



# Climate Change Impacts in Alaska: the Weather Perspective

September 18, 2007

NOAA's National Weather Service, Alaska  
Region

James Partain, Chief

Environmental and Scientific Services Division



# NOAA NWS Alaska Region - Overview

- 3 Weather Forecast Offices
- 12 Weather Service Offices
- River Forecast Center (covers AK and Pacific)
- Tsunami Warning Center (covers all N. America, Puerto Rico, USVI)
- 2 Aviation weather centers

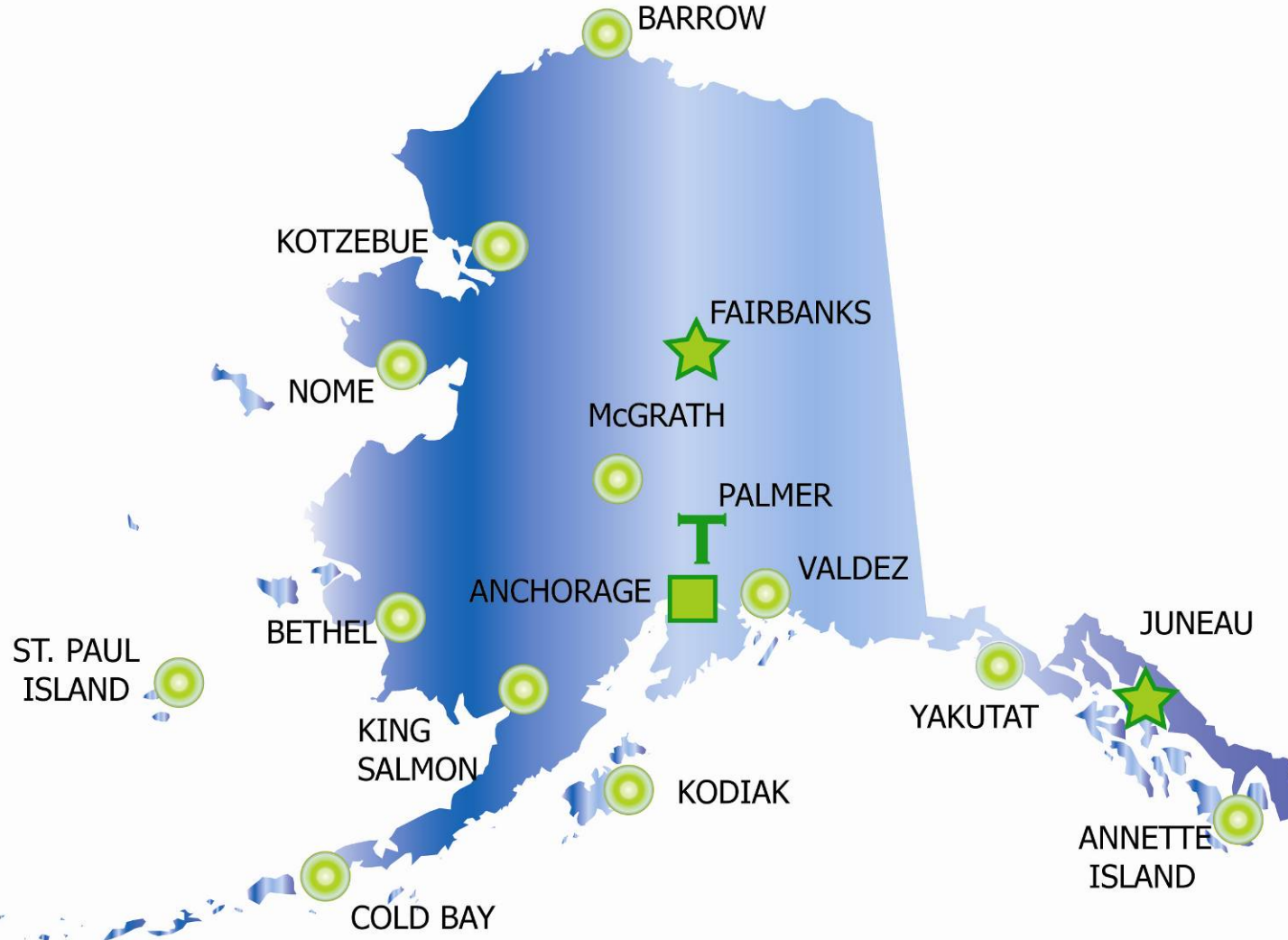
**Mission of NOAA's NWS: Protection of life & property; support safe & efficient Commerce & Transportation**



