

Climate in the Missouri River Basin

Information, Prediction, and Services

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NIDIS Missouri River Basin Kickoff Meeting

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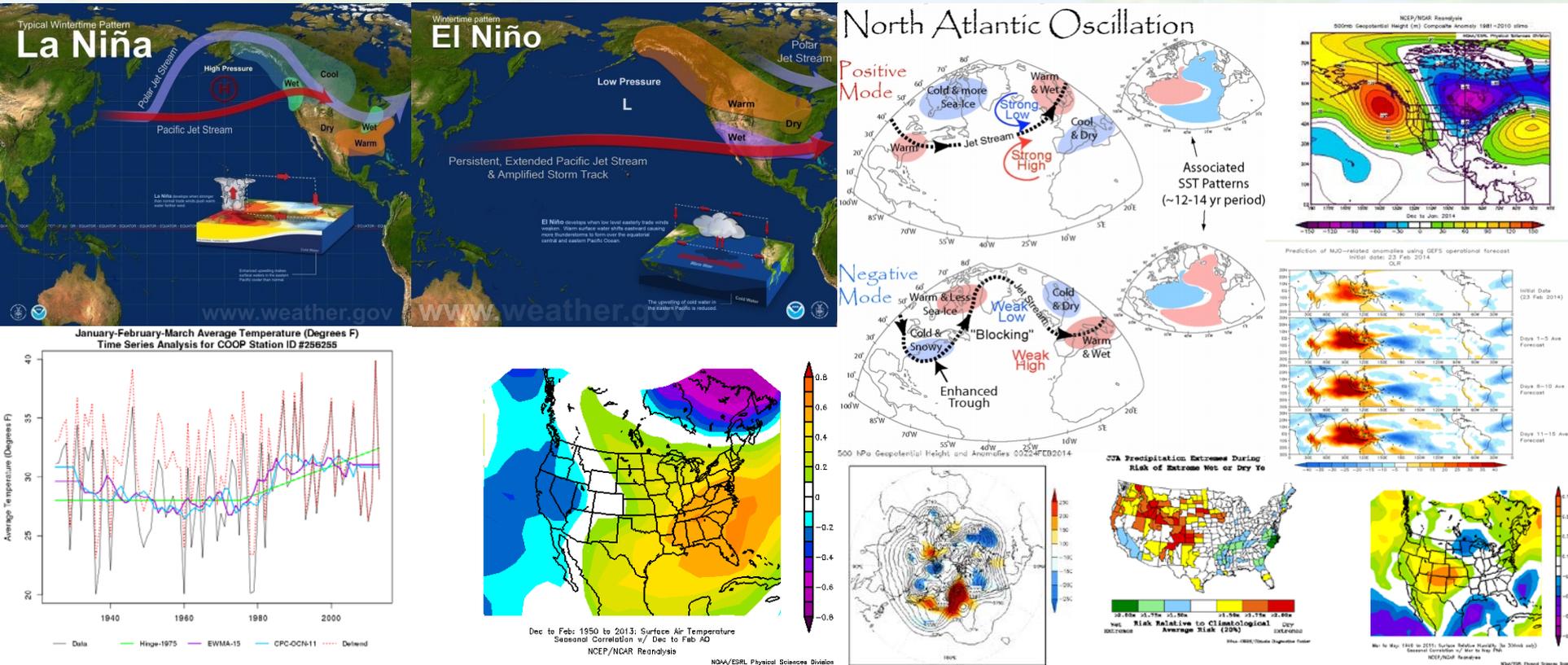
Nebraska City, NE

NWS: Decision Support Services

From the Weather-Ready Nation roadmap:

