

Skillful Week 3-4 Prediction of United States Extreme Warm Days and SPI in Boreal Summer

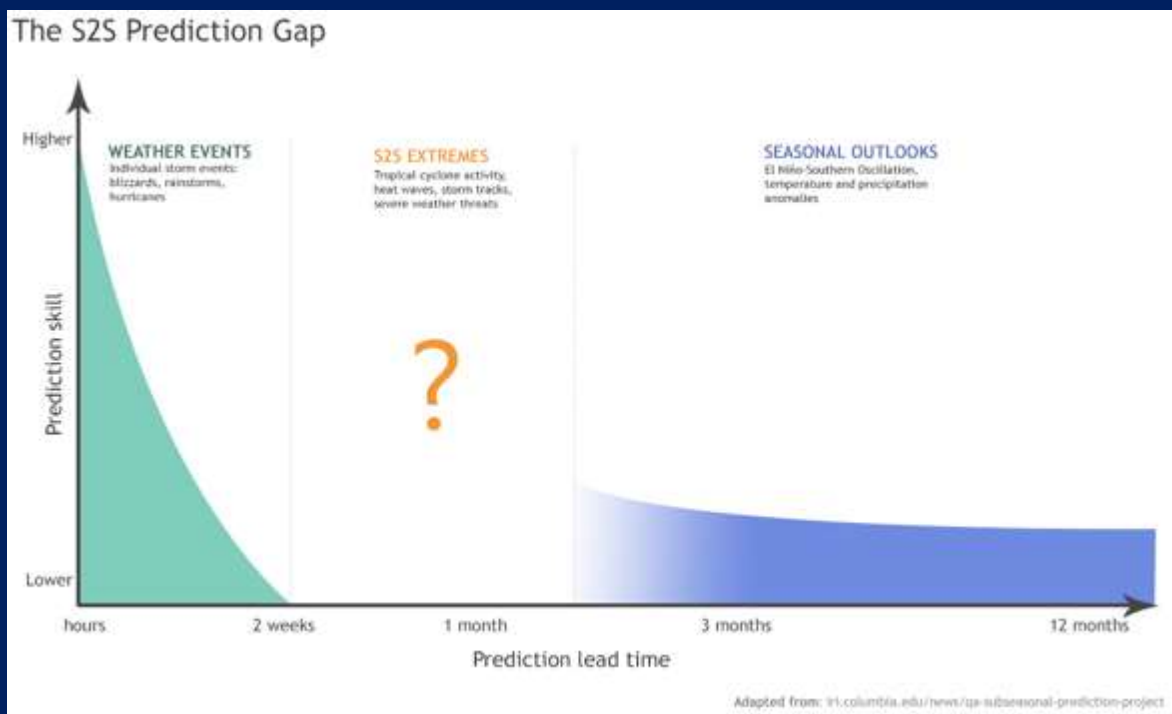
Douglas E. Miller, Zhuo Wang, Bo Li, Daniel Harnos, Trent Ford

45th CDPW

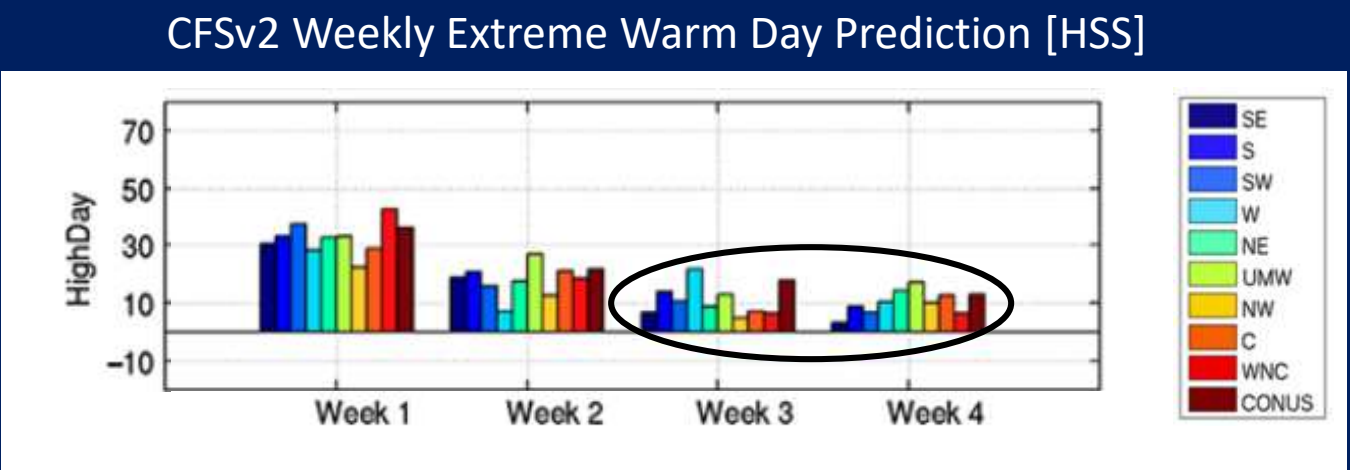
22 October 2020



Skillful subseasonal prediction of extreme heat events would greatly benefit multiple sectors, such as water management and agriculture



