the NAM CONUS nest (4 km) meteorology, defaulting the option in the HAZMAT-type application to the 1-hourly native-level NAM instead of the 3-hourly pressure-level NAM, adding radiological products, and incremental changes to output graphics.	To improve the HYSPLIT model forecasts at NCEP, to support NCEP's HYSPLIT customers, and to bring NCEP's operational version up to the then-current version at ARL.	ARL	NWS/NCEP/EMC	2013	Atmospheric model code	Code for NCEP predictions of wildfire smoke, dust, volcanic ash, radionuclides, and HAZMAT chemicals	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
12	ARL	HYSPLIT trajectory via NWS spot forecast webpage	The NWS capability to provide HYSPLIT trajectories as part of a NWS Spot Weather Forecast request.	To support NWS forecasters and their fire weather customers.	ARL	NWS Fire and Public Weather Services	2013	Atmospheric model code	Code for trajectories in support of fire weather forecasts	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
13	ARL	HYSPLIT/ALOHA Website	A new web-based dispersion modeling system developed by NOAA's Air Resources Laboratory (ARL) and NOAA's Office of Response and Restoration (OR&R) was successfully installed at the NOAA Web Operations Center (WOC). This system provides NWS forecasters with the ability to first simulate a release of a hazardous chemical to the atmosphere, using the extensive scenario-based source term configuration of the Areal Locations of Hazardous Atmospheres (ALOHA) model developed by OR&R and the EPA, and then simulate the resulting plume, using the HYSPLIT atmospheric transport and dispersion model developed by ARL.	By incorporating the ALOHA chemical source term model into the existing system, better estimates are made of the amount and the rate of release of the chemcial into the atmosphere, thereby providing a better forecast of the resulting concentrations that are made available to the local emergency responders.	ARL and NOS/OR&R	NWS	2013	web-based information tool (the tool istself was transitioned, not the output of the tool)	on-demand forecasts of chemicals in the atmosphere for first responders	Tech - System, Service	Single	Public - Federal - NOAA (not OAR)	Application - Emergency Management	Trans - Technology Transfer	Weather
14	ARL	HYSPLIT for Test Ban Treaty	Regular updates of the HYSPLIT transport and dispersion model code customized for verification applications are provided to the United States Air Force (USAF)	The HYSPLT model is used by the USAF for nuclear test ban treaty verification purposes.	ARL	USAF Technical Applications Center (AFTAC), Patrick AFB, Florida	2014	Atmopheric model code	Treaty verification	Tech - Model, Algorithm	Single	Public - Federal (not NOAA)	Application - Policy, Legislation, Law	Trans - Technology Transfer	Weather

15	ARL	HYSPLIT PC, linux and MAC	Continuous dispersion model development on a variety of platforms	Improve model performance for research, decision making, emergency applications	ARL	ARL web page		atmospheric model code	Not specific	Tech - Model, Algorithm	Single	Public - Federal - OAR	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
16	ARL	HYSPLIT Training	Training Tutorial for HYSPLIT Dispersion Model	Provides example applications for HYSPLIT model focused on the Windows PC version.	ARL	Universities, private companies, gov. agencies, international	2013	training	For operational NWS personel as well as not specific	Sci - Tacit Expertise	Infinite	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Extension and Outreach	Weather
17	ARL	READY Website	READY (Real-time Environmental Applications and Display sYstem) is a web based system that has been developed for accessing and displaying meteorological data and running trajectory and dispersion model products on ARL's web server. This system brings together dispersion models, graphical display programs and textual forecast programs generated by ARL. READY is the primary online portal for generating HYSPLIT simulations for other than NWS and a few other key customers.	Used extensively by academia, state governments, foreign goverments, hobbiests (balloonists, pilots, saylors) and the military	ARL	Approximately 150 web simulations per month for emergency response applications. Approximately 50,000 web simulatinos per month for air quality applications		Atmospheric information (via web-based tool that, itself, was not transitioned)	Not specific	Sci - Sythesized Product	Infinite	Cannot Determine	Cannot Determine	Dev - Predictions and Projections	Weather
18	ARL	NOAA/INL Mesonet	Real-time surface meteorological data from 34 stations in the Eastern Snake River Plain.	The data are used for forecast model initialization and for calculating evapotranspiration.	ARL	Multiple: ESRL/GSD; U.S Bureau of Reclamation, Agrimet Program	2014	weather data	weather forecasts and warnings for DOE nuclear site	Sci - Original Data	Several	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Weather
19	ARL	HYRad	Radiological dispersion and dose display system based on the HYSPLIT dispersion model for the Idaho National Lab	Provide displays of estimated doses for actual radiological releases at the INL for use in the INL Emergency Operation Center	ARL	Multiple: U.S. Dept. of Energy, Idaho National Lab; U.S. Dept. of Energy, Pacific Northwest National Lab	2014	Version 2 of display system	Emergency operations for DOE nuclear sites	Tech - System, Service	Several	Public - Federal (not NOAA)	Application - Emergency Management	Dev - Predictions and Projections	Weather
20	ARL	NOAA/NNSS Mesonet	Real-time surface meteorological data from 22 stations in Southern Nevada/Southern Great Basin.	Provide data to prepare area forecasts, issue Alerts, Watches, and Warnings. Prepare climatological reports. Provide data to be used in dispersion modeling for Consequence Assessment activities. Provide data to be used in Compliance reporting and Air Quality permit modeling. Provide data into national models for improved numerical forecasts.	ARL	NWS, DOE/NNSA NFO		weather data	dispersion modeling for Consequence Assessment, Compliance reporting, Air Quality permit modeling for DOE nuclear site.	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather
21	ARL	NOAA/NNSS Lightning Detection System	Real-time cloud-to-ground and cloud-to-cloud lightning strikes in Southern Nevada/Southern Great Basin.	Provide data to issue Alerts, Watches, and Warnings for personnel and property safety. Provide data for Wildland Fire preparedness and defense. Prepare climatological reports.	ARL/SORD, Las Vegas, NV	NWS, DOE/NNSA NFO		weather data	Alerts, Watches, and Warnings; Wildland Fire preparedness; climatological reports for DOE nuclear site.	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather
22	ARL	Radiation Corrections for Radiosonde Observations	A set of temperature corrections for radiosonde observations, for all major radiosonde types, for different sun angles.	Reduce the error in temperature profiles assimilated into NCEP forecast models	NESDIS/STAR, NWS/NCEP, and ARL	NWS/NCEP		synthesized weather data (not the procedure / alogorithm on how to correct past and future data)	NCEP forecasts	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather

23	ARL	Planetary Boundary Layer Mixing Height Algorithm	A robust, physically-based method of estimating the depth of the lowest layer of the atmosphere in which mixing occurs.	Allow analysis of large model-based and observational datasets to characterize mixing height for application to air quality, carbon cycle, climate, and weather forecasting.	ARL	European Centre for Medium Range Weather Forecasting, Transcom community		atmospheric model	air quality, carbon cycle, climate, and weather forecasting.	Tech - Model, Algorithm	Single	Public - International	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
24	ARL	Science in Support of 2014 WMO/UNEP Scientific Assessment of Ozone Depletion	Peer-reviewed research on climate change relevant to the stratospheric ozone layer.	Support the quadrennial assessment of stratospheric ozone depletion required under the Montreal Protocol.	ARL (and other labs, esp ESRL and GFDL)		2013	research report	assessment of stratospheric ozone depletion	Sci - Interpreted Product	Single	Public - International	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
25	ARL	Science in Support of IPCC Fifth Assessment Report	Peer-reviewed scientific research on observed climate change	Support the Intergovernmental Panel on Climate Change assessement activity.	ARL (and many others)	IPCC	2013	research report	IPCC climate assessment	Sci - Interpreted Product	Single	Public - International	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
26	ARL	Climate Data Record from Stratospheric Sounding Unit Observations	Peer-reviewed research demonstrating need for immprovements in satellite-derived stratospheric temperature records for 1979-2005.	Remove time-varying biases in long-term records that compromise the value of the observational record, particularly for estimating temperature trends.	ARL and others (particularly Colorado State Univ.)	NESDIS/STAR and UK Met Office	2013	Peer reviewed publications	Additional research	Sci - Interpreted Product	Several	Public - Federal - NOAA (not OAR)	Research	Res - Studies and Assessments	Weather
27	ARL	Port of ozone forecasting system	port of production-grade surface ozone concentration forecasting system and the developmental-grade surface particulate concentration forecasting system from a retiring NWS/NCEP supercomputer to the replacement computer on short notice.	Continuation of operational ozone and experimental fine particulate air quality forecasts by NCEP. Models and expertise were provided by ARL. Products are used by EPA and states to help protect human health.	NOAA/OAR/ARL	NWS/NCEP	2013	Ozone concentration model	operational ozone and experimental fine particulate air quality forecasts by NCEP	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
28	ARL	ARL model support for NASA DISCOVER-AQ program	Provision of real-time atmospheric chemical constituent concentration forecasts during NASA Deriving Information on Surface Conditions from Column and Vertically Resolved Observations Relevant to Air Quality (DISCOVER-AQ) field campaign	Support requested by NASA air quality program	ARL HQ	NASA	2014	Atmospheric forecasts	Additional research	Sci - Sythesized Product	Single	Public - Federal (not NOAA)	Research	Dev - Predictions and Projections	Cannot Determine
29	ARL	CRADA with Duke Energy	Improve Hub height Forecasts for Wind Energy Production	Improve Hub height Forecasts for Wind Energy ProductionTo provide a better understanding of how the meteorology at the surface affects winds at hub height. Evaluation of the NAM and HRRR at forecasting the hub Height winds.	ARL	Duke Energy, ESR	2014	research report (of hub height data) for wind energy production	wind energy production	Sci - Interpreted Product	Single	Private - For Profit	Application - Commerce	Dev - Predictions and Projections	Weather
30	ARL	Computational Science for Undergraduate Research Experiences	Atmospheric Chemistry and Canopy Exchange Simulation System (ACCESS) - computational science model of biosphere-atmosphere exchange and chemistry between deciduous forest canopies and the lower troposphere.	Provide computational science experiences for undergraduate students participating in the CSURE program at Oak Ridge National Laboratory	ARL	University of Tennessee	2013	atmospheric chemical exchange model	Additional research	Tech - Model, Algorithm	Single	Academic	Research	Trans - Technology Transfer	Weather
31	ARL	Ammonia (NH3) Emission from Fertilizer Application	Atmospheric ammonia (NH3) concentration and flux data set (chemical and micrometerological measurements)	To improve representativeness of NH3 meissions that are used in air quality models	ARL/ATDD	Univ. of Illinois at Urbana-Champaign	2014	atmospheric data	Additional research supports ozone and particulate matter operatational forecasts	Sci - Original Data	Single	Academic	Research	Res - Observations and Data	Weather

32	ARL	ARL contributions to National Atmospheric Deposition Program	Data from NOAA-operated atmospheric depostiion measurement programs. This includes data from six daily Atmospheric Integrated Monitoring Network stations, and three Atmospheric Mercury Network stations	Contribution to national atmospheric chemical deposition database	ARL	National Atmospheric Deposition Program	2014	atmospheric data	Supports NOAA Clean Air Act Amendment mandates concerning atmospheric deposition	Sci - Original Data	Single	Academic	Research	Res - Observations and Data	Weather
33	ARL	Global assessment of precipitation chemistry and deposition	Special Issue of Atmospheric Environment	Make available final report from the World Meteorological Organization Global Atmosphere Watch-sponsored study of global atmospheric deposition of sulfur, nitrogen, sea salt, base cations, organic acids, acidity & pH, and phosphorus	ARL	Atmospheric Environment	2014	research report	Global estimates of atmospheric chemical loadings to ecosystems; mass balance support for modeling community	Sci - Interpreted Product	Single	Private - For Profit	Cannot Determine	Res - Studies and Assessments	Weather
34	ARL	Atmospheric Mercury Deposition to the Great Lakes	Final report on sensitivity analysis of modeled estimates of atmospheric mercury deposition to the Great Lakes, including source attribution. The HYSPLIT-Hg model ("Hg" for mercury) was used to develop the estimates.	To provide information on the uncertainties associated with modeled estimates of atmospheric mercury deposition, so that the results can be used appropriately. The investigation found that the key features of the results were relatively invulnerable to uncertainties.	ARL	USEPA	2013	Research report	Local versus global atmospheric mercury loadings to the Great Lakes	Sci - Interpreted Product	Single	Public - Federal (not NOAA)	Cannot Determine	Res - Studies and Assessments	Cannot Determine
35	ARL	Atmospheric Mercury Emissions Inventory	Spatially explicit, speciated, annotated mercury emissions inventory for the U.S., Canada, and Mexico, for mapping and model input.	To allow mercury emissions to be mapped for a USGS synthesis report on mercury pollution	ARL	USGS	2013	Atmopsheric data	USGS synthesis report on mercury pollution	Sci - Original Data	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Weather
36	ARL	Atmospheric Mercury Emissions Inventory	Spatially explicit, speciated, annotated mercury emissions inventory for the U.S., Canada, and Mexico, for mapping and model input.	To allow mercury emissions to be mapped for a new, online, interactive public health and education tool	ARL	Joint Center and National Minority Quality Forum	2013	atmospheric data	online, interactive public health and education tool	Sci - Original Data	Single	Private - Not For Profit	Application - Education, Learning	Res - Observations and Data	Weather
37	ARL	White Paper on Mercury Pollution in the Gulf of Mexico	Synthesis report on mercury in the Gulf of Mexico	To provide information to stakeholders regarding the sources, behavior, cycling, and effects of mercury pollution in the Gulf of Mexico	ARL	Gulf of Mexico Alliance	2014	research report	Not specific	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Cannot Determine	Res - Studies and Assessments	Weather
38	ARL		Source code, including scripts, and tutorials for carrying out extensive back-trajectory analyses with the HYSPLIT model	To allow a detailed back-trajectory analysis to be carried out in conjunction with a climate-precipitation analysis	ARL	USGS	2014	Atmopheric model code	Additional research	Tech - Model, Algorithm	Single	Public - Federal (not NOAA)	Research	Trans - Technology Transfer	Cannot Determine
39	ESRL CSD	Information on ozone depleting substances	Fundamental chemical and physical data (photolysis rate; reaction rate coefficient with hydroxyl radical; reaction products, etc.) were determined by laboratory studies and reported to industry partner that supplied newly synthesized chemical compound as replacement for existing solvent, refrigerants, etc.	Provides information to stakeholder concerning environmental effects of replacement compounds before large-scale manufacture Provides information to stratospheric ozone assessment committee on atmospheric lifetimes and ozone-depletion potential (ODP) for new compounds	ESRL/CSD CIRES/CU	DuPont	2014	Information on ozone depleting substances	manufacturing: chemical compound as replacement for existing solvent, refrigerants, etc.	Sci - Sythesized Product	Single	Private - For Profit	Application - Commerce	Res - Observations and Data	Weather
40	ESRL CSD	CalNex 2010 data use by California Air Resources Board (CARB)	ESRL/CSD ozone, ozone precursor, and atmospheric transport data and analyses from the 2010 CalNex field mission were used by CARB to make a formal appeal to USEPA to dismiss ozone exceedence at a Fresno, CA, air monitoring station	Provide environmental intelligence to CARB concerning the sources of ozone pollution that affect CA air quality	ESRL/CSD CIRES/CU	California Air Resources Board	2014	Scientific information about the relative sources of ozone that contributed to an exceedance. The INFORMATION was used by state regulatory agencies to substantiate the appeal.	This information filled a knowledge gap on the part of the regulatory agencies.	Sci - Sythesized Product	Single	Public - State/Local/Tribal	Application - Resource Management	Res - Observations and Data	Weather
41	ESRL DO	Sensing Hazards with Operational Unmanned Technology (SHOUT)	Vertical atmospheric profiles of temperature, pressure, humidity, wind direction and wind speed collected from Global Hawk dropsondes	These data are assimilated into NCEP Hurricane Forecast Models. These data have been shown to improve hurricane intensity and track forecasts by 10% for some storms but not all storms	OAR Unmanned Aircraft Systems (UAS) Program	NWS NCEP	2014	Atmpsheric data	improve hurricane intensity and track forecasts	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather

42	ESRL DO	Puma All Environment Unmanned Aircraft Systems (UAS)	Low altitude short endurance UAS that can be hand-launched and flown for two hours to collect real-time visible and infrared imagery and high resolution photography	These UAS are increasing situational awareness for marine debris, oil spills, coastal hazards impacting the National Marine Sanctuary Program	OAR Unmanned Aircraft Systems (UAS) Program	NOS ONMS	2013	UAS	coastal restoration	Tech - Hardware, Equipment	Single	Public - Federal - NOAA (not OAR)	Application - Emergency Management	Trans - Technology Transfer	Coasts
43	ESRL GSD	Rapid Refresh v2	RAP (Rapid Refresh) is an operational NOAA/ NCEP hourly updating operational weather prediction system covering North America comprised primarily of a numerical forecast model and an analysis/assimilation system to initialize that model.Major upgrades for this version included EnKF-3DVAR hybrid DA, MYNN, PBL, 9-layer LSM, better cloud/precip anx	RAPv2 provides significant improvement over RAPv1, including better winds, mid-level moisture, near- surface fields, and convective environments. The enhancements will benfit users needing frequently updated short-range weather forecasts, including those in the US aviation community and US severe weather forecasting community. Also used prominently for energy-related (especially renewable) forecast guidance.	ESRL GSD	NWS/NCEP	2014	weather model (version)	frequently updated short-range weather forecasts	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
44	ESRL GSD	Science On a Sphere	Considered R2U for public educatioin and outreach, Science On a Sphere (SOS) is a room-sized global display system that uses computers and video projectors to display planetary data on a six-foot diameter sphere to help illustrate earth system science to people of all ages. The captivating display is in demand by science centers, museums, universities, schools, science conferences, and other venues. As of July 31, 2014, over 110 permanent installations of Science On a Sphere are operating in 18 countries around the world.	The transition was intended to improve the public's scientific knowledge about the earth system and to visually demonstrate NOAA's data, operations and research in a compelling way for the public. In the process, it helps to inspire K-12 students to consider pursuing careers in science. The SOS Users Collaborative Network establishes partnerships to create and share content and educational programming for SOS. GSD continues to develop new technologies and techniques to improve the SOS experience and transitions those to the SOS users.	ESRL GSD	1 Fuzhou Science and Technology Museum, Fuzhou, People's Republic of China (Jan2013). 2 South Florida Science Center and Aquarium, West Palm Beach, FL (Jan2013). 3 E.O.Wilson Biophilia Center, Freeport, FL (Mar2013). 4 Cyberinfrastructure Building at Indiana University, Bloomington, IN (Apr2013). 5 Museo delle Scienze, Trento, Italy (May2013). 6 Techmania Science Center, Pilsen, Czech Republic (Jul2013). 7 NOAA Headquarters, Silver Spring, MD (Jul2013), 8 Science Central, Fort Wayne, IN (Aug2013). 9 National Museum of	2014	Science On a Sphere	Domestic and international museum exhibits, visitor centers, K-12 education	Tech - Hardware, Equipment	Single	Public - International	Application - Education, Learning	Trans - Technology Transfer	Weather
45	ESRL PSD	Analog-Kalman filter bias correction for CMAQ PM2.5 forecasts	A set of code to produce bias corrections to the NOAA CMAQ air quality model's preditcion of particulate matter (PM2.5) was developed. The methodology uses a combination of Kalman-filtering and historical analog forecasts to correct the large bias errors that the model produces. A spreading technique was also developed that interpolates the corrections computed at PM2.5 observation sites to the entire model grid, allowing for corrected PM2.5 forecast maps to be produced.	This product was intended to improve NOAA's operational forecasts of PM2.5. It will be evaluated over the next year using PM2.5 observations from the EPA AIRNow network.	NOAA/ESRL/PSD	NOAA/NWS	7/6/1905	air quality model code	operational forecasts of PM2.5	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather

46	ESRL PSD	Climate Change analysis for Susitna Hydropower Project	Knowledge transfer, an analysis of the climate information needed to understand the risks to resources protected under NMFS mission for the Sustina River, AK	To support NMFS effort to have climate change considered by the Federal Energy Regulatory Commission in the licensing process for a large new hydropower dam on the Susitna River in Alaska. NMFS requested OAR climate expertise in this effort.	NOAA/ESRL/PSD	NMFS Alaska Fisheries and NOAA General Counsel	2013	Research report	Licensing for a large new hydropower dam	Sci - Interpreted Product	Several	Public - Federal - NOAA (not OAR)	Application - Policy, Legislation, Law	Res - Studies and Assessments	Oceans
47	ESRL PSD	Air-sea flux parameterization including effects of sea spray at very high wind	A set of codes developed here at PSD are being adapted for the NASA GEOS-5 global data assimilation model. The model has simple bulk parameterization of the air-sea fluxes of momentum, heat, and moisture. PSD is working with NASA/JCSDA to modernize their modules based on the PSD codes.	The flux parameterization upgrades are to improve the GEOS-5 models ability to resolve flux behavior at high wind speeds (U>15 m/s)	NOAA/ESRL/PSD	NASA/JCSDA	2014	Atmopheric model code	Additional reserach for imporved climate and weather prediction, in partcular, improved tropical cyclone/hurricane intensity forecasts	Tech - Model, Algorithm	Single	Public - Federal (not NOAA)	Research	Trans - Technology Transfer	Weather
48	ESRL PSD	Frost/Heat Forecast System	High spatial and temporal digital forecast system provding frost/heat forecasts from 1hr to 6 days out for vineyard frost mitigation and heat mitigation. Utilizes all availble dynamic and statistical forecast models and provides various outputs including email alerts to growers and water managers to upcoming critcal temparatures.	The tool was intended to inform growers and water managers of potential critcal temperatures so that they could better prepare for these events. This might inlcude increasing storage in off-stream ponds or water managers making pre-releases so that flows in the mainstem Russian or its tributaries would not be de-watered threathing endanged salmonid species.	NOAA/ESRL/PSD/CIRES	Sonoma County Water Agency	2014	weather prediction (not the prediction system itself)	agriculture and water management	Sci - Sythesized Product	Single	Public - State/Local/Tribal	Application - Resource Management	Dev - Predictions and Projections	Weather
49	ESRL PSD	Global reforecast data set and experimental products	Retrospective forecasts using 2012 version of NCEP GEFS system, 11 members/day every day from 1985-current. Also post-processed precipitation forecast guidance based on the ensembles.	Intended to support various post-processing activities in the NWS, including for hydrologic applications at OHD, for 6-10 day and week +2 forecasts at CPC, for hydrologic forecasts at WPC, tornado probabilities (SPC), and for testing of post-processing methodologies at MDL	NOAA/ESRL/PSD	CPC, OHD, MDL, WPC, EMC	2014	weather hindcasts, forecast guidance	hydrologic, tornado forecasts at NWS	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
50	ESRL PSD	Evaluation of the HWRF Experimental Physics Package	ESRL-EMC collaborative Implementation of a physics package that is suitable for working in NCEP's regional tropical prediction model(s) on a resolution of 3 km or finer.	Real-time parallel-runs in the 2013 Season of Tropical Cyclones, retropsective real cases and idealized simulations were completed with the different physics packages in order to evaulate the microphysics schemes and convection schemes to determine what issues in the operational schemes need to be addressed either through scheme improvement or scheme replacement. Idealized and retrospective experiments show a consistent result that the experimental physics package tends to produce stronger intensity. Real-time experiment shows, however, very promising track/intensity forecast skill so far. There is a need for further evaluation, extended diagnostics and scientific understanding.	NOAA/ESRL/PSD	NWS/NCEP/EMC	2013	weather model code	Additional research to support improved tropical cyclone/hurricane intensity forecasts	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Research	Trans - Technology Transfer	Weather

51	ESRL PSD	Diurnal corrections for Blended Sea Surface Temperature Analysis	A set of codes for simulating the amount of diurnal warming present at the specific time and location of a satellite retrieval of sea surface temperature was modified for forcing using GFS and wave model outputs and provided to NESDIS/STAR for inclusion in their Blended Sea Surface Temperature Analysis	The current operational blended sea surface temperature analyses combine satellite retrievals from multiple satellites collected at multiple times throughout the day. During the daytime, these retrievals can be affected by differing amounts of diurnal warming causing them to be different from the temperature prior to sunrise. An approach was needed to be able to adjust all the individual retrievals to a common reference time and depth to improve the accuracy and representativeness of the sea surface temperature analysis.	NOAA/ESRL/PSD	NOAA/NESDIS/STAR	2013	weather model code	satellite calibration/validation	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
52	ESRL PSD	HMT-Southeast Pilot Study	A network of observations was deployed in North Carolina and the data was made available to NWS, both visual graphics on the web and through MADIS	To provide improved situational awareness of signficant meteorological events (e.g., extreme precipitation and cold air damming)	NOAA/ESRL/PSD	NWS Weather Forecast Offices Raleigh and Greenville-Spartanburg, NWS Eastern Region, NWS Southeast River Forecast Center	2013	Weather information (via web-based tool that, itself, was not transitioned)	warnings and forecasts of extreme precipitation and cold air damming	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather
53	ESRL PSD	HMT-West QPF Grids for Verification	Grids of the Experimental Regional Ensemble Forecast System (ExREF) were reformatted and made available to the NWS Sacramento (SAC) weather forecast office and the California Nevada River Forecast Center for verification in the NWS GFE environment in AWIPS I and AWIPS II using the BOI Verify software.	Evaluate the ExREF precipitation forecasts in an environment where other model forecasts could be overlaid and evaluated simultaneously at the same resolution.	NOAA/ESRL/PSD	NWS STO and NWS CNRFC	2014	Weather information (synthesized from data)	verification of weather forecasts	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather
54	ESRL PSD	HMT-West ARO Deployment	An Atmospheric River Observatory was deployed at Bodega Bay, CA. The ARO consists of vertically pointing wind and preciptiation profiler measurements, GPS-derived water vapor, and surface instrumentation	To monitor extreme preciptiation events (ARs) impacting the CA coast	NOAA ESRL/PSD	CA Department of Water Resources	2013	Atmospheric River Observatory (hardware integrrated with software for larger service)	weather monitoring and situational awareness	Tech - System, Service	Single	Public - State/Local/Tribal	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
55	ESRL PSD	HMT-SEPS ARO Deployment	3 Atmospheric River Observatories have been deployed along the coast in the southeast U.S. (Moss Pt., MS; Johns Island, SC; Sydney, FL)	To monitor extreme preciptiation events, including hurricanes, impacting the southeast coast	NOAA/ESRL/PSD	NWS Eastern Region	2014	Weather observatories (hardware integrrated with software for larger service)	weather monitoring and situational awareness	Tech - System, Service	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
56	ESRL PSD	Ocean Climate Change Web Portal	A web-based system used for evaluating climate change using output fromfrom the Climate Model Intercomparison Project (CMIP) 5.	Used by NOAA fisheries (NMFS) to assess the vulnerability of fish stocks off the northeast US coast to climate change. The web portal has also been used by the Bureau of Reclamation to asses the risk of potential changes in flooding and drought.	NOAA ESRL/PSD	NOAA NMFS and Bureau of Reclamation (BoR),Science and Technology Division	2013; 2014	Climate information (via web-based tool that, itself, was not transitioned)	assess the vulnerability of fish stocks	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Oceans
57	ESRL GMD	AirCore	Atmospheric sampling system that samples the atmosphere and preserves a profile of the trace gas of interest.	Widespread vertical profiles of CO2, CH4, and other greenhouse gases for validation of satellite retrievals and development of Earth System and carbon models.	OAR/ESRL/Global Monitoring Division	Southwest Research Institute, and several research organizations worldwide	2013-14	Atmospheric sampling system	validating satellite data	Tech - System, Service	Several	Academic	Research	Trans - Technology Transfer	Climate

58	ESRL GMD	Annual Greenhouse Gas Index (AGGI)	Accumulated radiative forcing from long-lived Greenhouse Gases. The NOAA Annual Greenhouse Gas Index (AGGI) measures the commitment society has already made to living in a changing climate. It is based on the highest quality atmospheric observations from sites around the world. Its uncertainty is very low.	Product used annually in EPA Annual Report on the Environment	OAR/ESRL/Global Monitoring Division	EPA's Climate Change Indicators in the United States Report	2013	Atmospheric information (synthesized from data)	EPA Annual Report on the Environment	Sci - Sythesized Product	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Climate
59	ESRL GMD	Annual Greenhouse Gas Index (AGGI)	Accumulated radiative forcing from long-lived Greenhouse Gases. The NOAA Annual Greenhouse Gas Index (AGGI) measures the commitment society has already made to living in a changing climate. It is based on the highest quality atmospheric observations from sites around the world. Its uncertainty is very low.	Selected as a National Physical Indicator of Climate Change in support of the National Assessments	OAR/ESRL/Global Monitoring Division	USGCRP	2014	Atmospheric information (synthesized from data)	National Climate Assessment	Sci - Sythesized Product	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Climate
60	ESRL GMD	Annual Greenhouse Gas Index (AGGI)	Accumulated radiative forcing from long-lived Greenhouse Gases. The NOAA Annual Greenhouse Gas Index (AGGI) measures the commitment society has already made to living in a changing climate. It is based on the highest quality atmospheric observations from sites around the world. Its uncertainty is very low.	Update of the WMO Annual Greenhouse Gas Bulletin, which is distributed worldwide in 5 languages	OAR/ESRL/Global Monitoring Division	WMO Global Atmosphere Watch, Geneva, CH	2013	radiative information	WMO Annual Greenhouse Gas Bulletin	Sci - Sythesized Product	Single	Public - International	Application - Environmental Intelligence	Res - Observations and Data	Climate
61	ESRL GMD	Annual Greenhouse Gas Index (AGGI)	Accumulated radiative forcing from long-lived Greenhouse Gases. The NOAA Annual Greenhouse Gas Index (AGGI) measures the commitment society has already made to living in a changing climate. It is based on the highest quality atmospheric observations from sites around the world. Its uncertainty is very low.	Updated product on Cimate.Gov	OAR/ESRL/Global Monitoring Division	OAR/Climate Program Office/climate.gov	2014	Atmospheric information (synthesized from data)	Education. Product linked through climate.gov to reach broader sudience	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Education, Learning	Res - Observations and Data	Climate
62	ESRL GMD	Global CO2 record	Long-term trend of CO2 from all remote marine boundary layer sites in NOAA's global monitoring network. Far and away the most accurate, robust record of the "most important" (IPCC language) GHG in the atmosphere. Uses of this data set are extensive and varied (scientists, managers, policy makers, educators, general public).	National Indicator for Climate Change in support of the most recent National Climate Assessment	OAR/ESRL/Global Monitoring Division	USGCRP	2014	Atmopsheric data	National Climate Assessment	Sci - Original Data	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Climate
63	ESRL GMD	Carbon Tracker	CarbonTracker Code, CO2 and CH4 data from global network, CarbonTracker Products such as Carbon Weather, global carbon fluxes, etc. CarbonTracker is a CO2 measurement and modeling system developed by NOAA to keep track of sources (emissions to the atmosphere) and sinks (removal from the atmosphere) of carbon dioxide around the world.	CarbonTracker is a CO2 analysis system developed by NOAA to keep track of sources (emissions to the atmosphere) and sinks (removal from the atmosphere) of carbon dioxide around the world. It is constrained by NOAA's CO2 and CH4 monitoring network. NOAA's version has a strong focus on North America; Other nations and regions are adapting the code to incorporate their more granular observing systems in their nations and regions.	OAR/ESRL/Global Monitoring Division	e.g., Wageningen University Meteorology and Air Quality Department, Utrecht, Netherlands	2013	Carbon Tracker code	Supports WMO and other partners in understanding their CO2 and methane emissions	Tech - Model, Algorithm	Infinite	Public - International	Application - Environmental Intelligence	Trans - Technology Transfer	Climate

64	ESRL GMD	GLOBALVIEW data products	GLOBAL VIEW, a gridded distribution of CO2 and CH4 data based on GMD's monitoring network and updated annually. GLOBALVIEW data products are designed to enhance the spatial and temporal distribution of atmospheric observations of CO2, CH4 and other related atmospheric measurements. GLOBALVIEW products are specifically intended as tools for use in carbon cycle modeling studies.	GLOBALVIEW data products are designed to enhance the spatial and temporal distribution of atmospheric observations of CO2, CH4 and other related atmospheric measurements. GLOBALVIEW products are specifically intended as tools for use in carbon cycle modeling studies.	OAR/ESRL/Global Monitoring Division	Used in publications by numerous scientists and modelers around the world	2013	atmospheric data (syhtesized from raw data)	Additional research	Sci - Sythesized Product	Infinite	Academic	Research	Res - Observations and Data	Climate
65	ESRL GMD	CO2 Mauna Loa Trends	The Mauna Loa Data record, which NOAA makes available daily, are viewed at this site for the most up-to-date information on CO2. The Global Average CO2, which is similar, but slightly lower, takes a couple of months to come out.	The "iconic" climate record shared in near real time with the global research community and the public.	OAR/ESRL/Global Monitoring Division	WMO/GAW, numerous press reports, Climate.gov	2014	atmospheric data	Additional research, education, and policy support	Sci - Original Data	Several	Public - International	Research	Res - Observations and Data	Climate
66	ESRL GMD	ObsPack Data Products	Brings together direct atmospheric greenhouse gas measurements, prepares them with specific applications in mind, and packages and distributes them in a set of self-documenting files.	Observation Package (ObsPack) data products are intended to stimulate and support carbon cycle modeling studies.	OAR/ESRL/Global Monitoring Division	Used in publications by numerous scientists and modelers around the world	2014	atmospheric data	Additional research	Sci - Sythesized Product	Infinite	Academic	Research	Res - Observations and Data	Climate
67	ESRL GMD	Ozone Depleting Gas Index (ODGI)	Index of combined ozone depletion potential from all ozone depleting gases.	To make publicly available a simple measure of society's success in addressing stratospheric ozone depletion, by computing the decline in ozone-depleting potential from all long-lived, ozone-depleting gases.	OAR/ESRL/Global Monitoring Division	EPA Report on the Environment	2014	Atmospheric information (synthesized from data)	EPA Annual Report on the Environment	Sci - Sythesized Product	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Climate
68	ESRL GMD	Solar Calculator	A tool to predict the actual observed values of sunrise, sunset, solar noon, and solar position from any location on the globe.	Research community resource for instrument calibrations and alignments globally.	OAR/ESRL/Global Monitoring Division	Massachusetts Institute of Technology	2014	solar calculator	Additional research; education	Tech - Model, Algorithm	Single	Academic	Research	Trans - Technology Transfer	Climate
69	ESRL GMD	Publications and Governments Using GMD Data Outside NOAA	NOAA GMD data are made freely available to the world, in some cases within hours of its availability. These data are used in alerts, newscasts, daily/weekly summary reports, government policy documents and publications to inform the public, policy makers, politicians, educators and scientists. Much of the data GMD data forms the core of Environmental Assessments.	NOAA GMD data show that the composition of the atmosphere is changing rapidly. It is important that this data be analyzed and disseminated to the broadest audience timely and globally.	OAR/ESRL/Global Monitoring Division	Literally 1,000s of users around the Earth, in some cases, on a daily basis. For instance, a recent article in the New York times on the Presidents Climate Action Plan.	2014	atmospheric data	Additional research	Sci - Original Data	Infinite	Cannot Determine	Research	Res - Observations and Data	Climate

