Operational Near-real Time Drought Monitoring Using Global Satellite Precipitation Estimate

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Objectives

1. Evaluate the feasibility of using satellite precipitation Climate Data Records (CDRs) to detect and monitor drought on a global scale.

2. Implement the monthly and daily (running mean) SPI indices.

3. Evaluate SPI indices against in-situ indices and drought monitor over the continental US (and globally if possible).

4. Provide near-real time global monitoring capabilities using satellite precipitation data.

5. Develop an interactive global drought information dashboard to communicate drought information in near-real time.

Satellite CDR Precipitation Datasets

CMORPH-CDR (CPC P. Xie)

- Available 1998-Present (Daily) 0.25 x 0.25 degree (60N-60S, 0-360)
- Interim version of CMORPH-CDR is available routinely with 1-day lag-time (i.e. CMORPH-ICDR)
- The Bias-Adjusted version is available with 2-month lag-time

⇒ Use CMORPH-CDR + CMORPH-ICDR to detect and monitor droughts on a global scale in near-real time.

PERSIANN-CDR (UC-Irvine S. Sorooshian)

- Available 1983-Present (Daily) 0.25 x 0.25 degree (60N-60S, 0-360)
- The Bias-Adjusted version is available with 4-month lag-time
- Almost 40-year of Bias-Adjusted global daily precipitation data

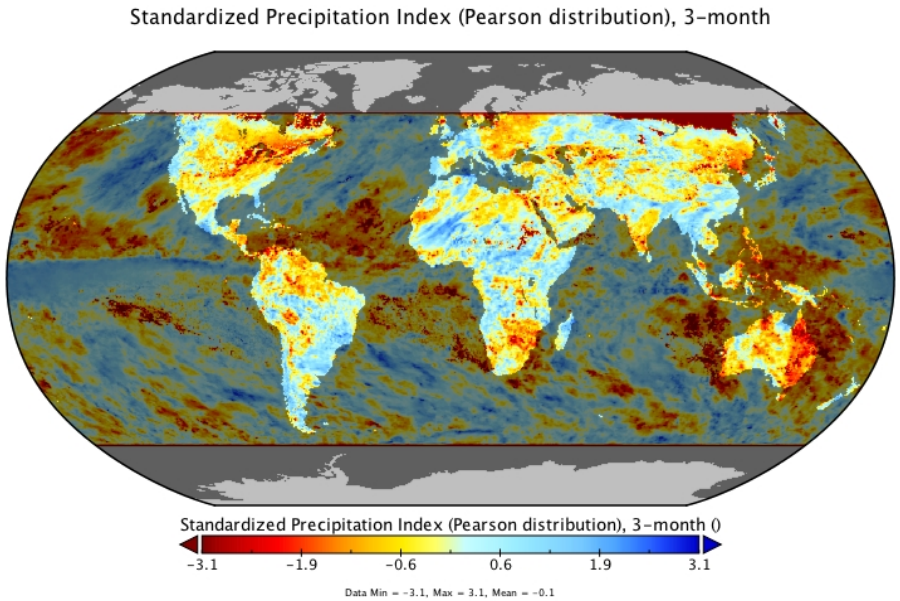
⇒ Use PERSIANN-CDR to increase the period of record (1983-) and quantify the SPI sensitivity to input rainfall data.