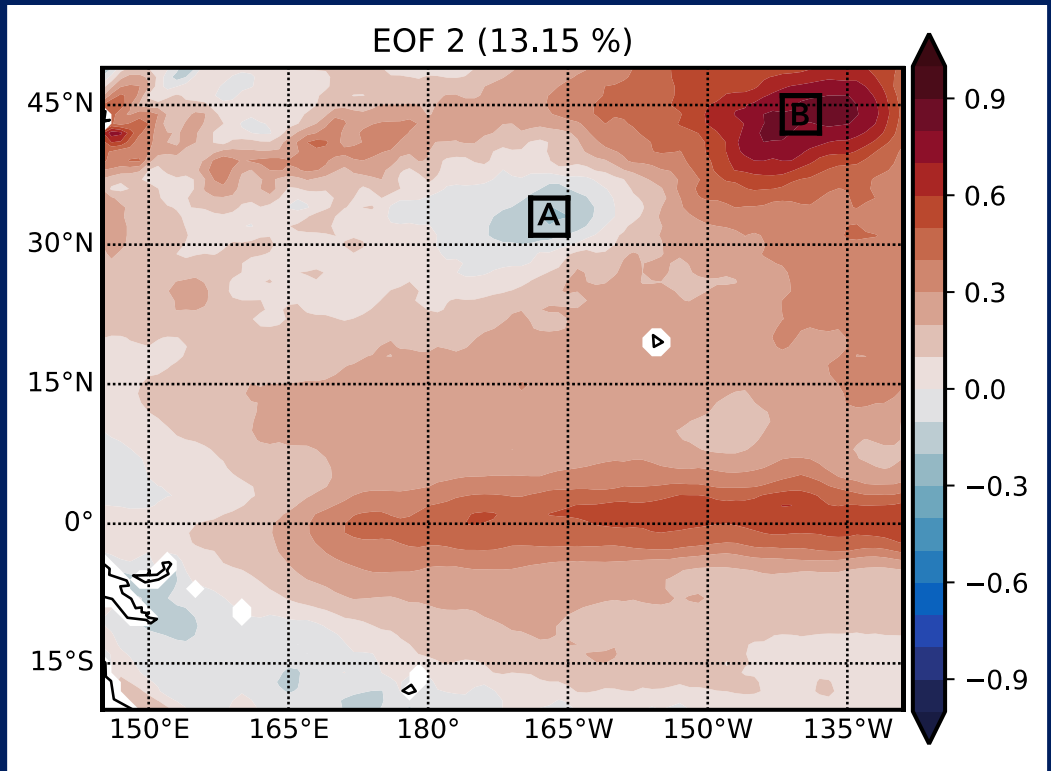
MAPP; S2S prediction task force



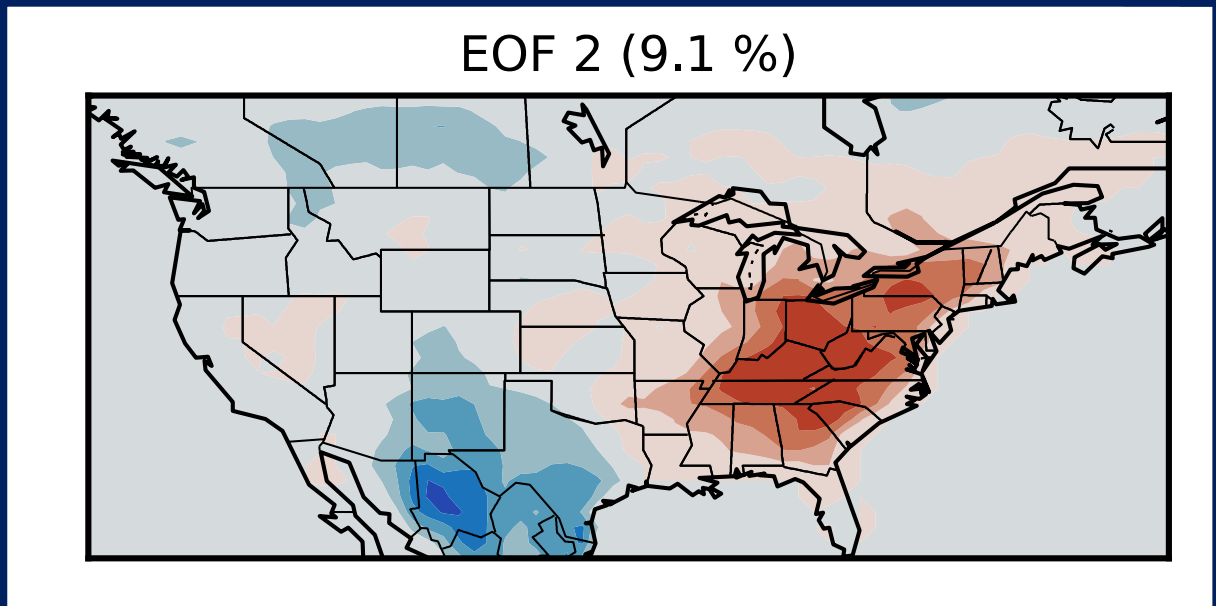
CFSv2 is hardly more skillful than climatology at week 4 (Tian et al., 2017).

