Multi-Index Drought Monitoring: A Global Drought GeoServer

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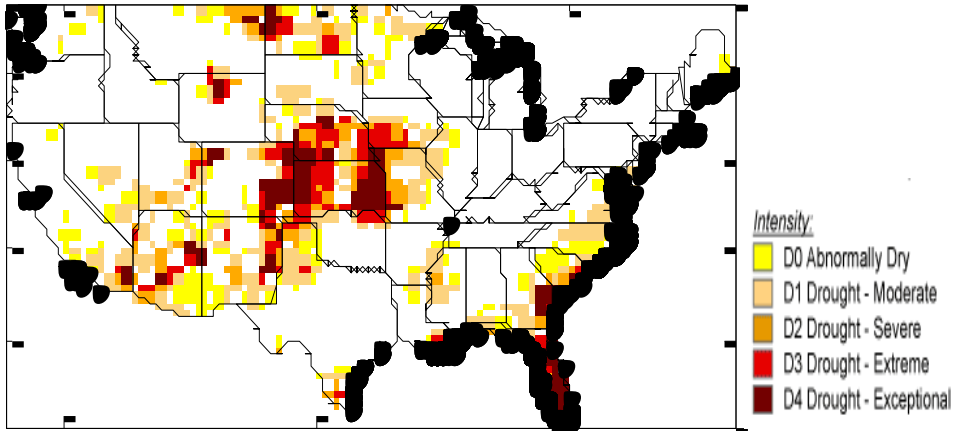
Multi-Index Drought Monitoring

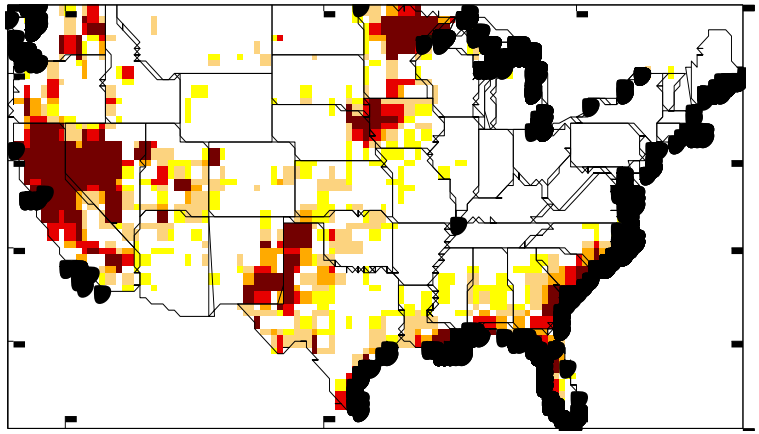
Different drought indices based on different climate variables (e.g., Precipitation, soil moisture):

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

SPI 2012-1



SSI 2012-1



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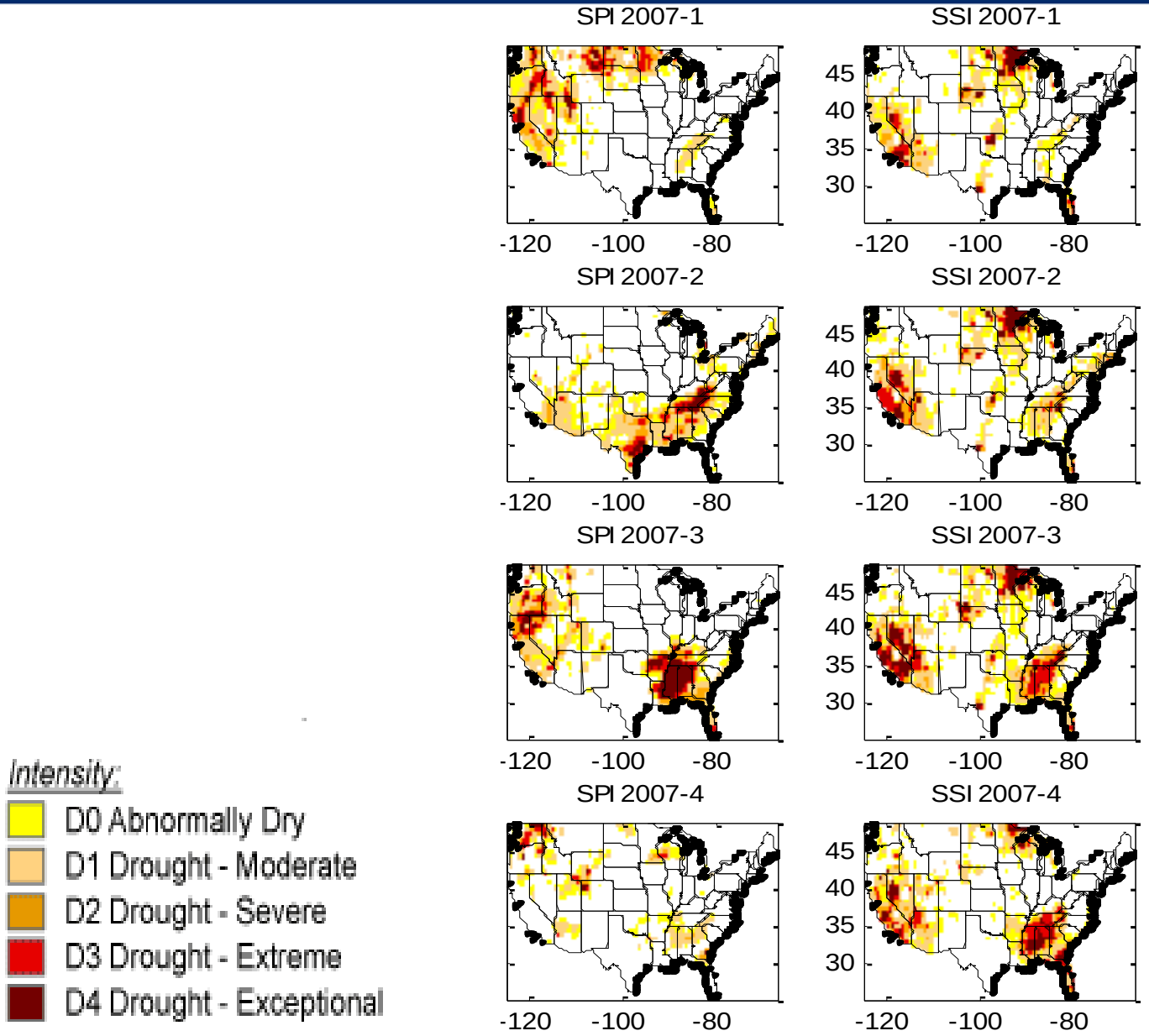
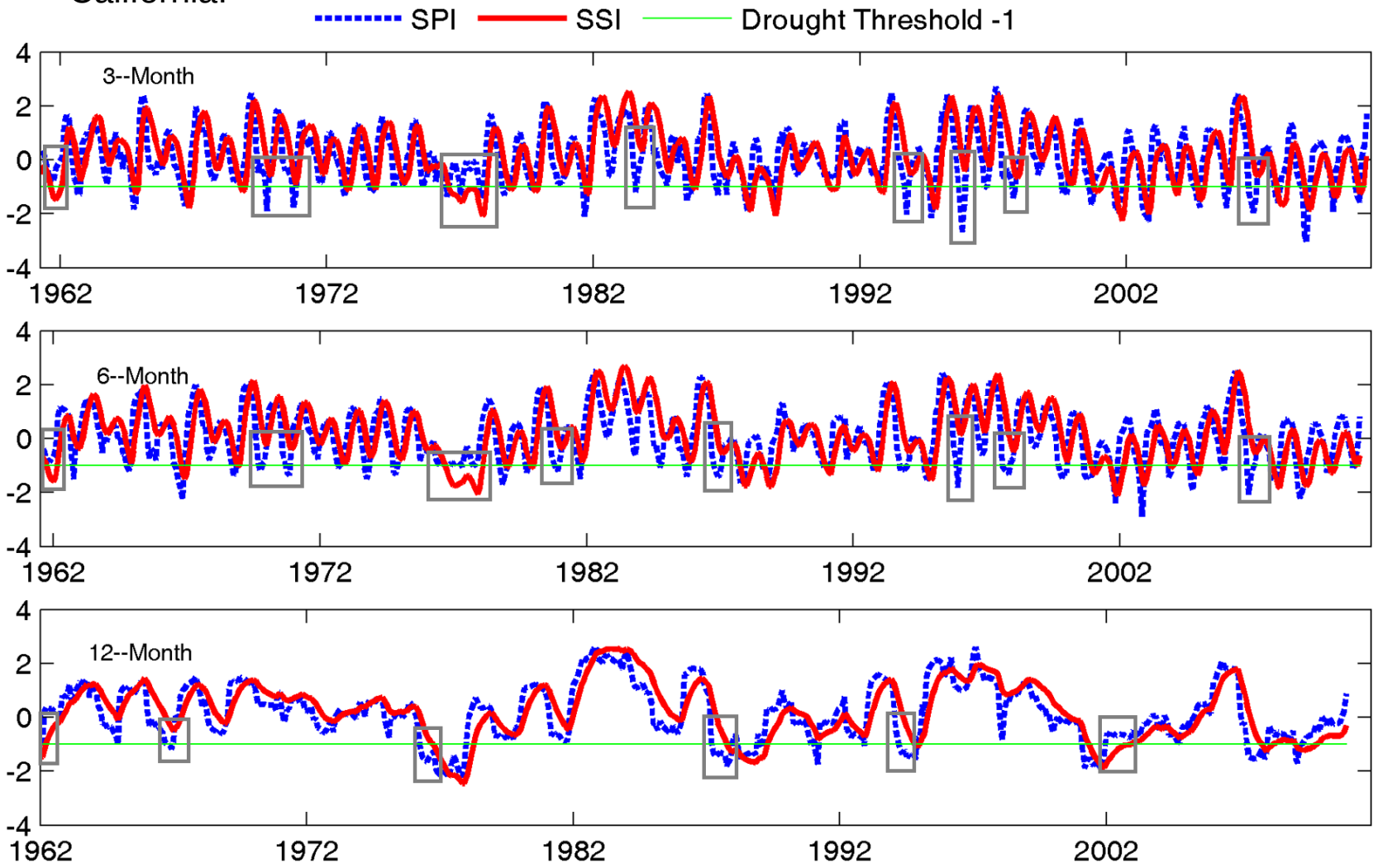


