



Multi-Index Drought Monitoring: A Global Drought GeoServer

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University of California, Irvine

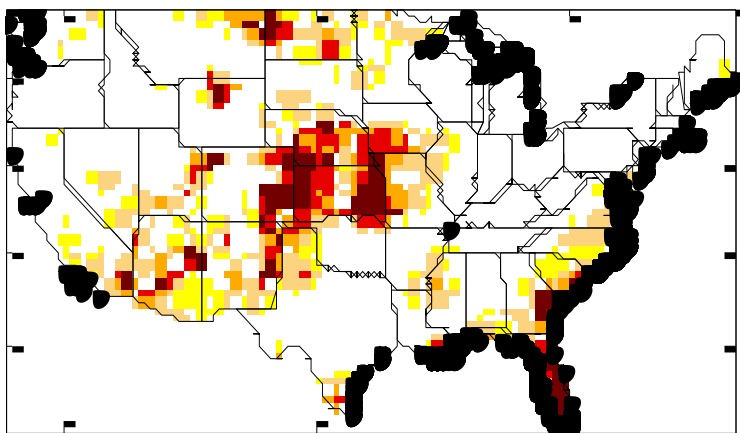


Multi-Index Drought Monitoring

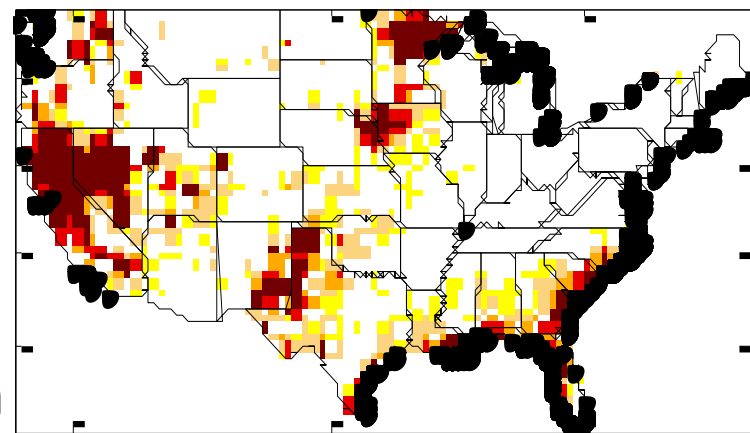
Different drought indices based on different climate variables (e.g., Precipitation, soil moisture):

- Standardized Precipitation Index (SPI)
- Standardized Soil Moisture Index (SSI)
- Standardized runoff Index (SRI)
- Palmer Drought Severity Index (PDSI)

SPI 2012-1



SSI 2012-1

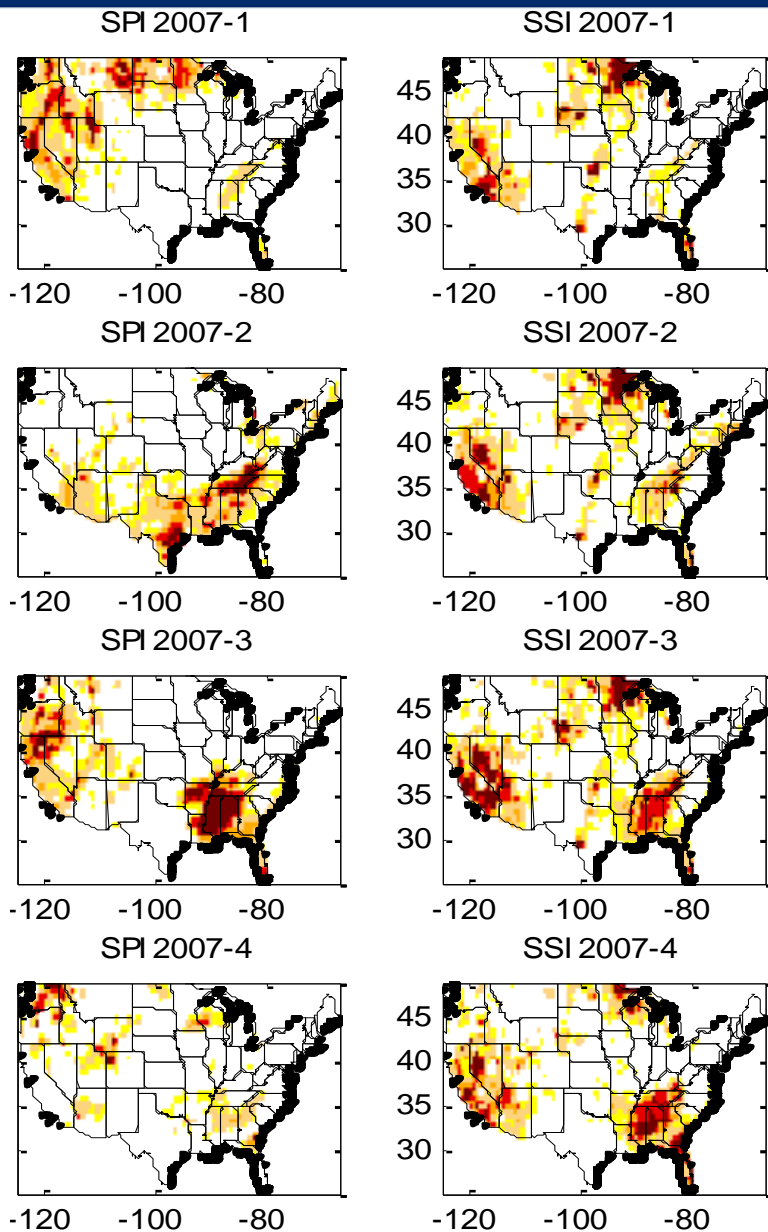


Intensity:
D0 Abnormally Dry
D1 Drought - Moderate
D2 Drought - Severe
D3 Drought - Extreme
D4 Drought - Exceptional










Multi-Index Drought Monitoring



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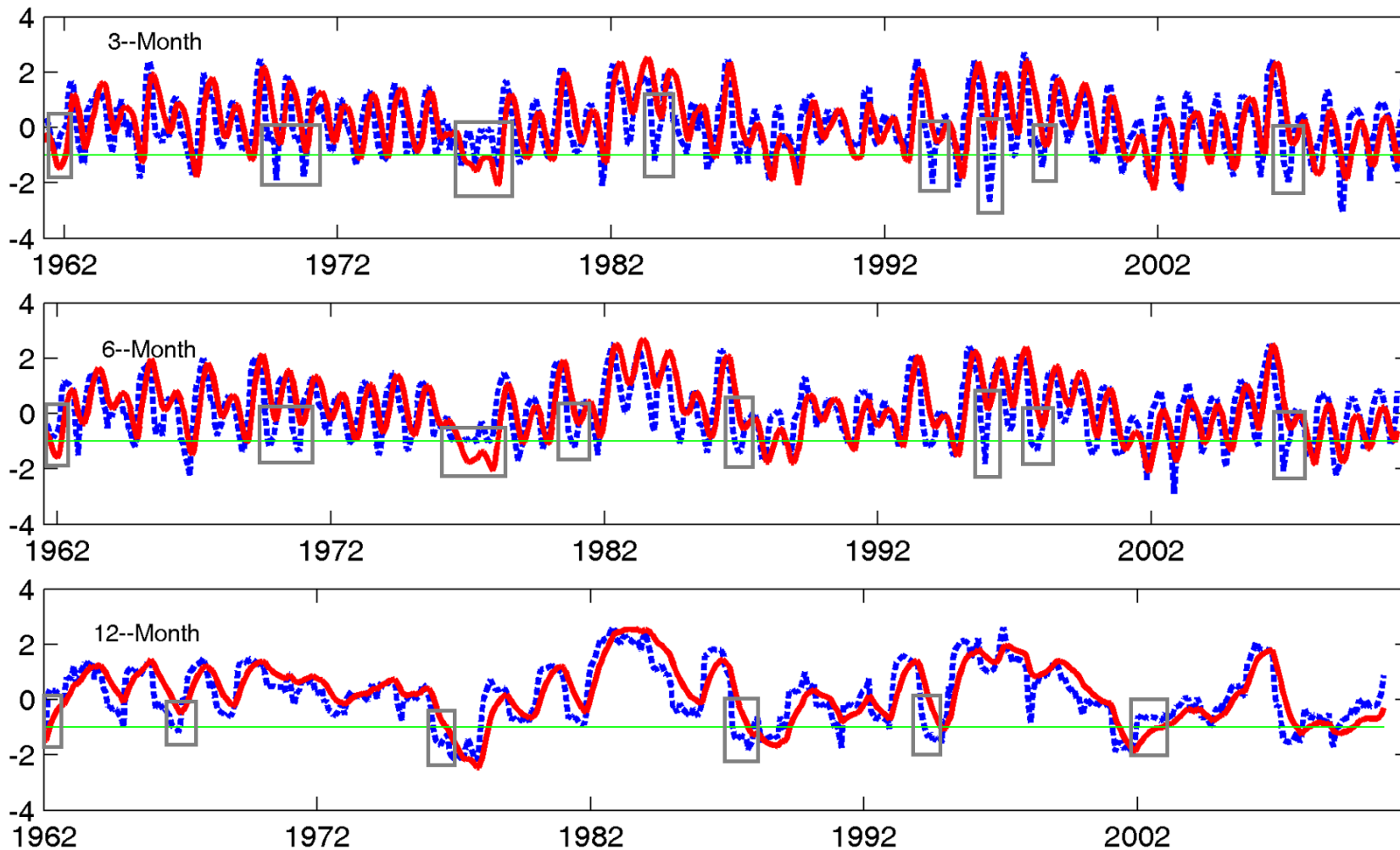