GOAL: Utilize a North Pacific SST Index and Soil Moisture PCs to predict July extreme warm days and 14-day SPI at weeks 3-4 using a Multiple Linear Regression Model

Two predictors were derived to predict extreme warm days per week after performing the EOFs on daily Pacific SST and soil moisture during July



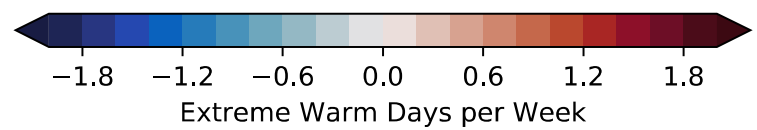
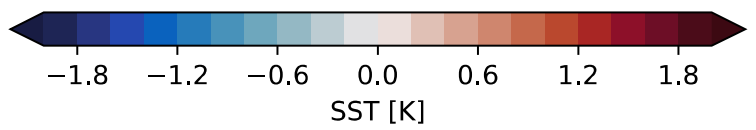
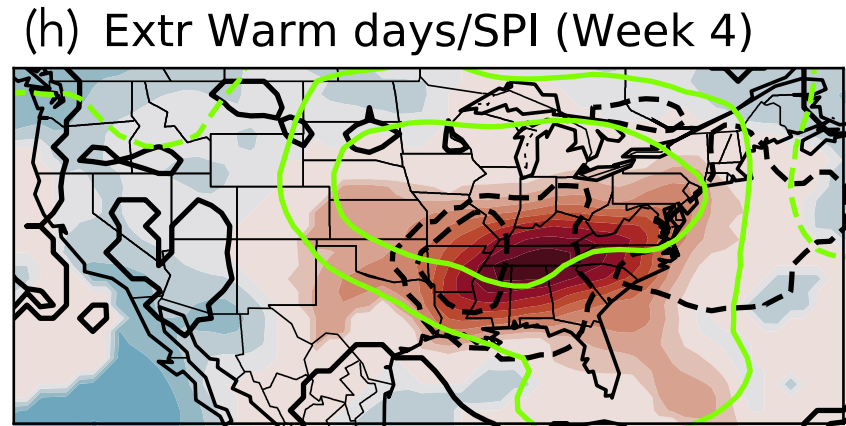
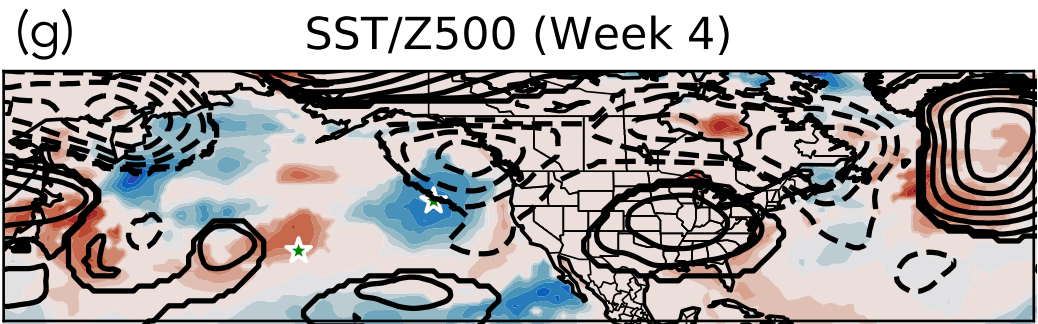
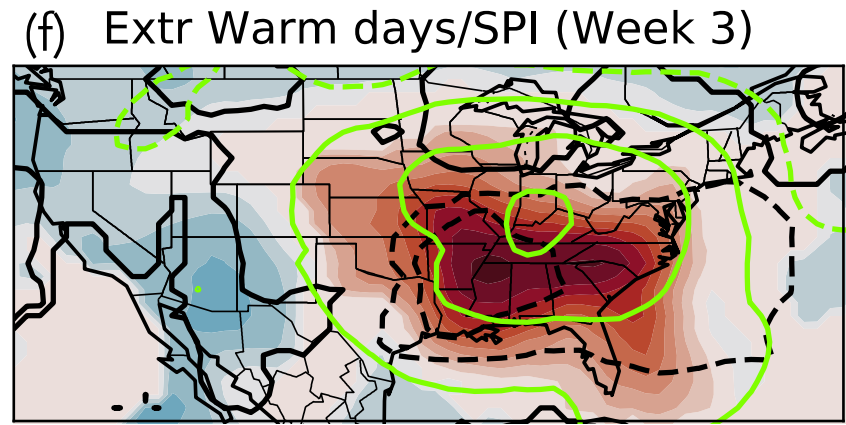
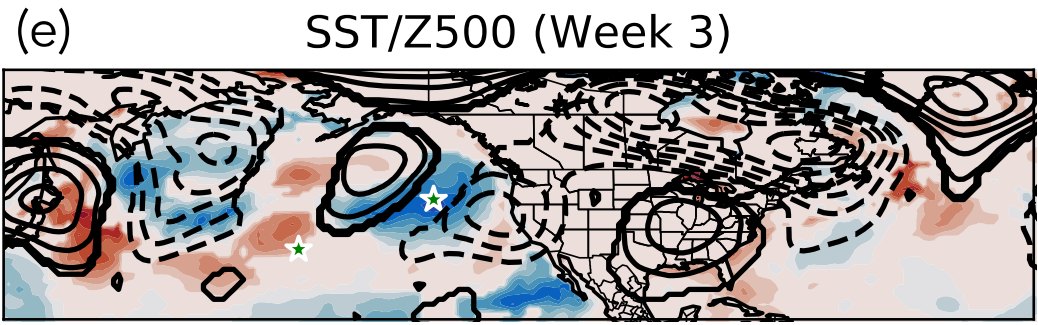
NPSST Index = B - A



