Alaska Climate Teleconferences
Hosted by the Alaska Center for Climate Assessment and Policy

CLIMATE CHANGE IMPACTS IN ALASKA: THE WEATHER PERSPECTIVE
James Partain, National Weather Service

Tuesday, September 18; 1:00-2:00PM (ADT)

SUMMARY

James Partain, Chief Operations Officer and Chief Scientist for the Environmental and Scientific Services Division of NOAA's National Weather Service presented the September Alaska Climate Teleconference, hosted by the Alaska Center for Climate Assessment and Policy, entitled CLIMATE CHANGE IMPACTS IN ALASKA: THE WEATHER PERSPECTIVE. We had over 20 participants including representatives from the Aircraft Owners and Pilots Association, Alaska Conservation Solutions, Alaska Public Radio, Alaska State Climate Impact Assessment Commission, Alaska State Department of Transportation, Arctic Region Supercomputing Center, City of Kotzebue, television and radio news media, Northern Alaska Environmental Center, NOAA Climate Prediction Center, NOAA National Weather Service, Pacific Environment, Office of Senator Murkowski, Office of Congressman Young, Office of Senator Therriault, The Wilderness Society, rural campuses of the University of Alaska Fairbanks and the ACCAP Steering committee.

PRESENTATION
The teleconference presentation by James Partain is available as a .pdf file on the ACCAP Climate Teleconference Website under "Archive of Past Conferences":
http://www.uaf.edu/accap/teleconference.htm

Climate Change Impacts in Alaska: The Weather Perspective
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The mission of NOAA's National Weather Service is to protect life and property and to support safe and efficient commerce and transportation. Because climate change impacts many people and every division of NOAA NWS, Alaska Region, it is a priority area for the National Weather Service.

The NWS Alaska Region includes 3 weather forecast offices, 12 weather service offices, a river forecast center (that covers Alaska and the Pacific), the tsunami warning center (that covers all of North America, Puerto Rico and the U.S. Virgin Islands), and 2 aviation weather centers. These offices are geographically dispersed throughout Alaska including offices in Annette Island,

Juneau, Yakutat, Valdez, Homer, Kodiak, Cold Bay, King Salmon, St. Paul Island, Bethel, Anchorage, Palmer, McGrath, Nome, Fairbanks, Kotzebue and Barrow.

The National Weather Service, Alaska Region covers a very large geographic area of responsibility compared to the lower 48 states. Alaska has 54% of the U.S. Coastline and 66% of the U.S. Continental Shelf. Ted Steven's International Airport in Anchorage is the leading air cargo hub in the country and the largest U.S. Coast Guard base is in Kodiak. Alaska waters provide half of all U.S. Seafood and Dutch Harbor is the leading commercial fishery port in the country.

Climate is the historical record of weather at any particular location in space and time. Those who are tasked with trying to predict how climate will change have a very difficult job. Indicators such as El Niño and La Niña, the Pacific Decadal Oscillation, the Madden Julian Oscillation, the Arctic Oscillation and the historical climate record can help understand climate trajectories. There are many complex indicators of future climate and prediction is difficult.

The National Weather Service Center does not predict climate, but is interested in the connection between the changing climate in Alaska and weather events that occur on the scale of one to several days. Climate change has impacted how the National Weather Service can forecast the weather and the ways that we can help people make use of NWS information.

The links between weather and climate change pose challenges to weather forecasting. Climate change is occurring in Alaska. Greatly reduced extent and thickness of multi-year sea ice increases the impact of coastal storms and creates related transportation, subsistence and hydrologic issues. Alaska is also experiencing later freeze-up in the fall and earlier break-up in the spring. Glaciers are retreating and permafrost is thawing.

Climate change impacts many NWS' service programs. Aviators experience more frequent icing conditions, low visibility, and changing patterns for safe flying. For example when shore fast ice is in place, aviators can fly through clouds without danger of icing. In the past, shore fast ice would exist by early to mid November and pilots would often fly by the calendar, rather than by the actual sea ice extent. Now, with shore fast ice forming later in the season, open - ocean conditions create clouds that contain what are known as super cooled water droplets, rather than ice crystals. These super cooled water droplets cause icing on aircraft. Therefore, because shore-fast ice forms later in the season leaving open ocean, it is possible to have icing on aircraft even in mid-November and it is no longer safe to fly by the calendar. Aviators must now be attentive to the actual ice extent.