Multi-Index Drought Monitoring

3-, 6- and 12-month drought conditions based on Standardized Precipitation Index (SPI) and Standardized Soil Moisture Index (SSI) for Climate Division 3 in California.

----- SPI ——— SSI ——— Drought Threshold -1





Multi-Index Drought Monitoring

A Multi-Index Approach Using a Joint Distribution Function

$$p = P(X \leq x, Y \leq y)$$

$$p = C[F(X), G(Y)]$$

C is the copula and $F(X)$ and $G(Y)$ are the marginal cumulative distribution functions of precipitation (X) and soil moisture (Y), respectively

Multi-Index Standardized Drought Index (MSDI)

$$MSDI = \phi^{-1}(p)$$

where ϕ is the standard normal distribution function.





Multi-Index Drought Monitoring

Deriving the Joint Distribution of Precipitation and Soil Moisture

$$p = C[F(X), G(Y)]$$

Non-Parametric Models

Yue et al., 1999

$$P(x_k, y_k) = (m_k - 0.44)(n + 0.12)^{-1}$$

where n is the length of the observations; and m_k is the number of the pair (x_i, y_i) for $x_i \leq x_k$ and $y_i \leq y_k$



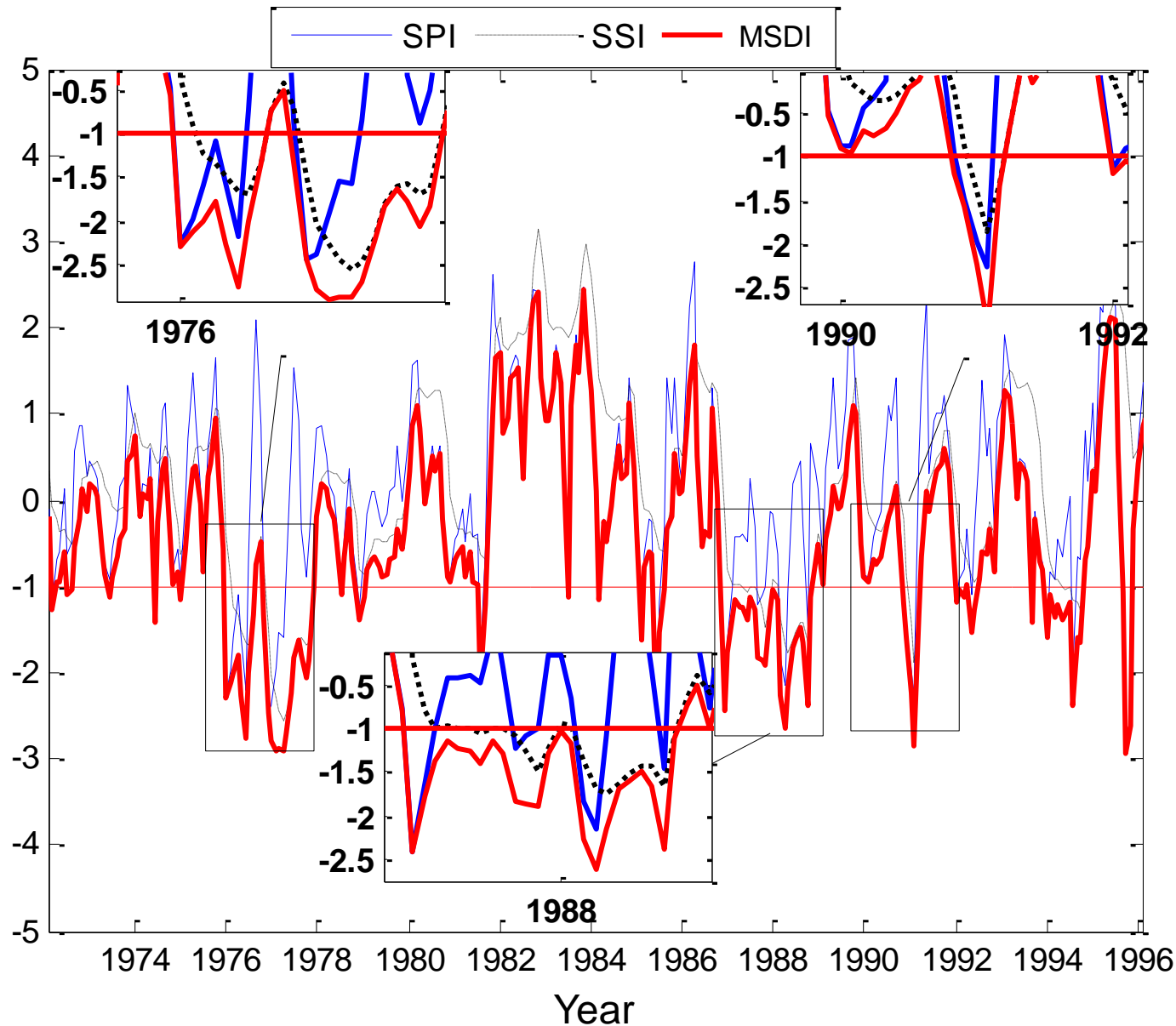


Multi-Index Drought Monitoring

Monthly precipitation and soil moisture from 1/1932 to 12/2010

Precipitation : NCDC
Soil Moisture: CPC

3-month SPI, SSI, MSDI for Climate Division 3 in California.



