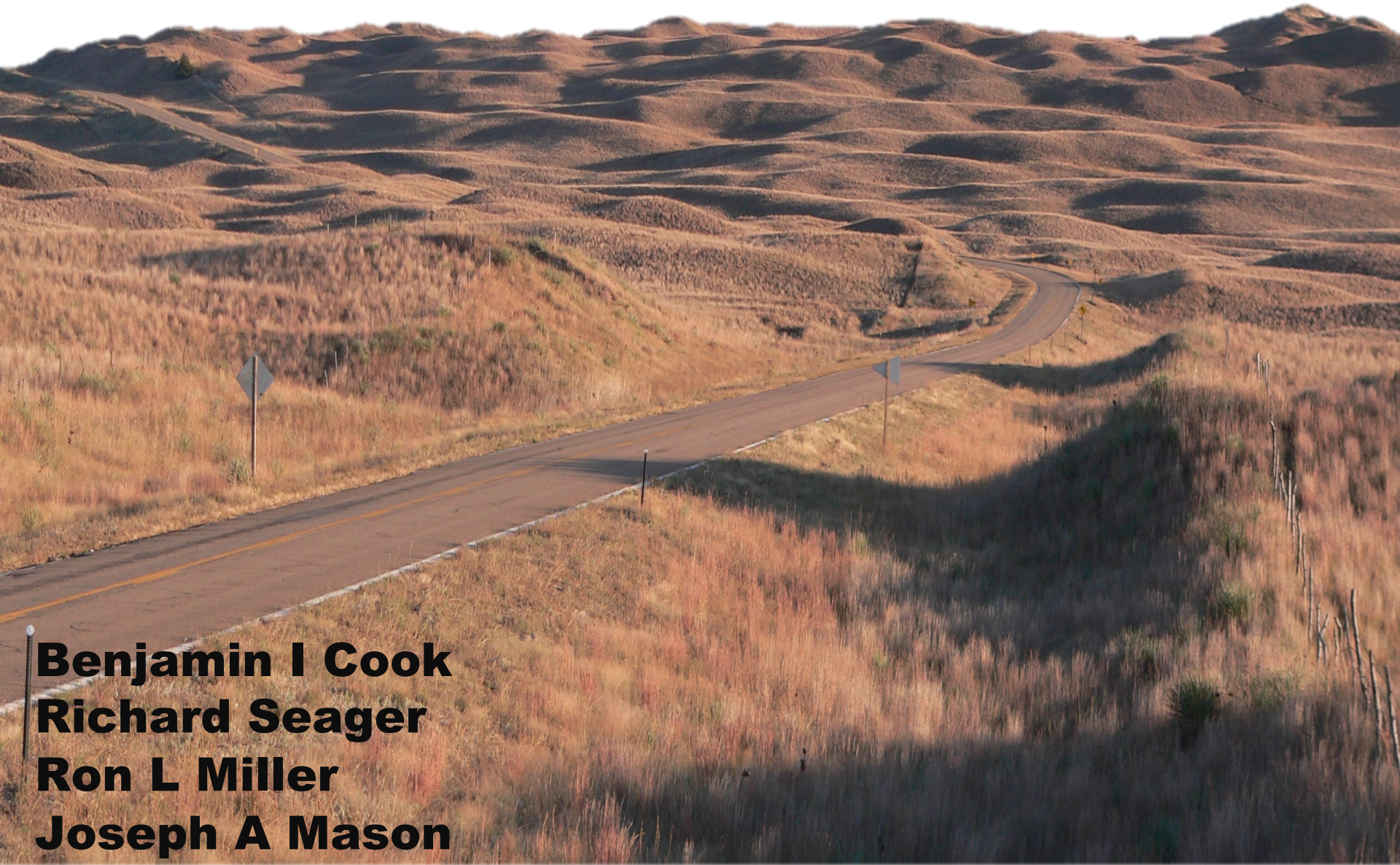
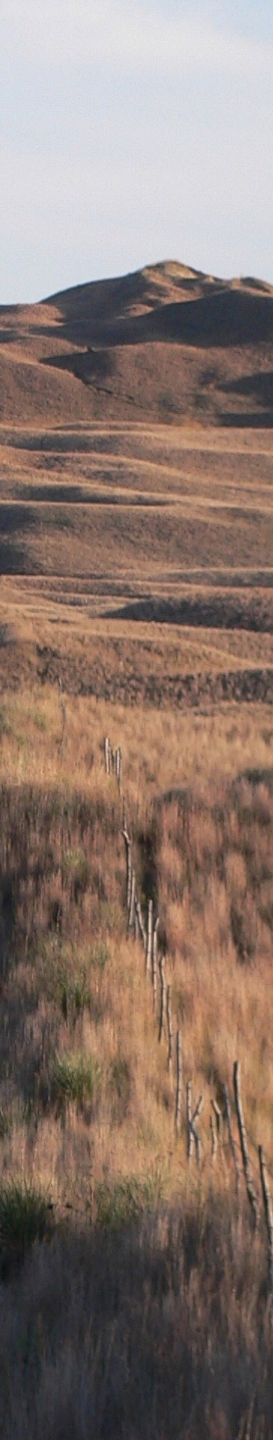


