Station-Based Indices for Drought Monitoring in the U.S.

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NADM Workshop

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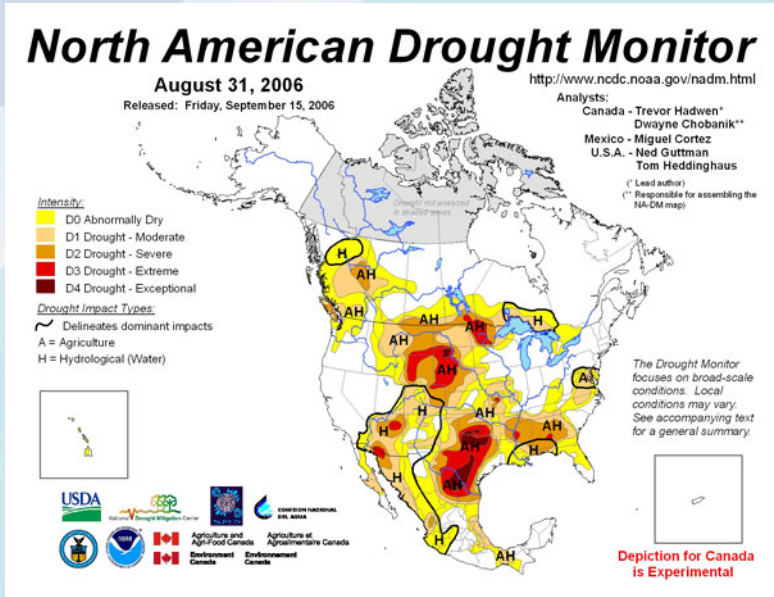
* (with graphical assistance provided by Mike Squires, Jesse Enloe)

Background

- ✓ **Drought monitoring in U.S. has been based on station data and climate division data**
- ✓ **Some drought indices require spatially and temporally complete data**
  - **Station data have missing months and different periods of record**
  - ***Climate division data have no missing data back to 1895***
- ✓ **Climate division data are area-averages and provide a large-scale picture of the climate**
- ✓ ***Station data are point measurements and provide a finer spatial resolution***

North America Drought Monitor

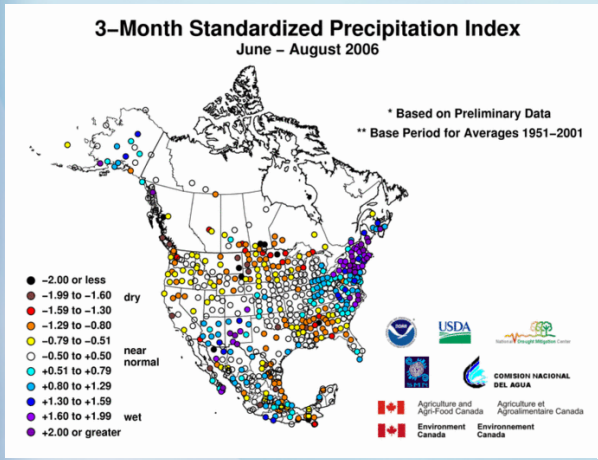
- ✓ **Trilateral partnership (U.S., Mexico, Canada) to improve drought monitoring on the North American continent and provide decision makers with information essential to planning, mitigation, & response activities.**
- ✓ **First meeting – 11/01**
- ✓ **First NADM workshop – 4/02**
- ✓ **First exp. NADM map – 12/02**
- ✓ **NADM maps released to public – 4/03**
- ✓ **US & MX portions "operational" – 6/05**

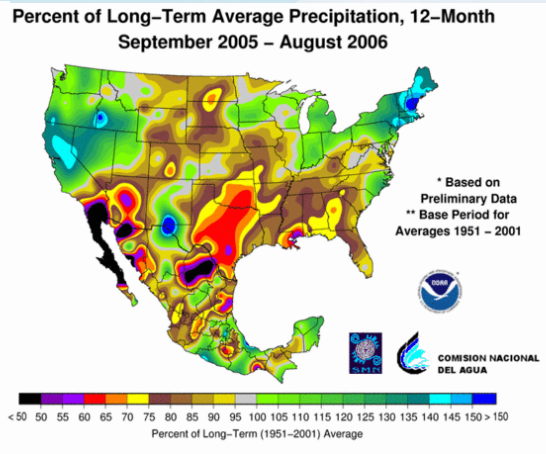


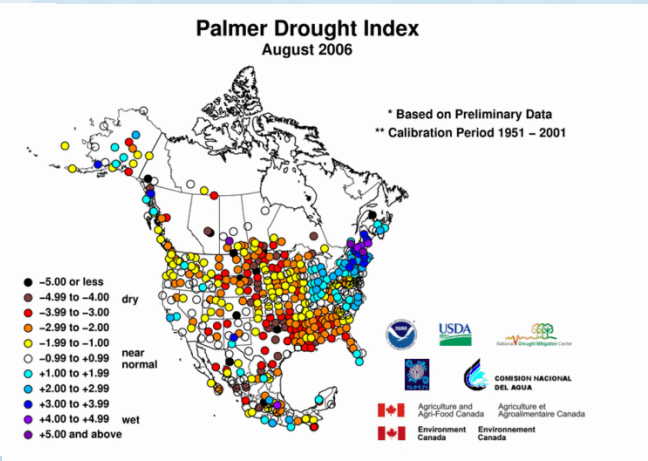
National Climatic Data Center

NADM Continental Drought Indicators

- ✓ **Drought conditions in US, MX, CN are determined independently based on different data, indices, & analyses within each country**
- ✓ **Drought indices covering entire continent are needed**
  - Same indices, same analysis period, same methodologies
  - This consistency needed for depiction across international boundaries





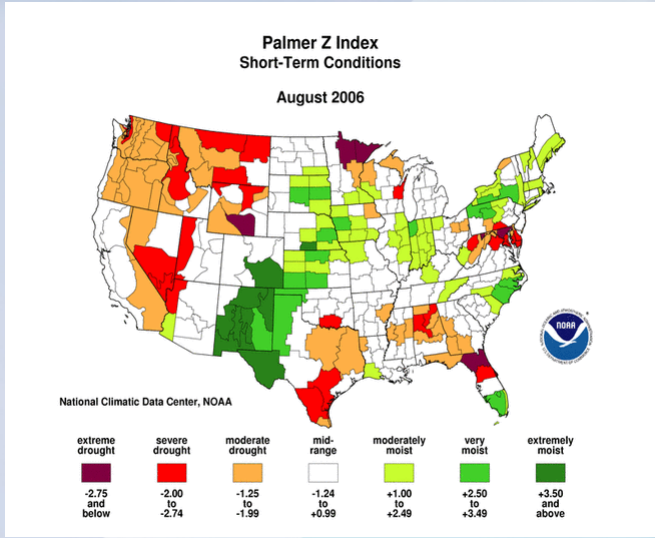


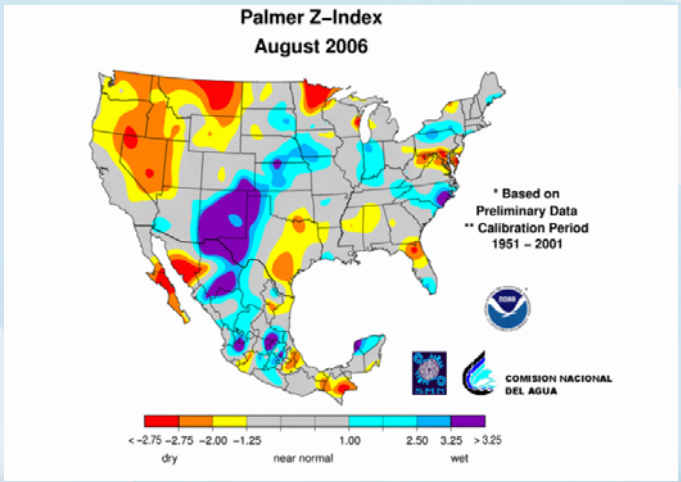
NADM Continental Drought Indicators

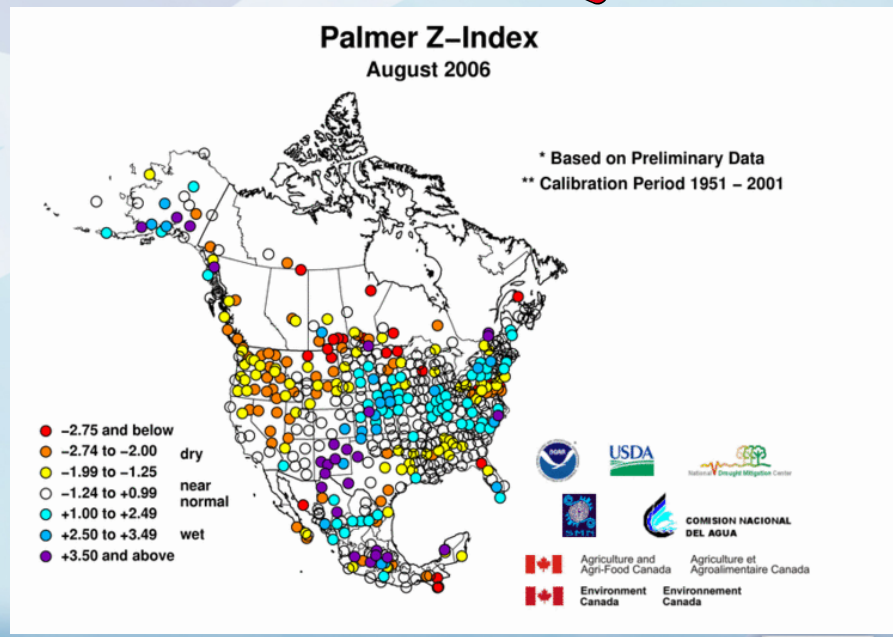
- ✓ **Mexico**
  - Monthly precipitation from 132 highest quality stations
  - Temperature from 65 high quality Observatory stations, plus 67 additional stations
- ✓ **Canada**
  - Monthly precipitation and temperature from ~ 200-300 daily near-real time stations
- ✓ **U.S.**
  - Alaska ASOS stations & 10 COOP stations along US-MX border
  - Climate division data for contiguous U.S.

