



What if there was this place on the Internet where  
I could find multiple data assets from the Arctic

Introducing The Alaska Ocean Observing System's  
ARCTIC DATA PORTAL: Serving up Arctic Observations, Old and New



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AOOS is 1 of 11 regional ocean observing systems that make up the United States Integrated Ocean Observing System. It's the only regional association within IOOS that includes Arctic waters and coastlines. IOOS is charged with coordinating nationwide coastal and ocean observing across federal, state, and local government agencies, private industry, research, NGOs, and local communities.

AOOS has a larger geographic scope than just coastal and ocean waters, as it also hosts data from inland Alaska and across the Arctic Ocean.

The main missions of AOOS are to:

1. Identify ocean monitoring gaps, and try to fill them very strategically.
2. Develop and maintain ocean and coastal observations around Alaska and the Arctic.
3. **Aggregate and provide easy access to information about the physical, chemical, and biological ocean and coastal ecosystems.**
4. **Generate tools to document and access data, as well as visualize, share, and explore what is available. We support the development of data products to help our stakeholders make informed decisions.**

# Local, State, National and International Partnerships



- Protection of the Marine Environment Working Group of the Arctic Council
  - Norway, Russia, Canada, Iceland, US
- Pacific Arctic Group (PAG)
  - Canada, China, Japan, Republic of Korea, Russia, US
- Distributed Biological Observatory (DBO)
  - Canada, China, Japan, Republic of Korea, Russia, US
- Marine Arctic Ecosystem Study (MARES)
  - Canada, US
- Canada Department of Fisheries and Oceans
  - Canada, US
- Russian-American Long-term Census of the Arctic (RUSALCA)
  - Russia, US
- Industry Arctic Data-sharing Agreement
  - Shell, ConocoPhillips, Statoil

AOOS has spent a lot of time building relationships with people in Alaska and throughout the US.

AOOS identifies what information people need, and then if it's available, we work on how to describe it well, how to show it on maps, and how to make it available to everyone else.

AOOS also works with international partners ...for example, we participate with groups from Russia, Canada, Iceland, China, Japan, Korea, and, Norway.

AOOS also has an Industry Arctic Data-sharing Agreement. That agreement laid the groundwork for AOOS to provide public access to oceanographic and environmental data from the Chukchi Sea that these companies collected in advance of lease sales (and during exploration). It's an incredible boon for the resource management and scientific communities, and it's now freely available through AOOS.

# Ocean Data Explorer



- Handles many data types
  - GIS/project type data
  - HF Radar Mapping
  - Satellite imagery
  - Real-time sensors
  - Forecast models
  - Historic ice records
- Visualize data stacks/layers
- Explore in space and time
- Download data



AOOS is probably best known for its data management and visualization tools that are accessed on the internet, and most easily found via the AOOS Website.

[www.aos.org](http://www.aos.org)

The statewide and regional data are found through the Ocean Data Explorer (ODE).

Specialized subsets of the Ocean Data Explorer are provided for immediate focus on a region of interest. The one that's most relevant to this group is the Arctic Data Integration Portal, or what we call the Arctic Portal for short.

This portal was developed with major funding from NOAA as part of the Spatial Tools for Arctic Mapping and Planning project, or STAMP. Funding like this allows AOOS to increase and improve data visualization and analysis tools available in the AOOS data portals, as well as provides resources to update and add new data streams.



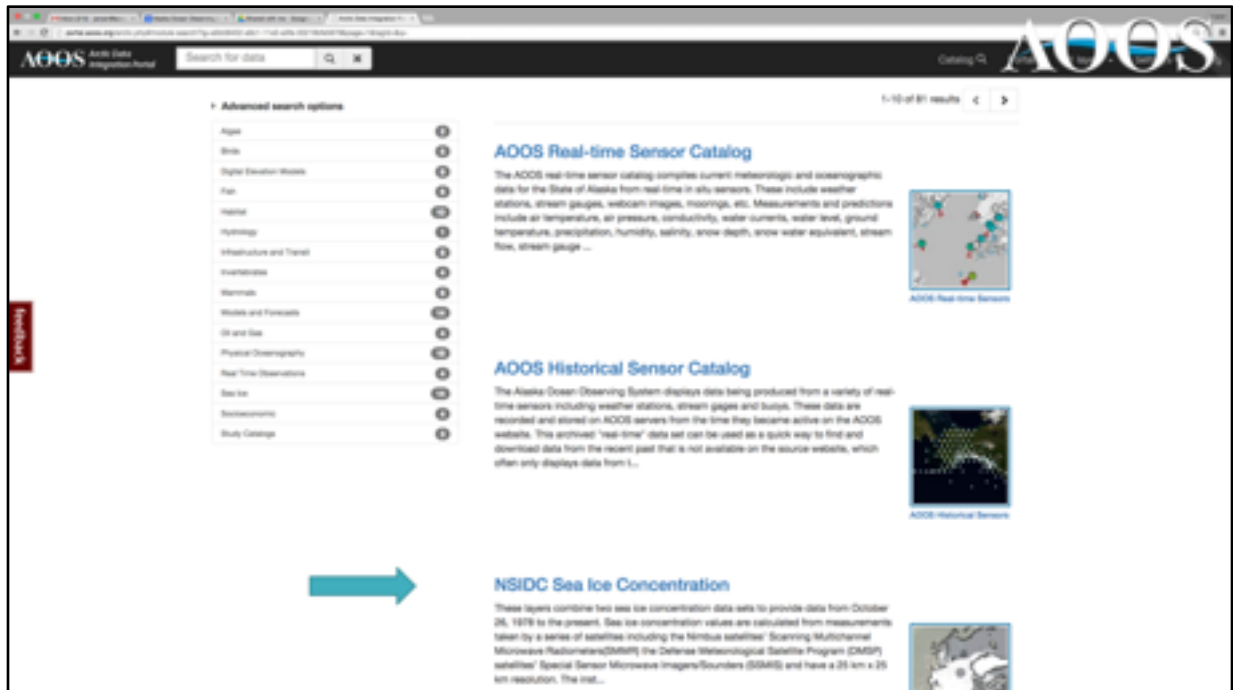
The Arctic Data Integration Portal (Arctic Portal) can be found at this internet address: <http://portal.aaos.org/arctic.php>

....or can be easily accessed via the AOOS website at [www.aaos.org](http://www.aaos.org).

**When the Arctic Data Integration Portal is accessed, there are a few options on how to search data:**

There is the Data layer Catalogue - a library of data options that include meteorological models, habitat and species information from field-based mapping projects, real-time sensors, and more. Users can browse data sets by category or keyword and search through metadata, or click to access brief project descriptions with links to original source data. Individual datasets can be stacked for viewing in the Arctic Portal, or simply uploaded for personal analysis.

There is also an Interactive Ocean Portal –with that tool, a map displays data in and around the Arctic. Users can spatially explore individual data sets such as temperature, using their mouse as a "virtual sensor" to extract a time series at specific map locations.



We can view what is available by Clicking on the *Data Catalogue* option.

This will allow the user to use Advanced Search options (shown on left menu on this screenshot), or to view and access the available data type options (shown on the left).

For example, at the top of the list shown here is the AOOS Real-Time sensor catalogue, which features real-time data from all public and some private sources across the state (terrestrial and ocean!).