70	ESRL GMD	IPCC Fifth Assessment Report	Lead authorship of chapters, Review Editor, Topic Editors . Scientific expertise. Comprehensive, multiyear data sets of GMD's global average greenhouse gas observations, ozone, surface radiation, and aerosols.	The Fifth Assessment Report (AR5) provides a clear and up to date view of the current state of scientific knowledge relevant to climate change. The Working Group I contribution provides a comprehensive assessment of the physical science basis of climate change.	OAR/ESRL/Global Monitoring Division	Intergovernmental Panel on Climate Change, Fifth Assessment Report, Working Group I and Executive Summary	2013	research report	IPCC climate assessment	Sci - Interpreted Product	Single	Public - International	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
71	ESRL GMD	State of the Climate Report	Comprehensive atmospheric observations, data sets, analysis, and author contributions by GMD to the annual State of the Climate Report.	Annual updates of the state of the climate in the BAMS State of the Climate Report. The report is read worldwide and GMD contributions on atmosphere have expanded through time. The report includes the work of 425 authors from 57 countries, uses dozens of climate indicators to track patterns, changes, and trends of the global climate system. These indicators reflect many thousands of measurements from multiple independent data sets.	OAR/ESRL/Global Monitoring Division	NOAA/NESDIS/National Climatic Data Center	2014	Research report	BAMS State of the Climate Report	Sci - Interpreted Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
72	ESRL GMD	U.S. National Climate Assessment -- Publications, Data	Scientific expertise; contributions through the Carbon Interagency Working Group of the US Global Change Research Program.	NOAA played a critical role in the development, authorship, and delivery of the report, with many scientists and staff helping develop technical inputs and climate scenarios.	OAR/ESRL/Global Monitoring Division	US Global Change Research Program	2014	Understanding of climate (unwritten)	National Climate Assessment	Sci - Tacit Expertise	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
73	ESRL GMD	WMO/UNEP Scientific Assessment of Ozone Depletion	Co-authors, contributors, and review editors of chapters and GMD's global data on stratospheric ozone trends and trends of all ozone depleting gases. Scientific expertise.	The most recent WMO/UNEP assessment contains the most up-to-date understanding of ozone depletion. It reflects the thinking of hundreds of international scientific experts. Atmospheric data come largely from NOAA's Global Monitoring and Chemical Sciences Divisions of ESRL and from NASA.	OAR/ESRL/Global Monitoring Division	UNEP Ozone Secretariat	2014	research report	WMO/UNEP Quadrennial Scientific Assessments of Ozone Depletion; 2014 is most recent	Sci - Interpreted Product	Single	Public - International	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
74	ESRL GMD	WMO Greenhouse Gas Bulletin	Information, Data, Authorship	Disseminating brief, global summaries and analysis of greenhouse gas trends and distributions. The GHG Bulletin is distributed worldwide in five languages.	OAR/ESRL/Global Monitoring Division	WMO Global Atmosphere Watch, Geneva	2013	research report	Informs science, management and policy decisions worldwide	Sci - Interpreted Product	Single	Public - International	Application - Policy, Legislation, Law	Res - Studies and Assessments	Climate
75	ESRL GMD	WMO Antarctic Ozone Hole Bulletins	The state and progression of the annual South Pole Ozone Hole as it is occurring.	Six bulletins came out monthly in 2013 reporting on progress and understanding of the ozone hole. Strong use of GMD data.	OAR/ESRL/Global Monitoring Division	WMO Global Atmosphere Watch, Geneva	2013	research report	Informs parties to Montreal Protocol, to which US is signatory.	Sci - Interpreted Product	Single	Public - International	Application - Policy, Legislation, Law	Res - Studies and Assessments	Climate
76	ESRL GMD	Global Ozonesonde Profile Data	Ozone profile data from balloon borne ozonesondes.	Ozone data is use in UV models and UV forecasts as well as in ozone research.	OAR/ESRL/Global Monitoring Division	World Ozone and Ultraviolet Radiation Data Center (WOUDC)	2014	atmospheric data	Additional research, Annual Ozone Hole Monitoring	Sci - Original Data	Single	Private - Not For Profit	Research	Res - Observations and Data	Weather
77	ESRL GMD	Global Total Column Ozone Data	Ozone total column data from Dobson Spectrophotometers.	Ozone data is use in UV models and UV forecasts as well as in ozone research.	OAR/ESRL/Global Monitoring Division	World Ozone and Ultraviolet Radiation Data Center (WOUDC)	2014	atmospheric data	Additional research, Annual Ozone Hole Monitoring	Sci - Original Data	Single	Private - Not For Profit	Research	Res - Observations and Data	Weather

78	ESRL GMD	Aerosol Data - Federated Aerosol Network	Approximately 18 variables measured and over 285 data sets available (globally).	The Federated Network is a component of WMO Global Atmosphere Watch (GAW) that provides robust data from a global network of sites using similar instrumentation and approaches. The data are sufficiently coherent to meaningfully assist in model development	OAR/ESRL/Global Monitoring Division	WMO Global Data Center for Aerosols, Norway	2014	atmospheric data	Additional research	Sci - Original Data	Single	Public - International	Research	Res - Observations and Data	Climate
79	ESRL GMD	Carbon Cycle Data	Approximately 10 compounds measured routinely at ~80 sites and over 1350 data sets available (globally).	The GMD Global Greenhouse Gas Reference Network measures the atmospheric distribution and trends of the three main long-term drivers of climate change, carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O), as well as carbon monoxide (CO) which is an important indicator of air pollution. Data from individual sites are frequently downloaded and used in publications.	OAR/ESRL/Global Monitoring Division	Global research community, World Data Centre of Greenhouse Gases, Disseminated in WMO WDCGG Data Summary and made available on line at Mapan Meteorological Agency	2014	atmospheric data	Additional research	Sci - Original Data	Infinite	Public - International	Research	Res - Observations and Data	Climate
80	ESRL GMD	Oil and gas field data methane emissions.	Unique in situ NOAA GMD measurements showing large emissions of methane from oil and gas fields have lead to new State of Colorado regulations on allowable methane emissions from these extraction activities. These regulations were made law in February 2014. Additional GMD studies have shown similar high methane emissions in Texas, New Mexico and Utah. National regulations are being considered.	Methane emitted to the atmosphere during fossil fuel extraction operations is a valuable lost resource and a potent greenhouse gas. If more than 4% of production is lost, the climate benefits of switching from coal to gas fuel for electricity generation is lost.	OAR/ESRL/Global Monitoring Division	Colorado Air Quality Control Commission	2014	atmospheric data	State regulations on methane emissions	Sci - Original Data	Single	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Res - Observations and Data	Climate
81	ESRL GMD	Wintertime ozone in rural Wyoming.	Knowledge on the causes and timing of high wintertime ozone production in rural Wyoming associated with oil and gas production.	Wintertime ozone production over oil and gas fields in rural Wyoming has put portions of the state into EPA non-compliance. GMD scientists published the first scientific paper identifying the causes and timing of the winter ozone production phenomenon. Wyoming subsequently put in place regulations on oil and gas field emissions. The regulations may be working as no winter ozone exceedances have been observed over the past 3 years.	OAR/ESRL/Global Monitoring Division	Wyoming Department of Environmental Quality	2014	research report	regulations on oil and gas field emissions	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Res - Studies and Assessments	Weather

82	ESRL GMD	Wintertime ozone in rural Utah.	Knowledge and research results on the causes, extent and timing of exceptional high winter ozone concentrations in rural Utah.	Wintertime ozone concentrations in the Uintah Basin, Utah, are the highest ever reported in winter in the U.S. Over the past four years, NOAA ESRL scientists and university/industry partners including GMD scientists have studied the phenomenon culminating in publications of scientific papers identifying the causes, timing and extent of the phenomenon and pointing towards possible control strategies.	OAR/ESRL/Global Monitoring Division	Utah Department of Environmental Quality	2014	research report	Findings influencing EPA, industry, local resource management decisions.	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Resource Management	Res - Studies and Assessments	Weather
83	ESRL GMD	DOE Carbon Dioxide Information and Analysis Center (CDIAC)	Access to GMD carbon cycle data through a link managed by DOE. When DOE gets a request from carbon cycle data the requester may choose to go form the DOE website directly into the NOAA GMD site.	The Carbon Dioxide Information Analysis Center (CDIAC) is the primary CO2 and greenhouse gas data center for the nation. It includes data from NOAA and NASA on atmospheric composition, and from other agencies on inventories. Products are used worldwide. http://cdiac.ornl.gov/	OAR/ESRL/Global Monitoring Division	Carbon Dioxide Information Analysis Center (CDIAC), DOE	2014	Atmopsheric data	Not specific	Sci - Original Data	Single	Public - Federal (not NOAA)	Cannot Determine	Res - Observations and Data	Climate
84	ESRL GMD	Solar Radiation Data	Approximately 20 variables measured and over 135 data sets available (globally).	The GMD Solar Radiation group is involved in observational and theoretical research of the Earth's surface and atmospheric radiation budgets, focusing on the extent and cause of observed radiation and climate variations, and collaborating with other research groups making satellite observations and climate model calculations.	OAR/ESRL/Global Monitoring Division	World Radiation Data Center, St. Petersburg, Russia	2014	radiative data	Additional research	Sci - Original Data	Several	Public - International	Research	Res - Observations and Data	Climate
85	ESRL GMD	SURFRAD sites	Seven long-term SURFRAD stations provide independent measures of upwelling and downwelling, solar and infrared measurements; direct and diffuse solar, photosynthetically active radiation, UVB, spectral solar, and meteorological parameters.	SURFRAD observations have been used for evaluating satellite-based estimates of surface radiation, and for validating hydrologic, weather prediction, and climate models; modelers; publications	OAR/ESRL/Global Monitoring Division	NASA Langley's Earth Observing System	2014	Radiative data	Validating satellite data, validating predictions, understanding climate change	Sci - Original Data	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Climate
86	ESRL GMD	Mobile SURFRAD sites	Two regional mobile SURFRAD stations measure surface radiation budget (upwelling and downwelling shortwave and longwave radiation), direct normal irradiance (DNI), global horizontal irradiance (GHI), spectral aerosol optical depth, cloud fraction, and spectral surface albedo.	Regional, shorter term studies for: 1) Verification and data assimilation (solar forecasting); 2) Surface radiation budget and aerosol radiative forcing (climate research); 3) Satellite verification (solar and IR radiation, AOD, NDVI, Land Surface Temperature, surface albedo); 4) Aerosol optical depth (verification of estimates of PM2.5 for Air Quality)	OAR/ESRL/Global Monitoring Division	NOAA/NESDIS/STAR	2014	Radiative data	Additional research	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Research	Res - Observations and Data	Climate
87	ESRL GMD	WMO WDCGG Data Summary	GMD greenhouse gas data sets transitioned to World Data Centre for Greenhouse Gases	Reports the latest status of greenhouse and some reactive gases in the atmosphere.	OAR/ESRL/Global Monitoring Division	Japan Meteorological Agency	2014	atmospheric data	Additional research and data products; global audience	Sci - Original Data	Single	Public - International	Research	Res - Observations and Data	Climate

88	ESRL GMD	Atmospheric Baseline Observatory Network	Use of facilities at 6 globally distributed and manned observatories by other NOAA LOs, U.S. agencies, U.S. universities, and international partners.	The data collected at the observatories cover up to 250 different measurements, many of them collected continuously and transmitted to end users and the public in real time.	OAR/ESRL/Global Monitoring Division	One such user out of a 100 is the Scripps Institution of Oceanography, La Jolla, CA.	2014	atmospheric data	Additional research	Sci - Original Data	Infinite	Academic	Research	Res - Observations and Data	Climate
89	ESRL GMD	Standards - WMO Global Scales	NOAA ESRL GMD is the World Meteorological Organization (WMO), Global Atmosphere Watch (GAW) Central Calibration Laboratory (CCL) for: CO2, CH4, N2O, SF6, and CO	A WMO Central Calibration Laboratory is responsible for maintaining and distributing the WMO Mole Fraction scale for a specified gas in air to the global research community.	OAR/ESRL/Global Monitoring Division	WMO partners and other partners and scientists investigating GHGs, private and public sectors.	2014	calibration scale for gas	Additional research	Tech - Standards, Protocols	Infinite	Public - International	Research	Trans - Technology Transfer	Climate
90	ESRL GMD	Standards - NOAA Scales	NOAA ESRL GMD maintains calibration scales for 21 minor gases (outside of the CCL)	NOAA maintains the Mole Fraction scale for a specified gas in air to the global research community.	OAR/ESRL/Global Monitoring Division	Gas standards are used by atmospheric scientists and chemical oceanographers around the world to study the lesser GHGs and ensure that their measurements will be compatible.	2014	calibration scale for gas	Additional research	Tech - Standards, Protocols	Infinite	Academic	Research	Trans - Technology Transfer	Climate
91	ESRL GMD	Standards - Dobson Regional Standards	Calibration of JMA and BoM Dobson Regional Standards in Boulder	Ensures globally traceable and compatible measurements for validating satellite retrievals of total and stratospheric ozone.	OAR/ESRL/Global Monitoring Division	WMO partners and other partners and scientists investigating total ozone.	2014	calibration scale for gas	Additional research	Tech - Standards, Protocols	Infinite	Public - International	Research	Trans - Technology Transfer	Climate
92	ESRL GMD	Standards - Central UV Calibration Facility	Highly accurate and long-term repeatable calibrations and characterizations of UV monitoring instruments.	The Central UV Calibration Facility is a joint project between NOAA and NIST. Its mission is to provide highly accurate and long-term repeatable calibrations and characterizations of UV monitoring instruments.	OAR/ESRL/Global Monitoring Division	USDA/Colorado State University/UV-B Monitoring and Research Program (UVMRP)	2014	UV instrument calibration	Informs Congress (US Clean Air Act triennial reports), EPA, and int'l parties to the Montreal Protocol	Tech - Standards, Protocols	Several	Academic	Application - Policy, Legislation, Law	Trans - Technology Transfer	Climate
93	GFDL	Model data for WCRP/CMIP	Over 180 terabytes of data were made publically available for use in the IPCC AR5	Used by the climate research community worldwide to assess the physical basis of climate change.	GFDL	Climate research community worldwide, climate impacts community	ongoing	data from coupled climate and Earth System models	IPCC assessment	Sci - Original Data	Infinite	Academic	Application - Environmental Intelligence	Res - Observations and Data	Climate
94	GFDL	Model data for the National Climate Assessment	Nearly 200 terabytes of data were made publically available in the CMIP3 and CMIP5 database, which were used in the National CLimate Assessment	Used by the climate research community in the U.S. to assess the physical basis of climate change.	GFDL	Climate research community worldwide, climate impacts community	ongoing	data from coupled climate and Earth System models	National Climate Assessment	Sci - Original Data	Infinite	Academic	Application - Environmental Intelligence	Res - Observations and Data	Climate
95	GFDL	MOM	The Modular Ocean Model (MOM) is the canonical ocean climate model use by many researchers around the world.	Provide an ocean model suitable for simulation at climate time scales to NCEP for use in the Climate Forecast System, version 2. MOM4 is used operationally and MOM5 is used experimentally	GFDL	NWS/NCEP, CSIRO (Australia), MOES (India)	2012 (MOM4); 2013 (MOM5); support ongoing	Ocean model	Climate forecasts at NCEP	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Climate
96	GFDL	GFDL Experimental Long Lead Seasonal Hybrid Hurricane Forecast System (HyHuFS)	Experimental forecasts of North Atlantic hurricane frequency	To facilitate and motivate research and discussion on the topic of long-lead seasonal hurricane forecasts.	GFDL	NWS/NHC, NWS/CPC, Willis Reinsurance	2013	hurricane forecasts	Additional research, seasonal hurricane prediction	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Research	Dev - Predictions and Projections	Weather
97	GFDL	North American Multi-model Ensemble (NMME)	Forecasts from initialized conditions are provided to the NMME each month for use in experimental climate predictions.	To improve the prediction data delivered to NWS/CPC on their operational schedule. NMME forecasts are already currently being used as guidance for operational forecasters.	GFDL	NOAA/CPC	2013	Monthly to interseasonal forecasts	Improve forecasts at NWS/CPC	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Climate