U.S. Indicators

- ✓ **The climate division data are area averages, not point measurements**
  - **Do not have the same spatial resolution as CN & MX data**
  - **Inhomogeneity at the international borders**

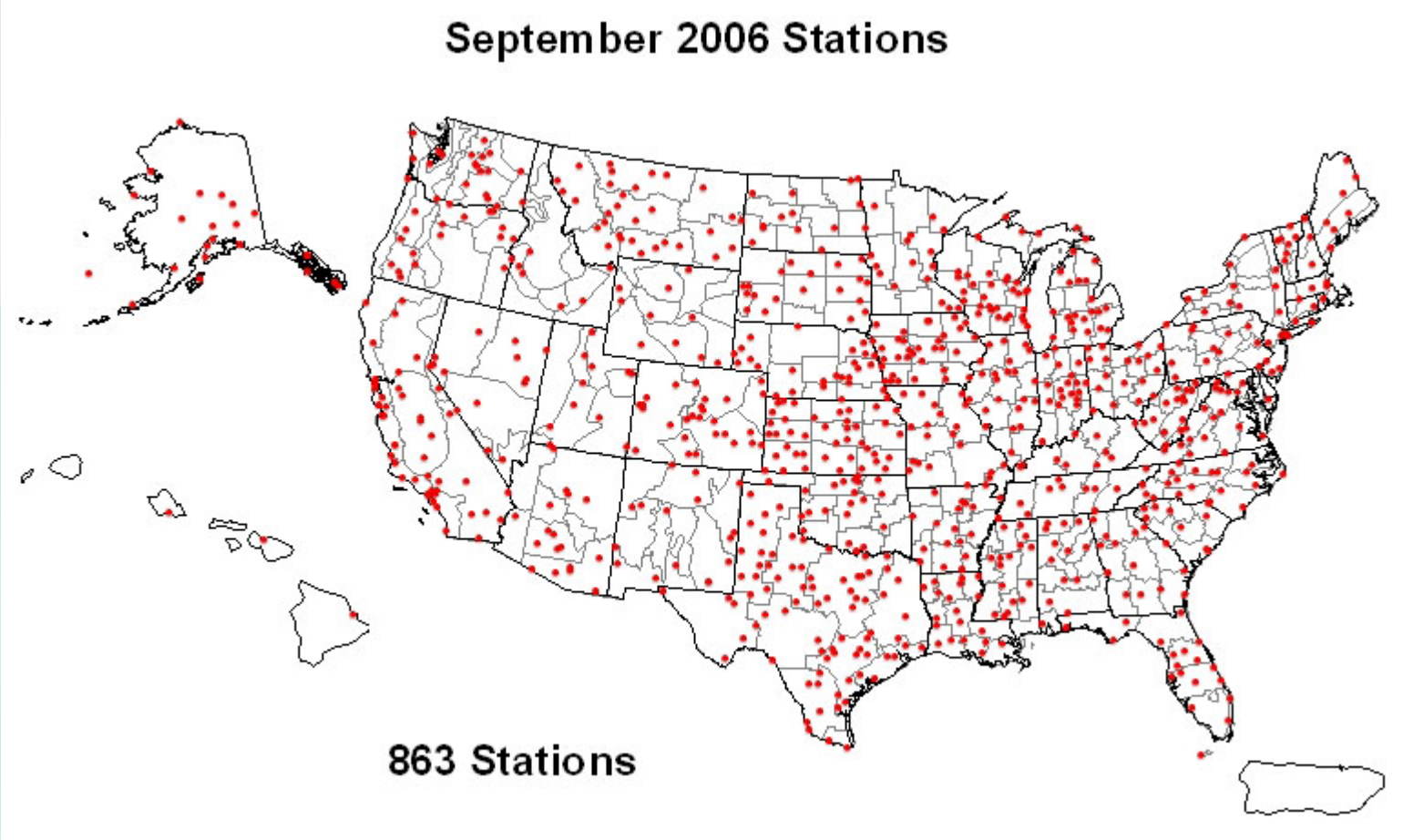






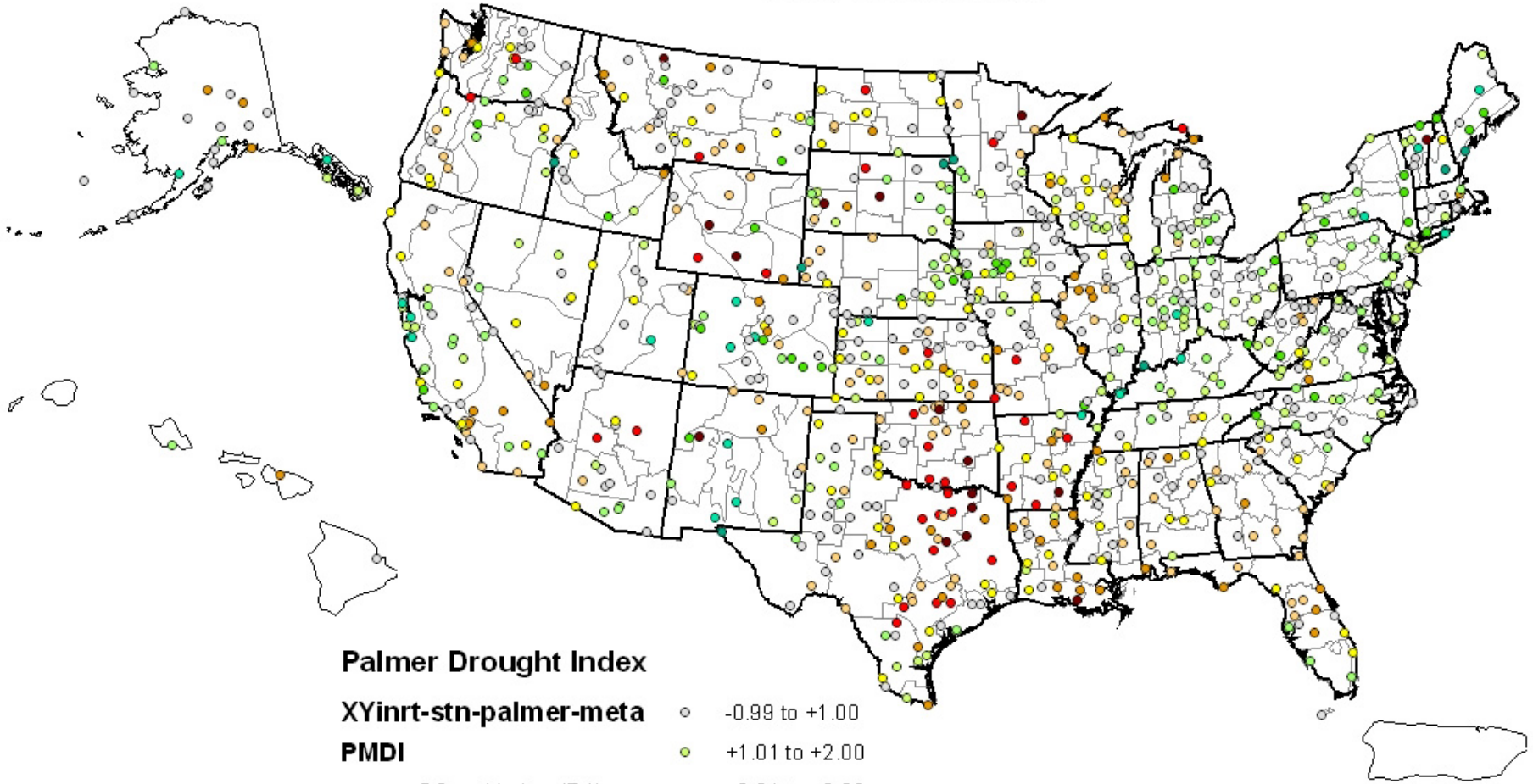
For the U.S., What Do We Do?

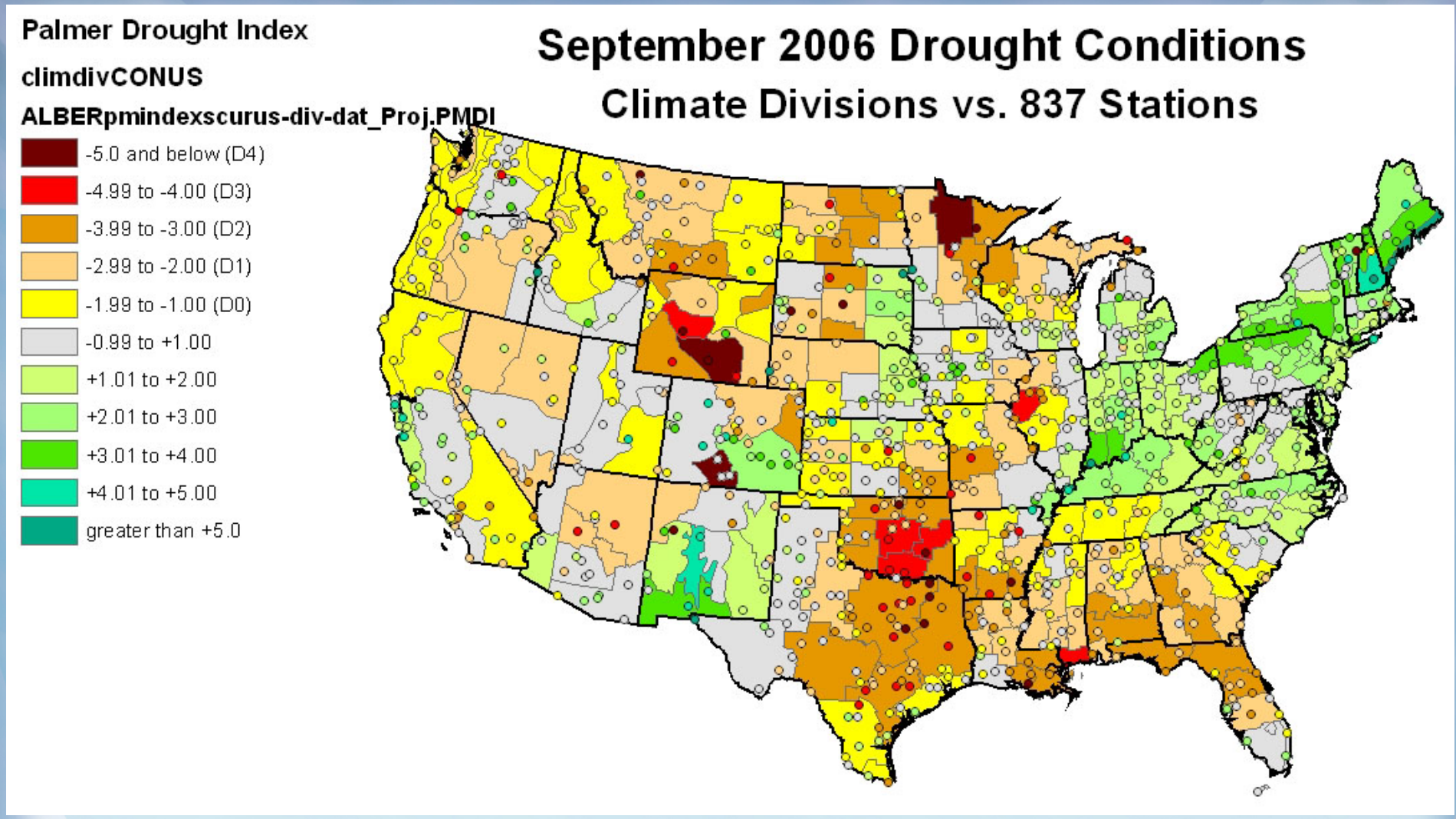
- ✓ **We need to transition from climate divisions to station data nationwide**
- ✓ **2159 COOP stations had both temperature and precipitation data for August 2006**
  - **1039 of them had data for August 2006, had at least 43 years of data, and were at least 85% complete for both temperature and precipitation from 1951-present**
  - **863 of them had data for September 2006, had at least 43 years of data, and were at least 85% complete for both temperature and precipitation from 1951-present**
  - **For some indicators like the Palmer index, we need to estimate the values for the missing months**
    - ➢ **For now, we used the 1951-2001 long-term means, but in the future we want to estimate by linear regression using neighboring stations**



Stations with at least 43 years of data which are at least 85% complete for both temperature and precipitation for 1951-present

September 2006 Drought Conditions
863 Stations





Comparison of the station PDI to the climate division PDI.