Multi-Index Drought Monitoring

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.



A Multi-Index Approach Using a Joint Distribution Function

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

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

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.

Deriving the Joint Distribution of Precipitation and Soil Moisture

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

Non-Parametric Models

Yue et al., 1999

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

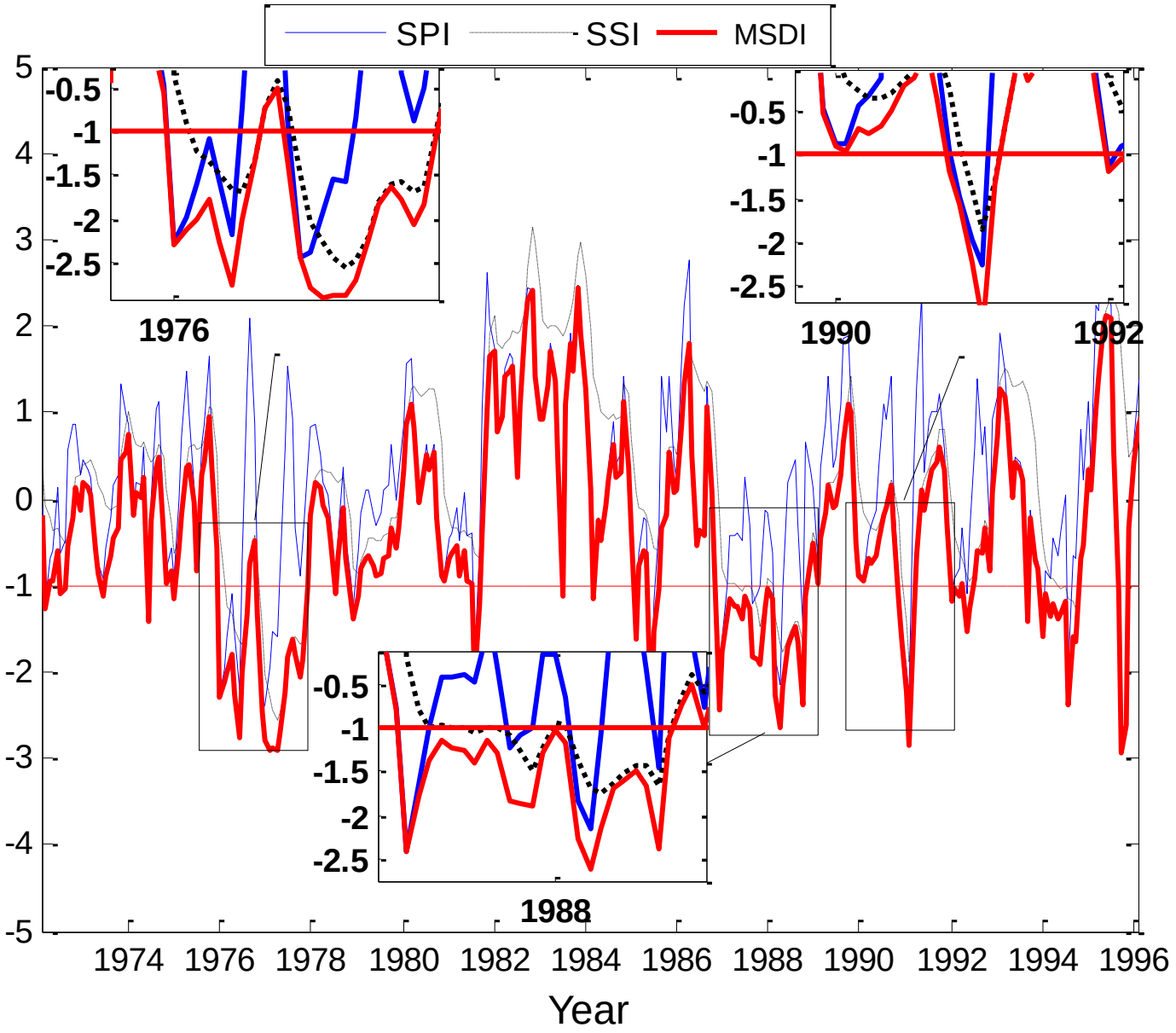
where n is the length of the observations; and m_k is the number of the pair (x_i, y_i) for $x_i \le x_k$ and $y_i \le y_k$

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.