98	GFDL	Dust Source inventory	Inverntory of dust sources derived from satallite data	To provide the best information on the location and origins of dust sources in in order to simulate dust events, compare them with observations, and study their potential effects on climate, vegetation, and ocean productivity.	GFDL	NWS, NASA GISS, NASA/GSFC, NOAA/ARL (NAQFC)	2013	Research report	Additional research, operational predictions of dust at NWS	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Research	Res - Studies and Assessments	Climate
99	GFDL	GFDL Hurricane Prediction System	Operational hurricane models	To continue providing one of the best hurricane prediction systems for use in NOAA and Navy operations.	GFDL	NOAA/NHC, U.S. Navy	2014	hurricane model	operational hurricane forecasts at NWS/NHC and Navy	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
100	GFDL	ARM analysis	Model simulations	Comparison of modeled and observed liquid water and ice water paths. Models from serveral organizations were involved.	GFDL	DOE/LLNL	2013	Simulations (as a model output)	Additional research	Sci - Sythesized Product	Single	Public - Federal (not NOAA)	Research	Res - Models and Experiments	Cannot Determine
101	GFDL	Ice water path	Model simulations	Comparison of modeled ice water path with satellite data. Models from serveral organizations were involved.	GFDL	NASA/JPL	2013	Simulations (as a model output)	Additional research	Sci - Sythesized Product	Single	Public - Federal (not NOAA)	Research	Res - Models and Experiments	Cannot Determine
102	GFDL	Research partnership with Princeton University: Extreme precipitation, air quality, sea-level rise, droughts, agriculture	AM2/CM2, AM3/CM3, ESM2, and their output	Use GFDL models and model output for climate impact studies	GFDL	Princeton University Civil Engineering, EEB, Woodrow Wilson School, PEI, CMI	ongoing	model output	Additional research	Sci - Sythesized Product	Several	Academic	Research	Dev - Predictions and Projections	Climate
103	GFDL	Simulations of Hurricane Activity	Information on hurricane activity	Enable the reinsurance industry, Army Corps of Engineers and collaborators to assess risks from hurricane activity	GFDL	Willis Reinsurance, Army Corps of Engineers, DOE/LLNL	2013	Weather information (synthesized from data)	Insurance, infrastructure planning	Sci - Sythesized Product	Several	Private - For Profit	Application - Emergency Management	Dev - Predictions and Projections	Weather
104	GLERL	Lake Erie Operational Forecasting System (LEOFS)	A wave and current model upgrade for Lake Erie was transitioned	Update of GLOFS Lake Erie (Princeton Ocean Model - POM) to FVCOM. Improves coastline resolution, water level tracking, and updates model code to NOS supported system.	NOAA-OAR GLERL Integrated Physical and Ecological Modeling and Forecasting Group	NOAA/NOS/OCS CSDL	2014	wave and current model code	Improves coastline resolution, water level tracking, and updates model code to NOS supported system.	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
105	GLERL	Ice type classification algorithm for satellite data	Algorithm for Great Lakes Ice Type Classification	The algorithm classifies and maps major Great Lakes ice types using satellite synthetic aperture radar (SAR) data. Users include: U.S. Coast Guard, Navy/NOAA National Ice Center, NOAA/NESDIS, researchers in under ice ecology.	NOAA-OAR GLERL Observing Systems and Advanced Technology Group	NESDIS Synthetic Aperture Radar Operational Products System (SAROPS) within NESDIS STAR (Center for Satellite Applications and Research)	2014	ice-type classification algorithm	Not specific	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Trans - Technology Transfer	Weather
106	GLERL	Great Lakes color algorithm for satellites data	Algorithm for determining concentrations of color-producing agents (CPA) in Great Lakes water, including algal blooms, sediment, and dissolved organic matter	The satellite algorithm retrieves and maps chlorophyll, CDOM (DOC), and suspended mineral from ocean color satellite data of the Great Lakes. Users include: Fisheries researchers, EPA, water intake managers, ecologists, Sea Grant	NOAA-OAR GLERL Observing Systems and Advanced Technology Group	NESDIS STAR (Center for Satellite Applications and Research)	2014	Ecosystem model algorithm	Not specific	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Trans - Technology Transfer	Oceans
107	GLERL	Great Lakes water levels dashboard	Interactive online viewer for past, present, and future Great Lakes water level data	Application improved access to Great Lakes water level data and forecasts to a host of users	NOAA-OAR GLERL Integrated Physical and Ecological Modeling and Forecasting Group	US Army Corps of Engineers, Great Lakes state agencies, resource managers, shipping industry, general public	2013	hydrographic information (via web-based tool that, itself, was not transitioned)	Not specific	Sci - Sythesized Product	Several	Public - Federal (not NOAA)	Cannot Determine	Res - Observations and Data	Weather
108	GLERL	Great Lakes hydroclimate dashboard and related products	Interactive online viewer for past, present, and future Great Lakes hydro-climate and related data	Application improves access to Great Lakes hydro-climate data to a host of users	NOAA-OAR GLERL Integrated Physical and Ecological Modeling and Forecasting Group	US Army Corps of Engineers, Great Lakes state agencies, resource managers, shipping industry, general public	2014	hydro-climate data (via web-based tool that, itself, was not transitioned)	Not specific	Sci - Sythesized Product	Infinite	Public - Federal (not NOAA)	Cannot Determine	Res - Observations and Data	Climate

109	GLERL	Lake Erie Harmful Algal Bloom Tracker	Nowcasts and forecasts of harmful algal blooms for Lake Erie, animation and data viewer	Informs decision-making by Great Lakes resource managers and users	NOAA-GLERL, CILER	Ohio EPA, resource managers, drinking water utilities, general public	2014	HAB forecast	Not specific	Sci - Sythesized Product	Infinite	Public - State/Local/Tribal	Cannot Determine	Dev - Predictions and Projections	Coasts
110	GLERL	Seasonal Harmful Algal Bloom Forecast for Lake Erie	Algal bloom intensity forecast for Lake Erie, derived from spring phosphorus loads from rivers	Informs decision-making by Great Lakes resource managers	NOAA-GLERL, CILER, University of Michigan	Ohio EPA, resource managers, drinking water utilities, general public	2014	HAB forecast	Not specific	Sci - Sythesized Product	Infinite	Public - State/Local/Tribal	Cannot Determine	Dev - Predictions and Projections	Coasts
111	NSSL	Radial-by-radial noise-power estimator	Algorithm description	WSR-88D data quality improvements. Reduced biases of radar variables and effective quality control.	NSSL	NWS/Radar Operations Center	2013	a (verbal) description of an algorithm	improved data from radars	Sci - Interpreted Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
112	NSSL	Coherency-based thresholding	Algorithm description	WSR-88D data quality improvement. Recovery of sensitivity loss from dual-polarization upgrade.	NSSL	NWS/Radar Operations Center	2013	a (verbal) description of an algorithm	improved data from radars	Sci - Interpreted Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
113	NSSL	Staggered PRT	Algorithm description, volume coverage patterns	WSR-88D data quality improvement. Mitigation of range-and-velocity ambiguities.	NSSL	NWS/Radar Operations Center	2014	a (verbal) description of an algorithm	improved data from radars	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
114	NSSL	Meteorological Phenomena Indicated Near the Ground (mPING)	Crowd-sourced precipitation type and severe weather reports.	Improves forecaster knowledge of meteorological ground-truth.	NSSL	NWS WFO Norman	2014	Weather data	validation of weather forecasts	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Weather
115	PMEL	SIFT	SIFT Tsunami Forecast System v.3.1	SIFT Vers. 3.1 is the first operational version of the SIFT tsunami forecsting software that was transitioned to and accepted by NWS. SIFT represents the first empirically-based forecast system for tsunamis.	OAR/PMEL	NWS/OCWWS/OS21 - Tsunami Warning Program, Pacific Tsunami Warning Center (Honolulu, HI), National Tsunami Warning Center (Palmer, AK)	2013	tsunami forecast system	NWS tsunami forecasts	Tech - System, Service	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
116	PMEL	NRS hydrophones	PMEL hydrophone technology	Nine Ocean Noise Reference Stations, using hydrophone technology developed by PMEL, are in the process of being deployed in nine locations within the U.S. EEZ, in NMFS regions and in NOS National Marine Sanctuary locations. To date, six of the nine hydrophone moorings have been deployed.	OAR/PMEL	NMFS Science Centers, NOS National Marine Sanctuaries, National Park Service	2014	hydrophone technology	oceanic ambient noise baseline	Tech - Hardware, Equipment	Several	Public - Federal - NOAA (not OAR)	Cannot Determine	Trans - Technology Transfer	Oceans
117	PMEL	Carbon Wave Glider	Carbon Wave Glider	PMEL developed and utilizes Carbon Wave Gliders in its research. In response to a request from the Council for Scientific and Indistrial Research (CSIR) in South Africa, PMEL transitioned its Cabon Wave Glider technology to CSIR. The onboard instrument package measures pCO2 and pH of the surface water (provided by a Batelle MAPCO2 system and a pH sensor) along with measurements of temperature and conductivity provided by a SeaBird CTD.	OAR/PMEL	Council of Scientific and Industrial Research (CSIR) of South Africa	2013	CO2 measurement capability appplied to autonomous vehicles	increased data to support ocean acidification research	Tech - Hardware, Equipment	Single	Public - International	Research	Trans - Technology Transfer	Climate
118	PMEL	SOCAT	Surface Ocean Carbon Dioxide Atlas: SOCAT version 2.	The SOCAT database is updated in discrete "chunks," providing a sizable increase in the amount of quality-controlled ocean carbon data available to scientists world-wide. PMEL developed and manages the SOCAT database for the international ocean carbon research community.	OAR/PMEL	International Ocean Carbon Coordination Project (IOCCP)	2013	qc'ed ocean carbon data	Additional research	Sci - Original Data	Single	Public - International	Research	Res - Observations and Data	Climate

119	CPO	State of the Climate Report	Global ocean data and products supported by CPO and OAR are analyzed, assesed, and contributed to the annual State of the Climate Report.	Annual updates of the state of the climate in the BAMS State of the Climate Report. There report is received by x people and COD contributions have grown through time.	NOAA/OAR/Climate Program Office/Climate Observation Division	Editors of the State of the Climate Report		Ocean information (synthesized from data)	BAMS State of the Climate Report.	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
120	CPO	Arctic Report Card	Arctic ocean, atmospheric, and ecosystem data and products supported by CPO and OAR are analyzed, assesed, and contributed to the annual State of the Climate Report.	The Arctic Report Card provides the public with information about the status of the Arctic region.	NOAA/OAR/Climate Program Office/Climate Observation Division	PMEL, CRREL, Office of Naval Research, Ocean, Atmosphere and Space Research Division, Ocean Battlespace Sensing Department		Arctic Information (synthesized from data)	Arctic Report Card	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Coasts
121	CPO	U.S. National Climate Assessment	Research approaches and resulting data products assessing and characterizing climate variability and change (e.g. changes in snowfall, regional and global temperatures, extremes in temperatures and precipitation, hurricane frequency and tracks)	Improve scope and confidence in quantifying and characterizing the range of climate variability and change of relevance for society	NOAA/OAR/Climate Program Office/Climate Observation Division	USGCRP		Research report	National Climate Assessment	Sci - Interpreted Product	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
122	CPO	IPCC Fifth Assessment Report	Research approaches and resulting data products assessing and characterizing climate variability and change (e.g. changes in snowfall, regional and global temperatures, extremes in temperatures and precipitation, hurricane frequency and tracks)	Improve scope and confidence in quantifying and characterizing the range of climate variability and change of relevance for society	NOAA/OAR/Climate Program Office/Climate Observation Division	Intergovernmental Panel on Climate Change, Fifth Assessment Report, Working Group I and Executive Summary		research report	Not specific	Sci - Interpreted Product	Single	Public - International	Cannot Determine	Res - Studies and Assessments	Climate
123	CPO	Monthly Ocean Briefings	Global ocean and Arctic data and products supported by CPO and OAR are analyzed, assesed, and contributed to NOAA CPC	The products and briefings improve NOAA's and the public's awareness of the state of the ocean.	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NWS/CPC		Arctic Information (synthesized from data)	Not specific	Sci - Interpreted Product	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Oceans
124	CPO	Indicators	Climate Observation Division funded work contributes data sets that become indicators of global change, including global sea level, sea surface temperature, Arctic sea ice extent.	The Indicators will be included in the National Pilot and Ongoing Indicators efforts for the National Climate Assessment.	NOAA/OAR/Climate Program Office/Climate Observation Division	USGCRP		Ocean data	National Climate Assessment	Sci - Original Data	Single	Public - Federal (not NOAA)	Application - Environmental Intelligence	Res - Observations and Data	Climate
125	CPO	OceanSITES network	Accumulated data from Oceansites moorings on ocean temperature, currents, salinity, carbon, atm temps, humidity, vector winds, atm radiation, precip, pCO2, and ocean carbon	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	Oceansites Global Data Centers: IFREMER Coriolis, France		ocean data	Additional research	Sci - Original Data	Single	Public - International	Research	Res - Observations and Data	Climate
126	CPO	OceanSITES network	Accumulated data from Oceansites moorings on ocean temperature, currents, salinity, carbon, atm temps, humidity, vector winds, atm radiation, precip, pCO2, and ocean carbon	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	Asia-Pacific Data-Research Center, IPRC		ocean data	Additional research	Sci - Original Data	Single	Academic	Research	Res - Observations and Data	Climate
127	CPO	OceanSITES network	Accumulated data from Oceansites moorings on ocean temperature, currents, salinity, carbon, atm temps, humidity, vector winds, atm radiation, precip, pCO2, and ocean carbon	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
128	CPO	Argo network	Accumulated data from global Argo floats on ocean temperature, salinity, velocity, and other ancillary measurements	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	Argo Global Data Centers		Ocean data	Additional research	Sci - Original Data	Single	Public - Federal (not NOAA)	Research	Res - Observations and Data	Cannot Determine
129	CPO	Argo network	Accumulated data from global Argo floats on ocean temperature, salinity, velocity, and other ancillary measurements	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate

130	CPO	Argo network	Accumulated data from global Argo floats on ocean temperature, salinity, velocity, and other ancillary measurements	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
131	CPO	Argo network	Technological developments: Interfacing of Iridium Router based Unrestricted Digital Interworking Connectivity Solution and Short Burst Data for telecommunications from profiling floats: interfacing of ARGOS-3 for telecommincations; development of software and firmware for transmiission of data using Iridium; identification and analysis of problems with and development of software and firmware for Deep Apex floats; performance of the "WOCE for Life (i.e., maintaining calibration and drift requirements for four years)" SBE61 sensor on Deep SOLO floats when compared with reference standards; technology for near-bottom operations of Deep SOLO float.	Iridium telecommunications - to allow for transmission of high resolution (i.e., 2 db) vertical profiles of temperature and salinity from 2,000 meter Argo floats; allow for the transmission on engineering data from new float models (e.g., NAVIS); allow for the incorporation of new sensors and transmission of data therefrom (e.g., BioGeoChemical) on profiling floats; allow real-time, two-way commination between floats and the operational centers for floats to adjust (for example) mission profiles; allow for the transmission of data to operational centers and the GTS in a timely manner. ARGOS-3 - to test the use of ARGOS-3 transmissions and possible two-way applications (result was that ARGOS-3 was ot a suitable alternative to either ARGOS-2 for data transmission and Iridium for both data trasnmission and two-way communications). SBE61 Development: to obtain highly precise obervations of temperature and salinity below 2,000 m (to 6,000 m), i.e., approxmately one-half of the	NOAA/OAR/Climate Program Office/Climate Observation Division	The global community implementing Argo, including instrument manufacturers. All information is freely and openly available. Instrument manufacturers include all float manufacturers in the U.S. and abroad and the only (presently) sensor manufacturer of CTDs for profiling floats - SeaBird Electronics.		Iridium telecommunications	Not specific	Tech - System, Service	Infinite	Private - For Profit	Cannot Determine	Trans - Technology Transfer	Climate
132	CPO	Global Sea Level Observing System (GLOSS) network	Accumulated data from GLOSS tide gauges on water level and land motion	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	GLOSS and PSMSL Global Data Centers		hydrologic data	Additional research	Sci - Original Data	Several	Public - International	Research	Res - Observations and Data	Climate
133	CPO	Global Sea Level Observing System (GLOSS) network	Accumulated data from GLOSS tide gauges on water level and land motion	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast and Tsunami centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
134	CPO	Global Sea Level Observing System (GLOSS) network	Accumulated data from GLOSS tide gauges on water level and land motion	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA NODC and NGDC		Ocean data	Not specific	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
135	CPO	Arctic Observing network	Accumulated data from sea-ice, ocean, atmosphere, and ecosystem sensors	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	IASOA Data Center, National Ice Center,		Ocean data	Additional research	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Research	Res - Observations and Data	Cannot Determine
136	CPO	Arctic Observing network	Accumulated data from sea-ice, ocean, and atmosphere sensors	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Cannot Determine
137	CPO	Arctic Observing network	Accumulated data from sea-ice, ocean, atmosphere, and ecosystem sensors	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Cannot Determine
138	CPO	Ships of Opportunity	Accumulated data from ships of opportunity instrumentation providing ocean temperature profiles and underway salinity, and meteorological information on temps, humidity, winds, SLP, and precip	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	JCOMM Ship Observations Team data centers and projects		ocean data	Additional research	Sci - Original Data	Single	Public - International	Research	Res - Observations and Data	Climate

139	CPO	Ships of Opportunity	Accumulated data from ships of opportunity instrumentation providing ocean temperature profiles and underway salinity, and meteorological information on temps, humidity, winds, SLP, and precip	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
140	CPO	Ships of Opportunity	Accumulated data from ships of opportunity instrumentation providing ocean temperature profiles and underway salinity, and meteorological information on temps, humidity, winds, SLP, and precip	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Weather
141	CPO	Ocean carbon observations	Accumulated ocean data from surface moorings and ships regarding ocean temperature, currents, salinity, carbon, atm temps, humidity, vector winds, precip, pCO2, and ocean carbon; Subsurface measurements during hydrographic cruises of ocean temperature, currents, salinity, carbon, pCO2, ocean carbon, and various tracers	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	Carbon Dioxide Information Analysis Center (CDIAC), DOE		Ocean data	Additional research	Sci - Original Data	Single	Public - Federal (not NOAA)	Research	Res - Observations and Data	Cannot Determine
142	CPO	Ocean carbon observations	Accumulated ocean data from surface moorings and ships regarding ocean temperature, currents, salinity, carbon, atm temps, humidity, vector winds, precip, pCO2, and ocean carbon; Subsurface measurements during hydrographic cruises of ocean temperature, currents, salinity, carbon, pCO2, ocean carbon, and various tracers	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
143	CPO	Ocean carbon observations	Accumulated ocean data from surface moorings and ships regarding ocean temperature, currents, salinity, carbon, atm temps, humidity, vector winds, precip, pCO2, and ocean carbon; Subsurface measurements during hydrographic cruises of ocean temperature, currents, salinity, carbon, pCO2, ocean carbon, and various tracers	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
144	CPO	Global Drifter Program	Accumulated data from Global Drifter Program buoys providing ocean SST, atmospheric pressure, winds, and other ocean and atmospheric variables.	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	University of Miami-CIMAS		ocean data	Additional research	Sci - Original Data	Single	Academic	Research	Res - Observations and Data	Climate
145	CPO	Global Drifter Program	Accumulated data from Global Drifter Program buoys providing ocean SST, atmospheric pressure, winds, and other ocean and atmospheric variables.	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
146	CPO	Global Drifter Program	Accumulated data from Global Drifter Program buoys providing ocean SST, atmospheric pressure, winds, and other ocean and atmospheric variables.	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
147	CPO	Global Tropical Moored Buoy Array	Accumulated data from moorings in the Tropical Atlantic (PIRATA), Indian Ocean (RAMA), and Pacific (select flux moorings) on ocean temperature, currents, salinity , atm temps, humidity, vector winds, atm radiation, precip, and air-sea fluxes	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	Global Tropical Moored Buoy Array Data Centers (PMEL, India, Brazil, France)		ocean data	Additional research	Sci - Original Data	Single	Public - International	Research	Res - Observations and Data	Climate

