EXTRATROPICAL STORM SURGE
ALASKA FOCUS GROUPS

FINAL REPORT
MARCH 16, 2015

Contract #EAJ33C-09-CQ-0034
Task Order #50

Prepared for:
NOAA National Weather Service
Washington, D.C.

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Executive Summary

At present, the NOAA National Weather Service's (NWS's) storm surge forecasting and messaging efforts relating to extratropical (ET) systems are separate from efforts relating to tropical cyclone (TC) storm surge. Beginning with the 2015 hurricane season, the National Hurricane Center will offer an experimental storm surge watch/warning product to highlight areas along the Gulf and Atlantic coasts of the United States that have a significant risk of life-threatening inundation by storm surge from a TC. Beginning in 2017, NOAA proposes to expand the storm surge watch/warning to ET storms.

NOAA tasked Eastern Research Group, Inc. (ERG) with conducting social science research to ascertain the ways in which ET storm surge dangers are currently communicated to communities (both in text and graphics) and potential barriers to implementing the storm surge watch/warning for ET events.

ERG traveled to Anchorage, Alaska, in December 2014 and conducted focus groups with Weather Forecast Office (WFO) staff, emergency managers (EMs), radio and television broadcasters, and Alaskan tribal community members.

Key Findings

The west coast of Alaska is extremely vulnerable to coastal storm events from a meteorological, cultural, and socioeconomic perspective. Since 1978, the state of Alaska has declared 20 disasters due to coastal storms in this region.[1] Of great concern are the rate of return of storms in recent decades and the new threats Alaska's coastlines face due to the impacts of a warming climate. Many Alaskan coastal communities are also located in areas that hamper communication and make evacuations difficult and costly.

Weather forecasters in Alaska are handicapped by a lack of many kinds of data and the difficulty in extrapolating available data points from one community to another. Forecasters noted that the Alaskan coastline is very intricate and constantly changing, making it difficult to provide reliable, detailed information to all coastal communities. Data needs include bathymetry, tidal times and height, geographic information system (GIS) data, topography mapping, model guidance, sea and ice interaction with surge, and more.

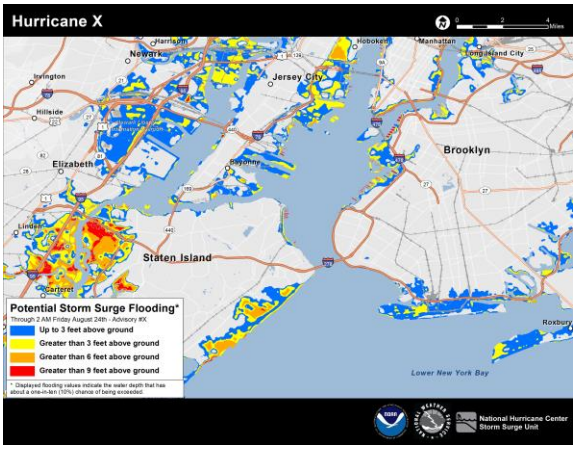
Alaskans *do not* use the term "storm surge." Although the WFO forecasters understand the term, they do not use it, as it is not familiar to their stakeholders. The focus group participants did not see a clear need for a storm surge watch/warning. If it is implemented, massive outreach will be necessary.

A storm surge warning could be confused with a tsunami warning. An additional concern is that a storm surge warning and a tsunami warning could occur simultaneously.

Communication in Alaska is a massive challenge. This is true given the size of the state and the remoteness of many of the coastal communities. Also, the communication infrastructure, while improving in many places, is fragile and lags in comparison to urban areas.

[1] Federal Emergency Management Agency (FEMA), Disaster Declarations. Accessed on 3/16/15: https://www.fema.gov/disasters/grid/state-tribal-government/86.

The Potential Storm Surge Flooding map (see example at right) is not practical for Alaskan communities. Broadcast meteorologists (BMs) stated that because they must cover the forecast for the entire state on air, they would not have enough air time to describe all the areas on the map that could be affected by a storm. Tribal community groups were not sure they could even view the map online, given the amount of time it would take to download it.



