

# Visualizing Hydro Atlas in Open Source Web-GIS

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<http://www.drought.unl.edu>





# Presentation Outline

- 1. US Drought Atlas**
- 2. Hydro Atlas using HCDN**
- 3. Overview of Web-GIS**
- 4. Application of Open Source Web-GIS**
- 5. Future Work**



# US Drought Atlas

NDMC



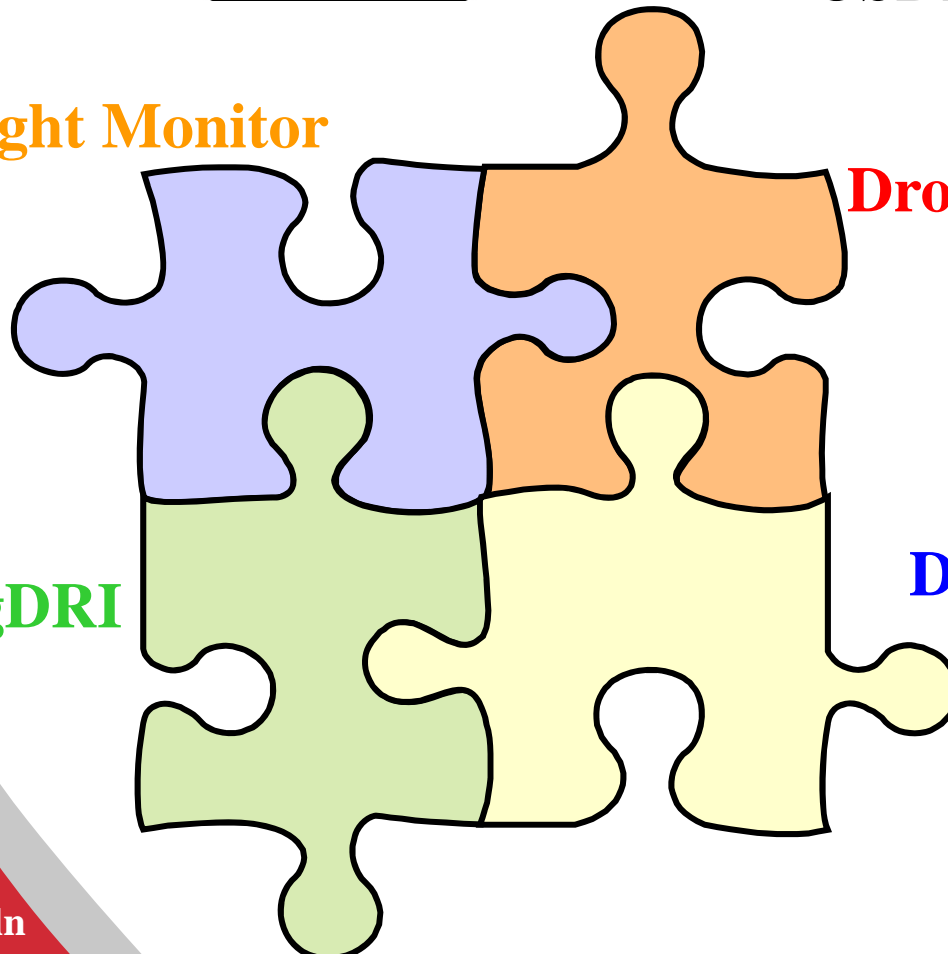
Risk Management Agency  
USDA

**Drought Monitor**

**Drought Impact  
Reporter**

**VegDRI**

**Drought Atlas**

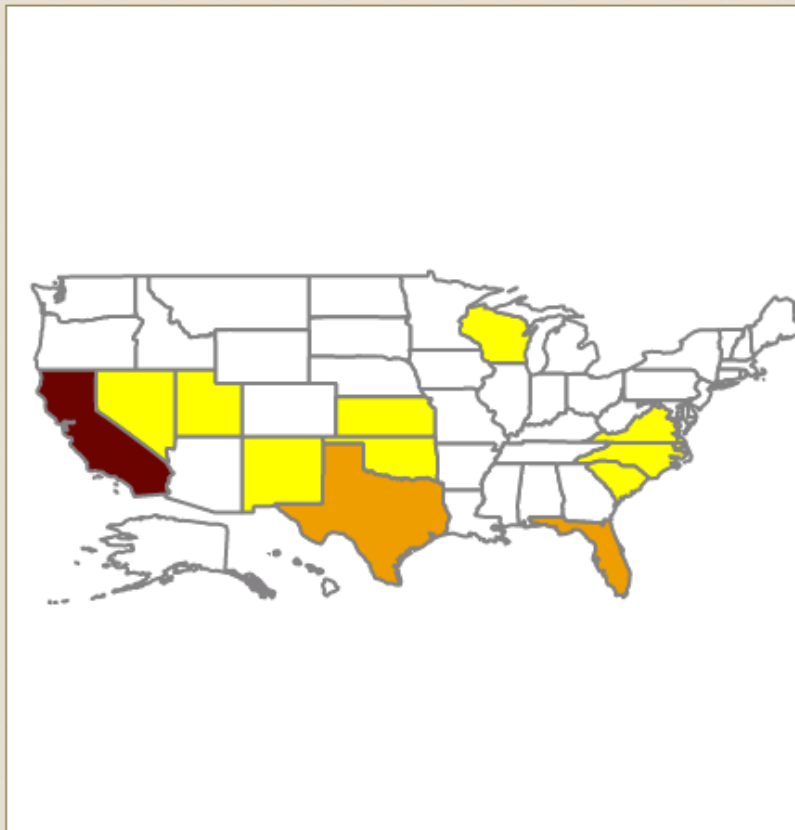


# Drought Impact Reporter

National Drought Mitigation Center



[View Drought Impacts](#) | [Add A Drought Impact](#) | [Time-Lapse Animation](#) | [About](#) | [Help](#) | [User Login](#)



### Map Options

#### Impact Categories:

- |  |  |
|--|--|
| <input checked="" type="checkbox"/> Agriculture  | <input checked="" type="checkbox"/> Fire   |
| <input checked="" type="checkbox"/> Water/Energy | <input checked="" type="checkbox"/> Social |
| <input checked="" type="checkbox"/> Environment  | <input checked="" type="checkbox"/> Other  |

Source:

Time Period:

[Show Drought Monitor Layers](#)

