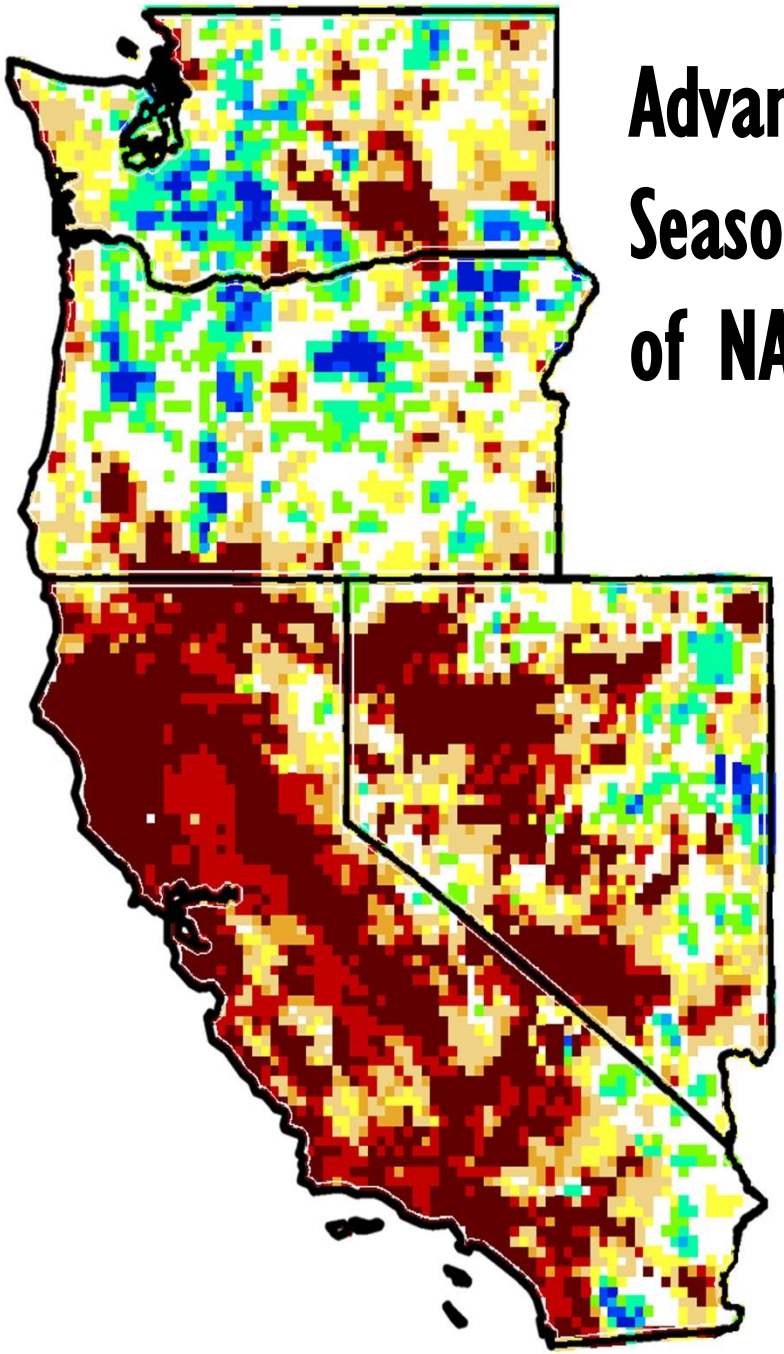


Advancing Drought Onset Detection and Seasonal Prediction Using a Composite of NASA Models and Satellite Data

Amir AghaKouchak, Soroosh Sorooshian, Kuolin Hsu, Shahrbanou Madadgar

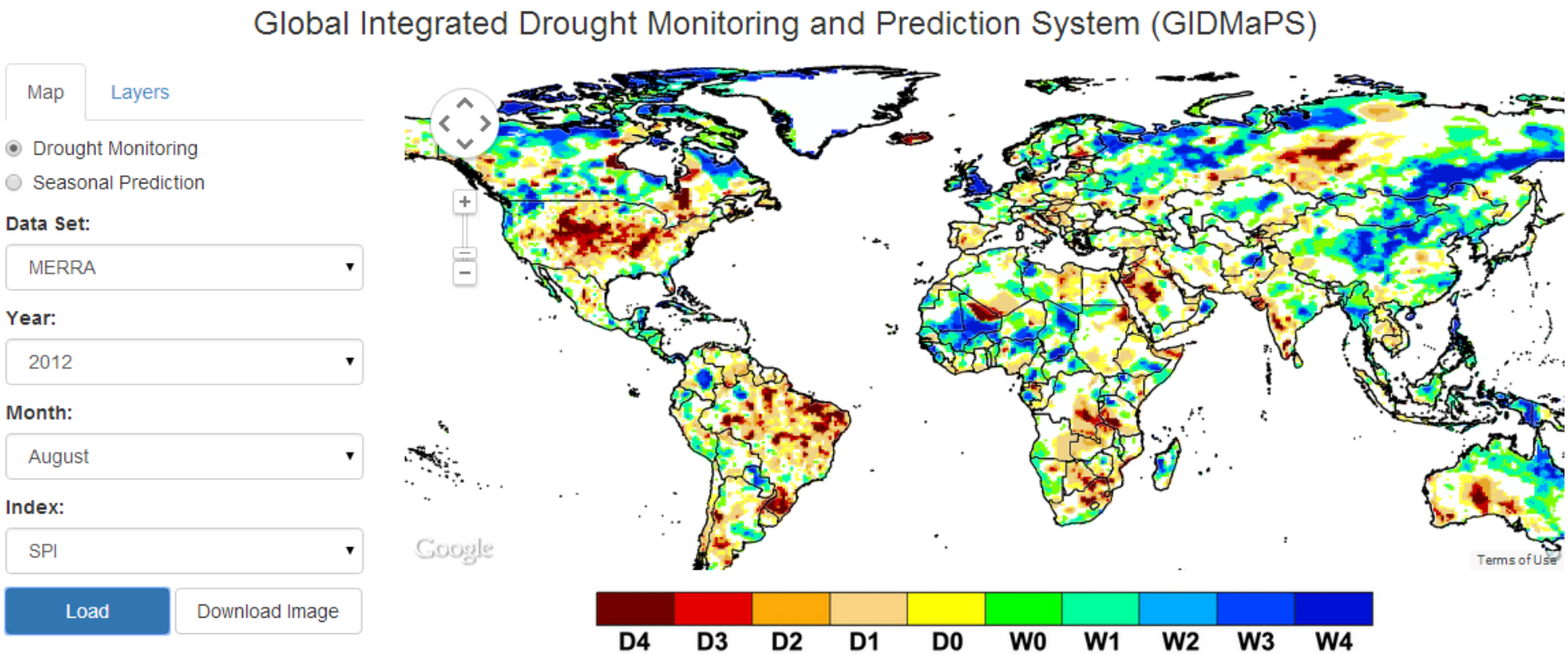
University of California, Irvine

Jeanine Jones, Michael Anderson

California Department of Water Resources

GIDMaPS: Global Integrated Drought Monitoring and Prediction System

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



Hao Z., AghaKouchak A., Nakhjiri N., Farahmand A., 2014, Global Integrated Drought Monitoring and Prediction System, *Scientific Data*, 1:140001, 1-10, doi: 10.1038/sdata.2014.1.
http://www.nature.com/articles/sdata20141