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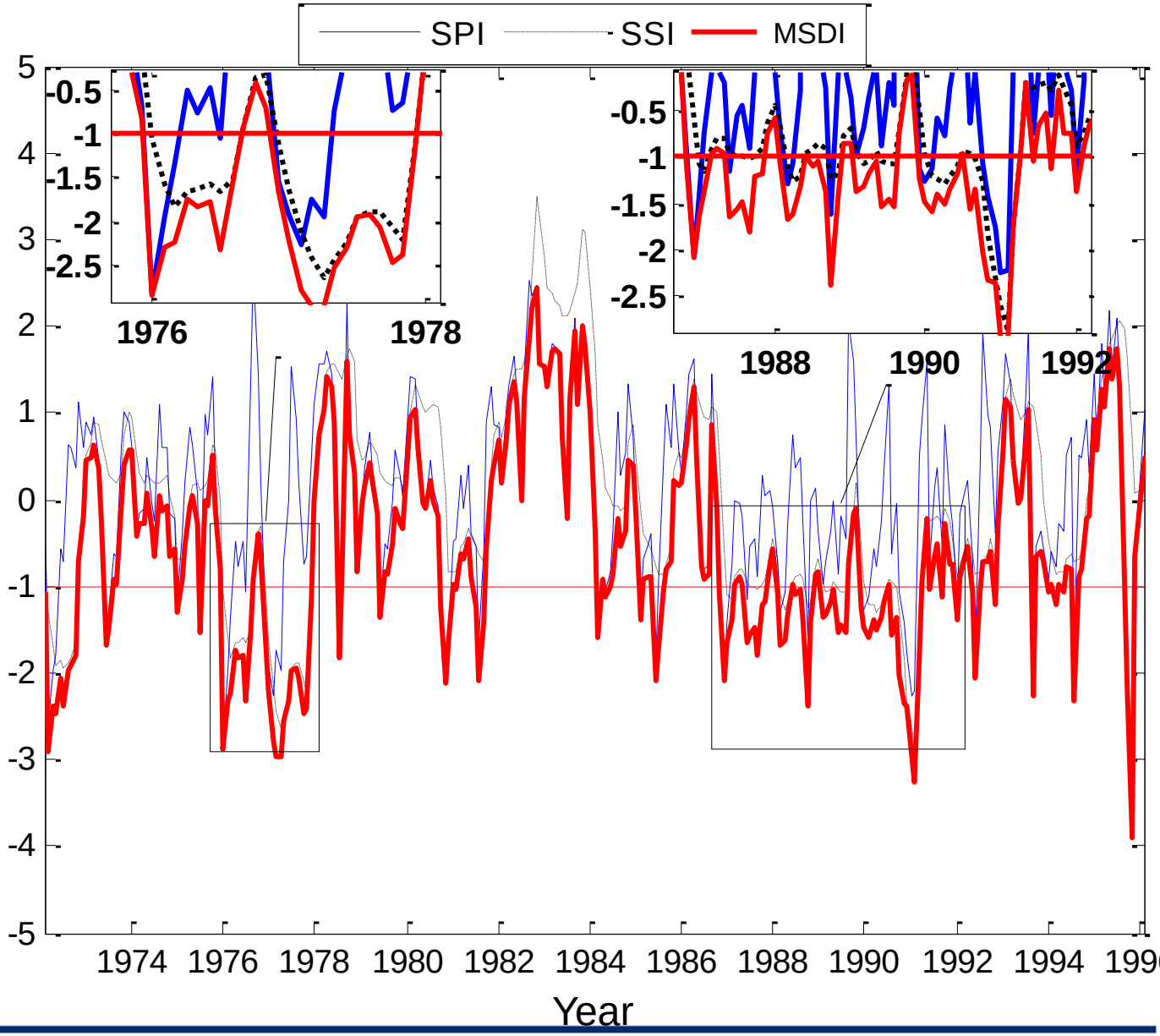
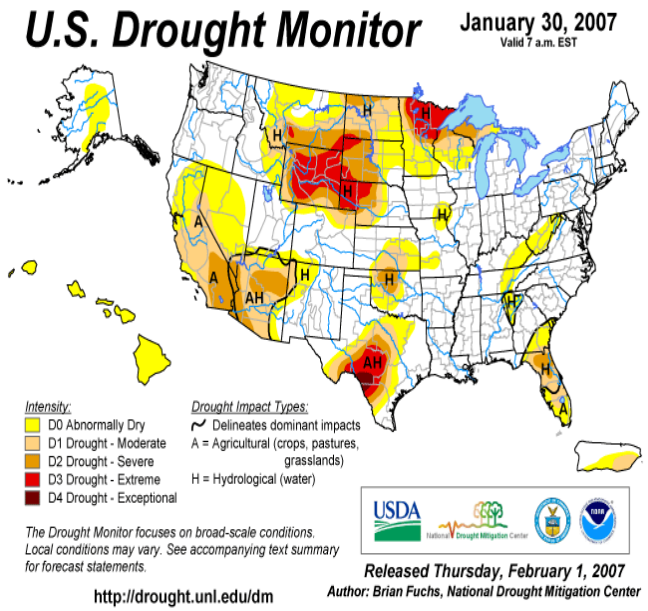


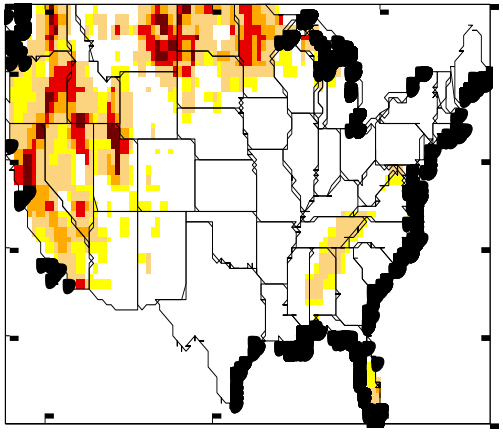
3-month SPI, SSI, MSDI for Climate Division 5 in California.

Multi-Index Drought Monitoring

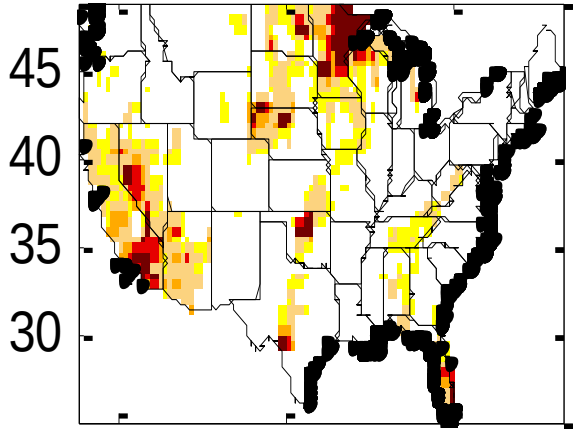
1-Month SPI and SSI Derived Using NASA MERRA-LAND Precipitation and soil moisture Data.



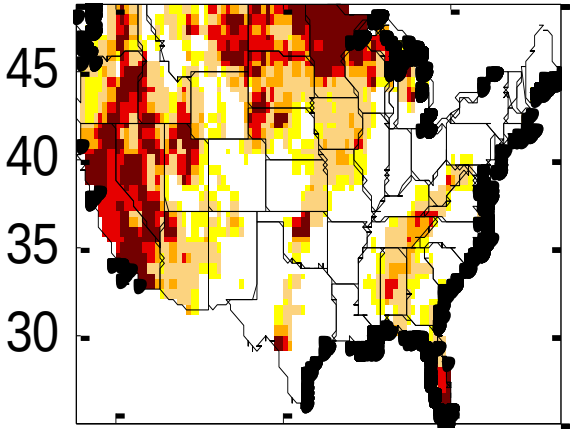
SPI 2007-1



SSI 2007-1



MSDI 2007-1



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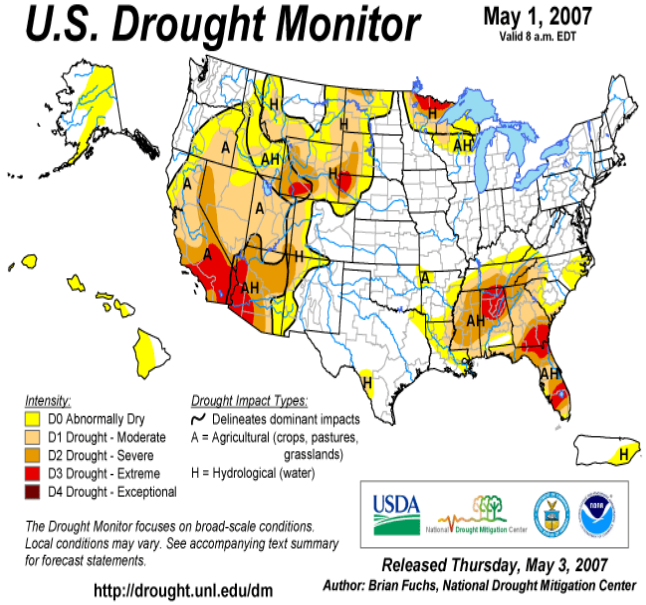
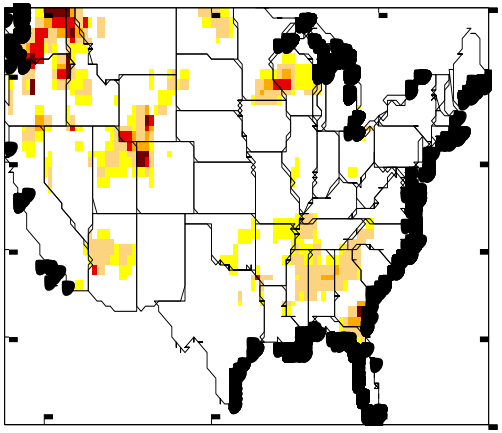