Overall, the public experiences more frequent weather extremes and less frequent conditions that were once considered normal. For example Alaska has experienced warmer warm and colder cold temperatures and wetter wet and drier dry precipitation conditions. Marine systems experience more frequent high impact events such as coastal erosion and salt water intrusion on drinking water sources, especially in areas of reduced sea ice. More frequent extremes can also be expected in the wildfire regime. For example, 2004 and 2005 burned record numbers of acres and also produced the greatest number of lightning strikes on record. Although, compared to the lower 48 states, there are fewer homes and valuable timber properties at risk to wildfire, taxpayer costs for fire suppression are elevated in Alaska.

The National Sea and Ice Data Center reports that as of Sunday, September 16, 2007, the ice free area in the Arctic Ocean is now at 1.6 million sq miles. This is four times larger than the previous ice-free record that was set in September 2005. In just the past week, 38 thousand sq

miles of sea ice have melted. The northern most ice edge is at it the farthest north position ever recorded. The deepest channel of the Northwest Passage has been completely opened since August. 11.

Hydrologically, river volume is more variable with associated issues of flooding, erosion, fresh water availability and barge transportation and shipping. Ice-dammed glacial lake releases also increase risk of flooding in specific locations. Even our climate program is changed by climate change. In the past we could count on a certain predictability related to El Niño and La Niña events. Now, due to sea ice loss and other climate related factors, we are losing predictability in longer range forecasts. Furthermore, in September of 2003, following a warm and dry summer, glacial melt exposed relic volcanic ash in Katmai (Land of 10 Thousand Smokes) allowing for re-suspension by strong winds. This volcanic ash event, that was not associated with any eruption created impacts on aviators, mariners and the public.

The NWS has many science needs in order to improve our understanding of climate and the impacts of climate change. More funding is needed to develop decision support tools, education and outreach as well as for more observations and improving numerical models that feed NWS forecasts. Observations form the backbone of forecasting and warning services. Improved forecasts for improved decision-making require more observations, both from radar and on the ground.

Existing numerical models have poor performance in the Arctic and Antarctic (high latitudes). This is partly due to lack of observations and to lack of understanding of high latitude surface events. Improved observations, models and better scientific understanding are needed in order to improve confidence in forecasts and give greater lead time to inform decision-making. Advances in education and outreach will help decision-makers and the public understand and interpret potential consequences of forecasts. The National Weather Service is putting increased attention on developing decision support tools, or ways of communicating information that are directly useful to decision makers.

The National Weather Service forecasts extend up to 7 days. Longer range forecast products beyond 7 days are issued by the NOAA Climate Prediction Center (CPC) and include 8-14 day, one month, and 3-month (seasonal) national outlooks for expected above and below normal temperatures and precipitation probability (http://www.cpc.ncep.noaa.gov). In these maps, darker colors indicate higher confidence in the forecast. The seasonal forecasts are available for up to 13 months in advance.

The CPC also issues hazard forecasts (http://www.cpc.ncep.noaa.gov) as well as 10, 30 and 90 day storm tracks graphics including sea ice extent (http://www.cpc.noaa.gov/products/precip/CWlink/stormtrack/strack_alaska.shtml). Storm tracks information includes documentation of past storms as well as forecasts for storm activity up to 3 months in advance. Coastal storm surge guidance information is available from the National Weather Service that graphically shows existing and projected hourly water level factoring in daily tidal oscillations (http://www.weather.gov/mdl/etsurge/index.htm?coast=ak&load=akmap.htm&map=0-48). Storm surge advisories are also issued in text form (http://www.arh.noaa.gov).

In summary, more and higher quality observations lead to better numerical weather prediction models. Improving observations requires continued and increased funding. Better models lead to enhanced information products for decision-makers, i.e. better, more confident forecasts provided with greater lead time. These products require continued decision-support

development in addition to funding. Climate change impacts involve complex feedbacks. The need has never been greater for research on climate change and its impacts that will lead to greater understanding of these interconnections. Finally, it is important to demonstrate and highlight how climate change impacts in Alaska affect people and conditions in the rest of the country.

