Water-Related Topics Overview Committee Devils Lake

Climate Outlooks for the Devils Lake Basin – NOAA / NWS Decision Support Services

Mark Ewens, Climate Services Focal Point NOAA National Weather Service Grand Forks ND

Climate Outlooks – Techniques and Cautions

- Climate Outlooks are a relatively new part of the meteorological landscape. We have issues with day to day forecasting due to the lack of information and our imperfect knowledge of the atmosphere.
- Our understanding of the complex interactions within the Ocean-Atmosphere-Land interface are deficient.
- Outlooks are based on two primary processes – Analogs and Computer Modeling.
- We have 120 years of surface data, with other "proxy data" (tree ring, soil cores, written journals, etc.) back several thousands of years.
- We only have 60 years of Upper Air data. This is simply not enough data to make very long term assessments.

Climate Outlooks – Techniques and Cautions

- There are two basic types of outlooks – seasonal and decadal.
- ***Seasonal outlooks*** are primarily based on a variety of analog techniques; i.e. the next 3 to 12 months will 'behave' in a manner similar to previous years with like atmospheric signals.
- ***Longer term*** (decadal) are primarily based on General Circulation Model (GCM) simulations of the Ocean-Atmosphere-Land interactions.
- Both must speak in very broad & general terms with ***probabilities*** assigned to the longer lead outlooks.
- These outlooks are just that – outlooks based on the best science of the day.
  - 67% of all statistics are made up on the spot.

Seasonal Outlooks
1 to 12 month

- Based heavily on the phase of large scale atmospheric signals, including the ENSO e.g. El Nino, La Nina. Excellent understanding.
- Also based on our understanding of shorter term climate signals such as the Arctic and North Atlantic Oscillations. Fair understanding.
- Also based on our emerging understanding of other very long term signals such as the Pacific Decadal and Atlantic Multi-decadal Oscillations. Poor understanding.
- Local downscaling techniques at the Grand Forks NWS attempt to put some specificity into the fist 3 – 6 month outlooks.
- Broad terms used in the 6 – 12 month outlooks based on atmospheric trends and the GCM.

Decadal and multi-decadal Outlooks

- Outlooks that span the next 1 to 100 years are based almost entirely on the GCM's
- GCM's are hindered by their lack of ability to properly capture large scale interactions.
- These models are based on the ***known quantities*** that make up our atmosphere.
- This includes our incomplete knowledge of the impact of human and natural influences.
- These outlooks are produced by several Multi-National meteorological outfits under the guise of the World Meteorological Organization (WMO) and International Panel on Climate Change (IPCC)

Outlook for the next few seasons

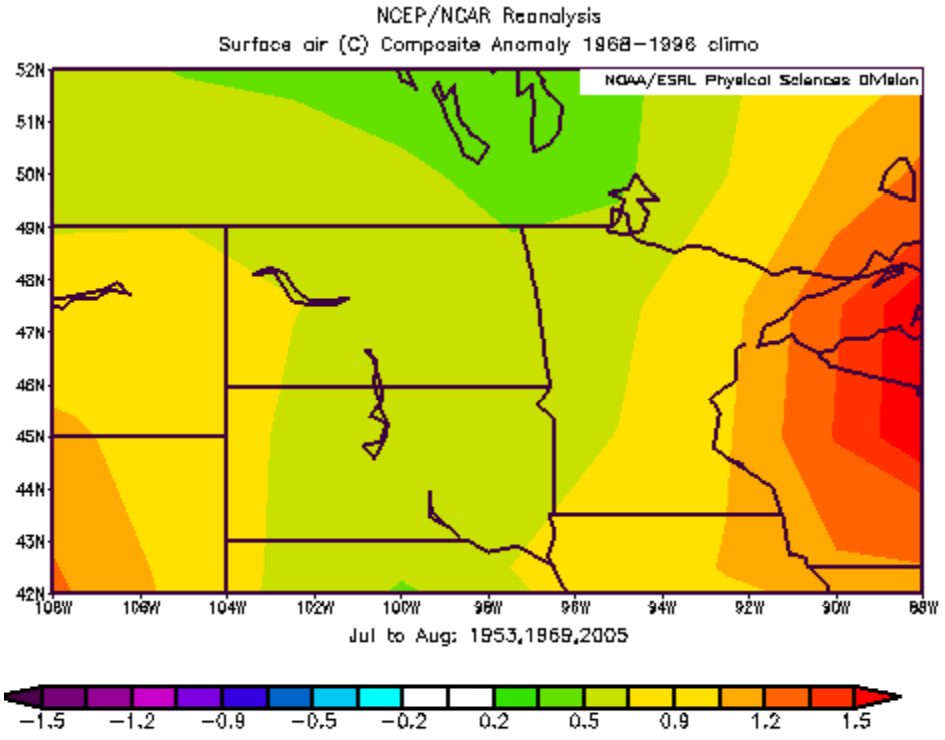
- Assumptions include:
- 1) A transition from El Nino to La Nina by the winter of 2010/2011 with “typical” fall and winter weather as a result.
- 2) Based on local research of shorter term climate signals such as the Arctic Oscillation and North Atlantic Oscillation.
- 3) Relies very heavily of the analog technique. That assumes a La Nina by this fall/winter and that the current atmospheric trends will yield like conditions as in prior years.