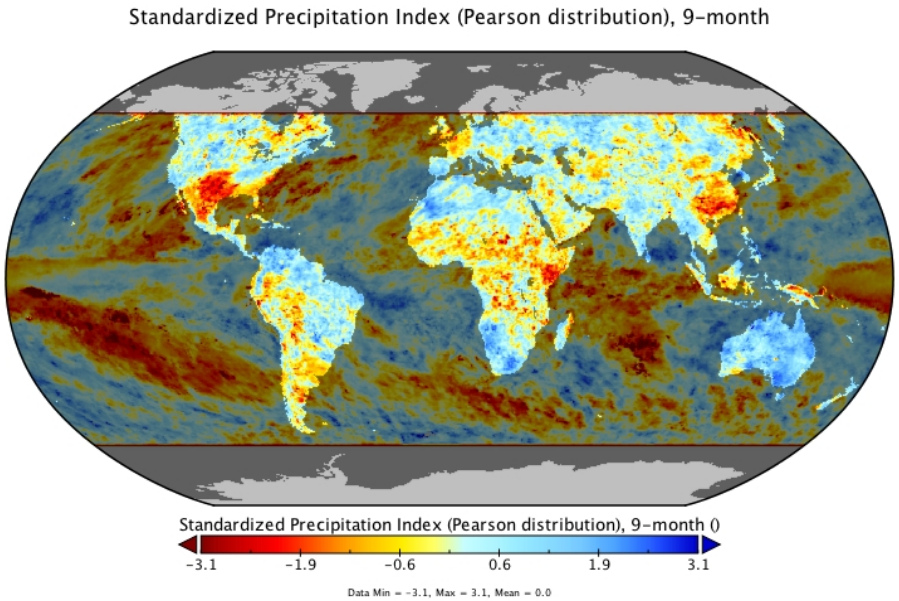
Monthly SPI : CMORPH vs. PERSIANN

3-month SPI : January 2003

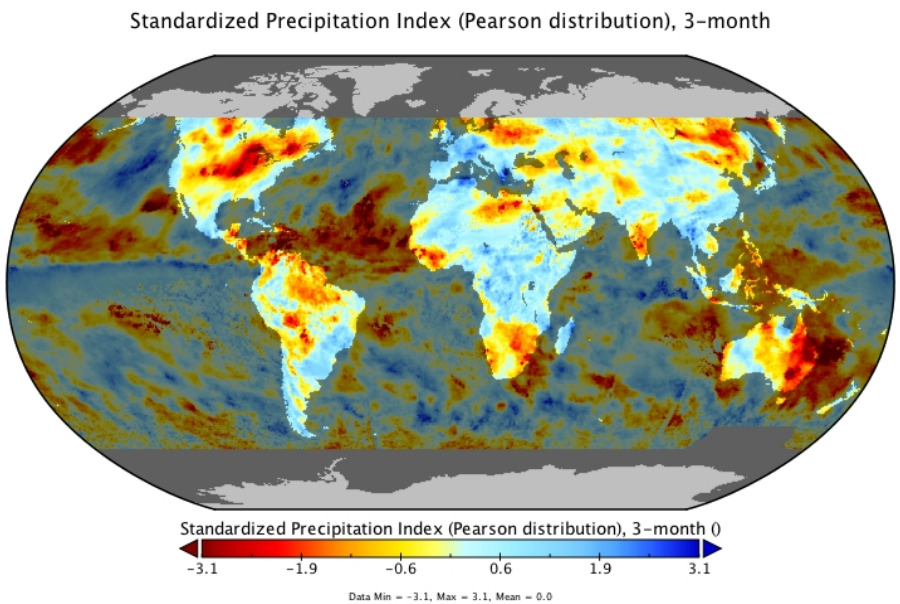
9-month SPI : July 2011

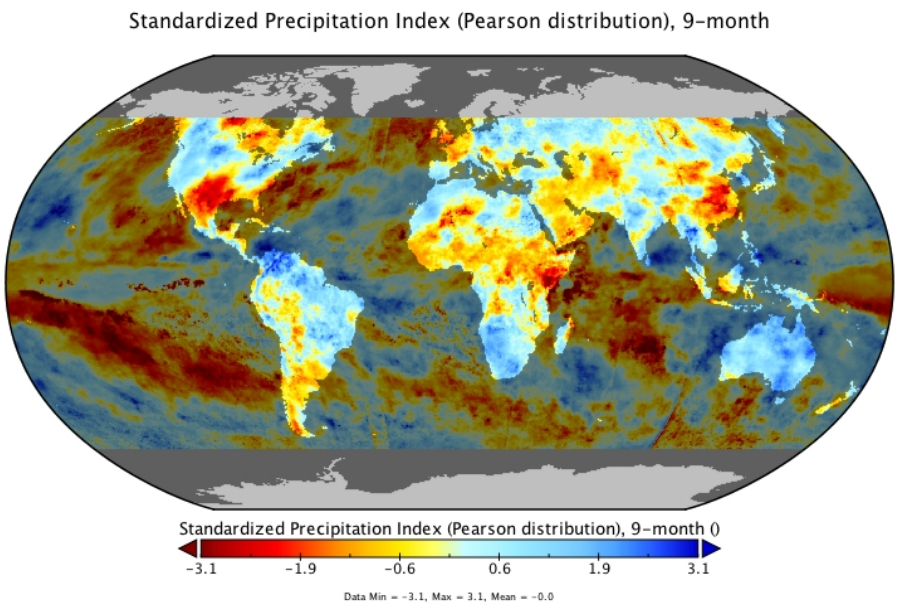
CMORPH



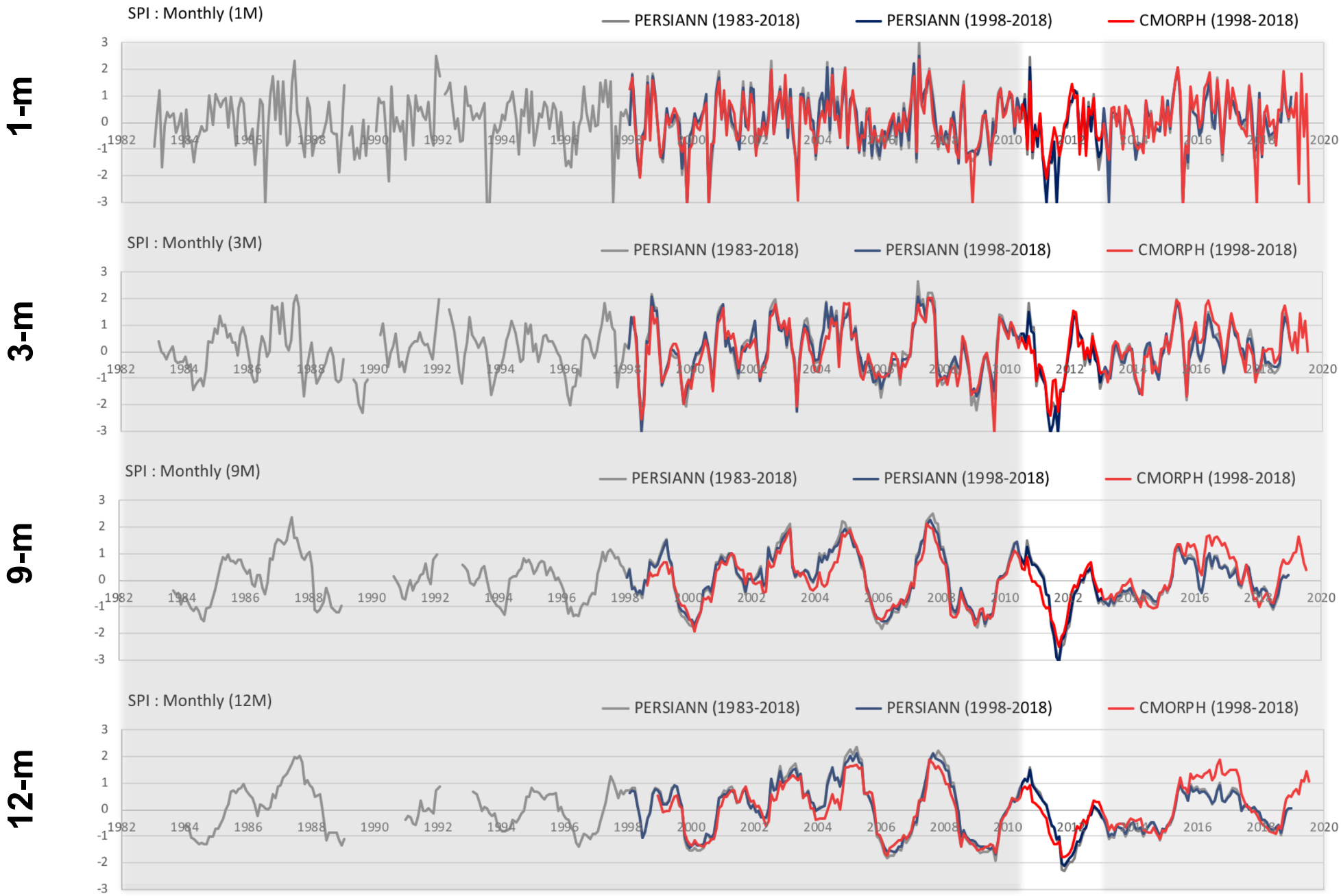


PERSIANN





Monthly SPI : CMORPH vs. PERSIANN



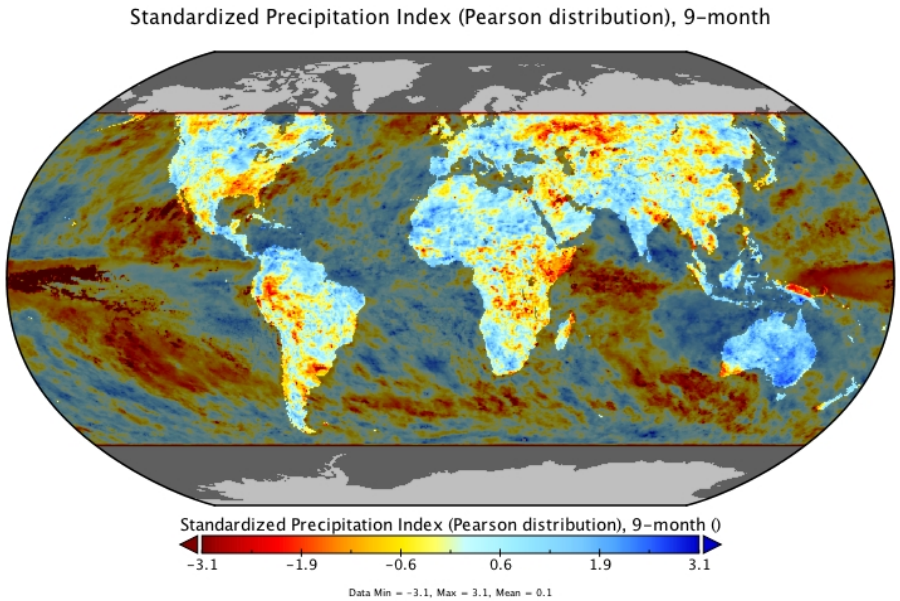
San Antonio (TX)