GIDMaPS: Global Integrated Drought Monitoring and Prediction System

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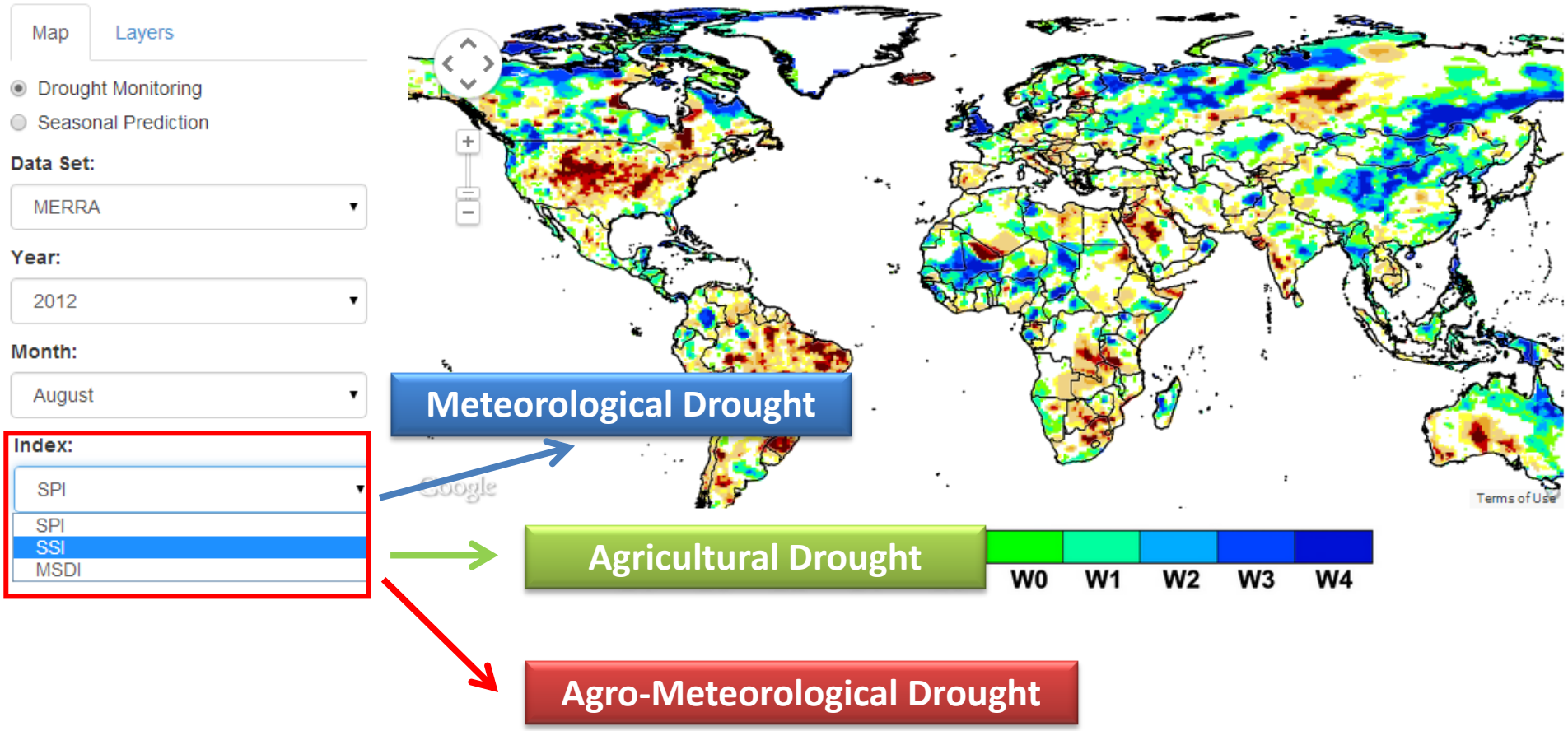
Global Integrated Drought Monitoring and Prediction System (GIDMaPS)



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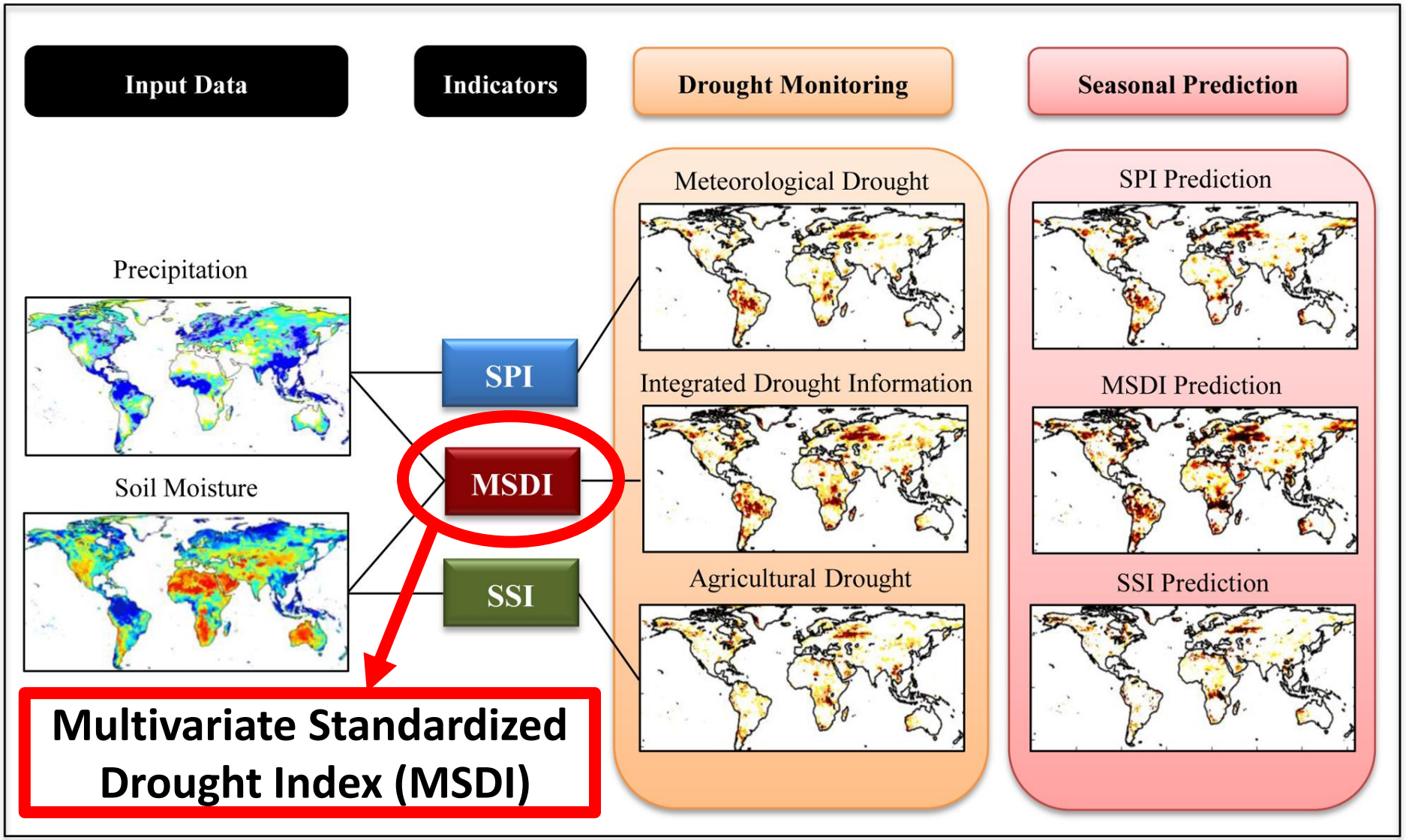
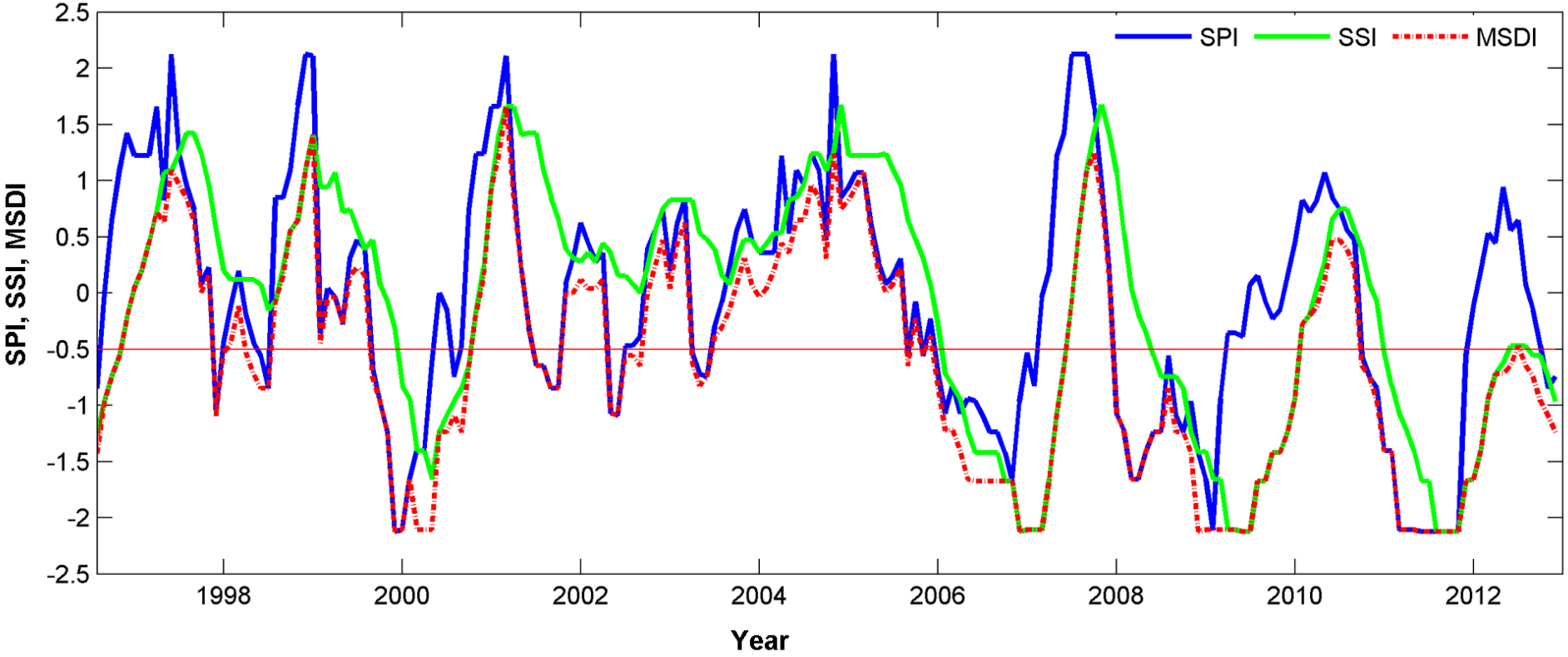
GIDMaPS: Global Integrated Drought Monitoring and Prediction System