Many participants questioned whether the map could even be made given the intricacies of the coastline and lack of data; they felt that investing in data-gathering technology, such as buoys and tidal information, would be a better use of resources.

Summary

The focus groups provided an opportunity to engage stakeholders in a dialogue around storm surge in Alaskan coastal communities. They helped to identify the unique vulnerabilities to ET storms faced by these communities and provided insights on the populations most at risk. The results from these focus groups do not support a change to the existing system—both because the present system is understood and because a change could be both confusing and difficult to implement given the size of the state, the remoteness of coastal communities, and the of lack of communication channels.

The next step in this project is to interview WFOs, EMs, and the media in other regions of the United States that experience ET storms to discern their vulnerability and experience with ET storm surge and to gain insights into their opinions about the introduction of a new NWS storm surge watch/warning product and map for ET surge.

I. Background

At present, the NOAA National Weather Service's (NWS's) storm surge forecasting and messaging efforts relating to extratropical (ET) systems are separate from efforts relating to tropical cyclone (TC) storm surge. Beginning with the 2015 hurricane season, the National Hurricane Center will offer an experimental storm surge watch/warning product to highlight those areas along the Gulf and Atlantic coasts of the United States that have a significant risk of life-threatening inundation by storm surge from a TC. Beginning in 2017, NOAA proposes to expand the storm surge watch/warning to ET storms.

The NWS tasked Eastern Research Group, Inc. (ERG) with conducting social science research to ascertain:

1. Geographical areas and populations that are vulnerable to ET surge.
2. Ways in which ET storm surge dangers are currently communicated to communities (both in text and graphics).
3. Current misunderstandings of ET storm surge forecasts, or misunderstandings that could occur if a storm surge watch/warning product were implemented starting in 2017.
4. Any other barriers or conflicts that the NWS should be aware of, from both an operational and a communications perspective, before implementing the storm surge watch/warning for ET events.

The primary customers of this new product are broadcast meteorologists (BMs), emergency managers (EMs) and groups that make decisions that affect public safety (e.g., school boards, transportation managers, fire and rescue, tribal authorities).

ERG traveled to Anchorage in early December 2014 to conduct focus groups with media (TV BMs and radio hosts), EMs, and the local NWS Weather Forecast Offices (WFOs) of Anchorage and Fairbanks, as well as tribal community members in attendance at the 2014 Bureau of Indian Affairs (BIA) Annual Meeting. The following questions guided focus group discussions:

1. What is the regional experience and vulnerability with TC and ET events and associated inundation and surge? What terms do you, your partners, and the public use to talk about these threats?
2. How do you warn for coastal flooding hazards and what products do you issue?
3. How do you currently warn for ET storm surge hazards?
4. Do you have specific criteria and thresholds for issuing these products?
5. Have you encountered any public/partner confusion or other issues in using any of these products? How have you addressed it?
6. Could any of these products that you currently use overlap or be in conflict with a new ET storm surge watch/warning?
7. If the NWS replaces the current coastal flooding watch/warning system with a new ET storm surge watch/warning system, what do you see as the major issues (both from your perspective and for EMs, BMs, and the public)?

8. What graphic images and what product formats should the NWS consider developing to best convey the timing, threat level, impacts, and call to action for ET storm surge events?

This assessment in Alaska is part of a larger, more comprehensive effort to ensure the smooth implementation of the new storm surge watch/warning product for both TC and ET storms.

Sample

Table 1 lists the number of participants by location and stakeholder group. The Alaska Regional NWS office was responsible for identifying and recruiting EMs, BMs, and WFO staff. WFO staff from Anchorage and Fairbanks both participated. To reach coastal community residents, the Alaska Region coordinated an invitation to the 2014 BIA Provider's Conference, held in downtown Anchorage. Tribal community members from all over the state attended, seeking to improve communication with federal agencies. The BIA organizers gave ERG an entire three-hour session on ET storm surge.