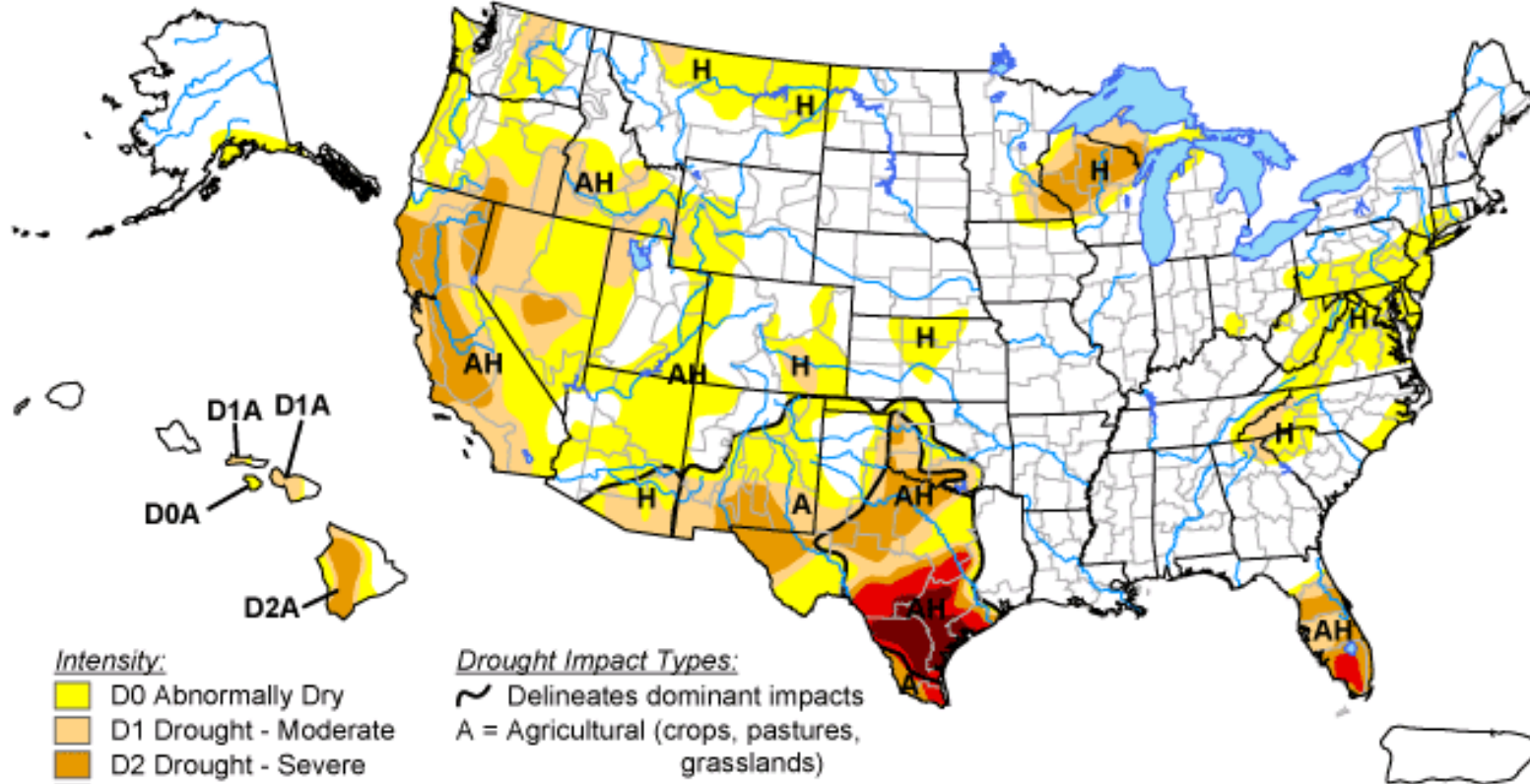
### Legend

- |  |                          |
|--|--------------------------|
|  | No reported impacts      |
|  | 1 - 14 reported impacts  |
|  | 15 - 27 reported impacts |
|  | 28 - 41 reported impacts |
|  | 42 - 54 reported impacts |
|  | 55 - 68 reported impacts |

**Instructions:** Click on a state to see the reported drought impacts that affect that state.

# U.S. Drought Monitor

April 21, 2009  
Valid 8 a.m. EDT



Intensity:

- D0 Abnormally Dry
- D1 Drought - Moderate
- D2 Drought - Severe
- D3 Drought - Extreme
- D4 Drought - Exceptional

Drought Impact Types:

- Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

<http://drought.unl.edu/dm>



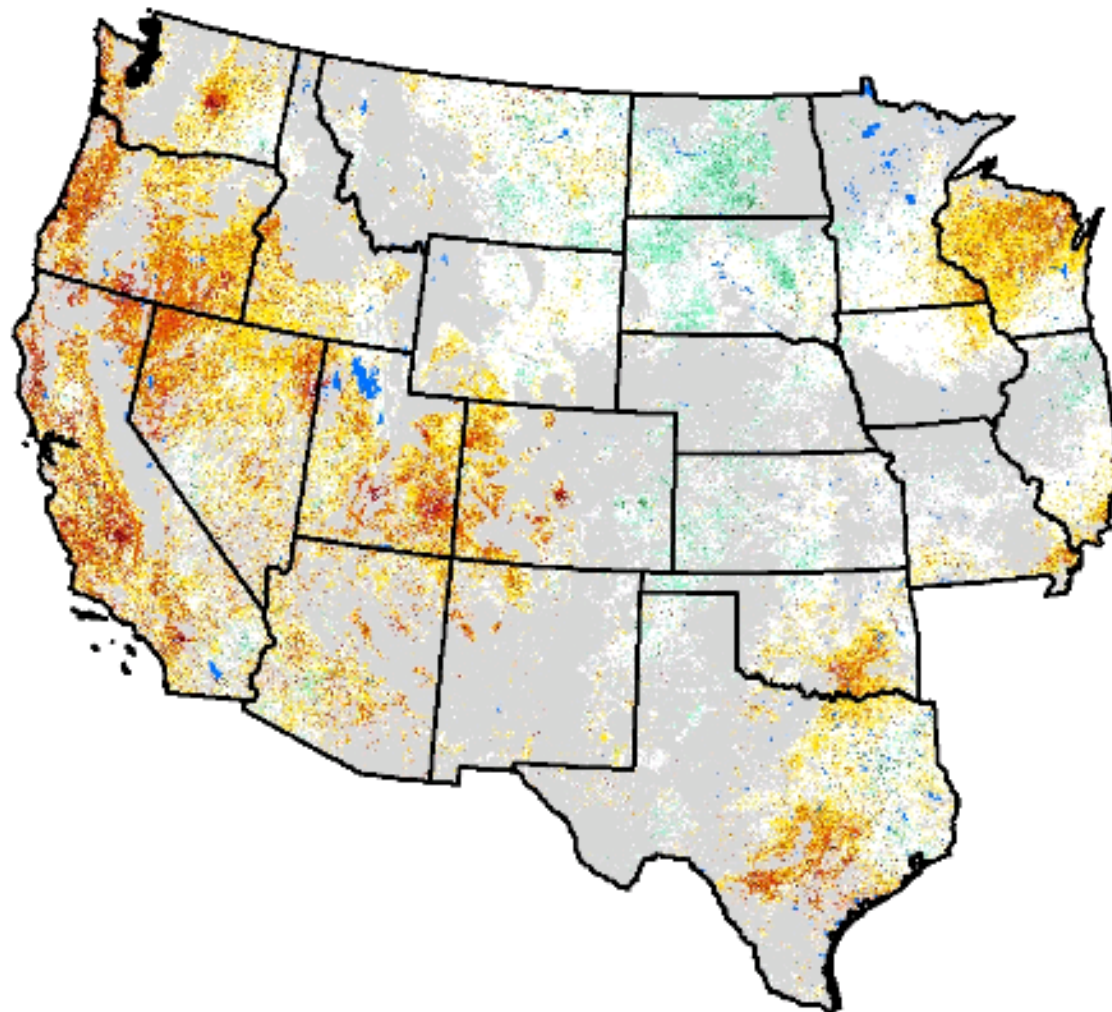
Released Thursday, April 23, 2009



Authors: Richard Heim/Liz Love-Brotak, NOAA/NESDIS/NCDC

# Vegetation Drought Response Index Complete

April 20, 2009

## Vegetation Condition



-  Extreme Drought
-  Severe Drought
-  Moderate Drought
-  Pre-Drought
-  Near Normal
-  Unusually Moist
-  Very Moist
-  Extremely Moist
-  Out of Season
-  Water