148	CPO	Global Tropical Moored Buoy Array	Accumulated data from moorings in the Tropical Atlantic (PIRATA), Indian Ocean (RAMA), and Pacific (select flux moorings) on ocean temperature, currents, salinity , atm temps, humidity, vector winds, atm radiation, precip, and air-sea fluxes	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
149	CPO	Global Tropical Moored Buoy Array	Accumulated data from moorings in the Tropical Atlantic (PIRATA), Indian Ocean (RAMA), and Pacific (select flux moorings) on ocean temperature, currents, salinity , atm temps, humidity, vector winds, atm radiation, precip, and air-sea fluxes	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NODC		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
150	CPO	Sustained Glider lines	Accumulated data from glider deployments in the western Pacific and Southern California Current region on ocean temperature, currents, salinity and other measurements	Climate, ocean, and weather research	NOAA/OAR/Climate Program Office/Climate Observation Division	Scripps Institution of Oceanography		ocean data	Additional research	Sci - Original Data	Single	Academic	Research	Res - Observations and Data	Climate
151	CPO	Sustained Glider lines	Accumulated data from glider deployments in the western Pacific and Southern California Current region on ocean temperature, currents, salinity and other measurements	Climate, weather, and ocean forecasting services	NOAA/OAR/Climate Program Office/Climate Observation Division	NCEP/CPC, EMC, Navy, international forecast centers		Ocean data	Climate, weather, and ocean forecasts	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
152	CPO	Sustained Glider lines	Accumulated data from glider deployments in the western Pacific and Southern California Current region on ocean temperature, currents, salinity and other measurements	Climate, ocean, and atmospheric data stewardship and archival	NOAA/OAR/Climate Program Office/Climate Observation Division	Integrated Ocean Observing System		Ocean data	Not specific	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Cannot Determine	Res - Observations and Data	Climate
153	CPO	Observing System Monitoring Center	Capability to monitor status of the globa ocean observation system and contributions by platform and country	To enhance management of the ocean observing system	NOAA/OAR/Climate Program Office/Climate Observation Division	JCOMM Observations Coordination Group		cannot determine	not specific	Cannot Determine	Single	Public - International	Cannot Determine	Res - Observations and Data	Cannot Determine
154	CPO	JCOMM	Improved standards, best practices, and increased coordination of sustained ocean observing	Improve international coordination and standardization across global ocean observing communities and facilitate data access and product delivery in support of a sustained global ocean observing "system"	Global ocean observing groups of best practice (e.g. Argo, Global Drifter Program, IOCCP, Oceansites, Go-SHIP, GLOSS)	JCOMM Observations Coordination Group		standards, best practices, for ocean observing	Not specific	Tech - Standards, Protocols	Single	Public - International	Cannot Determine	Trans - Extension and Outreach	Oceans
155	CPO	Satellite Validation	Global ocean and Arctic data supported by CPO and OAR are transferred to and used operationally by NESDIS, GHRSST, and other satellite operators and projects	Validation of global satellite sensors and algorithms for weather, ocean, and climate purposes	NOAA/OAR/Climate Program Office/Climate Observation Division	NESDIS, GHRSST		Ocean data	Validation of satellite data	Sci - Original Data	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Observations and Data	Climate
156	CPO	Adopt a Drifter Program drifter datasets and lesson plans	Drifting buoy datasets and lesson plans transitioned to educators for use in the classroom	Intended for public education and outreach	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/Channel Islands National Marine Sanctuary/Education Office		Lesson plans	Education (K-12)	Sci - Interpreted Product	Single	Public - Federal - NOAA (not OAR)	Application - Education, Learning	Trans - Extension and Outreach	Climate
157	CPO	SEAREAD (Scientific Educational Resources and Experience Associated with the Deployment of Argo profiling floats in the South Pacific Ocean)	Teaching resources that use data gathered by the Argo program. Modules developed to date are: (1) What is Weather for lower primary school, (2) What is Climate for upper primary school, and (3) Oceans Rising a unit on sea level for lower secondary school. A draft of the fourth unit on Climate Change is presently being circulated.	Provide a teaching resource that compliments the current teaching curriculum and demonstrates the value of scientific knowledge through realistic and locally relevant applications. Teach Teachers and Teacher Trainers the fundamental measurements that describe the physical state of the ocean (temperature, salinity, ocean current), and the exchanges between the ocean and atmosphere of heat, water, and momentum	NOAA/OAR/Climate Program Office/Climate Observation Division	National Institute of Water and Atmospheric Research (New Zealand), University of Auckland		curriculum, teaching materials	K-12 education	Sci - Interpreted Product	Single	Public - International	Application - Education, Learning	Trans - Extension and Outreach	Climate

158	CPO	Increased knowledge, improved products and prediction of Arctic sea ice variability and its impacts on weather, climate and ecosystems (Arctic Report Card)	Transition to Ocean Today Kiosk team to produce video	Improve public knowledge and understanding of the state of the Arctic sea ice and connections with lower latitudes.	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA National Ocean Service/Ocean Today Kiosk		Arctic sea ice information	Cannot determine	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Education, Learning	Res - Observations and Data	Coasts
159	CPO	Sea Surface Temperature Analyses for Climate	SST analyses for satellite calibration/validation (GPRA for satellite bias estimates)	This analysis improves understanding of the potential satellite bias error and helps determine where to place drifting buoys to further reduce the error.	NOAA/OAR/Climate Program Office/Climate Observation Division	NOAA/NESDIS/NCDC		Analyses of ocean data	satellite calibration/validation	Sci - Interpreted Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
160	CPO	Enhancing seasonal drought prediction capabilities for the U.S. and globe Using the National Multi model ensemble	Near real time SPI forecasts over the United States	To support operational drought monitoring and outlook at CPC	CPC. R&D	CPC operation		drought forecasts	Cannot determine (How is the forecast applied to a monitoring activity?)	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
161	CPO	North American Land Data Assimilation System (NLDAS) Phase 2	NLDAS forcing generation algorithm, four land surface models (Noah, Mosaic, SAC, VIC), River Routing model housed at EMC, and all NLDAS-related scripts and codes for NLDAS v2.0.3	Provide reliable NLDAS products to US operational applications such as US operational drought monitoring and prediction and weather/climate prediction.	NCEP Environemntal Modeling Center	NCEP Central Operations (NCO)		weather model algorithm	drought monitoring and prediction and weather/climate prediction	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Climate
162	CPO	North American Multi Model Ensembled	Data including semi-operational multi-model climate predictions out to a 9 month lead	Intended to improve operational prediction capabilities.	Multiple partners (Miami, GFDL, NASA, Environment Canada, NCAR); project led by University of Miami	CPC operations		climate predictions	operational climate predictions	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Climate
163	CPO	North American Multi Model Ensembled	30-year hindcast dataset	Intended to improve operational prediction capabilities.	Multiple partners (Miami, GFDL, NASA, Environment Canada, NCAR); project led by University of Miami	CPC operations		climate hindcasts	operational climate predictions	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Climate
164	CPO	Predictability of Atlantic Hurricane Activity by the NMME Coupled Models	Weekly global tropical storm activity prediction for Week 1 through Week 4 based on the operational CFSv2 45-day forecasts	To support CPC's Global Tropical Hazards Outlook	CPC	CPC		weather prediction	CPC's Global Tropical Hazards Outlook	Sci - Sythesized Product	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
165	CPO	Towards improving convection parameterization and the MJO in next-generation climate models	Revised parameterizations of convection in the NOAA/GFDL global model HiRAM and the NASA global model GEOS5	To provide better simulation of the Madden-Julian Oscillation - a key mode of tropical weather and climate variability	CIRES/Univ. of Colorado and NOAA/ESRL PSD	NOAA GFDL, NASA GSFC		Revised parameterizations of global model	Additional research	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Research	Trans - Technology Transfer	Climate
166	CPO	NOAA Environmental Software Infrastructure and Interoperability (NESII)	New release of OpenClimateGIS v0.08b	This OpenClimateGIS release includes another suite of core capabilities necessary for a public, non-beta release. Specifically, the ability to use seasonal time aggregations for calculations has been added. This expands the standard set of climatological summary capabilities.	NOAA Environmental Software Infrastructure and Interoperability (NESII) Group	OpenClimateGIS users (To be completed)		Software update	Not specific	Tech - System, Service	Infinite	Cannot Determine	Cannot Determine	Trans - Technology Transfer	Climate

167	CPO	NOAA Environmental Software Infrastructure and Interoperability (NESII)	New release of ES-DOC's Common Information Model (CIM) Questionnaire version 0.11.0.0	This release represents a major refactoring of the CIM Questionnaire code. This includes the addition of a unit testing framework and simplification of the underlying class structure. These two changes have improved the code robustness and significantly reduced the number of memory leaks that were causing server instability. The code refactoring also allows users to save partially-completed documents, a major improvement in the user experience since many CIM documents take more than one session to complete. Additionally, projects now have an index page where their documents are listed for easier access.	NOAA Environmental Software Infrastructure and Interoperability (NESII) Group	ES-DOC's Common Information Model (CIM) Questionnaire users (to be completed).		Model code update	Not specific	Tech - Model, Algorithm	Infinite	Cannot Determine	Cannot Determine	Trans - Technology Transfer	Climate
168	CPO	NOAA Environmental Software Infrastructure and Interoperability (NESII)	New release of Earth System Modeling Framework (ESMF) - ESMF v6.3.0rp1	In ESMF v6.3.0rp1 the ESMF Python interface (ESMPy) has been integrated with the ESMF source distribution. Users interested in ESMPy no longer need to deal with two separate packages. ESMPy is still considerd in beta phase and the build and installation process has been kept separate from the ESMF build in this release. Also in this release, the ESMF regridding utilities were extended as a result of user feedback to offer destination fraction normalization for the conservative interpolation scheme in addition to the regular destination area normalization. Finally the portability of the library was enhanced in several areas: ESMF can now be built with native support for the Intel MIC architecture, the Apple Clang/LLVM C++ compiler is supported on both Linux and Darwin, and ESMF's dependency on the NetCDF C++ interface has been removed to reduce the number of build dependencies.	NOAA Environmental Software Infrastructure and Interoperability (NESII) Group	ESMF users (to be completed). This list includes: NCEP/EMC; ESRL/GSD		Model code update	Not specific	Tech - Model, Algorithm	Several	Public - Federal - NOAA (not OAR)	Cannot Determine	Trans - Technology Transfer	Climate
169	CPO	Analysis of CMIP5 model output for North American Projections	Publications detailing research results.	Informing the IPCC report	MAPP-funded Pis	IPCC WG1		research report	IPCC climate assessment	Sci - Interpreted Product	Single	Public - International	Application - Environmental Intelligence	Res - Studies and Assessments	Climate
170	CPO	Changes in Intraseasonal to Interannual Variability of the Pan American Monsoons Under a Warmer Climate and Their Impacts on Extreme Events as Assessed by the CMIP5 Models and Observations	summer drought early warning indicator for US southern Plains	support state agencies, river authorities and stakeholders for water resource planning	Jackson School of Geosciences, University of Texas at Austin	Texas Water Development Board		drought prediction	water resource planning	Sci - Sythesized Product	Single	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Dev - Predictions and Projections	Climate

171	CPO	Development of an Extended Long-range Precipitation Prediction System over the Pacific Islands	Seasonal prediction of precipitation	Practical applications	IPRC, University of Hawaii	Government policy and regulations, resource management, public education and outreach. Products are also shared with ENSO Application Center, University of Hawaii.		weather prediction	Not specific	Sci - Sythesized Product	Infinite	Cannot Determine	Cannot Determine	Dev - Predictions and Projections	Climate
172	CPO	Enhancing operational drought monitoring and prediction results through synthesis of N-LDAS and CPPA research results	Princeton CFSv2 hydrologic and drought forecasting system to NCEP's Environmental Modeling Center and Climate Test Bed. The products support CPC's drought briefing activities (by Kingtse Mo). CFSv2 downscaling algorithm, one land surface model (VIC) and all related scripts and codes for NLDAS v2.0.3	Provide an experimental drought forecasting and hydrologic forecasting system that extends the NLDAS monitoring system at EMC to enable NCEP/EMC to assess the products for US operational drought monitoring and prediction and weather/climate prediction.	Princeton University	NCEP Environmental Modeling Center, Climate Test Bed (CTB)		hydrologic and drought model and code	operational drought monitoring and prediction and weather/climate prediction	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Climate
173	CPO	Enhancing operational drought monitoring and prediction results through synthesis of N-LDAS and CPPA research results, and A US National Multi-Model Ensemble ISI Prediction System	Princeton's African Flood and Drought Monitoring and Forecasting System to AGRHYMET (a regional center in Niamey, Niger). Transitioned was VIC-based drought monitor, GFS-based short term weather forecast products, NMME-based seasonal SPI and seasonal temperature forecast products. Information includes all related in-situ and remote sensing products for monitoring floods and droughts, including relevant scripts.	Provide an experimental flood and drought monitoring and forecasting system so AGRHYMET can provide regional guidance related to water and food security for west African countries.	Princeton University	AGRHYMET a NGO located in Niamey, Niger. The work was requested by UNESCO, without providing funds.		Princeton's African Flood and Drought Monitoring and Forecasting System	regional guidance related to water and food security for west African countries	Tech - System, Service	Single	Public - International	Application - Environmental Intelligence	Trans - Technology Transfer	Climate
174	CPO	U.S Drought Monitor	A weekly map of drought conditions that is producted jointly by NOAA, the U.S. Department of Agriculture, and the National Drought Mitigation Center (NDMC) at the University of Nebraska-Lincoln. The U.S. Drought Monitor website is hosted and maintained by the NDMC.	The USDA's Farm Service Agency used the U.S. Drought Monitor to distribute an estimated $1.64 billion from 2008 to 2011 through the Livestock Assistance Grant Program; and additional funds through the Non-Fat Dry Milk Program in 2003 and 2004. The Internal Revenue Service also used the U.S. Drought Monitor to determine the replacement period for livestock sold because of drought. As part of its response to the drought of 2012, the USDA streamlined the process for secretarial disaster declarations, making declarations nearly automatic for a country shown in severe drought on the U.S. Drought monitor for eight consecutive weeks.	University of Nebraska, Lincoln (with NOAA and USDA partners)	USDA Farm Services Agency; IRS		Geographic information - hydrology	to determine the replacement period for livestock sold because of drought	Sci - Sythesized Product	Several	Public - Federal (not NOAA)	Application - Resource Management	Res - Observations and Data	Climate
175	CPO	National Drought REsilience Partnership concept	A structured partnership design, crafted by NIDIS, based on years of research on early warning and drought risk reduction, to the executive team crafting the President's Climate Action Plan. The idea was adopted by CEQ in June 2013. It was announced by the President at a Feb. 20, 2014, White House meeting with the Western Governors, and in the President's statement following the signing of the public law authorizing NIDIS.	To build within the federal family a strucutred partnership for building from the foundation of early warning capacity to address coordinated planning and preparedness.	NOAA/NIDIS	CEQ/USDA		"structured partnership design"	coordinated planning and preparedness (among federal agencies)	Tech - Standards, Protocols	Single	Public - Federal (not NOAA)	Application - Policy, Legislation, Law	Trans - Extension and Outreach	Climate

176	CPO	Sea Level Rise Tool for Sandy Recovery	Future flood elevations integrating sea level rise scenarios (OAR CPO and the Consortium for Climate Risk in the Urban Northeast - CCRUN - NE RISA) with FEMA flood elevations were provided to NOS to create interactive maps of future flood zones in the NOAA Geoplatform	The flood maps, part of the Sea Level Rise Tool for Sandy Recovery, supported Hurriance Sandy Recovery. Specifically, the flood risk information supported 16 local laws in NYC, the implementation of Community Development Block Grants, designs for a multi-purpose levee, beach, dune and wetland restoration, updates to NYC's Natural Hazard Mitigation Plan, and ConEd's rate case testimony	OAR CPO CSI (global sea level rise scenarios) and CCRUN RISA (NYC sea level rise scenarios)	NOS, USGCRP, and NYC		Flood elevation predictions	interactive maps of future flood zones in the NOAA Geoplatform	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Emergency Management	Dev - Predictions and Projections	Coasts
177	CPO	State of Louisiana Hazard Mitigation Plan	Chapters on sea level rise and climate variability and change for the State of Louisiana Hazard Mitigation Plan	FEMA requires each state to update their Hazard Mitigation Plans every three years in order to receive funding in case of a disaster.	OAR CPO CSI funded Souther Climate Impacts Planning Program	Louisiana State University		research report	Hazard Mitigation Plans	Sci - Interpreted Product	Single	Academic	Application - Resource Management	Res - Studies and Assessments	Cannot Determine
178	CPO	Drought Planning with Tribal Communities in the Four Corners	First ever drought impacts report in the Quarterly Hopi Drought Status Report for the January-March 2014 time period	Accurately capture drought impacts in the Four Corners area among tribal communities. Observation networks related to drought are sparse. Impacts reporting can help NIDIS and federal partners better understand and aid response for drought in the Four Corners	OAR CPO CSI funded Climate Assessment in the Southwest	Hopi DNR, University of Arizona		drought impacts report	drought response	Sci - Interpreted Product	Several	Public - State/Local/Tribal	Application - Resource Management	Res - Studies and Assessments	Climate
179	CPO	Projecting Climate Change Mitigation and Adaptation in Fire-Prone Forests Under Future Climate Change	Maps depicting the influence of fuels treatments and climate change on wildfire to feed into the Sierra Nevada Forest Plan revision currently underway	Sierra Nevada forest management plan. This plan is the first attempt to directly incorporate climate change into forest management plans by the Forest Service, and will serve as a template for similar processes to be launched in other Forest Service regions around the western US.	OAR CPO CSI funded Califiornia-Nevada Applications Program (CNAP)	Scripps Institution of Oceanography, UC Merced, Desert Research Institute, and US Forest Service		wildfire information (mapped)	forest management, US Forest Service	Sci - Sythesized Product	Several	Academic	Application - Resource Management	Dev - Predictions and Projections	Climate
180	CPO	Climate and water use efficiency in agriculture	soil moisture sensing system coupled with variable rate irrigation (VRI) enabled center pivots	To prepare for and mitigate the impacts of drought. The University of Georgia Smart Sensor Array (UGA SSA) soil moisture sensing system coupled with variable rate irrigation (VRI) enabled center pivots was adopted by the Flint River Soil & Water Conservation District as the technological solution for automated irrigation scheduling in the Lower Flint River Basin.	OAR CPO CSI funded Southeast Climate Consortium (SECC)	University of Georgia		soil moisture sensing system	automated irrigation scheduling in the Lower Flint River Basin	Tech - System, Service	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Technology Transfer	Climate
181	OER	Collaborative Telepresence-Enabled Exploration Methods	Five years of concentrated research, development, and testing led to development of protocols, tools, and processes to support telepresence enabled exploration. Capabilities provide framework for increasing pace and efficiency for interdisciplinary expeditions conducted via telepresence.	To increase efficiency of operations on other platforms; gain partner support to refine existing and develop new tools for telepresence-enabled exploration.	OER	IFREMER	2013	protocols, tools, and processes to support telepresence enabled exploration	Additional research	Tech - Standards, Protocols	Single	Public - International	Research	Dev - Emerging Technologies	Oceans