Table 1. Sample by Stakeholder Group

Stakeholder Group	
WFO staff	8
EMs	8
Media (TV)	3
Media (radio)	5
Tribal coastal residents*	60+
Total	**84+**

** Conference attendees were allowed to come and go during the session, but a good portion of them stayed for the three-hour duration.*

II. Alaska's Experience and Vulnerability with Extratropical Storm Surge

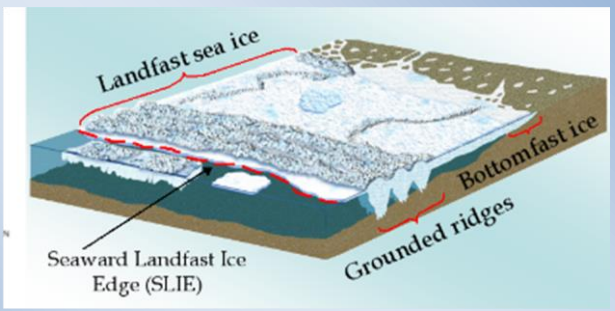
A storm of historic intensity continues to pound the west coast of Alaska today. Twice the size of Texas, the storm is as deep as a category 3 hurricane. The National Weather Service is calling it a "life-threatening epic storm" due to its dangerous combination of towering waves (observed at 40 feet in the Bering Sea), winds over 100 mph, storm surge flooding, and blinding snow.

—Jason Samenow, Capital Weather Gang
Posted at 12:12 PM ET, 11/09/2011

The west coast of Alaska is extremely vulnerable to coastal storm events from a meteorological, cultural, and socioeconomic perspective. Since 1978, the state of Alaska has declared 20 disasters due to coastal storms in this region.[2] Of great concern is the rate of return in recent decades. Since the mid-2000s, the Norton Sound region of western Alaska has received five state disaster declarations directly due to coastal storms, four of which became Presidential Declarations.[3] Some of these declarations were attributed to single powerful storms, others to multiple consecutive strong storms. For example, western Alaska was pummeled by four damaging coastal storms over nine days in November 2013. These multiple events added injury to an already crippled community infrastructure, *and* they inhibited mobilization of emergency relief.

Declining sea ice, later formation of shorefast sea ice (see box), melting permafrost, and erosion are additional factors that are increasing these coastal communities' vulnerability to storms and battering waves. The remote location of many coastal communities is also factor. Communities are often located off the road system, only accessible by air, boat, or exposed travel across the wilderness. Communication infrastructure, while improving in many places, is fragile and lags in comparison to urban areas. Power systems are often off the grid, with a central plant often serving as the sole provider for a community.

What Is Shorefast Ice?



Shorefast ice is "sea ice which forms and remains fast along the coast, where it is stably attached to the shore…it may extend a few metres or several hundred kilometres from the coast."

Source: *UN Terminology Database*
http://unterm.un.org/dgaacs/unterm.nsf/8fa942046ff7601c85256

The communities of western Alaska are largely Alaska Native villages. The villagers' connection to community, the region, and

[2] Federal Emergency Management Agency (FEMA), Disaster Declarations. Accessed on 3/16/15: https://www.fema.gov/disasters/grid/state-tribal-government/86.
[3] Ibid.

subsistence lifestyle is strong and dates back millennia. Though their history of permanently living in their present locations is relatively recent (dating back to the late 1920s, when the BIA built mandatory schools there), these places have been seasonal hunting sites for much longer. Therefore, moving or evacuating communities is akin to moving an entire culture, not simply moving people.

Climate Change Vulnerabilities

Alaska's coastlines are now facing additional threats due to the impacts of a warming climate. Over the past 50 years, temperatures across Alaska increased by an average of 3.4°F. Winter warming was even greater, rising by an average of 6.3°F.[4] A warming climate is contributing to a number of physical changes in the environment, which are increasing the vulnerability of some Alaskan coastal communities to ET storms.