Soil moisture index = PC2

During extreme NP SST index days, a wave train is evident with an anticyclone over the eastern United States → Increase in extreme warm days per week, negative SPI, and increased blocking frequency

Composites (NP SST index < 10th percentile)



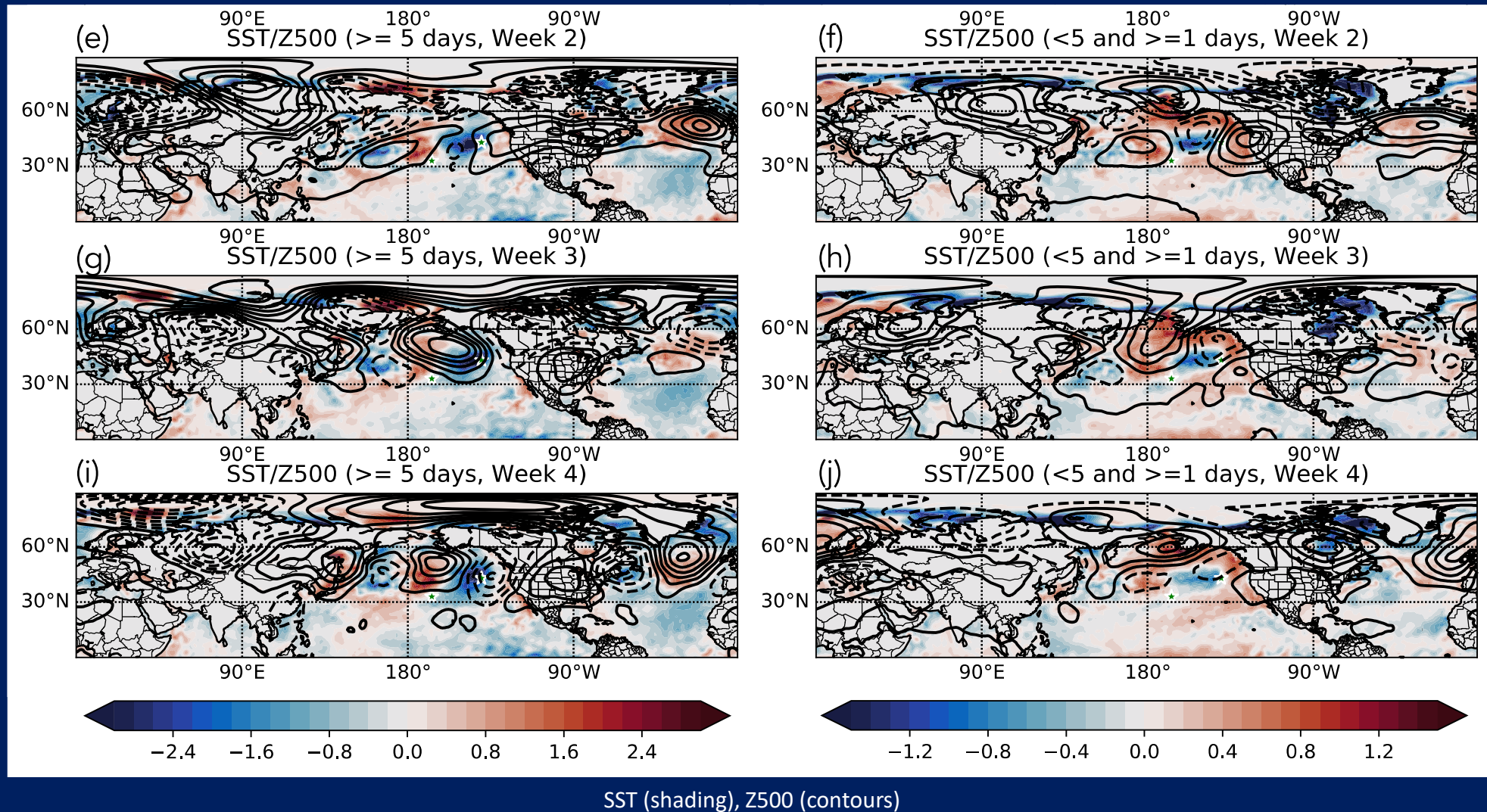
SST (shading), Z500 (contours)

Ext warm days (shading), SPI (black contours), BF (green contours)

The NPSST anomalies are related to the Circumglobal Teleconnection (CGT) pattern. After construction of a CGT index, we find that the impacts of CGT on NPSST and US extremes are nonlinear: only persistent CGT events have impacts on SST and extremes, and NPSST helps select those events.