182	OER	End-to-End ocean data management system	OER's end-to-end data management system on Okeanos Explorer ensures data is cataloged, documented, and stored ready for archive. This includes protocols, a virtual dashboard to check data disposition. Components of OER's data management system were adapted by E/V Nautilus to ensure data integrity and usability, and speed in which data gets to NOAA's archives.	E/V Nautilus is operated by the Ocean Exploration Trust. Nautilus utilizes some of the same sonars as Okeanos Explorer and is committed to ensuring public access to data. Installation of components of OERs data management system and provision of protocols are allowing Nautilus data managers to quickly document, transfer, and make publicly accessible sonar data from its expeditions, increasing the amount of publicly available data.	OER	OET	2014	data management system	Additional research	Tech - System, Service	Single	Private - Not For Profit	Research	Trans - Technology Transfer	Oceans
183	OER	End-to-End ocean data management methods and tools	OER's end-to-end data management system on Okeanos Explorer ensures data is cataloged, documented, and stored ready for archive. This includes a virtual dashboard to check data disposition. Components of OER's data management system including dashboard and transfer protocols were installed on R/V Falkor	R/V Falkor is operated by the Schmidt Ocean Institute. Falkor utilizes some of the same sonars as Okeanos Explorer and is committed to ensuring public access to data. Installation of components of OERs data management system (e.g., dashboard) and provision of protocols allowed Falkor to quickly document, visualize, transfer, and make publicly accessible data from its expeditions, increasing the amount of publicly available data.	OER	SOI	2013	data management system	Additional research	Tech - System, Service	Single	Academic	Research	Trans - Technology Transfer	Oceans
184	OER	Baseline characterization of Deep Gulf of Mexico	OER on Okeanos Explorer collects baseline data on deep water ecosystems. Data includes video, characterizations, and sensor data of deepwater species, habitats, processes, and features.	All data was transitioned to operational use by scientists and managers in the Gulf of Mexico. Data contributed to management decisions by the fisheries management council, and was provided to multiple groups within NOAA, BOEM and BSEE. Data improved efficiency and accuracy of follow-on research and sampling expeditions conducted by multiple academic cruises. Data transition reduced the time spent on searching for optimal sampling locations so additional sampling could be done to increase data quality and quantity by external scientists.	OER	GMFMC BOEM Duke Marine Lab Temple University FSU	2012. 2014.	ocean data	fisheries management	Sci - Original Data	Several	Public - State/Local/Tribal	Application - Resource Management	Res - Observations and Data	Oceans
185	OER	ACUMEN	Several years and multiple ships worth of deepwater bathymetry, backscatter, water column, and video data from Cape Hatteras to the Canadian EEZ in previously undocumented US Atlantic Canyons.	Data was used to inform mid-Atlantic states coastal resilience plans, support fisheries management councils, and provide base data for follow-on research	OER	MARCO States, Fisheries Councils, VA Sea Grant	2013	ocean data	fisheries management, coastal resilience plans	Sci - Original Data	Several	Public - State/Local/Tribal	Application - Resource Management	Res - Observations and Data	Oceans

186	OER	Water Column Gas Seep Detection Methodology	Over two years OER invested in collecting data and manually identifying gaseous seeps from acoustic multibeam water-column backscatter data using commercial software FMMidwater, developed by QPS. Inc. The data was used to identify hundreds of previously undetected gas seeps along the US Atlantic Margin and in the Gulf of Mexico. Manual detection methods using for seep detection are very time consuming and can be subjective between data-processors, who often have varying levels of experience processing water-column backscatter.	OER communicated with QPS, Inc. regarding data-processing difficulties and inconsistencies. QPS, Inc. used this to inform the development of a new automated tool for gaseous seep detection in water-column backscatter. QPS built the tool using an algorithm developed by UNH CCOM partner, Dr. Tom Weber using data he collected aboard an OER expedition. Data collected by OER were used to test and improve the new the tool's capacities. QPS, Inc. now packages the tool in their commercial software, allowing for increased the accuracy and rate of seep identification over manual identification. The tool will be used by Okeanos Explorer Program in the future to increase the rate of ocean water-column exploration.	OER	QPS	2014	Ocean data	test and improve new tool's capacities	Sci - Original Data	Single	Private - For Profit	Application - Commerce	Res - Observations and Data	Coasts
187	OER	Ocean Exploration Film Making	Multiple years of high definition video collected by OER on Okeanos Explorer.	Video was provided to producers for development of documentary films to improve outreach to the public and create a public informed on ocean issues.	OER	Greenfire Productions	2013	data (video)	K-12 education	Sci - Original Data	Single	Private - For Profit	Application - Education, Learning	Res - Observations and Data	Coasts
188	OER	Collaborative Telepresence-Enabled Exploration Methods	Five years of concentrated research, development, and testing led to development of protocols, tools, and processes to support telepresence enabled exploration. Capabilities provide framework for increasing pace and efficiency for interdisciplinary expeditions conducted via telepresence.	Nautilus adopted OER standard, protocols, tools, and documentation to increase efficiency and productivity of telepresence-enabled explorations	OER	Ocean Exploration Trust	2014	protocols, tools, and processes to support telepresence enabled exploration	Additional research	Tech - Standards, Protocols	Single	Private - Not For Profit	Research	Trans - Technology Transfer	Coasts
189	OER	Deepwater Bathymetry of Hudson Canyon for Tsunami Modelling	Two years of deepwater multibeam bottom bathymetry and backscatter in areas of Hudson Canyon by Ocean Exploration and Research on Okeanos Explorer.	Data was provided to OAR National Center for Tsunami Research to validate models of non-seismic tsunami genesis. Modeling is supporting National Tsunami Warning Center with improving tsunami warning system.	OER	OAR NCTR	2013	ocean data	validate tsunami models	Sci - Original Data	Single	Public - Federal - OAR	Application - Environmental Intelligence	Res - Observations and Data	Weather
190	OER	Deepwater bathymetry and ROV observational data of Mid-Cayman Rise	Multibeam bottom bathymetry and backscatter of priority areas of the Mid-Cayman Rise, and ROV observational data of Mount Dent and the Cayman Trough acquired by Okeanos Explorer.	Data was provided to scientists at WHOI, University of Southampton, University of Wyoming, and other locations (including the public domain). Data supported more effective and efficient follow-on research and sampling operations.	OER	WHOI University of Southampton	2011-2013	ocean data	Additional research	Sci - Original Data	Several	Academic	Research	Res - Observations and Data	Coasts
191	OER	Deepwater Canyon Bathymetry off-shore of New York State	Two years of gridded multibeam bathymetry of Toms Canyon off New York and surrounding areas.	Data was provided to the New York Department of State Office of Planning & Development for integration into an online Geographic Information Gateway story.	OER	NYSDEC	2014	ocean data	community planning	Sci - Original Data	Single	Public - State/Local/Tribal	Application - Environmental Intelligence	Res - Observations and Data	Coasts
192	OER	Deep Discoverer ROV System	Several years of R&D with OER, commercial business and universities led to development of OER's ROV Deep Discoverer (D2). D2 is a fully-integrated two body ROV system capable of characterizing the ocean to 6000m depth, providing high definition video and sensor data. D2 is the only ROV system integrated into a NOAA vessel, Okeanos Explorer.	D2 was developed to provide science and management communities access to 90% of the world ocean, especially deep water areas never before visited and documented. Operationalizing D2 increases the pace and efficiency of characterizing the mostly unknown ocean and providing critical information to scientists and resource managers.	OER	OER	2013	ROV	Additional research	Tech - System, Service	Single	Public - Federal - OAR	Research	Trans - Technology Transfer	Coasts

193	OER	Educator Professional Development Workshops	Two-day professional development for MS and HS educators conveying NOAA science on exploration strategies and discoveries of the NOAA Ship Okeanos Explorer	Educators understand why ocean exploration is important and how it is conducted onboard the NOAA Ship Okeanos Explorer and through telepresence. They are then equipped with skills and resources to take back into classrooms to engage students. Logic Model is available at [to be inserted].	NOAA OER Education, HQ	13 Education Alliance Partners nationwide	2013	teacher training	K-12 education	Sci - Interpreted Product	Several	Academic	Application - Education, Learning	Trans - Extension and Outreach	Coasts
194	OER	Deep-sea Discoveries in the Atlantic onboard the NOAA Ship Okeanos Explorer: An Online Workshop to Advance Transatlantic Ocean Science Literacy	The exploration science and discoveries of the North Atlantic Canyons Expeditions onboard the NOAA Ship Okeanos Explorer, the education products developed for these missions, and international conversations about transatlantic ocean literacy based on the science/exploration content shared.	Use of NOAA exploration science in the formal and informal education settings at the international level; advancing the conversation about transatlantic ocean literacy at the international level.	NOAA OER Education, HQ	The College of Exploration Website, http://www.coexploration.org/oe2014/	2014	curriculum, teaching materials	K-12 education	Sci - Interpreted Product	Single	Academic	Application - Education, Learning	Trans - Extension and Outreach	Coasts
195	OER	Expedition Education Modules	Expedition Education Modules reside on the Ocean Explorer or Okeanos Explorer websites as education units and convey the science of OER's expeditions to educators and others interested in education materials related to each mission.	Engaging educators and students in the science and activities of each expedition. Serves to enhance ocean science literacy. Web Team gathers statistics for web sites.	NOAA OER Education, HQ	OER Web Team	2013	curriculum	K-12 education	Sci - Interpreted Product	Single	Public - Federal - OAR	Application - Education, Learning	Trans - Extension and Outreach	Oceans
196	OER	NOAA Ship Okeanos Explorer Education Materials Collection: Why Do We Explore? (Vol. 1) and How Do We Explore? (Vol. 2)	Science content on why we should explore the ocean with a focus on four areas (climate change, ocean health, human health, and energy) was translated into activities appropriate for MS and HS classroom use (Vol. 1). Activities were also developed to convey the unique assets and capabilities of the NOAA Ship Okeanos Explorer as well as NOAA's exploration strategy to formal and informal educators (Vol. 2). The two Volumes together are used in a two-day professional development offering for educators to convey NOAA's leadership in ocean exploration for the Nation.	An understanding of why ocean exploration is important, how it is done and NOAA's leadership role in it.	NOAA OER Education, HQ	13 Education Alliance Partners nationwide	2013	teaching materials	K-12 education	Sci - Interpreted Product	Several	Academic	Application - Education, Learning	Trans - Extension and Outreach	Coasts
197	OER	Ocean Sampling Day Education Video and Website	Science content about OSD and NOAA's role in it.	Public awareness of OSD and the importance of microbial biodiversity in the global ocean.	NOAA OER Education, HQ	Ocean Explorer Website (http://oceanexplorer.noaa.gov/ocean-sampling-day/welcome.html), NOAA Education Website	2014	Adverstising	K-12 education	Sci - Interpreted Product	Single	Public - Federal - OAR	Application - Education, Learning	Trans - Extension and Outreach	Coasts
198	OER	USNA/OER Exploration Professional Development	USNA STEM Robotics content is blended with OER Exploration science content into a day-long professional development for MS and HS educators	An understanding of how robotics are used in ocean exploration	NOAA OER Education, HQ	USNA	2013	Education materials	Science eduction (K-12)	Sci - Interpreted Product	Single	Public - Federal (not NOAA)	Application - Education, Learning	Trans - Extension and Outreach	Coasts

199	OER	Cooperative Research and Development Agreement between NOAA and Boeing	Use of large AUV to meet ocean exploration and other NOAA mission requirements. Large AUV's provide endurance, payload and energy capacity to enable sonars such as the EK-60 to be used for bottom characterization and ecosystem resource assessment	Improve ocean bottom characterization through use of acoustic and optical sensors deployed on a robotic vehicle. Use of robotics for NOAA missions could increase observing capacity beyond ship based data collection and improve efficiency.	NOAA OER HQ	NMFS Southwest Fisheries Science Center	2014	ocean data (not the AUV which provided it)	Additional research	Sci - Original Data	Single	Public - Federal - NOAA (not OAR)	Research	Res - Observations and Data	Coasts
200	OER	OER Telepresence	Technology, design and implementation of the new command center in Ifremer Brest resulting from the collaboration between OER and Ifremer	Ability to follow NOAA ocean exploration from a new telepresence command center located in Brest France	OER	Ifremer Brest Science Center	2013	command center technology, design	Not specific	Tech - Standards, Protocols	Single	Public - International	Cannot Determine	Trans - Technology Transfer	Coasts
201	OER	Office of Naval Research Unmanned science and technology demonstration	ONR unmanned underwater technology (platforms, sensors and processing) for NOAA needs	The event (2015) will provide NOAA with the opportunity to evaluate ONR unmanned underwater technology (platforms, sensors and processing) for NOAA needs (bottom mapping and bottom characterization, AUV CONOPS, data processing and automated target recognition, multi-vehicle operations, etc.)	Office of Naval Research	OER and other NOAA offices	2015	knowlege of how to use the technolgy (through demonstration)	Not specific	Sci - Tacit Expertise	Several	Public - Federal - OAR	Cannot Determine	Trans - Technology Transfer	Cannot Determine
202	OWAQ	Joint Hurricane Testbed	Improving the operational TC models at NOAA/NCEP and Navy/FNMOC"	Upgrade operational GFDL and GFDN models for the 2012 and 2013 seasons, and additional enhancements for the operational implementations at NCEP and FNMOC for the 2014 hurricane/typhoon/tropical cyclone seasons (to improve operational forecasting guidance)	NOAA/GFDL & University of Rhode Island	NWS/NCEP/NHC	2013	hurricane model code	operational forecasting guidance	Tech - Model, Algorithm	Single	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Trans - Technology Transfer	Weather
203	OWAQ	HMT-West QPF Grids for Verification (USWRP-funded))	Grids of the Experimental Regional Ensemble Forecast System (ExREF) were reformatted and made available to the NWS Sacramento (SAC) weather forecast office and the California Nevada River Forecast Center for verification in the NWS GFE environment in AWIPS I and AWIPS II using the BOI Verify software.	Evaluate the ExREF precipitation forecasts in an environment where other model forecasts could be overlaid and evaluated simultaneously at the same resolution.	NOAA/ESRL/PSD	NWS STO and NWS CNRFC	2014	Weather information (synthesized from data)	validation of weather forecasts	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
204	OWAQ	Global reforecast data set and experimental products (USWRP-funded)	Retrospective forecasts using 2012 version of NCEP GEFS system, 11 members/day every day from 1985-current. Also post-processed precipitation forecast guidance based on the ensembles.	Intended to support various post-processing activities in the NWS, including for hydrologic applications at OHD, for 6-10 day and week +2 forecasts at CPC, for hydrologic forecasts at WPC, tornado probabilities (SPC), and for testing of post-processing methodologies at MDL	NOAA/ESRL/PSD	CPC, OHD, MDL, WPC, EMC	2014	Retrospective weather forecasts	various post-processing activities in the NWS, including for hydrologic applications at OHD	Sci - Sythesized Product	Several	Public - Federal - NOAA (not OAR)	Application - Environmental Intelligence	Dev - Predictions and Projections	Weather
205	SG	New policy instrument helps reform Florida's boating and anchoring law.	New policy model	Five coastal communities adopt new model anchoring and mooring ordinances developed by Florida Sea Grant legal specialists.	Florida Sea Grant legal specialists at the University of Florida's law school	Florida Fish and Wildlife Conservation Commission and the governments of 5 local communities (St. Augustine, St. Petersburg, Sarasota, Key West, and Stuart)	2013	best practices, policy	anchoring and mooring ordinances	Tech - Standards, Protocols	Several	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Trans - Extension and Outreach	Coasts
206	SG	Innovative mapping tool helps manage Florida's waterfronts and waterways.	Mapping tool and decision-making framework	New mapping tool and decision-making framework help Charlotte County amend comprehensive planning language to prioritize future waterfronts and waterways planning.	Florida Sea Grant extension specialists	Charlotte County, Board of County Commissioners	2013	"mapping tool"	community planning	Tech - Model, Algorithm	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Technology Transfer	Coasts