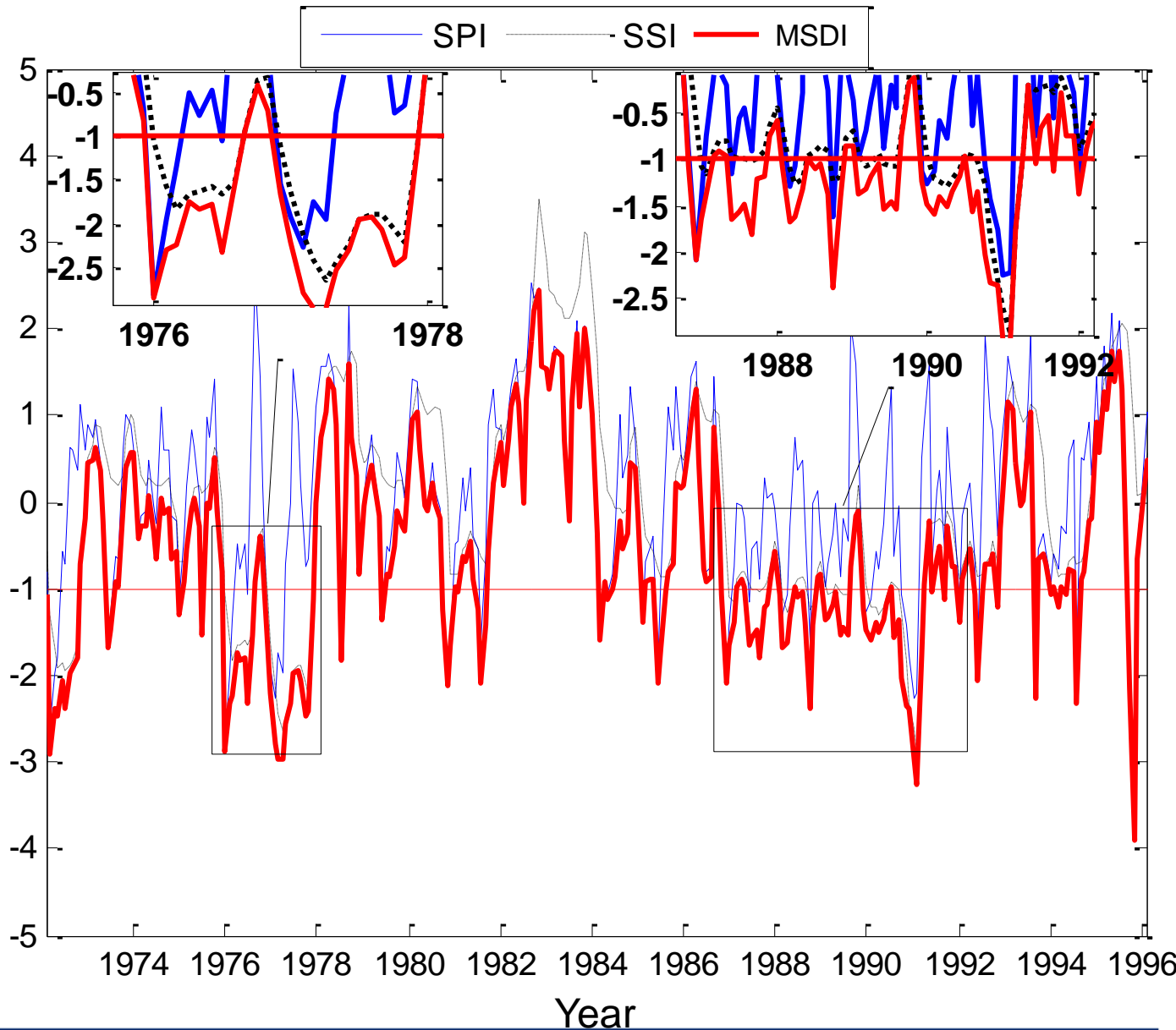


Multi-Index Drought Monitoring

Monthly precipitation and soil moisture from 1/1932 to 12/2010

Precipitation : NCDC
Soil Moisture: CPC

3-month SPI, SSI, MSDI for Climate Division 5 in California.

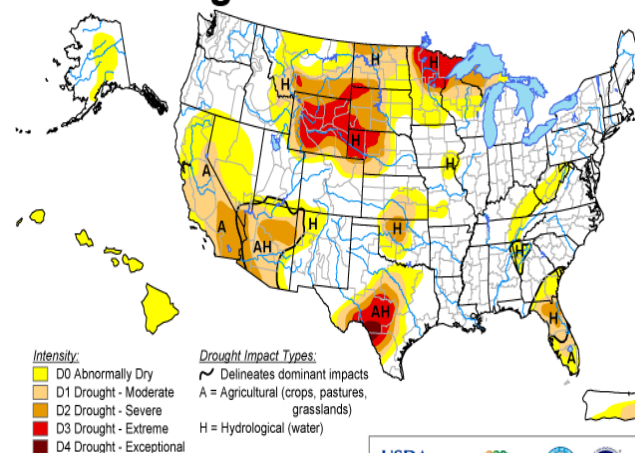




Multi-Index Drought Monitoring

1-Month SPI and SSI Derived Using NASA MERRA-LAND Precipitation and soil moisture Data.

U.S. Drought Monitor January 30, 2007 Valid 7 a.m. EST



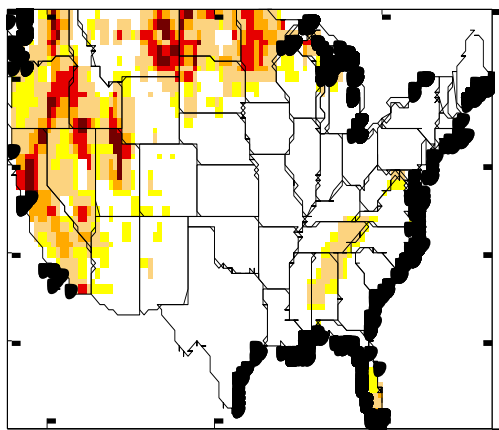
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.



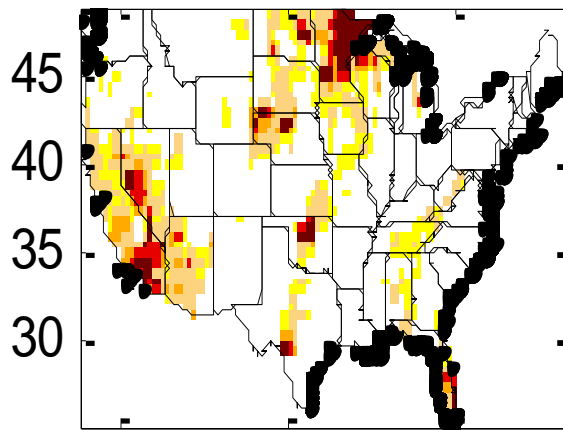
Released Thursday, February 1, 2007
Author: Brian Fuchs, National Drought Mitigation Center