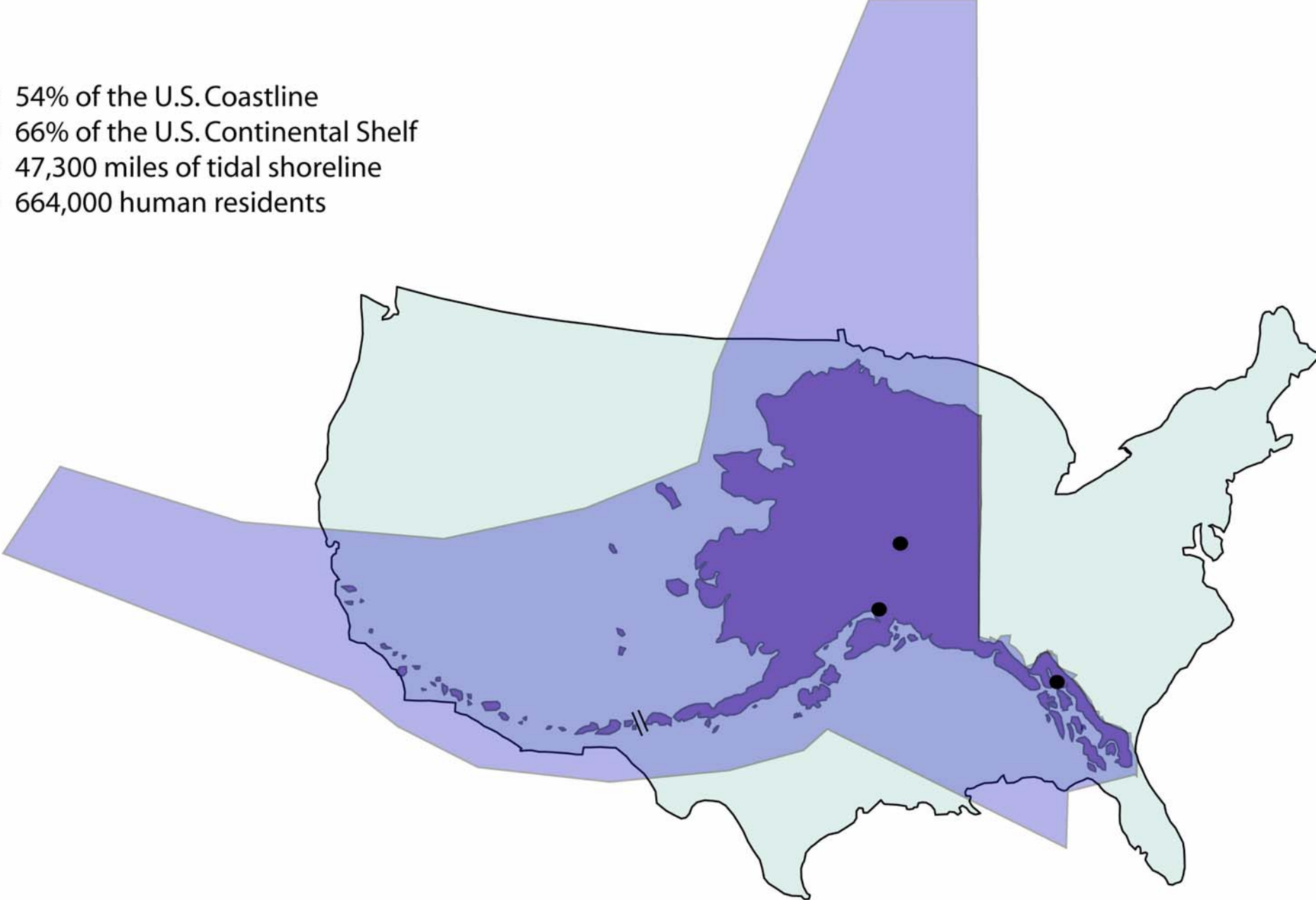
# NOAA NWS Alaska Region - Facilities



-  WFO
-  WSO
-  ATWC
-  In Anchorage:
  - WFO
  - AWU
  - CWSU
  - ARH
  - RFC



- 54% of the U.S. Coastline
- 66% of the U.S. Continental Shelf
- 47,300 miles of tidal shoreline
- 664,000 human residents



- Hazards - More than 3,000 maritime vessels travel through Unimak Pass on the Great Circle Route.
- Alaska waters provide half of all U.S. seafood
- Alaska has the nation's leading air cargo hub and leading commercial fishery port



## Challenges Due to Weather/Climate Linkage

- Climate change in Alaska:
  - Decades-old warming at locations all across Alaska
  - Greatly reduced extent *and* thickness of multi-year sea ice
    - More impacts from coastal storms in Fall and Spring
    - Many resulting transportation, subsistence, hydrologic issues
  - Later freeze-up in Fall and earlier break-up in Spring
  - Glaciers retreating, Permafrost melting with attendant issues.



## Climate Impacts on NWS' Service Programs

- Aviation – more frequent icing conditions, low visibility; changed flying “paradigms”
- Public - more frequent extremes in weather
- Marine - more frequent high-impact events, esp. in areas of reduced sea ice (e.g. coastal erosion, water quality)
- Wildfire - more variable regime-dependent fuel-moisture conditions (e.g. 2004 and 2005 burned record # of acres in Alaska, and also produced the greatest number of lightning strikes ever recorded)
  - However, we need to relate this to socio-economic impacts – saying we burned 6.7M acres in 2004 without understanding human impacts is important to sell this to the rest of the country (e.g. it costs \$4,000 to attack a fire immediately, but it costs between \$3M and \$30M to suppress a wildfire)

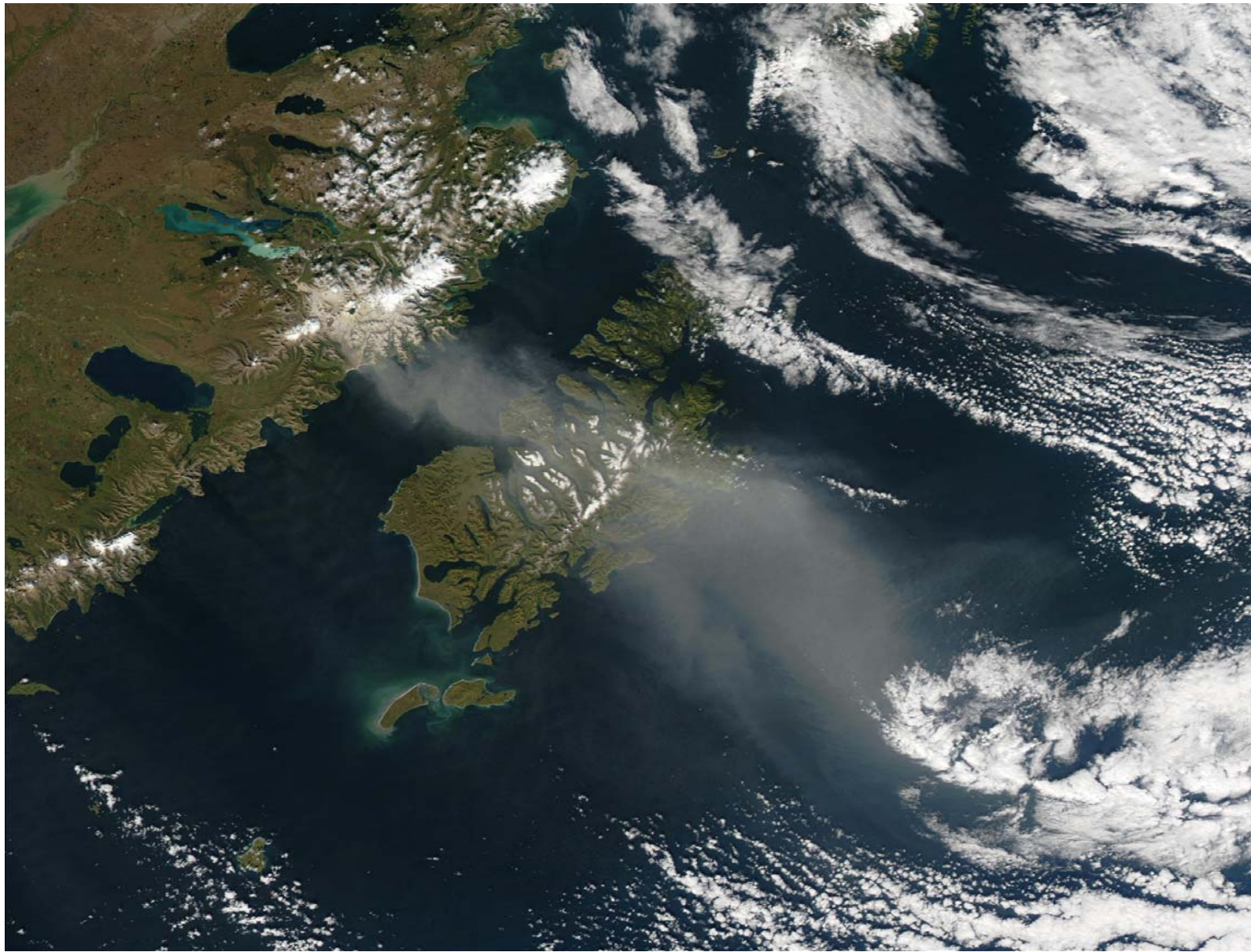


# Climate Impacts on NWS' Service Programs

- Hydrology - greater variability in river volume & related flooding and erosion, transportation, and fresh-water availability; ice-dammed glacier lake releases
- Climate – loss of predictability for El Niño/La Niña events due to unknowns from climate change (e.g. open water impacts)
- Tsunami – sea-level rise may have eventual inundation impacts
- Volcanic Ash – resuspension of relic ash and resultant impacts on aviation, marine, and public services.