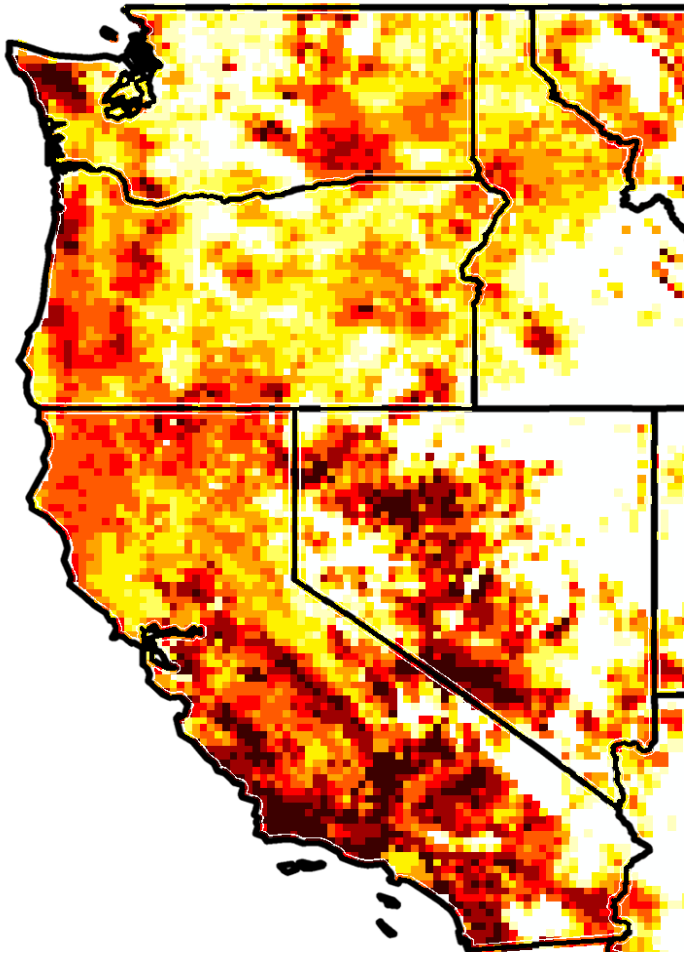
Multi-Index Drought Monitoring



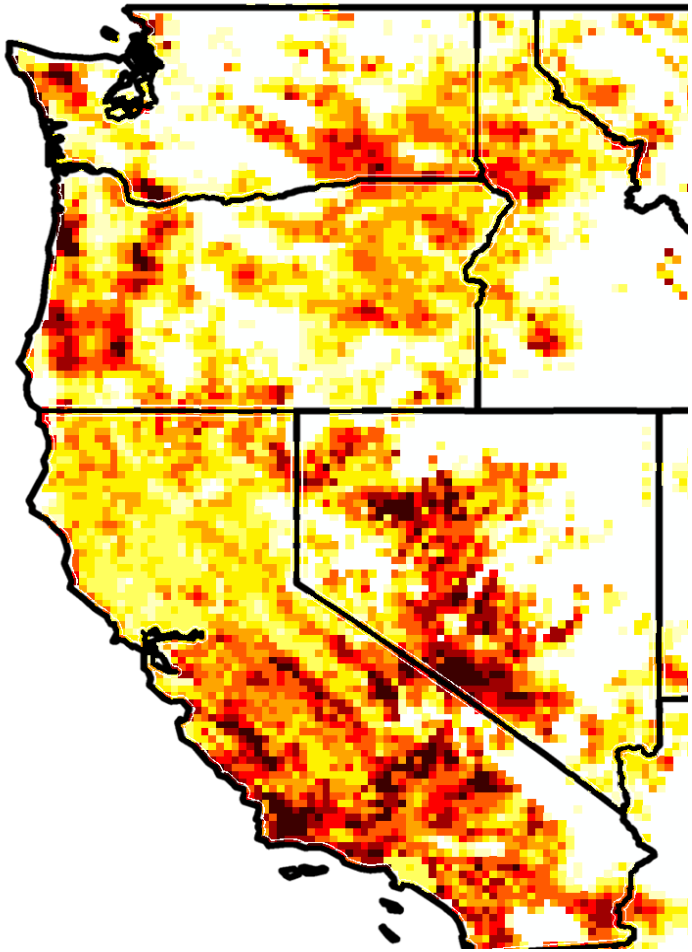
Sample time series of the 6-month SPI, SSI and MSDI for a grid cell (Location: longitude 100 W and latitude 30 N).

Probabilistic Drought Prediction

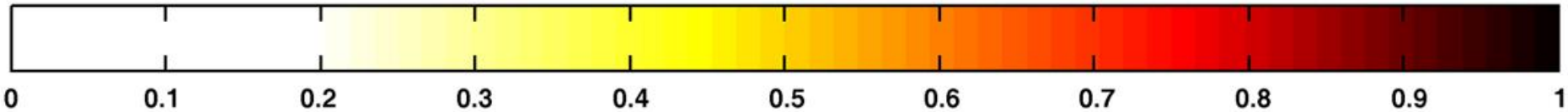
2-Month Lead
Dec. 2014



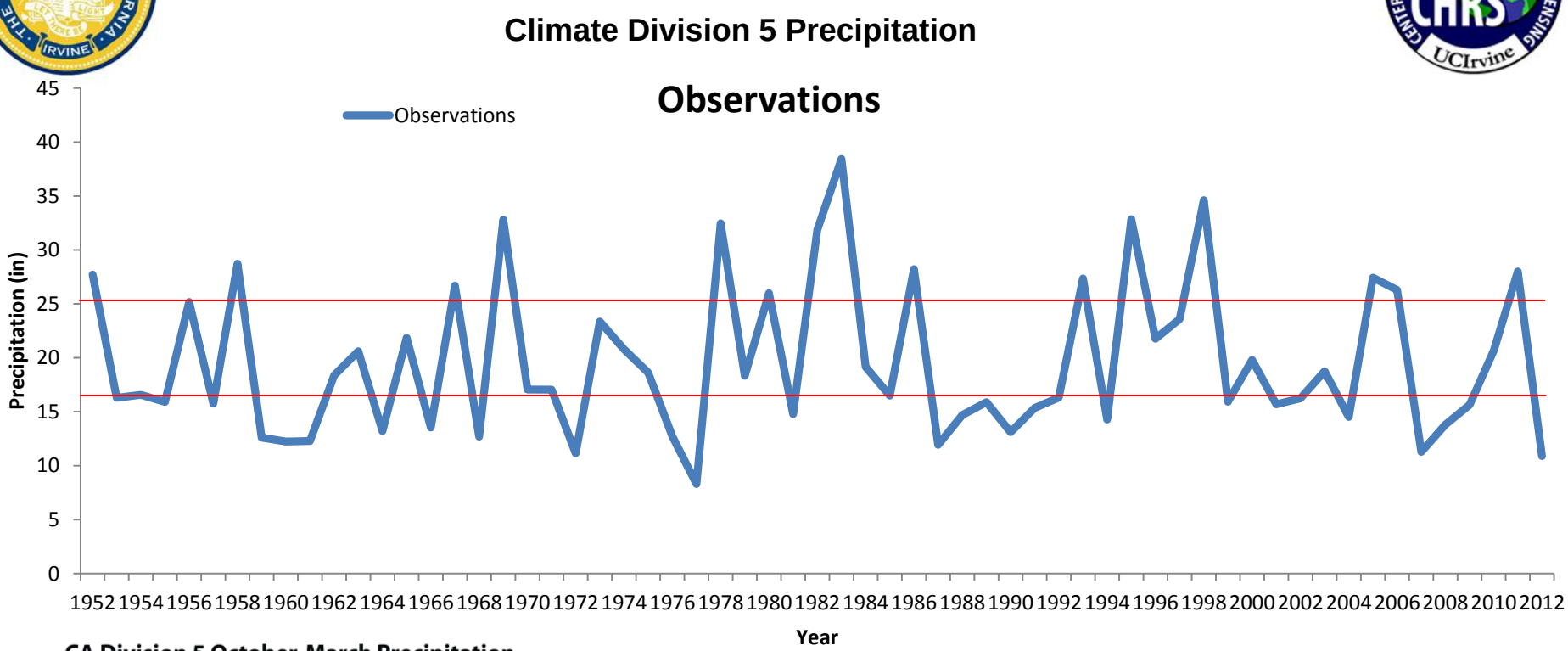
2-Month Lead
Jan. 2015

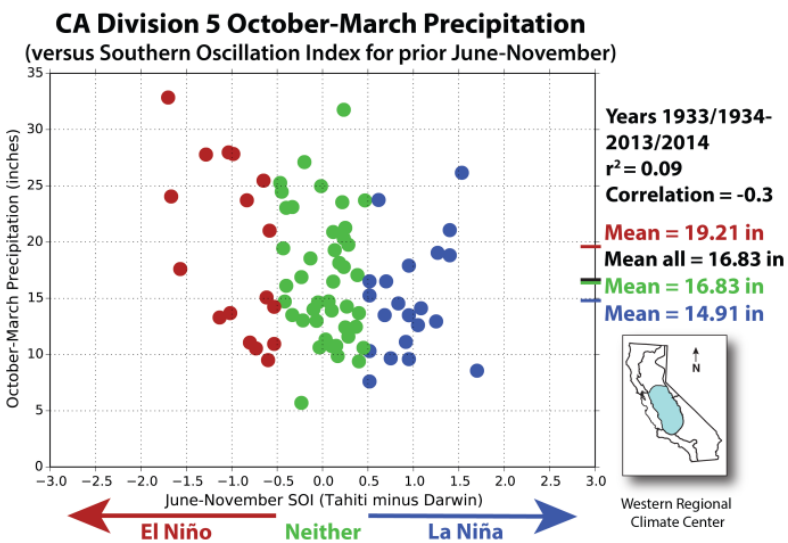


Probability



Drought Definition and Indicators





$$f(PDO, MEI, SOI, \ldots) \sim \begin{cases} \Pr(P > AN) \\ \Pr(P \sim NN) \\ Pr(P < BN) \end{cases}$$