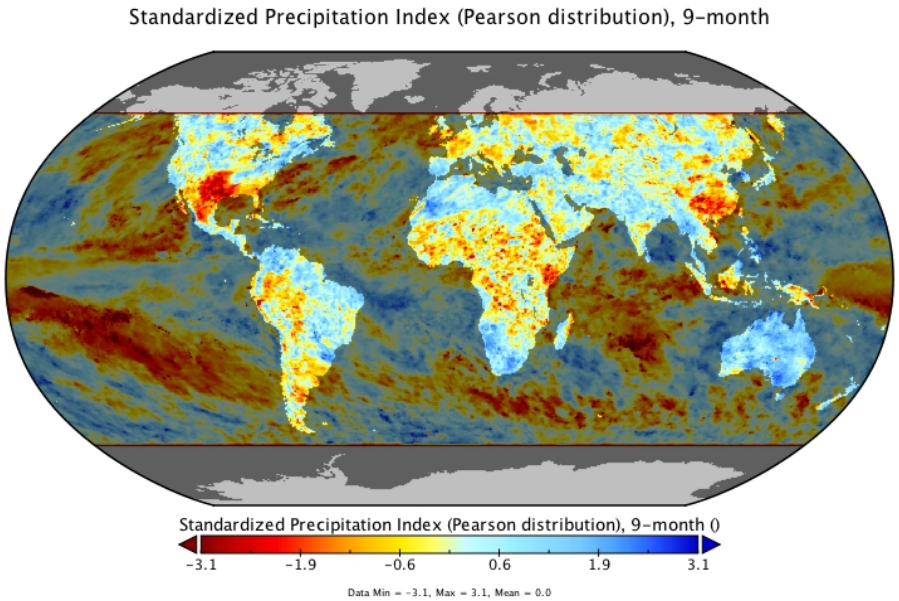
2010-2012 Texas-Mexican Drought

CMORPH SPI : Daily vs. Monthly

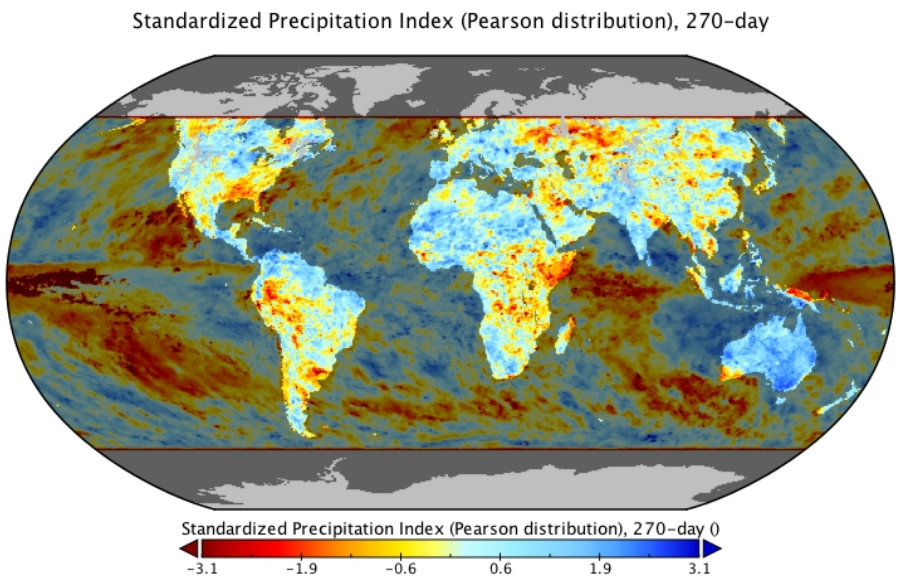
February 2011 | **August 2011**

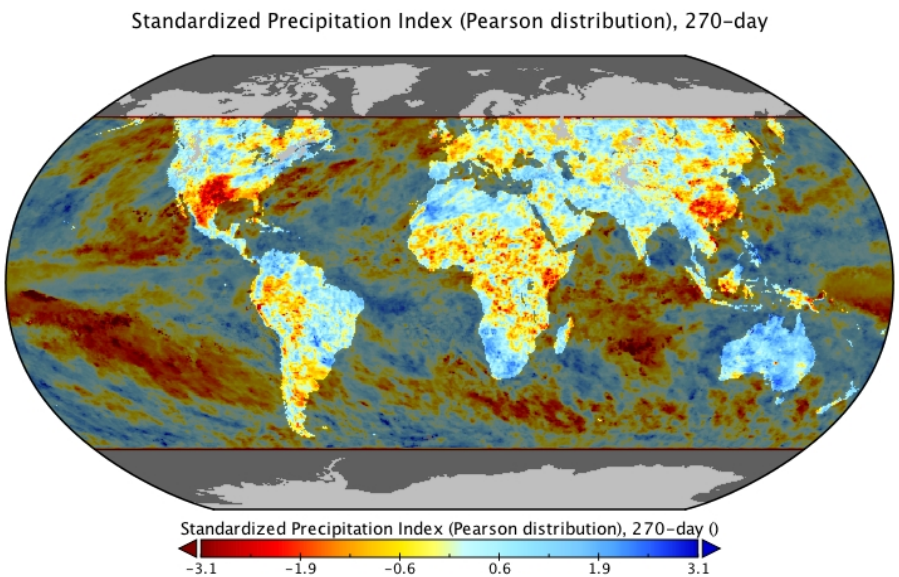
9-month





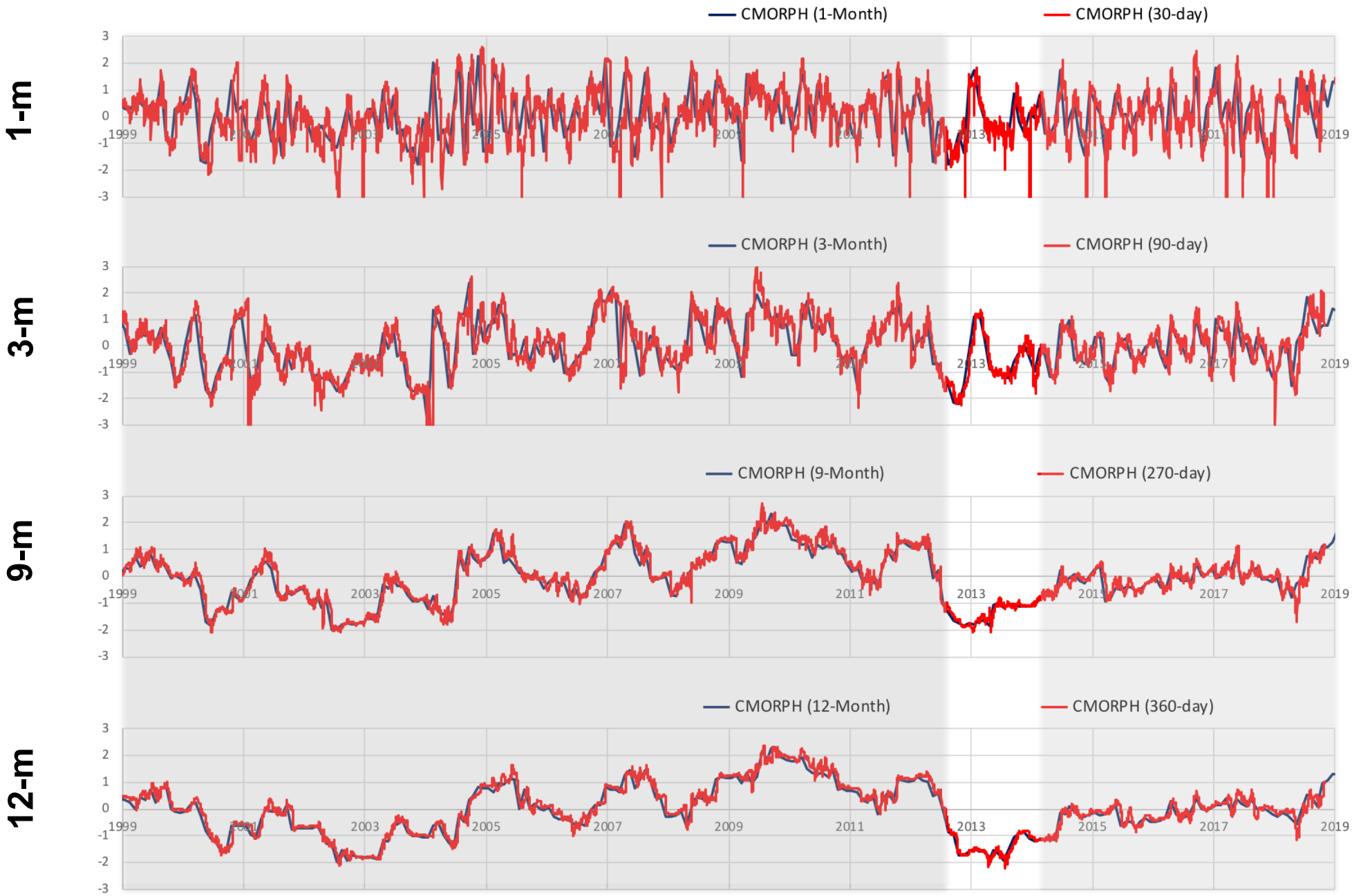
270-day





March 1 2011 | **September 1 2011**

CMORPH SPI : Daily vs. Monthly

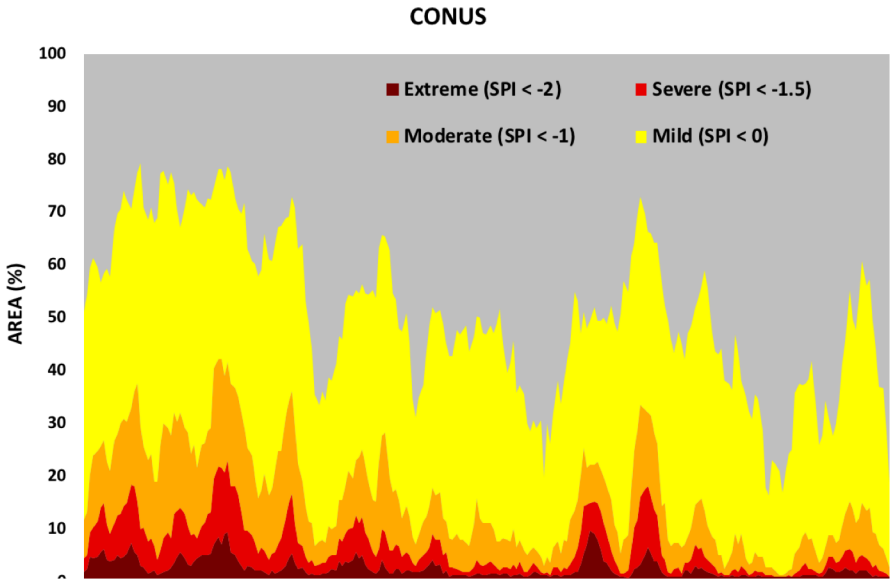


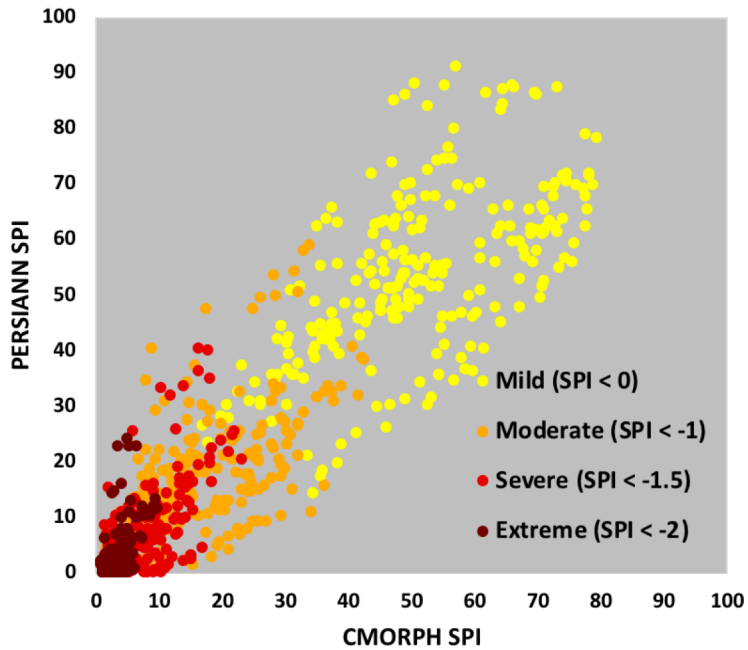
McCook (NE)

2012-2013 Midwestern Drought

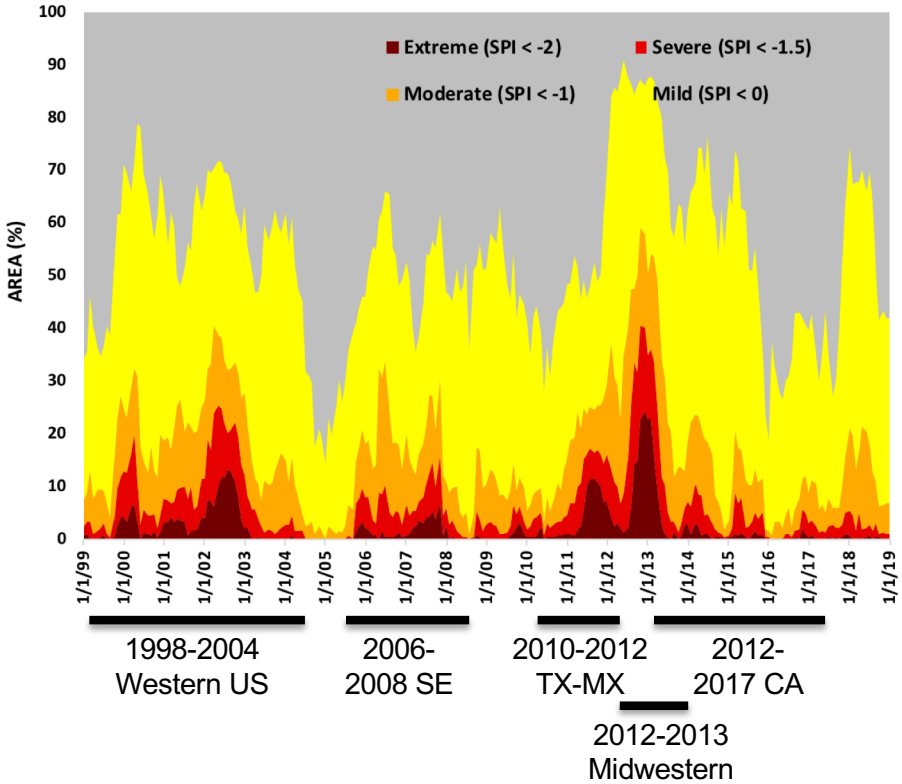
CONUS : 9-month SPI – CMORPH vs. PERSIANN