## September 2003, Katmai "Re-Suspension" Event





# Climate Science Needs

- Improving Climate Science, and therefore Climate Services, involves, among other things:
  - Observations
  - Numerical models
  - Decision-support tools
  - Education & Outreach



# Climate Science Needs - Observations

- Observations form the backbone of forecast and warning services:
  - Allows forecasters and rest of the world know what's "really happening"
  - Allows decision-makers (e.g. harbormaster, airline dispatcher, Emergency Manager, civic planners, policy makers) and numerical modelers know what to do to make decisions and make things better
- Both remotely-sensed (e.g. radar, satellite) and in-situ (e.g. weather stations, humans) are needed



# Climate Science Needs - Models

- In Alaska, guidance from numerical models is especially critical for forecasts & warnings beyond 6-hours
- Models currently do poorest at the poles...Alaska is the 2<sup>nd</sup> worst of the 12 parts of the planet that are verified for global models (Antarctica is worst)
- Observations make the models better, as do R&D initiatives aimed at improving the models to better understand Arctic conditions and issues
- Improved models lead to improved and more confident services by forecasters and decision-makers with greater lead time

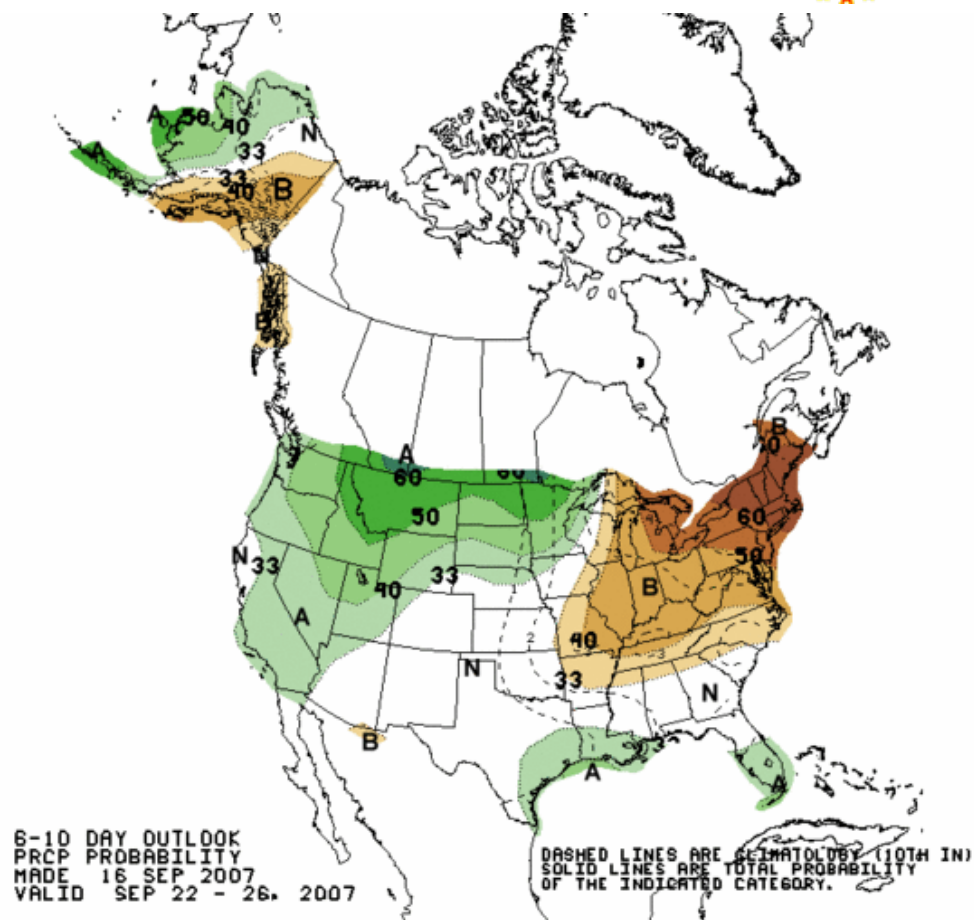
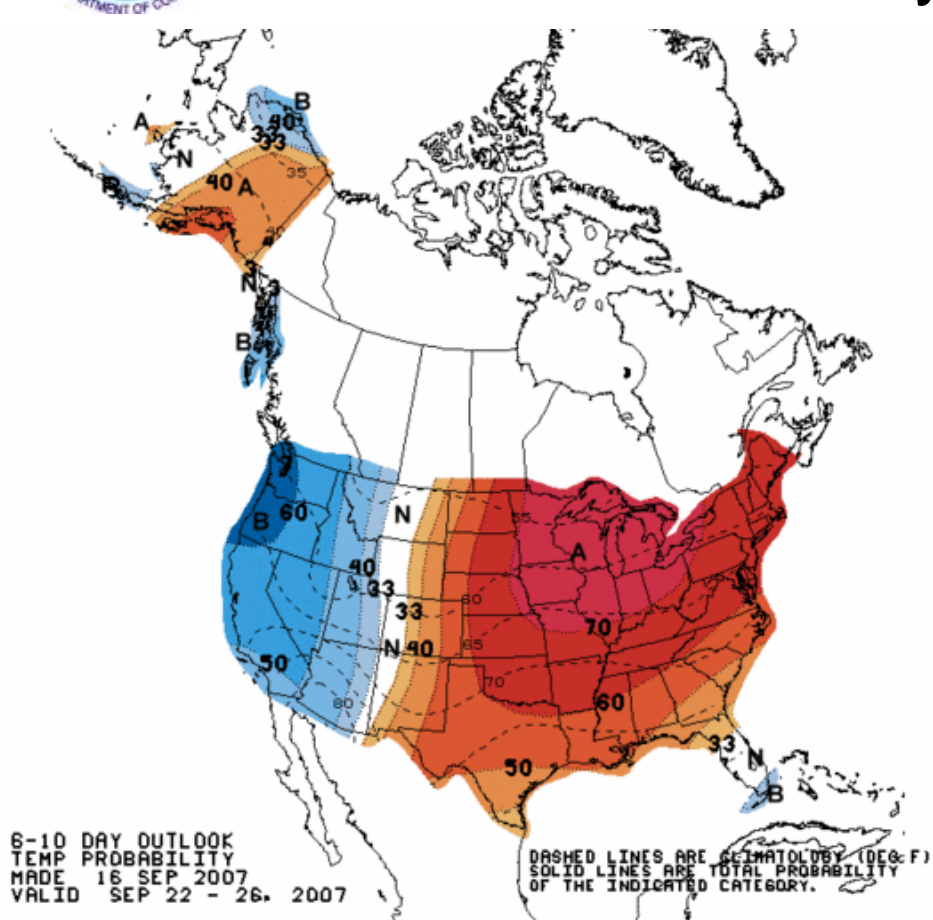


## Climate Science Needs – Decision Support and Outreach/Education

- Decision-support bridges the realms of observations, models, research, and human factors and their implications for real-world application
  - In Alaska, help is needed by many, including those involved in transportation and subsistence activities, deciding where to move villages so they will not be in harm's way in 30 years, how to deal with toxic releases when a village washes into the ocean, etc
- Outreach and education are the tools by which decision-support outputs are made effective
  - A perfect forecast or warning is *entirely useless* unless the customer understands its meaning and impact and can make appropriate decisions to mitigate the impacts.



