



Improving assessment of regional climate change in supporting regional resilience to extreme climate events over the US Southern Great Plains: *Developing a flash drought warning indicator (IFDW)*

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“Flash droughts” and their predictability

- Droughts that intensify rapidly over the spring and summer, coupled with a strong increase in surface temperature in the summer (e.g. 2011 Texas, 2012 Great Plains)
- Seasonal climate forecast models were largely unable to predict the observed intensification in both the 2011 and 2012 events. *Why?*
- Models have weaknesses in predicting summer rainfall and soil moisture feedback correctly
- They perform better at capturing large scale atmospheric circulation anomalies – e.g. blocking high pressure systems, wind anomalies, surface temperature anomalies, etc.

Scientific basis of the IFDW

- Developed based on atmospheric circulation and land surface conditions in the winter/spring known to influence and subsequent summer (June-Aug) precipitation

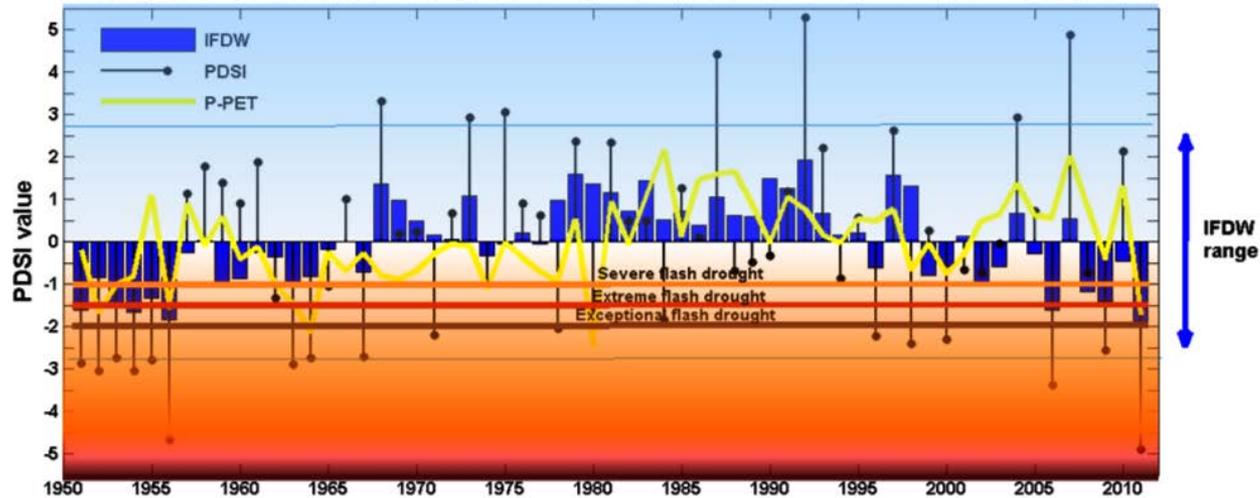
$$D(x, y, t+3) = F[\delta Z^*_{500\text{hPa}}(x, y, t)] + G\left[\int_{t_0}^t (\delta ET - \delta P) dt\right] + H[\delta T_{700\text{hPa}}(x, y, t) - \delta T_d(x, y, t)]$$

$$I_{\text{FDW}}(x, y, t+3) = [D(x, y, t+3) - D(x, y, t)] / \sigma_{D(x, y, t)}$$

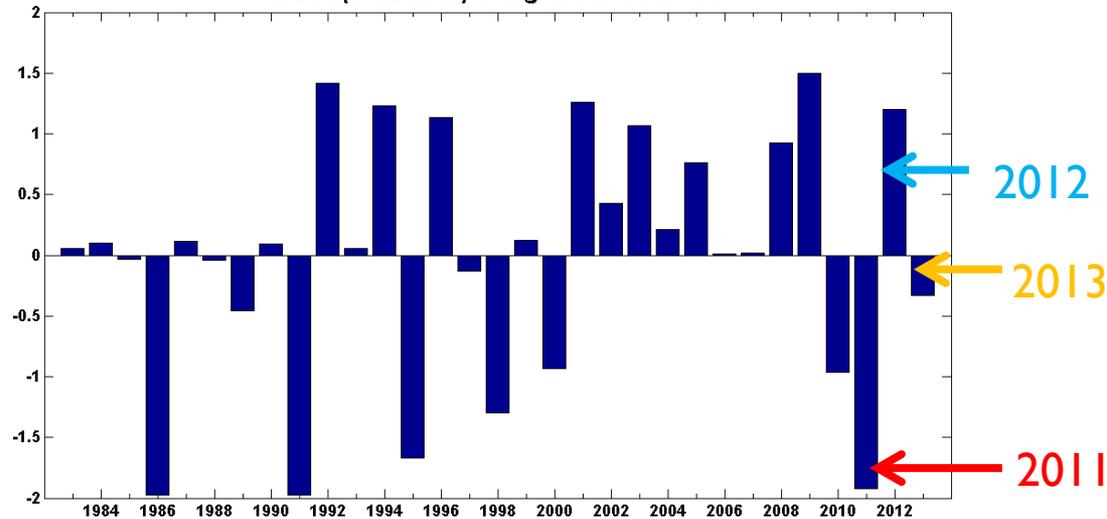
- *April 500 hPa geopotential height anomalies reconstructed from leading mode of rotated empirical orthogonal function (REOF) of detrended Z500hPa over the Great Plains*
- *Cumulative P-ET from November to April*
- *April difference in temperature at 700 hPa and surface dewpoint (proxy for Convective Inhibition or CIN at the surface)*

Performance of the IFDW: *prototype and real-time forecast*

Prototype IFDW, mean JJA PDSI and cumulative JJA P-PET for South Central US



IFDW (1982-2013) using observed fields



Projected flash droughts using CMIP5 data

Probability density function for observed (1976-2005), CCSM historical (1976-2005) and CCSM RCP8.5 (2051-2080)