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

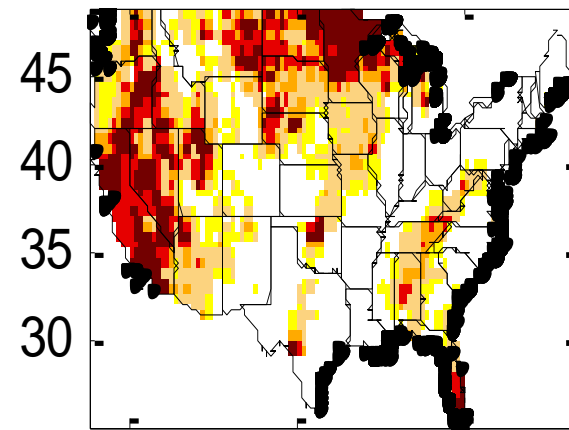
SPI 2007-1



SSI 2007-1



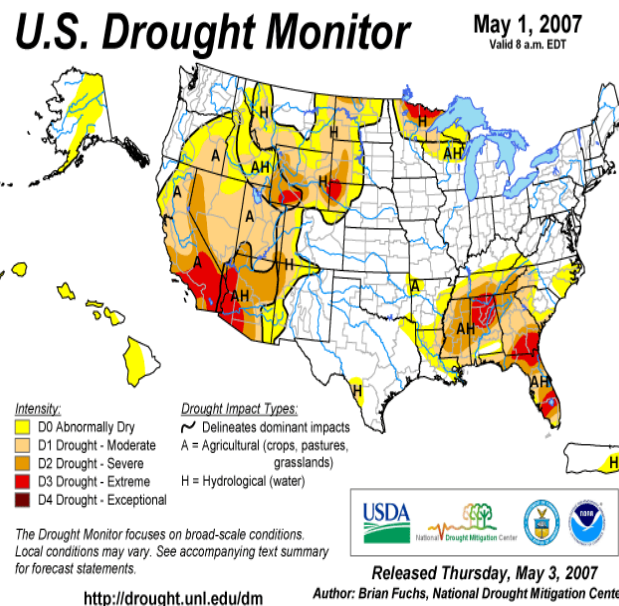
MSDI 2007-1



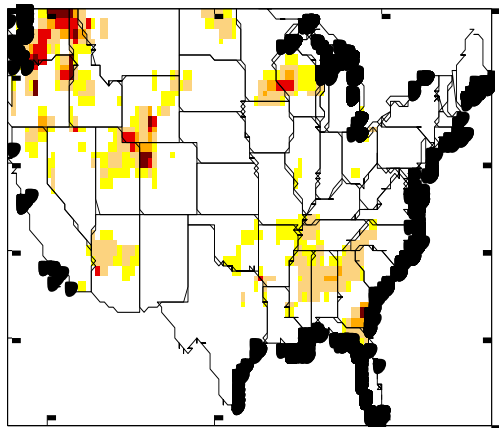


Multi-Index Drought Monitoring

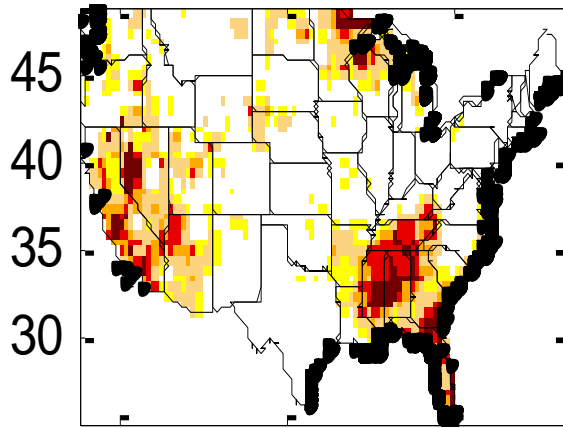
1-Month SPI and SSI Derived Using NASA MERRA-LAND Precipitation and soil moisture Data.



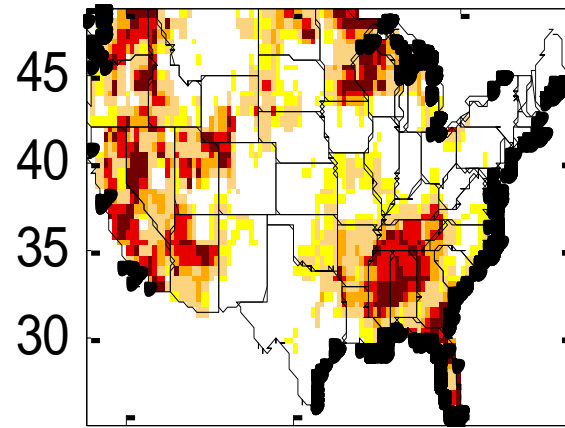
SPI 2007-4



SSI 2007-4



MSDI 2007-4



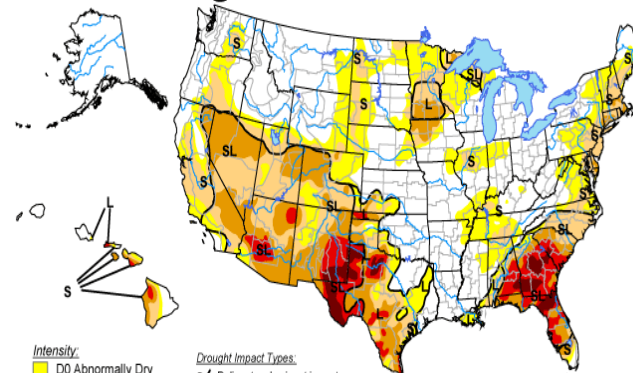


Multi-Index Drought Monitoring

1-Month SPI and SSI Derived Using NASA MERRA-LAND Precipitation and soil moisture Data.

U.S. Drought Monitor

May 1, 2012
Valid 7 a.m. EDT



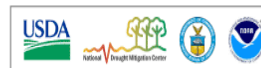
Intensity:

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Drought Impact Types:

- ~ Delineates dominant impacts
- S = Short-Term, typically <6 months (e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months (e.g. hydrology, ecology)

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

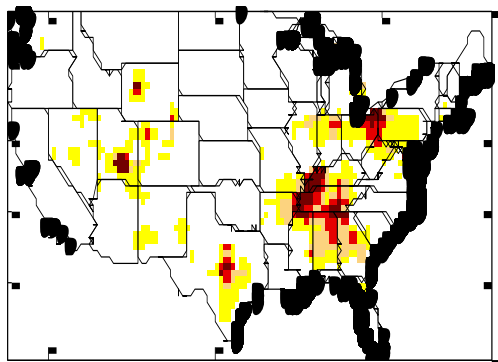


Released Thursday, May 3, 2012

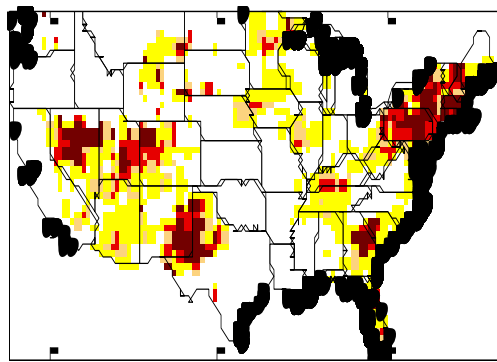
Author: Matthew Rosenkrans, NOAA/NWS/NCEP/CPC