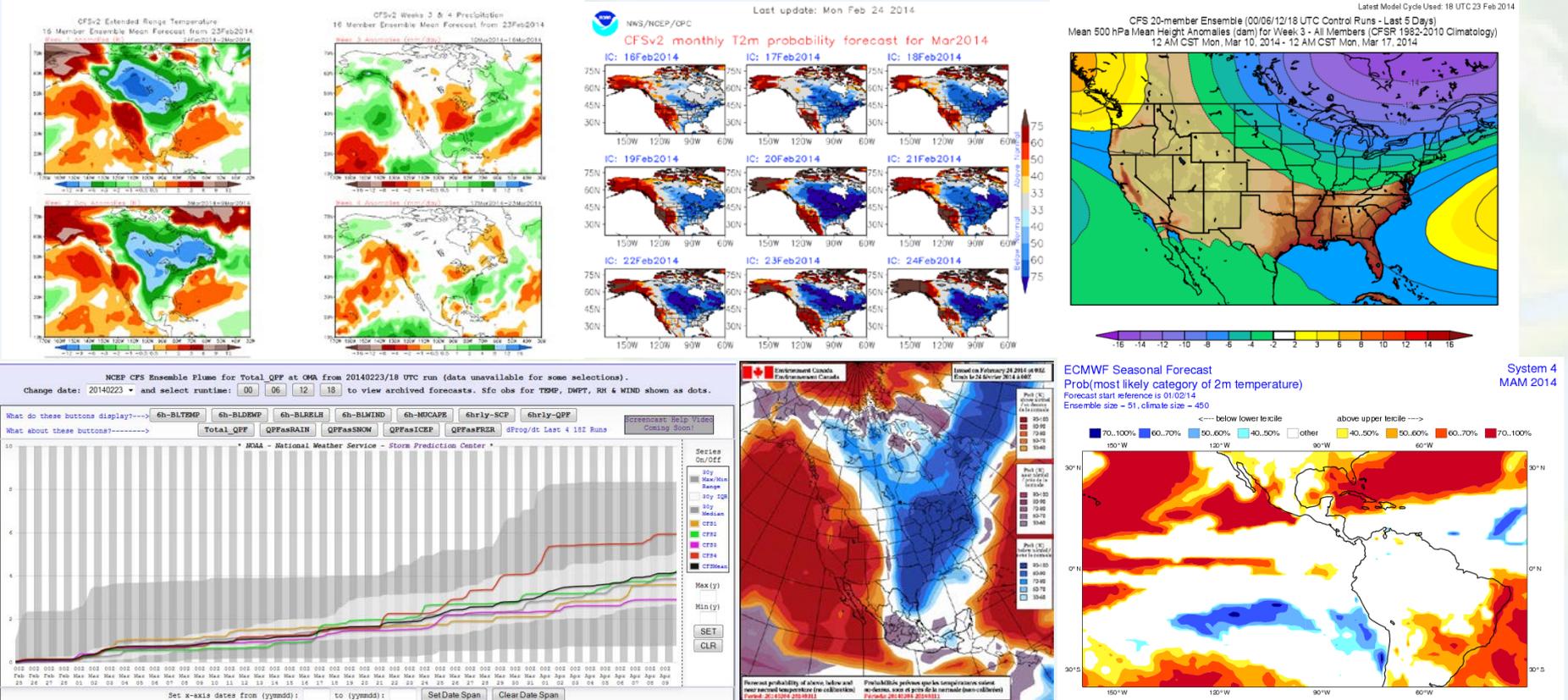
- **Impact-Based Decision Support Service:** NWS' provision of relevant information and interpretative services to enable core partners' decisions when weather, water, or **climate** has a direct impact on the protection of lives and livelihoods.
- **Climate predictions** and **outlooks** support not only traditional preparation, but also policy decision-making for mitigation and adaptation considerations. NWS field offices will engage users, identify regional and community needs, and work with NOAA's other line offices to **develop and deliver climate information** and decision support that will allow communities to respond to changing climate conditions
- When climate predictions indicate a significant weather event, NWS Emergency Response Specialists (ERSs) will proactively support core partners before and during the event, and well into the recovery phase.
- NWS ERSs will serve as a conduit into the wealth of climate information available to **assist core partners in decision-making**. Local climate services that **link climate to water and weather** services and **provide information on preparedness for extreme events** will be a critical component of IDSS.
- ERSs will serve as a key resource to link climate to water and weather services to help the Nation address environmental impacts.

Climate Forecasting: Players in Our Regional Climate



- Climate teleconnection patterns: El Niño/Southern Oscillation, North Atlantic Oscillation, Arctic Oscillation, Madden-Julian Oscillation
- Trends
- Persistent weather patterns: Blocking highs

Climate Forecasting: Model Displays

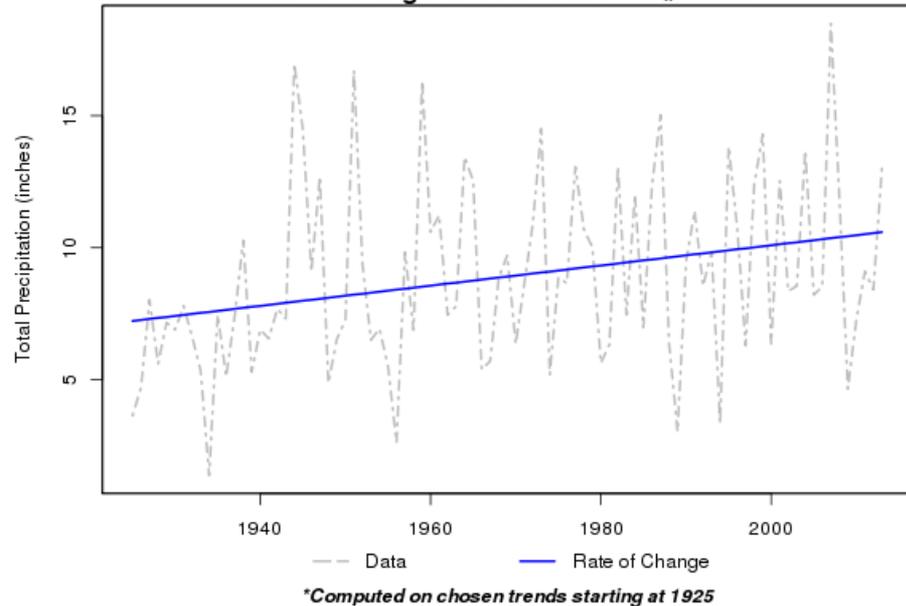


System 4
MAM 2014

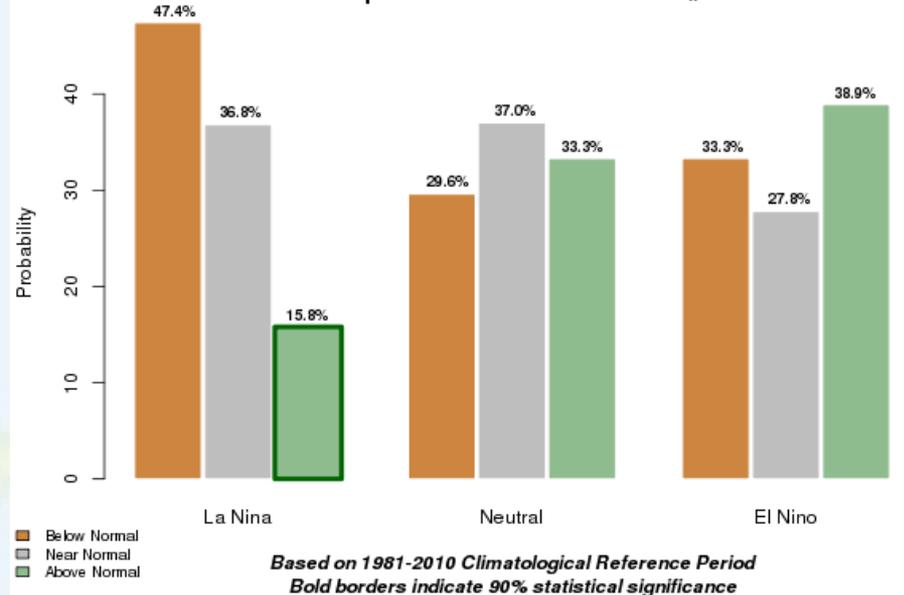
- NCEP's Climate Forecast System version 2 (CFSv2) – several pages to access
- North American Ensemble Forecast System
- European Center for Medium-Range Weather Forecasting
- Requires expertise to interpret and assess (just like with weather models)