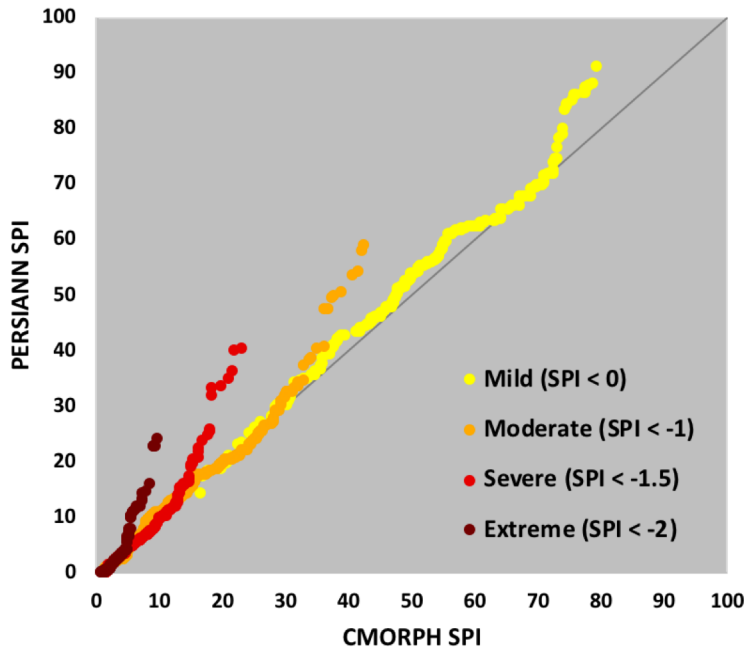
CMORPH



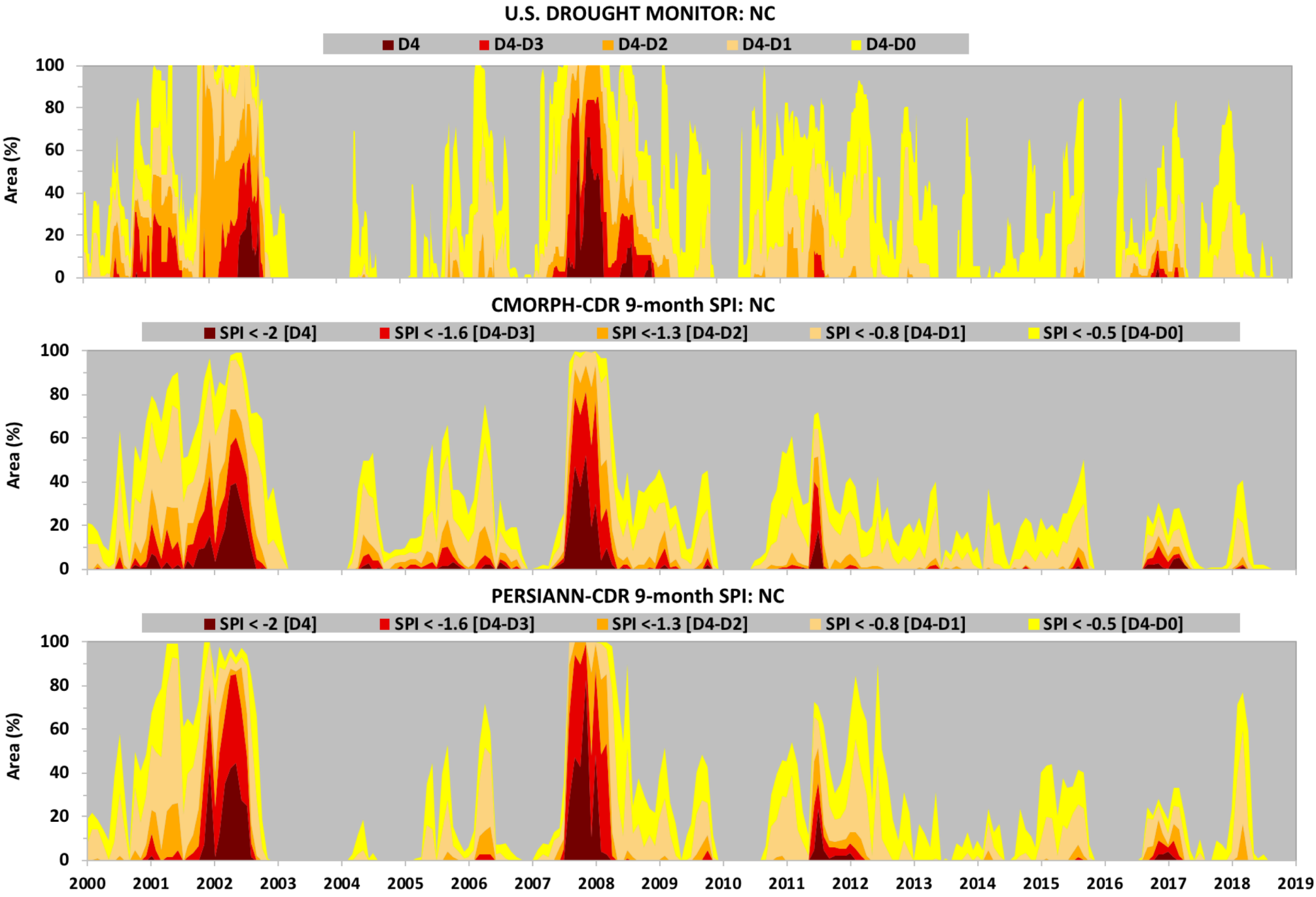


PERSIANN

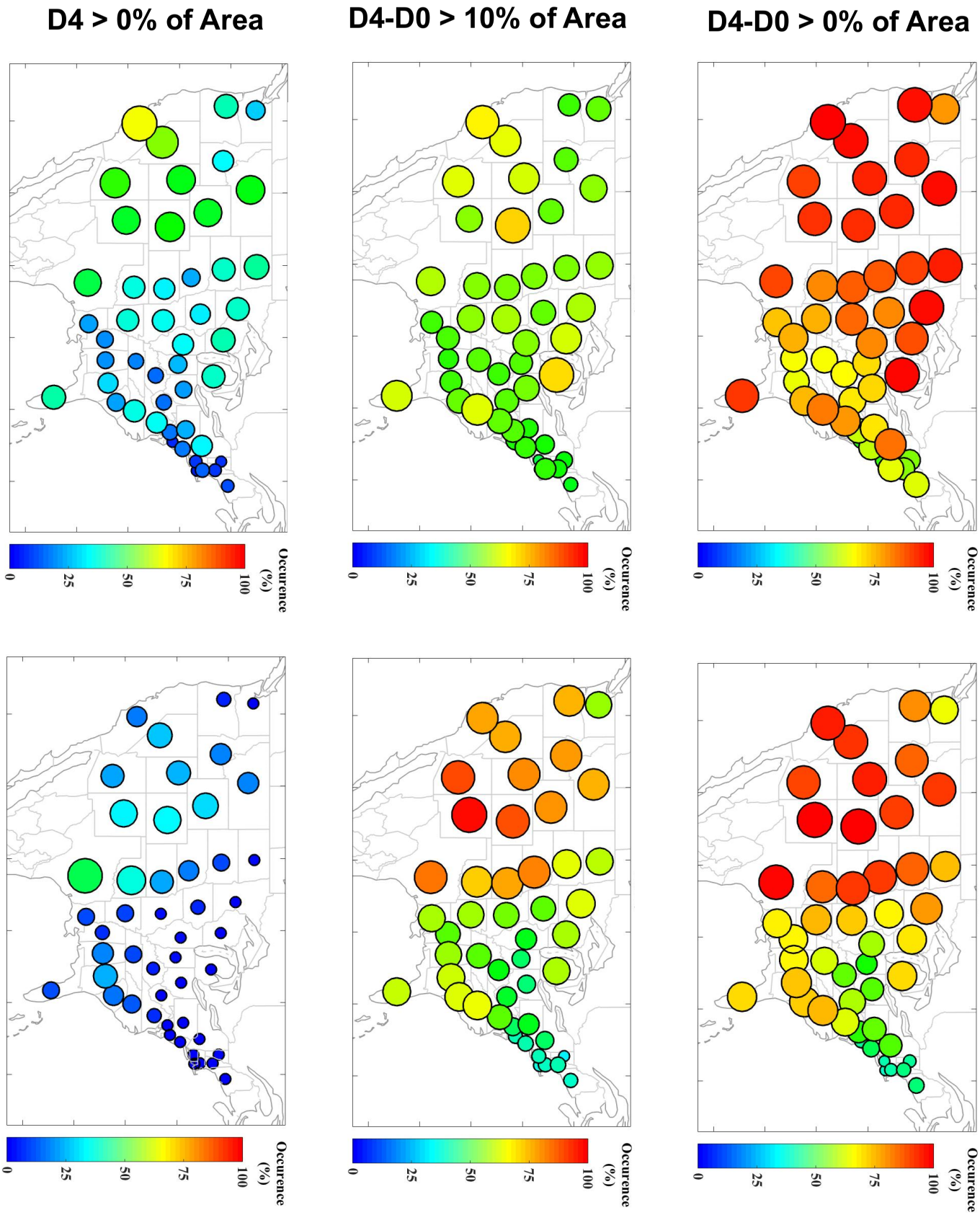




NORTH CAROLINA : 9-month SPI – Satellite vs. USDM

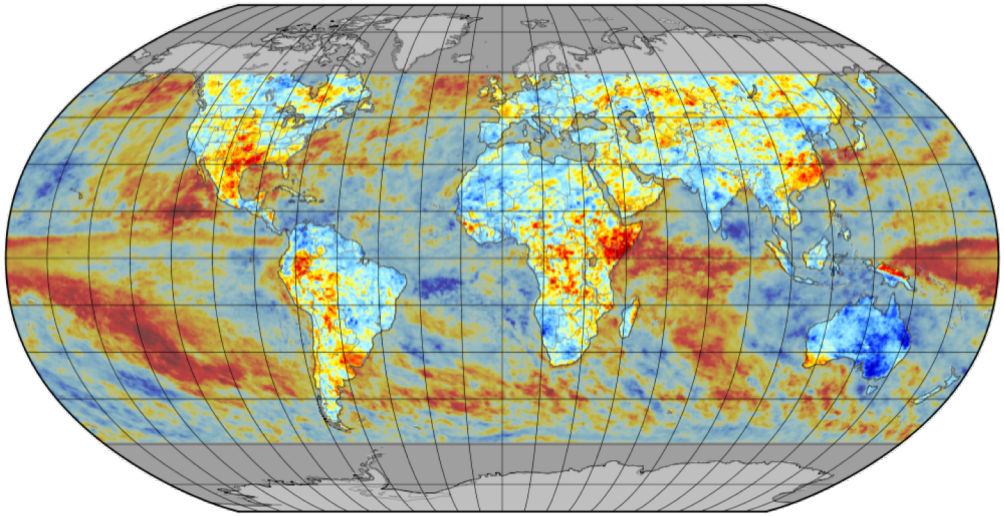


Drought Frequency
Satellite vs. USDM

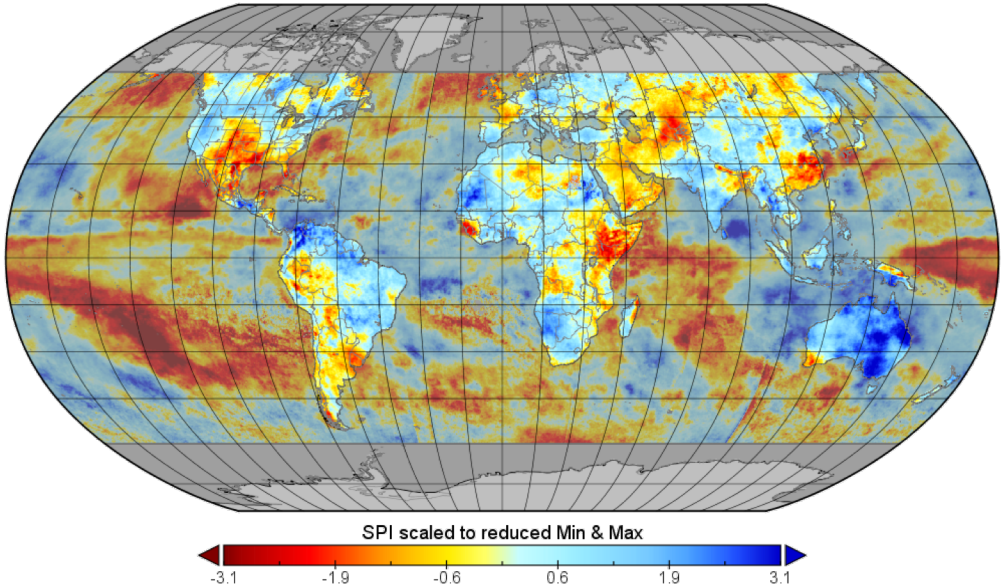


SPP SPI vs. GPCC_DI : April 2011

CMORPH SPI – 9-Month



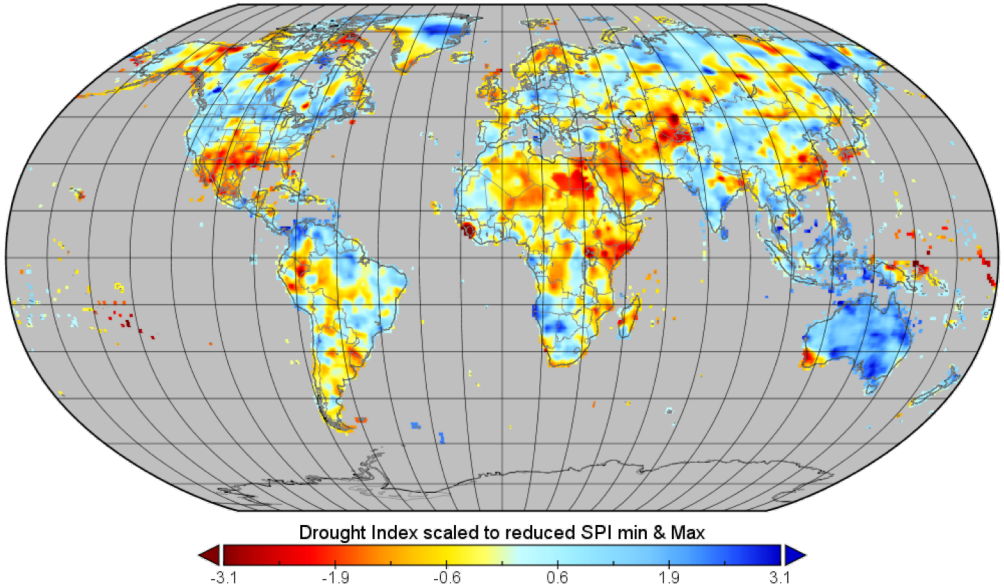
CMORPH SPI – 9-Month



SPP : Satellite Precipitation Products*

- **GPCC_DI available monthly since 2013.**
- **One month lag-time (now 01/02/2020).**
- **Average of SPI and SPEI.**

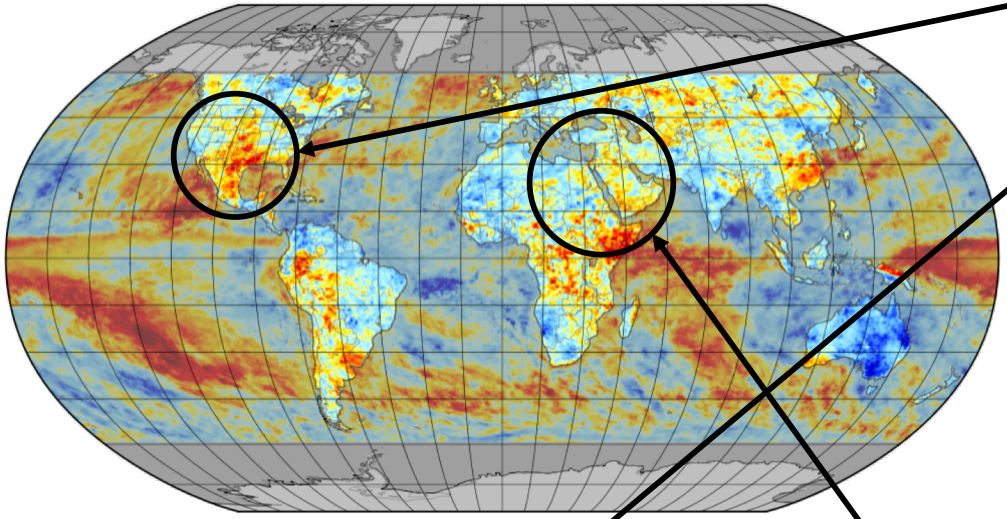
GPCC_DI – 9-Month



- **GPCC *'First Guess Product'* used for precipitation.**
- **CPC Monthly Global Surface Air Temperature Data used for PET.**