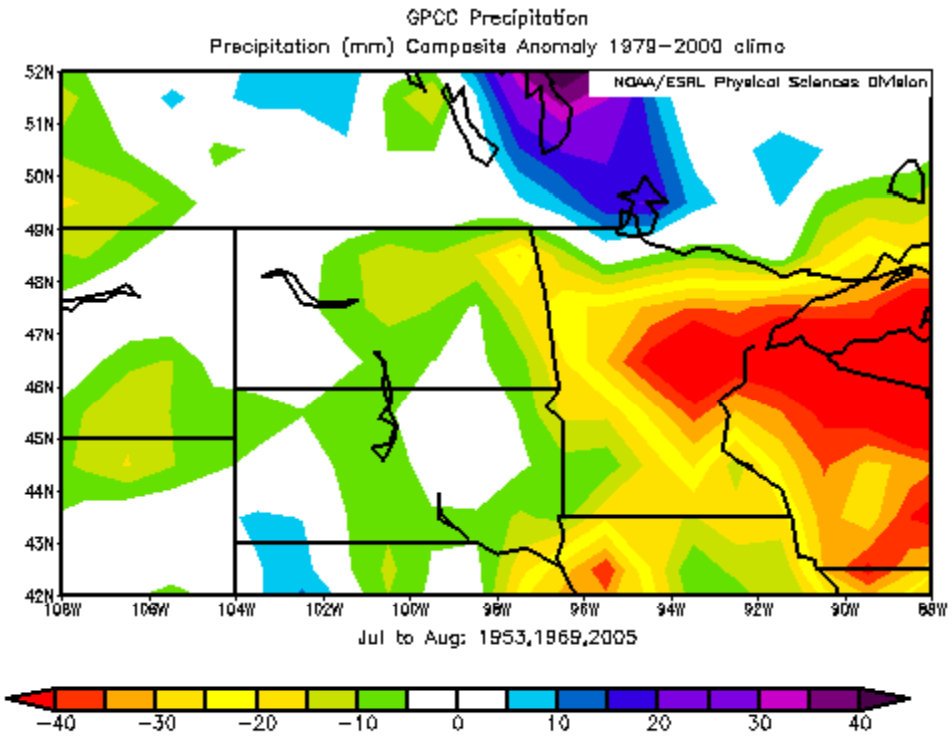
Summer 2010 – Winter 2010/11 Outlook

- Transition from current cold and damp to milder and drier during the summer.
- ***Assuming*** La Nina conditions develop a milder but wetter fall, with normal to above normal precipitation and below normal temperature patterns during the winter of 2010/2011.
- At this very early juncture the years used in the analogs are 1952, 1953*, 1958, 1962, 1969*, 1983, 1984, 1988, 1992, 1993 and 2005*