At the time of this presentation, there were 81 data types in the Arctic Portal catalogue, and as many as 500 data layer options.

To illustrate what is behind each item in the catalogue, I refer to the NSIDC Sea Ice Concentration link (next to blue arrow). This will also illustrate the power of the visualization tools.

If following this presentation, Click on NSIDC Sea Ice Concentration (blue arrow)...this takes us to the Sea Ice Concentration data layer page.



Clicking on the NSIDC Sea Ice Concentration Data Catalogue option from the previous slide brings the user here.

This layer combines two sea ice concentration data sets to provide a single daily concentration map for a chosen date. Data span from October 26, 1978 to the present...and concentrations from any date between can be plotted...will show how to do this in a bit.

But first, a brief Metadata and project description informs the user what data sets are being used to generate the sea ice concentrations.

Visit the source page directly by clicking on the METADATA URL link near the top of this page (blue arrow) to see what the source data link looks like, to find the data itself, and to determine if the source page offers any mapping or visualization tools or products.



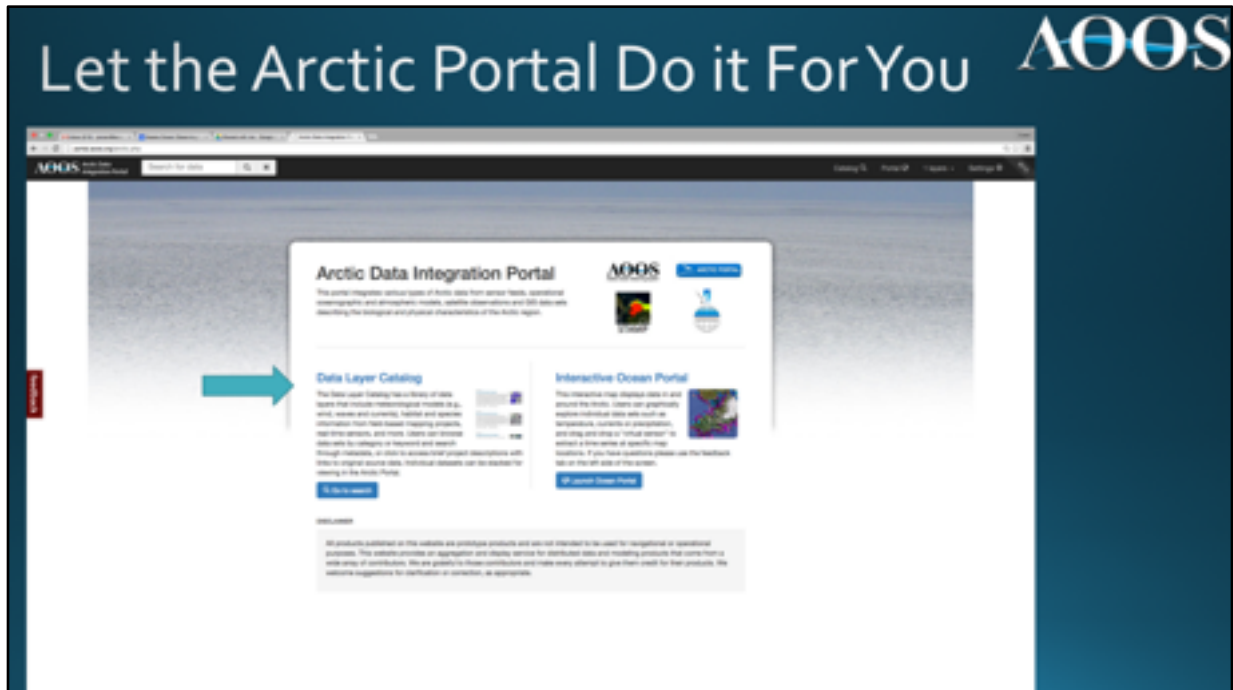




When I click on the NIMBUS-7 option on the previous slide, and get to the source page, there are No Mapping options available. I can upload the data... but the data are Binary. This would require downloading data here, one “image” at a time, in order to process data and somehow generate maps. This would have to be done individually for every image file of interest.

Though the NSIDC site offers some data products, daily maps for the imagery of interest are not on offer. Rather than serving up only the data and the link, **this is where AOOS finds a way to add value to an existing data product.** We take existing data products like this, and build tools that make them more accessible or useful for the user. Tools AOOS develops are based on what stakeholders say they would like to have access to and what would be useful.

AOOS does not reinvent the wheel, even with plotting products that are available via other sources. This leads to another added value aspect of the AOOS data portals, which are able to plot multiple data layers that come in different data formats and or sources, simultaneously, to the same scale...at last but not least, all at one website location.



Next is an illustration of a full data discovery journey from the start:

Go back to the AOOS Arctic Data Integration Portal and walk thru an example of how to plot a daily sea ice concentration map.

To follow, Click on Data Layer Catalogue (blue arrow)

The screenshot shows the AOS Data Explorer interface. At the top right is the AOS logo. Below it is a search bar with the text "Search for data". To the left is a sidebar titled "Advanced search options" with a list of categories: Age, Area, Digital Ocean Models, Run, Island, Hydrology, Infrastructure and Transit, Invertebrate, Mammals, Mobile and Forecasts, Oil and Gas, Physical Oceanography, Real Time Observations, Sea Ice, Seismicity, and Study Details. Each category has a circular icon next to it. A red vertical bar on the left side of the sidebar contains the text "Data Explorer".

On the right side of the page, there are three sections:

- AOS Real-time Sensor Catalog**: A heading followed by a paragraph describing the catalog and a small map of Alaska with sensor locations. Below the map is the text "AOS Real-time Sensors".
- AOS Historical Sensor Catalog**: A heading followed by a paragraph describing the catalog and a small map of Alaska with sensor locations. Below the map is the text "AOS Historical Sensors".
- NSIDC Sea Ice Concentration**: A heading followed by a paragraph describing the data and a small map of Alaska with sensor locations. Below the map is the text "NSIDC Sea Ice Concentration".

A blue arrow points from the left towards the "NSIDC Sea Ice Concentration" section.

Next, click on NSIDC Sea Ice Concentration option (blue arrow).