A key factor is that sea ice is declining, making more of the coastline vulnerable to waves, storm, surges, and erosion. This is particularly true during the fall season, when sea ice is in a transition state, and when storms tend to be stronger with higher storm surges. In addition, rising temperatures are causing shorefast ice to form later in the year, leaving Alaskan villages even more vulnerable to fall storms.[5] Additionally, there is evidence that a lack of sea ice is causing storms to produce larger waves and more coastal erosion.[6]

Signs of a Changing Climate

Members of all the groups that ERG met with in Alaska (EM, broadcasters, forecasters, and tribal communities) said they are witnessing many physical changes in their environment due to a changing climate. The amount of water with storms is higher than they are accustomed to; their coastline is changing shape; and both the amount and extent of snow and ice pack are lessening.

Forecast Vulnerabilities

During the focus groups, the NWS WFOs in Anchorage and Fairbanks, EMs (at the local, state, and federal levels), and tribal community participants all noted that they are handicapped by a lack of many kinds of data, which makes forecasting ET storms difficult. WFOs stated that their data needs include bathymetry, tidal times and height, GIS data, topography mapping, model guidance, sea and ice interaction with surge, and more. Tribal communities mentioned the need for more weather buoys, wave height information, wind speed and direction, and water temperature.

Another challenge is that the few points of data that the NWS *does* have are not easily extrapolated to other communities, which makes forecasting for them near to impossible. One WFO Anchorage employee said: "There are only a few points on the west coast that we can use, but if the storm has a slightly different fetch, it doesn't necessarily mean that the community north of that point will have the same impact." Part of the challenge is that the coastline is so intricate, making it difficult for the NWS to provide reliable, detailed information to all coastal

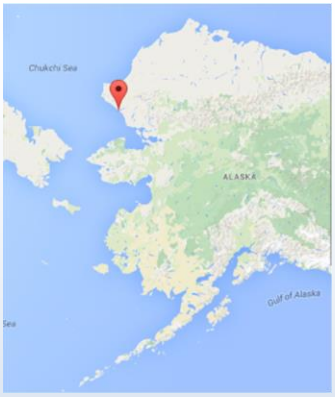
[4] Karl, T.R., J.M. Melillo, and T. C. Peterson (eds.). 2009. *Global Climate Change Impacts in the United States*. United States Global Change Research Program. Cambridge University Press.
[5] Karl, T.R., J.M. Melillo, and T. C. Peterson (eds.). 2009. *Global Climate Change Impacts in the United States*. United States Global Change Research Program. Cambridge University Press.
[6] Markon, C. J., S. F. Trainor, and F. S. Chapin, III. 2012. *The United States National Climate Assessment—Alaska Technical Regional Report.* U.S. Geological Survey Circular 1379.

communities. Thus, the uncertainty of the ET storm forecasts increases for communities further away from available data points.

This shortage of data affects the WFOs' ability to issue reliable coastal flood watches and warnings. Without enough information, the details of the coastal flood warning (in terms of timing, impacts, and location) are not always reliable given the massive amounts of uncertainty in the data used to create them. As a result, the Alaska WFOs issue broad-based coastal flood warnings that provide very little detail on when the inundation of water will occur, how much inundation will occur, and what impact it will have on respective communities.

This lack of detail has contributed to tribal community members feeling as if they have experienced sudden evacuations due to flooding with "no warning." Although coastal flood warnings are issued, communities often have too little information to respond appropriately.

Kivalina



Kivalina is above the Arctic Circle in Alaska's Northwest Arctic Boroughs, on the southern tip of a barrier island between the Chukchi Sea and a lagoon at the mouth of the Kivalina River. A 2005 storm prompted a quick evacuation of the community.

The decision to evacuate came at 2:00 a.m., as the surge was physically observed encroaching on the community. According to the Northwest Arctic Borough EM, the evacuation was partly accomplished through several nine-passenger plane flights to another, less vulnerable community. At a cost of $750 per hour, this air evacuation was not chosen lightly. Others from Kivalina crossed a waterway by skiff, then traveled 54 miles by wagons and four-wheelers to seek shelter in a mining camp until the storm passed. State EMs believed that this evacuation, in the dark of night, was as dangerous as the surge itself.