*** Denotes years that exhibit the strongest climate signal as compared to the present time.**

Remainder of the 2010 Summer

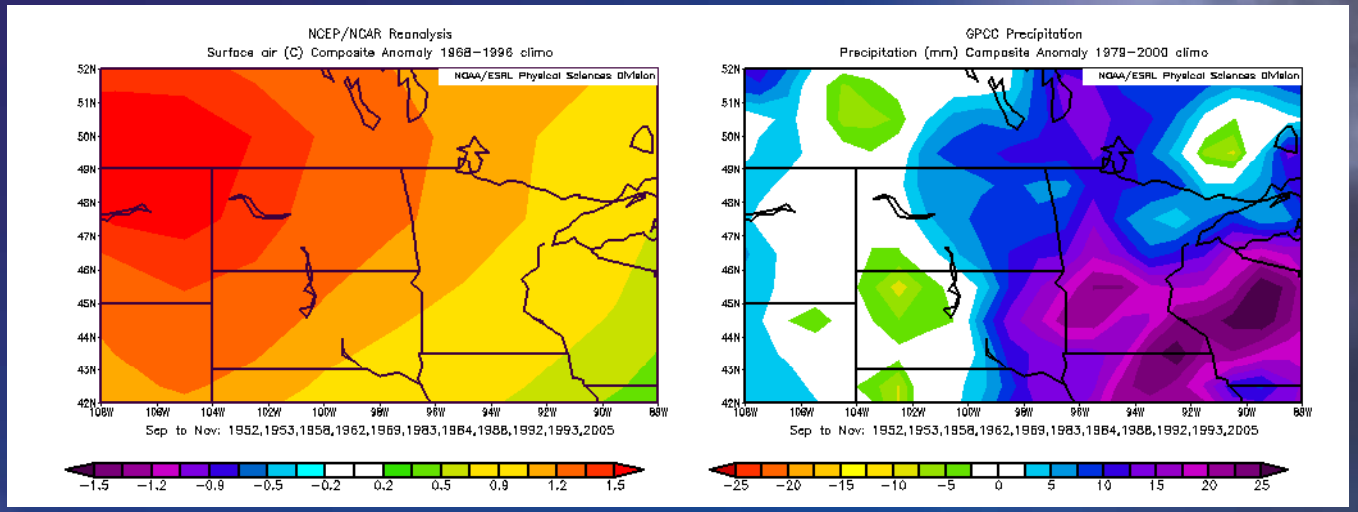




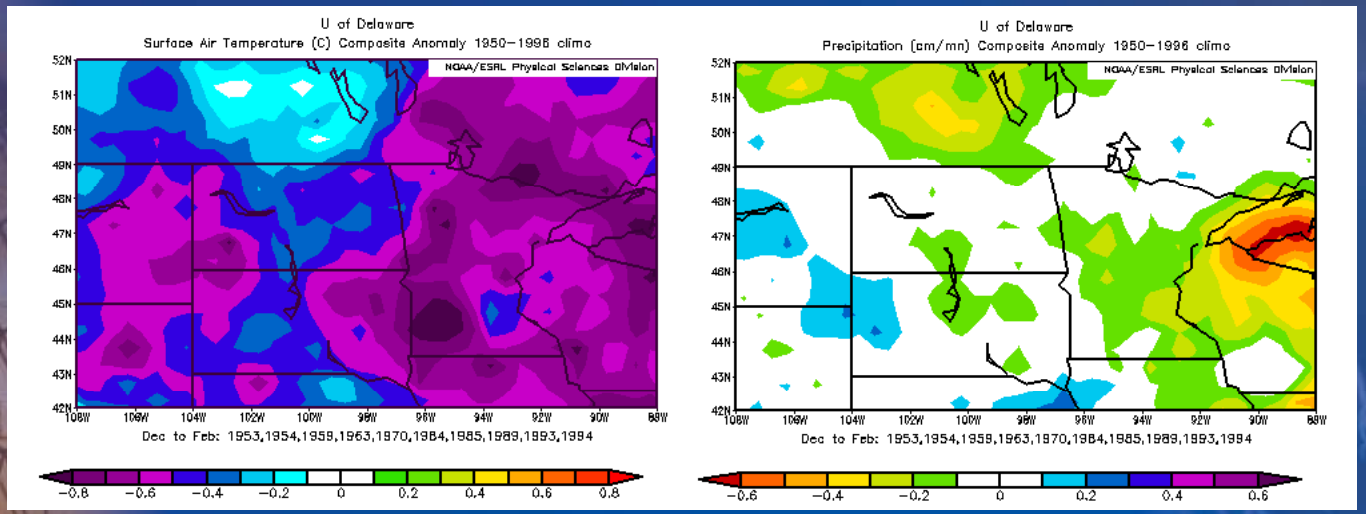
Experimental Outlook for July and August 2010.