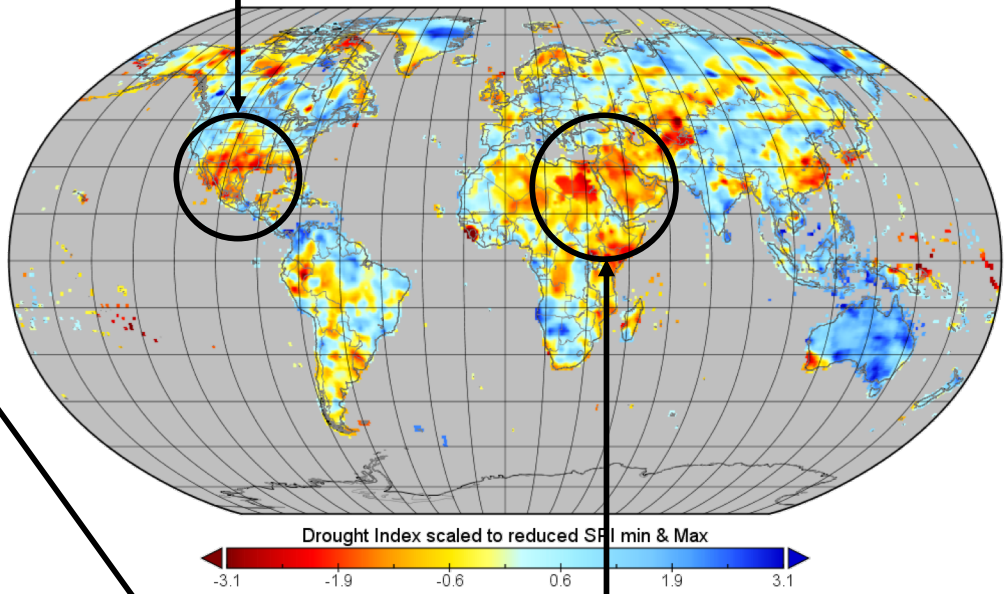
SPP SPI vs. GPCC_DI : April 2011

CMORPH SPI – 9-Month

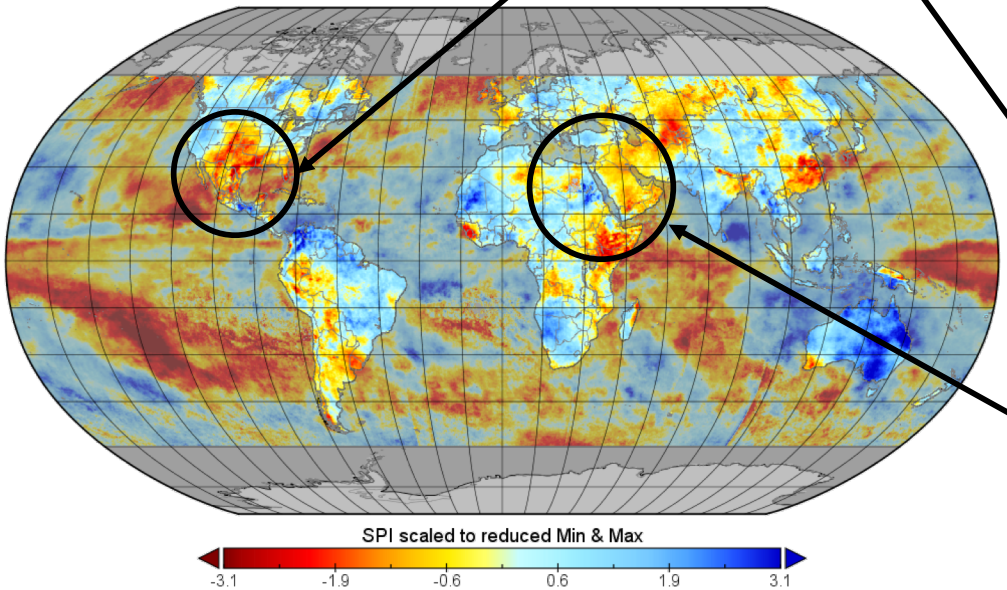


Comparable patterns between SPP and in-situ SPI (TX-MX)