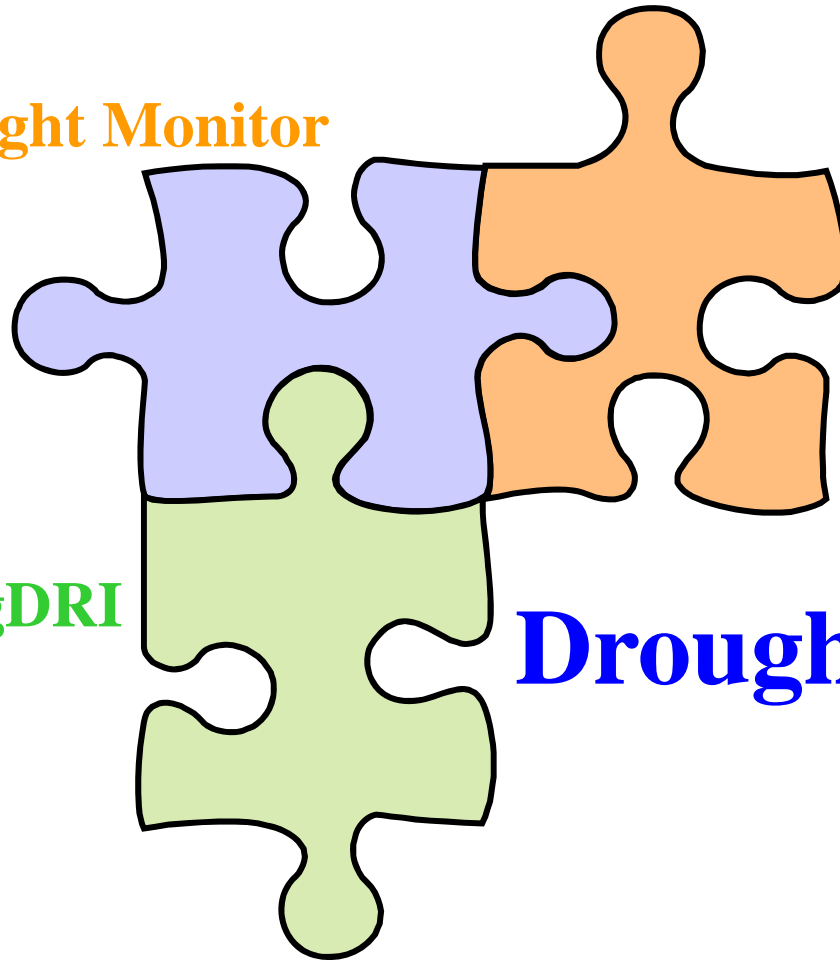


**Drought Monitor**

**Drought Impact  
Reporter**

**VegDRI**

**Drought Atlas**



# US Drought Atlas

- National Drought Atlas (US Army Corps of Engineers)
- Ray Linsley, Former Professor of Civil Engineering at Stanford University
- Precipitation, 102 Climate Divisions, Historical Climatology Network (HCN)
- Streamflow, 16 USGS Watersheds, Hydroclimatic Data Network (HCDN)



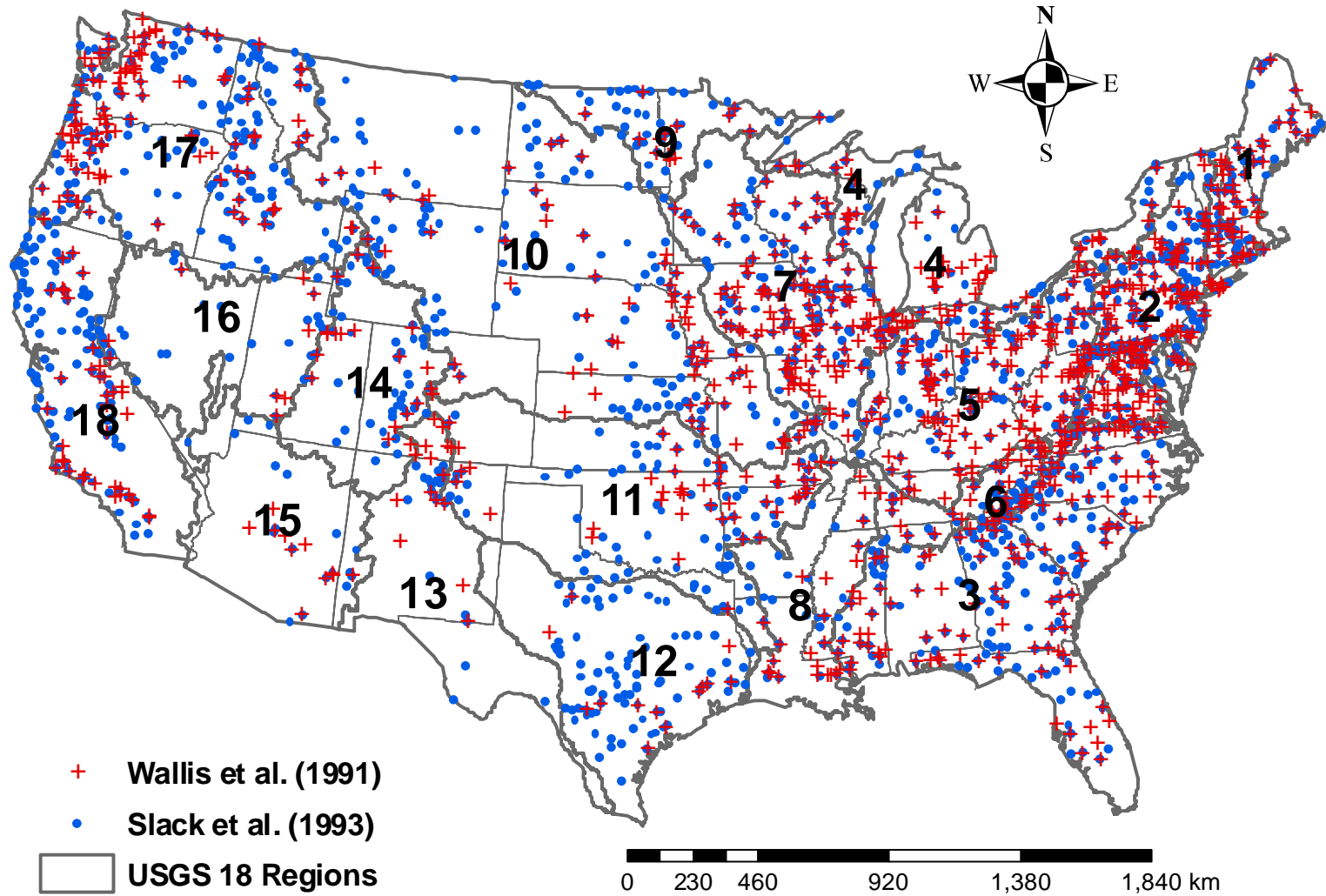


# Hydroclimatic Data Network (HCDN)

- First set of HCDN data, 1,009 sites, Daily average flow, full data w/o missing, 1948-1988 (Wallis et al. 1991)
- Second set of HCDN data, 1,659 sites, Daily discharge, Monthly and annual statistics, 1874-1988 (Slack et al. 1993)
- Subset of HCDN, 1,456 sites for US Drought Atlas, 1874-1988 (Werick et al. 1994)
- Subset of HCDN, 1,376 sites, 1951-1990 (Vogel and Sankarasubramanian, 2005)
- No visualization efforts has been made