How Do the Station and Climate Division PDI Compare if they are Contoured?

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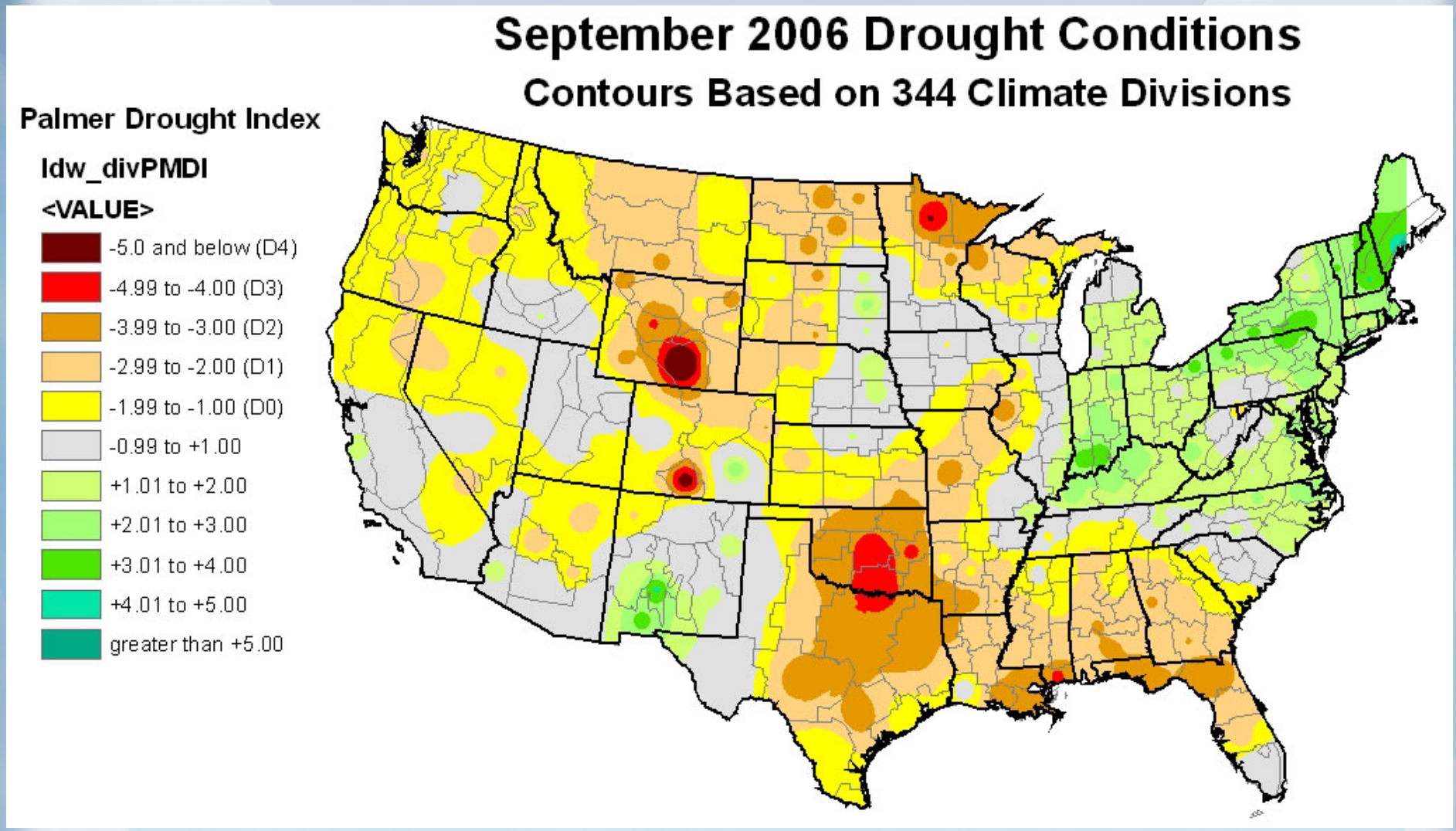

Climate Division PDI Contoured

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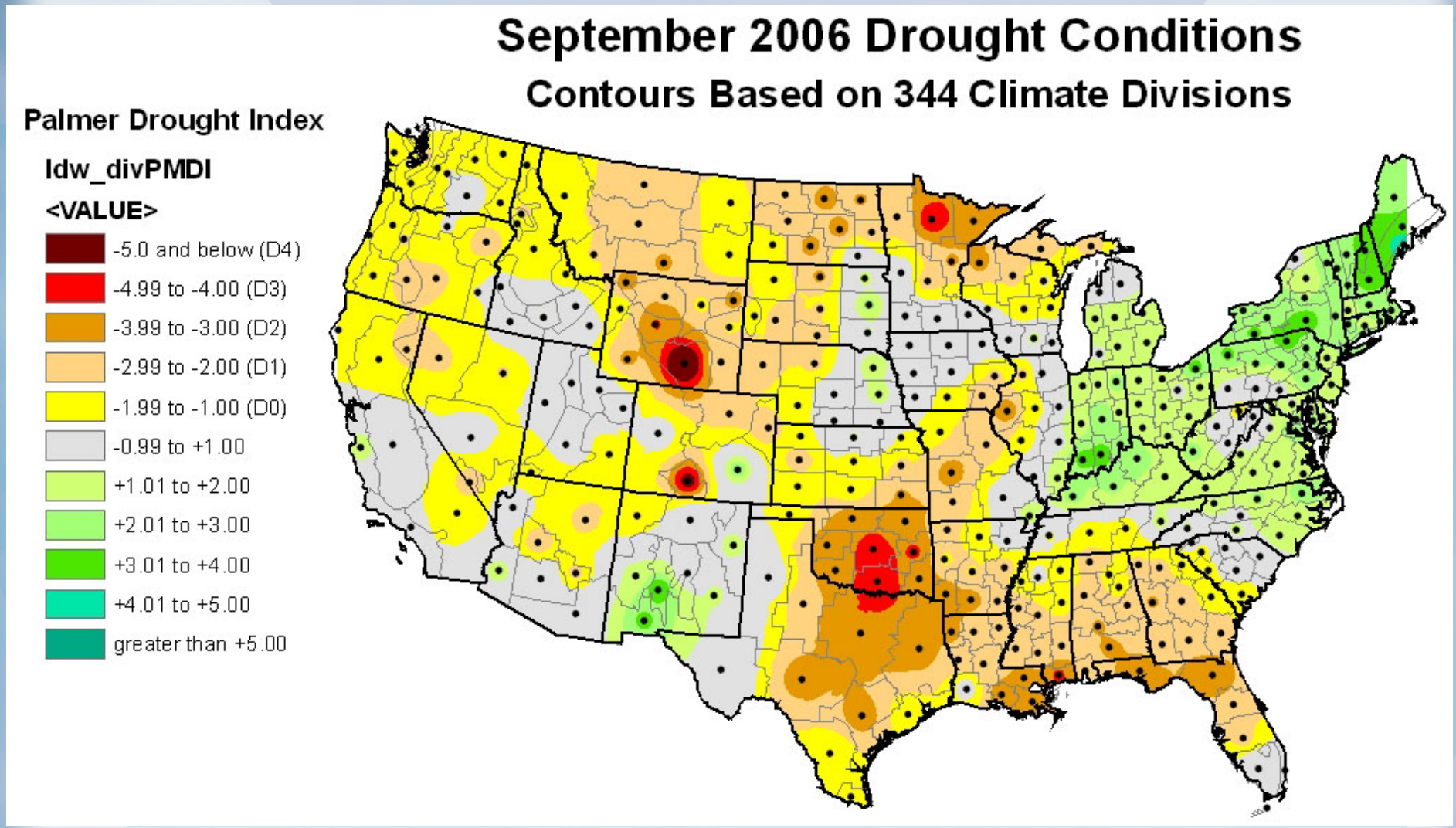
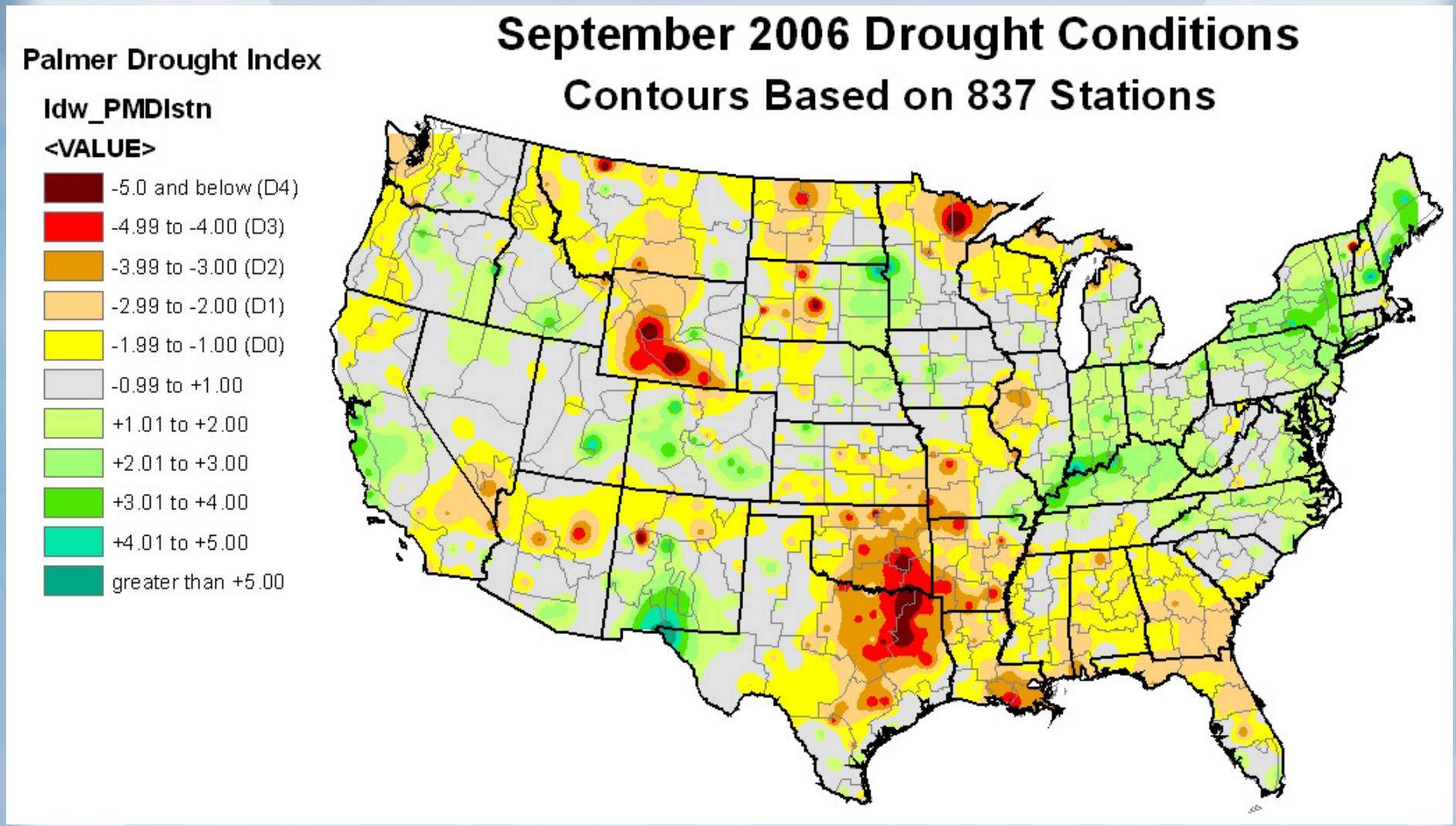