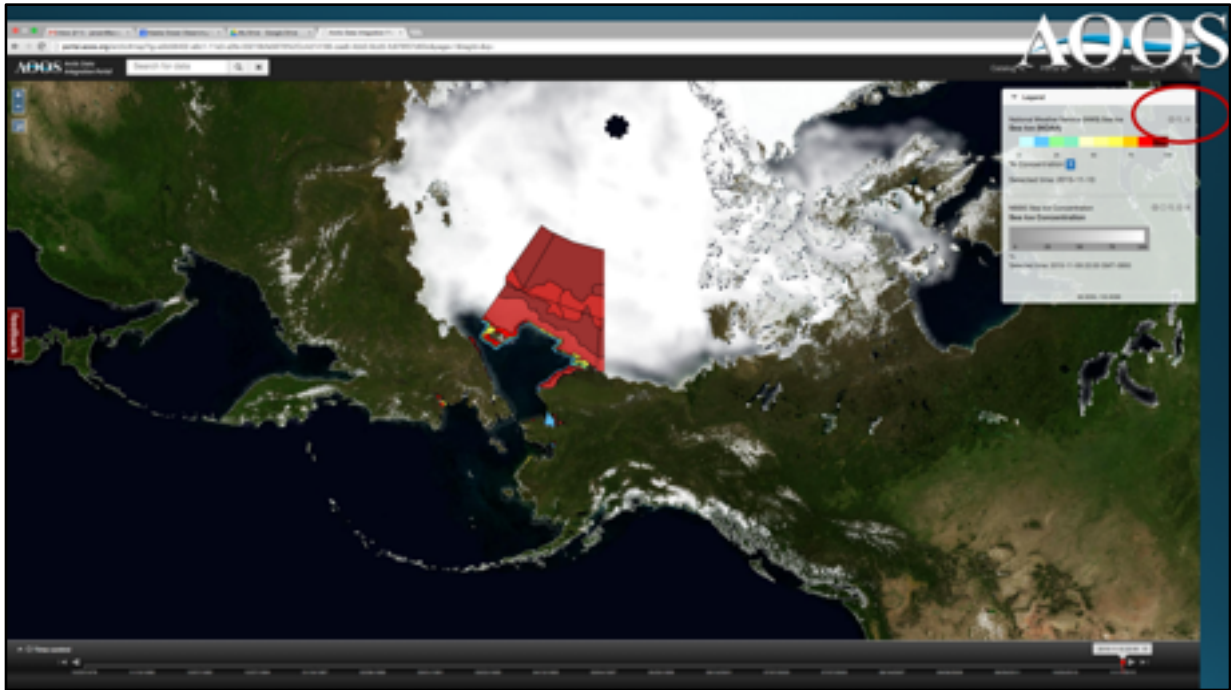
To add Sea Ice concentration to the map, click the + sign shown in red to the right of the screenshot.

This allows the user to return to the catalogue, and select another data type to plot with the sea ice concentration.

Or, the user can simply plot sea ice concentration now by clicking on the map, or Clicking PORTAL circled in red (blue arrow)

Doing either will take the user directly to a map for further viewing and manipulation.

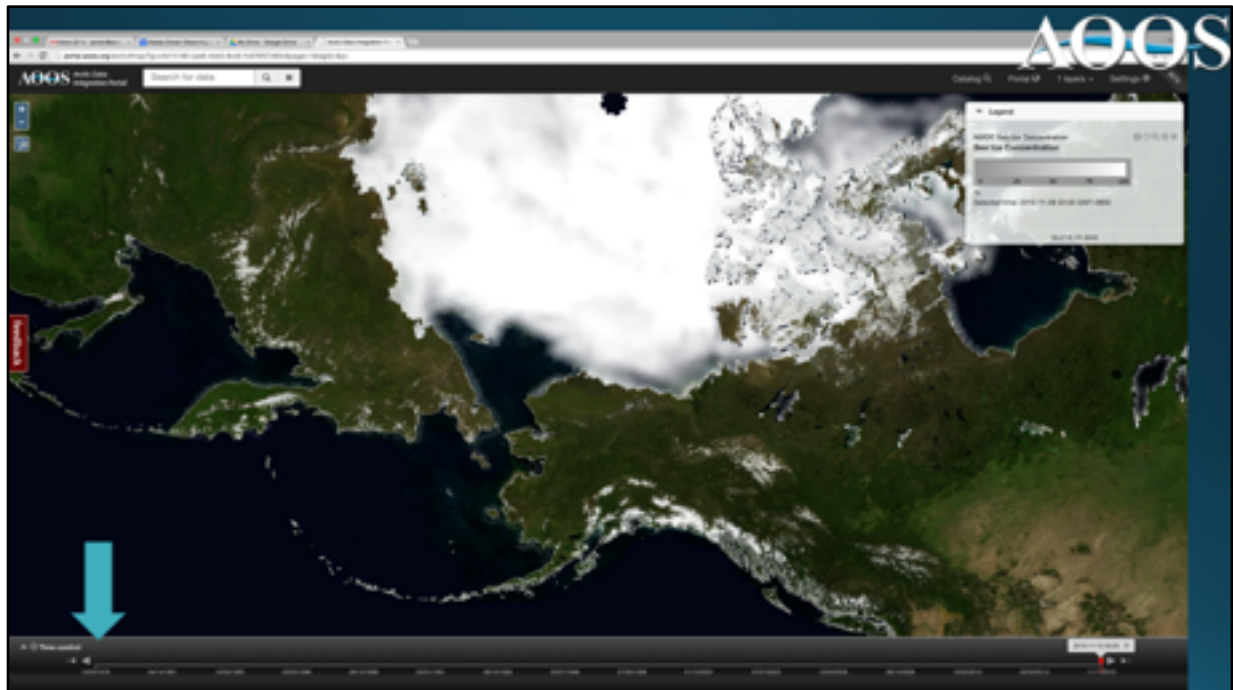
The latest available data will be displayed on the map (see next slide)



The map now fills the screen, and loads the most current ice concentration image ... Look at the slider time bar along the bottom of the map for date of latest image.

Notice that the slider is positioned on the latest date an image is available.

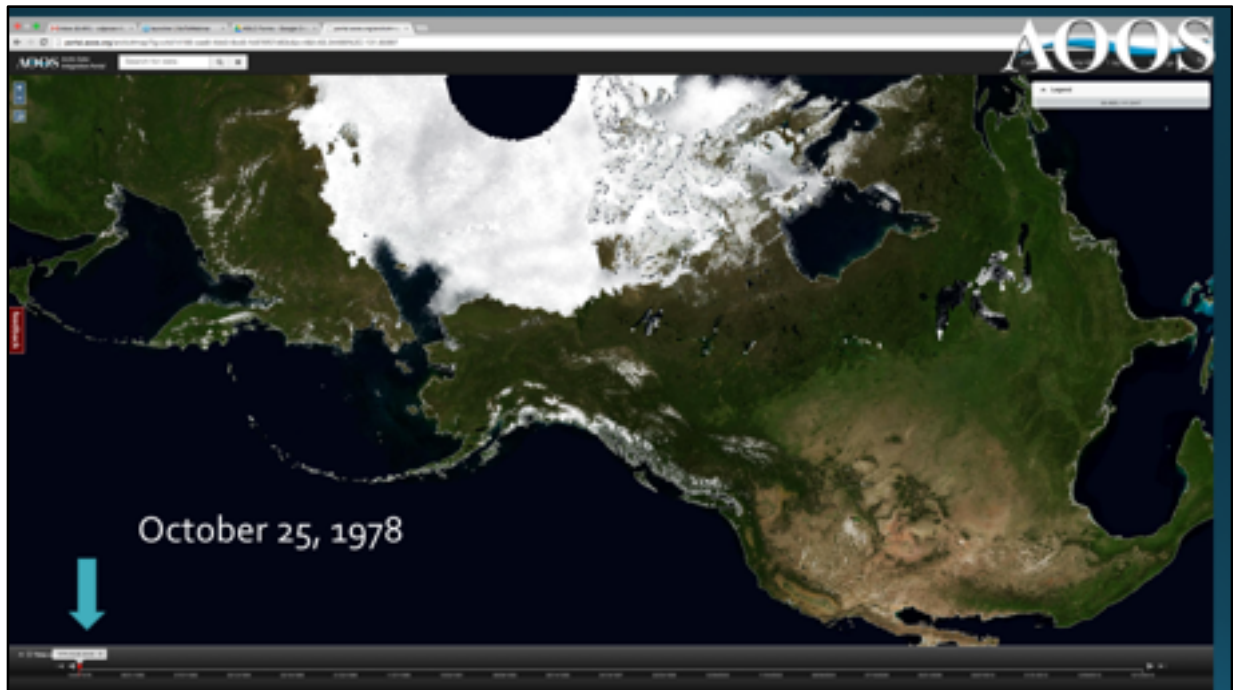
ASIDE: When entering the Arctic Portal, there is a default data layer that will plot on the map, regardless of whether or not this layer is selected...it is the modeled sea ice contours. It is easily removed by clicking the X in the legend box shown on the right side of the map. (circled in red)