GPCC_DI – 9-Month



CMORPH SPI – 9-Month

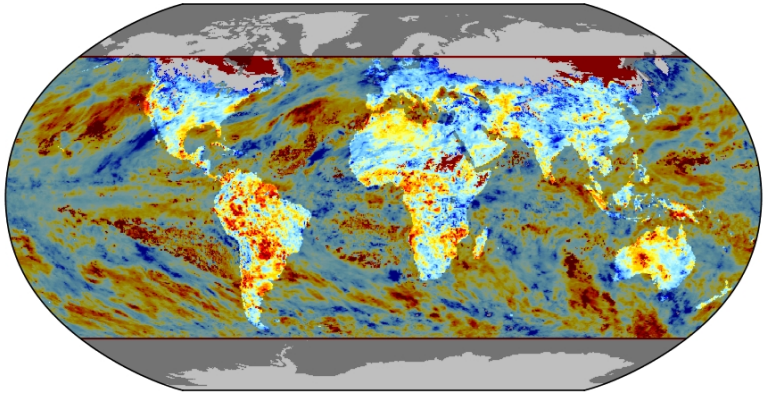


Important differences between SPP and in-situ SPI over desert areas

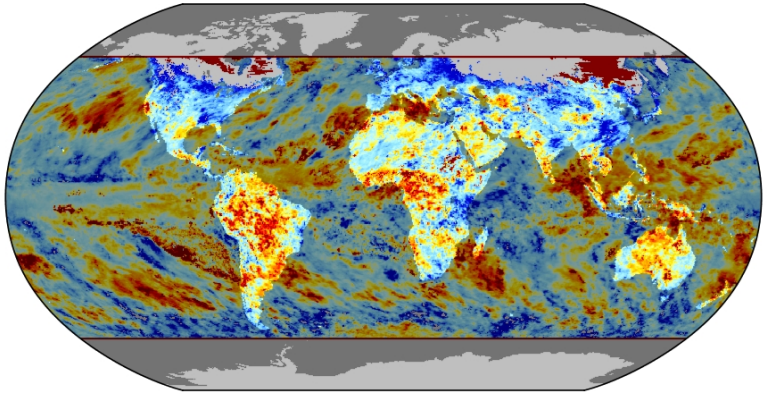
SPP : Satellite Precipitation Products*

Current Drought Conditions*

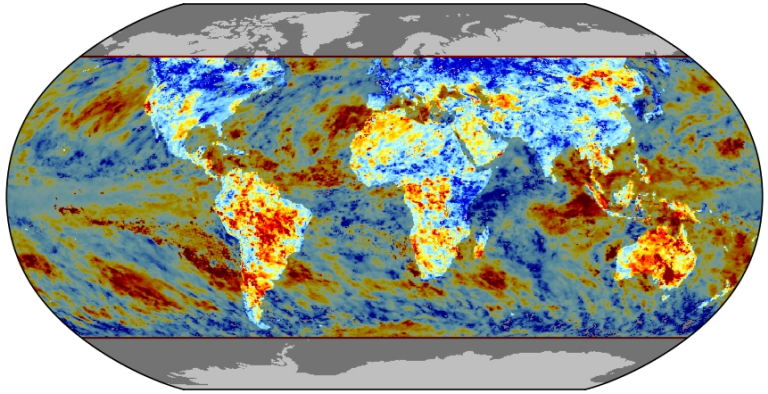
30-Day



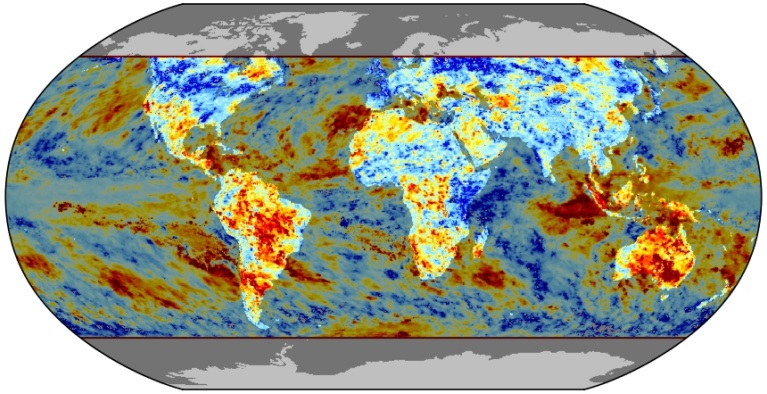
90-Day



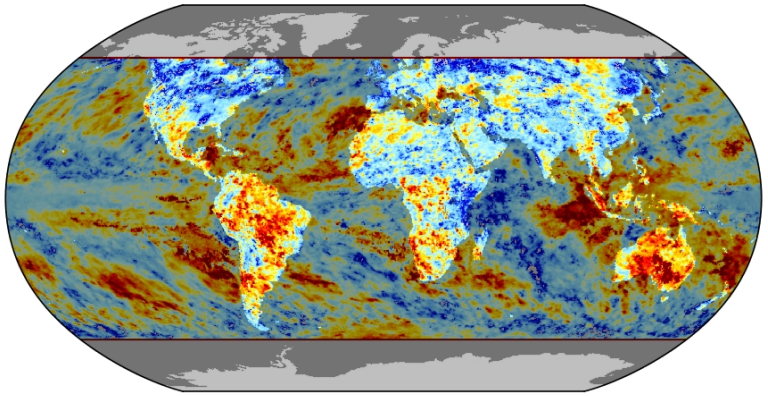
180-Day



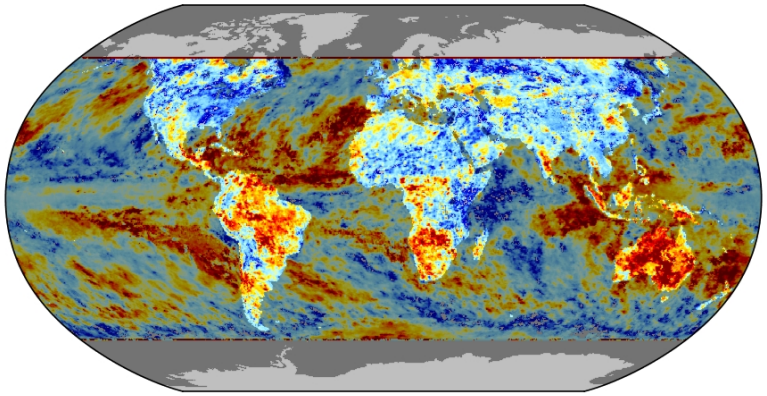
270-Day

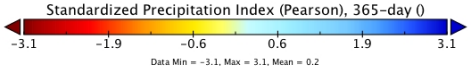


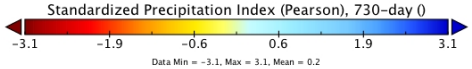
365-Day



730-Day



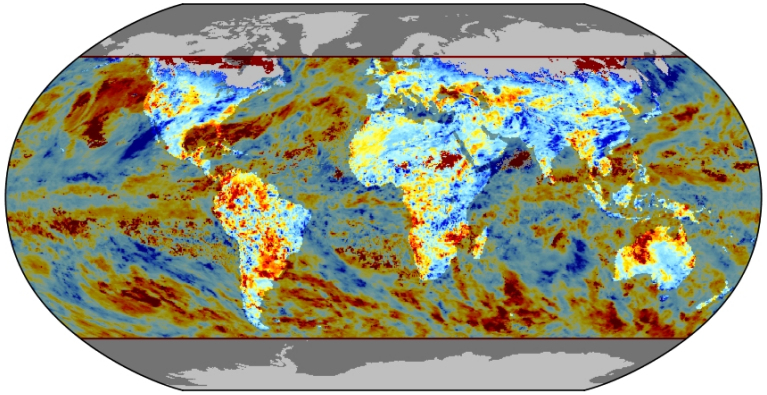




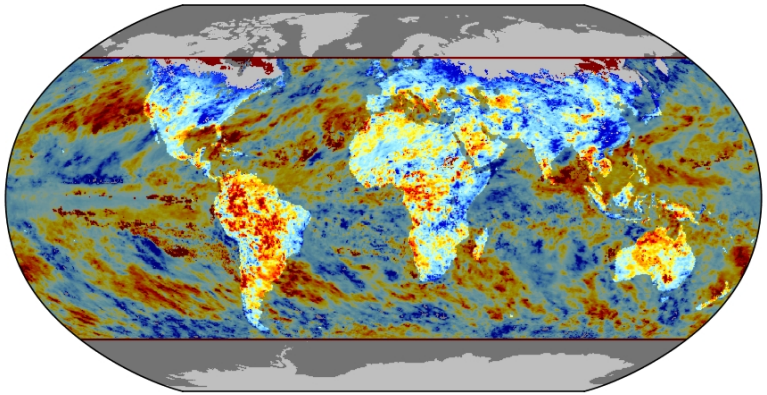
*March 15th

Current Drought Conditions*

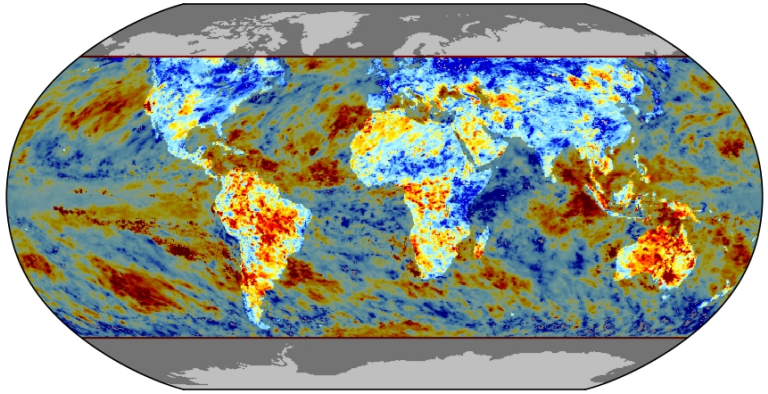
30-Day



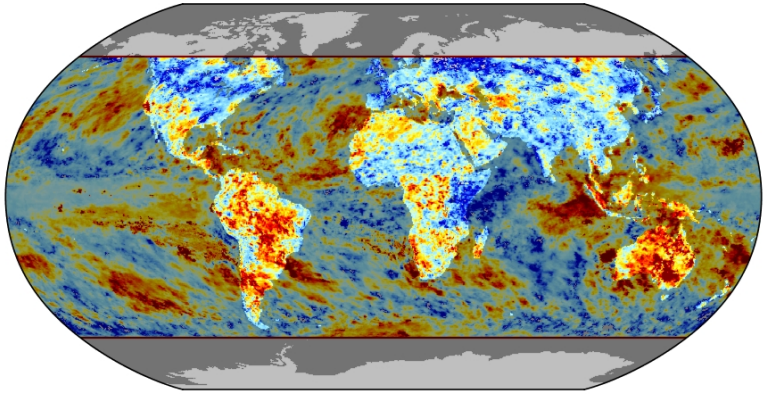
90-Day



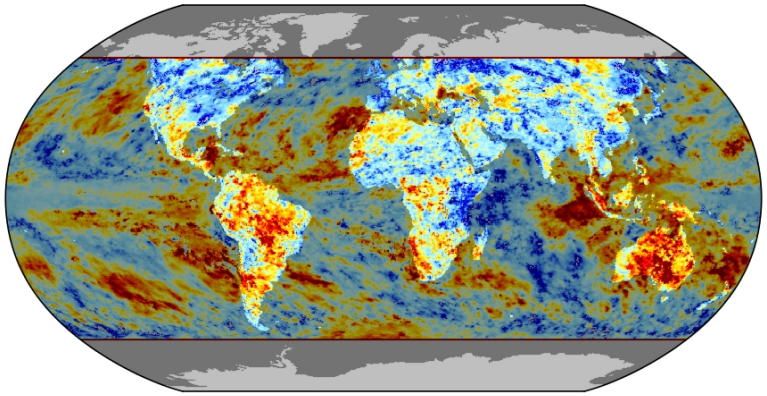
180-Day



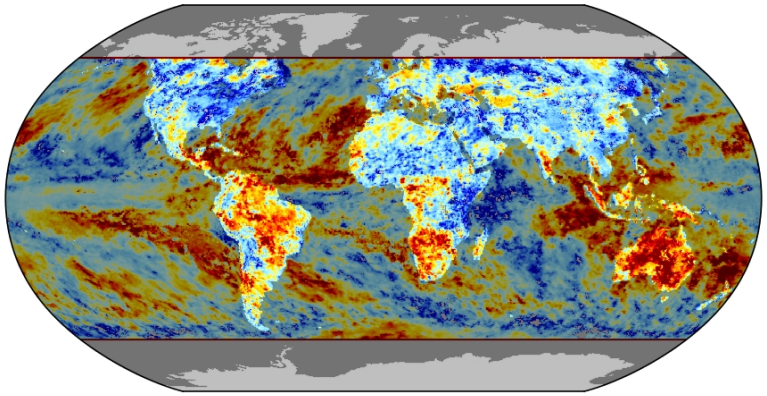
270-Day

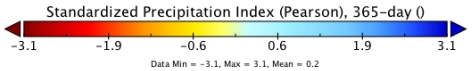


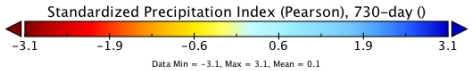
365-Day



730-Day



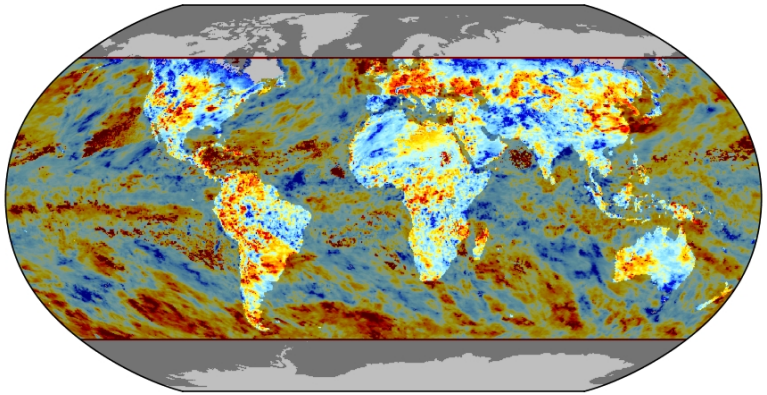




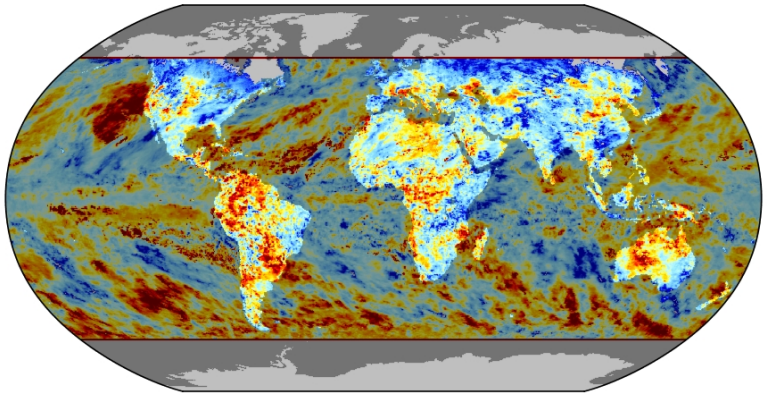
*April 1st

Current Drought Conditions*

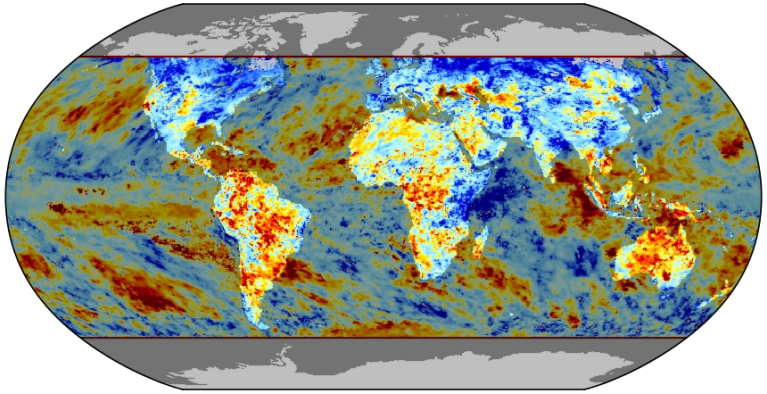
30-Day



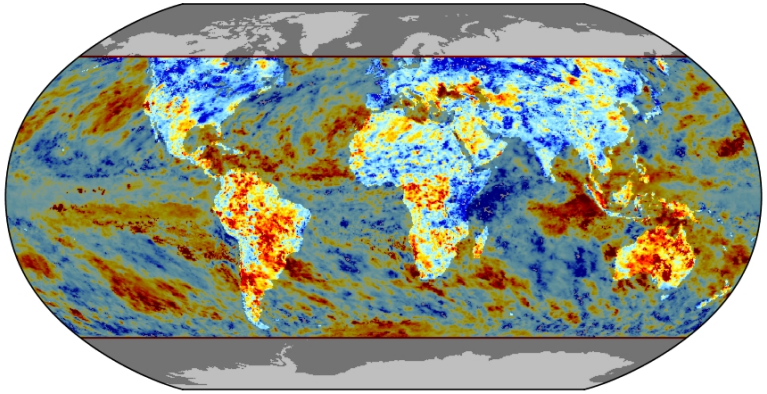
90-Day



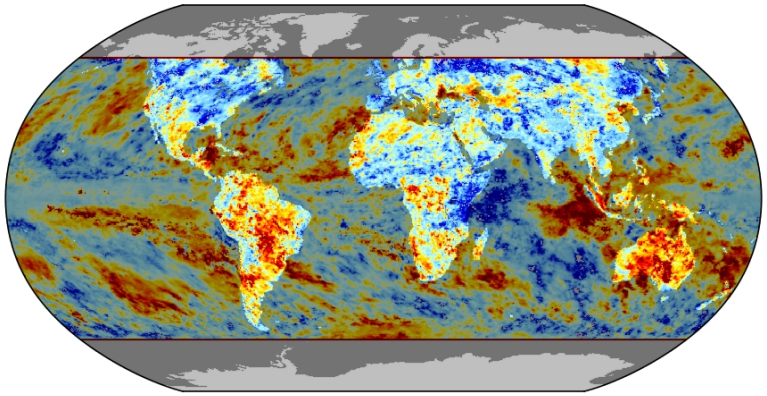
180-Day



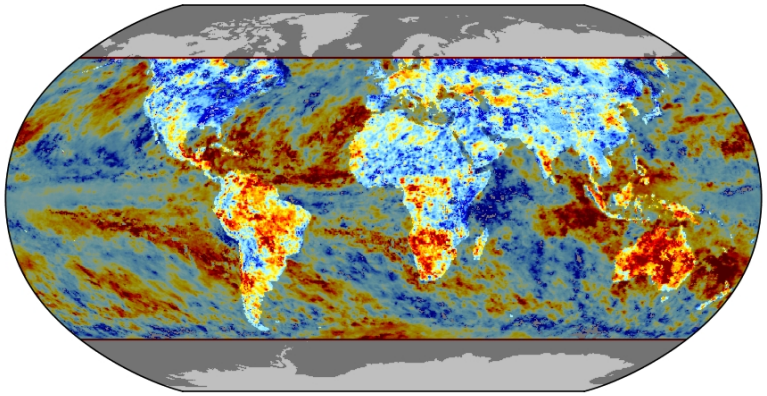
270-Day

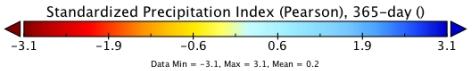


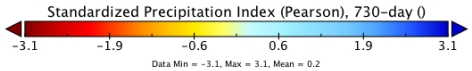
365-Day



730-Day







*May 1st

Conclusions

1. Monthly and daily SPI were implemented on a global scale using precipitation satellite data from CMORPH-CDR (since 1998) and PERSIANN-CDR (since 1983).