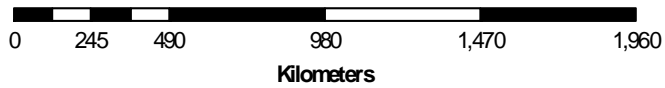
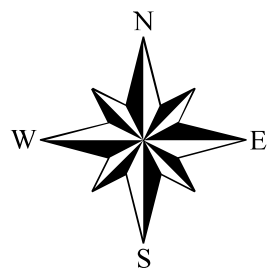
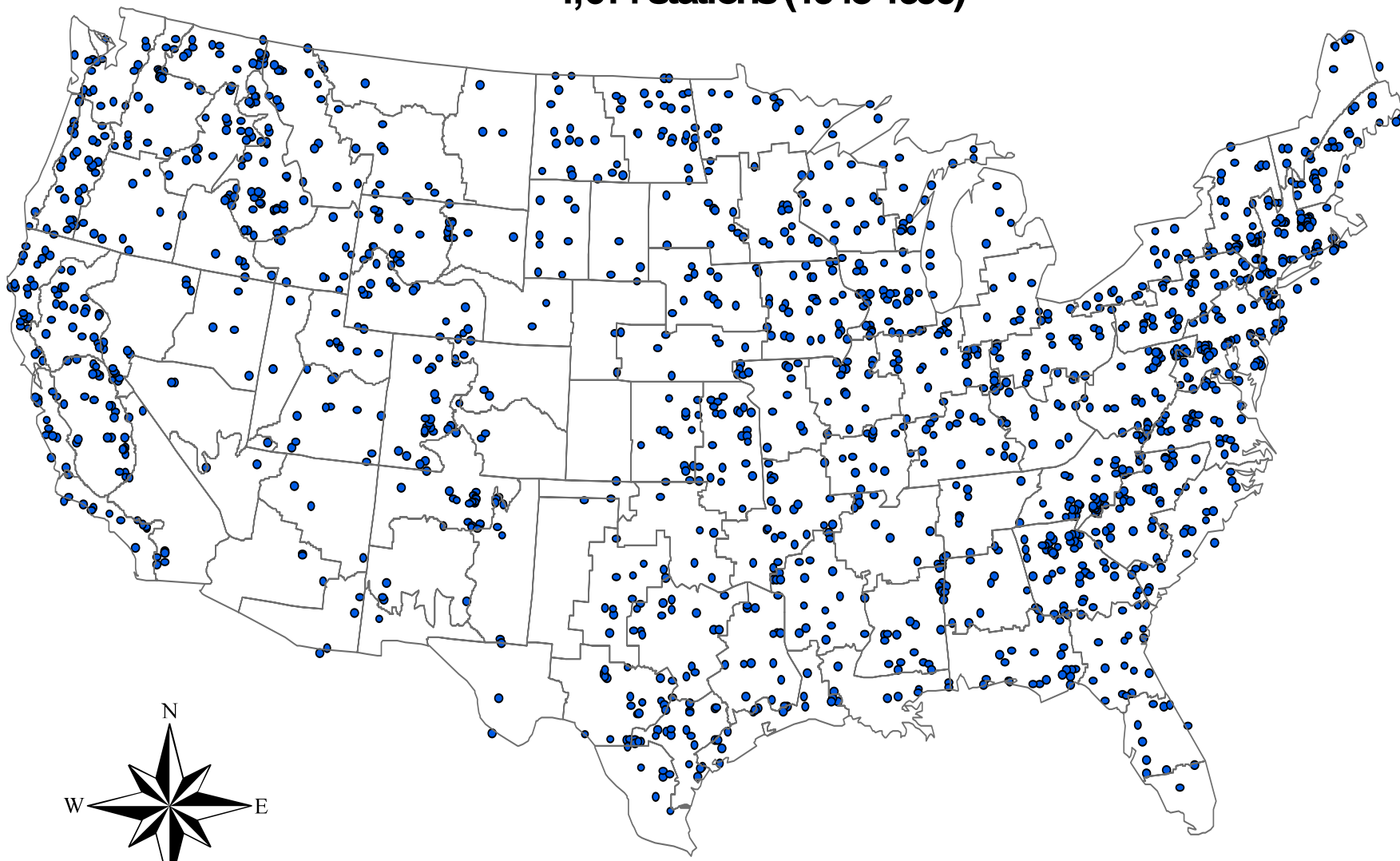


# U.S. Hydroclimate Data Network (HCDN)

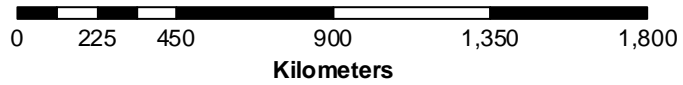
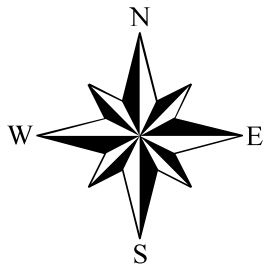
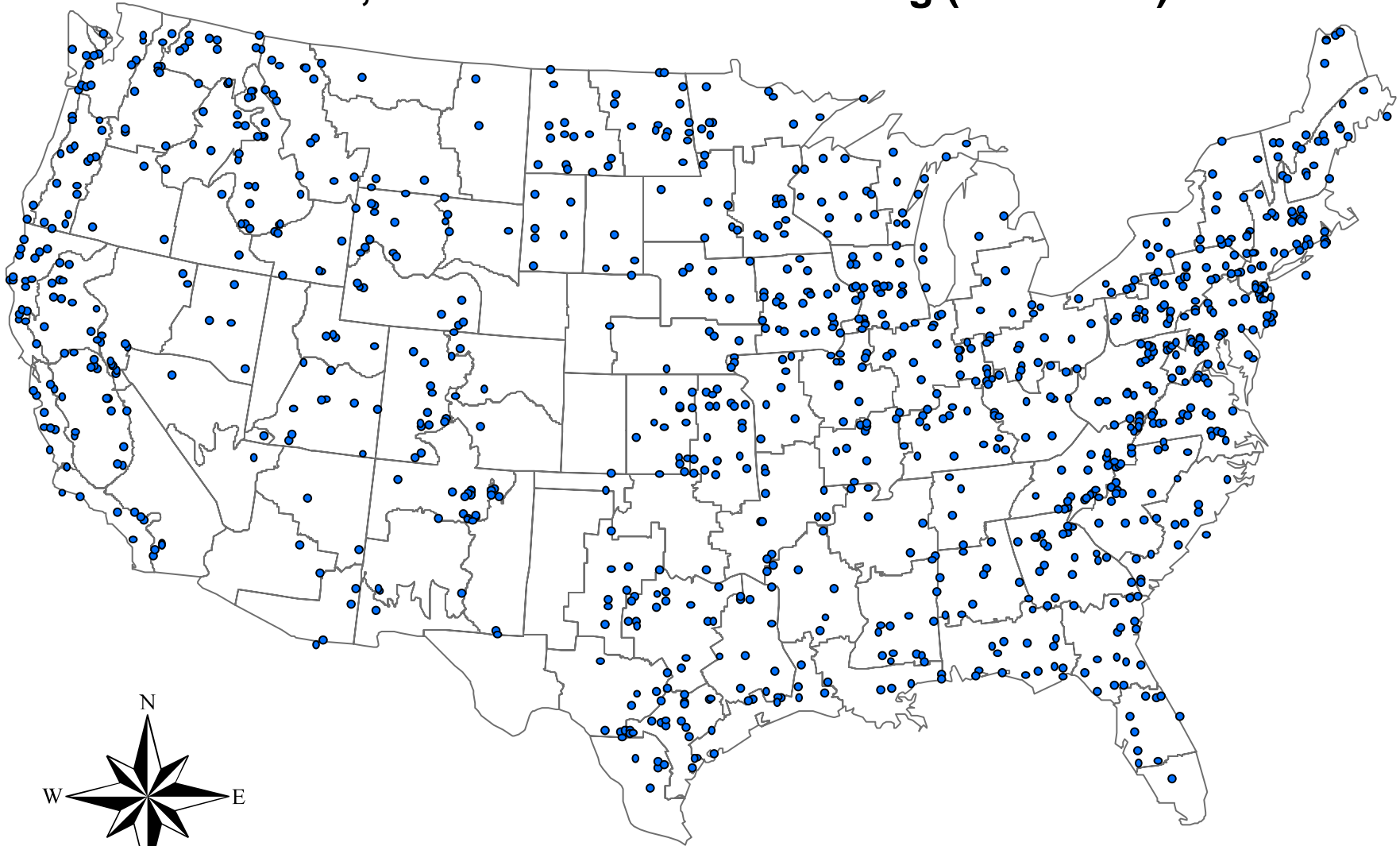