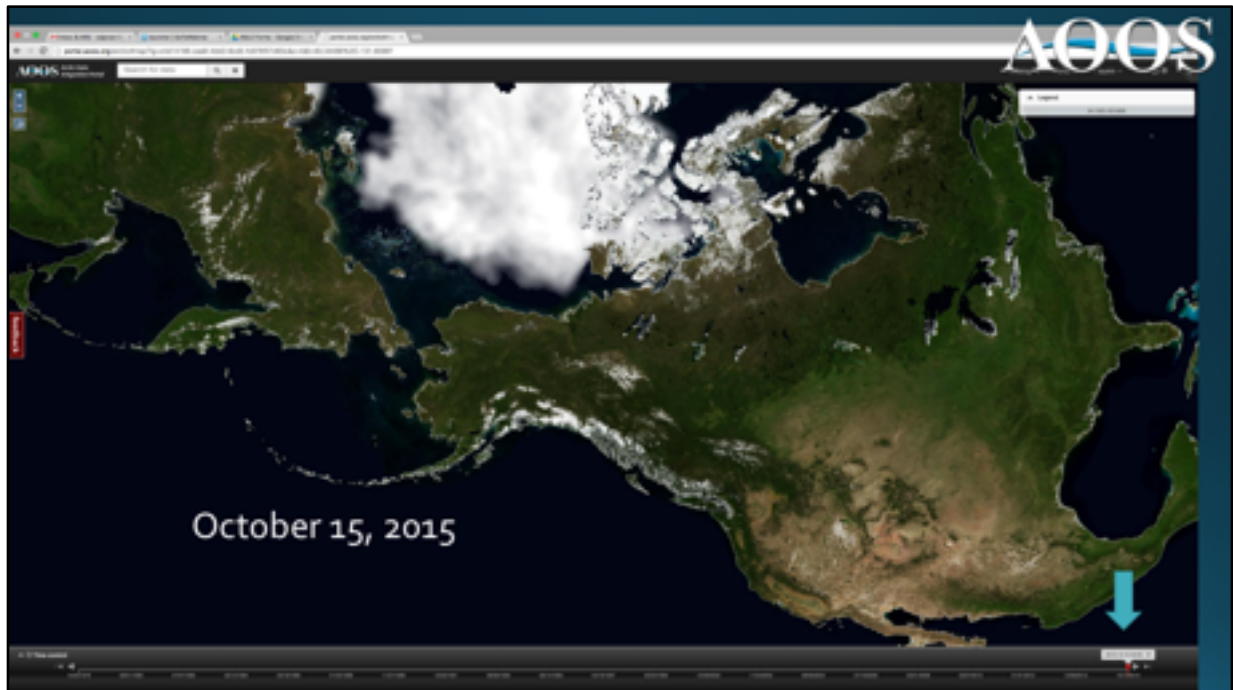
Remove the ice model layer by clicking X on the legend from previous slide.

This now leaves just the ice concentration map shown here.

Now, let's see how the end of summer 2015 sea ice extent has changed since 1978. Use the slider time bar on the bottom of the image to scroll back in time all the way to the beginning of the ice record. Simply click on the current position of the slider, and move it back to where the blue arrow on this plot is.



By moving time slider to the left, all the way back to October 1978, plot the sea ice concentration for whatever day in October 1978 that is desired that has an image. As an example, let's compare this to October 15, 2015 by moving the slider back to the right. (see next plot)



Moving the time slider bar (denoted by the blue arrow) to October 15, 2015...quickly illustrates how the sea ice concentration looks 37 years later.

Hopefully, you can see how and why is this useful. With these maps, it is easy to compare changes in time in a very short amount of time.

This visually shows how over the past 37 years, the sea ice extent has decreased by about 13.4% per decade.

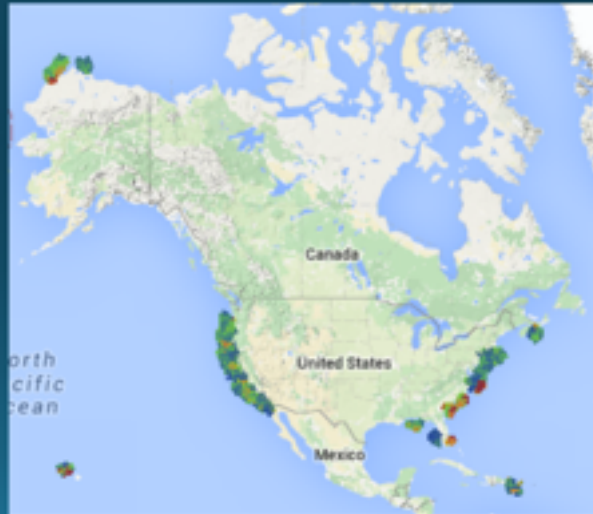
And just a point of interest, 2015 was the 4<sup>th</sup> lowest ice extent on satellite record.



# Real-Time Arctic Observations

AOOS

National  
HF RADAR  
INSTALLATIONS



Next, is a demonstration of some other activities and options the Ocean Data Explorer and Arctic Portal offer in terms of data access and tools. In particular, real-time data.

Currently, the AOOS Ocean Data Explorer serves over 3000 real-time observations across the entire region, including measurements in the interior. Real-time observations are limited in the Arctic, but there are a few assets worth demonstrating here.

One remote sensing technology that is becoming a mainstay in ocean observing is High Frequency radar, used to monitor nearshore sea surface currents. The National IOOS program supports HF Radar mapping of surface currents across the US, including AK. Country wide installations are shown here on this map.

AOOS also helps support this effort in Alaska, along with Federal and Industry partners in the Arctic.

# HF Radar Remote Installation on the North Slope Using Renewable Energy

See Poster by Rachel Potter  
in the lobby.

[www.chuckchicurrents.com](http://www.chuckchicurrents.com)

photo: Courtesy:  
Hank Statscewich, UAF



As a teaser for Rachel Potter's poster being presented here at this meeting, I show a picture of one Arctic HF Radar installation. Rachel is standing to the right in this photo.

These remote power modules utilize renewable energy (wind and solar) to charge batteries used to power the HF Radar installation. These power modules are necessary in the remote Arctic regions that are off the power grid.

For more details on the Alaska HF Radar program and how these systems are operated in Alaska, See here in the poster session: *Remotely Powered Radars Autonomously Monitor Ocean Surface Currents*, by Rachel Potter, Hank Statscewich, and Thomas Weingartner.