AN: Above Normal (> 66th Percentile)
NN: Near Normal
BN: Below Normal (< 33th Percentile)

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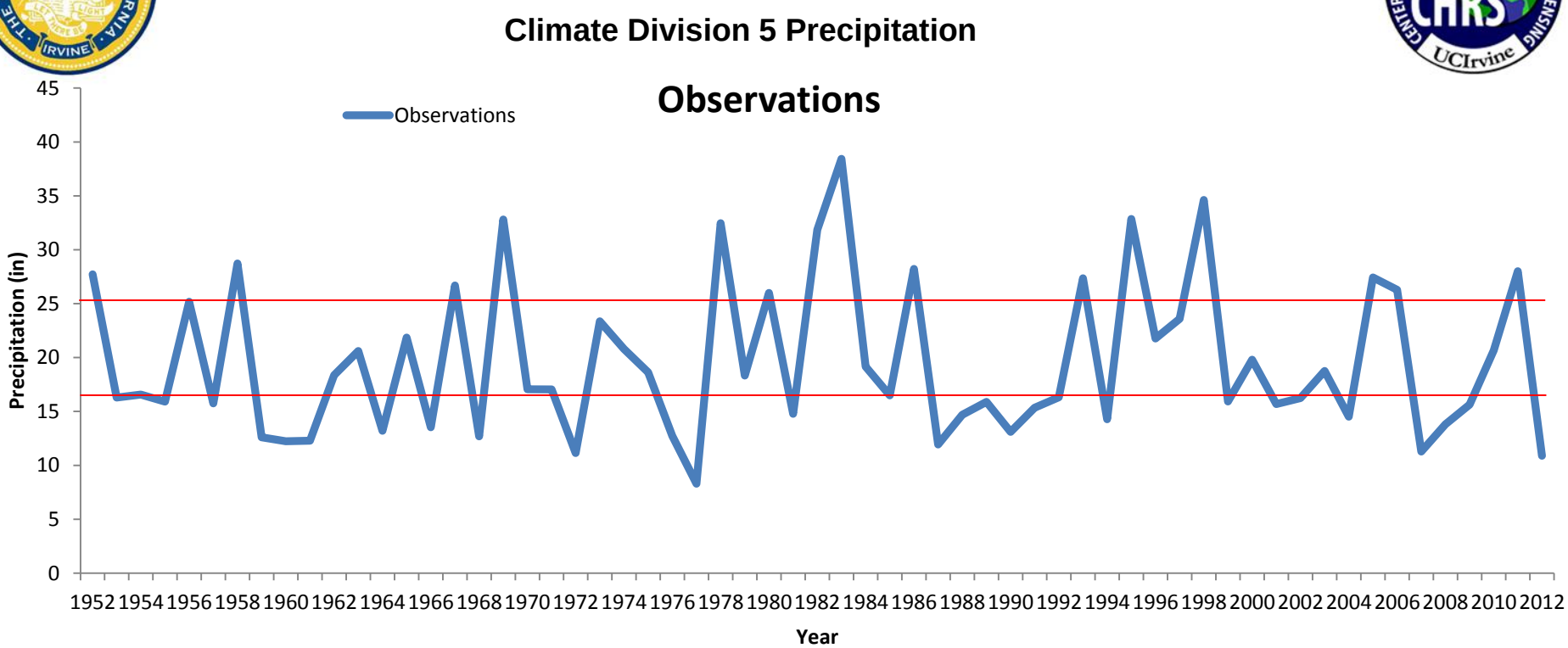

Early drought onset detection using satellite observations?

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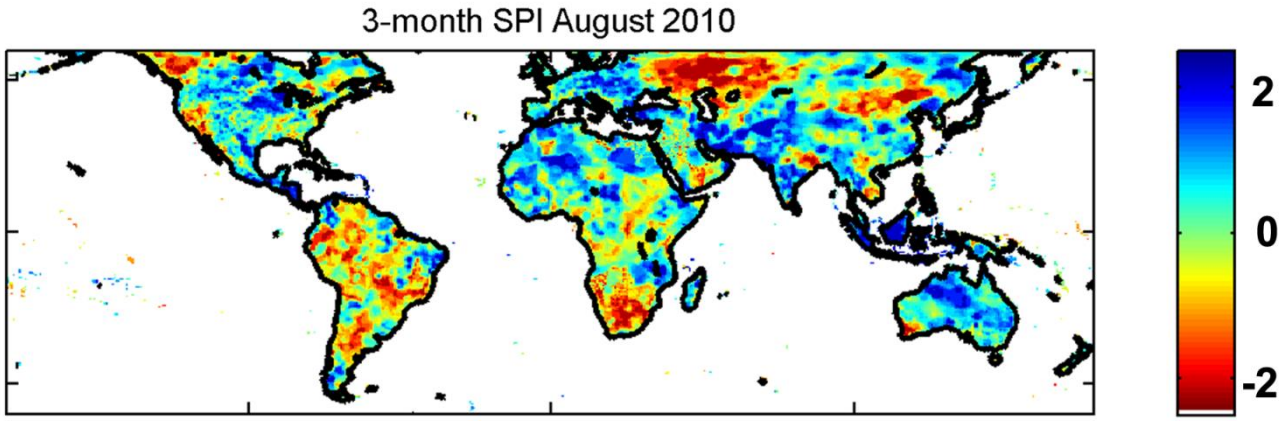
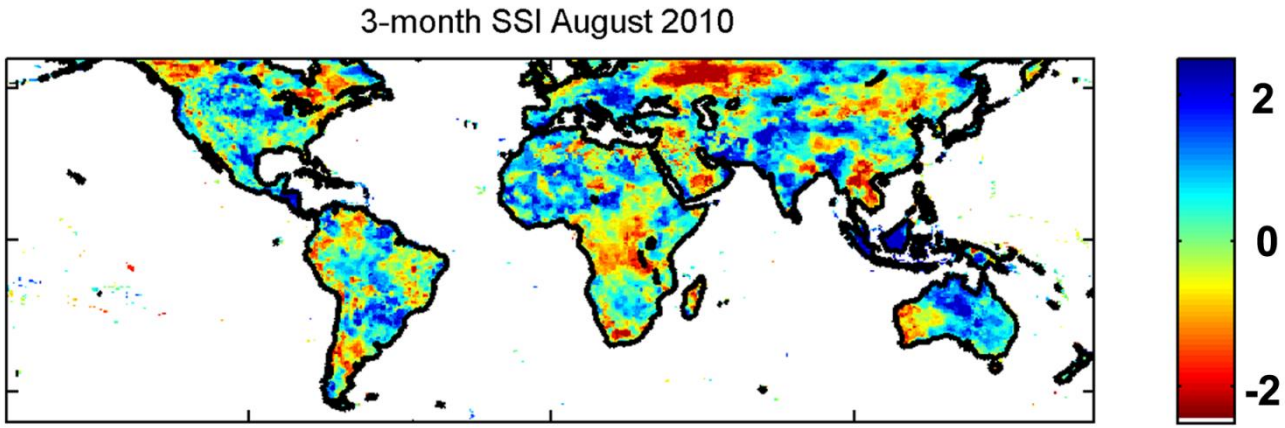
Integration of AIRS Data into GIDMaPS