Up to 1990

# U.S. Hydroclimate Data Network (HCDN) 1,614 stations (1948-1990)



# U.S. Hydroclimate Data Network (HCDN) 1,046 stations with no missing (1990-2006)

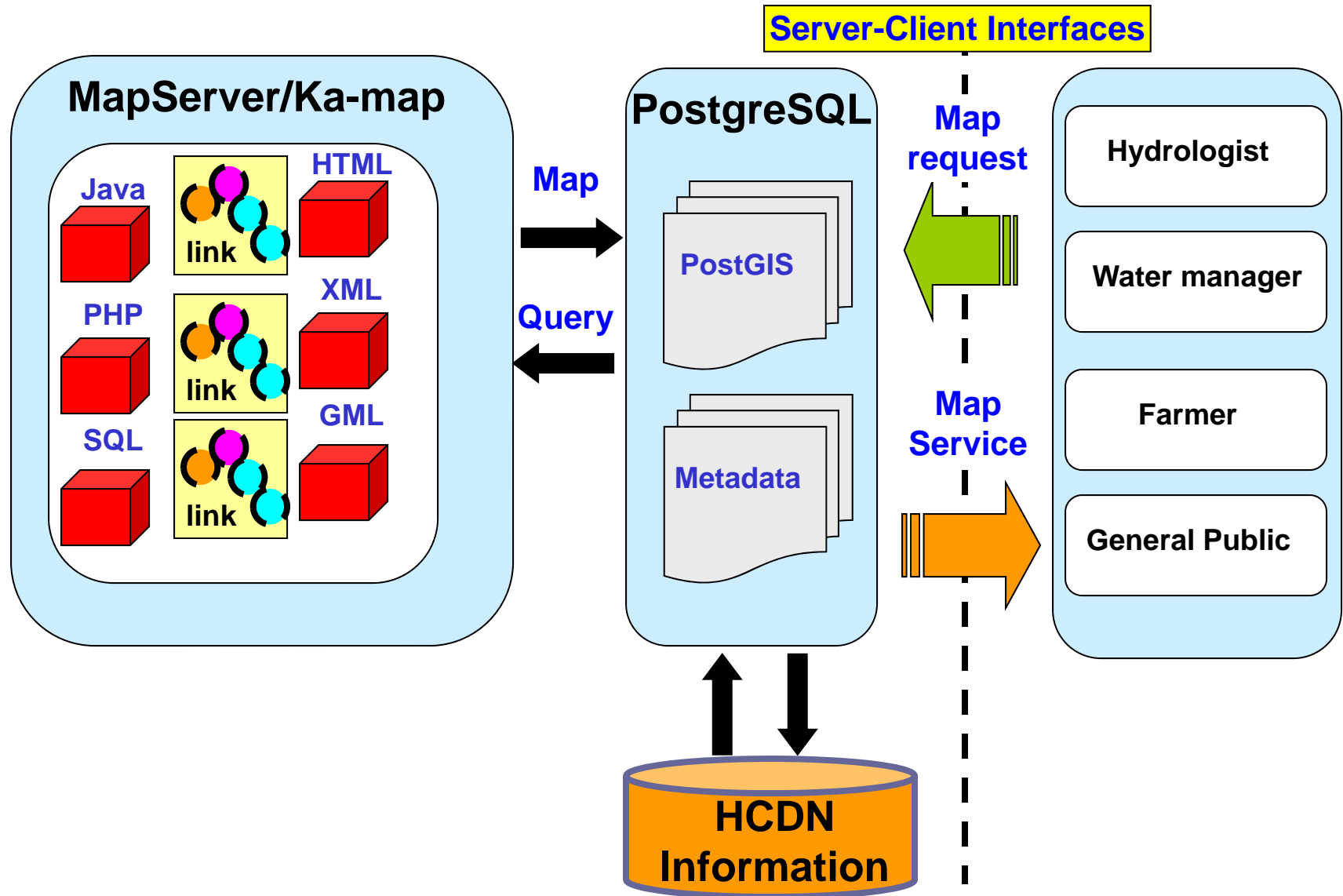


# Web-GIS Applications

- ArcIMS (ESRI)
  - Commercial, cost, server, license
- Google Map/Microsoft Virtual Earth
  - Commercial, free with condition, online key
- MapServer (UMN)
  - Open source, free of charge, GNU License



# A Framework of Open Source Web-GIS



U.S. Drought Atlas Demonstration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://rainier.unl.edu/atlas/index.html

Most Visited Customize Links Free Hotmail Windows Marketplace Windows Media Windows mapserv.exe (PNG Im...

Google office depot Search Bookmarks Check AutoLink AutoFill Send to Settings

# U.S. HYDRO DROUGHT ATLAS DEMONSTRATION

Ka-Map (AJAX) + Mapserver (GIS Server) + PostGIS (Geospatial Database) = Openso National Drought Mitigation Center

Home About US Services Hydro Data Publication Contact Us

Atlas 1:21000000

## Search

Type in USGS gage station number (e.g. 6783500)

6783500

Search

Search string:  
6783500

Layer Name:  
HCDN Gage Stations

results: 1

StationID	State	Zoom to	Streamflow
06783500	NE		

<http://rainier.unl.edu/atlas>

kilometers 400 800 1200

Find: Next Previous Highlight all Match case

Done

U.S. Drought Atlas Demonstration - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://rainier.unl.edu/atlas/#

Most Visited Customize Links Free Hotmail Windows Marketplace Windows Media Windows mapserv.exe (PNG Im...

Google arcmapping query null val Search + Bookmarks Check AutoLink AutoFill Send to arcmapping >> Settings

# U.S. HYDRO DROUGHT ATLAS DEMONSTRATION

Ka-Map (AJAX) + Mapserver (GIS Server) + PostGIS (Geospatial Database) = Opensource Framework

National Drought Mitigation Center

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Atlas

## Search



Type in USGS gage station number (e.g. 6783500)