The communities also noted that evacuations are complicated and costly due to the remote locations of many of these villages, which makes the lack of detail even more problematic.

Coastline Vulnerabilities

The focus group participants provided a great deal of detail about the intricate, constantly changing coastline of Alaska. One EM remarked, "It's a soft coast where you could have 30 feet gone tomorrow." They noted a number of factors that are increasing the vulnerability of

communities on the coastline, including land subsidence, erosion, changes in fetch areas, melting permafrost, and the complicated variations of sea ice (see box).

Impacts of Different Forms of Sea Ice

Different forms of sea ice—whether it is shorefast, over a foot thick, or in a slush form—all result in different coastal flood impacts to the coastlines. For example:

- During a storm, **slush ice** near shore can pile up and form a protective barrier, leaving minimal damage to coastlines.
- **Shorefast ice** can also act as a protective barrier if it is strong. However, some situations can cause shorefast ice to become unsecured from the sea floor. Winds and waves can then push this ice onshore.
- **Sea ice** can often help a community by dampening waves or creating a makeshift berm to break waves. However, storms can also loosen and break up sea ice, particularly **sea ice in the first-year state.** This can result in ice shoves, where ice piles up on shorelines, damaging structures and objects in its path.

Participants explained that land subsidence, which can be as much as one to two feet annually in some locations, is a key concern—especially when combined with storm surge. Some also noted that in recent years, they have seen higher inundation levels with storms, wind pattern changes, and more frequent storms, all of which are increasing coastal communities' vulnerability.

Many of the state's satellite resources have imagery that is hampered by cloud cover associated with weather systems over the coast. This means the most recent view of sea ice near a potentially affected coastline could be two or three days old. This can lower forecasters' confidence in the current sea ice state.

Goodnews Bay

In November 2011, storm surge laden with sea ice inundated homes in the village of Goodnews Bay in the middle of the night. Ice projectiles caused more property damage than the water alone would have.

Infrastructure Vulnerabilities

The infrastructure in Alaskan coastal communities is extremely vulnerable to storm surge and coastal flooding. Most community infrastructure in Alaska is above ground, and much of this ground is at sea level, which makes *all* infrastructure vulnerable to storm surge. Even communities with underground water and sewer lines are finding that this infrastructure is at risk from coastal flooding, thanks to erosion. Storm surge can also threaten a community's infrastructure when spray from the surge freezes on power lines, increasing the risk of damaged lines and loss of electricity. Storm surge can also contribute to the sea ice breakup and carry broken ice onshore.

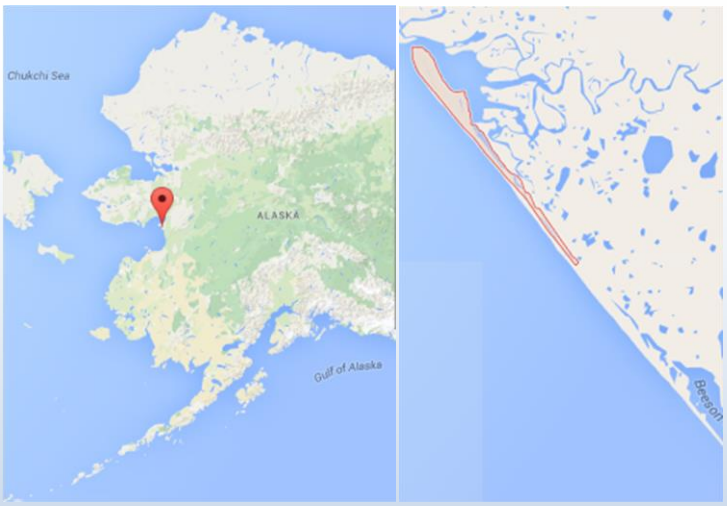
One EM stated that “Kivalina, Shishmaref, Shaktoolik are days, months, hopefully years away from having their sewage lagoons and dumpsites washed into the ocean. Shishmaref is months away to losing its air strip and road to the dump.” A tribal community member from Golovin stated, “Critical infrastructure for the village is all at low elevations. School, store, health clinic, fuel, and power generator.”