Climate Tools: Local Climate Analysis Tool (LCAT)

March-April-May Total Precipitation (inches)
Rate of Change for COOP Station ID #256255



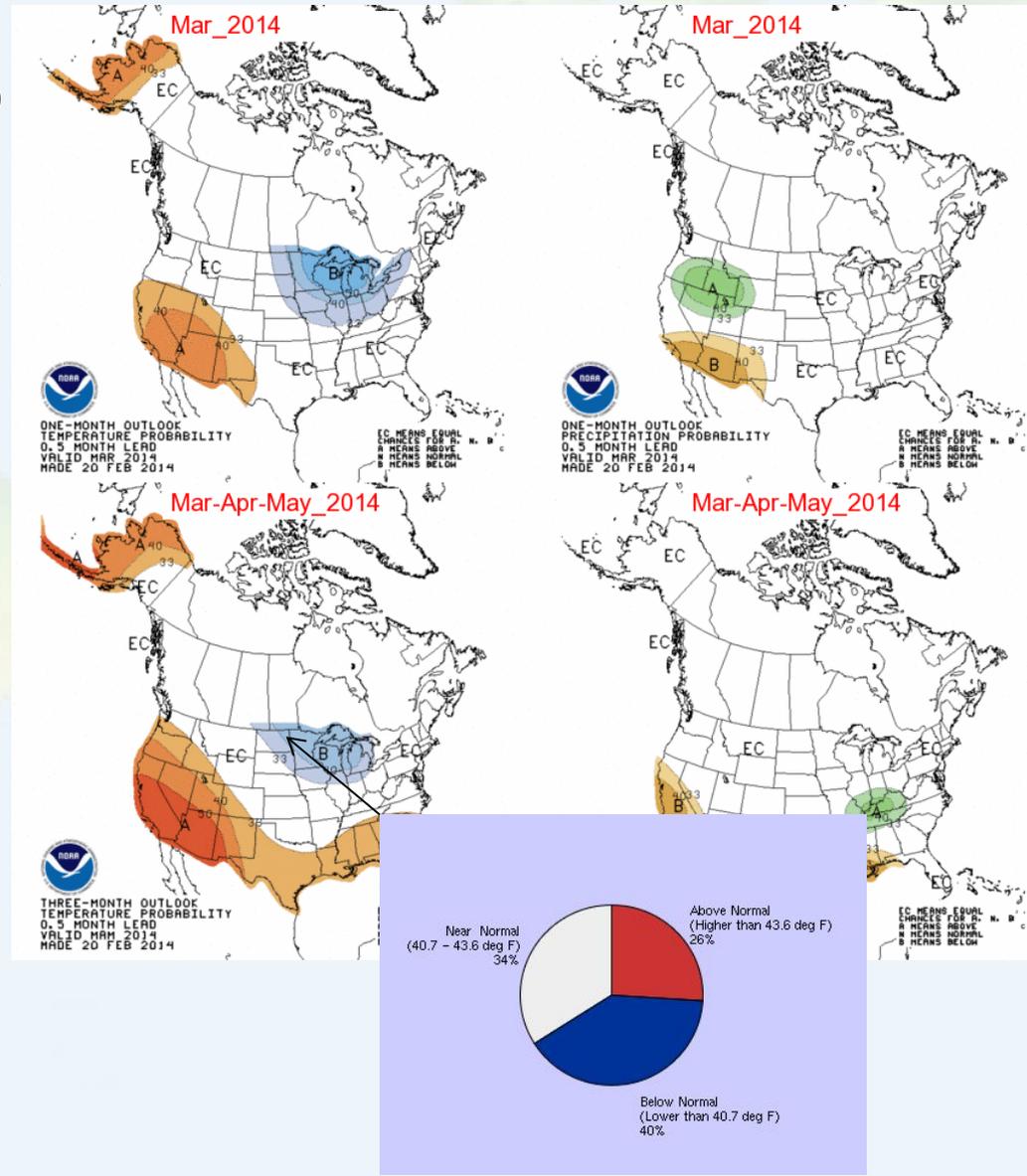
ENSO Probability Distribution [1950-2013] of January-February-March
Total Precipitation for COOP Station ID #256255