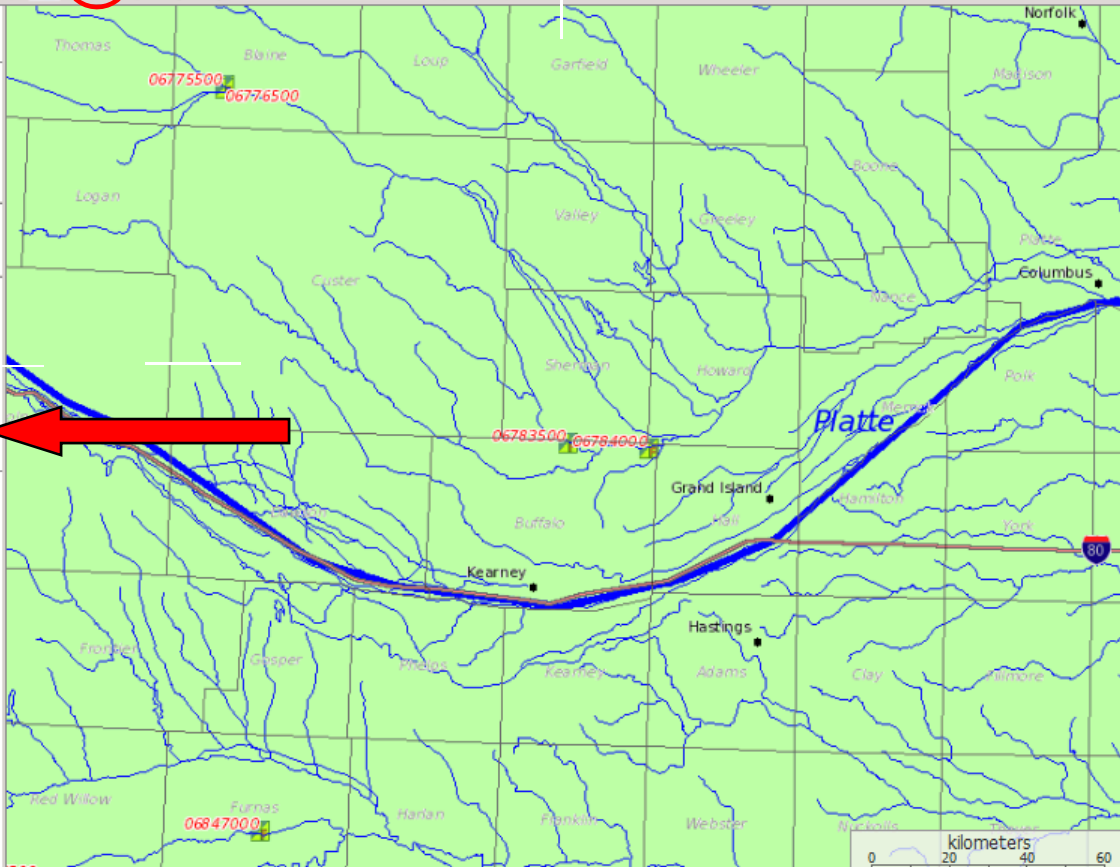
Search

Search string:  
**6783500**

Layer Name:  
**HCDN Gage Stations**

results: 1

StationID	State	Zoom	Streamflow
06783500	NE		



Find:  Next Previous Highlight all Match case

Done



2

**Start Year**  
1980

**End Year**  
1982

OK

**Start Time**  
Year Mon Day  
1973 1 1

**End Time**  
Year Mon Day  
1973 1 1

**Start Year**  
1980

**End Year**  
1982

**Hydro Drought Index**  
6 months

Show Volume Bars  
 Vertical Grid  
 Horizontal Grid  
 Log Scale

**Chart Type**  
CandleStick

**Moving Average**  
Bollinger Band

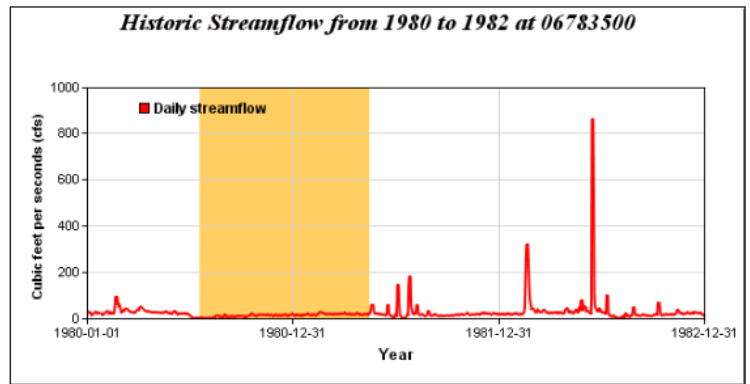
**Moving Averages**  
Simple 10  
Simple 25

**Technical Indicators**  
None  
None  
None  
None

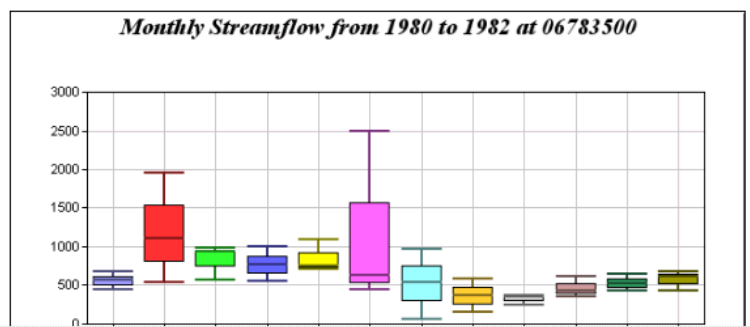
Update Chart

**Station ID:** 06783500 (USGS Link)  
**Name:** MUD CREEK NEAR SWEETWATER, NE  
**State:** NE  
**Latitude:** 41.0375  
**Longitude:** -98.9930556  
**Elevation:** 2013.69  
**Period of Record:** 1933/5/1 - Current

1



3

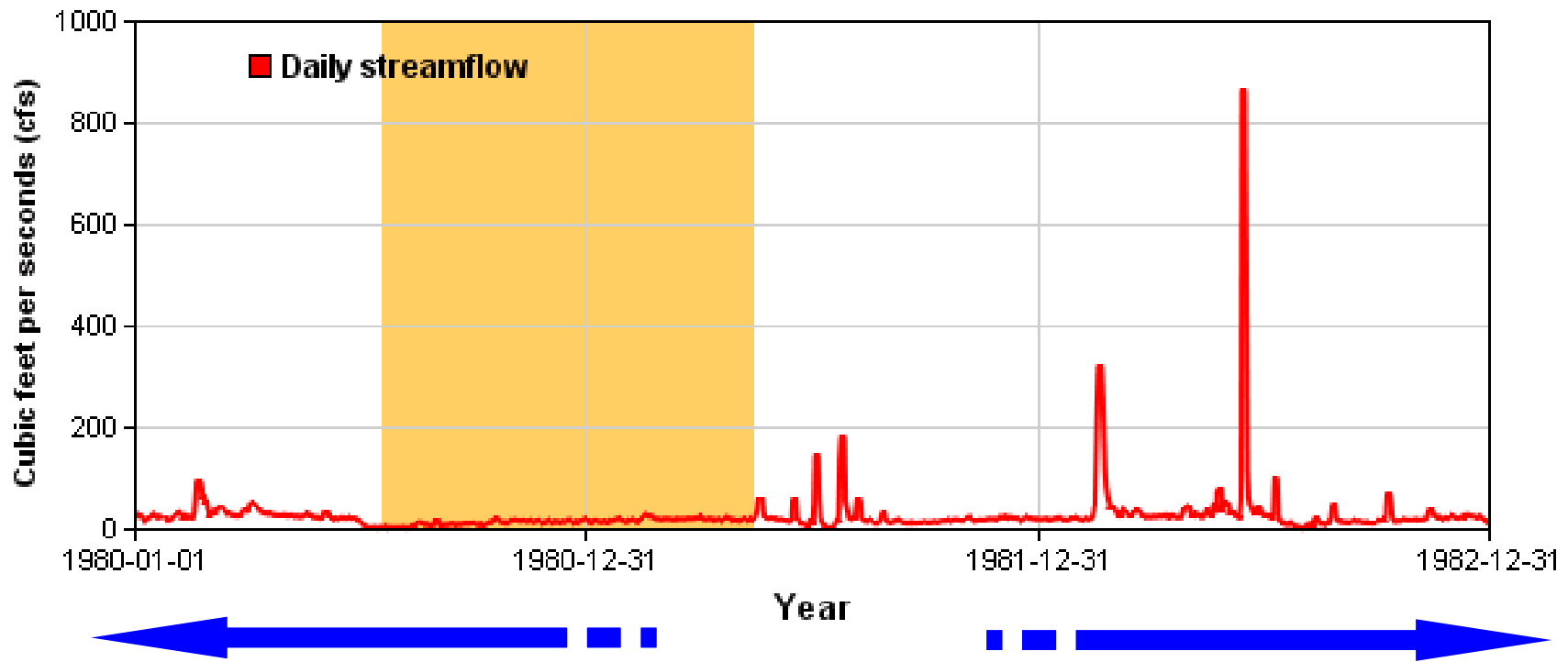


# Time Series Plot

Fields from database  
(PostgreSQL)