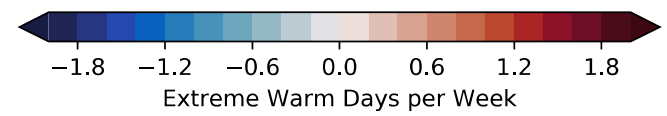
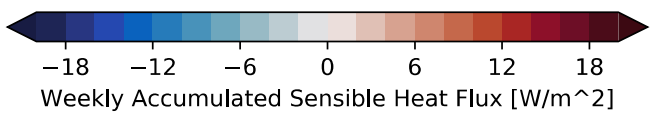
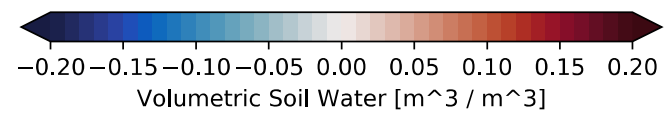
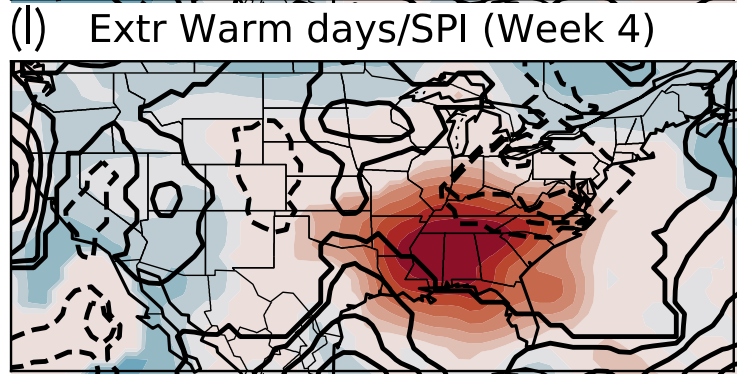
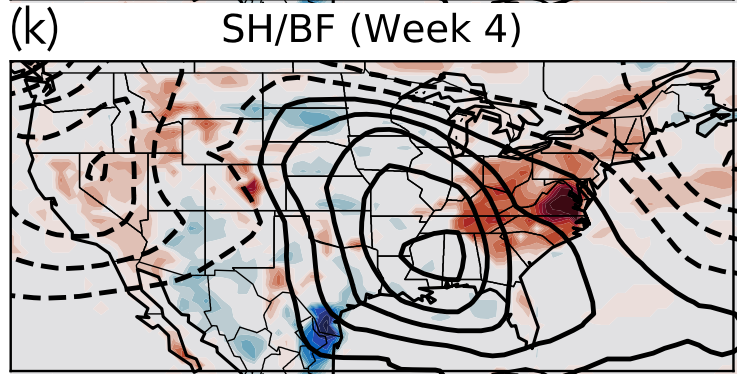
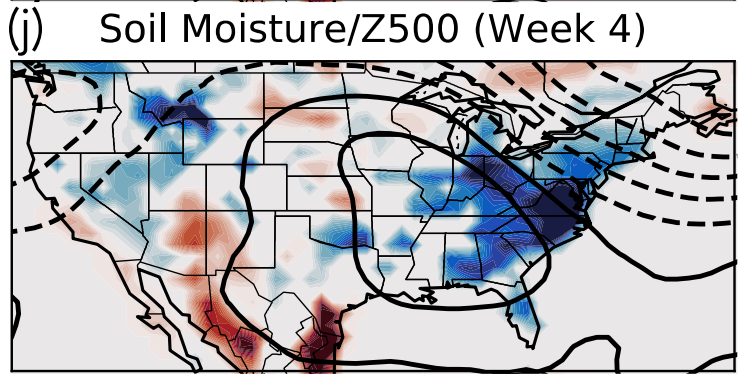
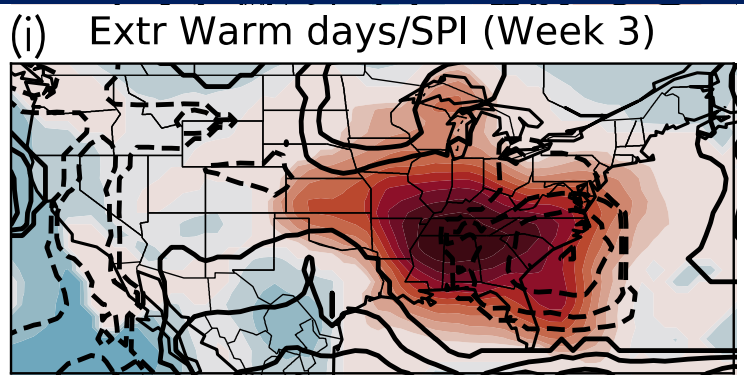
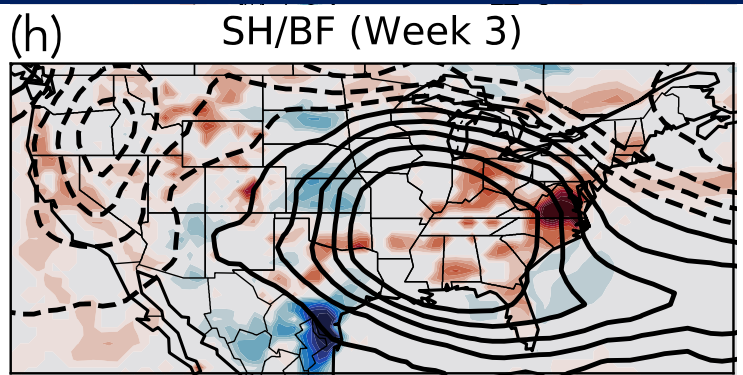
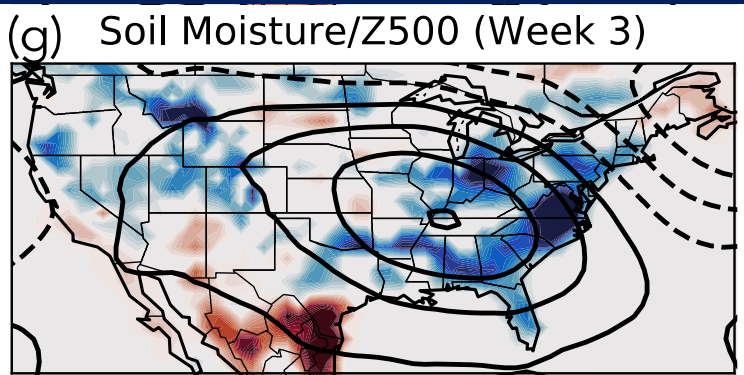
$|CGTi| > 1.0$ stdv for at least 5 days within week -1