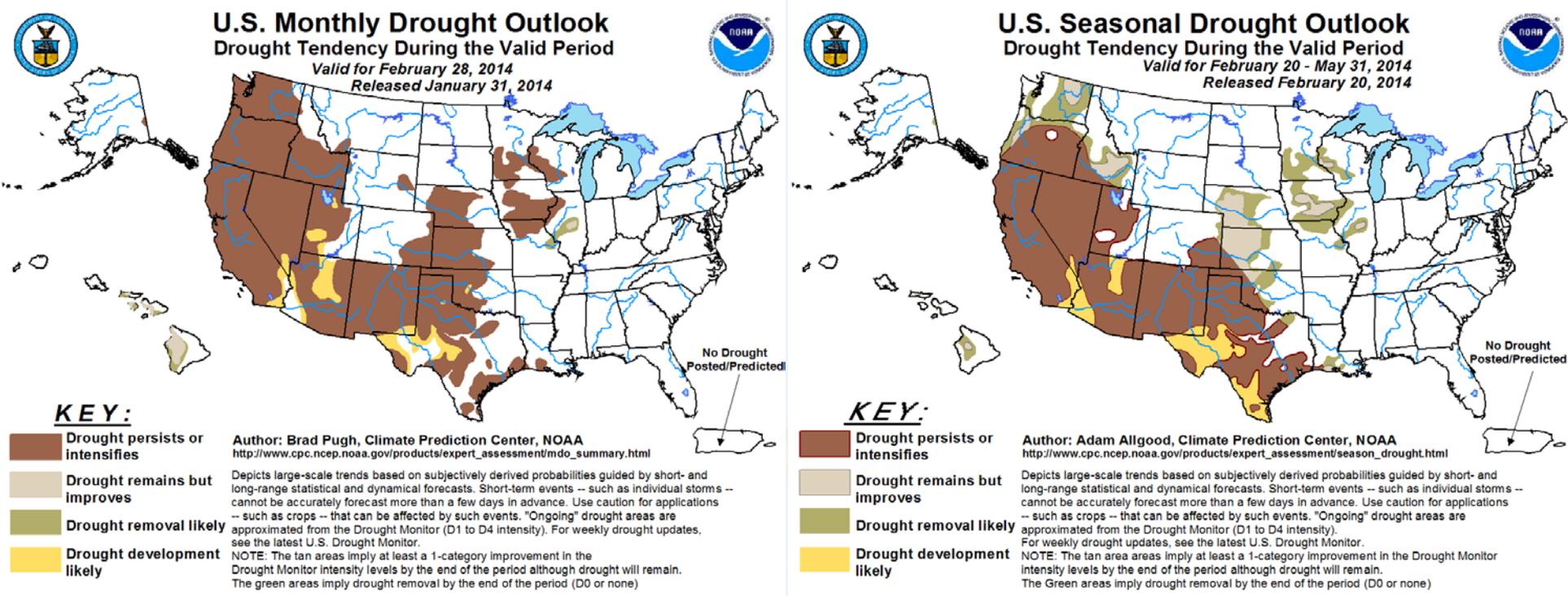
- Accounts available to NWS partners. (<http://nws.weather.gov/lcat/>)
- Analyze climate change trends, climate variability signals (ENSO now, others coming).
- Interpreting these results:
 - ◆ Mar-Apr-May precipitation at Omaha is rising by 0.38 inches per decade.
 - ◆ La Niña is associated with a significantly lower chance of precipitation like the wettest third of 1981-2010 climatology in Jan-Feb-Mar at Omaha.

CPC Outlooks: One-Month and Three-Month

- Predicting chances for *temperatures and precipitation* to fall in the *upper, middle, and lowest thirds*.
 - ◆ “EC” (Equal Chances) = odds of each category match climatology
 - ◆ “40%” = 40-50% chance of that category (instead of the usual 33%)
- Issued 3rd Thursday of each month
- Based on ENSO, trends, climate models, soil moisture
- Local 3-Month Temperature Outlook: downscaled to single points

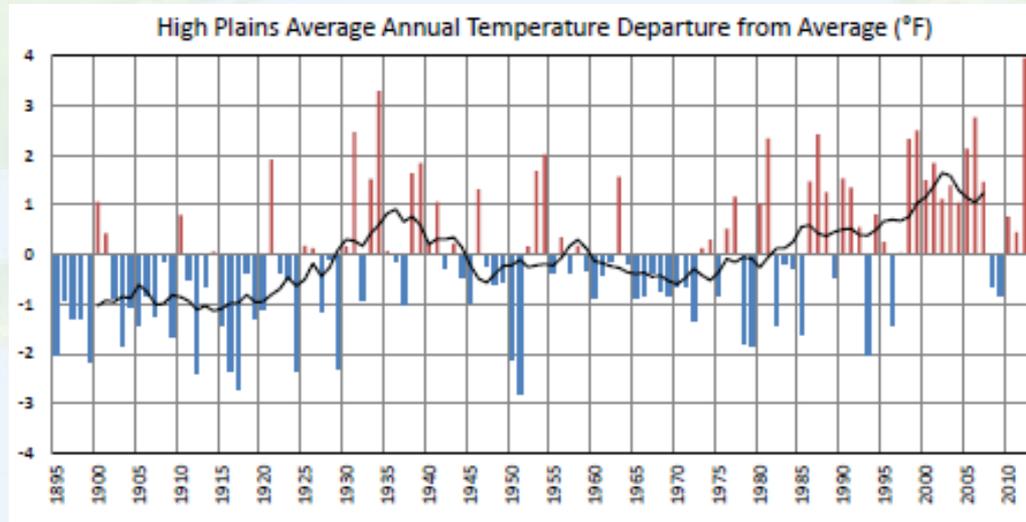


CPC Outlooks: Drought (One-Month and Three-Month)



- Predicting changes to Drought Monitor categories during the valid period.
- New: monthly outlook updated at the end of the previous month.
- Seasonal (3-month) outlook updated on the 3rd Thursday of the month with the rest of the 3-month outlook package.