<http://droughtmonitor.unl.edu/>

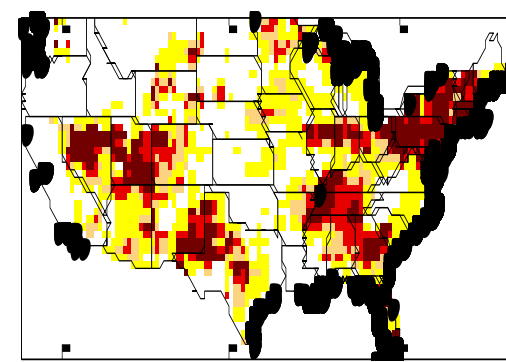
SPI 2012-4



SSI 2012-4



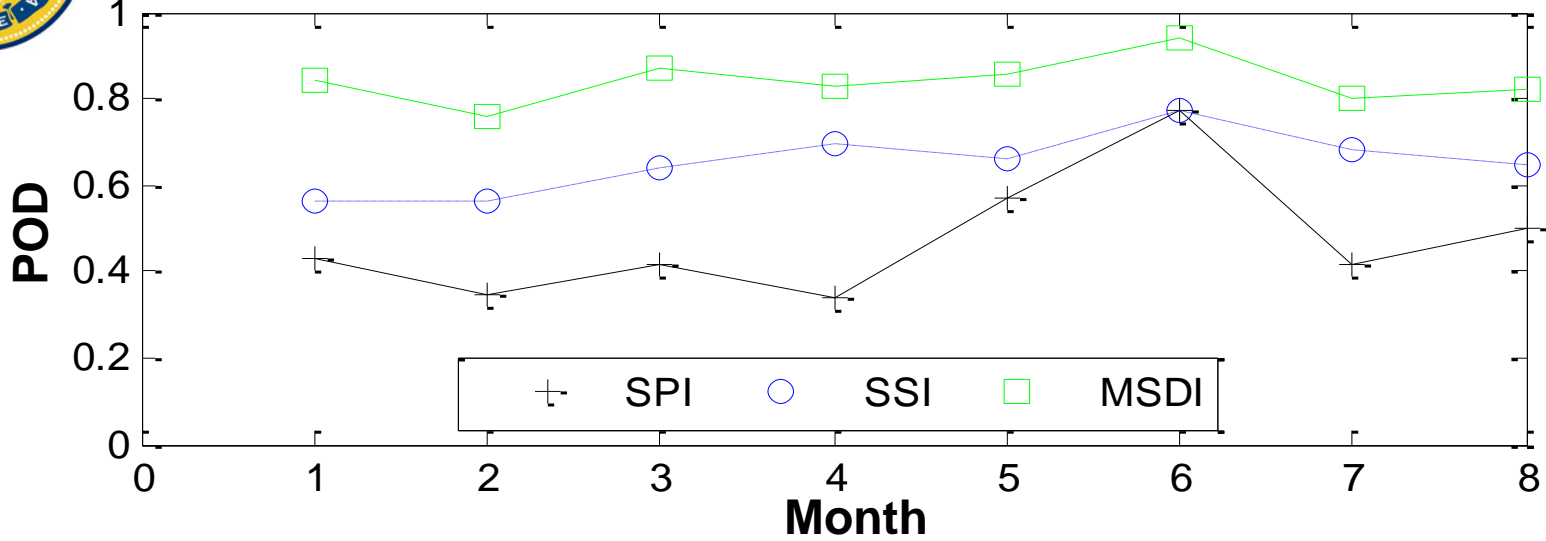
MSDI 2012-4



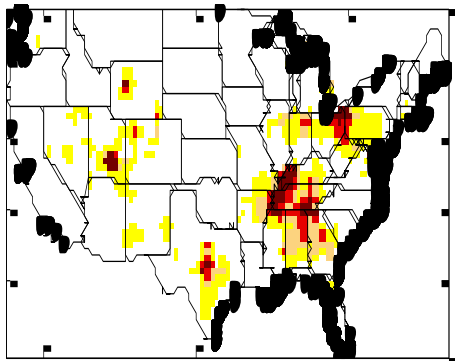


Multi-Index Drought Monitoring

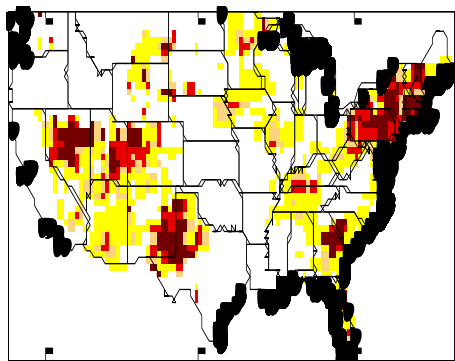
Probability of detection (POD) of drought using 1-month SPI, SSI and MSDI



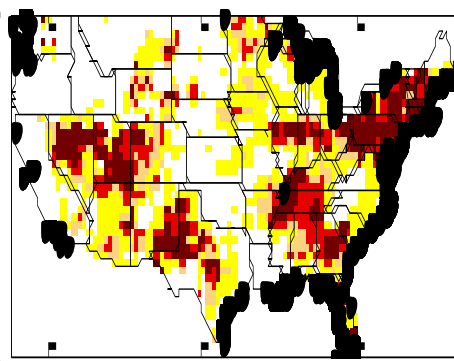
SPI 2012-04



SSI 2012-04

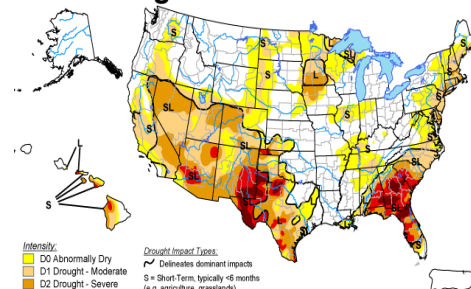


MSDI 2012-04



U.S. Drought Monitor

May 1, 2012
Valid 7 a.m. EDT



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 D4 Drought - Exceptional

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 Author: Matthew Rosencrans, NOAA/NWS/NCEP/PCP