Temperature departure (left) and precipitation departure (right)

Experimental Fall / Winter 2010 Outlook



Preliminary Experimental temperature (left) and precipitation (right) outlook fall 2009

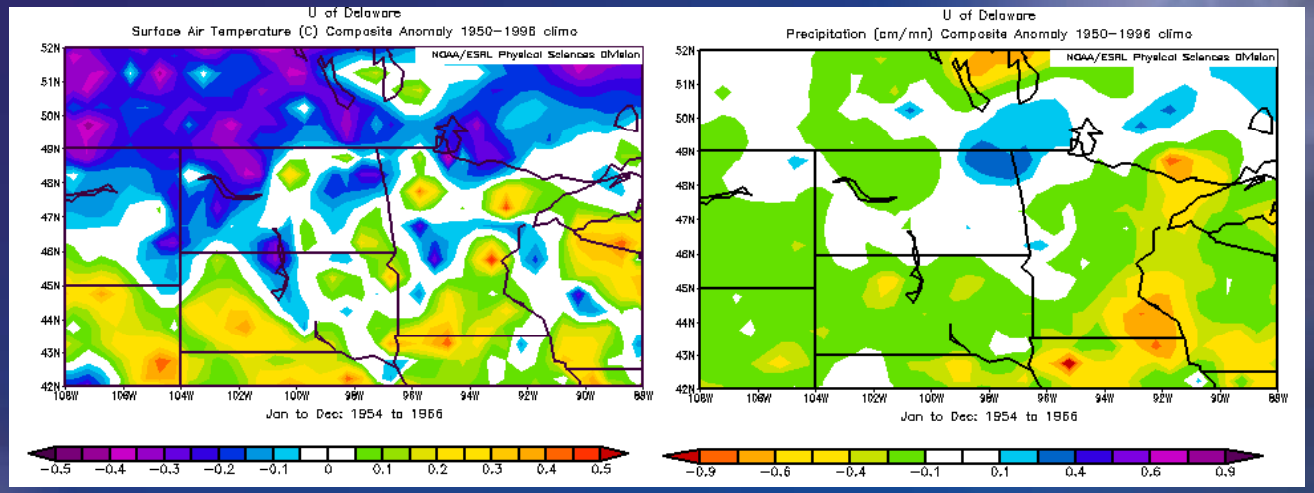


Preliminary Experimental temperature (left) and precipitation (right) outlook winter 2009/2010