Climate Change: Temperatures Already Rising

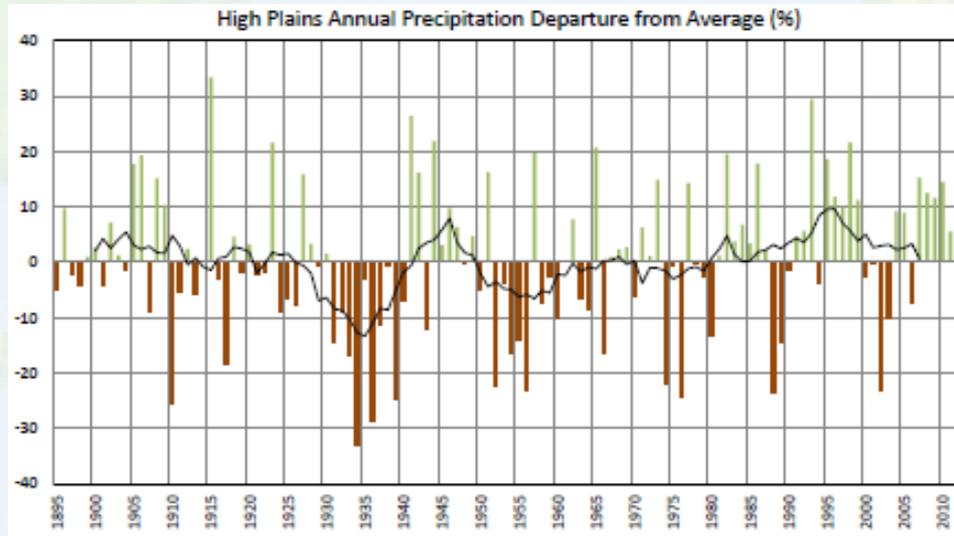


Statewide Average Temperature Change by Season (1895-2012)				
Temperature in degrees F				
State	Spring	Summer	Autumn	Winter
North Dakota	2.6	2.0	1.5	5.5
South Dakota	2.2	1.8	1.1	4.2
Nebraska	1.8	1.0	0.0	2.0
Kansas	1.7	1.0	-0.1	2.2
Wyoming	3.0	2.5	1.0	1.3
Colorado	2.0	1.1	0.4	1.9
Average	2.2	1.6	0.7	2.9

Departure of annual average temp. in the High Plains from the 118-year average

Source: High Plains Regional Climate Center

Climate Change: Precipitation Already Rising



Statewide Annual Climate Trends (1895-2012)				
Temperature in degrees F, Precipitation in percent				
State	Average Temperature	Maximum Temperature	Minimum Temperature	Precipitation
North Dakota	2.9	2.5	3.4	6%
South Dakota	2.4	1.6	3.2	3%
Nebraska	1.3	0.6	1.9	2%
Kansas	1.3	0.9	1.7	5%
Wyoming	2.0	2.7	1.3	-13%
Colorado	1.5	1.5	1.4	-1%
Average	1.9	1.6	2.2	1%

Departure of annual precipitation in the High Plains from the 118-year average

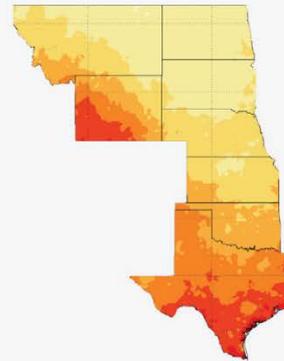
Source: High Plains Regional Climate Center

Climate Change: Temperatures and Precipitation

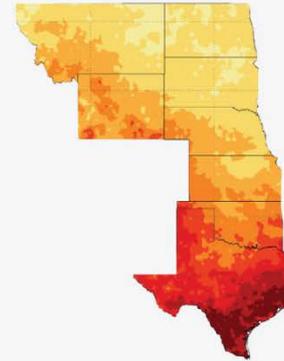
Higher Emissions Lead to More Heat and Heavy Downpours

Little or No Change to Emissions: "Business as Usual"