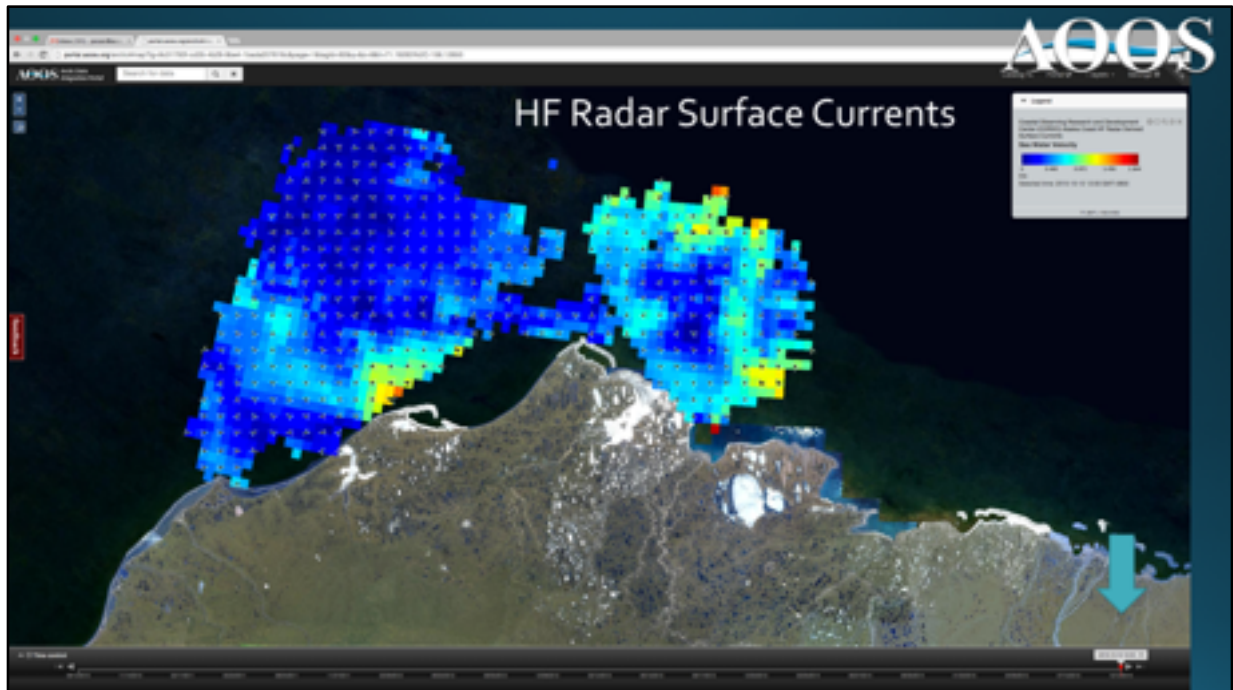


To access the HF Radar data on the AOOS Arctic Portal, go through the Data Catalogue...since the data are shown as contoured speed and direction on a surface spatial map.

In contrast, Real Time Sensor data are plotted usually as a single time series. So though HF Radar data are near real-time, they are mapped to a surface and are not a single sensor measurement point.

Click on the Coastal Observing Research and Development Center, Alaska Coast HF Radar Derived Surface Currents in the data layer option (shown by blue arrow).

This will take you to the metadata file page where you then just click on + then Portal to generate a map like this (next slide).

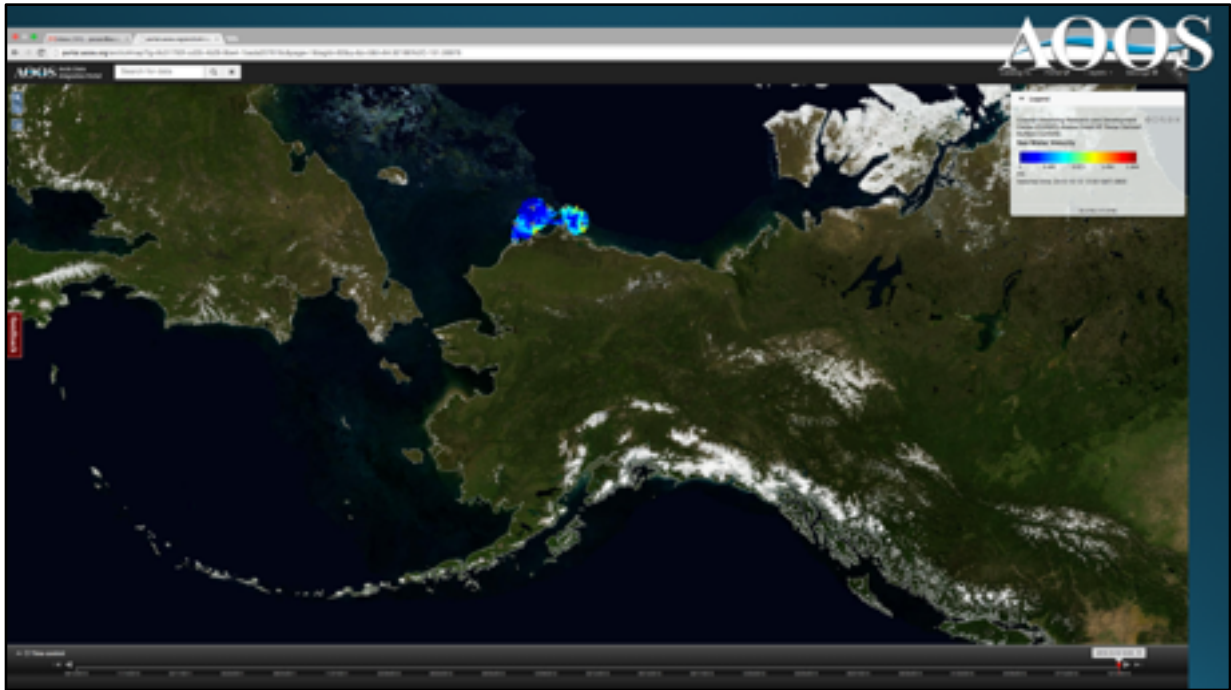


The HF Radar data provide an excellent example of some near real-time data available in the Arctic Data Portal. They are a perfect example of how data are mapped and displayed spatially. Adding even more capability, these data can be overlain with other data layers, like Sea Ice concentration, surface winds, SST (though not shown here).