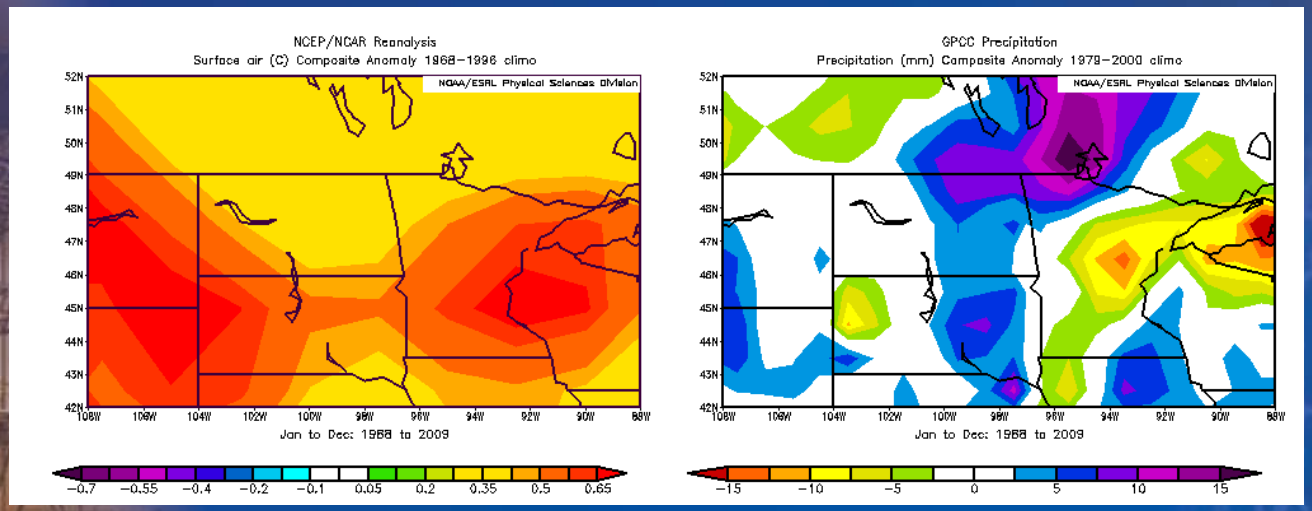
Climate Outlook next 1 to 5 years

- Based on a combination of the NOAA / IPCC reports and local research into large scale atmospheric impacts.
- Year to year variations driven by various atmospheric interactions that are impossible to predict at this time.
- General trends of cooler and wetter summers with milder and less snowy winters likely.
- Current “wet cycle” should persist over the next 1 to 5 year range. The ‘average’ precipitation would remain in the same general range as the 1954 – 1966 and 1998 – present.
- ***If*** the AMO signal weakens as anticipated, the wet cycle would diminish beyond year 5.