When critical infrastructure is damaged in these communities, public health often becomes a significant concern. If power is lost during a storm, or fuel becomes contaminated, a community can be at higher risk of literally freezing to death. Water and sewage contamination is also a concern. During the winter of 2013–2014, the community of Newtok cut ice from the river and melted it for drinking water, as the village supply was contaminated during the November storms. Due to freezing conditions, a full damage assessment was not even possible until the following summer. Additionally, because villages are often in remote areas not accessible by roads, their airstrips are their lifelines. If the airstrips are flooded or damaged, the village’s very survival can be threatened.

Kotlik

Surge is not only a concern for ocean coastlines, but also for communities along the coastal rivers, as surge can back up the river. In 2013, the village of Kotlik’s utility infrastructure was severely damaged, as were many houses, when river water and ice inundated the community.

Shaktoolik



The community of Shaktoolik has only one viable evacuation route—a road from the spit to more stable land, without shelter or aircraft landing facilities. In November 2013, that option was lost, as about 30 feet of the roadway was eroded due to surge and high surf. The road is along a choke point between the coast and the Tagoomenik River, which is also the village's drinking water source. The community's present plan is to shelter in place at the school. The school is a robust structure, but its position along an eroding coastline means it, too, is vulnerable.

Social/Community Vulnerabilities

The social structure of many Alaskan communities also contributes to their vulnerability. A state EM captured this best, stating, "When you normally have a disaster in the community, you have a fire department, a police department. Here, it is a community response because you don't have the organized level of services." Although there may not be anyone with the title of EM, policeman, or fireman, community or tribal leaders will have those roles and responsibilities. What complicates them is that many of these important people also participate in subsistence or other cultural activities that can take them out of communication range during a coastal event.

In fact, the village of Shaktoolik experienced this exact issue. All city leaders were away from the village during the worst of the November 2013 storm series. The town clerk stayed at the office to listen to radio reports, but only for her own knowledge, as she was not empowered to call for emergency measures.

One key finding of *all* the focus groups is how expensive and complicated evacuations are in many of these communities. Most coastal communities in Alaska require days to evacuate from flooding, given their remote locations and their small landing strips (which limit the size of passenger planes that can use them). Yet, even as evacuations have to be arranged days in advance, the forecasts for coastal flooding events are typically fraught with uncertainty. One

tribal villager proclaimed, “We need more time, more warning for planes to reach these communities so that we can evacuate.” Another stated, “Isn’t that going to be costly?” Perhaps in response to these cost factors, one villager explained, “Water has to go over the main road, and then people start moving uphill.”

Coastal flooding has become commonplace for these communities--which makes evacuations difficult to implement, as conditions that prompt evacuation are seen as normal. For extreme events where evacuations have occurred, communities have hoped for disaster declarations, which mean that state or federal funds cover their evacuation costs, including hours of airplane time.

But with these vulnerabilities, expenses, and challenges come true stories of resilience and ingenuity. During the focus groups, the tribal communities shared stories of how they have resourcefully prepared for coastal flooding, such as by building berms out of snow or from logs washed up on shore. They also explained that they use their intimate, local knowledge of the weather, water, and environment to enhance the NWS forecast. For example, many villagers repeated the adage, “Red skies at night is a sailor’s delight; red skies in the morning is a sailor’s warning.” One youthful villager proclaimed, “I trust my grandma more than The Weather Channel”—a playful way to explain the importance of listening to elders.

III. Communicating Storm Surge

A key finding from the focus groups is that Alaskans *do not* use the term "storm surge." Although the WFO forecasters understand the term, they do not use it, as it is not familiar to their stakeholders. In fact, it was unclear from the tribal community focus group if they understood the term at all. The terms the tribal community most commonly uses to describe flooding are "tides" and "wind direction." Broadcasters and EM also use these terms widely, though they also use "high surf," "coastal flooding," "high tide," and "high water." An explanation for the use of these multiple terms is that one phrase doesn't capture the hazards of the intricate coastline. One community may experience a "storm surge," yet the neighboring community will not because the wind direction is entirely different.