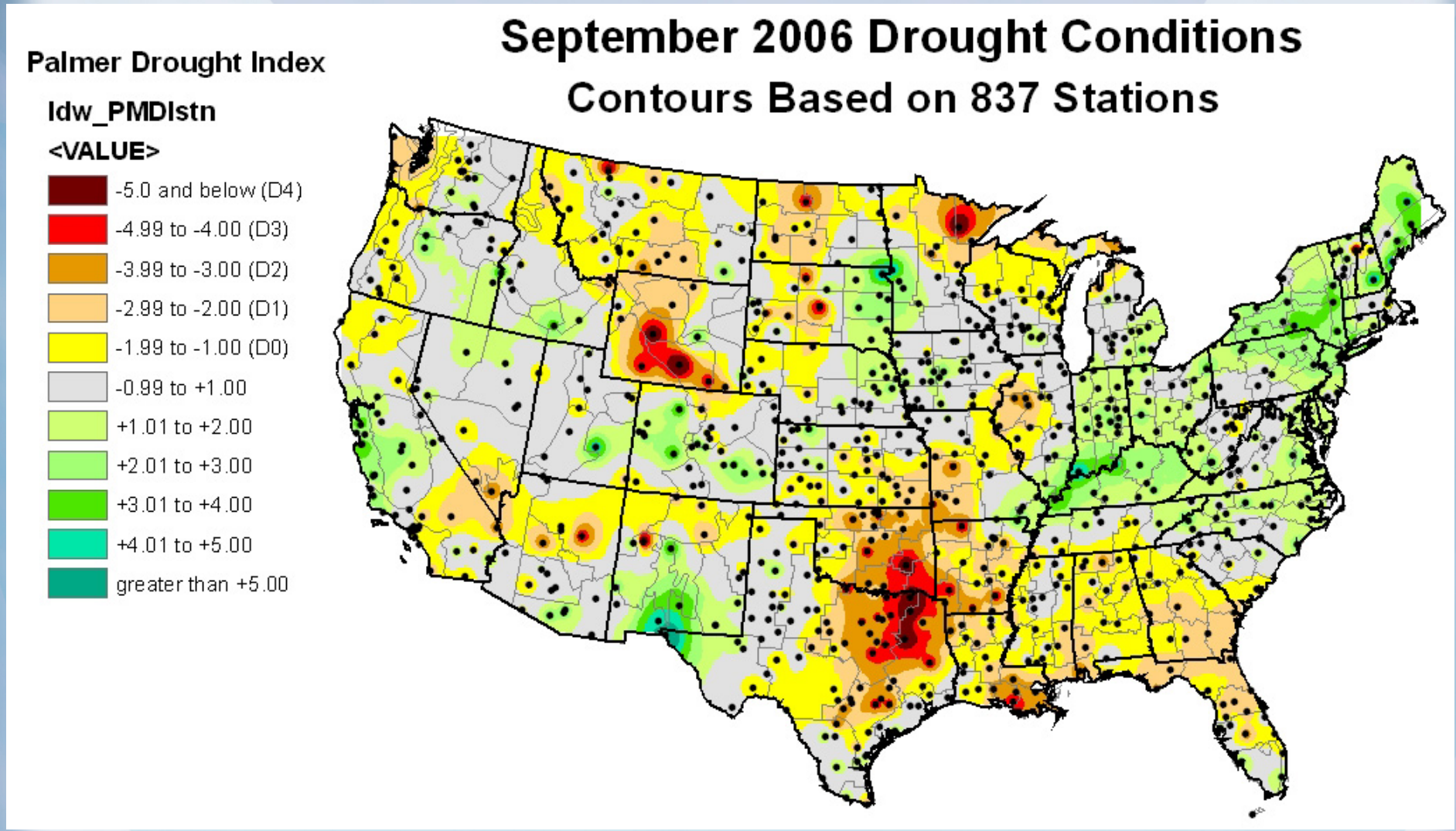
Climate Division PDI Contoured, with division center-points plotted

How Do the Station and Climate Division PDI Compare if they are Contoured?



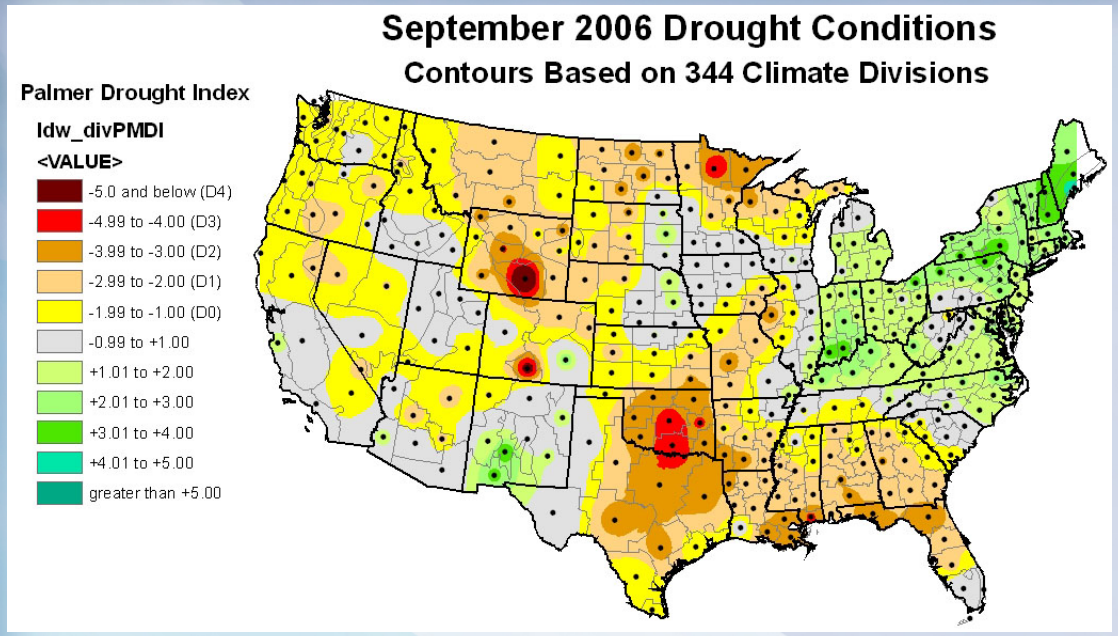
Station PDI Contoured

How Do the Station and Climate Division PDI Compare if they are Contoured?

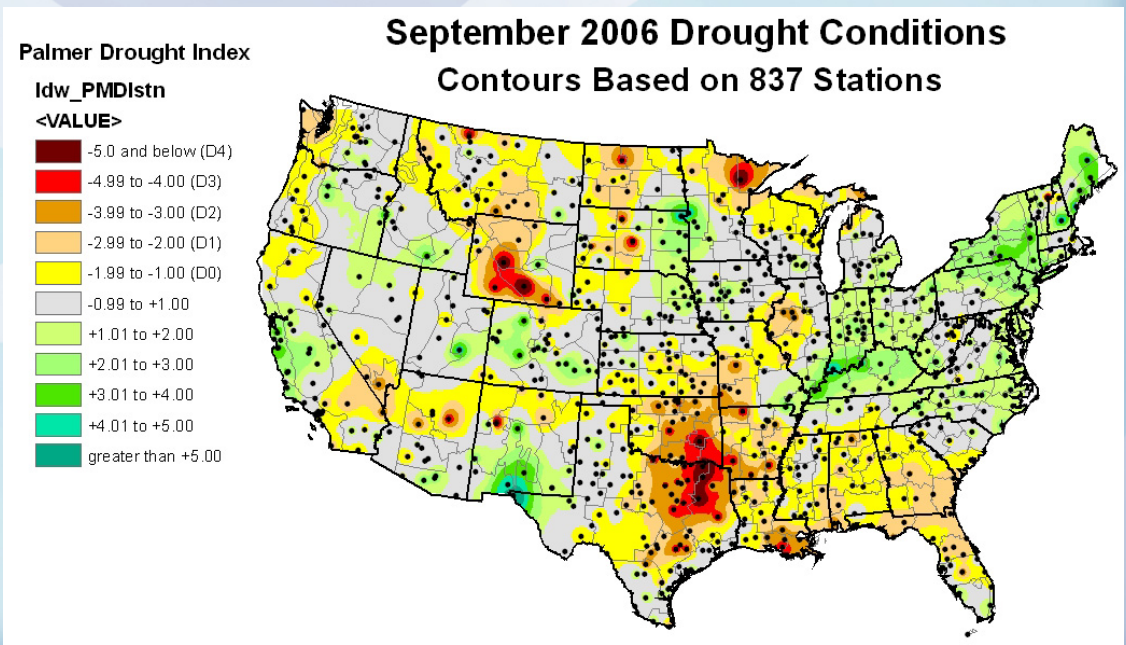


Station PDI Contoured, with station locations plotted

How Do the Station & Climate Division PDI Compare if they are Contoured?