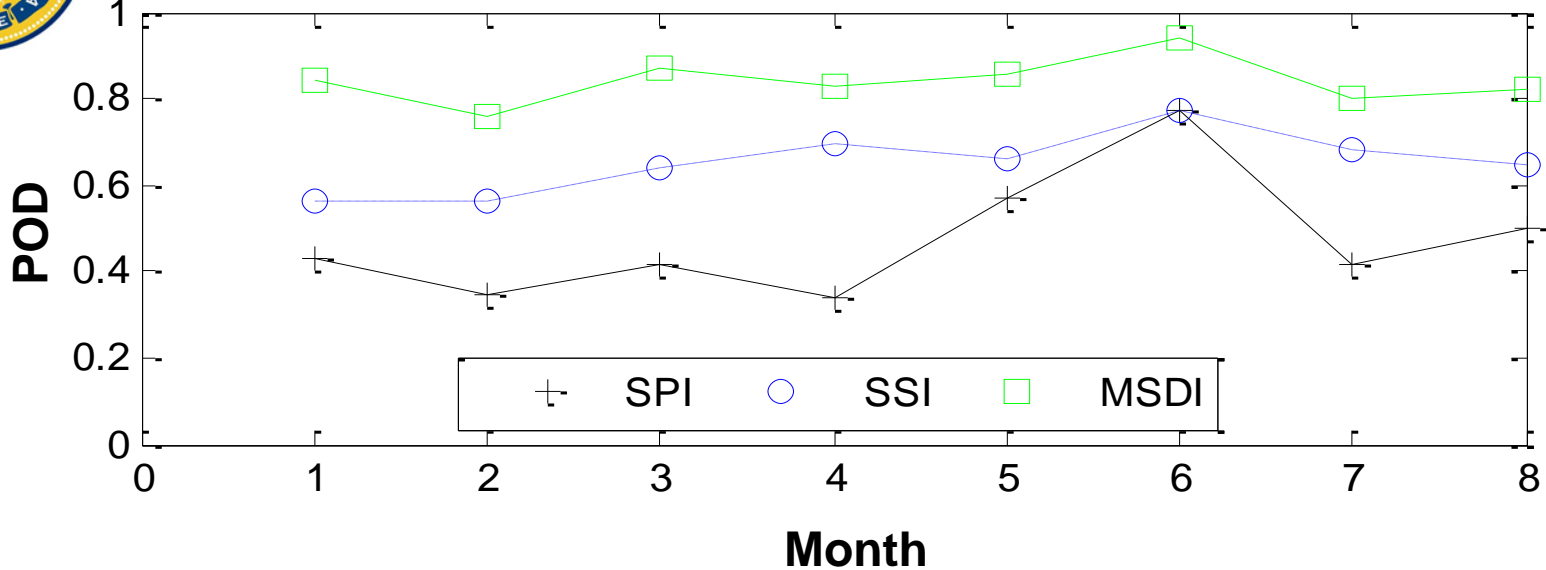
<http://droughtmonitor.unl.edu/>



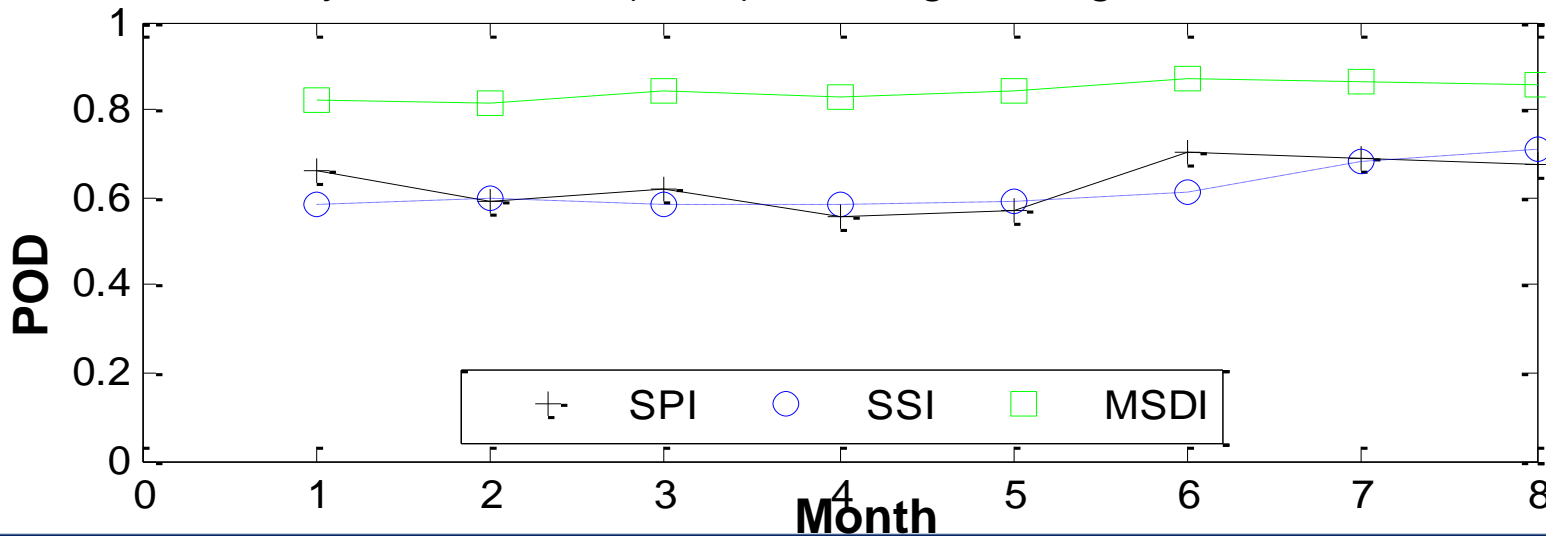


Multi-Index Drought Monitoring

Probability of detection (POD) of drought using 1-month SPI, SSI and MSDI



Probability of detection (POD) of drought using 6-month SPI, SSI and MSDI





A Global Drought GeoServer

<http://drought.eng.uci.edu/index.html>

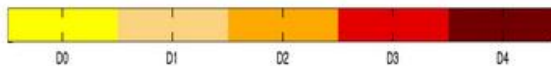
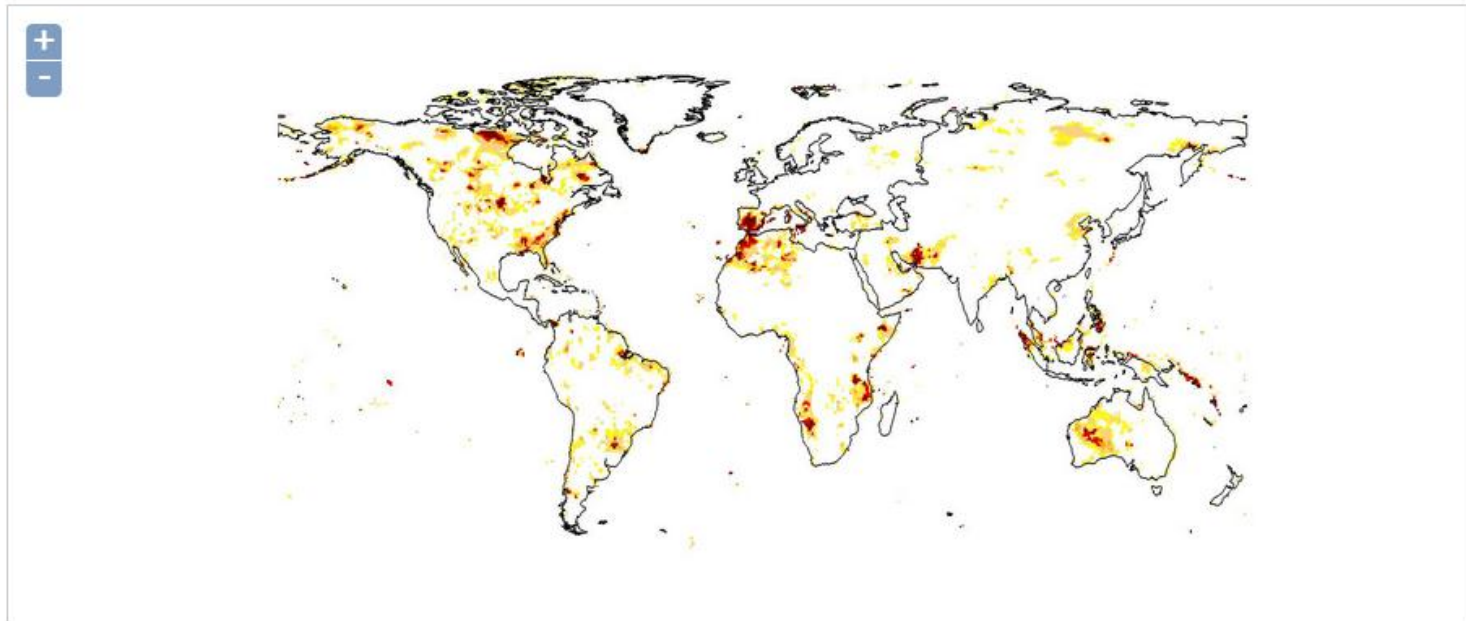


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Global Drought Data

Data Set: MERRA GLDAS
Year: 1981 Month: December Index: SSI



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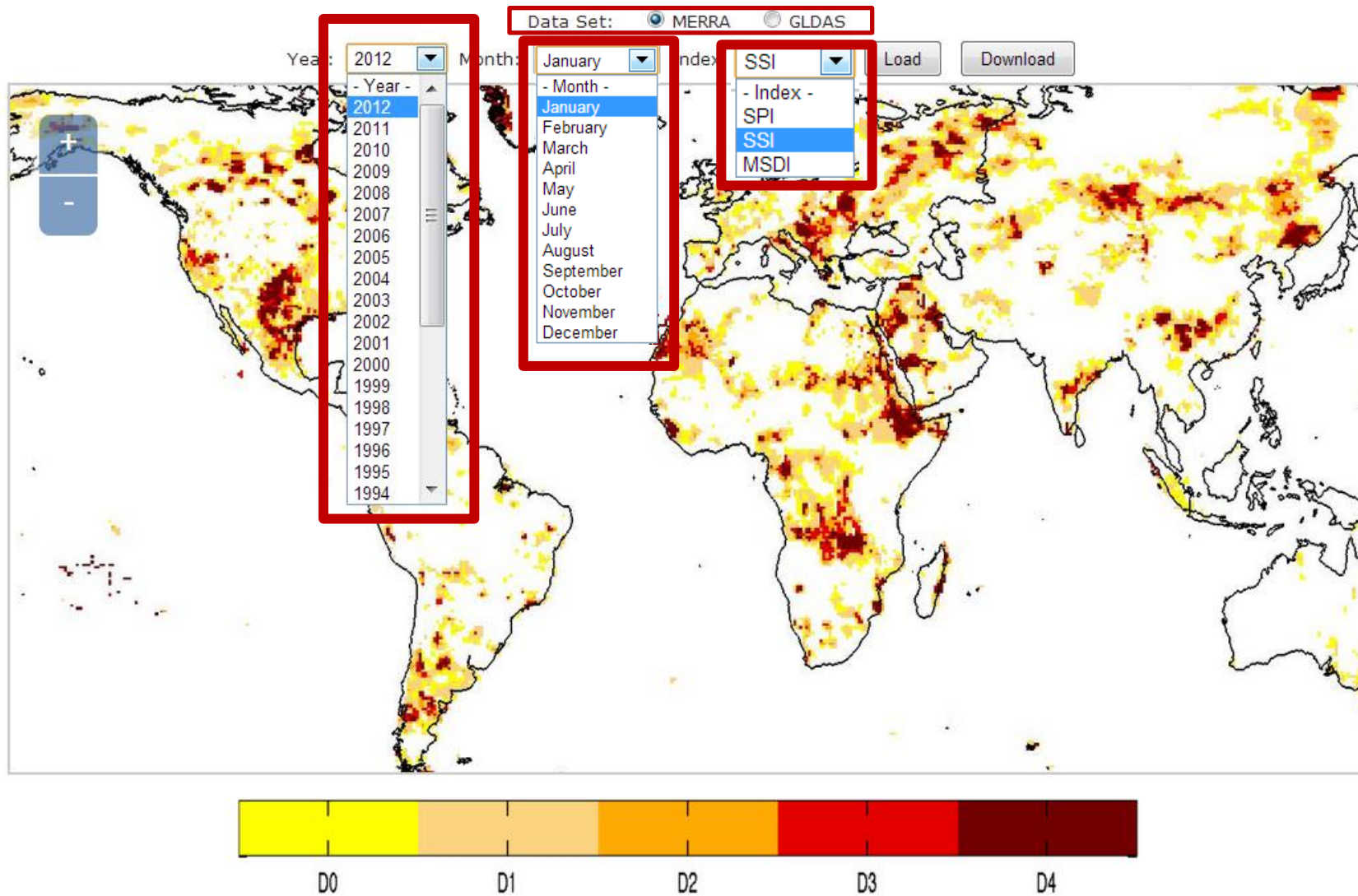