Basic Climatology 1954-1966 and 1998-2009

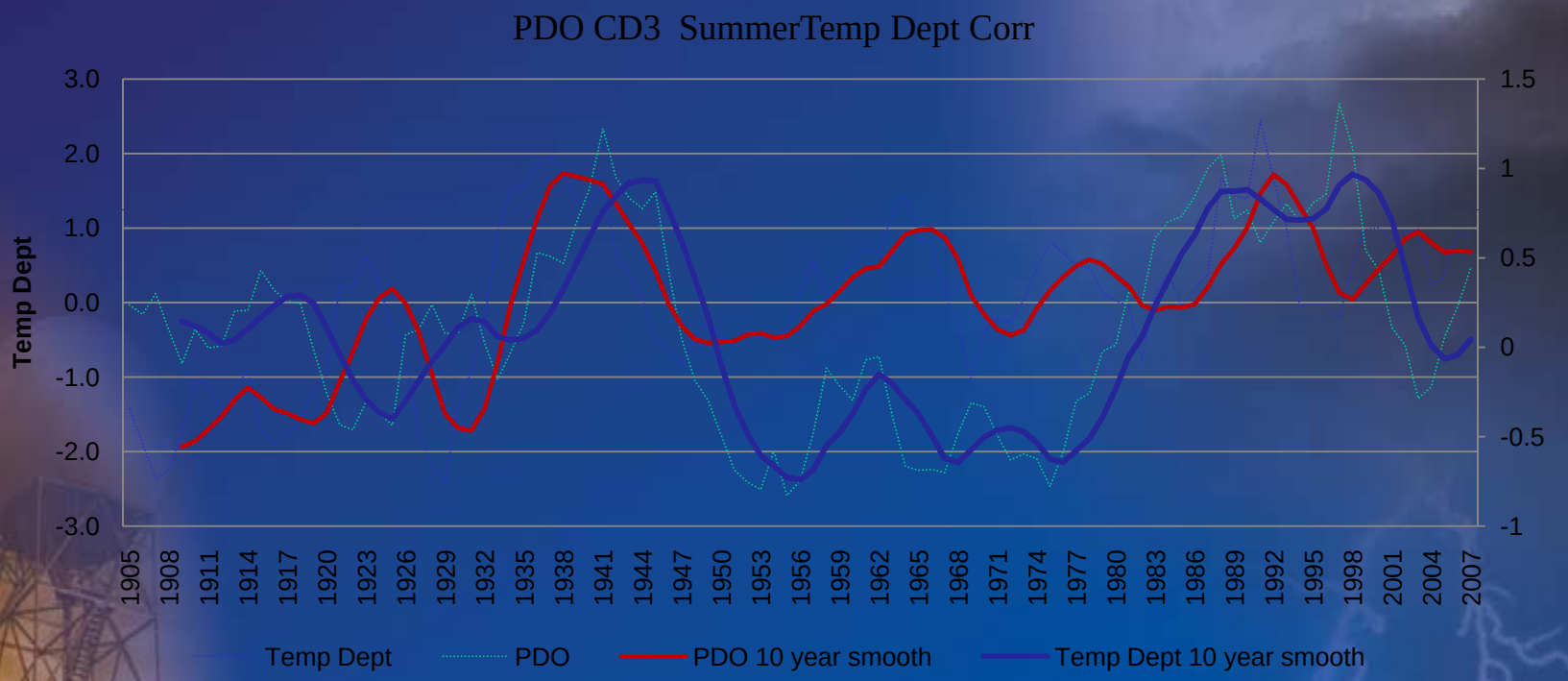


General temperature (left) and precipitation (right) anomalies1954 to 1966.



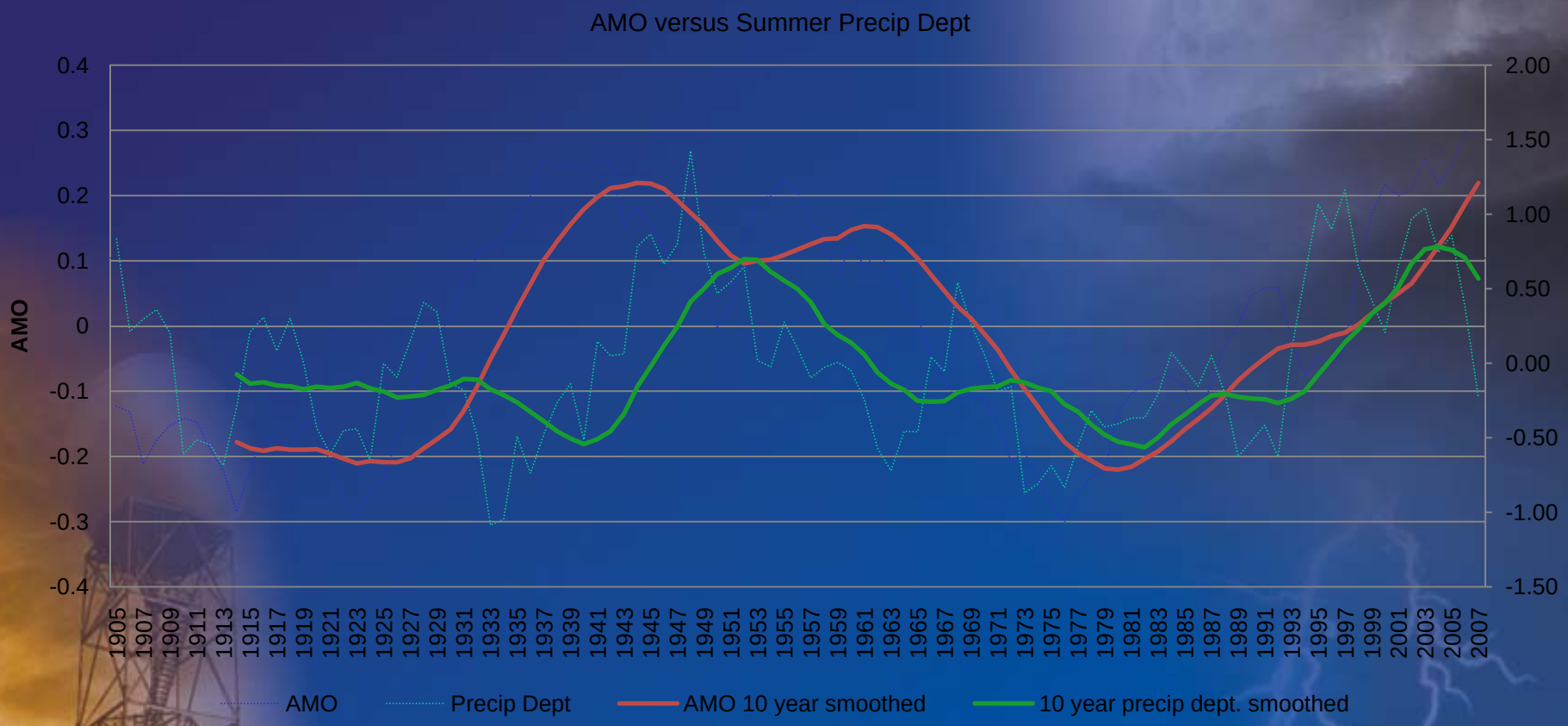
General temperature (left) and precipitation (right) anomalies 1998 to 2009.