SPI 2007-4



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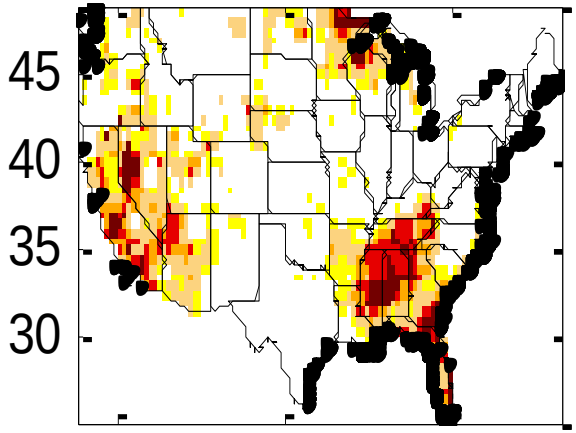

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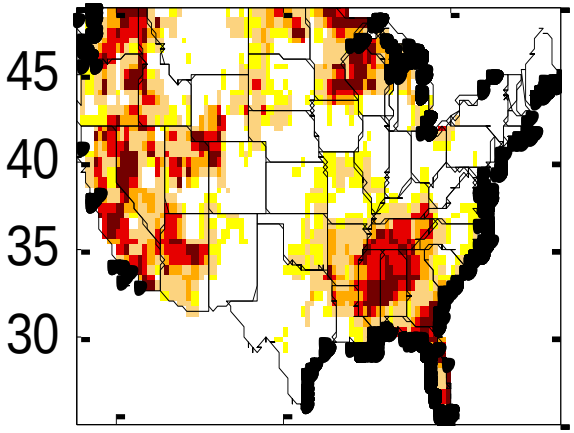

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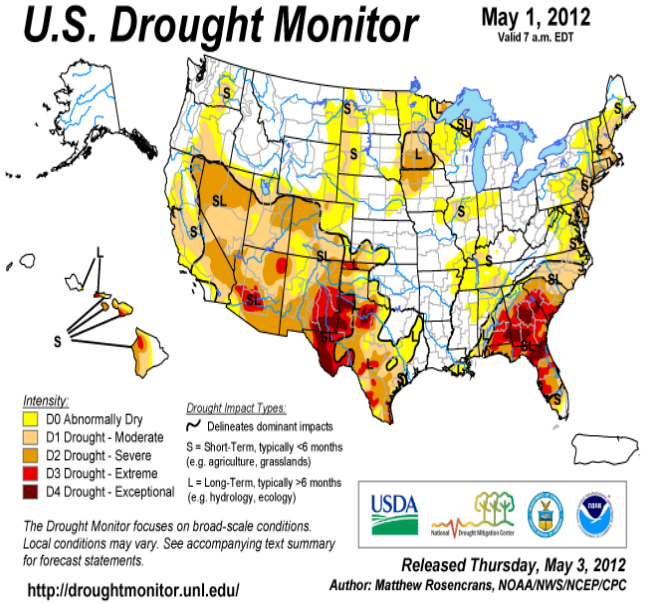
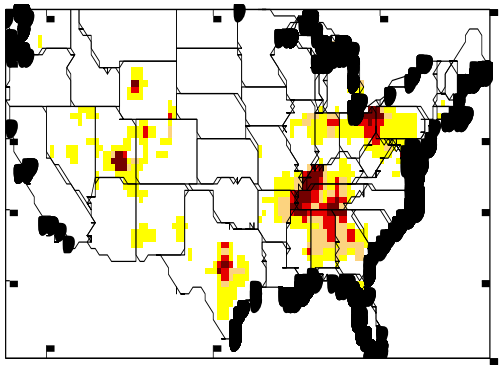


SPI 2012-4



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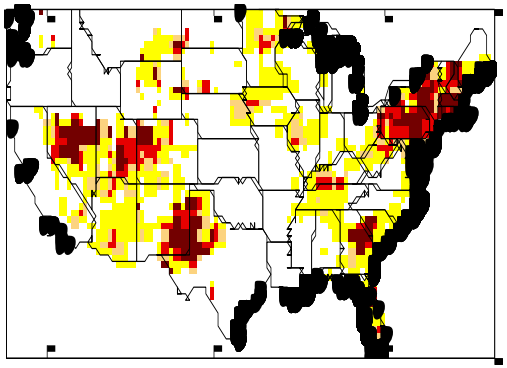
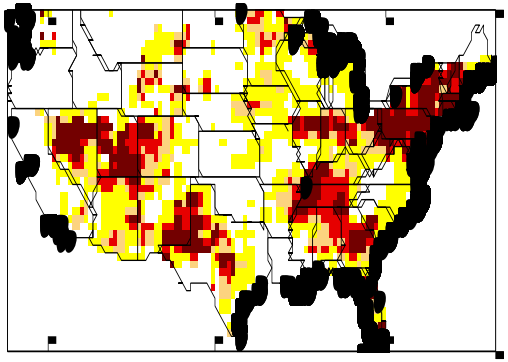
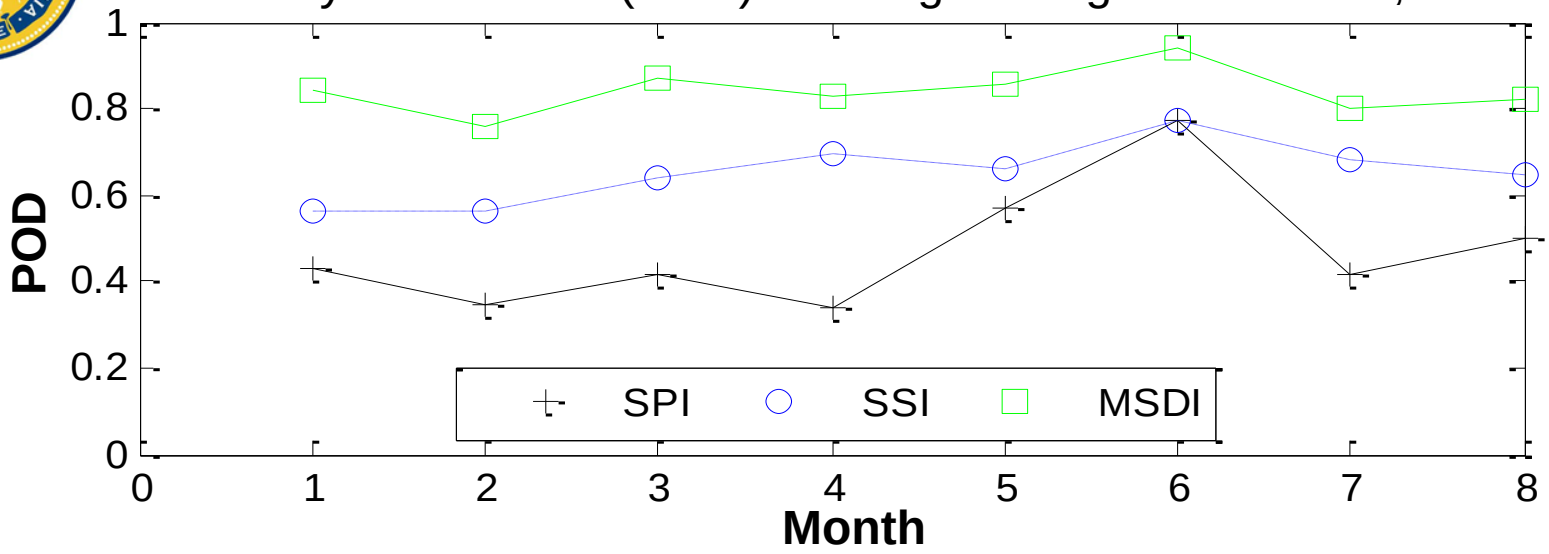