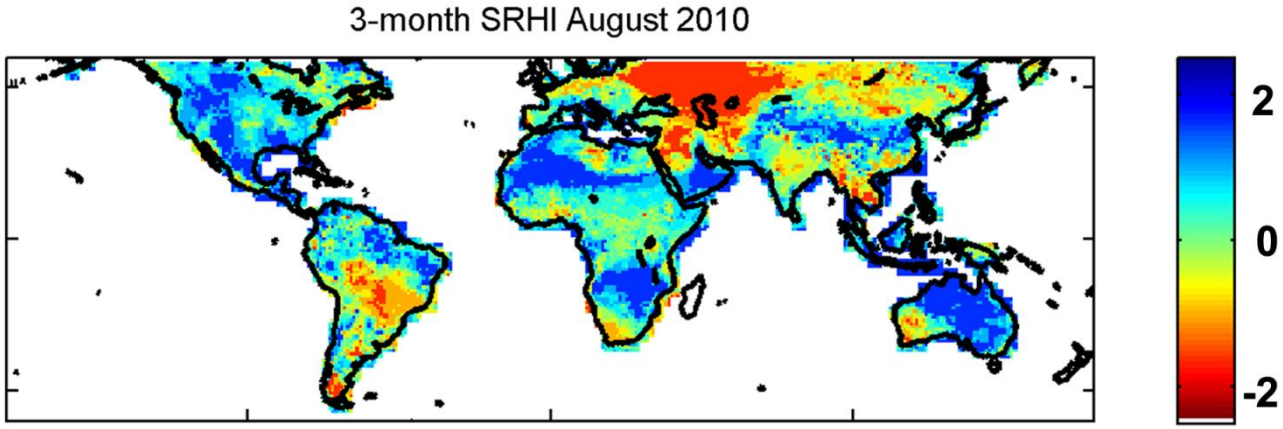
Precipitation (MERRA)



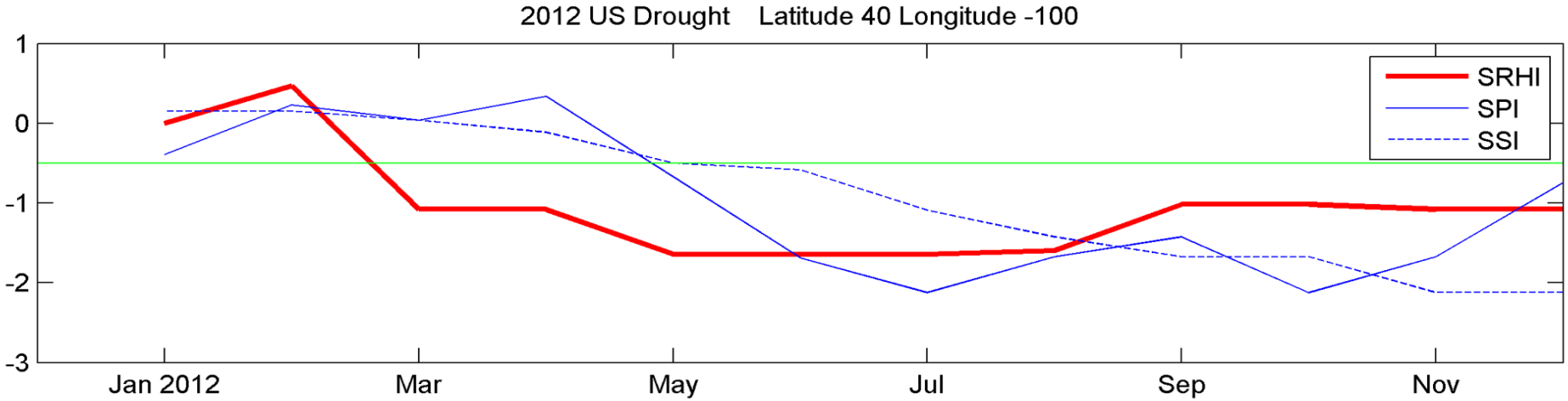
Soil Moisture (MERRA)

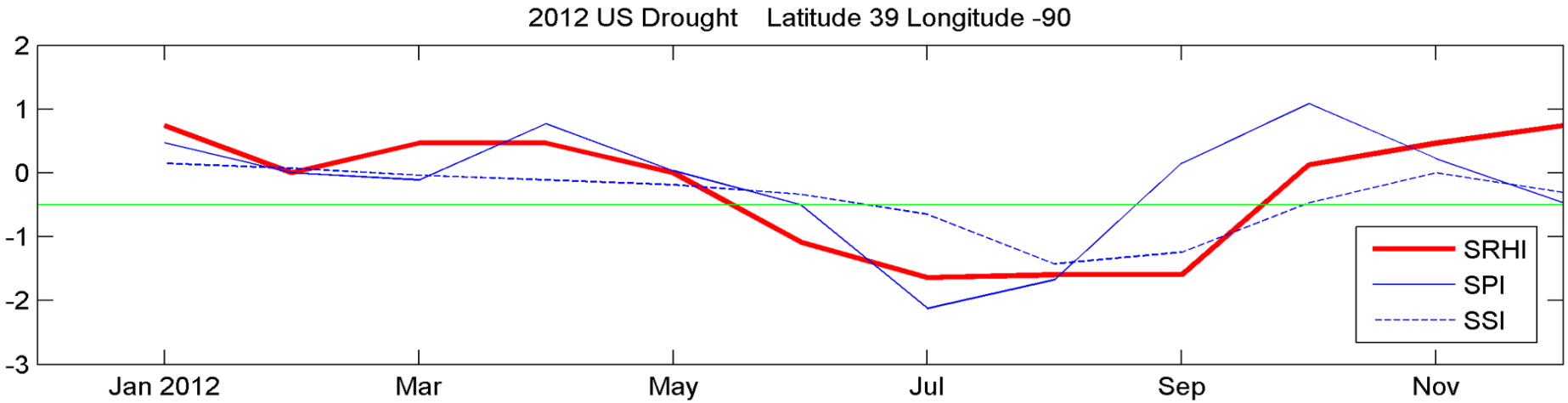


Relative Humidity (AIRS Data)



Integration of AIRS Data into GIDMaPS



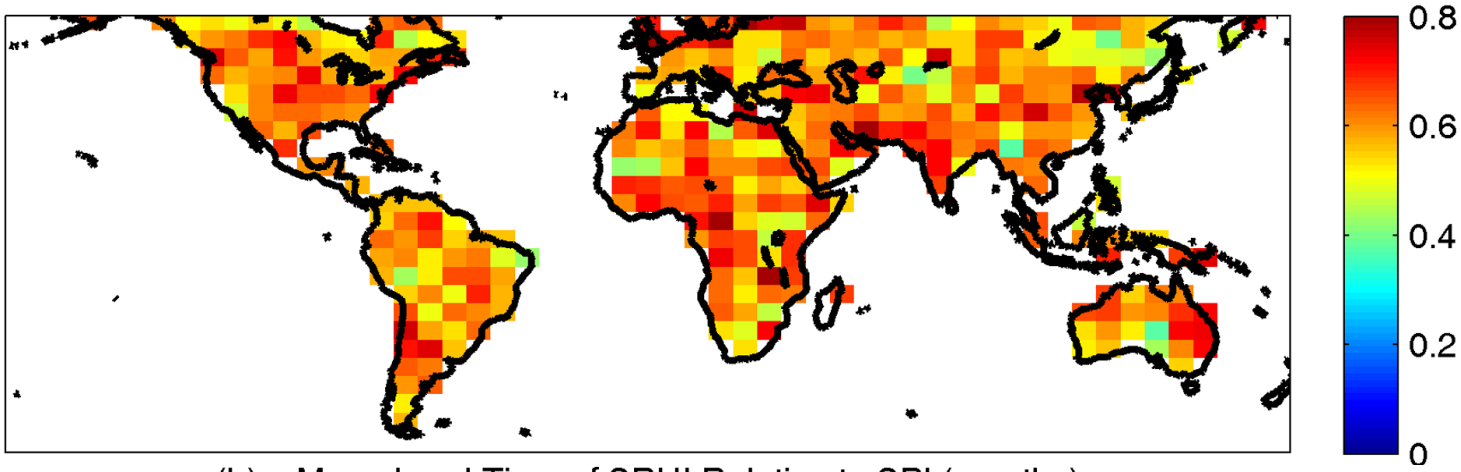


Farahmand et al. 2015; http://www.nature.com/srep/2015/150225/srep08553/full/srep08553.html

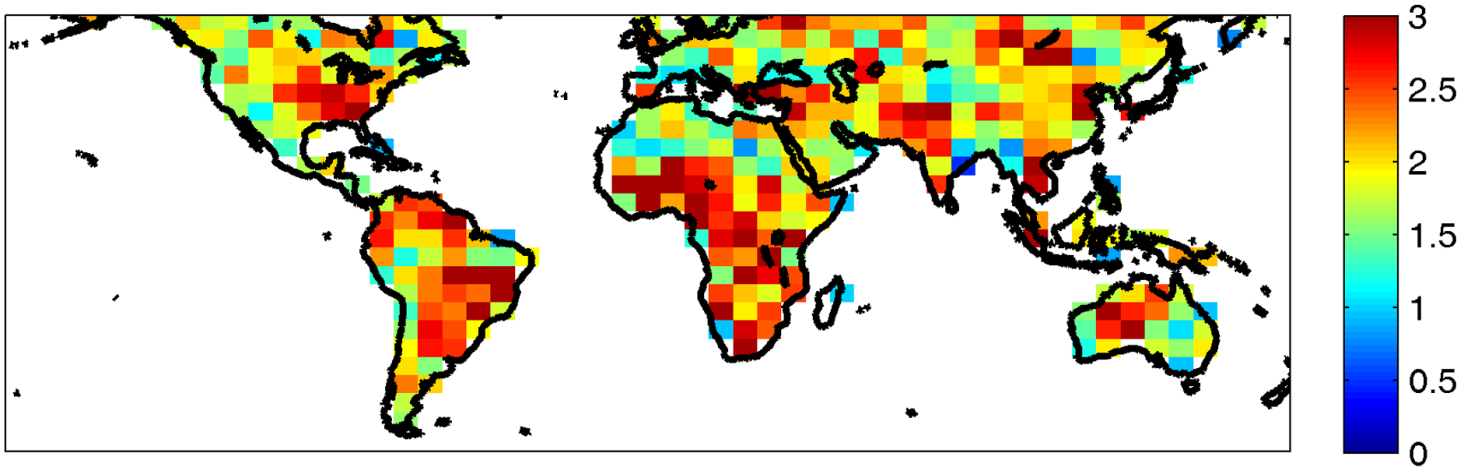
Integration of AIRS Data into GIDMaPS

Probability of drought detection (i.e., fraction of detected drought) when Drought Onset (DO) based on SRHI is less or equal to that of SPI (a), mean lead time based on SRHI relative to SPI (months)(b).