# Existing Climate Products 6-10 Day Outlooks

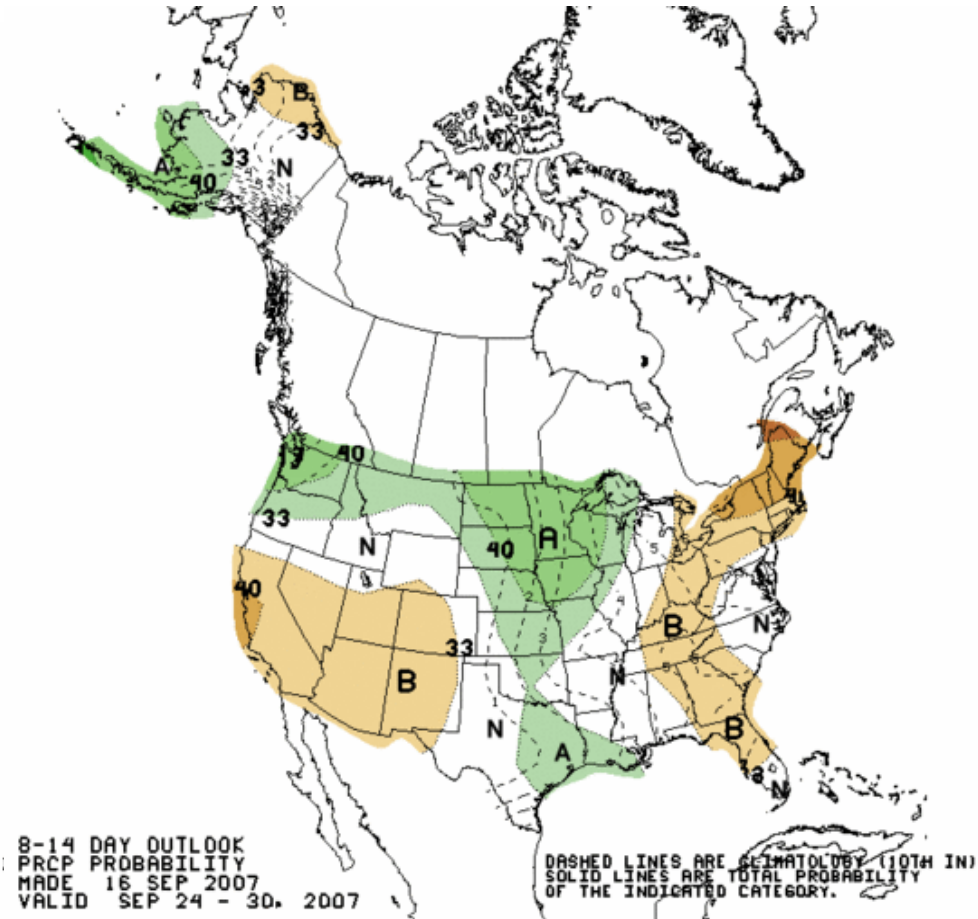
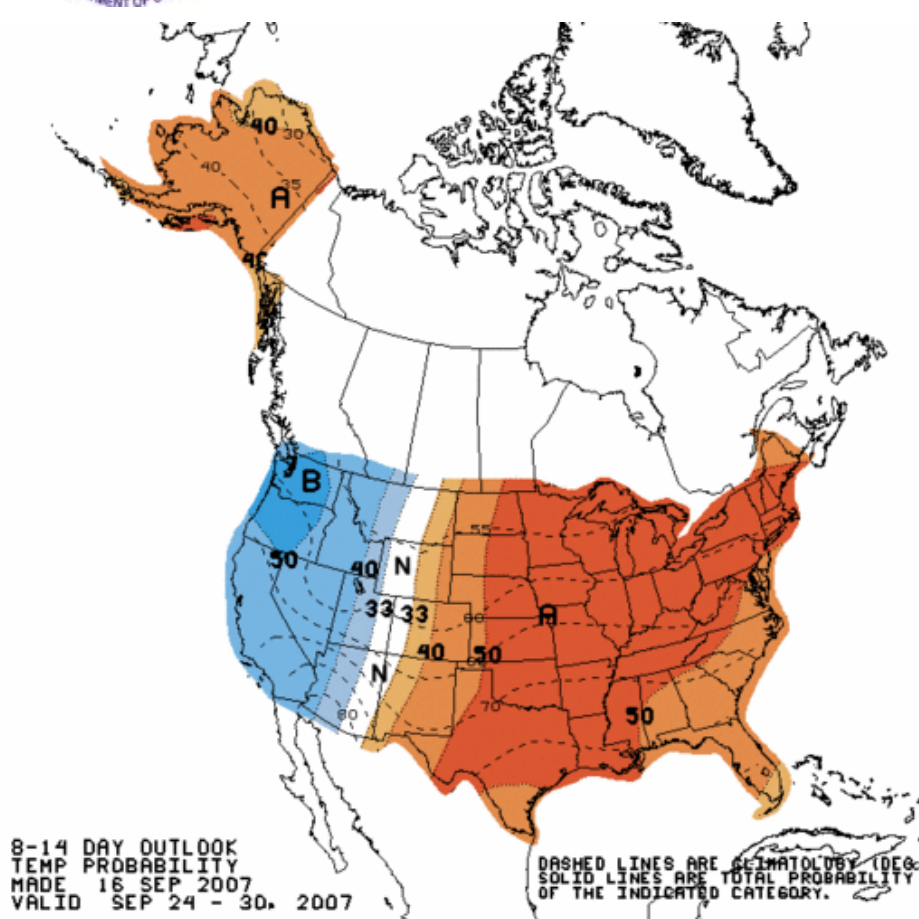


Contours/shading are odds of the most likely category of three: above, normal, below, whose random odds are 1/3 each. Climatology lines are dashed, in degrees F and inches.