MSDI 2012-4

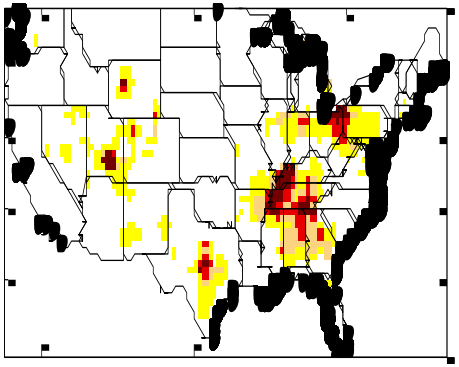


Multi-Index Drought Monitoring

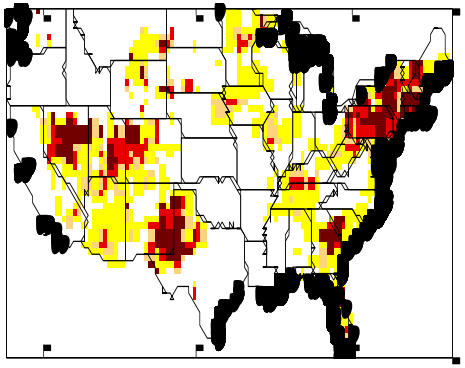
Probability of detection (POD) of drought using 1-month SPI, SSI and MSDI