(a) $POD_{SRHI} \mid DO_{SRHI} \leq DO_{SPI}$



(b) Mean Lead Time of SRHI Relative to SPI (months)



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GIDMaPS: Global Integrated Drought Monitoring and Prediction System

Prediction component is based on a drought persistence model which requires historical observations. The seasonal drought prediction component is based on two input data sets (MERRA and NLDAS) and three drought indicators (SPI, SSI and MSDI).

Ai+1(1)= Si-4+ Si-3+ Si-2 +Si-1+ Si +S(1)i+1
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.....

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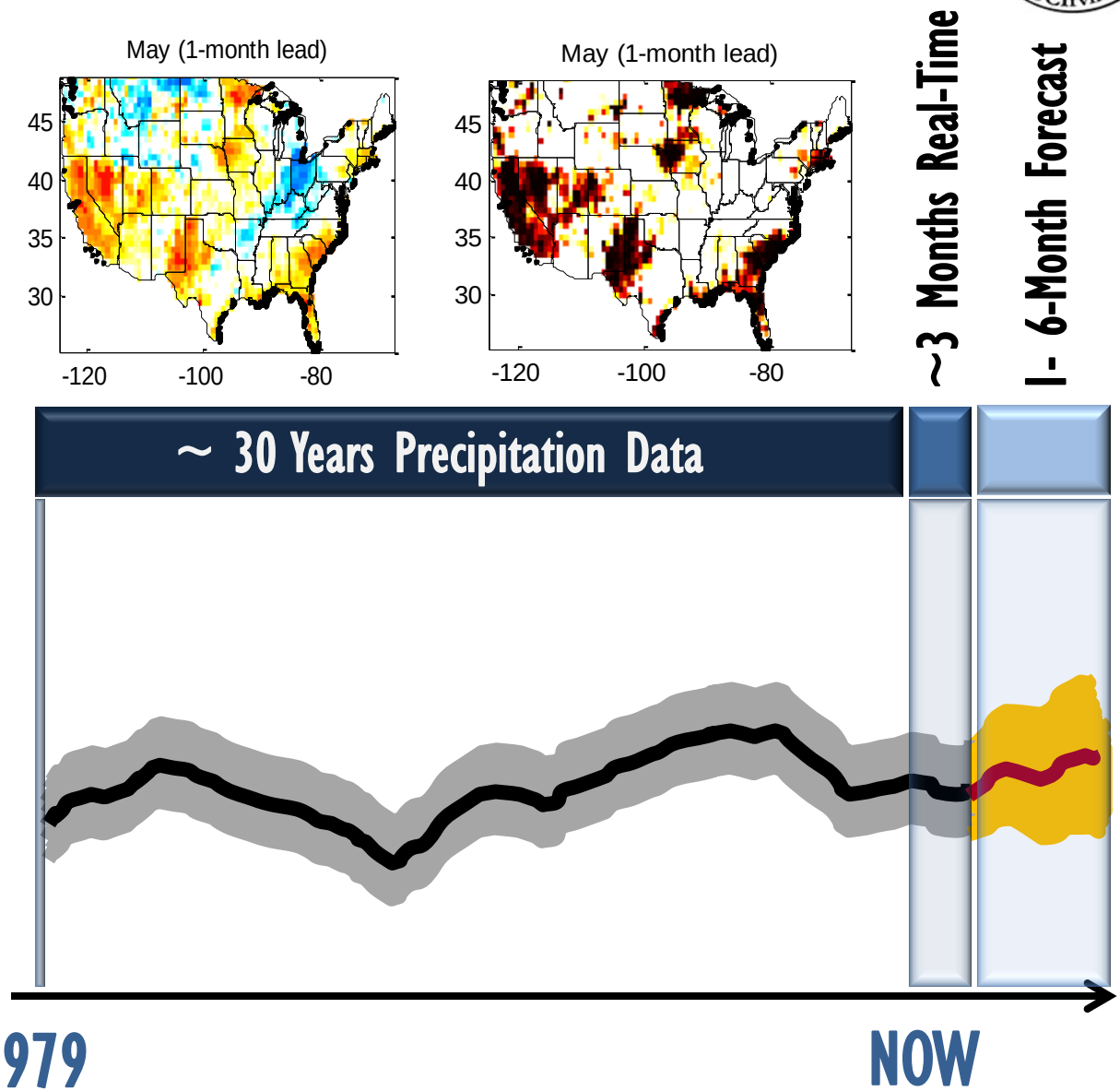