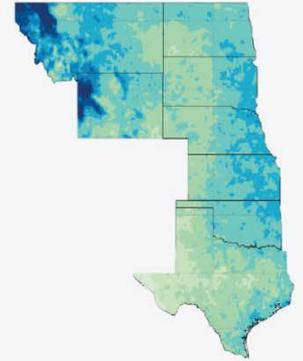
Highest Maximum Temperature



Highest Minimum Temperature

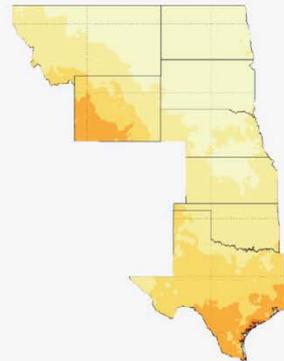


Heaviest Daily Precipitation

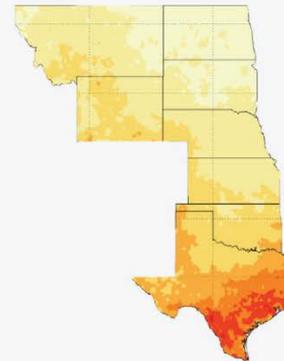


Strict Limits to Emissions Soon

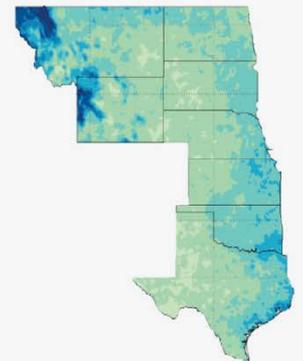
Highest Maximum Temperature



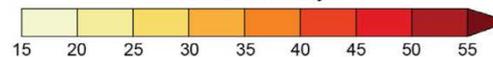
Highest Minimum Temperature



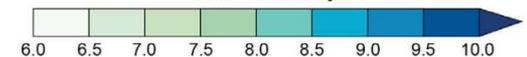
Heaviest Daily Precipitation



Number of Days



Number of Days

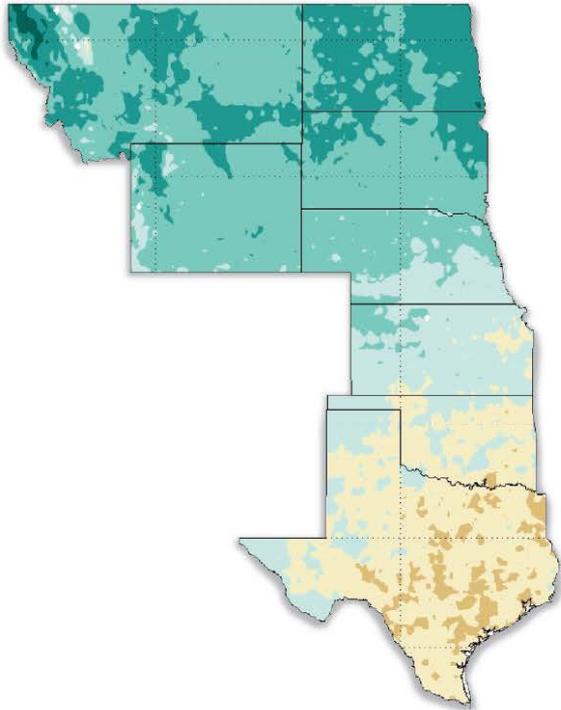


- Projections of changes in temperatures and days with precipitation in 2041-2070.
- Temperature changes depend on:
 - ◆ Time of day
 - ◆ Night warming faster than day
 - ◆ Time of year
 - ◆ Winter warming faster than summer
- Precipitation changes:
 - ◆ Depends on time of year
 - ◆ Spring increasing, fall decreasing
 - ◆ May include both longer droughts and more heavy rain events

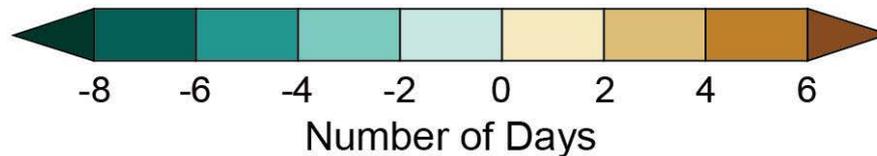
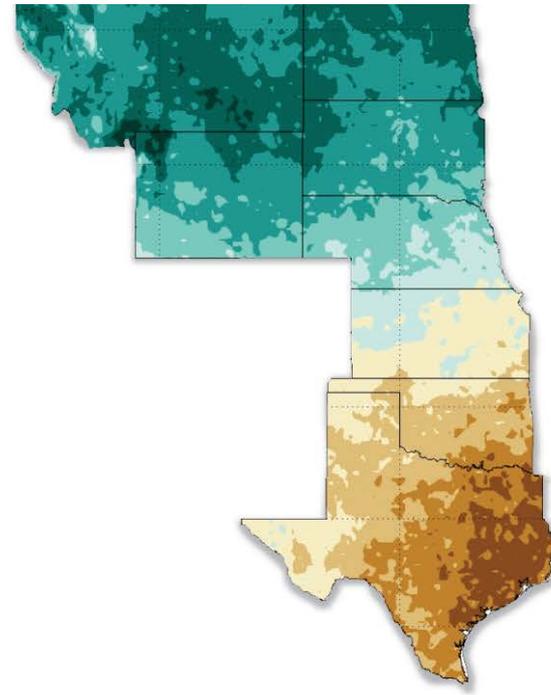
Climate Change: Number of Dry Days