DISCUSSION COMMENTS AND QUESTIONS

- Please elaborate issues specific to Southeast Alaska and the Tongass National Forest.
  - Response: There are challenges with Southeast Alaska experiencing stronger storms and associated storm surge. When combined with an out-going or in-coming tide, there can be very powerful extreme currents that impact commercial (fishing and tourism) and private boat traffic. In addition, as glaciers melt, water is trapped in lakes. These lakes are often released in a single, catastrophic event or outburst flood creating a hazard for communities and individuals directly down-stream. If the melt water lake associated with the Hubbard glacier becomes significantly large and deep, for example, there is potential to ruin a major fishery in the Situk River. At this time we are uncertain how climate change will impact flammability and fire potential in the Southeast forests. In summary, tourism, barge traffic, recreational boaters and fishing vessels are all potentially impacted.

- Does local scale information exist in map form? I am looking for maps and information that is easily viewed and interpreted to help residents in Bethel understand combined factors of environmental, cultural and economic change. I have been able to locate jet stream changes, real-time sea ice conditions and transportation routes. People don't necessarily have a need or very detailed information, but they do need to see the basic information. However, coastal storm surge information is very useful on a local level. For example, climate change information is particularly useful in conjunction with information about socio-economic change in the re-locating villages and land fills from coastal erosion. There is a need for this in particular in Southwestern Alaska.
  - Response: We are building GIS tools to use in conjunction with weather and climate data. We have in the past worked with the Aviation and Aircraft Owners Association to build a GIS tool to show the location of accidents, current weather observations, and help with future planning activities. Building decision support tools with stakeholder input to meet the specific information needs is a goal of the National Weather Service, ACCAP and the NOAA Alaska Region Coordination Team.

- Are these issues transferable across the North, for example in terms of the Beufort Sea and Northwest Passage?
  - Yes, these issues are certainly applicable to the rest of the Arctic. Many of our collaborators at the University of Alaska, Fairbanks are involved with Canadian and pan-Arctic research groups. Also, there is a great deal of research focused on the Arctic at this time with the International Polar Year, including legacy observing stations to help us answer these pan-Arctic questions. In addition, Senator Inouye in Hawaii has provided research support to study coastal erosion because communities in the South Pacific are experiencing similar problems. If you remove the sea ice, much of what is happening in the tropical Pacific is the same as what is happening in Alaska.

- For the last few years we have had winter rain events, in December and February. Those definitely cause problems, for example with icing on the tundra and then the caribou can't

get to their food. Are those events becoming more frequent? What is the projection for the future in terms of winter rain events?
  - As we see more storms coming in from a south western direction impacting Alaska, we are prone to seeing more warm weather events during the cold weather season. In the interior, the frequency of mid-winter rain events is increasing. This makes meteorological sense as climate change increases the longer open water season (i.e. ice free ocean) on the Chukchi, Beufort and Bering Seas and increases water temperatures during those times.

- Given that the environment is very arid in Southwest Alaska (Bethel), one suggestion for development of decision support tools is to investigate the relationship of precipitation to potable water.
  - Response: That is a great suggestion. Fresh water collection systems often rely of precipitation for water recharge. Changes in precipitation certainly have the potential to influence this. Similarly, storm events can cause salt water intrusions and impact drinking water availability.

- We're seeing the same things in Kotzebue. Winter is shrinking. The caribou are starting to winter further and further north. Its going to come down to water supplies and a lot of people are dependent on caribou for food. If the weather keeps warming up, there won't be a reason for the caribou to come south in the winter. Water is an important factor.

- Congressman Young and Senator Murkowski have introduced the Alaska Water Resources Act. Both legislators are looking to increase or study of potable water and ways to increase observation networks (H.R. 1114, S. 200).