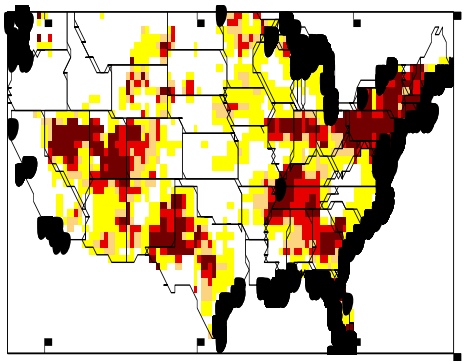
SPI 2012-04

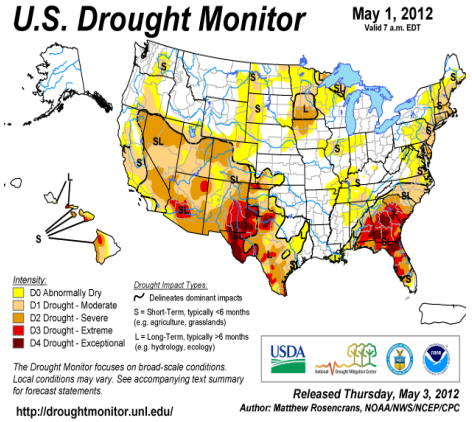


SSI 2012-04



MSDI 2012-04





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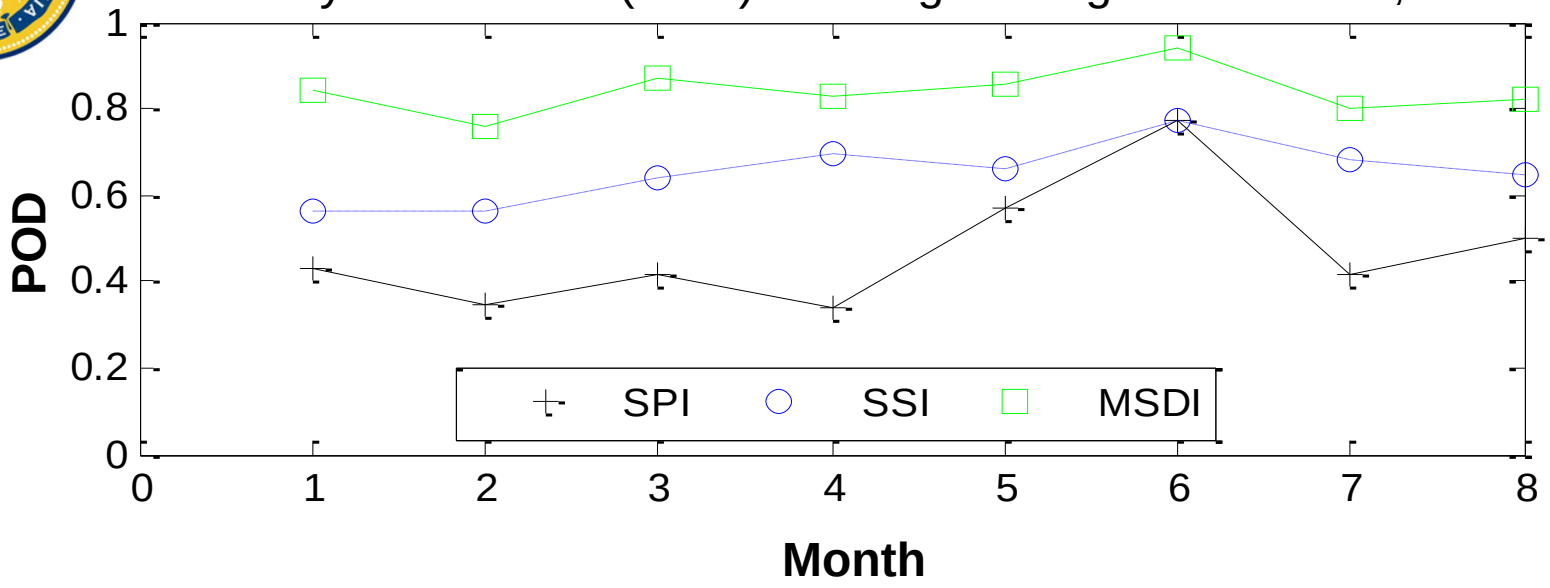
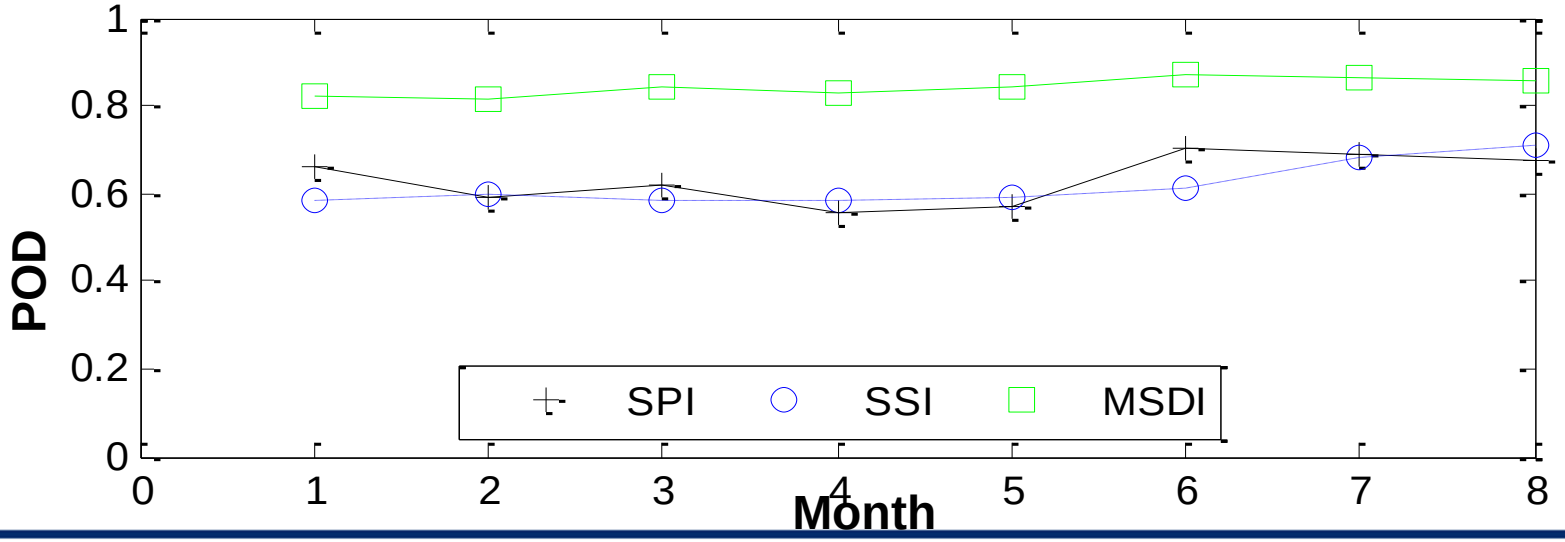
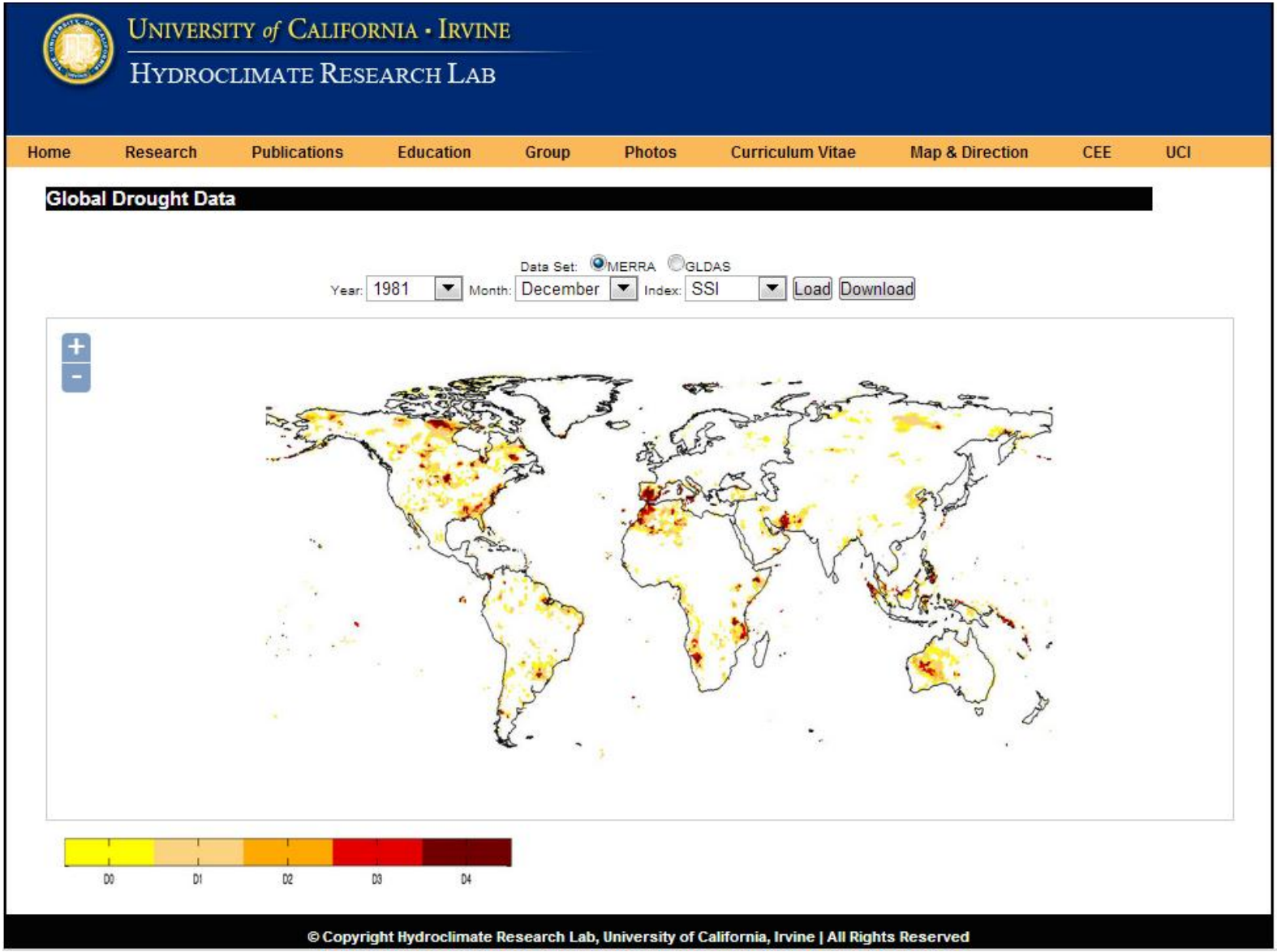


Probability of detection (POD) of drought using 6-month SPI, SSI and MSDI



A Global Drought GeoServer

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



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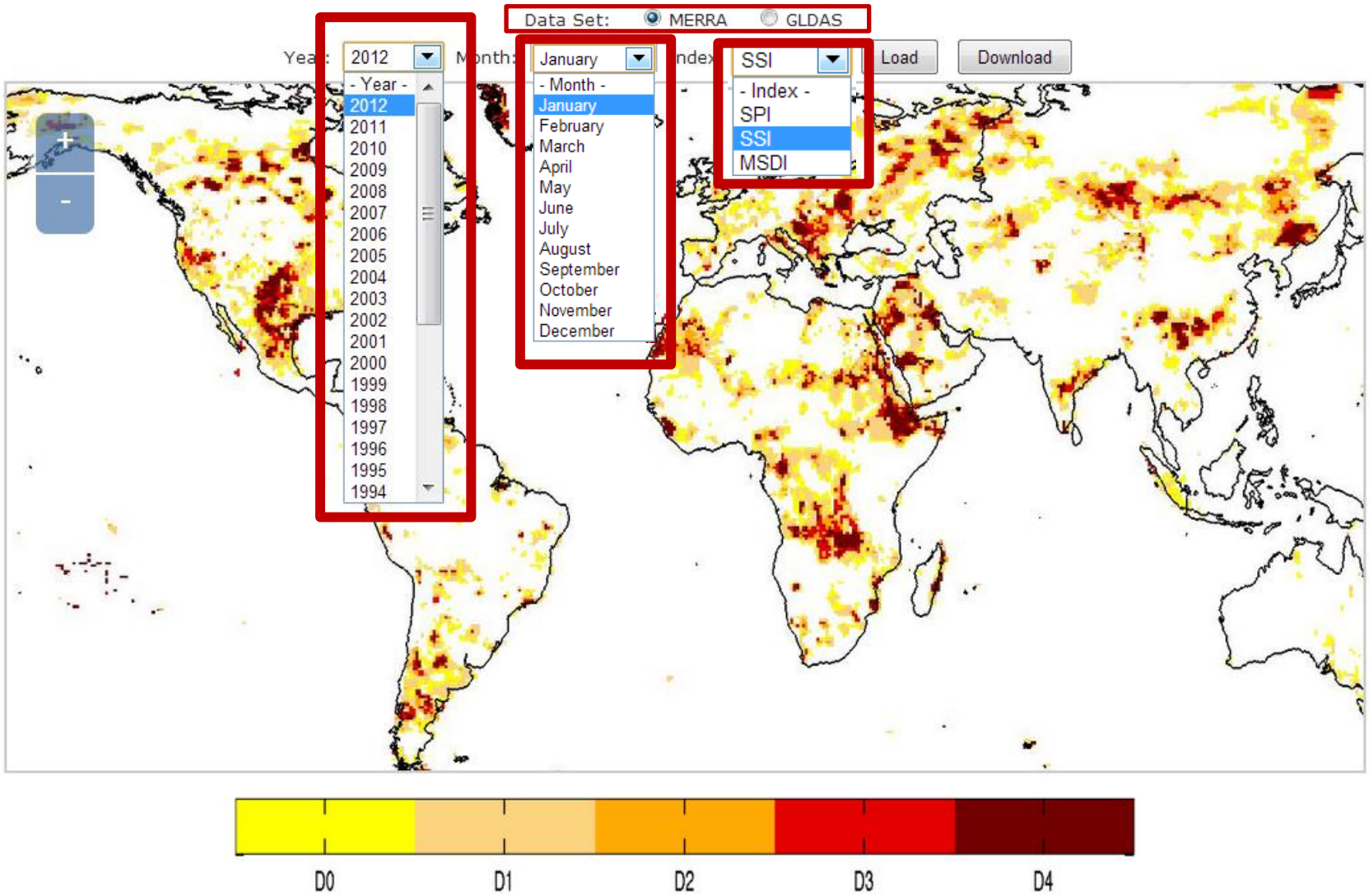