207	SG	Best management practices for natural debris removal are used by the US Fish and Wildlife Service to protect habitat critical to the endangered Gulf sturgeon.	Best management practices for natural woody debris removal	Best management practices for natural woody debris removal are used by the U.S. Fish and Wildlife Service to protect riverine ecosystems critical to the endangered Gulf sturgeon.	Florida Sea Grant's legal experts	US Fish and Wildlife Service	2013	Best practices - environmental management	Protect riverine ecosystems	Tech - Standards, Protocols	Single	Public - Federal (not NOAA)	Application - Resource Management	Trans - Extension and Outreach	Coasts
208	SG	Coastal Communities Use Sophisticated Modeling to Help Planners Anticipate the Effects of Climate Change	sophisticated modeling to help planners anticipate the effects of climate change.	The cites of Brunswick and Garden City, along with Chatham County, now use storm surge models that incorporate climate change considerations when they plan for future development and infrastructure.	Georgia Sea Grant Marine Extension	Cities of Brunswick, Garden City, and Chatham County	2013	climate model	plan for future development and infrastructure.	Tech - Model, Algorithm	Several	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Trans - Technology Transfer	Coasts
209	SG	Tybee Island Takes Prompt Action to Implement Sea Level Rise Adaptation Plan	The Tybee Island Sea Level Rise Adaptation Plan	Created through the NOAA Sea Grant's Coastal Community Adaptation Initiative, the Tybee Island Sea Level Rise Adaptation Plan led to significant adaptive actions by the City of Tybee Island: 1) raising the pump stations for city wells; 2) retro-fitting stormwater tide gates on the south end of the island to prevent the inundation of infrastructure during high tides; and 3) opening discussions with the Georgia Department of Transportation and Chatham County to include sea level rise projections in plans to improve the US Hwy 80 causeway, along with steps to improve their Community Rating System score.	Georgia Sea Grant	City of Tybee Island	2013	management plan	community planning	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts
210	SG	Coastal Governments Use New Ordinances and BMPs to Address Flood Threats	Educational workshop, best management practices and ordinances to avoid costly effects of flooding.	Georgia Sea Grant and Marine Extension organized an educational workshop for communities to develop best management practices and ordinances to minimize costly local effects of flooding. The cities of Bloomingdale, Brunswick, Darien and Pembroke updated their floodplain damage prevention ordinances and adopted BMPs to reduce flood damage.	Georgia Sea Grant Marine Extension	Cities of Bloomingdale, Brunswick, Darien and Pembroke.	2013	best practices, policy	updated floodplain damage prevention ordinances	Tech - Standards, Protocols	Several	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Trans - Extension and Outreach	Coasts
211	SG	Hawaii Sea Grant increased community capacity on hazard preparedness in the Sea Grant network and Pacific region	Homeowner's Handbook to Prepare for Natural Hazards	Hawaii Sea Grant supported hazard resilience efforts in communities throughout the state, Sea Grant network, and Pacific region through its homeowner's handbook publication. Two other Sea Grant programs produced their own versions of the handbook based on the Hawaii Sea Grant publication.	Hawaii Sea Grant	Hawaiian communities	2013	Handbook	hazard resilience efforts in communities	Tech - Standards, Protocols	Infinite	Public - State/Local/Tribal	Application - Emergency Management	Trans - Extension and Outreach	Coasts

212	SG	Hawaii Sea Grant participated in the development of a University of Hawaii system-wide Sustainability Policy	System-wide sustainability Policy	Hawaii Sea Grant participated in a University of Hawaii system-wide sustainability summit in Spring of 2013 that led to the development of a system-wide sustainability strategy for the University of Hawaii. The sustainability strategy was later adopted into policy in early 2014 and committed the University of Hawaii to work with the stakeholders in the state to support and implement sustainability best practices.	Hawaii Sea Grant	University of Hawaii system, Board of Regents, and Chancellors	2013	"participation" in a summit, which led to a strategy, which led to a policy	University Policy	Cannot Determine	Single	Academic	Application - Education, Learning	Trans - Extension and Outreach	Coasts
213	SG	Diver's Awareness Campaign-Vessel Encroachment Prevention	spor buoys.	LSG promoted a responsible mariner practices educational plan geared toward both dive vessels and fishermen. The effort included dive awareness brochures, posters and decals designed by LSG Communications, as well as outreach efforts reaching nearly 400 fishermen at the Louisiana Fisheries Summit and Delcambre Dock Days. Oilfield support firms and diving companies implemented mariner safety communication methods in their weekly safety drills. LSG has also promoted the use of spor buoys which are now implemented in the diving industry to show the location where divers are submerged.	Louisiana Sea Grant	Oilfield support firms, diving companies	2013	brochures, posters and decals, outreach efforts	mariner safety awreness in fish and oil industries	Tech - Standards, Protocols	Infinite	Private - For Profit	Application - Emergency Management	Trans - Extension and Outreach	Coasts
214	SG	Mapping Louisiana's Coastal Cemeteries facilitates restoration following Hurricane Isaac	Geospatial cemetery data collected by LSG	Geospatial data collected by LA Sea Grant for the Coastal Cemetary Project was used in the restoration efforts of two cemeteries in Plaquemines parish. Having the full perimeter points allowed for the boundaries of the cemetery to be shown, being of great value in the restoration and re-interment of graves.	Louisiana Sea Grant	Louisiana Department of Health and Hospitals Disaster Mortuary Response Team	2013	geospatial data	cemetary restoration	Sci - Original Data	Single	Public - State/Local/Tribal	Application - Resource Management	Res - Observations and Data	Coasts
215	SG	Community Resilience Index improves preparedness of coastal municipalities in Mississippi, Alabama	Community Resilience Index	At least 10 municipalities across the Gulf of Mexico region have increased their resilience to natural hazards as a result of participation in the Community Resilience Index.	MASGC	Foley, Alabama	2013	resilience index	community planning	Tech - Standards, Protocols	Single	Public - State/Local/Tribal	Application - Emergency Management	Trans - Extension and Outreach	Coasts
216	SG	Biloxi adopts new regulation to become more resilient to storms, flooding and sea-level rise.	A plan to share climate information and risks with the public and city officials to increase awareness of these risks.	The formation of a climate team, facilitated by MASGC, for the City of Biloxi, resulted in three city actions that have reduced the risk of sea-level rise and storms to its citizens (Flood Damage Prevention Ordinance, Stormwater Management Ordinance, updated hazard mitigation plan)	MASGC climate team	City of Biloxi	2013	management plan	community planning	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Trans - Extension and Outreach	Coasts
217	SG	Forecasting Effects of Nutrient Loading, Changing Land Use, and Changing Climate on Coastal Lagoons of the Delmarva Peninsula	Web-based model for managers to use that shows nitrogen amounts in coastal lagoons in the Delmarva Peninsula.	MD Sea Grant researchers have developed a web-based model for managers to use that shows nitrogen amounts in coastal lagoons in the Delmarva Peninsula. The model can be used to predict changes in	University of Maryland Center for Environmental Science Chesapeake Biological Laboratory, VA Institute of Marine Science	Chesapeake Bay Program's Submerged Aquatic Vegetation Work Group	2013	web-based infromation tool	coastal management	Tech - System, Service	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts

218	SG	Volunteer Training and Green Jobs Programs Install Stormwater Management Practices State-wide	Volunteer training and green jobs programs that resulted in installation of nearly 800,000 square feet of “rainscaping,” or green design projects.	Maryland Sea Grant Extension Program (MDSGEP) specialists supported volunteer training and green jobs programs in Maryland. This resulted in the installation of nearly 800,000 square feet of “rainscaping,” or green design projects. The projects provided summer jobs for 44 students, included 9700 hours of work by volunteers (valued at over $200,000), and helped restore local water quality.	Maryland Sea Grant Extension Specialists through the Watershed Stewards Academies and the Restore the Environment and Developing Youth (READY)	Maryland's Howard County, Cecil County, and the Eastern Shore	2013	rainscaping knowledge, via volunteer training	rainscaping	Sci - Tacit Expertise	Several	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts
219	SG	Economic Analyses Inform Revised Regulations and New Legislation Governing Commercial Fisheries	Economic analyses that informed new rules about the commercial and recreational fisheries in Maryland that led to changed permit fees and supported the adoption on an Individual Transferable Quota system in the Maryland striped bass fishery.	Maryland Sea Grant Extension’s (MDSGEP) fisheries economics specialist conducted analyses that informed new rules about the commercial and recreational fisheries in Maryland and the striped bass fishery in the Chesapeake Bay. As a result of the first analysis, Maryland changed permit fees for commercial fishermen, which generated more funding for fisheries management. The second analysis provided support for the adoption on an Individual Transferable Quota system in the Maryland striped bass fishery.	Maryland Sea Grant Extension	Maryland Department of Natural Resources	2013	research report	fisheries management	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Resource Management	Res - Studies and Assessments	Oceans
220	SG	Application of FVCOM Inundation System to Other States and Foreign Countries	FVCOM inundation code	The FVCOM inundation code has helped establish a coastal inundation forecast system in other states and foreign countries. The FVCOM model has been adapted by several universities and federal agencies that are appling its use to regional areas and companies in Japan for tsunami’s assessment experiments.	MIT Sea Grant	University of Connecticut (UC), University of Maryland (UM) and also NOAA laboratories in Silver Spring and Great Lakes. Long Island Sound and University of Maryland	2013	model code	tsunami assessment experiments	Tech - Model, Algorithm	Several	Academic	Research	Trans - Technology Transfer	Coasts
221	SG	MIT Sea Grant Technology Spinoff Company, NK Labs, Supports Local Economy	Cell phone Technology	NK Lab recognized a need to support environmental monitoring throught cell phone use. The MIT Sea Grant developed portable technology to expand underwater exploration and data-gathering by citizen scientists. Water quality sensors were designed to be carried by students’ remotely operated underwater vehicles, and waterproof temperature sensors were developed for smartphones. These MIT Sea Grant research and educational projects demonstrated that valuable environmental data can be collected through crowdsourcing and online collaboration. In turn, this portable technology has inspired Google’s creation of an innovative modular smartphone. By empowering individuals to incorporate unique sensors into their own phones and transmit data over a wireless internet connection, MIT Sea Grant created a compelling case for Google’s development of the Project Ara modular phone.	NK Labs	Users in public agencies and private institutions, citizen scientists	2013	Water quality sensors, temperature sensors for smartphones.	to expand underwater exploration and data-gathering by citizen scientists.	Tech - Hardware, Equipment	Infinite	Cannot Determine	Application - Education, Learning	Trans - Technology Transfer	Coasts

222	SG	Extension Specialists Create Tool for Tracking Stormwater Management Practices	Online, interactive tool that allows counties across Maryland to record stormwater management practices that residents have installed on their properties.	Maryland Sea Grant Extension Program (MDSGEP) specialists, in collaboration with Towson University, developed an online, interactive tool that allows counties across Maryland to record stormwater management practices that residents have installed on their properties. These data will help the counties document their progress in taking steps to improve water quality in the Chesapeake Bay.	Maryland Sea Grant Extension specialists and Towson University	County stormwater managers in Maryland	2013	capabilities of "Online, interactive tool"	stormwater management	Tech - System, Service	Infinite	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts
223	SG	Reducing drowning incidents in Puerto Rican beaches through statistics	Analysis of beach drowning statistics by Puerto Rico Sea Grant	The Police Department, The Department of Natural and Environmental Resources and The Interagency Beach Management Board are using beach drowning incidents statistics generated by Puerto Rico Sea Grant to justify the need to improve aquatic safety services in Puerto Rico.	Puerto Rico Sea Grant	PR Police Department, Department of Natural and Environmental Resources, the Interagency Beach Management Board	2013	research report	improve aquatic safety services in Puerto Rico	Sci - Interpreted Product	Several	Public - State/Local/Tribal	Application - Emergency Management	Res - Studies and Assessments	Coasts
224	SG	Research Guides Identification of Strategic Habitat Areas for NC Saltmarsh Fish	North Carolina Sea Grant researchers at NC State University used novel tagging techniques to provide data being used by state resource managers charged with protecting habitats that are strategic to fish production.	Coastal development can threaten North Carolina's saltmarsh habitats. Responses to development are most discernible among the assemblage of smaller fishes and invertebrates that use the marsh platform for foraging and refuge. These species are key in the food web. North Carolina Sea Grant researchers at NC State University used novel tagging techniques to provide data being used by state resource managers charged with protecting habitats that are strategic to fish production.	North Carolina Sea Grant researchers from NC State University	NC Division of Marine Fisheries, Division of Coastal Management	2013	tagging techniques	fisheries management, habitat protection	Sci - Original Data	Single	Public - State/Local/Tribal	Application - Resource Management	Res - Observations and Data	Oceans
225	SG	NC Remote-Sensing Maps Marsh Vulnerability to Sea Level Rise	Model simulations of high and low marsh habitats	A North Carolina Sea Grant-funded graduate fellow mapped low- and high-marsh habitats in the Rachel Carson component of the NC National Estuarine Research Reserve. The results were evaluated relative to vulnerability to sea level rise. Model simulations suggest the reserve will lose a great deal of its salt marsh by 2050. Land managers now have the information at hand during long-term planning efforts. The fellowship reflects a strong, ongoing partnership for NC Sea Grant and NC NERR.	NC Sea Grant and NC NERR	NC land managers	2013	sea level rise information (mapped)	land management	Sci - Sythesized Product	Infinite	Public - State/Local/Tribal	Application - Resource Management	Dev - Predictions and Projections	Coasts
226	SG	N.H. town leaders increase their capacity to adapt to a changing climate with Sea Grant assistance	Targeted assistance to leaders in the community	At least nine coastal communities increased their technical, financial and human resources for adaptation. Digitizing data for maps; participating in vulnerability assessments; contributing to economic analyses; modifying master plan chapters; and identifying protection priorities related to sea level rise, floodplains or flood storage.	NH Sea Grant and the Coastal Adaptation Workgroup	NH Coastal communities	2013	"Targeted assistance"	community planning	Sci - Tacit Expertise	Infinite	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts

227	SG	Reducing Introduction of Aquatic Invasive Species through Educational Pathways	Developed curriculum and created a toolbox of resources on aquatic invasive species education.	Western region and local regional partnerships increased their capacity to reach stakeholders in order to address the school pathway as a source of aquatic species invasions. Education strategies to address the introduction of aquatic invasive species and to prevent future infestations have been developed for both formal and informal education through meetings, publications, provision of new curriculum and additional resource development	USC, Washington, and Oregon Sea Grant Programs	Educators throughout the Pacific Northwest	2013	curriculum	K-12 education	Sci - Interpreted Product	Infinite	Public - State/Local/Tribal	Application - Education, Learning	Trans - Extension and Outreach	Oceans
228	SG	Wisconsin Sea Grant Helps Save Millions in Harbor-Dredged Material Storage Costs	A national summit, follow-up webinar, along with a new booklet “Beneficial Use of Dredged Material in the Great Lakes” on using the dredged material for projects such as beach restoration or mining land reclamation	Wisconsin Sea Grant (WISG) helped save, by a conservative estimate, $125 million in storage costs for harbor-dredged material for Wisconsin and Minnesota ports. WISG’s coastal engineer also shared his knowledge through a national summit and follow-up webinar, along with a new booklet on using the dredged material for projects such as beach restoration or mining land reclamation. This year, he rounded out five years of service as co-chair of the Great Lakes Dredging Team, having successfully mentored successors for that role.	Wisconsin Sea Grant's coastal engineer	Wisconsin Department of Transportation engineers	2013	summit, webinar, booklet	harbor dredging	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts
229	SG	Faster Test for Deadly Fish Virus Ensures Healthier Great Lakes Catch	Two new tests for viral hemorrhagic septicemia in fish	A University of Wisconsin-Madison research team created two tests for viral hemorrhagic septicemia virus (VHSV). Both tests are faster and nonlethal, as opposed to current testing options. The first test reveals infected fish in a place where there hadn’t been infection the past. The second is for a water body that has been affected and managers want to know how susceptible the fish are to future disease, in essence, whether the first outbreak provided antibodies so fish could withstand a future outbreak. Additionally, the scientists found that the virus may continue to circulate even when fish might not be dying off. This is important to communicate to anglers and boaters who need to abide by regulations to prevent the spread of disease even when there is no evidence of active virus. The new research offers evidence that ongoing regulations are necessary to protect valuable fish—giving managers the justification they need for potentially unpopular precautions. Researchers are working with the	University of Wisconsin-Madison Sea Grant	Wisconsin Department of Natural Resources	2013	virus tests	fisheries management	Tech - Standards, Protocols	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Technology Transfer	Oceans

230	SG	Wisconsin Sea Grant Work Leads to Policy Change, $7.5 Million in Infrastructure Cost Savings	Research on freshwater harbor infrastructure corrosion and identification of repair and rehabilitation methods leads to policy change.	Wisconsin Sea Grant support for research and outreach helped solve the mystery of freshwater harbor infrastructure corrosion and to identify viable repair and rehabilitation methods. In 2013 alone, the efforts protected $7.5 million in assets. The work has also spawned policy change. This is updated material from a previous reporting period.	University of Wisconsin-Madison Sea Grant	Duluth-Superior Harbor, other Great Lakes ports	2013	Research report	freshwater harbor infrastructure corrosion	Sci - Interpreted Product	Infinite	Public - State/Local/Tribal	Application - Resource Management	Res - Studies and Assessments	Coasts
231	SG	Connecticut Sea Grant partners on coastal riparian landscaping guide to reduce future salt spray and inundation losses	Homeowners, resource managers, NGOs and beach associations are employing web-based tools developed by Connecticut Sea Grant with University of Connecticut partners to help minimize future coastal landscaping losses caused by salt spray, flooding, and erosion.	Two major storms cost Connecticut coastal residents $1000s in damaged landscaping. Flooding killed plants and shrubs immediately; salt spray traveling up to two miles inland damaged or killed grass, shrubs and trees over ensuing weeks. Absent deeper-rooted riparian buffers, shallow-rooted lawns eroded and septic systems were exposed. With EPA support, Connecticut Sea Grant (CTSG) partnered with UConn's Center for Land Use Education and Research and Department of Plant Science and Landscape Architecture to produce the web-based tool, Coastal Riparian Landscaping Guide for Long Island Sound (http://clear.uconn.edu/crlg/index.html). Twenty landscape layouts and native coastal plant lists are suggested based on exposure, level of protection, and property slope. The layouts, produced by a graduate student, enhance storm protection while maintaining water views and access. Information on riparian corridors and how to prep, plant and maintain sites is provided. A	Connecticut Sea Grant	Connecticut Department of Environmental Protection	2013	web-based infromation tool	coastal management	Tech - System, Service	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts
232	SG	Connecticut Sea Grant research yields modeling tool used to simulate sea level, select dredge sites, manage hypoxia	Connecticut Sea Grant new modeling tool utilized for sea level simulation, dredge disposal site selection, hypoxia management and mapping programs for Long Island Sound.	Rising sea level and increasing coastal development in Long Island Sound (LIS) lead to conflicts between State conservation and habitat restoration goals and, increasing demands to protect coastal infrastructure and property. Quantification of the extent / effects of flooding faced by coastal municipalities is central to improving understanding of challenges faced and need for better planning. Connecticut Sea Grant researchers customized the 3-D FVCOM coastal ocean circulation model (developed by Woods Hole and UMass-Dartmouth) to model LIS circulation influenced by tides, river flows and winds. The FVCOM-LIS model simulated sea level response to storms and bottom water temperature sensitivity to river flow variations. The scientists assessed how effectively the model simulated tides and storm surges compared to actual observations; they also investigated long-term temperature and salinity trends. The model demonstrated that the	Connecticut Sea Grant	Connecticut lawmakers	2013	sea level rise simulations	community planning	Sci - Sythesized Product	Infinite	Public - State/Local/Tribal	Application - Policy, Legislation, Law	Dev - Predictions and Projections	Coasts