- It would be useful to have a greater overview of what decision tools already exist. This will prompt more thinking about additional useful tools. Specific to aviation, the distribution of smoke is a real challenge for the aviation community that flies under visual flight rules. It would be useful to have additional information and good forecasts for smoke associated with wildfire
  - Response: NWS Coastal Services Division in South Carolina has put together a decision support tool to assist emergency managers with inundation from coastal storms (http://www.csc.noaa.gov/cspPNW/mapping.html) and they are working with the Alaska Region staff to develop a similar tool in Alaska. This tool allows you to overlay a suite of geographic data sets along with weather forecasts and predicted wave heights and periods. The user can zoom in to a particular community and select topographic features including inundation zones and evacuation routes. This is an example of a web-based, GIS decision-support tool that serves mariners, aviation, emergency managers and civic planners. We are working to develop a similar tool for Alaska.
  - Continued question: What is the status of this tool development? Do you have a timeline for having something operational?
  - Response: The NWS Alaska Region and scientists from the University of Alaska (Dave Atkinson) have been collaborating with the Coastal Services Division in South Carolina. Right now, they are seeking further funding to continue the project. We have been able to utilize funding from Hawaii because the systems are similar.

- From the NWS forecaster perspective, it would be useful to get a better understanding of how stakeholders perceive and interpret the inherent uncertainty in forecasts. Right now, there may be reluctance to issue forecasts that have a higher degree of uncertainty because

we do not know how they will be understood and acted upon. It would be useful to have a discussion about uncertainty in forecasts.

- What data is available out of the Russian Far East and Northern China?
    - Response: That data has been problematic. We have no way to control the weather observations of other countries, such as balloon launches. One of the reasons why our numerical models perform poorly is lack of observations. Because weather comes from the West our models are hungry for observations in those regions. Weather forecasts are extremely difficult without those upstream observations. It is important to get high quality data observations. Many observations of poor quality are not useful. The quantity and quality of especially Russian observations has decreased over the past several years and this has been an issue for NWS. We are trying to correct that through meetings, collaborations and engaging international scientists in the International Polar Year scientific research focus.

- You discussed the need for better models. Can you quantify the relative contribution of lack of topographic data and/or number of observations versus the algorithms in the models themselves?
    - Response: The work of error analysis and teasing out relative impact of observations, the resolution of topographic data, the resolution of the model itself, the physics, and the actual equations in the model is in its infancy. The models are very sensitive not only to the observations themselves, but also to the type of observation. For example observations from balloons that gather information all the way up to the stratosphere provide much more information than a single on-the-ground observation. In addition, the physics behind the model are not well understood in the Arctic regions both with frozen ground, changing fluxes (as in open-ocean from sea ice retreat). I am not aware of definitive research on how much models have been improved by change in observations versus change in resolution versus change in the physics.

- Has there been any work done on impacts of increased Arctic shipping to commerce in Western Alaska?
    - Response: The Arctic Marine Shipping Assessment lead by Lawson Brigham has been doing quite a bit of work in that area (http://arcticportal.org/pame/amsa). This is a big issue in terms of security and safety. The River Forecast Center in Alaska tries to get information out related to river barge transport (http://aprfc.arh.noaa.gov). In recent years we've seen both very low river levels that have prevented barge traffic and goods transport as well as very high river levels such that barges didn't have anywhere to tie off in docking. The River Forecast Center puts out both low and high river forecasts. In addition, barges have a threshold in wave height. When the waves get too high on the open ocean, they have to stop and tie up somewhere. With diminished sea ice extent, we have more open water and increased wave heights. This is also a safety issue for small boats.

    - Continued comments: Changes in sand bars, for example in the Kuskokwim Bay, are also a big issue for resident subsistence hunters and fishers. Increased shipping traffic also has the potential to increase flotsam (i.e. parts, diesel motors).

    - Continued comments: The risk assessment generated by increased traffic in Bering Sea is well underway. A bill from the house to the senate proposes $3.6 million for

risk assessment in the Bering Sea and Cook Inlet. The shipping safety partnership has about 22 members and is pushing on this issue. If appropriated, this money will go into the Coast Guard budget and the Coast Guard will give the money to the marine board of the National Academy of Science to pull together the group to do the research.

- Additional questions or comments can be directed to James Partain: James.Partain@noaa.gov

To provide feedback on this summary, the teleconference, or to suggest topics for future teleconferences please contact: Sarah Trainor, fnsft@uaf.edu, 907-474-7878.