*Historic Streamflow from 1980 to 1982 at 06783500*

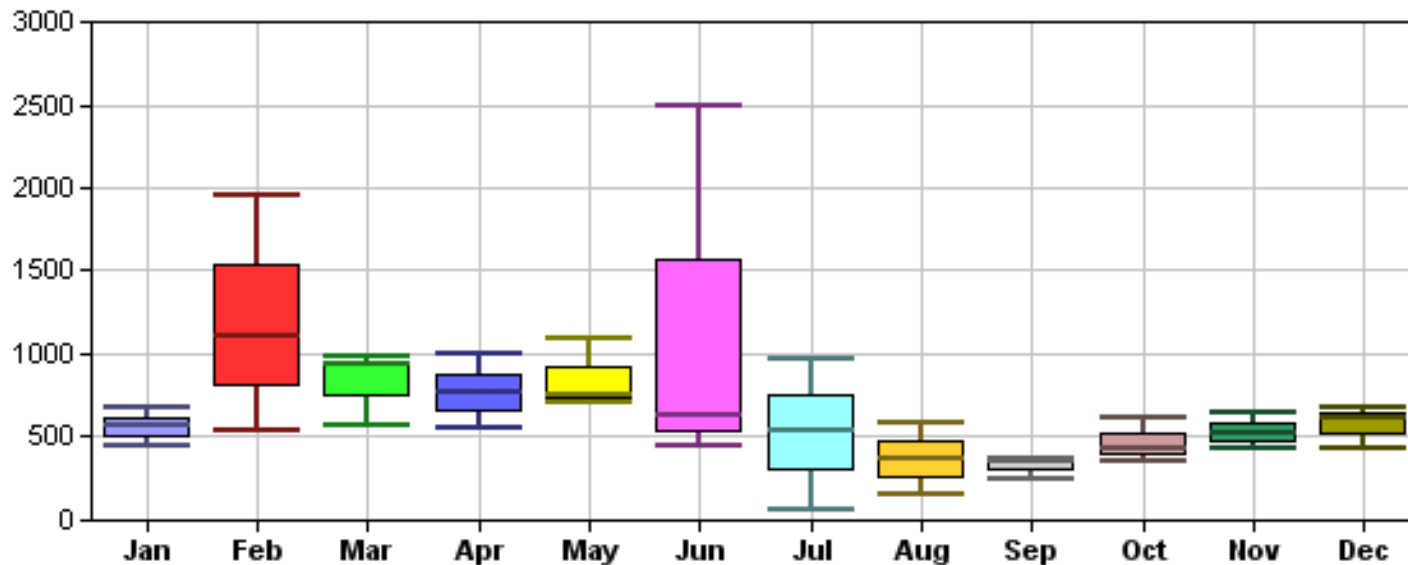


# Boxplot

Fields from database  
(PostgreSQL)



*Monthly Streamflow from 1980 to 1982 at 06783500*

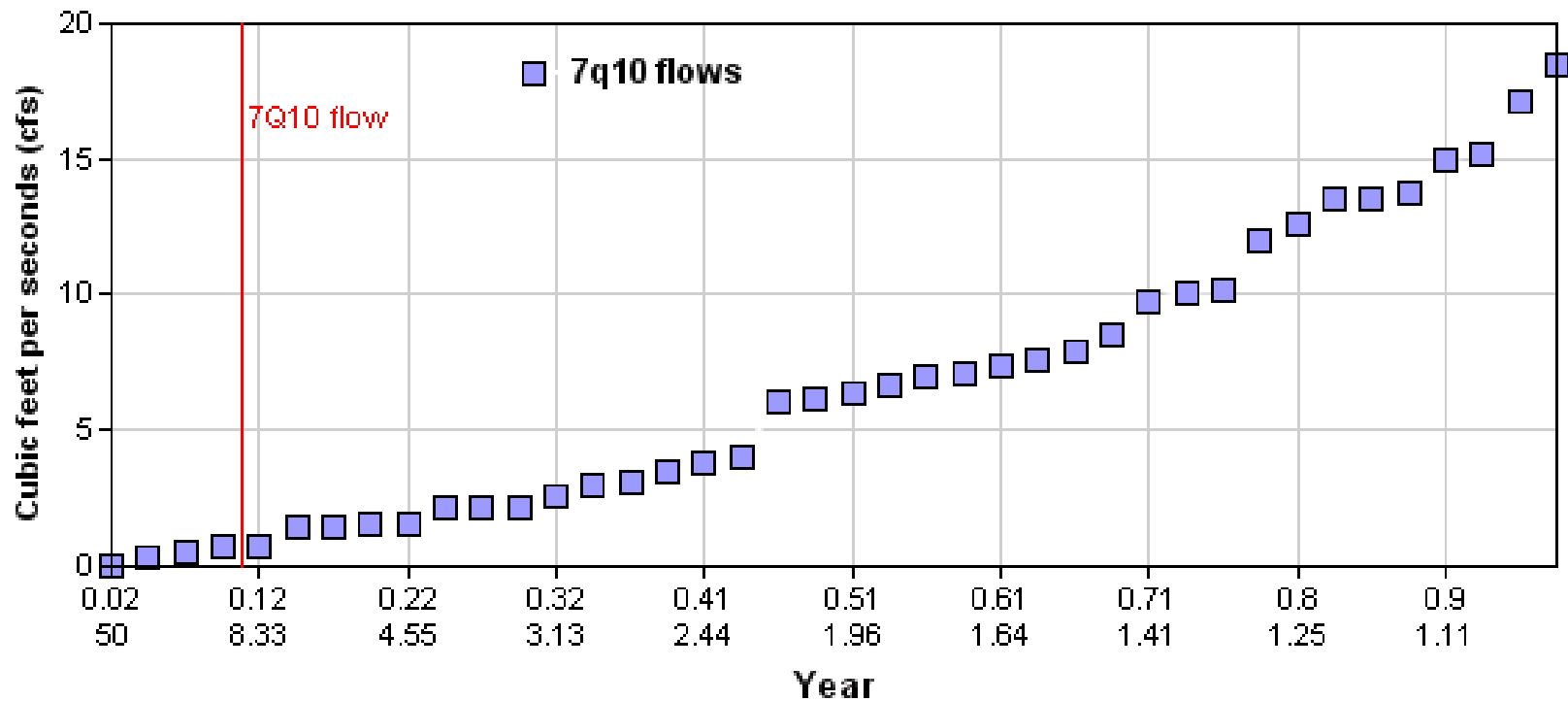


# Low flow exceedance probability plot

Fields from database  
(PostgreSQL)