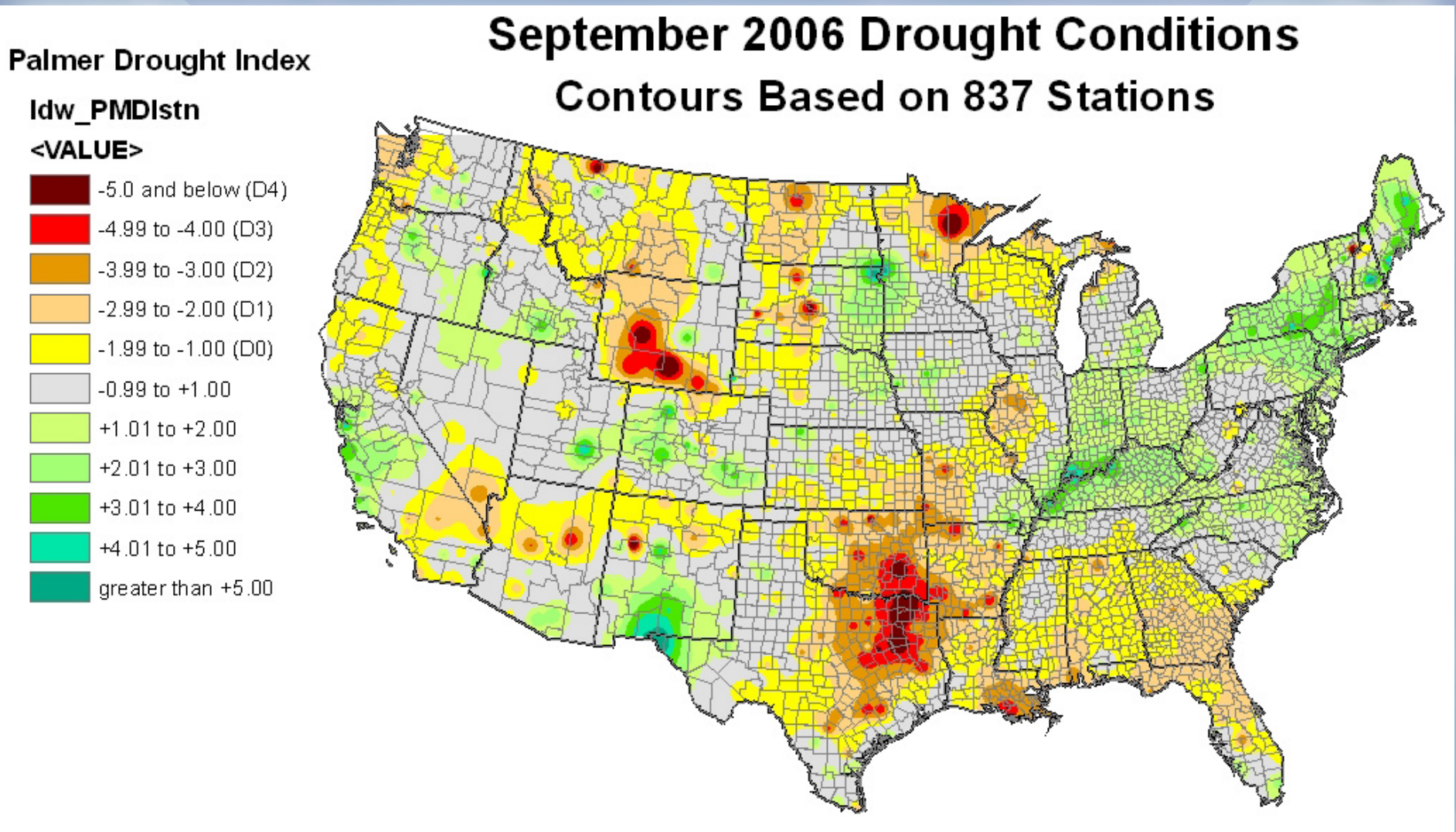
Climate Division PDI Contoured



Station PDI Contoured

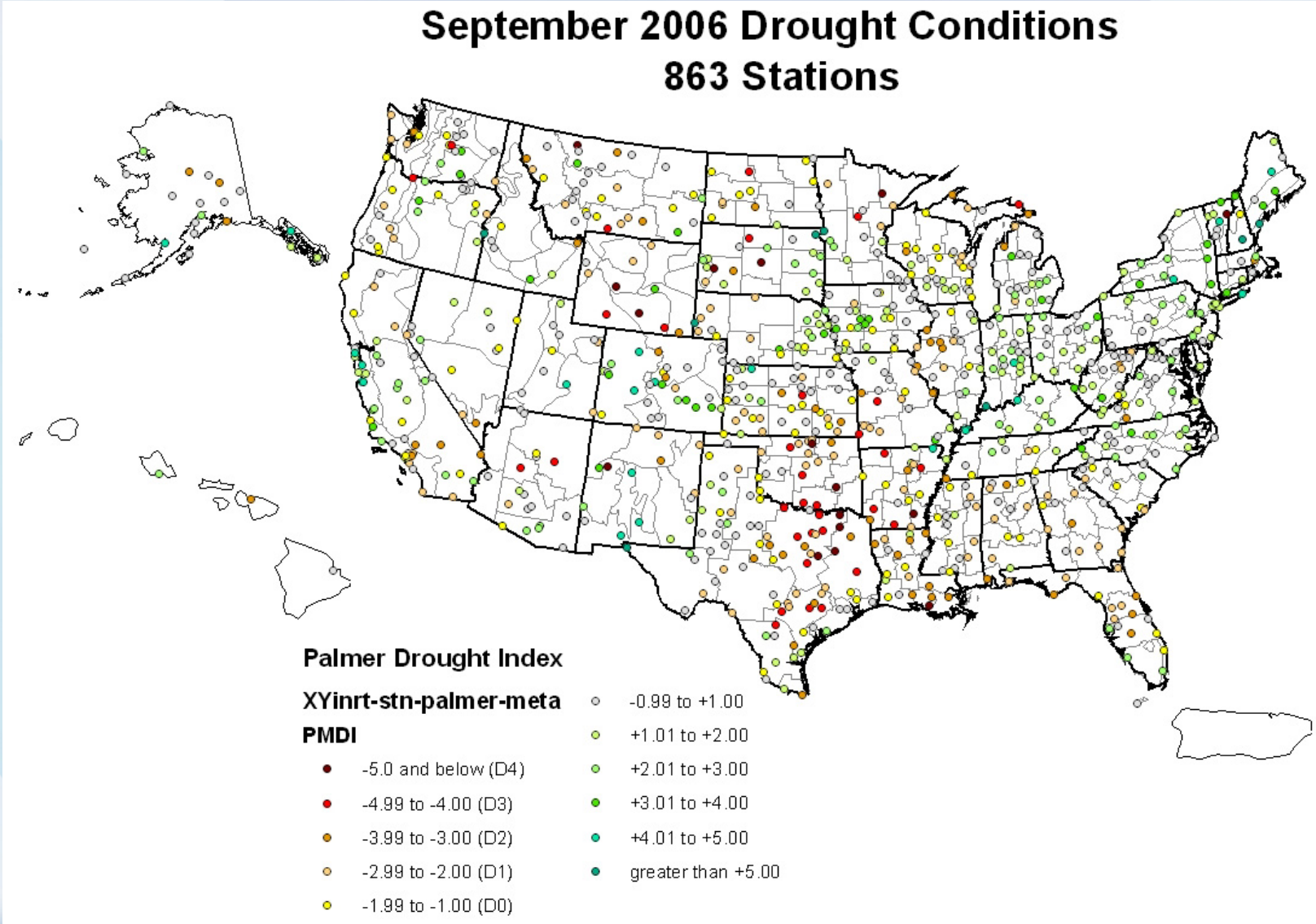
September 2006 Drought Conditions

Contours Based on 837 Stations



Contoured Station PDI with State and County boundaries.
Station data is better for county resolution than Climate Division data.

How Do the Station PDI Compare to the US Drought Monitor?