$|CGTi| > 1.0$ stdv for at least 1 day, but less than 5



Extreme soil moisture conditions persist through the four week period → increase in sensible heat flux helps maintain the anticyclone → contributes to the increase in blocking frequency, extreme warm days, and negative SPI

Composites (SM index < 10th percentile)



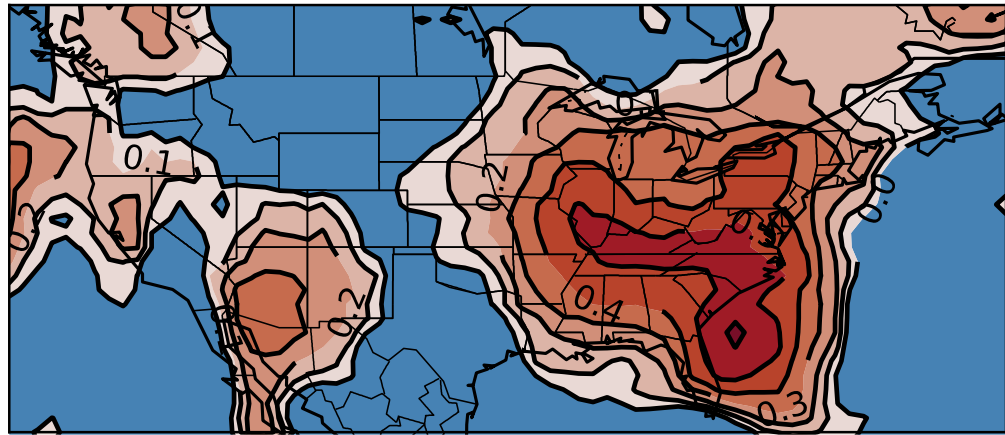
Soil Moisture (shading), Z500 (contours)

Sensible HF (shading), BF (contours)

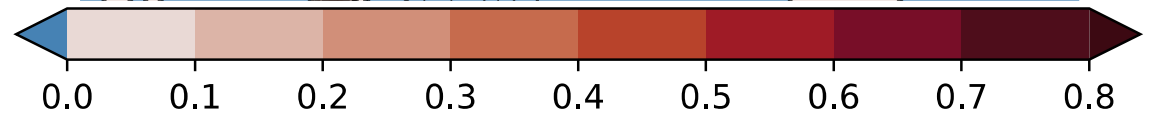
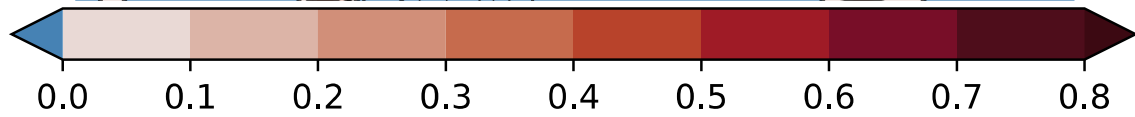
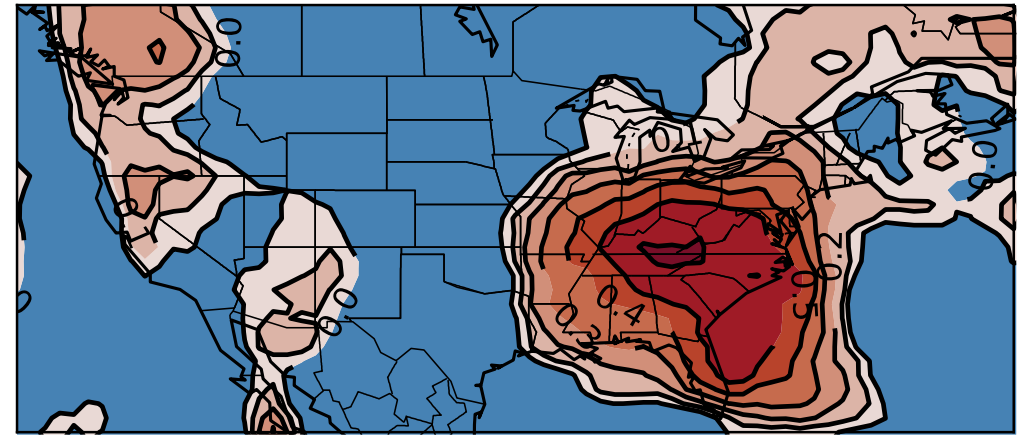
Ext warm days (shading), SPI (Contours)