# Existing Climate Products

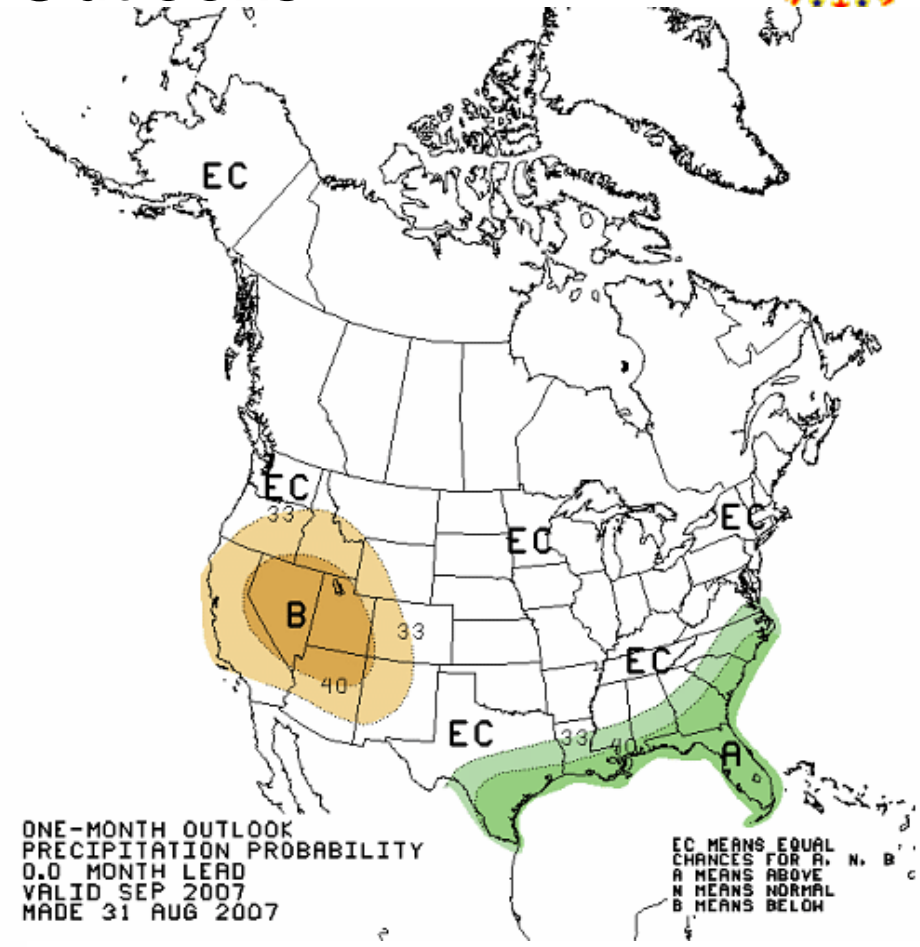
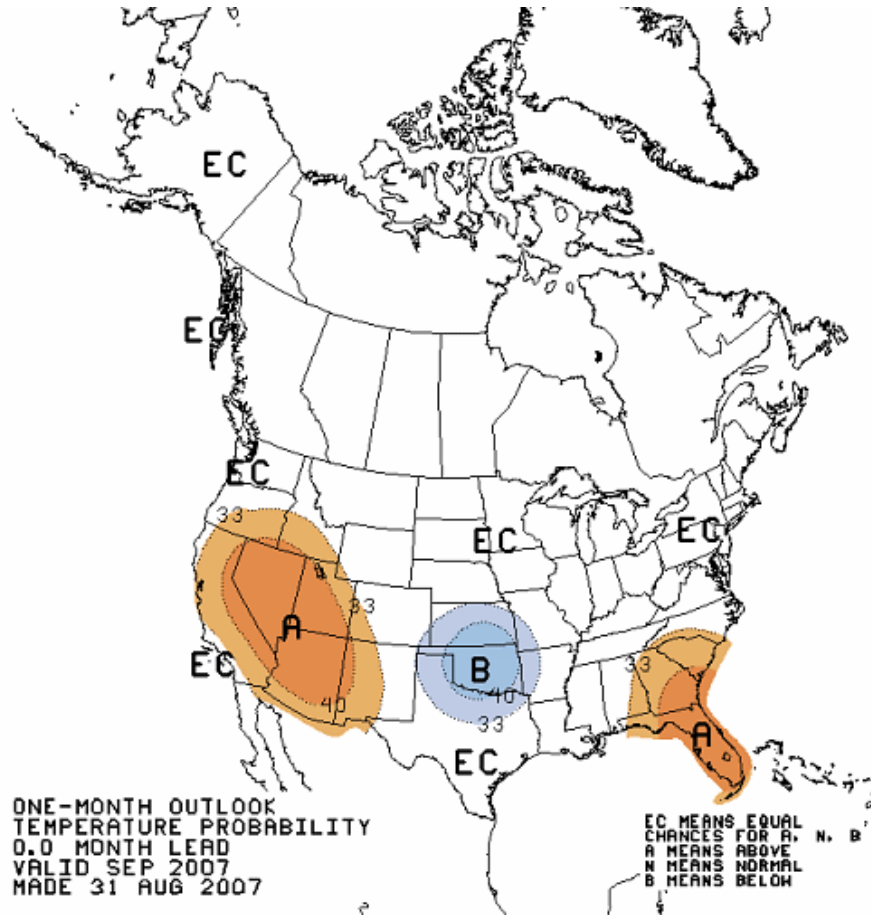
## 8-14 Day Outlooks



Contours/shading are odds of the most likely category of three: above, normal, below, whose