Projected Change in Number of Dry Days

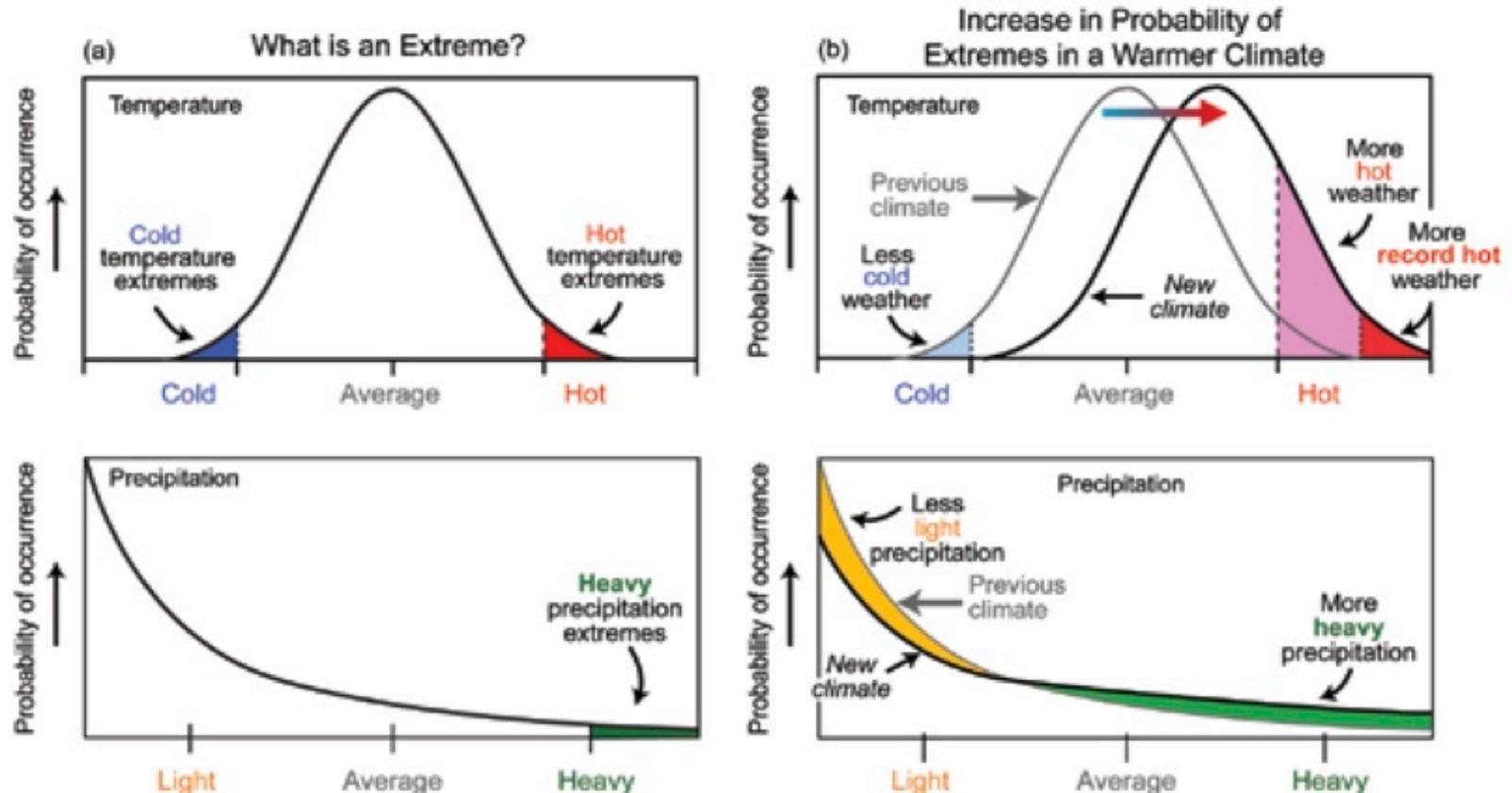
Strict Limits to Emissions Soon



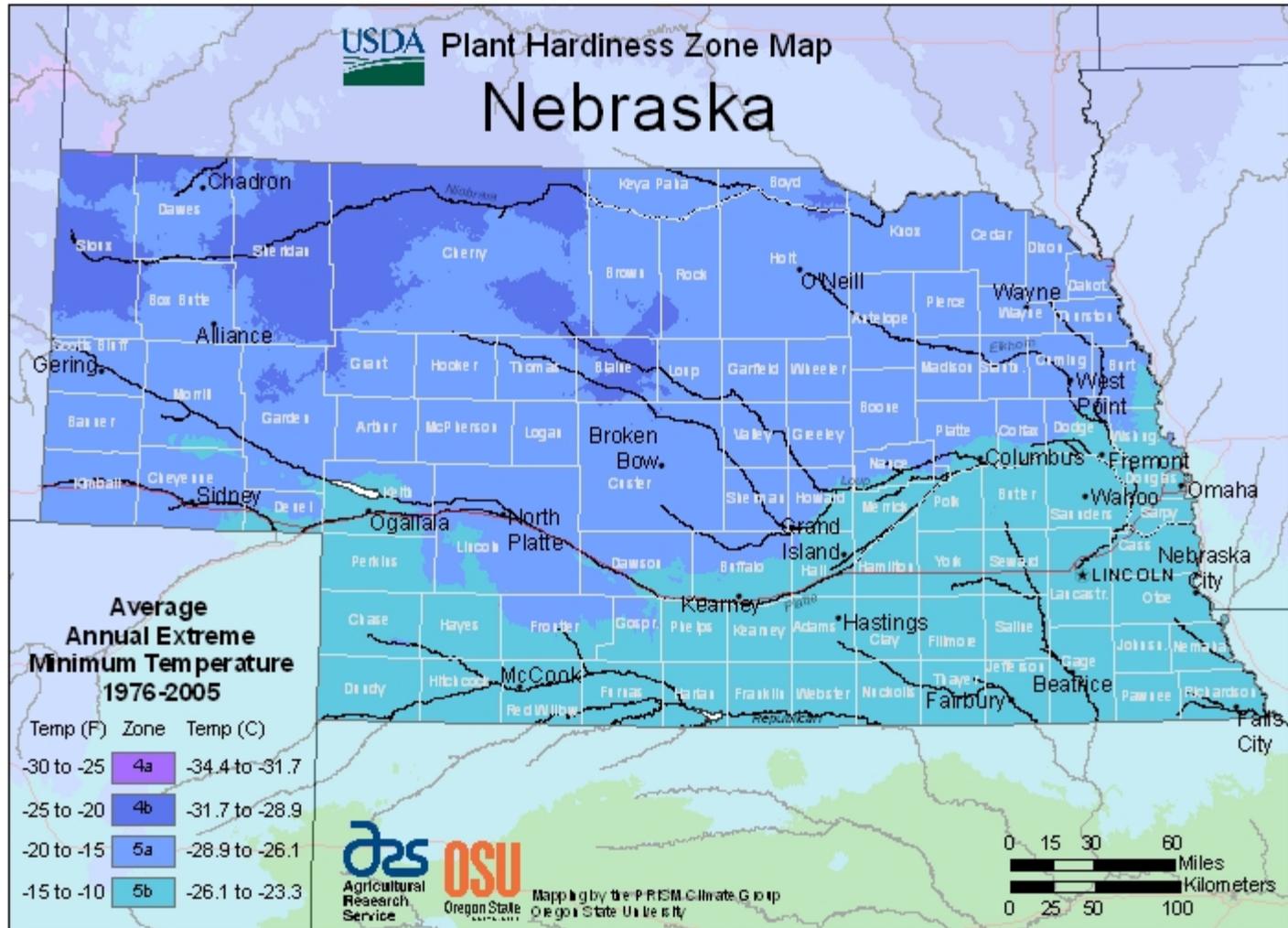
**Little or No Change to Emissions:
“Business as Usual”**