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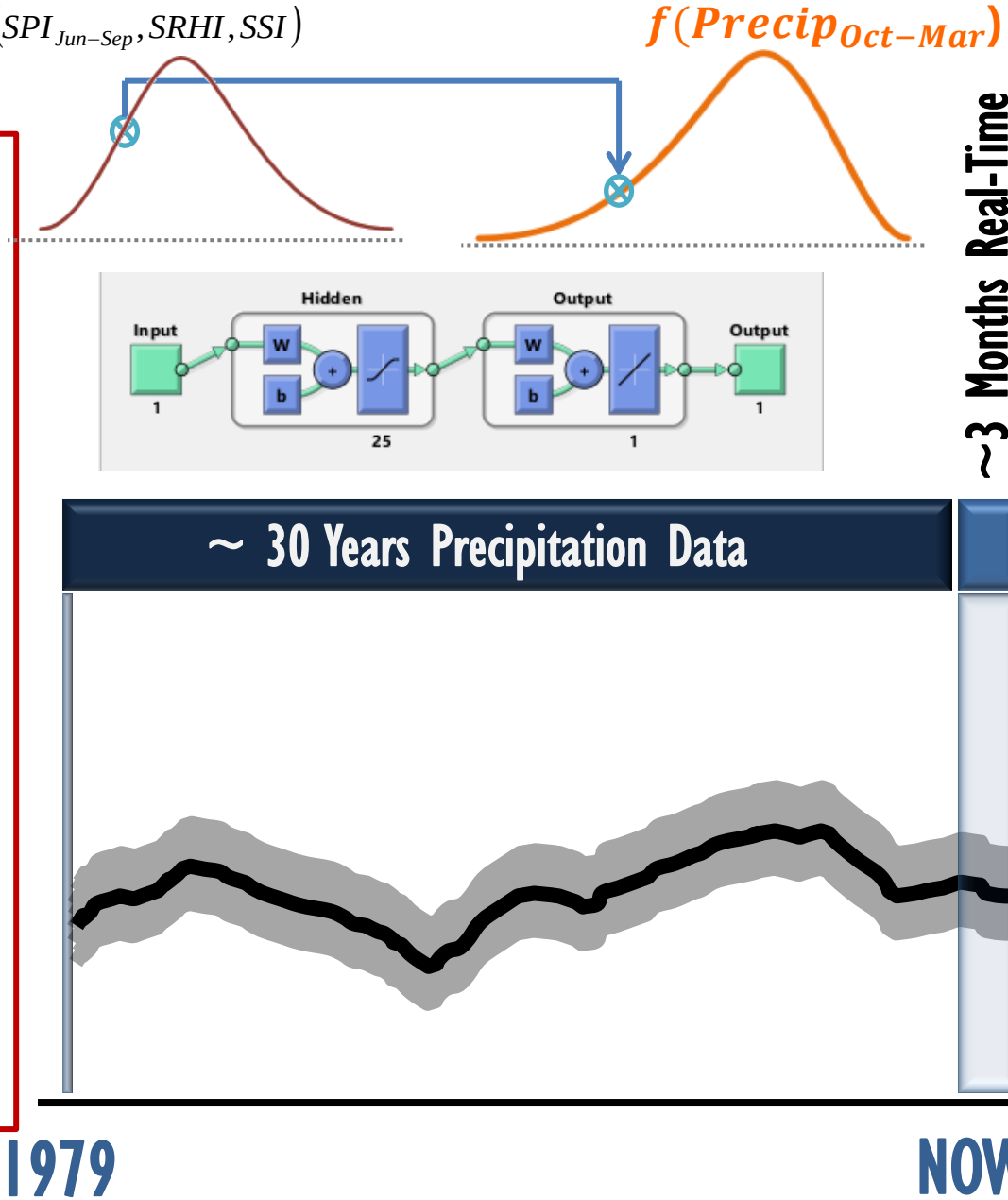
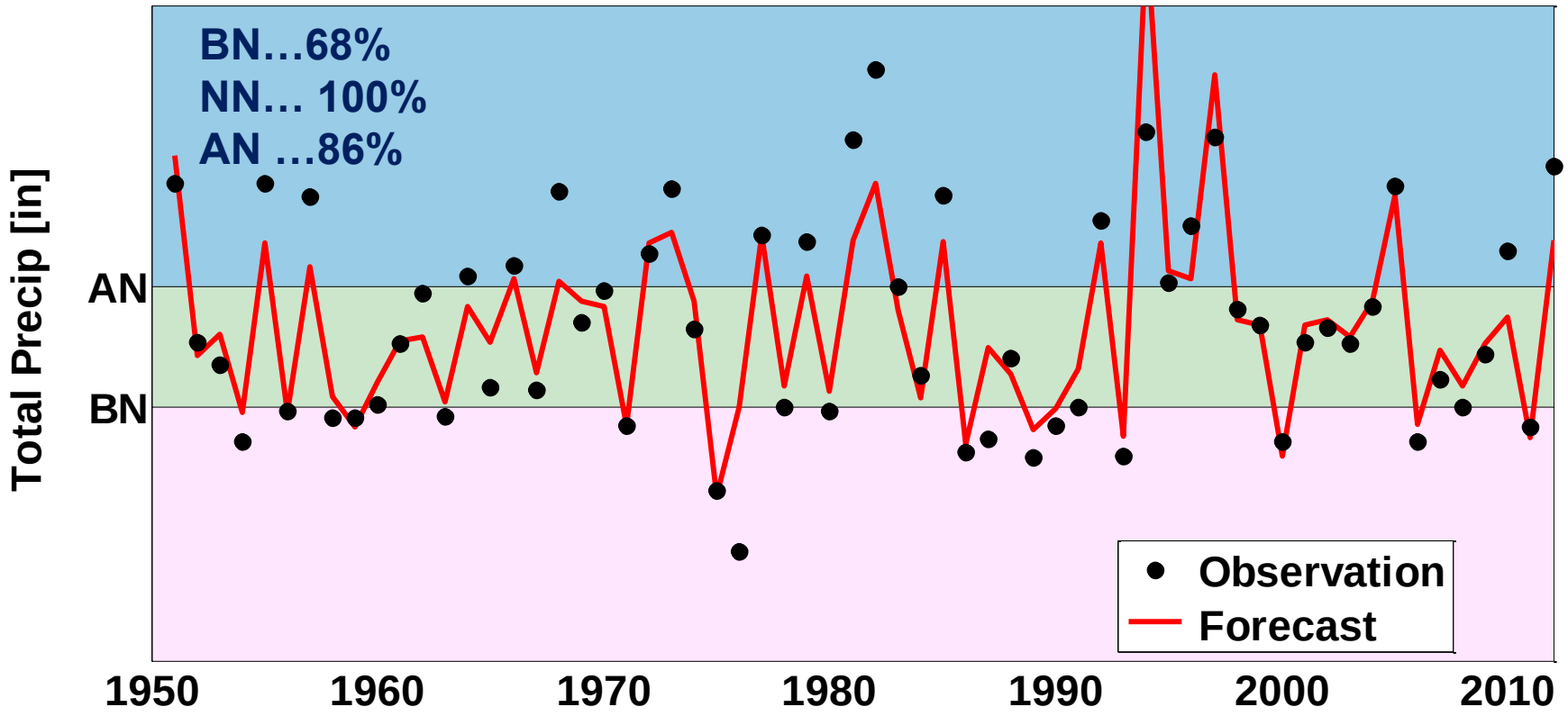


Preliminary Results

- **Climate Index: $SOI_{Apr\text{-}Sep}$, $PDO_{Apr\text{-}Sep}$**
- **$SPI_{Jun\text{-}Sep}$**