random odds are 1/3 each. Climatology lines are dashed, in degrees F and inches.



# Existing Climate Products 1-Month Outlooks

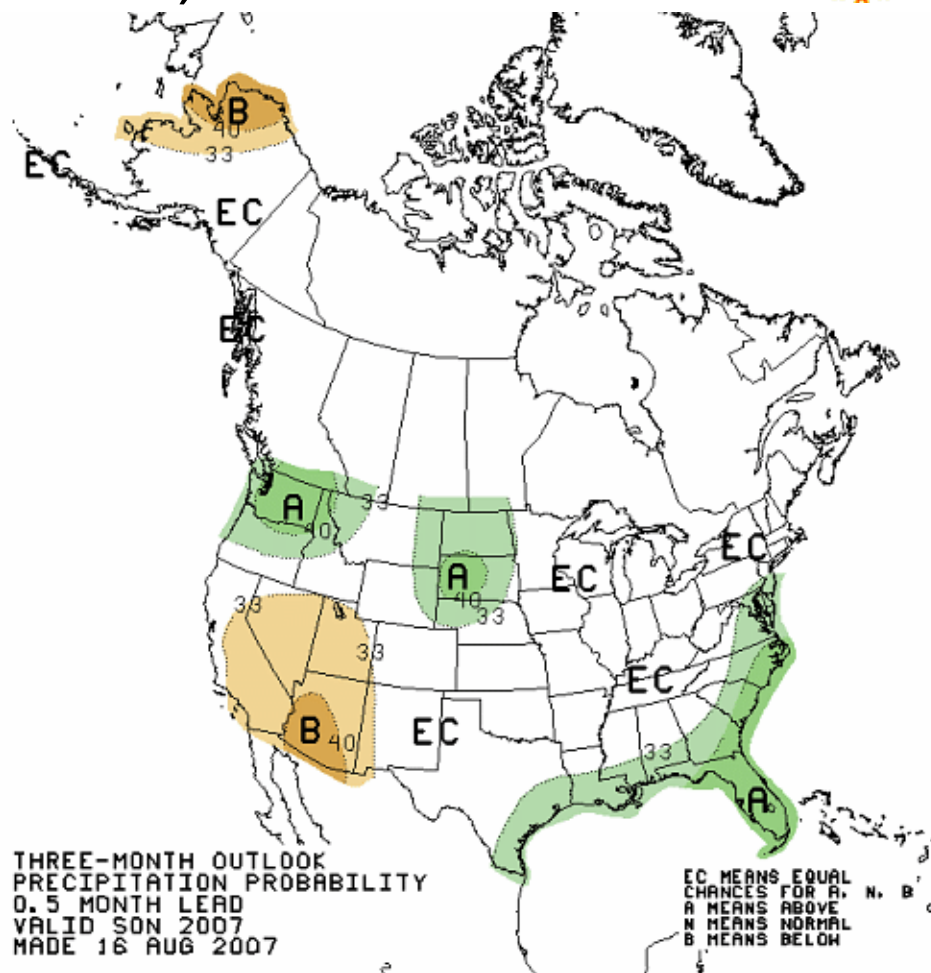
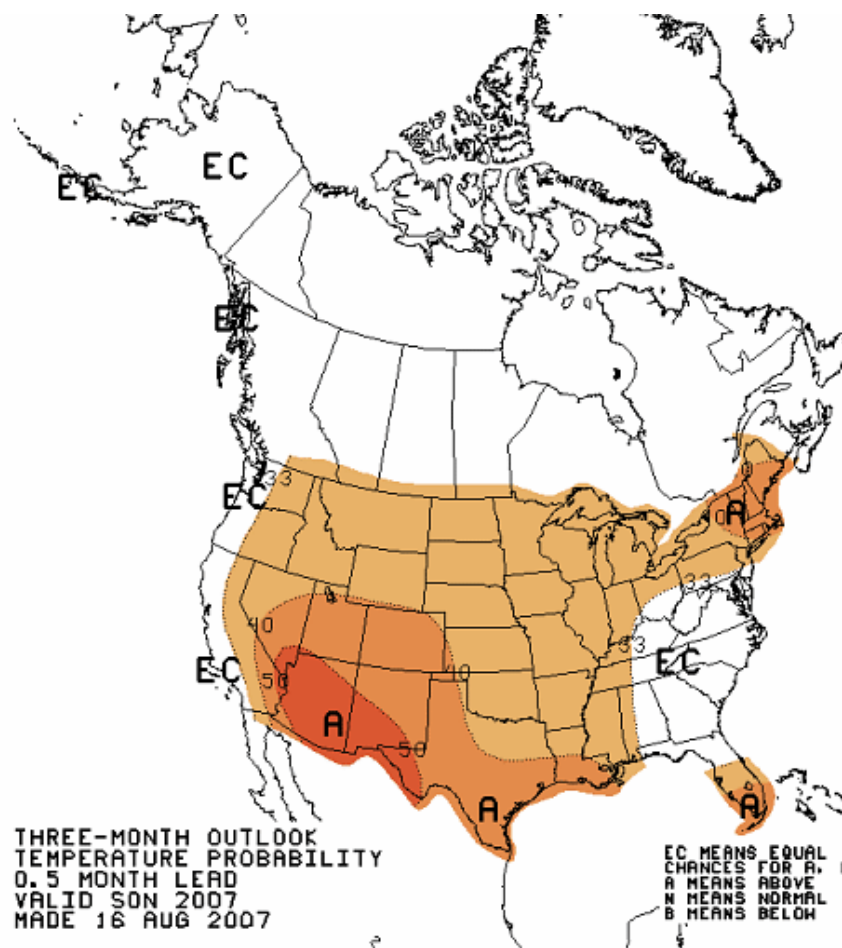