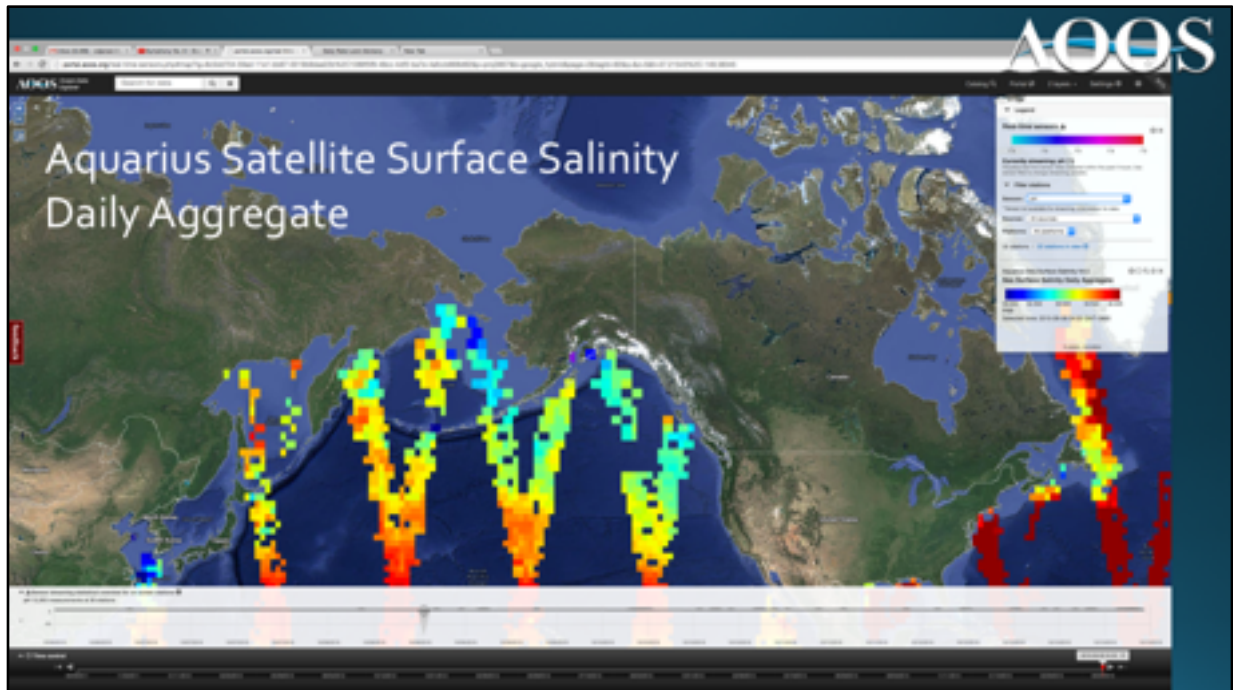
The HF Radar data are gridded using established algorithms converting HF signals into estimates of surface current velocity. The contours are presented in gradated color, showing speed, and vector heads to indicate direction.

Using the Time bar along the bottom, look at how currents change in time for periods when the HF Radar was operating (i.e. open water season).

It is important to note here, HF Radar will not produce a surface current display during ice covered times of the year for obvious reasons (ice cover prevents HF Radar reflection on surface waves). If you see some holes in the coverage, this might suggest the presence of ice, or it may be caused by a lack of any significant surface wind waves on the water.



During 2015, there were 4 HF Radar deployed on the North Slope providing high resolution surface currents along the NW coast of Alaska.  
...four stations give you this much coverage, which indicates we have a long way to go.

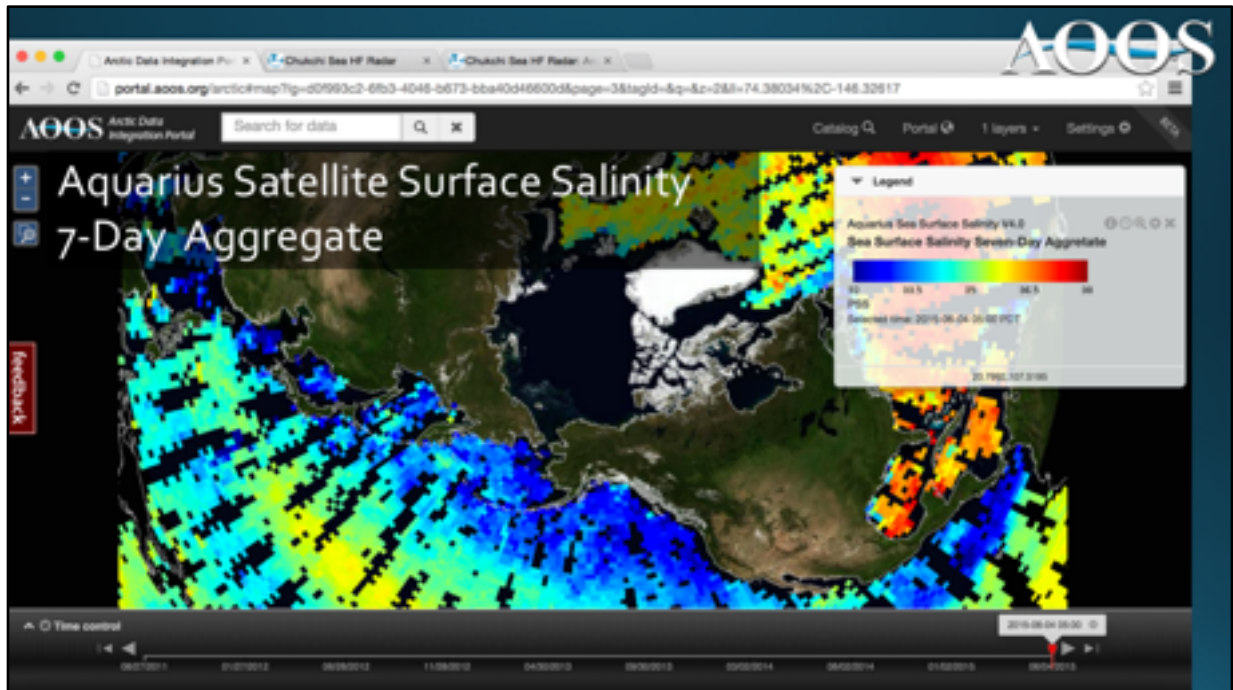


Next are shown some of the other types of data accessible on the AOOS Arctic Portal.

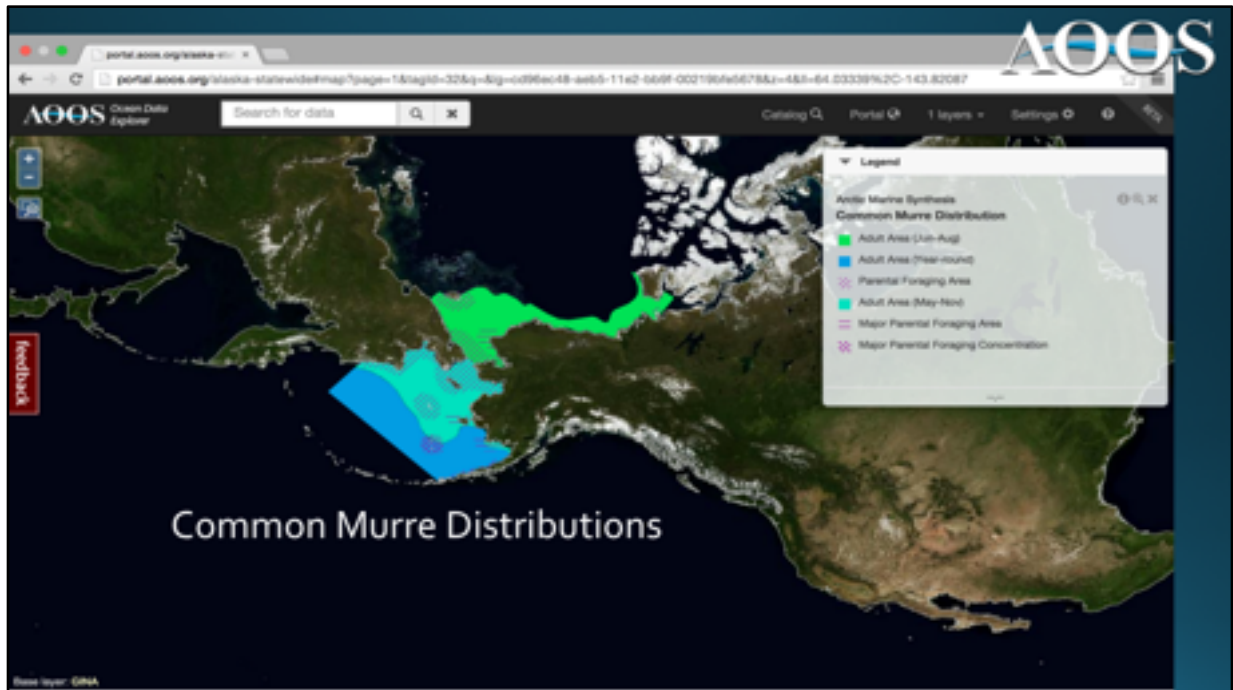
This screenshot is of Aquarius Satellite Surface salinity. Again, though accessible from the source page, which includes maps like this, the AOOS Arctic Portal builds on the source site capacity, and allows multiple data layer, providing a useful tool for more in-depth data synthesis and analysis.