MLR Model

(a) MLR Week 3 (Extreme Warm Days)



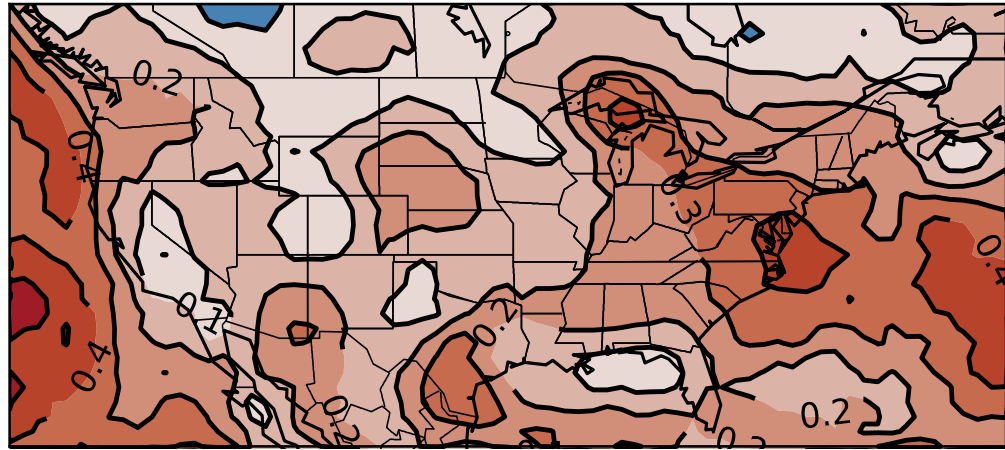
(b) MLR Week 4 (Extreme Warm Days)



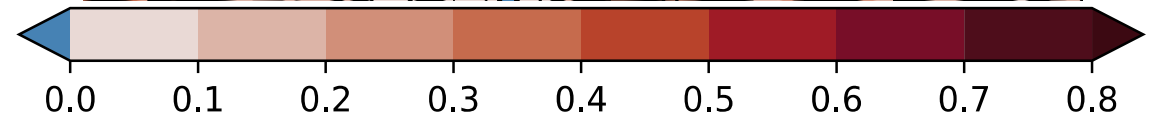
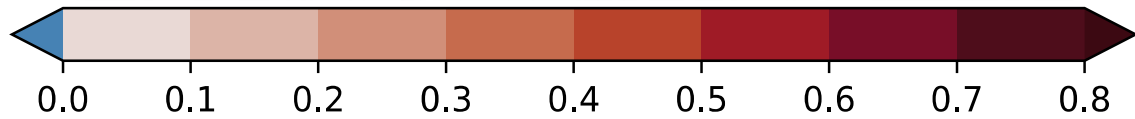
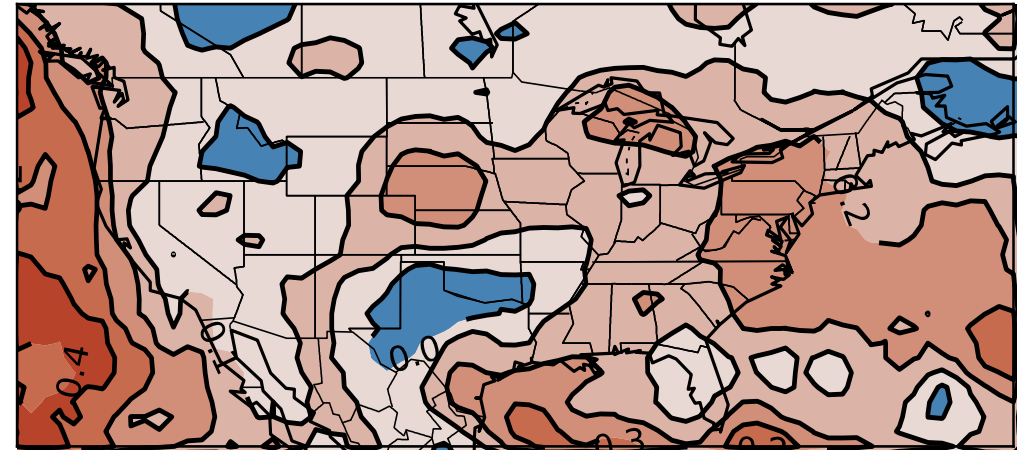
Spearman rank Correlation