Forecast Period= Oct-Mar



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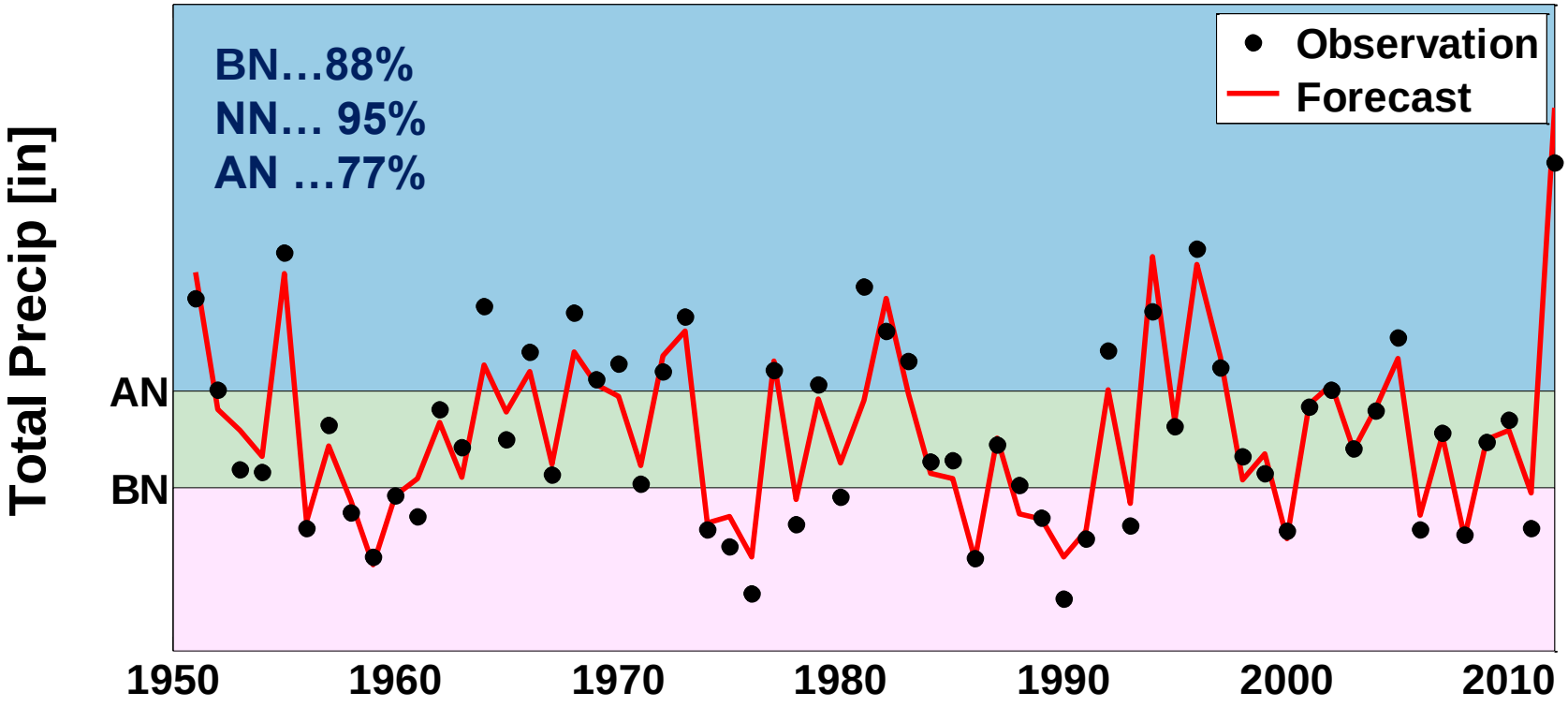
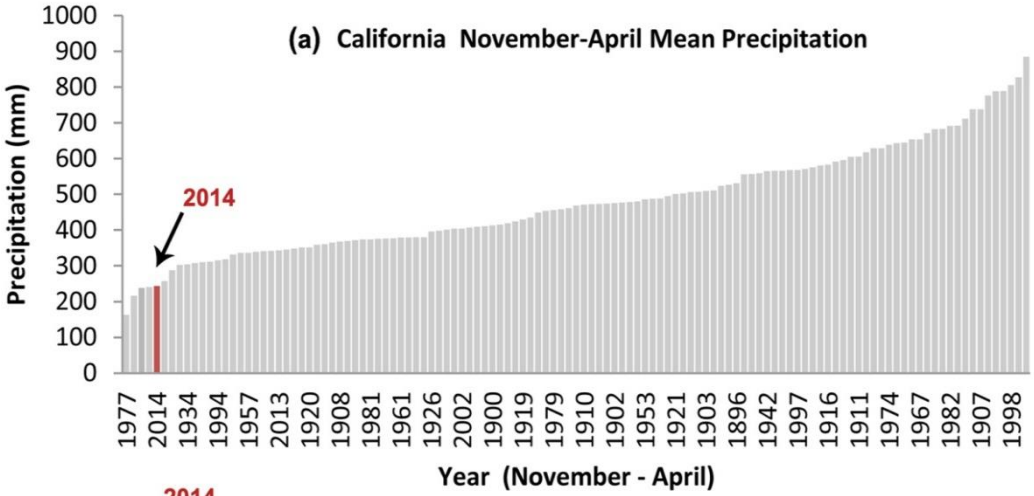
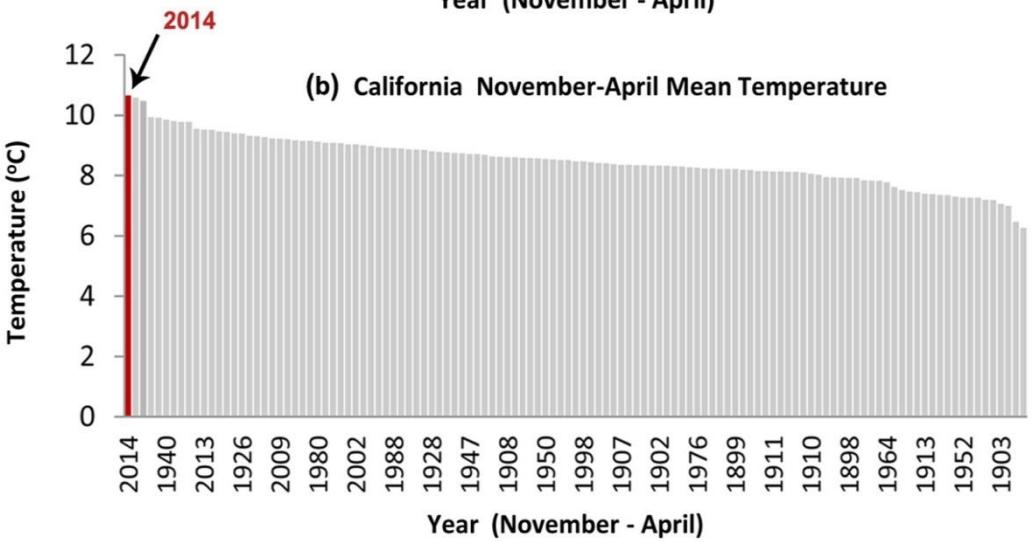
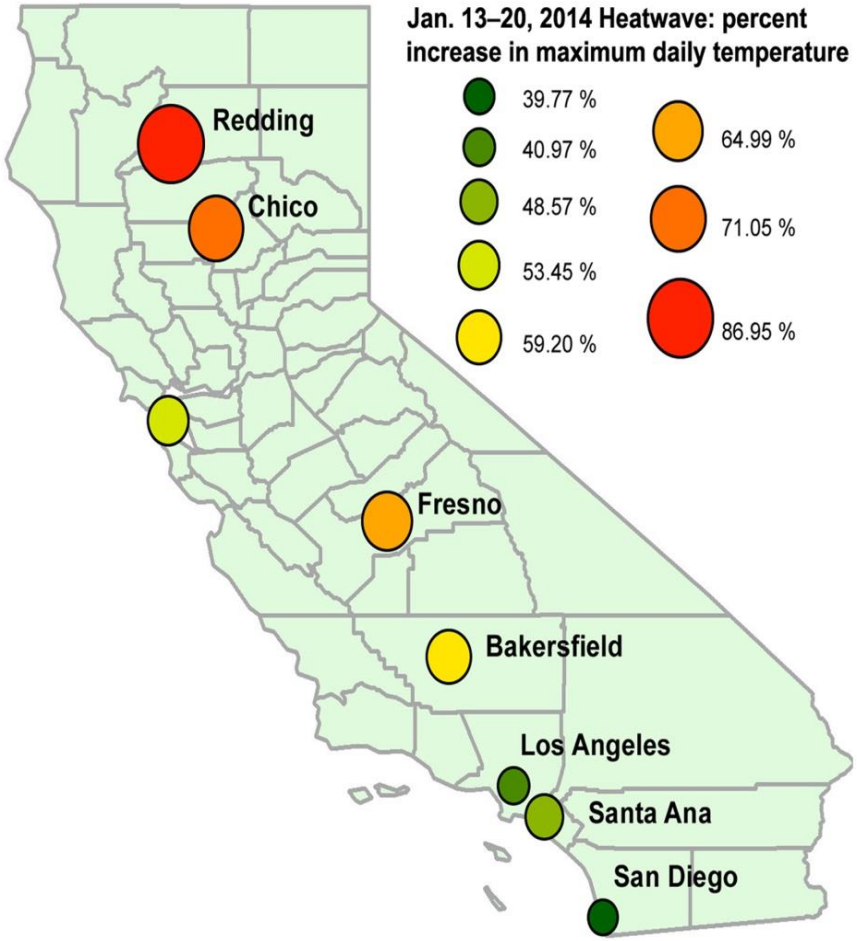


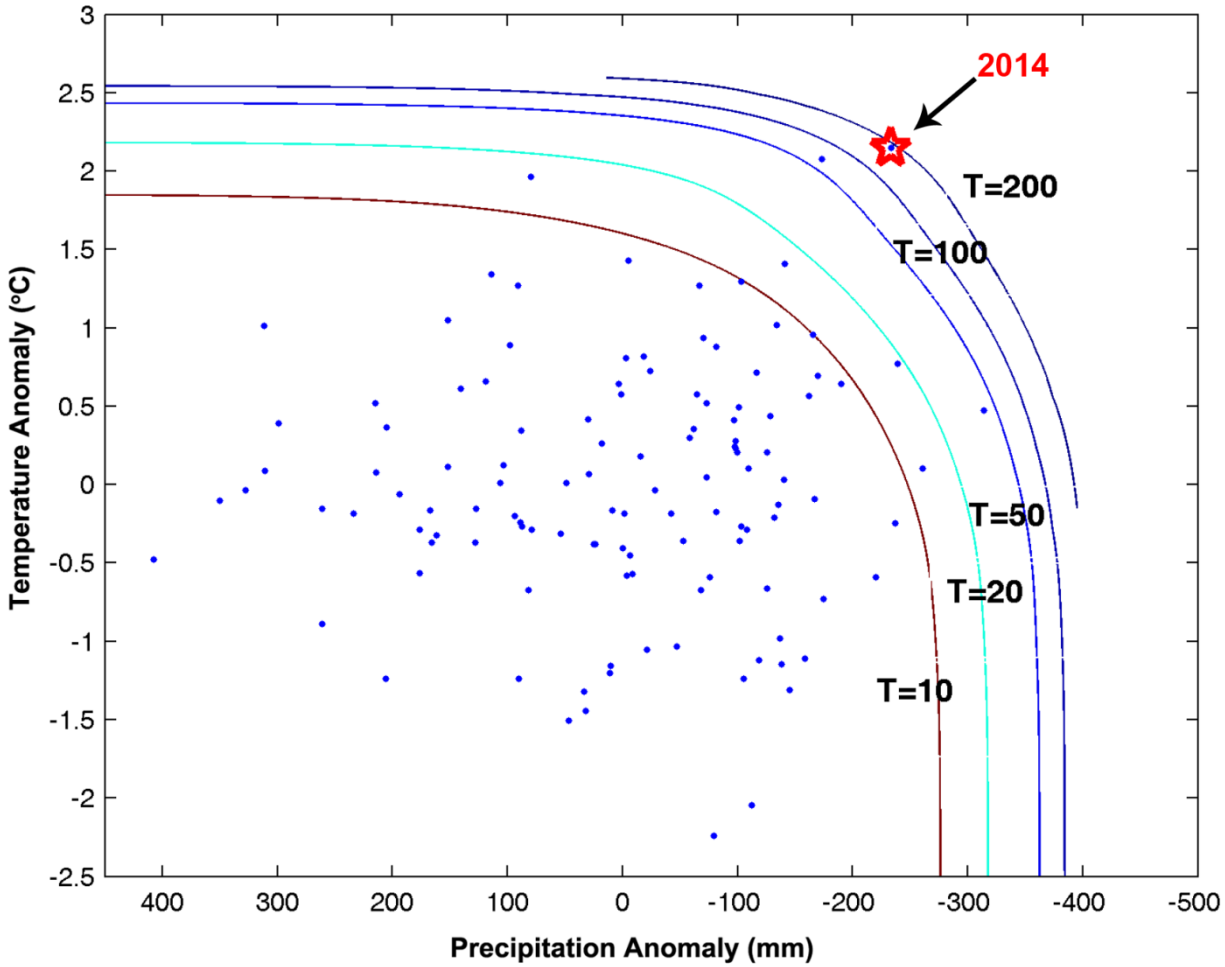
California Drought







AghaKouchak A., Cheng L., Mazdiyasni O., Farahmand A., 2014, Global Warming and Changes in Risk of Concurrent Climate Extremes: Insights from the 2014 California Drought, Geophysical Research Letters, doi: 10.1002/2014GL062308.



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We acknowledge support from:

NASA

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