It is important to remember that the Arctic Portal offers access to lot of different data sets from many different sources all in one location for convenience.

This ultimately saves the user from having to visit multiple websites to access data they are interested in acquiring or plotting. It also allows them to plot the disparate data sets simultaneously. Furthermore, the user will likely have a better chance at discovering data they might otherwise never known existed.



Here is a surface map showing the 7-day surface salinity from Aquarius Satellite data. The multi-day aggregates are obviously more extensive as they include multiple satellite passages over several days. Monthly aggregate mean surface salinity maps for the region or the whole earth are the most complete surface map product offered.

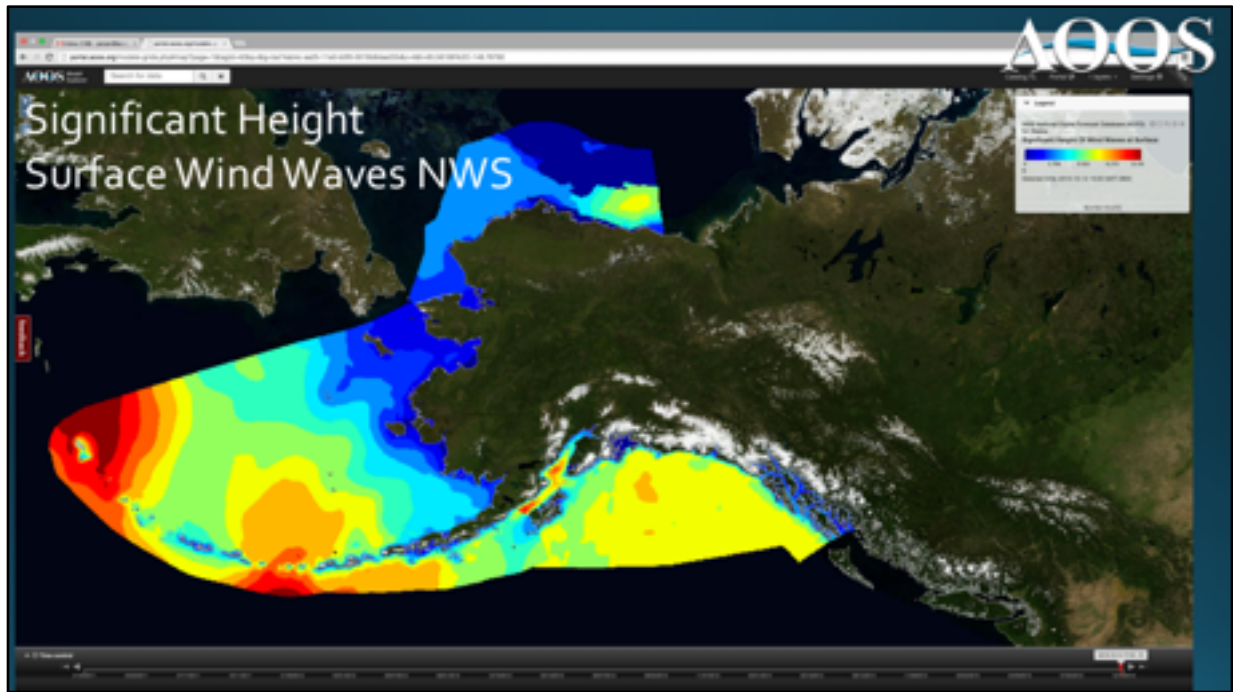


In this example, AOOS has improved on the data sets assembled in the Arctic Marine Synthesis, a collection of biological and habitat distributions for the Arctic.

The AOOS data science team AXIOM produced data visualizations such as this map showing the Common Murre Distributions for the Bering and Chukchi Seas...data delineations illustrated here include major foraging areas, adult year round areas etc.

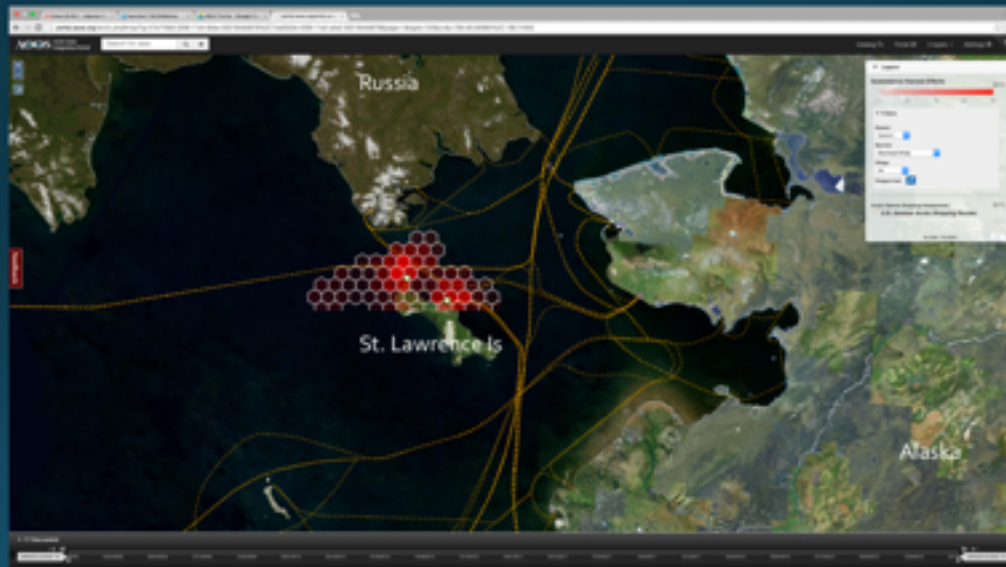
The Arctic Marine Synthesis data set is rich and includes many species and habitat variables; however, the synthesis alone does not offer products like this. Data accumulated in this synthesis are very valuable, and now with this tool, interactive data plots are available. AOOS added value to this synthesis project in the form of data access and visualization.





This image is just one example of some model data visualization that is available on the AOOS Ocean Data Explorer (and the subset Arctic Data Portal).

# Community Based Knowledge



AOS is also working to better incorporate traditional and community based knowledge being collected on projects across the region.

Shown here from Native Subsistence communities are survey results highlighting areas important for hunting. Data can be sorted and delineated by prey and season or both simultaneously using the legend box options shown in the upper right hand corner.