*Low flow 7q10 at 06783500*

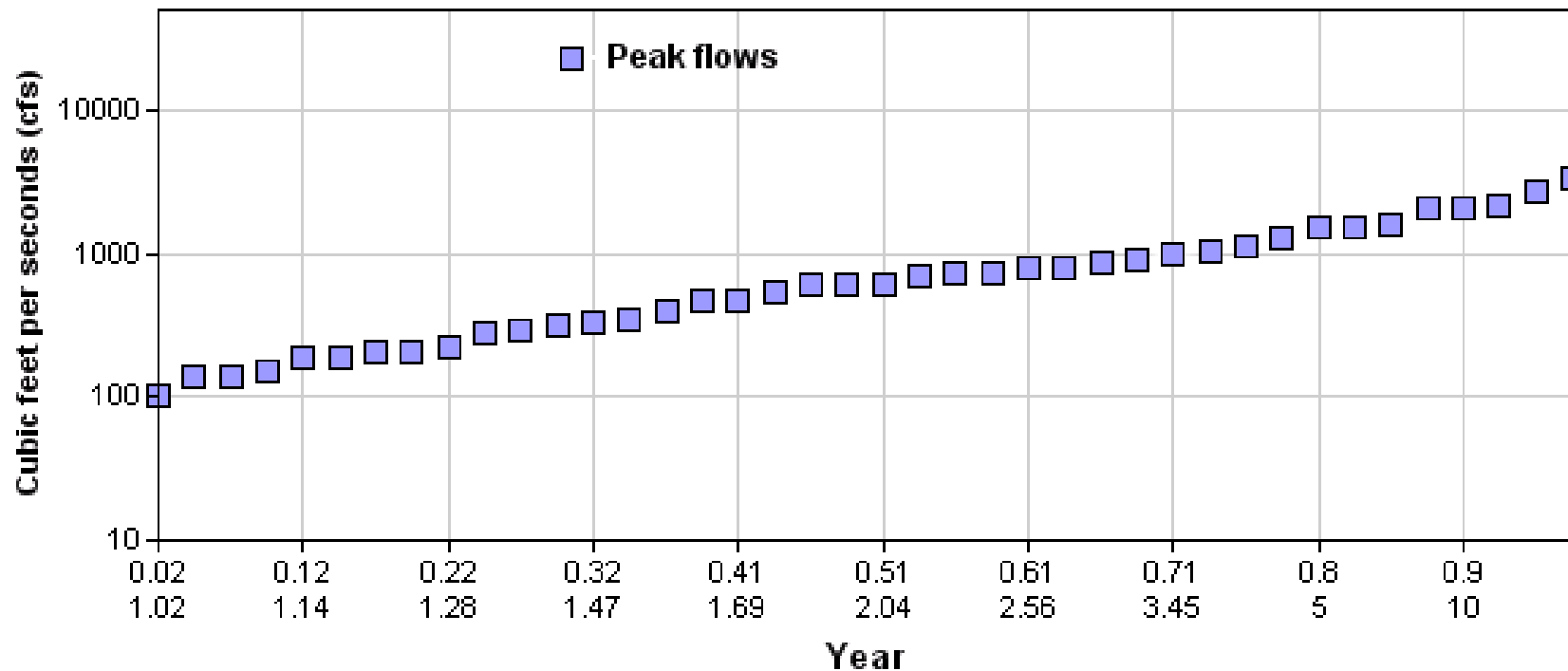


# Peak flow exceedance probability plot

Fields from database  
(PostgreSQL)

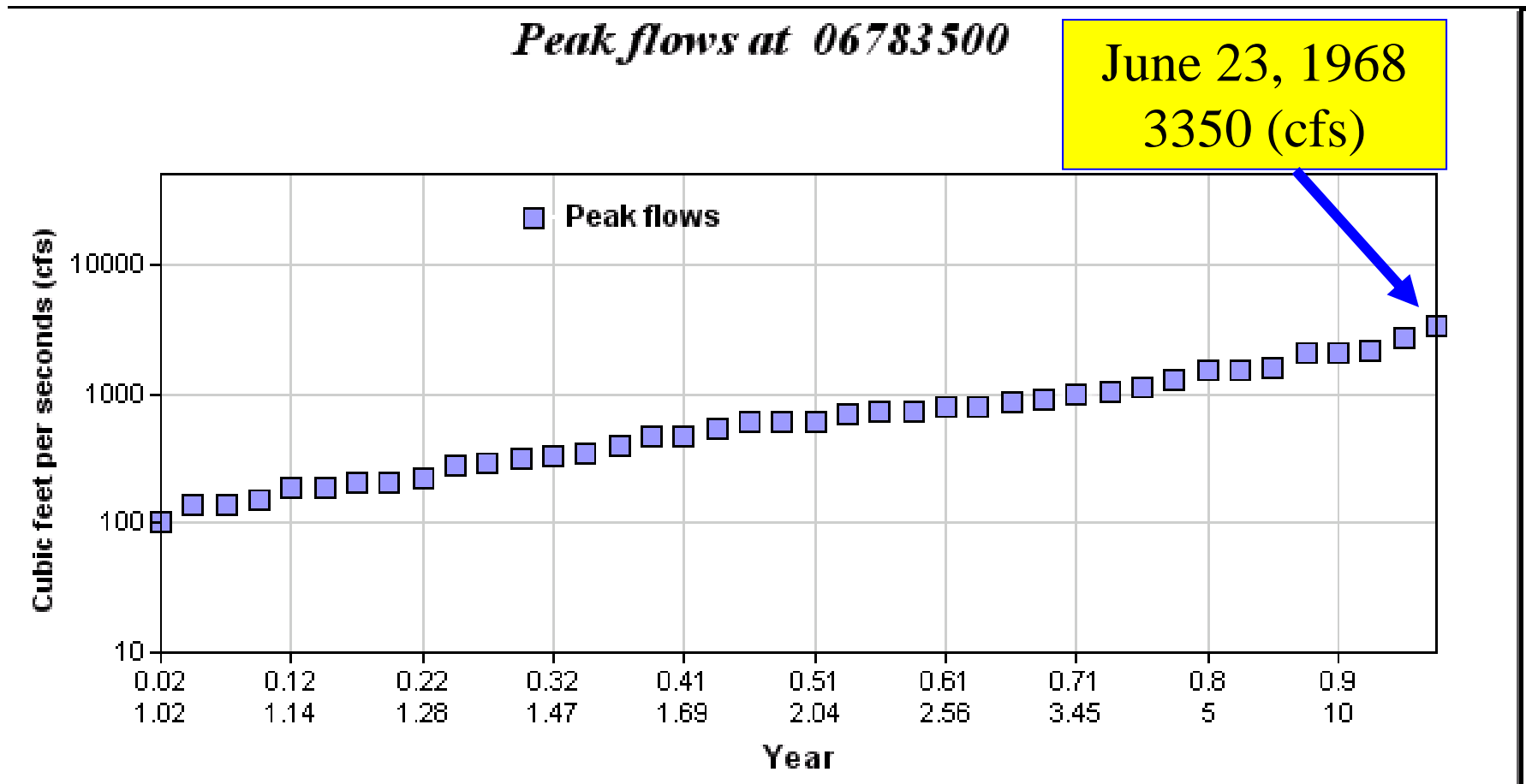


*Peak flows at 06783500*



# Peak flow exceedance probability plot

Tooltip functionality



## Future Work

- Data Extension (Climate Change and Variability)
- Enhance Open Source Web-GIS Capability
- More visualization activities (e.g. frequency analysis, cluster analysis)
- Many multidisciplinary research potential
  - Public health, crime map, political analysis, crop mapping, water quality



Thank you !!!

Contact: Jae Ryu

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