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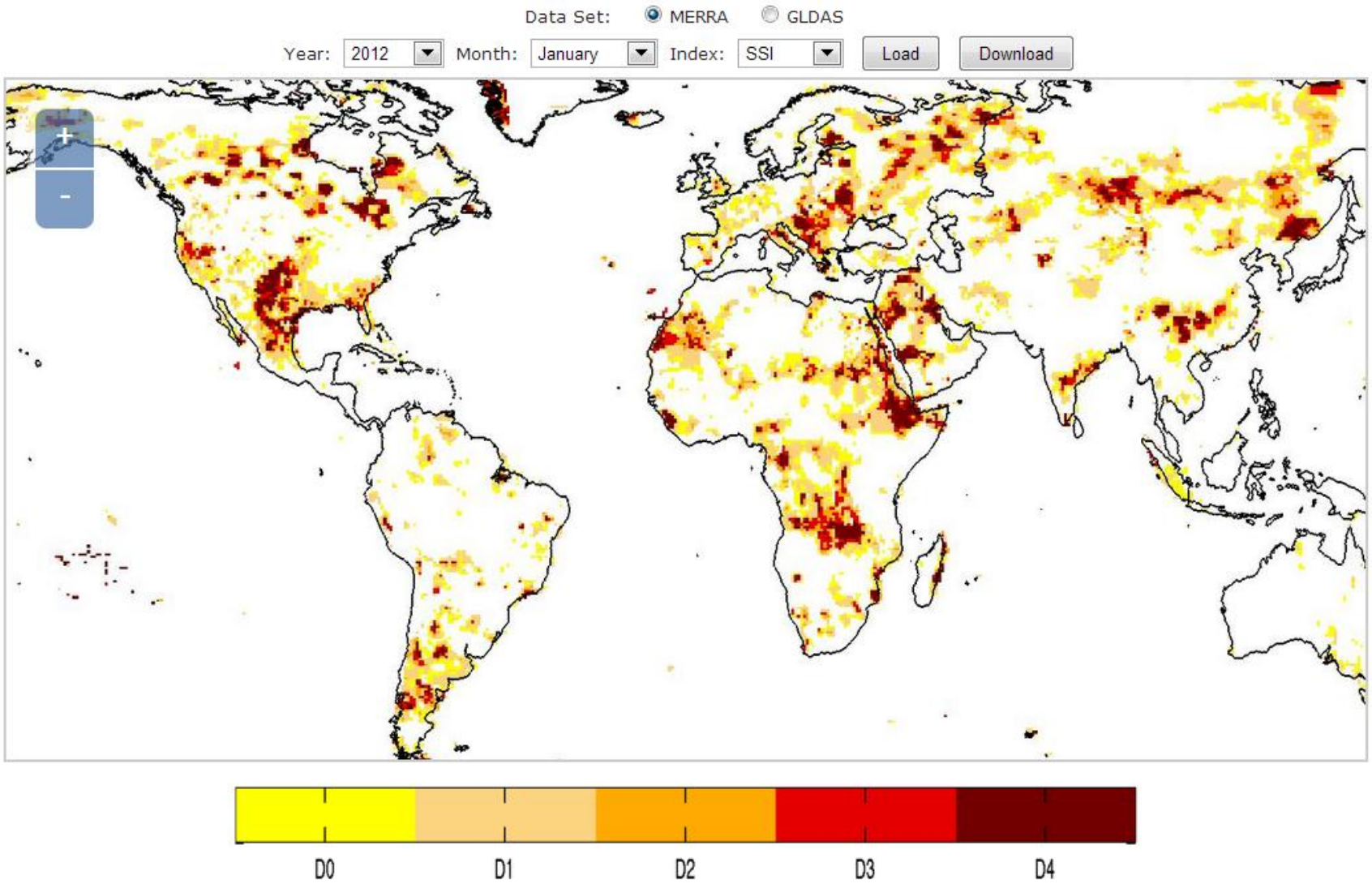

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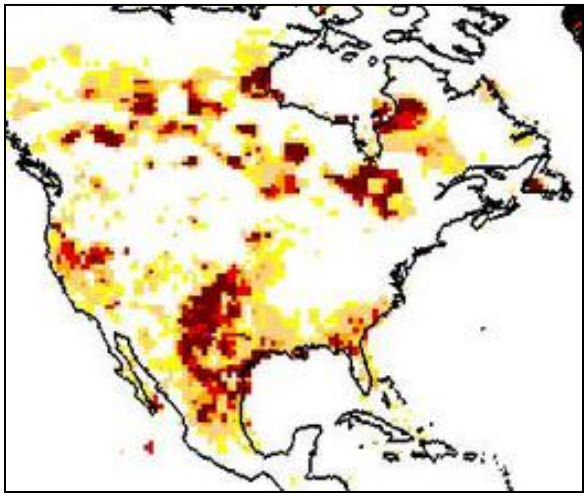
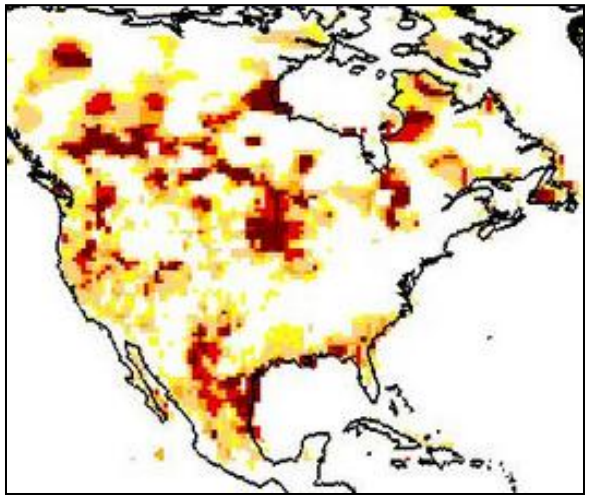
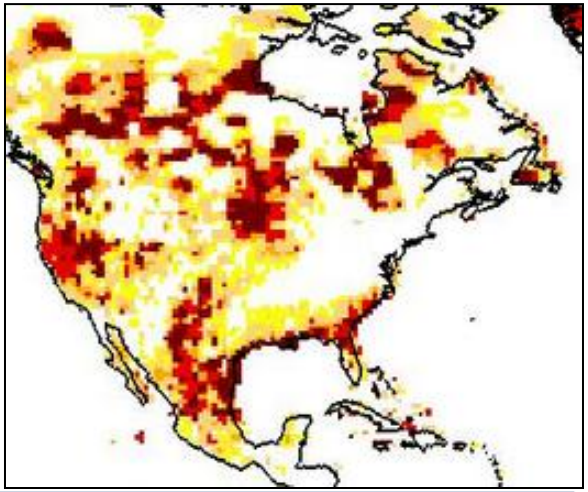
Soil Moisture