Temperature Correlation based outlook



- **Long term temperature trends are driven, in part, by the temperature fluctuations to in the Pacific Basin**

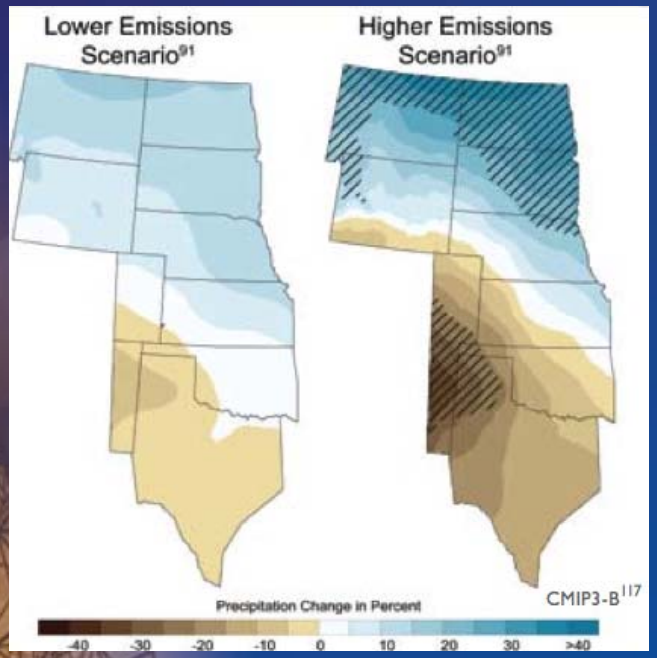
Precipitation Correlation based outlook

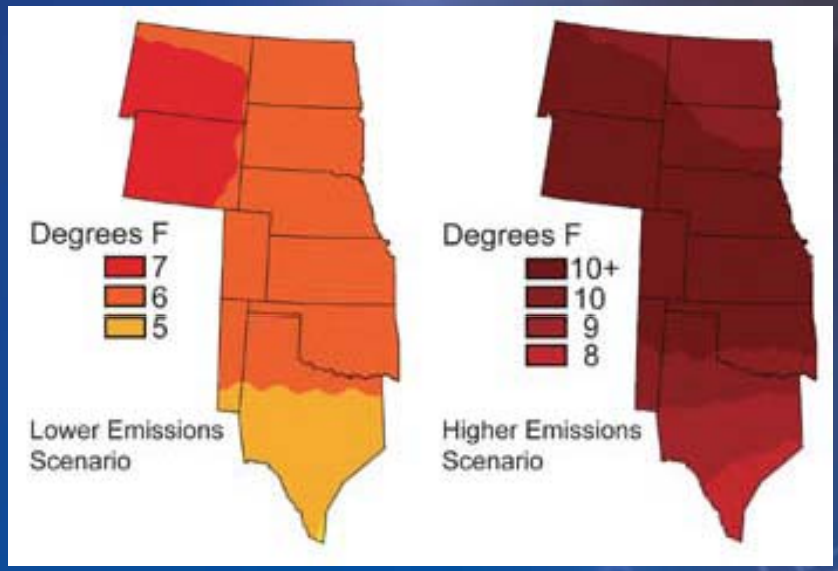


- **Long term precipitation trends are driven, in part by the temperature fluctuations in the Atlantic.**

Multi-decadal outlook

- **The official NOAA / IPCC Outlook for the Devils Lake region indicate wetter winters and springs, warmer & drier summers, and little change in fall precipitation. (Source: Global Climate Change Impacts in the United States, 2009)**



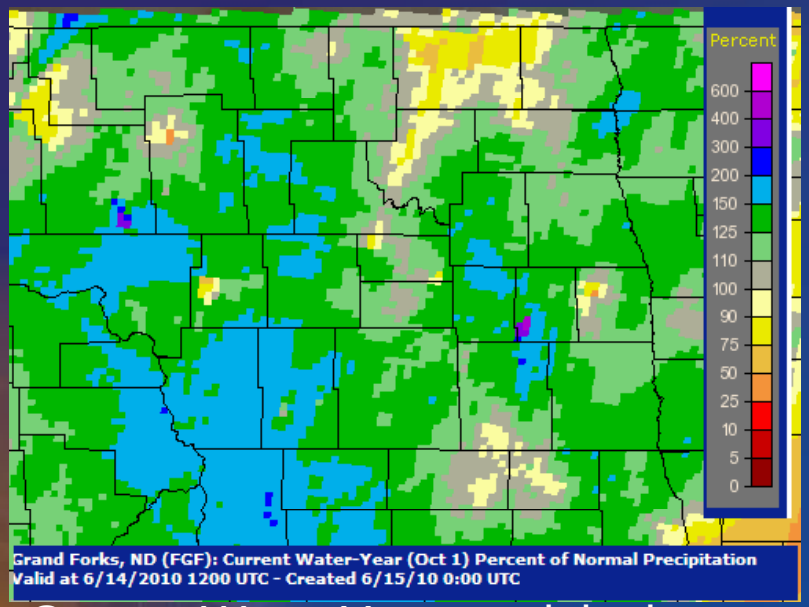


Projected Spring precipitation change (left) and annual temperature change (right) by 2080s-2090s, based on the CMIP-3. The change in precipitation is compared with a 1960-1979 baseline. Confidence in these changes is highest in the hatched areas. (Source: Global Climate Change Impacts in the United States, 2009)

Concluding comments

- ***These are Outlooks, not forecasts.*** **Our understanding of the very large scale interactions that make up the long term climate are poorly understood. This is especially true for the very long term (multi decadal) periods.**
- **Some climatologists suggest the past ~20 years 'weather' is the leading edge of the new climate regime. Others believe this is part of the natural variability we have discussed.**
- **It is difficult to separate out natural climate variability from other signals, including human influences.**
- **Regardless, History teaches us that weather and climate do indeed cycle (excessively wet, drought) and timing the end to the current wet cycle is difficult.**
- **Extremes are the true normal in both weather and climatology.**

Questions?



Current Water Year precipitation anomaly. NWS AHPS

Drainage to Stump Lake. Courtesy USGS

Near Davenport ND April 16 2009. NWS Photo