233	SG	Land trust completes Phase 1 of Connecticut Sea Grant habitat-based management plan, clears 22 acres of invasive plants	Following a Connecticut Sea Grant habitat-based management plan outlining site-specific restoration priorities, a local land trust removed 22 acres of invasive plants from one of its coastal protected properties, opening up substantial coastal forest understory and doubling the amount of open field habitat.	As municipalities, non-profits, and land trusts acquire and legally protect properties, stewardship and management responsibilities arise. Development pressures, invasive species, climate change, and fragmentation are factors adversely affecting the sustainability of protected lands. Stewards are challenged to identify allowable activities, assess key natural or cultural resources, and determine which management or restoration actions are highest priorities.In 2009, Connecticut Sea Grant partnered with the Connecticut River Coastal Conservation District to prepare a management plan for the Old Lyme Land Trust, using Sea Grant's Habitat-based Management Planning Tool (http://clear.uconn.edu/tools/open_space/index.htm). Written for the Watch Rock Preserve, a trust property abutting the Connecticut River estuary, the plan addressed coastal moist forest, open field, conifer grove, and salt marsh habitats.n 2013, the Land Trust used USDA NRCS funding to	Connecticut Sea Grant	Old Lyme Land Trust		management plan	coastal management	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Resource Management	Trans - Extension and Outreach	Coasts
234	SG	Sea Grant aquaculture research increases yields of farmed oysters	Building off the previous year's impact, the West Coast oyster industry implemented a cross breeding program, increasing the yield of farmed Pacific oysters.	On the U.S. West Coast, shellfish aquaculture is hatchery-dependent and accounts for over 40% (worth $110 million per year) of the national bivalve harvest. Sustainability of the shellfish aquaculture industry will be challenged by competition for alternative uses of coastal regions and by the degradation of coastal and estuarine habitats. Thus, shellfish aquaculture will need to become more efficient, producing more from the same or less area than it now uses. Sea Grant funded scientists and extension staff set out to apply advanced biotechnology to increase the efficiency of aquaculture by increasing the yields of farmed Pacific oysters. The research team employed modern genomic technologies to discover the key genes and biochemical pathways that might serve as novel biomarkers for early detection of superior hybrids. Commercial quantities of "improved" hybrid seeds were distributed to three California farms for assessment of yield. The three California farms	California Sea Grant	Grassy Bar Oyster Company, Hog Island Oyster Company, Taylor Shellfish Company	2013	breeding method	fisheries management	Tech - Standards, Protocols	Several	Private - For Profit	Application - Resource Management	Res - Models and Experiments	Oceans

235	SG	Sea Grant Researchers' Efforts Lead to New Kelp Silage for Abalone Production	To help abalone farmers in California, researchers developed a new silage production method to keep abalone stock fed during times of kelp shortages.	During poor winters and El Nino warming events, California abalone farmers have difficulty harvesting kelp for their stock and experience feed shortages.To optimize the culture of kelp and red algae, the Sea Grant-funded scientists successfully created kelp silage for the first time known to science. Used by the Monterey Abalone Company at a commercial scale to produce more than 50 tons for the past 2 years, this new silage production method allows more efficient seaweed culture methods and allowed the company to maintain abalone farming operations during two consecutive poor winters. The scientists shared the silage production method and feeding results with 2 additional California abalone farms, 3 additional international abalone farms, and 2 firms exploring storage of kelp for biofuel production. It is anticipated that all California abalone farms will utilize this dried kelp as a feed stock sometime during the year. The final implementation will	California Sea Grant	Monterey Abalone Company and other California abalone farms	2013	kelp production method	aquaculture	Tech - Standards, Protocols	Several	Private - For Profit	Application - Commerce	Trans - Technology Transfer	Oceans
236	SG	Vibrio research at UNH leads to formulation of control plans to protect human health and preserve shellfish businesses	N.H. Sea Grant-funded research helped inform Vibrio control plans that increase the awareness of the potential risks from eating raw or undercooked shellfish and the appropriate measures to reduce those risks and protect the New England shellfish industry.	An increasing number of New England shellfish beds are being temporarily closed down due to the presence of pathogenic Vibrios — bacteria that may be present in raw and undercooked shellfish and can lead to gastroenteritis in humans. Changing ecological and climatic conditions may influence the abundance and strain distribution of pathogenic Vibrios in New England shellfish such as oysters.With funding provided by NHSG, researchers identified components of climate change that alter microbial communities in oysters and potentially impact the abundance and distribution of pathogenic Vibrios. Researchers presented this information to the public, shellfish growers and regulators at numerous venues in 2013. These information sessions assisted in the formulation of various Vibrio control plans aimed at protecting human health and preserving shellfish businesses in New England.	New Hampshire Sea Grant	shellfish businesses in New England	2013	information on pathogen	increase the awareness of the potential risks from eating raw or undercooked shellfish and the appropriate measures to reduce those risks	Sci - Interpreted Product	Infinite	Private - For Profit	Application - Environmental Intelligence	Trans - Extension and Outreach	Oceans

237	SG	Approval of shellfish virus indicator based on N.H. Sea Grant research leads to increased aquaculture opportunities	N.H. Sea Grant-funded research on shellfish virus indicators has led to increased employment opportunities for shellfish harvesters. The Interstate Shellfish Sanitation Conference is changing policies for using male-specific coliphage to manage shellfish growing areas and harvesting of shellfish near wastewater treatment plant discharge.	Many acres of shellfish beds remain permanently closed in the Northeastern U.S. due to concerns about the reliability of male-specific coliphage (MSC) as an indicator of virus contamination in shellfish near wastewater treatment plant effluent.With funding provided by the NOAA Sea Grant Aquaculture Research National Strategic Initiative (NSI), N.H. Sea Grant researchers conducted studies to determine the efficacy of using MSC as an indicator of virus contamination in shellfish near wastewater treatment plant discharge. Their results showed that MSC is a more appropriate indicator for this than fecal coliform levels, the previous method used to determine the presence of viruses in shellfish meat. Based on data results from this research, the Interstate Shellfish Sanitation Conference (ISSC) adopted and integrated a method for detecting MSC in quahogs into the National Shellfish Sanitation Program (NSSP) guidance document. Research results are also serving	New Hampshire Sea Grant	Interstate Shellfish Sanitation Conference (ISSC)	2013	research report	fisheries management	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Resource Management	Res - Studies and Assessments	Oceans
238	SG	Wholesaler incorporates N.H. Sea Grant research into business model for local seafood	Based on research funded by N.H. Sea Grant, a seafood wholesale company now places more emphasis on underutilized seafood species and tracks their product to place a premium on responsibly caught fish.	N.H. Sea Grant-funded research indicates that consumers are interested in purchasing local seafood, as long as the product is fresh and is a familiar species. The researchers' surveys also showed that consumers want to connect to the fishermen who catch their seafood and want to know the premium they pay for local products goes to support those fishermen. Red's Best Seafood, a seafood wholesale company in Boston, Massachusetts, incorporated these research findings into their business practices. They began placing additional emphasis on underutilized species and have implemented a real-time source tracking that places a premium on responsibly caught fish.By incorporating NHSG research results into their business model, seafood wholesalers are connecting to new higher-value marketing channels and providing a fair price to fishermen for their catch.	New Hampshire Sea Grant	Red's Best Seafood, a seafood wholesale company in Boston, Massachusetts	2013	research report	seafood retail	Sci - Interpreted Product	Single	Private - For Profit	Application - Commerce	Res - Studies and Assessments	Oceans

239	SG	NC Sea Grant Research Limits Negative Impact on National Wildlife Refuge	Responding to concerns by the US Fish & Wildlife Service, NC State University researchers funded by North Carolina Sea Grant developed a mesocosm study to determine impacts of rerouting water into the Alligator River National Wildlife Refuge as part of a proposed wetland restoration project. Study results enabled the project to move forward. Data indicated no negative impacts on the refuge waterways, but rather significant nitrate reduction should occur within the wetlands prior to discharge to ARNWR.	US Fish & Wildlife Service partners were concerned that rerouted agricultural drainage water through restored and existing wetlands into the northern portion of Pamlico Sound would potentially lead to eutrophication of waters in the Alligator River National Wildlife Refuge (ARNWR). NC State University's Biological & Agricultural Engineering Department, with North Carolina Sea Grant funding, developed a wetland mesocosm study to test nitrogen removal in simulated conditions in the wetland restoration areas. Preliminary results indicated that significant nitrate-nitrogen removal will occur in the wetlands if managed properly, and this will prevent the rerouted water from causing a threat to areas outside of the restoration. USFWS partners used this information to make an informed decision to allow the restoration project to move forward as designed. Therefore, once the restoration is complete, agricultural drainage water will be rerouted into the wetlands and	North Carolina Sea Grant	US Fish & Wildlife Service	2013	Research report	Wetland restoration	Sci - Interpreted Product	Single	Public - Federal (not NOAA)	Application - Resource Management	Res - Studies and Assessments	Coasts
240	SG	Connecticut Sea Grant seaweed culture/nutrient bioextraction research spawns two new seaweed fertilizer-based interests	Connecticut Sea Grant research on seaweed culture for human food leads to spin-off enterprises for seaweed-based fertilizer. http://www.business.uconn.edu/cms/p242/r1050/a703	Cultured seaweeds have many potential uses in addition to human food, providing seaweed farmers with a number of ancillary revenue sources. Seaweed naturally removes nutrients like nitrogen from the water to fuel growth and reproduction, in a process called bioextraction. When the seaweed is harvested, the nutrients taken up in the plants are removed from the water and can be used as fertilizer components. This removal benefits waters where too many nutrients cause pollution and water quality problems. Two UConn-Stamford undergraduates working with a School of Business faculty member collaborated on a new business plan and a formula for organic liquid seaweed-based lawn fertilizer. The formula was developed with input from UConn Departments of Marine Sciences, Chemical Engineering, and Plant Sciences faculty. At the same time, the first Connecticut company permitted to grow and harvest seaweed for human consumption diversified by selling	Connecticut Sea Grant	Sea Green Organics, an organic liquid seaweed-based lawn fertilizer company http://seagreenorganics.com/	2013	formula for organic liquid seaweed-based lawn fertilizer	new business (fertilizer)	Tech - Standards, Protocols	Single	Private - For Profit - Startup	Application - Commerce	Trans - Technology Transfer	Oceans

241	SG	Connecticut Sea Grant nutrient bioextraction research creates potential new market source for nitrogen trading credits	Connecticut Sea Grant-supported research into bioextractive properties of seaweed shows promise of both improved water quality and economic benefits for seaweed farmers from nitrogen trading credit programs.	Seaweed aquaculture removes nutrients from seawater that could otherwise fuel the growth of potentially harmful plankton blooms. Bloom prevention through bioextraction can help reduce bottom water hypoxia. Seaweed aquaculture can serve as one management tool used to remove nutrients from urbanized coastal waters, while providing new business opportunities for US seaweed farmers. Recent studies in Long Island Sound (LIS) and Bronx River, supported by Connecticut Sea Grant, EPA, National Fish and Wildlife Foundation, and Bronx River Watershed Initiative, investigated the culture of two seaweed species for human consumption and for bioextractive properties. Gracilaria tikvahiae is a red seaweed that grows well in LIS during the summer. Optimally, it may grow more than 16% / day, and accumulate up to 6% nitrogen (N)/gm of dry tissue. Sugar kelp (Saccharina latissima) is a brown seaweed that grows well during the winter/spring, yielding over 18 kg fresh	Connecticut Sea Grant	Connecticut Nitrogen Credit Trading Board	2013	research report	Seaweed aquaculture	Sci - Interpreted Product	Single	Public - State/Local/Tribal	Application - Commerce	Res - Studies and Assessments	Coasts
242	SG	Alaska Sea Grant-funded student identifies high-performing oyster for Alaska	An Alaska Sea Grant–funded graduate student and Marine Advisory specialists confirmed the existence of a high-performance, superior-quality broodstock oyster seed, which performs well for Alaska shellfish farmers.	Alaska waters are too cold for Pacific oyster reproduction, requiring Alaska farmers to purchase oyster seed from Pacific Northwest hatcheries for grow-out. Because not all purchased seed grows well in Alaska, the industry needs a unique cold-water oyster brood line for Alaska farmers. Alaska Sea Grant–funded graduate student Stuart Thomas, in collaboration with shellfish farmers, completed the last three years of a 12-year broodstock development and grow-out project as part of the USDA Molluscan Broodstock Program to identify a high-performing Pacific oyster. Ray RaLonde, Marine Advisory aquaculture specialist, advised Thomas during his research. MAP seafood specialist Alex Oliveira did oyster analysis, and MAP faculty and graduate students prepared oyster samples for testing. Thomas confirmed the existence of a unique, high-performance Pacific oyster brood line for colder Alaska farms with a significantly improved survival	Alaska Sea Grant	Taylor Shellfish Farms	2013	breeding method	aquaculture	Sci - Tacit Expertise	Single	Private - For Profit	Application - Commerce	Trans - Technology Transfer	Oceans

243	SG	Connecticut Sea Grant support is springboard for cultured coral wholesale business and coral conservation consortium	Connecticut Sea Grant small development project leads to cultured coral wholesale business and coral conservation consortium	Globally, coral reefs are facing destruction and depletion from a number of factors. Among these factors is the harvest of corals, fish and invertebrates for the live aquarium trade. The successful culture of coral species for sale to aquarium hobbyists will help reduce the pressure on coral reef systems. In 2007, Connecticut Sea Grant supported a development project looking at the feasibility of coral aquaculture in Long Island Sound water, which led to immediate and positive local outcomes.Years later, the positive outcomes continue to accrue and Sea Grant support continues to be recognized as being an important step to the ongoing success of the funded individual. System design ideas and techniques first explored and refined as part of the Sea Grant project continue to be utilized. In 2012, the former PI and partner co-founded the wholesale company, ReefGen. Based at the Long Island Aquarium in Riverhead, NY, this company produces aquacultured corals, invertebrates, fish and	Connecticut Sea Grant	ReefGen	2013	breeding method	aquaculture	Sci - Tacit Expertise	Single	Private - For Profit	Application - Commerce	Trans - Technology Transfer	Oceans
244	SG	Maryland Sea Grant Oyster Research leads Hatchery to Produce 1.2 Billion Spat for Aquaculture and Restoration	The Maryland Sea Grant Extension Program's (MDSGEP) shellfish aquaculture specialist and his staff produced more than one billion oyster “spat on shell” (oyster larvae that have attached to shells) through the Horn Point Oyster Hatchery in 2013 and donated $156,000 worth of spat to regional oyster growers.	The state of Maryland has dedicated considerable resources to restoring oysters to the Chesapeake Bay. The estuary’s oyster populations declined dramatically beginning in the 1950s as a result of overfishing and disease. The loss contributed to worsening water quality in the Bay and its tributaries and has deprived commercial watermen in Maryland of income. Efforts to restore oyster populations are expected to provide habitat for fish and other animals, help to reduce nutrients and sediments in the estuary, and enhance the Maryland economy. Both wild oyster restoration projects and aquaculture businesses, however, require a supply of oyster shell and larvae in order to build new reefs and stocks.The Horn Point Oyster Hatchery, directed by MDSGEP’s shellfish aquaculture specialist in partnership with government agencies and non-governmental organizations, is among the largest operations of its kind on the East Coast of the United States. Using new methods and	Maryland Sea Grant	The Horn Point Oyster Hatchery	2013	breeding method	fisheries management	Tech - Standards, Protocols	Single	Academic	Application - Resource Management	Trans - Technology Transfer	Oceans

245	SG	Crabcake Success Keeps NC Processor in Business	A crab processor in North Carolina, has established a crabcake line that is marketed as fresh from NC waters. The product is based on a formulation developed with key assistance by North Carolina Sea Grant seafood technologist. The economic impact is estimated at $225,000 per year and the processor notes that it is key to the business that has about 60 seasonal jobs.	North Carolina seafood processors need to develop value-added products in order to meet consumer demand while also competing with imported seafood that is cheaper but often of lower quality.A North Carolina crab processor came to North Carolina Sea Grant's seafood technologist about 2006 for help in developing a retail line of crabcakes based on the flavor profile of a classic recipe. NC Sea Grant assisted with testing for commercial-scale production, as well as sensory panels. This included identifying ingredients and the respective sources. This effort resulted in the new product, that continues to be widely available via seafood vendors and at least one grocery store. The processor reports that the crabcake has kept the company going, including about 60 seasonal jobs. The price point is approximately $2 per cake wholesale. The company is producing about 1,000 crabcakes per day in season. To conservatively estimate 75 production days, that would be $150,000 per year. Additional	North Carolina Sea Grant	North Carolina Crab Processor	2013	crabcake recipe	local business (seafood)	Tech - Standards, Protocols	Single	Private - For Profit	Application - Commerce	Trans - Technology Transfer	Oceans