Communication Channels

The physical and social vulnerabilities that impact Alaskan coastal communities also extend to almost all of their communication mechanisms. As such, the NWS and the EMs use every channel possible to communicate storm surge threats, including the Internet, cell phones, social media (mostly Facebook, some Twitter), public radio, television, VHF/marine radio, and satellite phone. Even so, everyone emphasized that if subsistence activities are occurring, it is possible that *none* of these communication mechanisms will work.

Size of Communication Area

The three NWS local offices in Alaska monitor and forecast the weather for a huge area (see map at right). Although people do not live in all areas of the state, they often travel to remote portions for subsistence activities—so, for storm surge communication to be effective, communication is necessary for the *entire area.* This is true for both the NWS forecasters and the BMs. It stands in stark contrast to the lower 48 states, where broadcasters have a limited region to cover. Only one of the three Anchorage broadcasters who participated in the focus groups stated that she is given more airtime (up to six or seven minutes) to accommodate the viewing size. All of the others have about two minutes and 30 seconds to describe the weather for the entire state. Given these time constraints, forecasts are very general with few details.

This map shows the extent of coverage for each of the three WFOs in Alaska (Anchorage, Juneau, and Fairbanks) compared to the lower 48 states.

Most communication sources use English. However, some local radio stations do translate the information into their respective native language.

NWS as a Trusted Source

All focus group participants (including TV and radio personnel, EMs, and the public) say that they heavily rely on the NWS for their forecasts. The radio hosts said that they read NWS watches and warnings on air almost verbatim, although they did express a desire for "more simple,

understandable language" from NWS. Several EMs suggested that the NWS have more of a radio presence. "It is your job to go on the radio. We called the NWS and told them that."

NWS watches and warnings also trigger many state communication mechanisms for planning and preparedness. Although the state does not require communities to evacuate, once the NWS issues a coastal flood warning, it triggers the state emergency management office to communicate with the local villages. Thus, NWS watches and warnings are a critical source of information for any weather event.

IV. Impressions of a Storm Surge Watch/Warning

The focus group participants were asked to provide feedback on whether a separate storm surge watch/warning would be useful. NWS would issue the watch/warning for life-threatening storm surge situations. It could be used in addition to, or in place of, the current coastal flood watch/warning.

As noted earlier, Alaskan coastal communities do not commonly use the phrase "storm surge"; "high surf," "coastal flooding," "high tide," and "high water" were the common phrases. One broadcaster asked, "What does surge mean? A flood is a flood. But what is a surge? Are you talking about a surge in football? Or a surge in Afghanistan? When listeners are distracted, 'flood' is easier to understand."

In fact, there was some indication that "surge" may be more commonly associated with tsunamis, which is a threat that Alaskans fear. One television broadcaster remarked, "Make sure there's no confusion in terminology": along with the radio broadcasters, they felt that their viewers would confuse a storm surge warning with a tsunami warning. The deeper concern is that a storm surge warning and a tsunami warning could occur simultaneously, which the broadcasters feel would be problematic.

Participants also questioned whether a new watch/warning is needed. A state EM commented, "Why would you want to change something that works so well?" This prompted a local EM to elaborate, "When you issue a coastal storm warning, it gets us going. If you are trying to tell us that it's going to be more intensified, we know that already. We don't say it's just another storm. We're on it already. Why would you want to change it?"

This sentiment was shared by the local WFOs. "Another product would create confusion. Preference would be to swap out [the storm surge warning for a coastal storm warning] instead of add, but I am reluctant to even go there."