Precipitation



Soil Moisture & Precipitation



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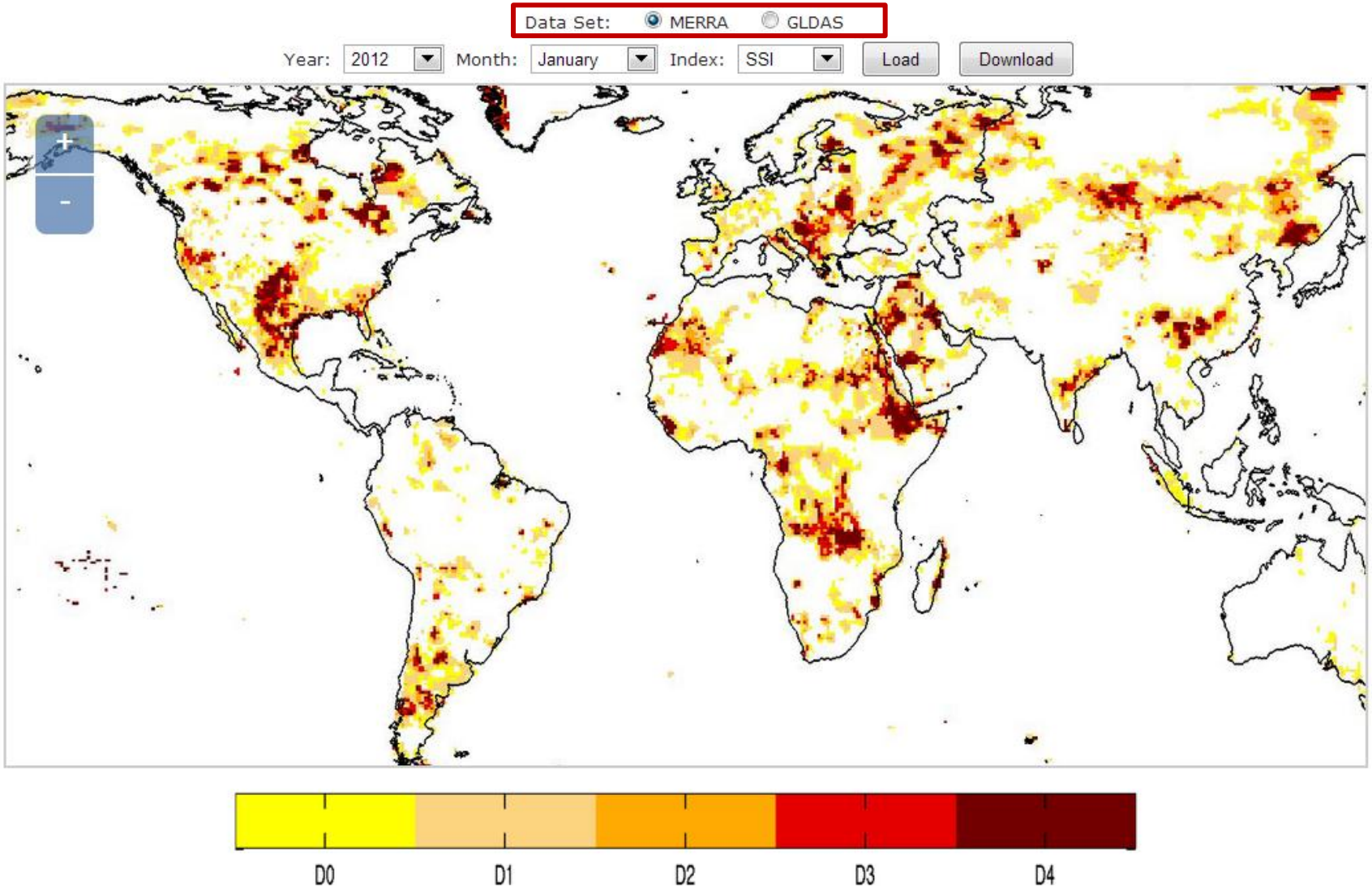

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A near real-time satellite-based global drought climate data record

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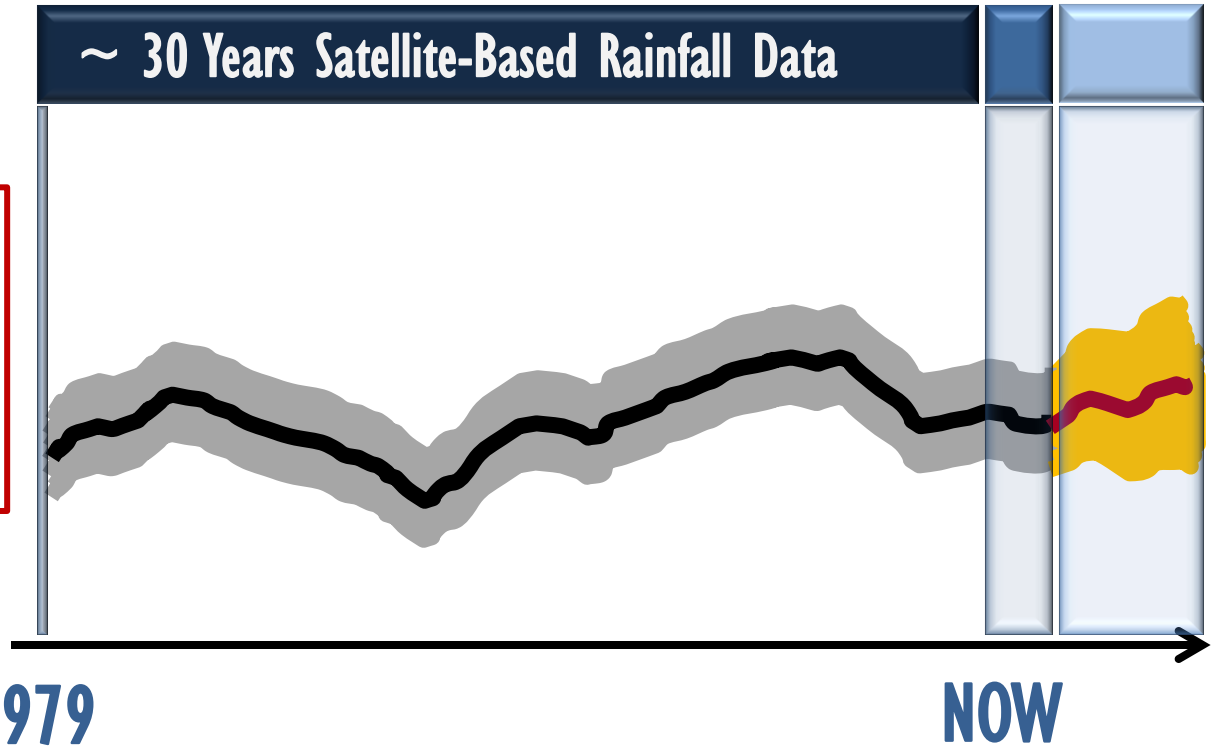
http://amir.eng.uci.edu/publications/12_RG_Drought_CDR_ERL.pdf

Short-term forecasts of Drought Likelihood based on CFSv2 simulations



Thank You for Your Attention