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# Existing Climate Products

## 3-Month (Seasonal) Outlooks

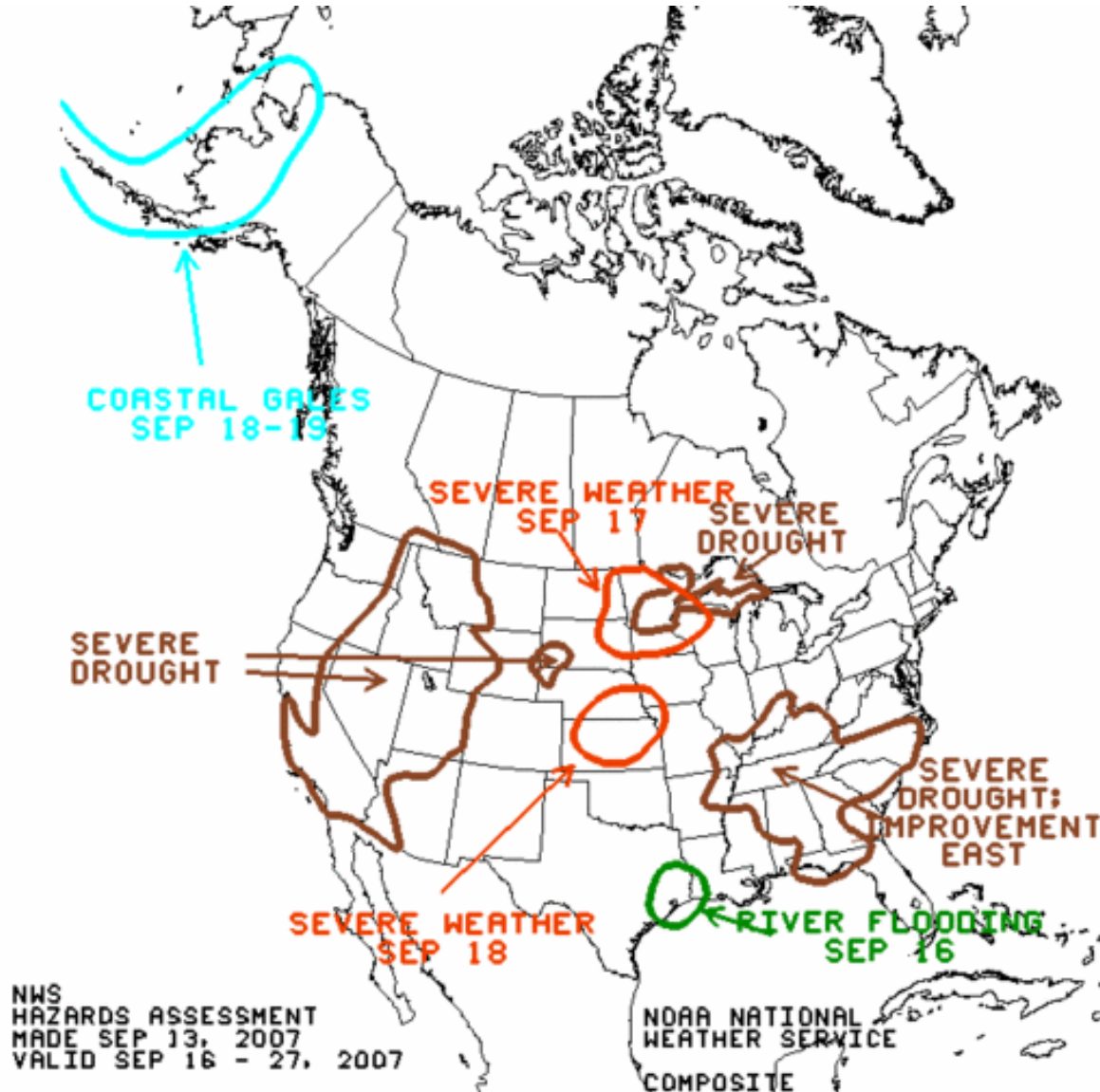


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# Existing Climate Products

## 8-14 Day Hazard Assessment



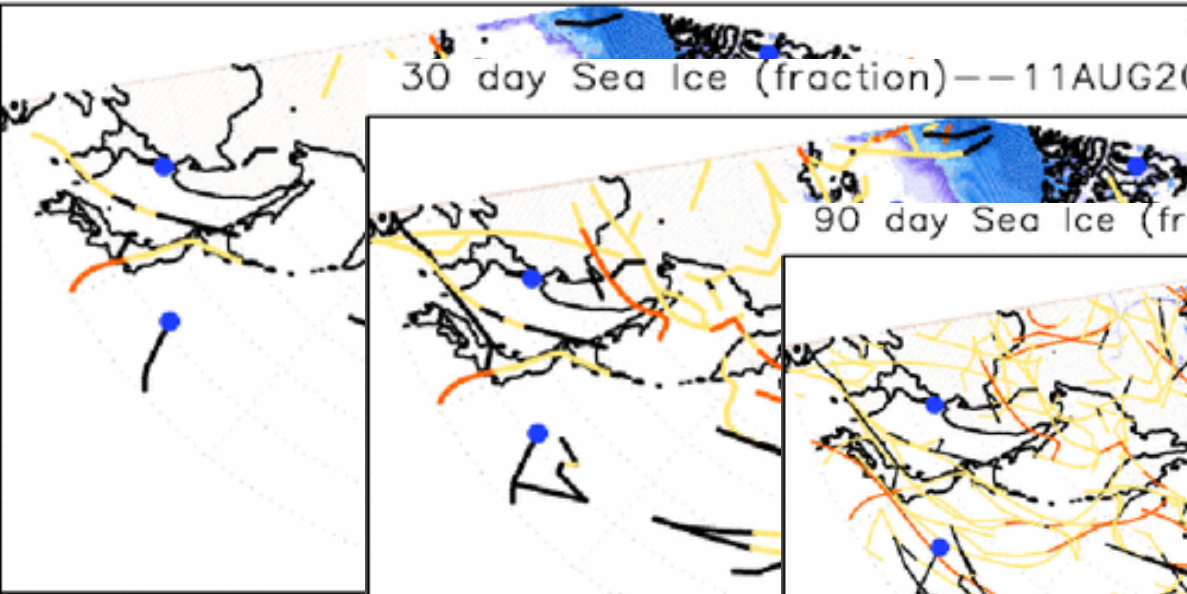


# Existing Climate Products

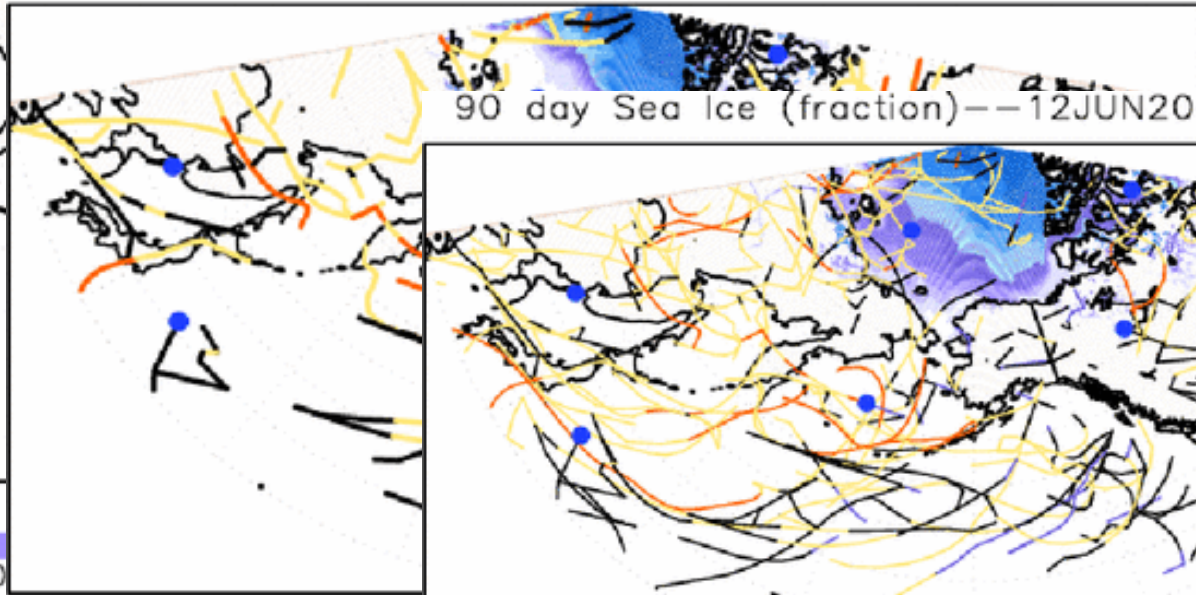
## 10-, 30-, 90-day Storm Tracks



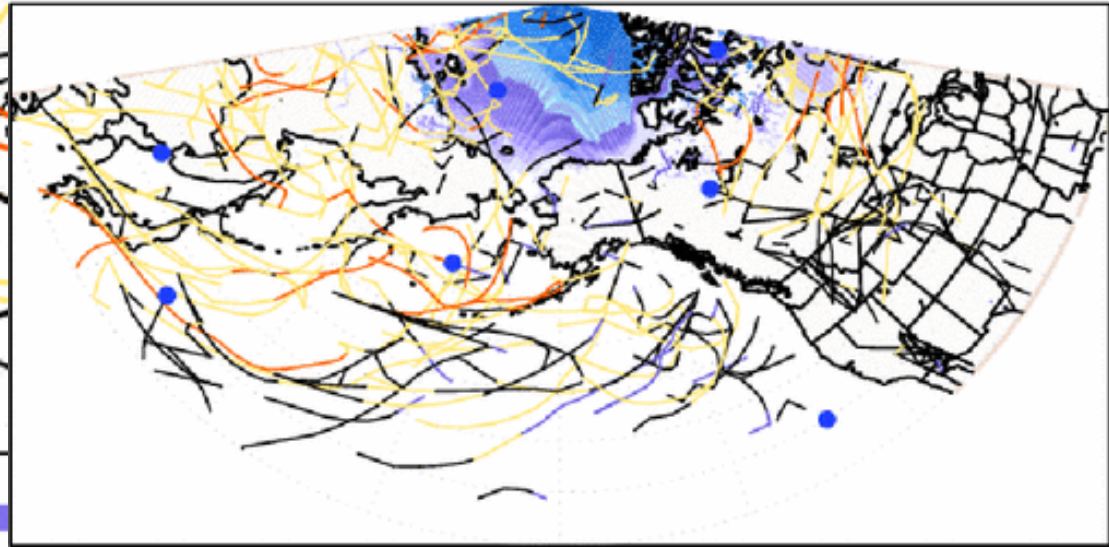
10 day Sea Ice (fraction) -- 31AUG2007-09SEP2007