CFSv2

(c) CFSv2 Week 3 (Extreme Warm Days)



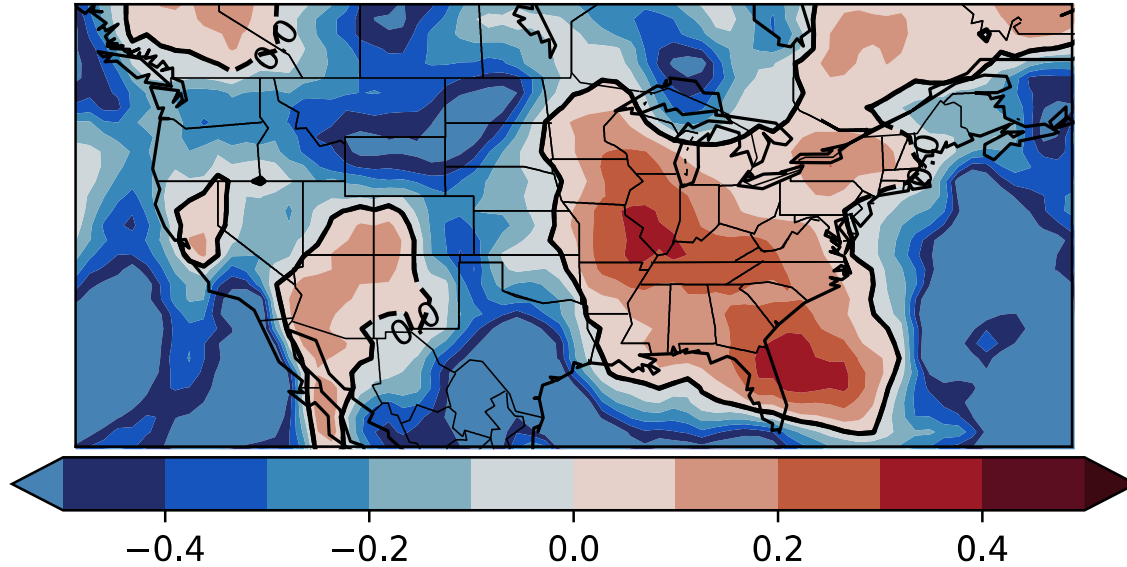
(d) CFSv2 Week 4 (Extreme Warm Days)



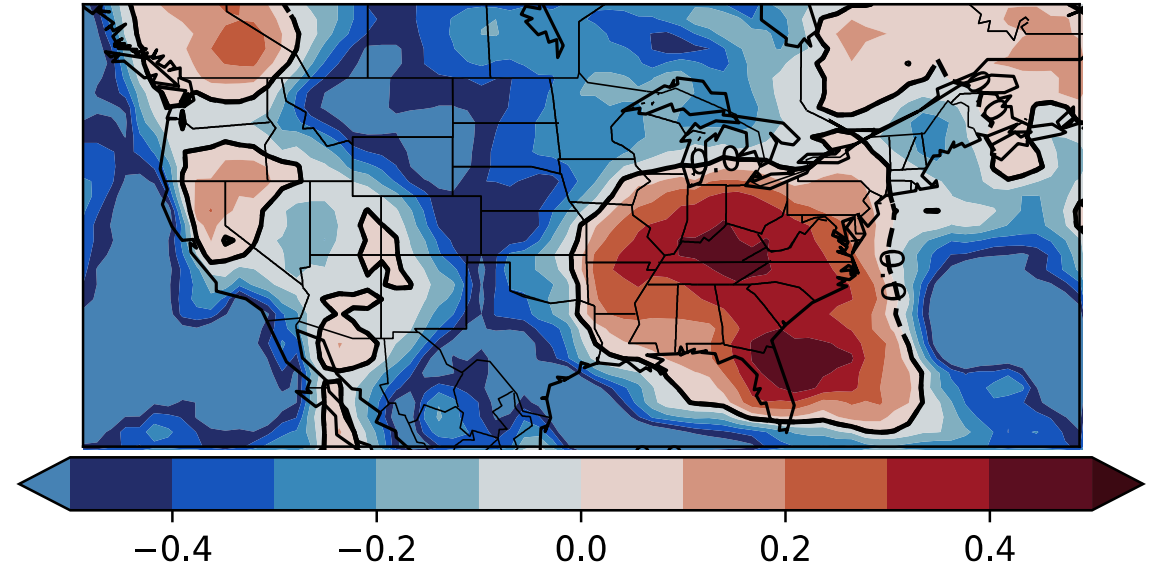
Spearman rank Correlation

MLR - CFSv2

(e) MLR - CFSv2 Week 3 (Extreme Warm Days)



(f) MLR - CFSv2 Week 4 (Extreme Warm Days)



Spearman rank Correlation

A North Pacific SST index and the second leading principle component of soil moisture are the two predictors which contribute to significantly greater skill at weeks 3-4 over the CFSv2.

Thank you!

-Douglas E. Miller, Ph.D. Candidate

- dem2@Illinois.edu