Climate Change: Why the Extremes Matter



USDA: Plant Hardiness Zone Changes



Extreme
nature

Temp (C)

-51.1 to -48.3

-48.3 to -45.6

-45.6 to -42.8

-42.8 to -40

-40 to -37.2

-37.2 to -34.4

-34.4 to -31.7

-31.7 to -28.9

-28.9 to -26.1

-26.1 to -23.3

-23.3 to -20.6

-20.6 to -17.8

-17.8 to -15

-15 to -12.2

-12.2 to -9.4

-9.4 to -6.7

-6.7 to -3.9

-3.9 to -1.1

-1.1 to 1.7

1.7 to 4.4

4.4 to 7.2

7.2 to 10

10 to 12.8

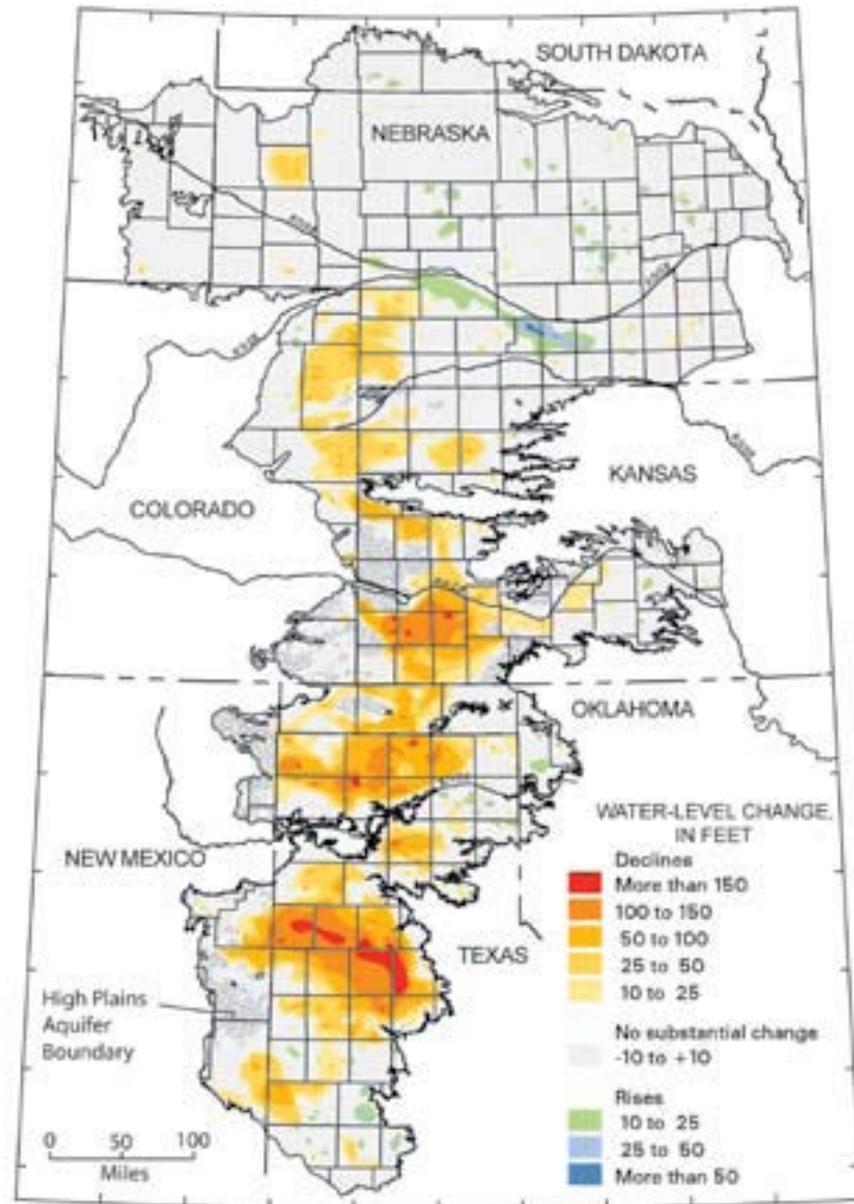
12.8 to 15.6

15.6 to 18.3

18.3 to 21.1

Water Resources

- Ogallala Aquifer: Water levels trending downward
- Additional stress from climate change:
 - ◆ Rising temperatures
 - ◆ Increasing evaporation
 - ◆ More sustained drought



Source: 2009 NCA

Links and Resources

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National Weather Service, Omaha/Valley NE: <http://www.crh.noaa.gov/oax/>

NOAA Climate Services: <http://www.climate.gov/>

NOAA National Climatic Data Center: <http://www.ncdc.noaa.gov/oa/ncdc.html>

Global Change Impacts in the U.S.:

<http://www.globalchange.gov/publications/reports/scientific-assessments/us-impacts>

International Panel on Climate Change: <http://www.ipcc.ch/>

HPRCC Climate Change: http://www.hprcc.unl.edu/climate_change.php

HPRCC “Climate Change on the Prairie”:

<http://www.hprcc.unl.edu/publications/files/HighPlainsClimateChangeGuide.pdf>

USDA Plant Hardiness Zones: <http://www.ars.usda.gov/is/pr/2012/120125.htm>

National Climate Assessment (Draft report): <http://ncadac.globalchange.gov/>

NWS Weather-Ready Nation Roadmap:

http://www.nws.noaa.gov/com/weatherreadynation/files/nws_wrn_roadmap_final_april17.pdf