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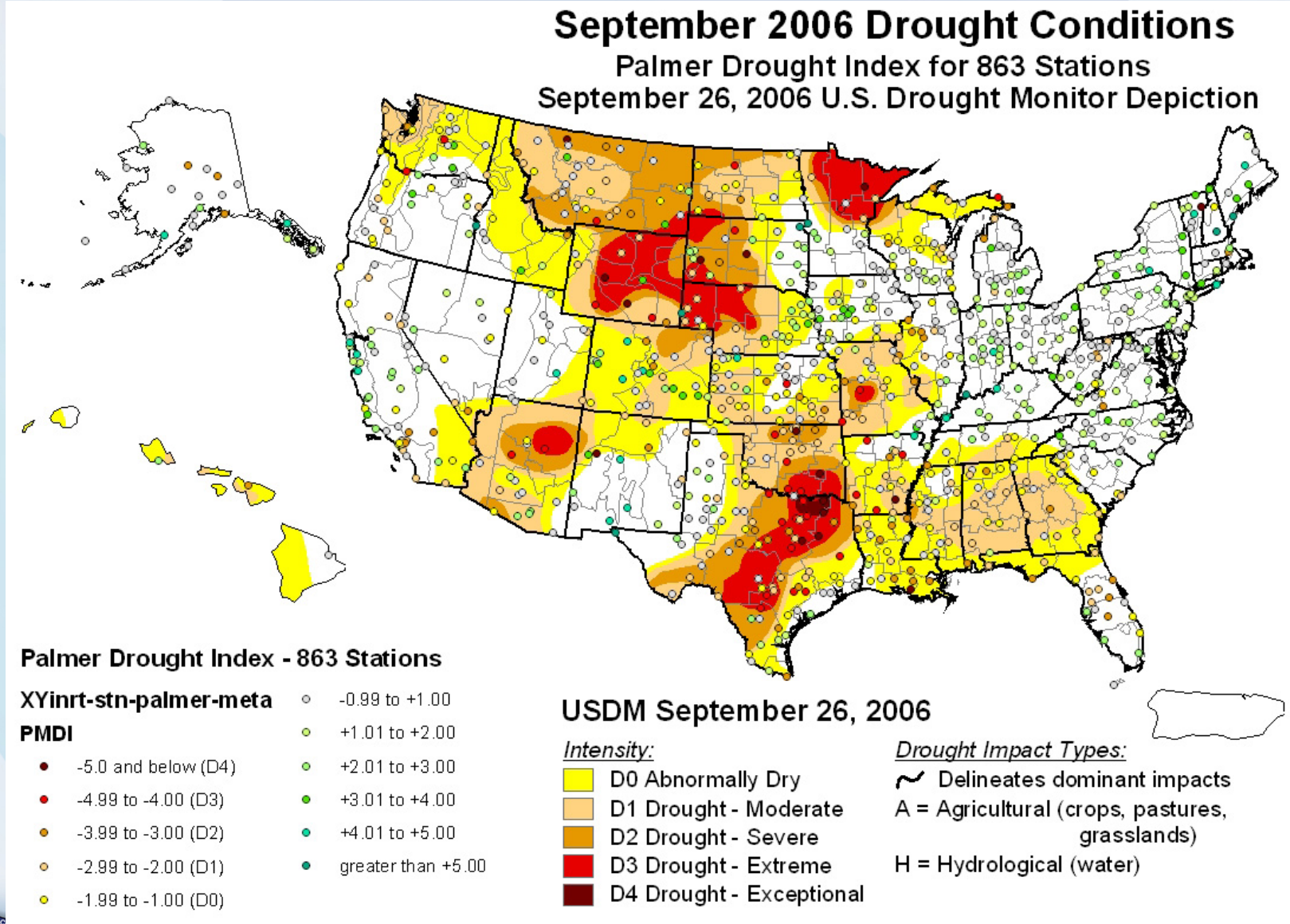
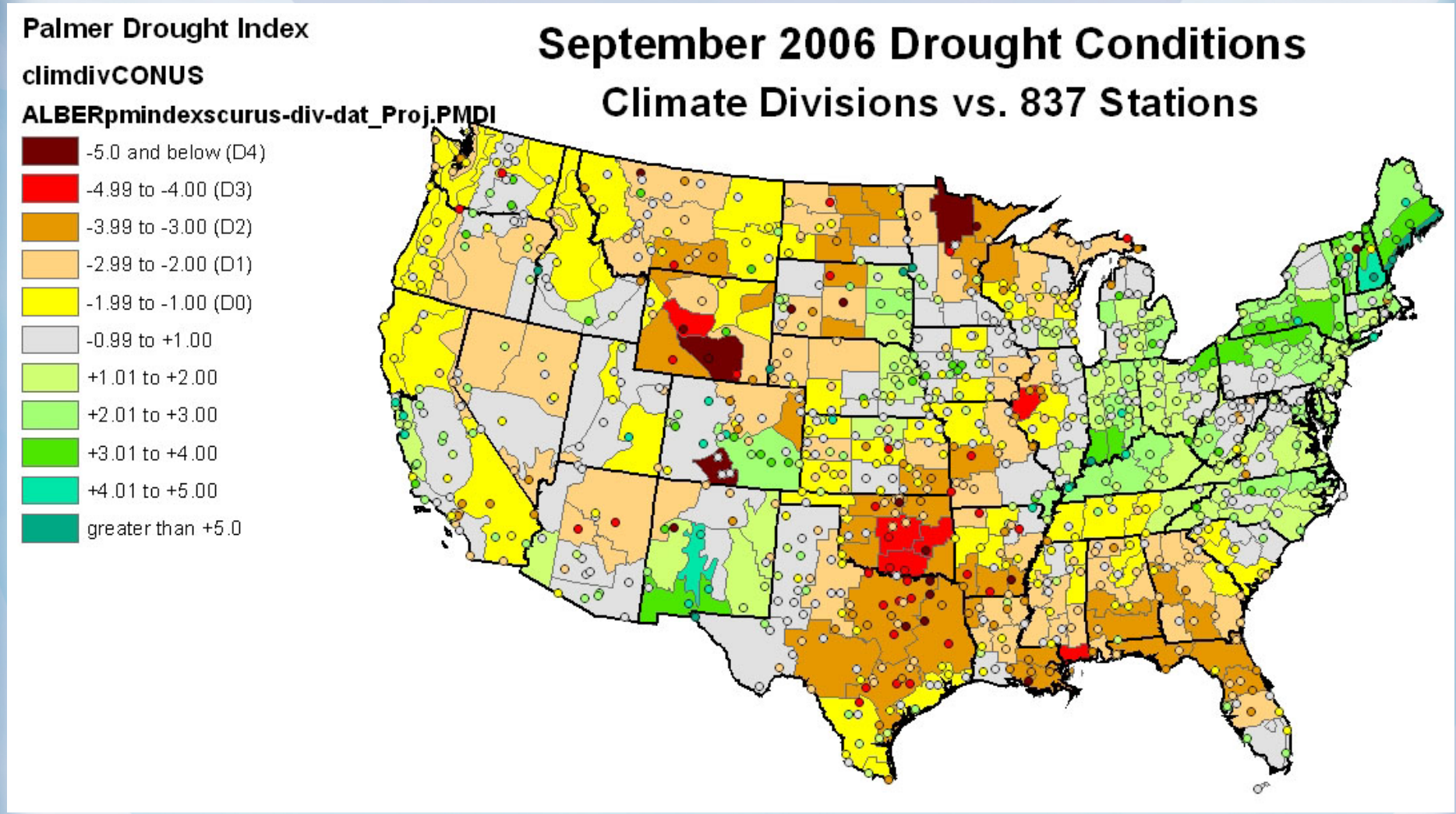
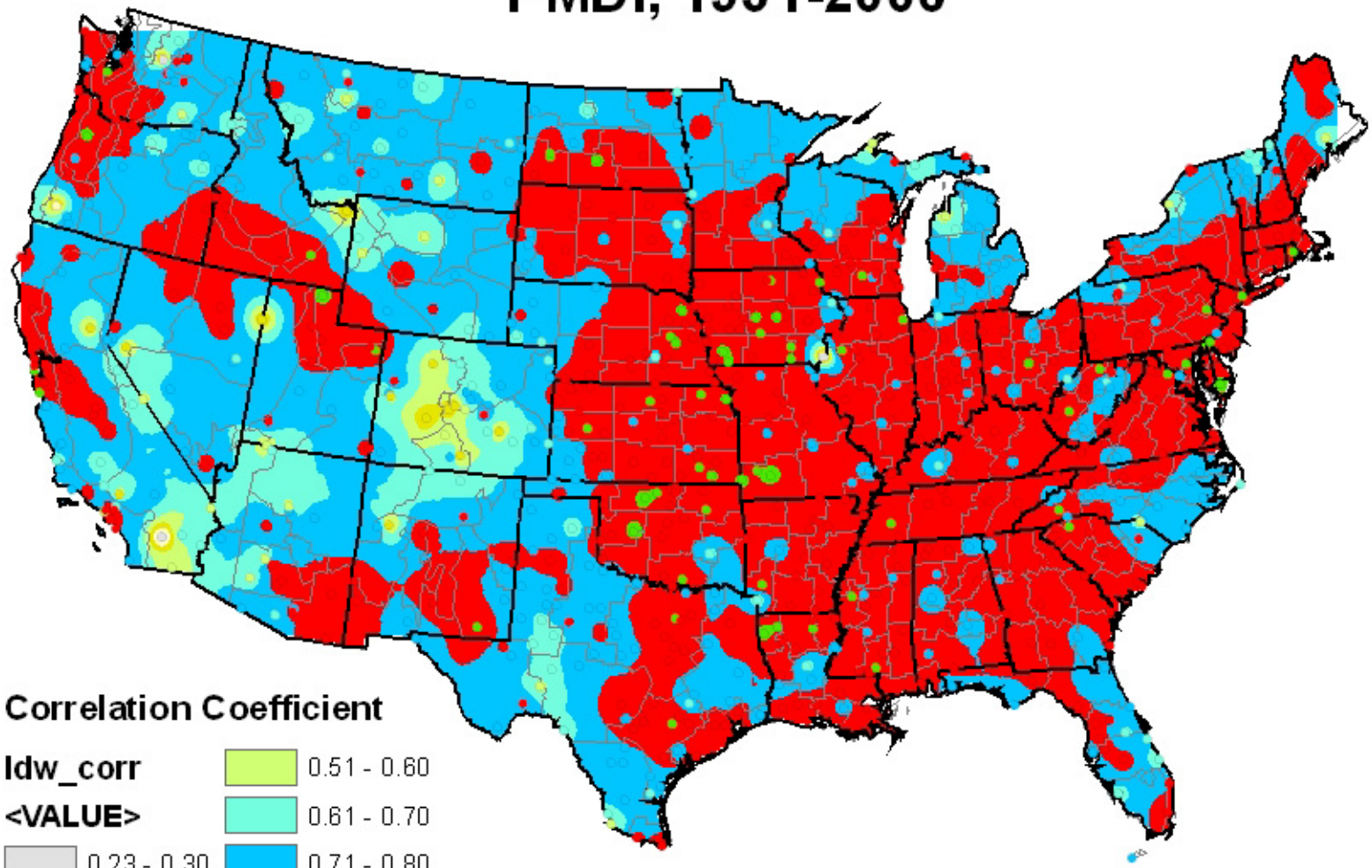


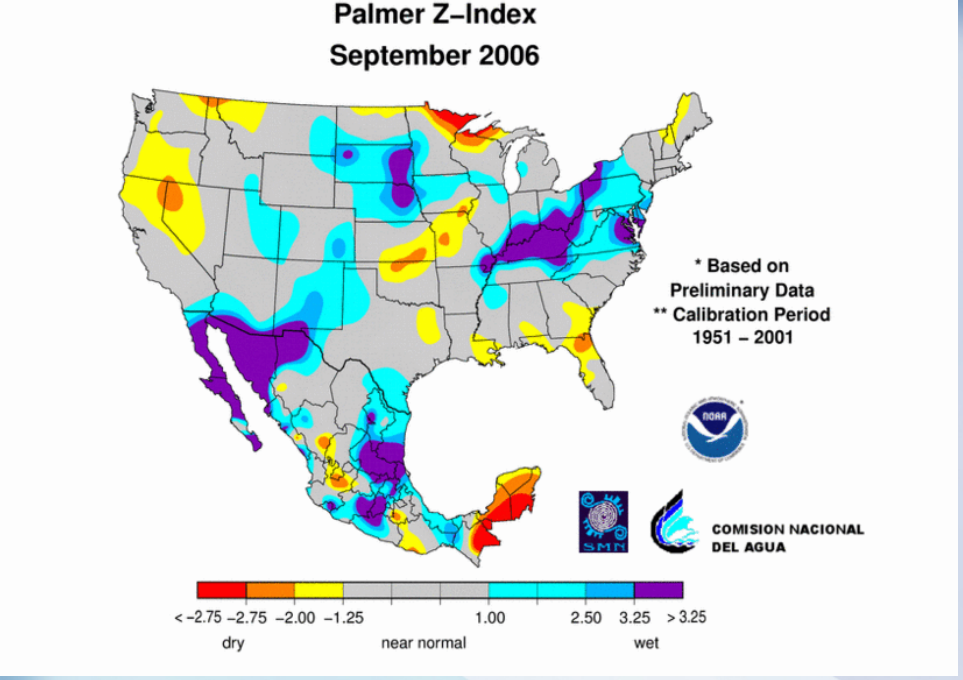
How Do the Station PDI Compare to the Climate Division PDI throughout the Historical Record?