Hydroclimate Research Lab, Department of Civil & Environmental Engineering, University of California, Irvine



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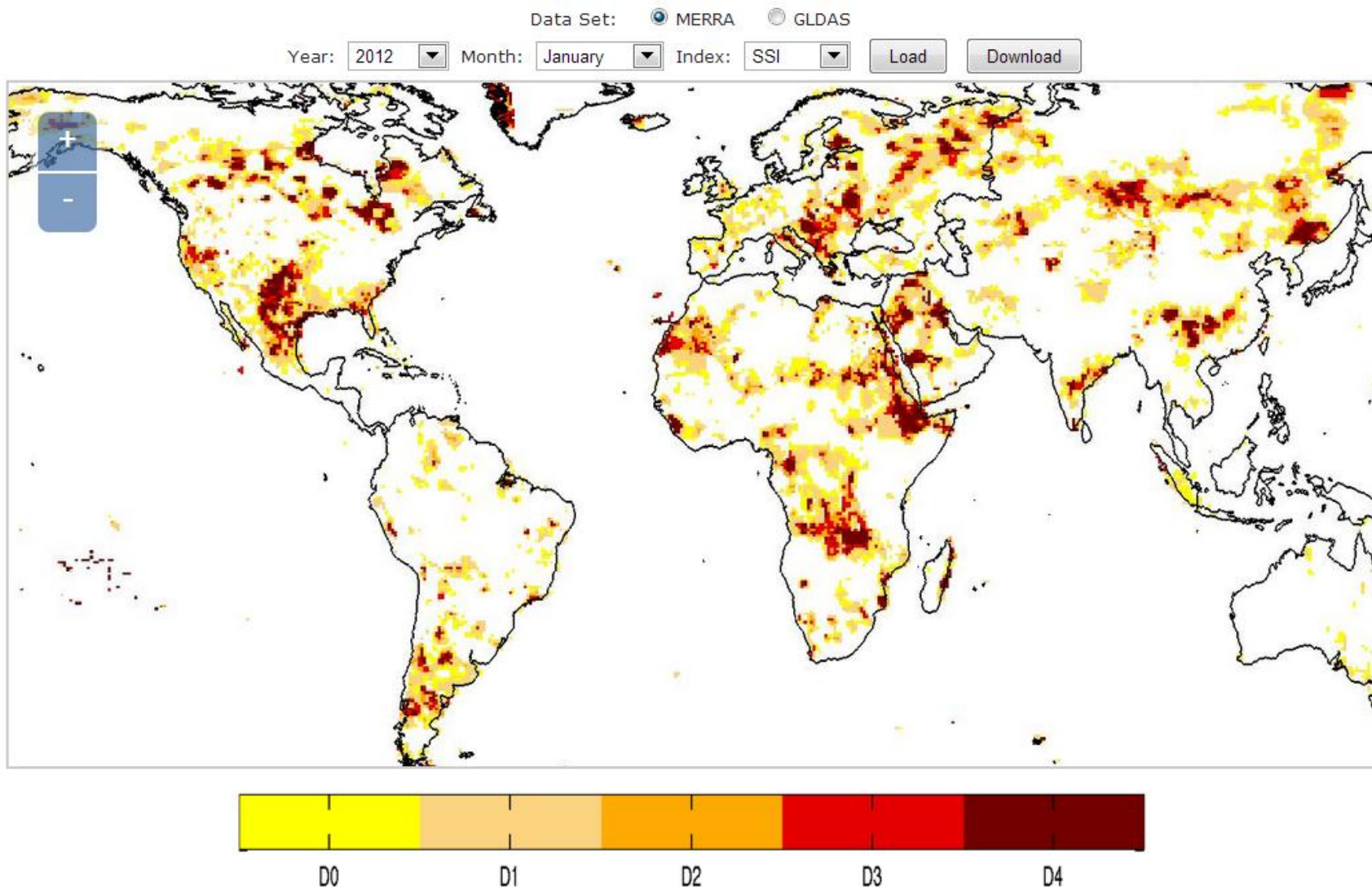
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A Global Drought GeoServer

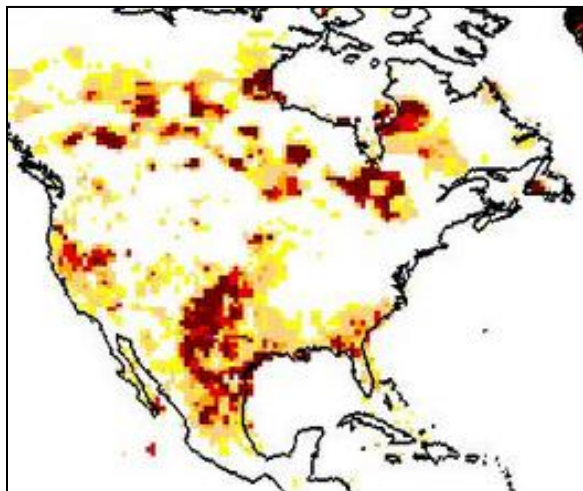
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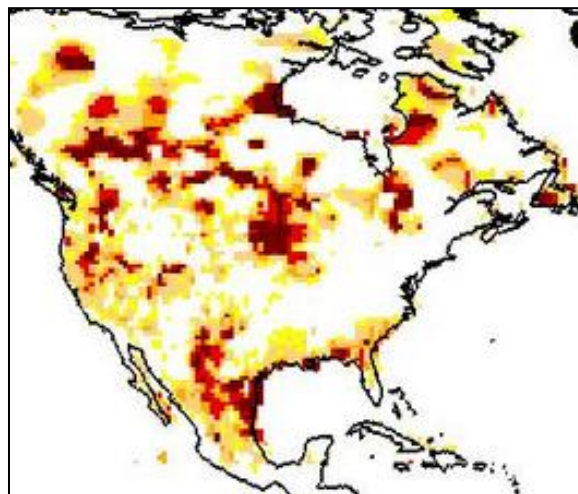