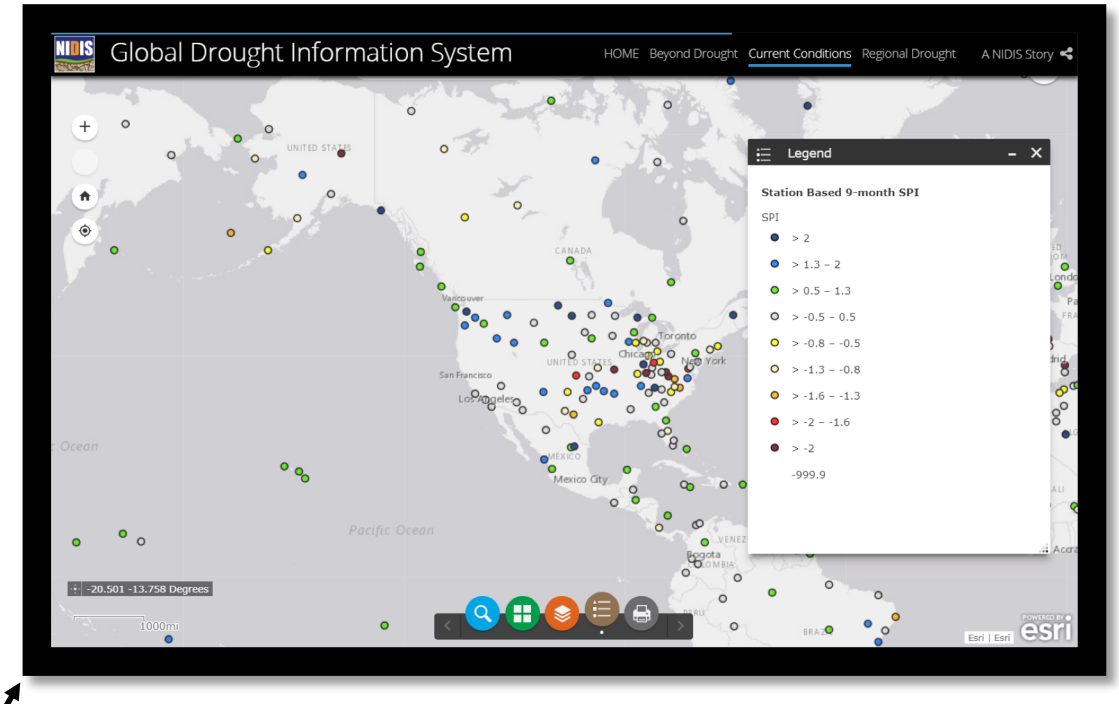
2. Both CMORPH-CDR and PERSIANN-CDR presented the same global patterns. Differences are observed locally in term SPI values and drought classification.

3. Both Monthly and Daily SPIs present the same timing and area for the major droughts episodes over CONUS and the globe.

4. Further validation is needed as results may differ in term of magnitude and severity when compared to SPI or other drought indices derived from in-situ data.

Interactive global drought information dashboard for near-real time drought monitoring

NIDIS (National Integrated Drought Information System) is developing an interactive global drought information dashboard to provide timely drought monitoring resources to mitigate drought information and assess disparities between global and regional scales.



Global current conditions according to station data

Courtright et al. (AGU 2019)

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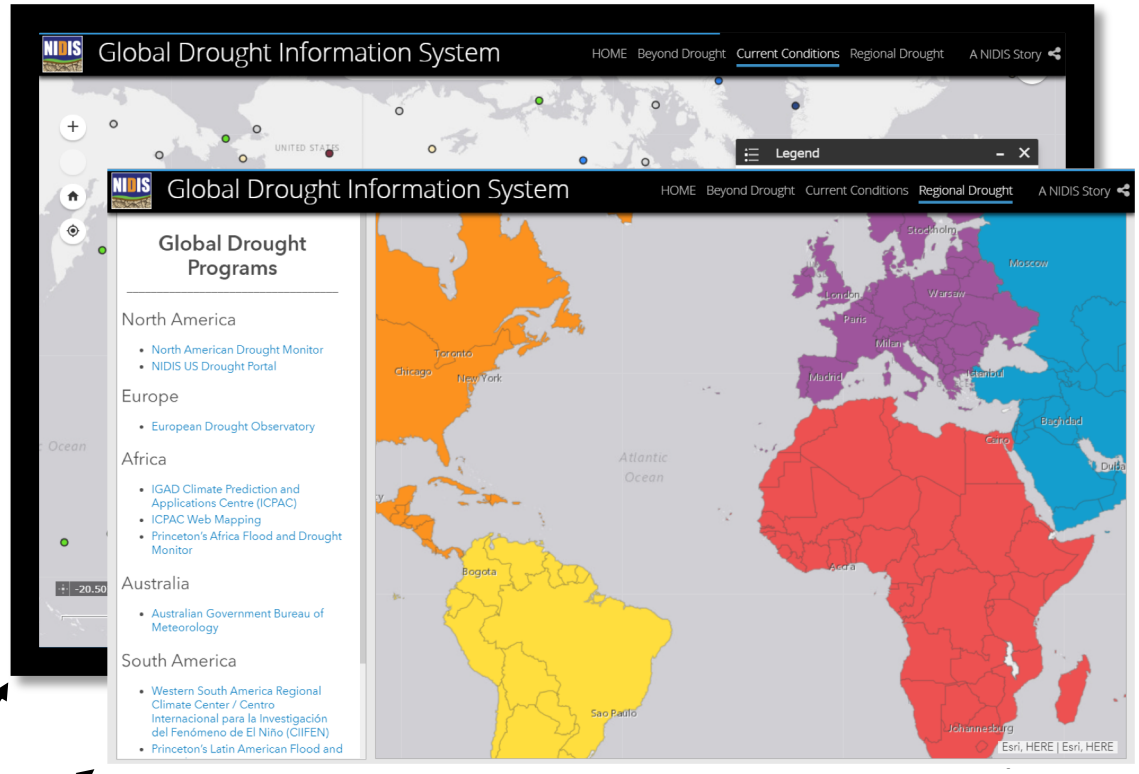

External , region specific drought resources

Courtright et al. (AGU 2019)

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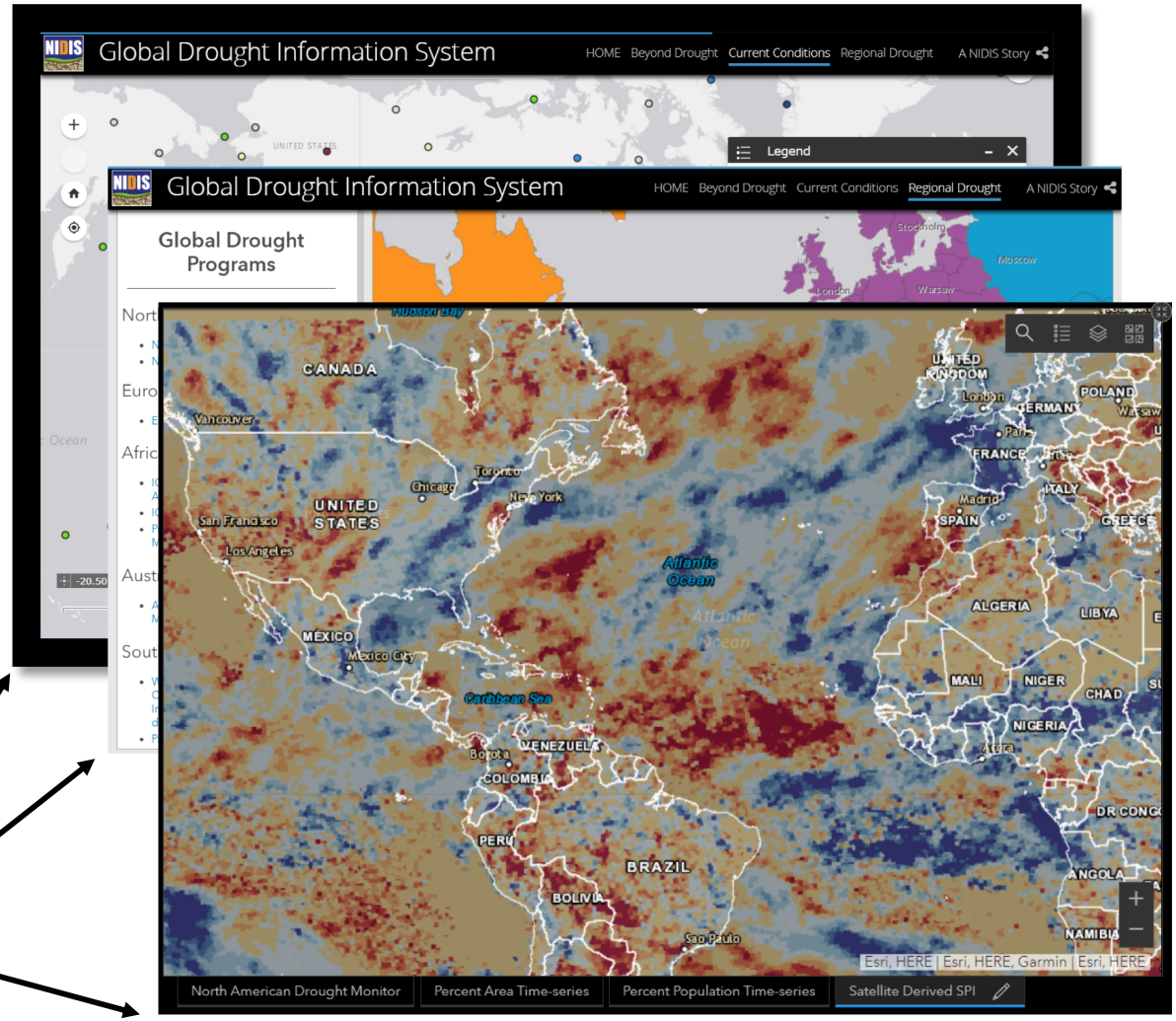

Near-real time Satellite derived SPI

Courtright et al. (AGU 2019)

Interactive global drought information dashboard for near-real time drought monitoring