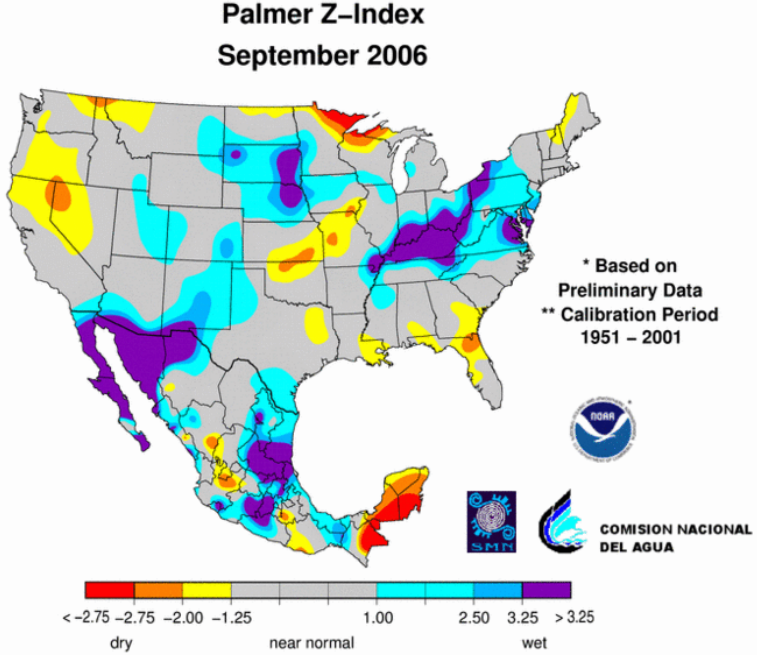
Station vs. Climate Division Correlations
PMDI, 1951-2006



How Do the US-MX Contoured NADM Indicator Maps Compare: U.S. Climate Divisions vs. U.S. Stations?

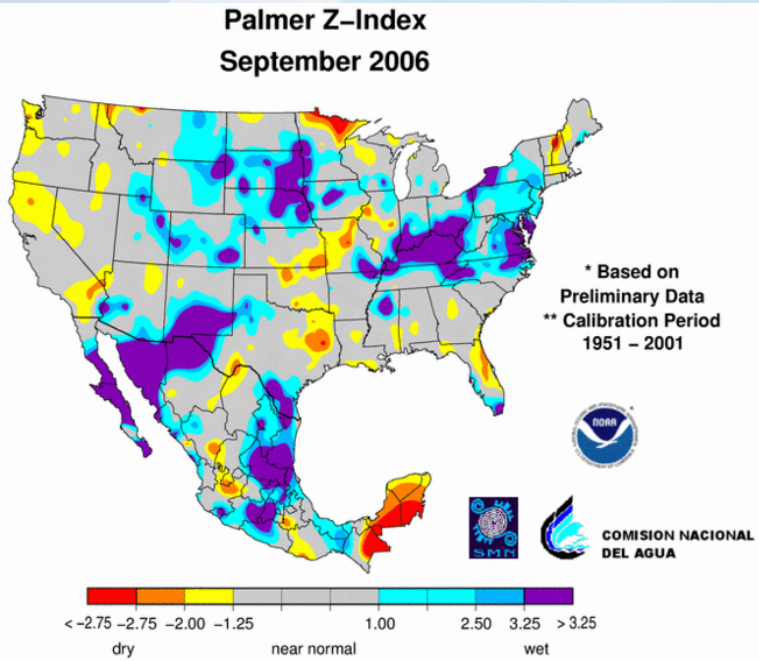


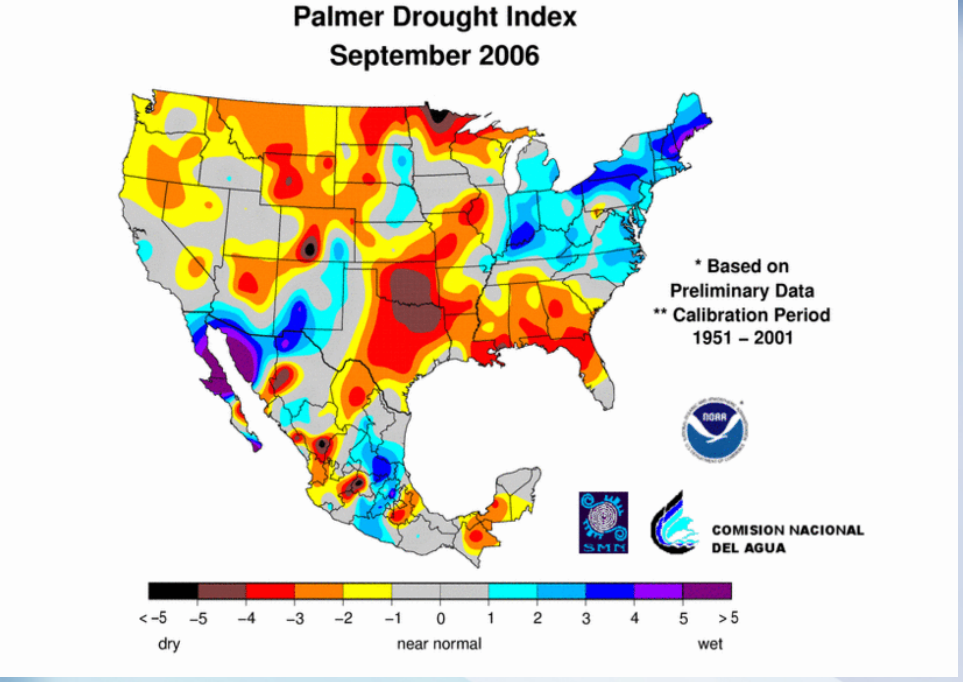
U.S. Climate Divisions



U.S. Stations

U.S. Climate Divisions





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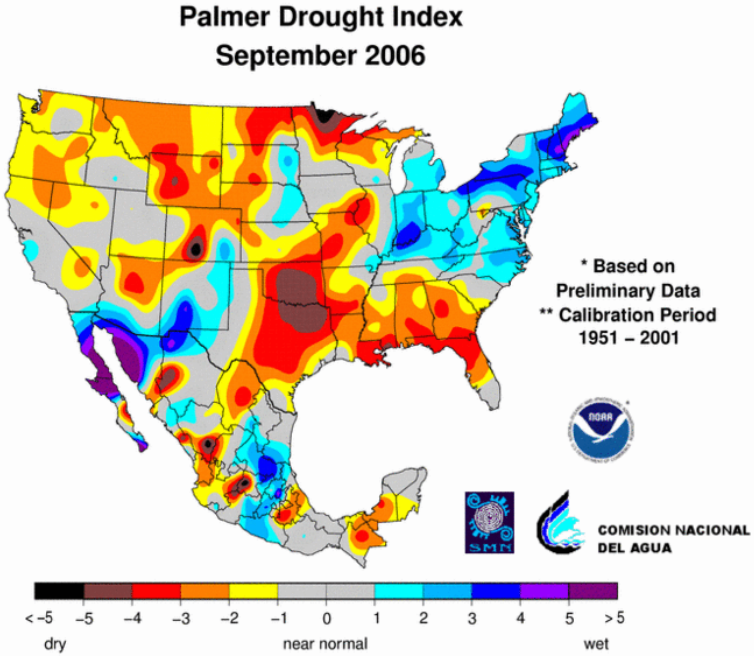