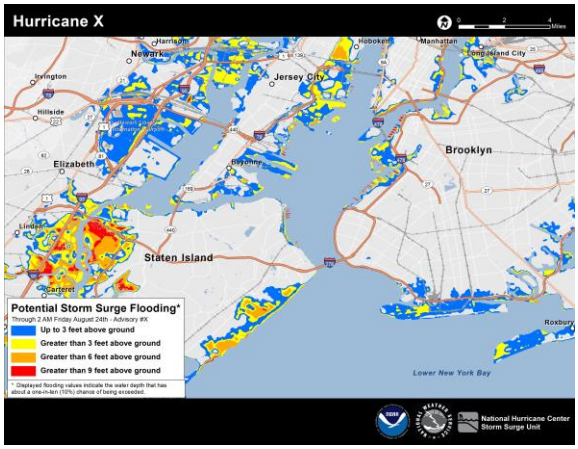
Although focus group participants voiced concerns about a new storm surge watch/warning, community partners did emphasize that they will support the NWS should the agency decide to implement a new product. The radio and TV broadcasters were quick to say that they will read "whatever the NWS issues."

Participants also stated that if the NWS plans to introduce a new term, such as "storm surge," it must do massive outreach in advance of any change. Outreach suggestions included interviews on radio with the NWS so it could describe the new watch/warning; partnering with state-wide agencies and organizations to connect with village leaders and environmental observers; and participation in events such as the Alaska Federation of Natives Convention, the BIA Tribal Providers Conference, and the Alaska Forum on the Environment to reach village residents and leaders. Participants also emphasized that conducting the necessary outreach would be challenging given the size of Alaska and the remoteness of many of the coastal communities.

V. Reactions to Potential Storm Surge Flooding Map

The focus groups reviewed an NWS "Potential Storm Surge Flooding" map that was used experimentally for the first time during Hurricane Arthur in 2014. Developed over several years in consultation with social scientists, EMs, BMs, and others, this map shows:

- Areas where inundation from storm surge could occur
- How high above ground the water could reach in those areas



Sample Potential Storm Surge Flooding map.

The participants were asked whether a similar product would be useful for their communities.

Focus group participants were in agreement that the map was not practical for Alaskan communities. A chief of police commented that the "map isn't practical because GIS doesn't exist. People will rely on common sense and tradition." A WFO representative echoed this sentiment by saying, "I don't see this map as [a] realistic [possibility]."

All of the groups questioned whether or not the map could even be made. The WFOs were more emphatic, however. They didn't question the possibility; they said it was impossible. All groups, including the tribal communities, said the money could be better spent on data gathering technology, such as buoys and tidal information. The map was generally liked in the abstract, but—to sum it up best—an EM said, "[The map] is never going to be a need. We have people who will go out and respond to this [coastal flooding] anyway." In other words, Alaska is prepared for coastal flooding whether there is a map or not.

BMs observed that the map would need updating every day due to the changing coastline in Alaska. That money to pay that expense could instead be used to fill one of their data shortages. The broadcasters also noted that because they convey the forecast for the entire state of Alaska, they would have to zoom into each community to show the individual variation. They noted that there is simply not enough time on air to do this. One broadcaster proclaimed, "What if 1,500 miles of coast is impacted? That happens."

The tribal community groups also had concerns about their ability to view the map online. They explained, "The map you showed us would take 10 minutes to download." Although many do have Internet access, it is very slow, so downloading a large map is not ideal. Some did ask whether the map could be sized for a text message or social media. The TV and radio media, as well as the EMs, said that—if the map were possible—they would most likely share it on social media.

VI. Conclusions and Next Steps

The focus groups engaged stakeholders in a dialogue around storm surge in Alaskan coastal communities. They helped to identify the unique vulnerabilities to ET storms faced by these communities and provided insights into the populations most at risk. The focus groups also shed light on the massive communication challenges in the state and the barriers to a comprehensive, coordinated outreach campaign.

A key finding from this research is that "storm surge" is not a term that is used or understood in Alaska, and that, among NWS partners, there is a good understanding and use of the coastal flood warning products. The results from these focus groups do not support a change to the existing system—both because the present system is understood and because a change could be both confusing and difficult to implement given the size of the state, the remoteness of coastal communities, and the lack of communication channels.

The next step in this project is to interview WFOs, EMs, and the media in other regions of the United States that experience ET storms to discern their vulnerability and experience with ET storm surge and to gain insights into their opinions on the introduction of a new NWS storm surge watch/warning product and map for ET surge.