30 day Sea Ice (fraction) -- 11AUG2007-09SEP2007



90 day Sea Ice (fraction) -- 12JUN2007-09SEP2007



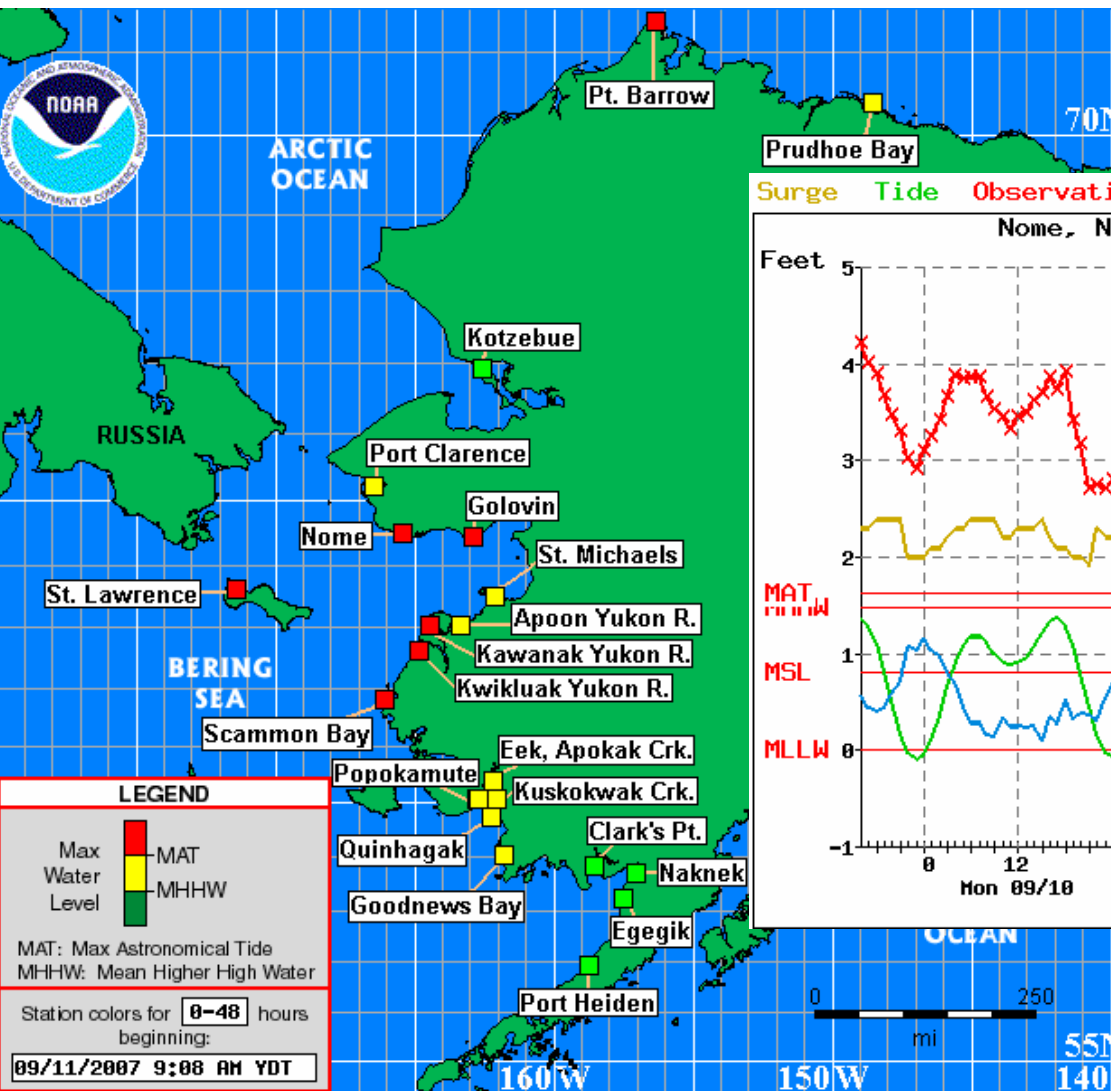
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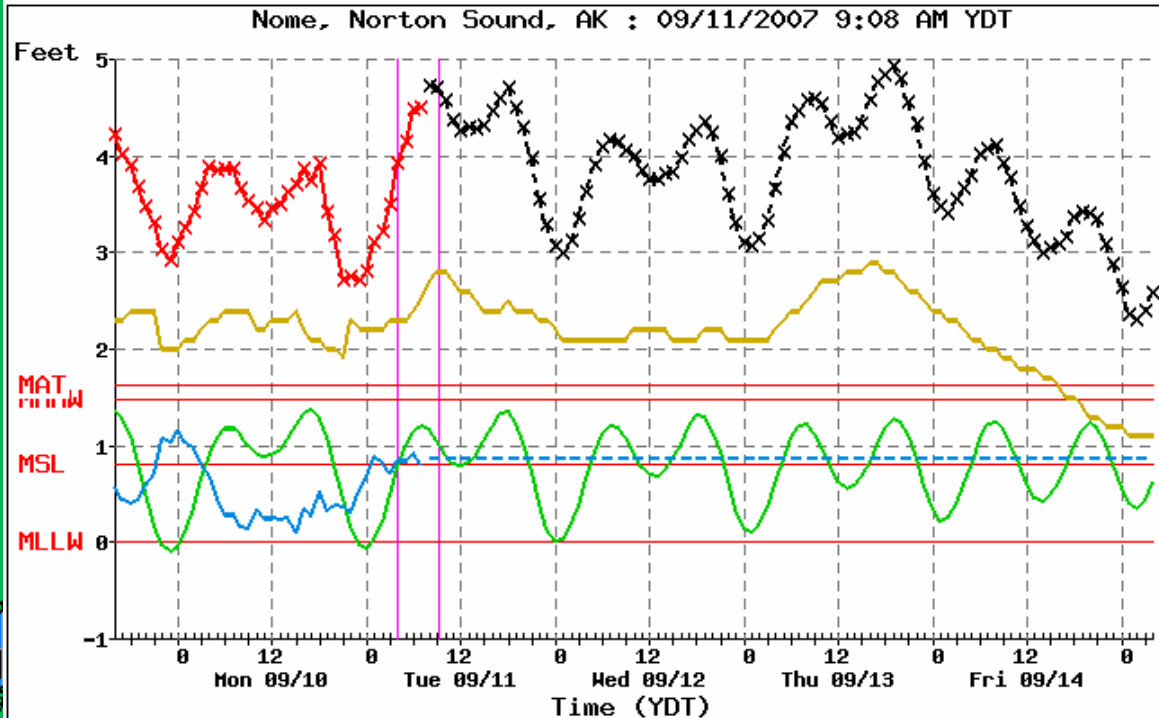
STORM TRACK KEY:  
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992 mb - 1004 mb  
1004 mb - 1012 mb  
> 1012 mb



# Coastal Storm Surge Guidance



Surge Tide Observation Prediction Anomaly=(Obs.-(Tide+Surge))





# Storm Surge - Advisory

SOUTHERN SEWARD PENINSULA COAST - INCLUDING...NOME...WHITE MOUNTAIN...GOLOVIN

**1127 AM ADT TUE SEP 11 2007**

**...COASTAL FLOOD WARNING IN EFFECT UNTIL 10 PM ADT THIS EVENING BETWEEN PORT SAFETY AND SOLOMON...**

THE NATIONAL WEATHER SERVICE IN FAIRBANKS HAS ISSUED A COASTAL FLOOD WARNING...WHICH IS IN EFFECT UNTIL 10 PM ADT THIS EVENING.

ALASKA DOT HAS REPORTED WATER ON THE NOME-COUNCIL ROAD DUE TO WAVE ACTION BETWEEN MILE MARKERS 23 AND 24. AS WAVE ACTION CONTINUES THIS AFTERNOON INTO THIS EVENING...EXPECT A DITCH TO CUT INTO THE ROAD MAKING IT IMPASSABLE. TIDES WILL RUN ABOUT 3 FEET ABOVE NORMAL TODAY...AND SOUTHEAST WINDS TO 35 MPH WILL PRODUCE SEAS OF 6 TO 9 FEET ALONG THE NORTHERN COAST OF NORTON SOUND FROM GOLOVIN WEST. WINDS WILL SHIFT TO THE SOUTH AND WEAKEN TO LESS THAN 30 MPH OVERNIGHT AND THE WATER LEVEL IN NORTON SOUND WILL DROP AS THE NEXT LOW TIDE APPROACHES AROUND MIDNIGHT.

A COASTAL FLOOD WARNING MEANS THAT RISING SEA WATER CAUSING FLOODING IS EXPECTED OR OCCURRING. COASTAL RESIDENTS IN THE WARNED AREA SHOULD BE ALERT FOR RISING WATER...AND TAKE ACTIONS TO PROTECT LIFE AND PROPERTY.



# Conclusions

- Better, more observations lead to better numerical weather prediction models (**requires funding**)
- Better models lead to better, more confident forecasts, lead time, and information for decision-makers (**requires funding, decision-support development**)
- Climate change impacts include a tremendous number of feedback loops that we are only at the threshold of understanding (**requires research**)
- We must prove to the rest of the country that what is happening in Alaska is important to THEM, not just to US (**requires wisdom and tact**).