U.S. Stations

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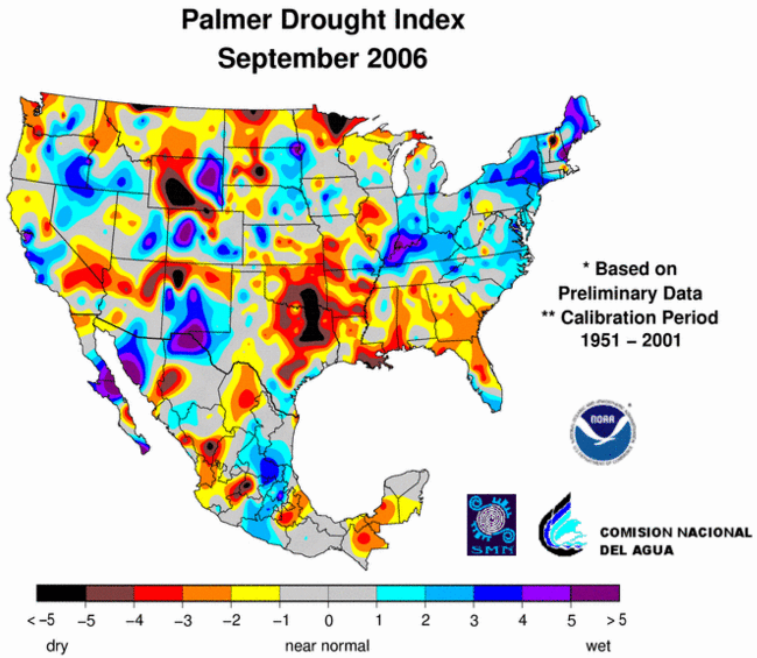
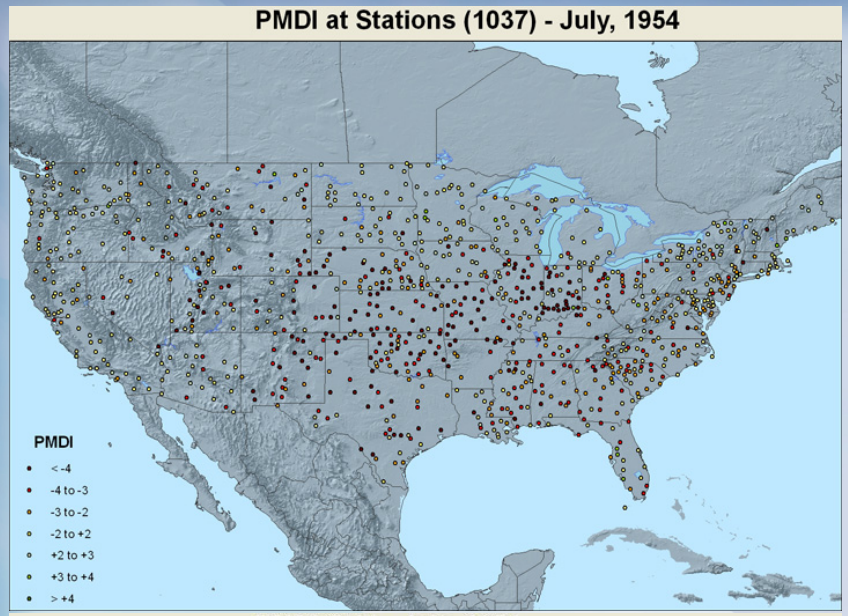
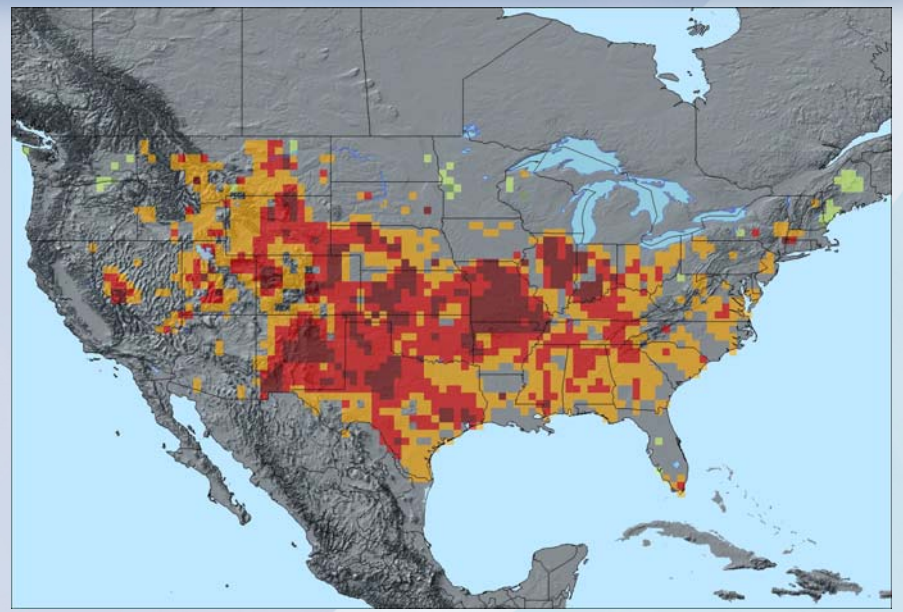
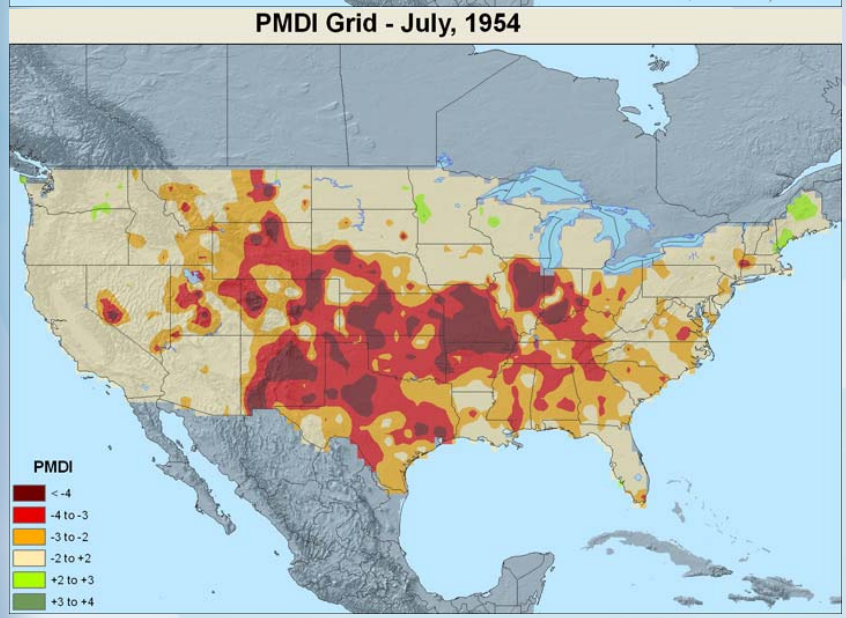


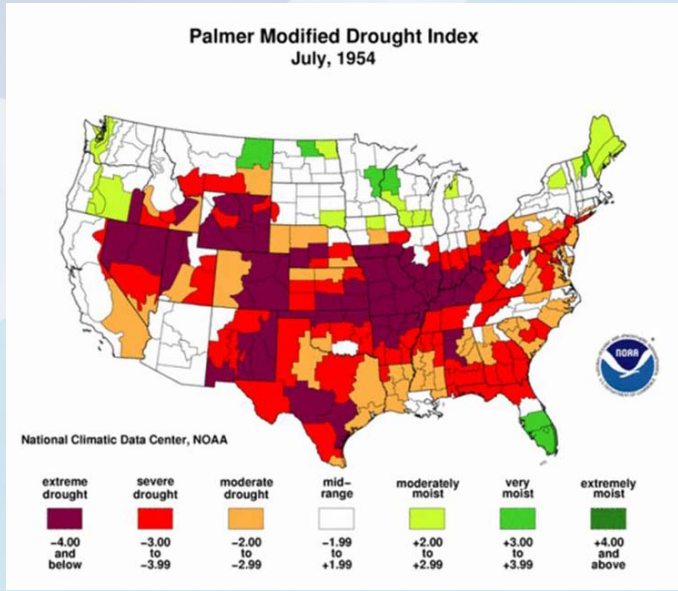
Using Station Data – Strengths and Weaknesses

- ✓ **Strengths:**
  - Point measurements
  - Fine spatial resolution
- ✓ **But stations suffer from missing data, & different periods of record.**
- ✓ **Also, contours based on station data will be different depending on which stations are used, and on the number of stations used.**
- ✓ **The Solution?**
  - Using a gridded dataset, we can take care of the missing data and consistent period of record issues.
  - Use a consistent station data base historically to create the gridded dataset.









Grids (.5x.5 degree) created from July 1954 station data.

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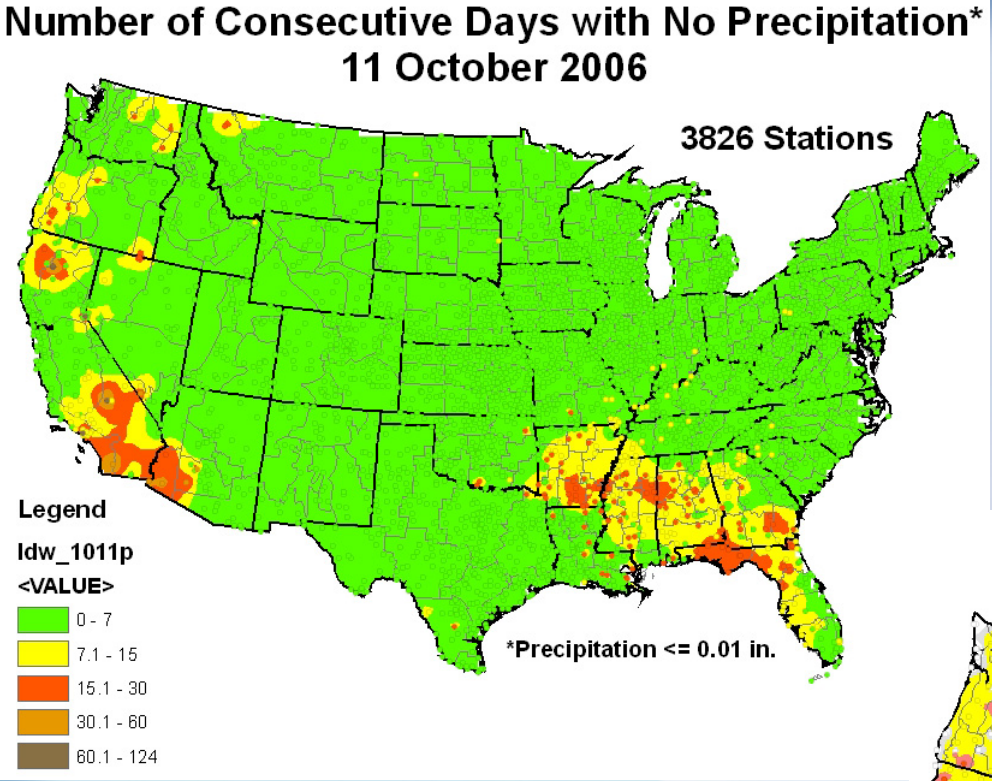
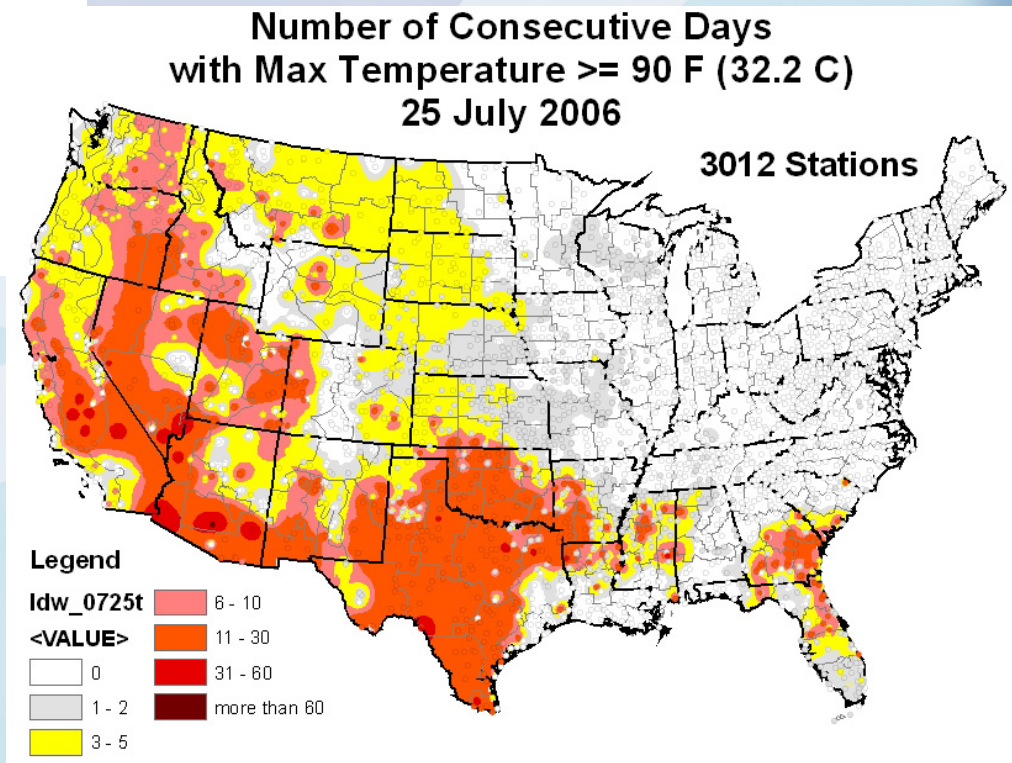


Additional drought indicators that can be created from daily station data include Number of Consecutive Days indices.



North America Drought Monitor web page:
http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/index.html

Gracias!

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