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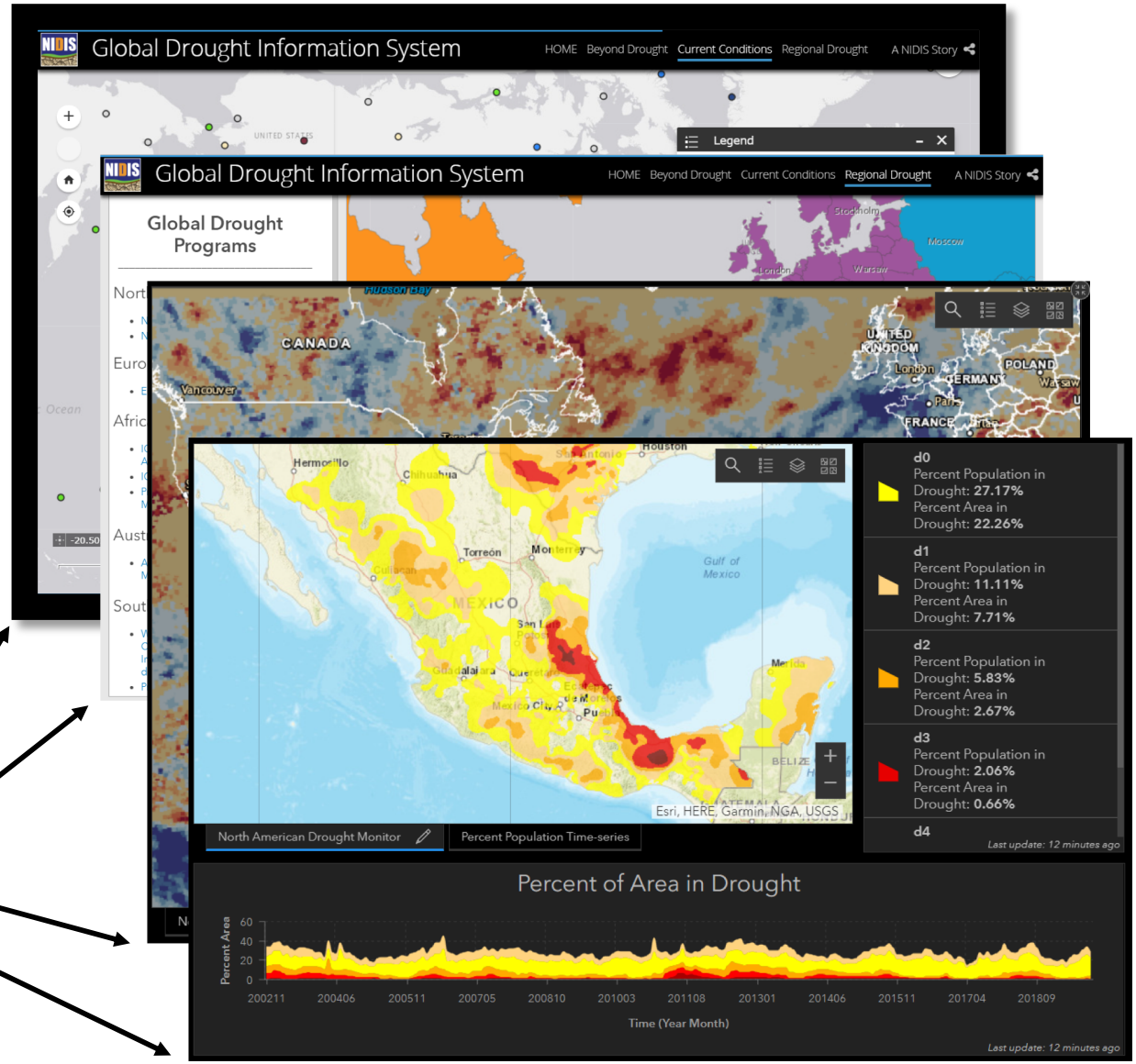

NA drought conditions map and percent area drought coverage time-series graph

Courtright et al. (AGU 2019)

Near-real Time Drought Monitoring Using CMORPH-CDR and ICDR :

1. **Operational Products:**
   - **Monthly and daily SPI values are routinely calculated globally.**
   - **A Near-real time, global, daily SPI is available within 1-day to the current day *(i.e. when ICDR is available).***
2. **Data Product services:**
   - **Operational SPI products will be provided to the public through an Interactive Global Drought Information Dashboard.**
   - **A beta version of the near-real time SPI products will be available through a NOAA/NCEI website. It will complement in-situ derived drought indices (SPI, SPEI, PDSI). Release will coincide with the new Drought.gov website in May/June.**

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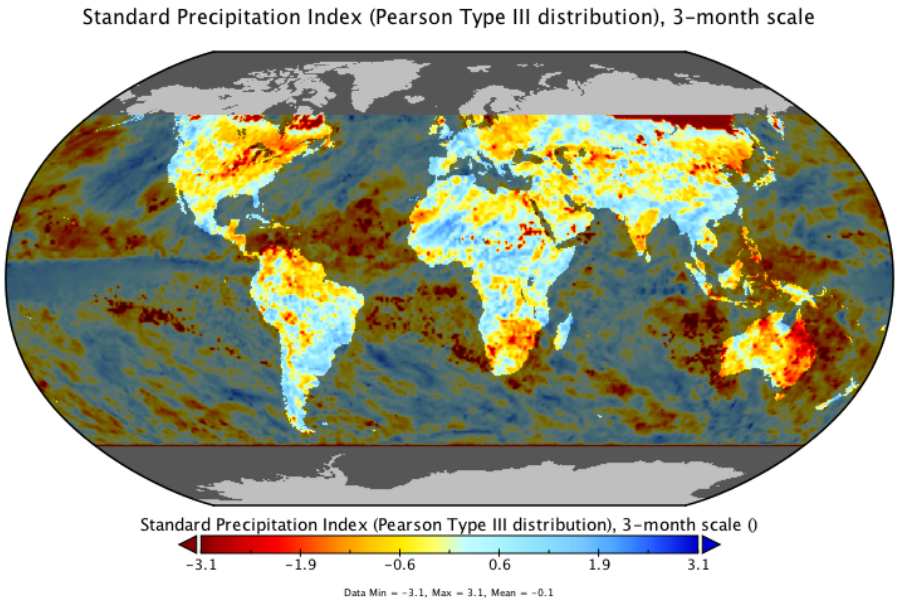
Additional Slides
Discussion

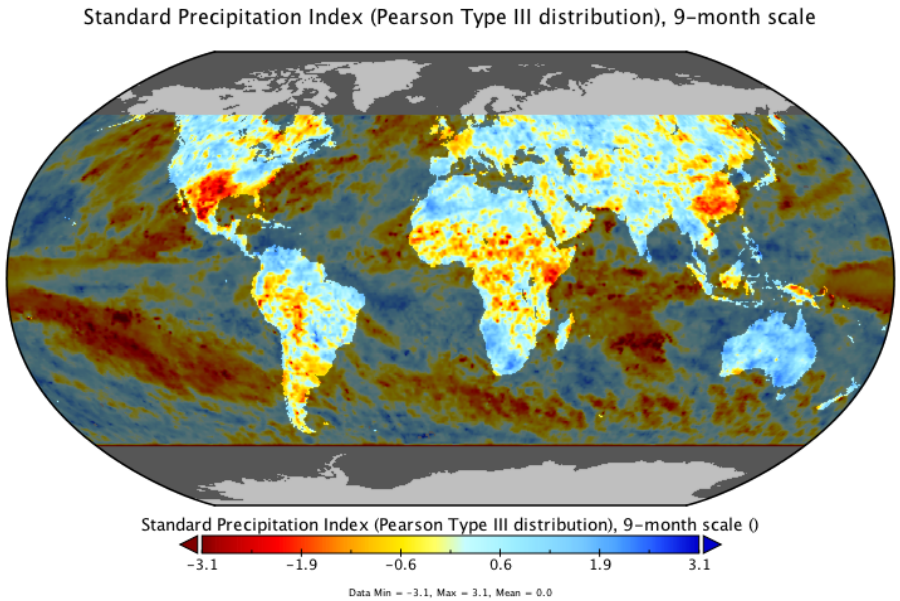
Monthly SPI : Bias-Adjusted vs. Real-Time

3-month SPI : January 2003

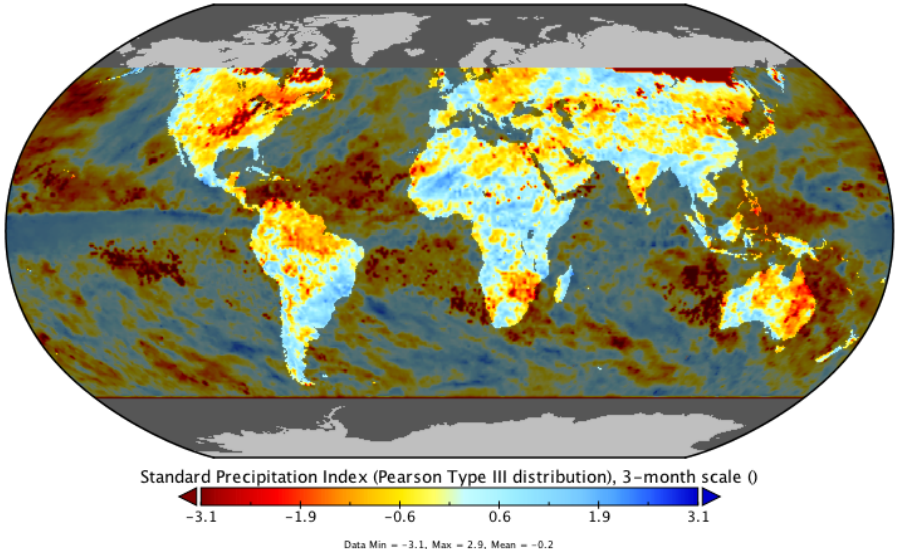
9-month SPI : July 2011

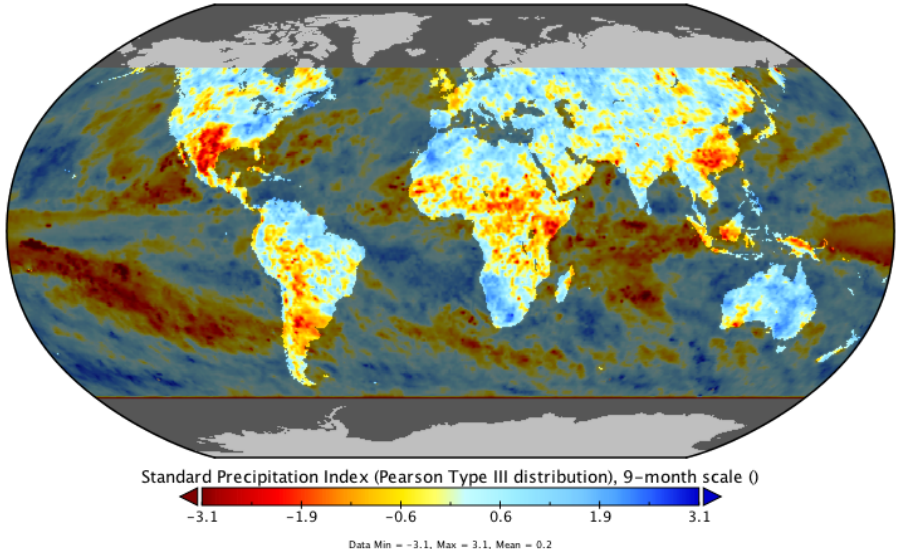
CMORPH-CDR Bias-Adjusted





CMORPH-ICDR Real-Time





⇒ Differences between SPIs computed with CMORPH-CDR and CMORPH-ICDR over the period 1998-2017.