A Global Drought GeoServer

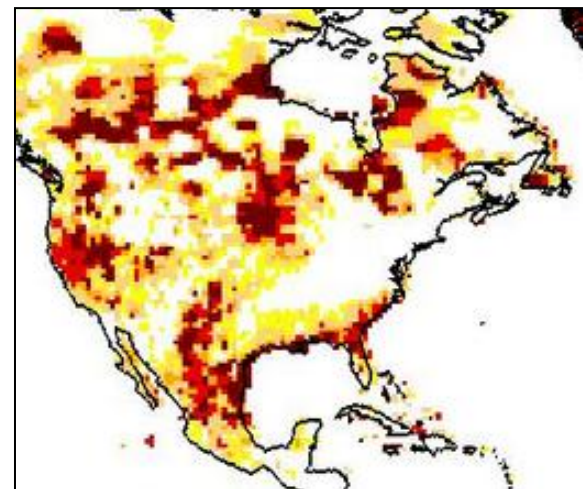
Soil Moisture



Precipitation



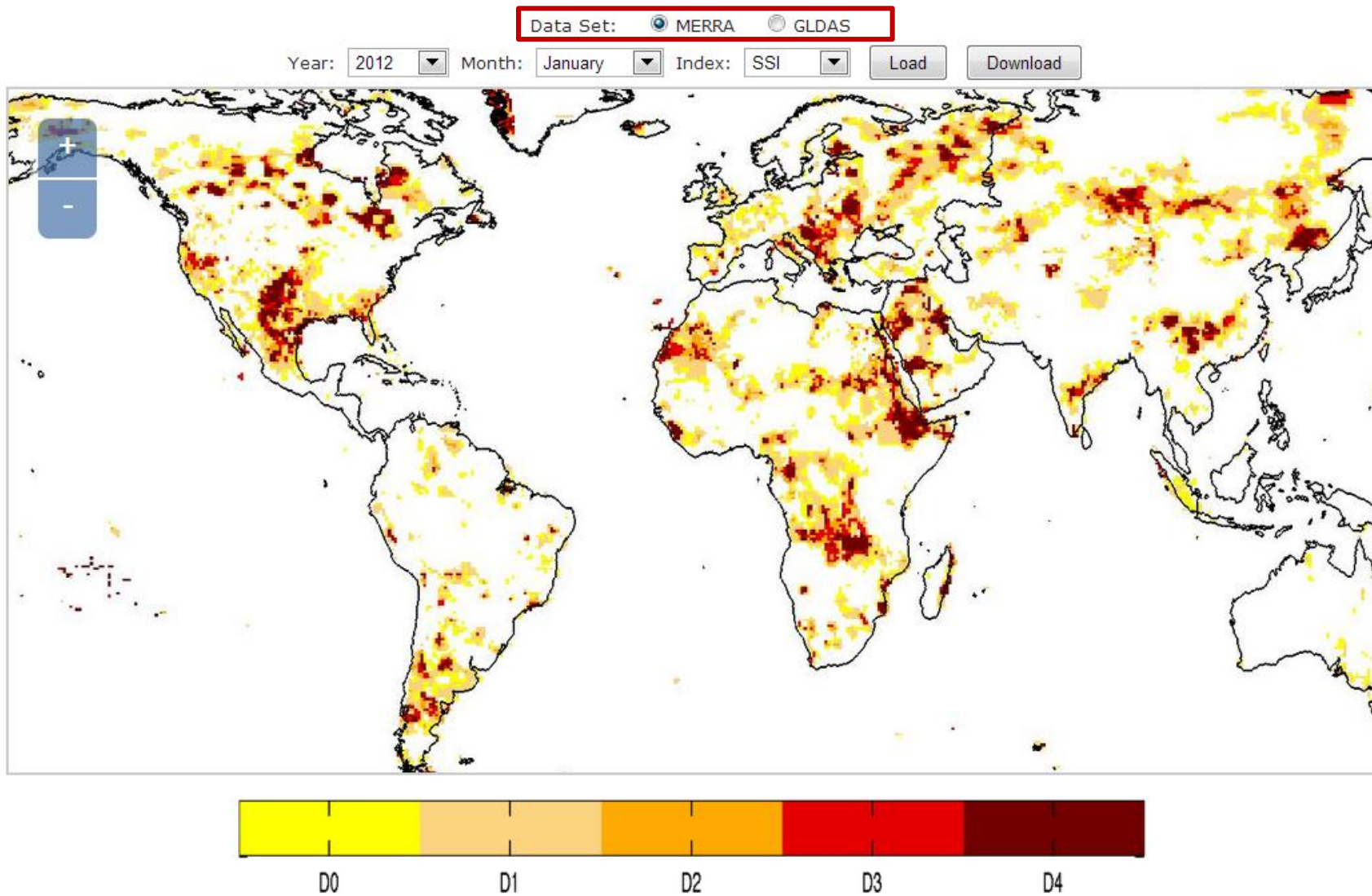
Soil Moisture & Precipitation





A Global Drought GeoServer

<http://drought.eng.uci.edu/index.html>





A Global Drought GeoServer

IOP PUBLISHING

Environ. Res. Lett. 7 (2012) 044037 (8pp)

ENVIRONMENTAL RESEARCH LETTERS

doi:10.1088/1748-9326/7/4/044037

A near real-time satellite-based global drought climate data record

Amir AghaKouchak and Navid Nakhjiri

University of California Irvine, E4130 Engineering Gateway Irvine, CA 92697, USA

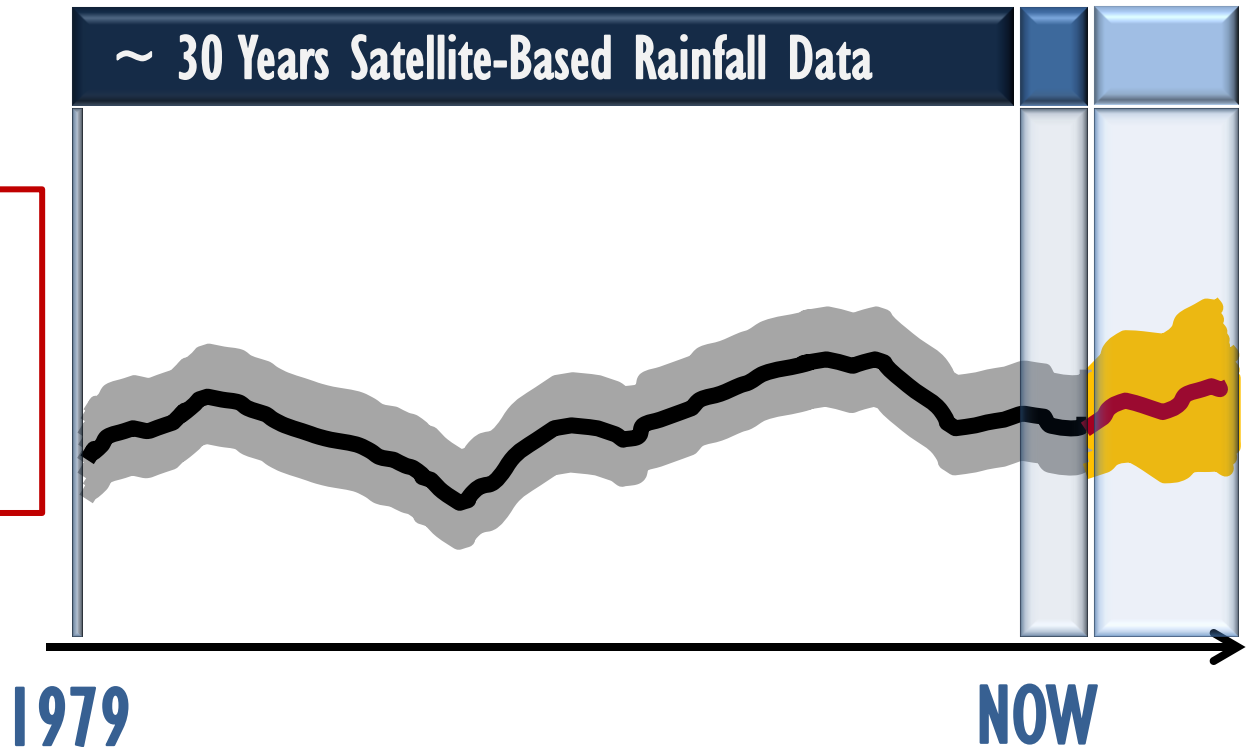
http://amir.eng.uci.edu/publications/12_RG_Drought_CDR_ERL.pdf

9-18 Months Real-Time

3-, 6-Month Forecast

~ 30 Years Satellite-Based Rainfall Data

Short-term forecasts of Drought Likelihood based on CFSv2 simulations





**Thank You for
Your Attention**