Data layers like these can then be overlaid with other information, such as the proposed Arctic Shipping routes shown here.

This slide is another example of how the Arctic Portal can provide critical information for analysis, for example, by providing potential conflicts with shipping and subsistence hunting during high shipping months of the year. Tools like this can be used by the Coast Guard, shipping companies, communities, planners and decision makers to prepare for and evaluate how to best navigate these sensitive issues before they arise.

# Bering Sea Sub-Network (BSSN) - Russian Translation

Feedback

## Bering Sea Sub-Network (BSSN) - Russian Translation

• Metadata URL: <http://bsn.net/the-communities/>

Данная исследовательская работа была проведена в рамках проекта Берингово-океанская Сеть Системных Наблюдений (БССН). БССН – это международная сеть наблюдений жителей восьми деревень-партнеров, расположенных на берегу Берингова моря на территории Чукотки и Камчатки Российской Федерации и Аляски, США. Проект проводился под началом Алеутской Международной Ассоциации в сотрудничестве с Университетом Аляски в Анкоридже. Главной целью БССН является продвижение знаний об экологических изменениях, имеющих значение для понимания ландшафтных процессов, что в свою очередь, позволит ученым, жителям северных поселков и правительству прогнозировать, планировать и реагировать на эти изменения. БССН предоставляет возможность коренным народам, живущим вокруг Берингова моря, регистрировать свои наблюдения об окружающей среде для того, чтобы совместно синтезировать знания об изменениях, влияющих на их благополучие и жизнедеятельность.

## охота/рыбалка для удовлетворения собственных нужд (Russian Translation)

Portal +

• Metadata URL: <http://bsn.net/the-communities/>

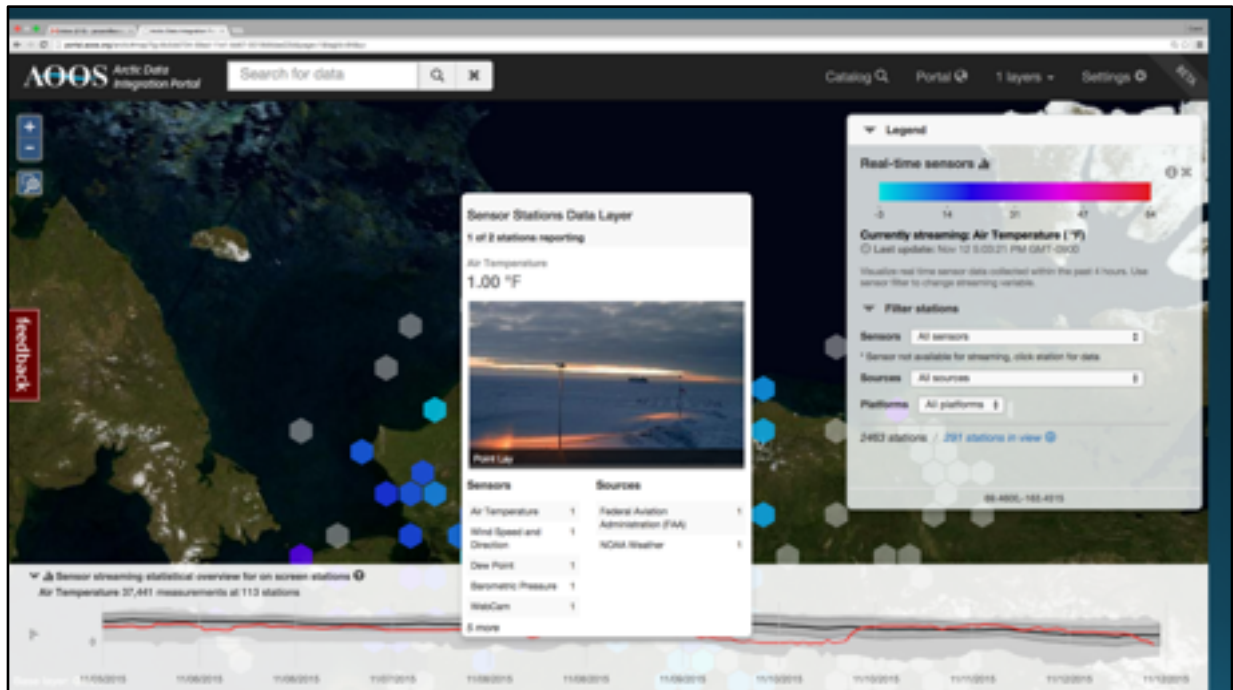
В течение 4-х лет респондентам было предложено ответить на вопросы 3-х различных анкет. Всего было опрошено 802 респондента, в результате чего получено 7170 ответов. Результаты, представленные ниже, являются результатами одного из опросов, проводимого дважды в год и нацеленного на то, чтобы обозначить места охоты и рыбалки за последние 6 месяцев. Несмотря на то что количество участников варьировалось от поселка к поселку и от года к году, одни и те же участники опрашивались на протяжении всех 4-х лет (см. таблицу 1). Результаты обозначают места охоты и рыбалки в зависимости от времени года (зимой, весной, летом и осенью).

Вид охоты/рыбалки	Количество респондентов	Процент респондентов
Охота на оленей	471	58%
Охота на морского зверя	111	14%
Рыбалка	129	16%

When appropriate, AOS will extend the data layers into other useful contexts.

For example, the traditional knowledge plot on the previous slide was generated by data as part of a joint effort across both Russian and US subsistence communities.

To improve accessibility, the AOS Arctic Portal offers this data layer with metadata and project description in both English and Russian. This better serves the user groups across state and international boundaries.



With the interactive tools, a user can cruise over an area of interest, look at available webcam footage feeding live, see the past week air temp for example, find the source of data and learn how many observations are available in that area at the current time.

With one click on the different locations denoting a data presence (hexagons), one can immediately learn what the conditions are now and maybe, if the site has a webcam, the visit can provide visual context as well. Again, this can all be dialed in at one site...the AOOS Arctic Data Integration Portal.

## Arctic Data Portal

- The AOOS Arctic Data Portal can offer assistance to supporting observations in the Arctic
  - Provides data sharing services
  - Offers a comprehensive top-n-shop for data in the Alaskan Arctic and beyond
  - Provides project a website presence
  - Promotes data product development
  - Creates data tools to help make decisions easily and quickly, all in one place
  - Partner with AOOS to support observing activities

We hope you have learned something here today, and will take advantage of the AOOS Arctic Data Integration Portal (the Arctic Portal for short).

AOOS encourages user to provide feedback on how to improve the tools and data visualization options on the site.

AOOS is also available for supporting project data needs by providing project data sharing sites for research teams, and this can be as public or private as the project requires. For more information, contact the AOOS office (contact information provided on: [www.AOOS.org](http://www.AOOS.org)).

We also support and present project data on the standard website data explorer portals like the Arctic Portal demonstrated here. If you have data you want to share, please let us know, and we will help find a way to make it accessible to others.

One last thing, The AOOS DAC can really help get projects out in the open on a fast track with less expense of having to recreate a website or visualization tools, and it serves as a public outreach tool for various types of programs across all sectors (private, public, NGO, community based). Perhaps your project can take advantage of this tested and available infrastructure in a partnership with AOOS.

[www.aos.org](http://www.aos.org)



Thank you for your attention today.