# **Intensification of North American megadroughts through surface and dust aerosol forcing.**

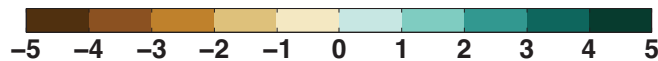


**Benjamin I Cook**  
**Richard Seager**  
**Ron L Miller**  
**Joseph A Mason**

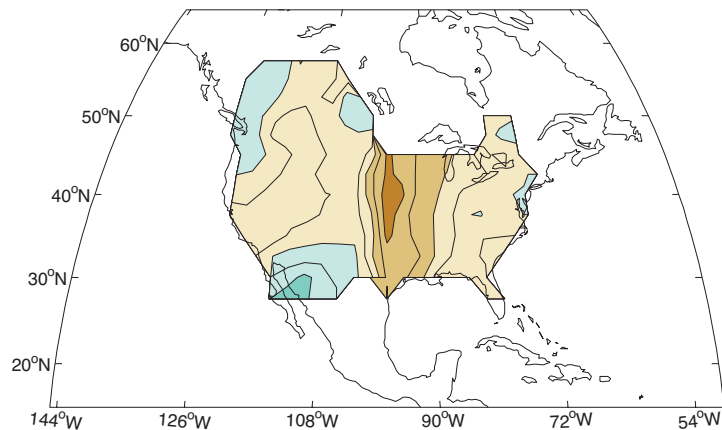




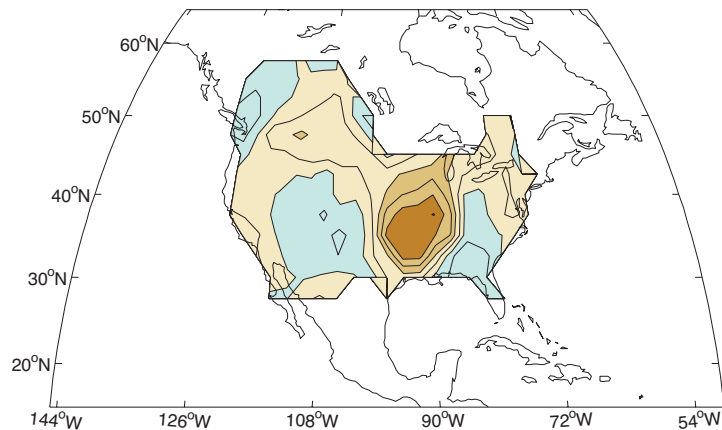
# Medieval Megadroughts



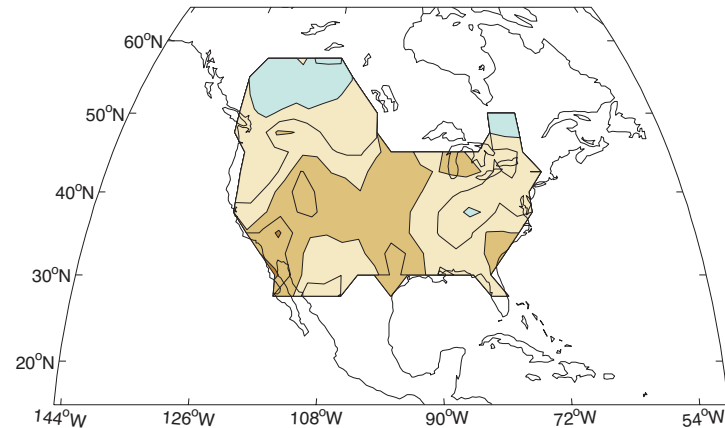
**1225–1250**



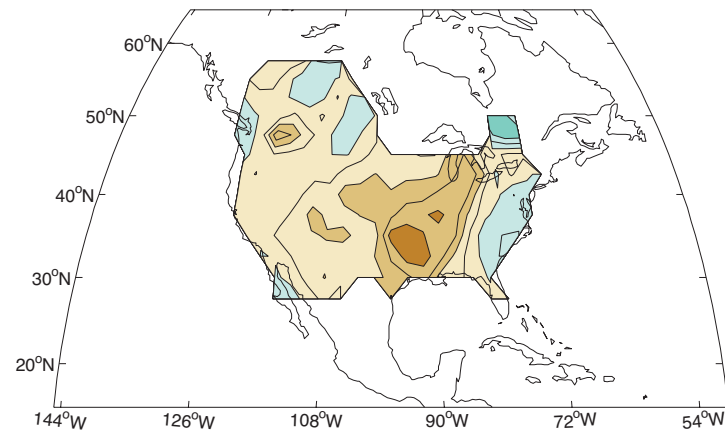
**1379–1388**



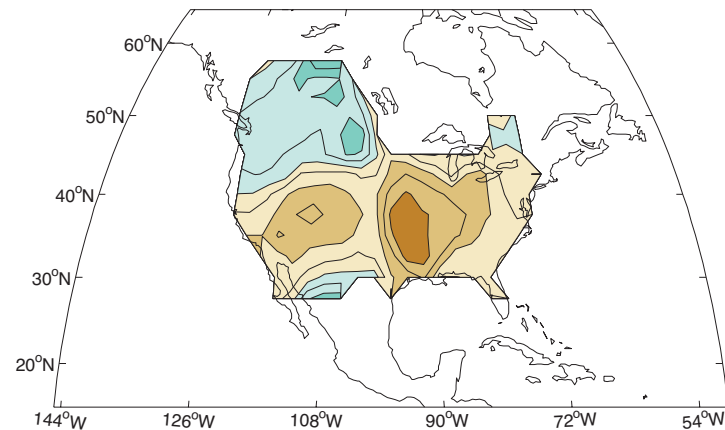
**1120–1160**



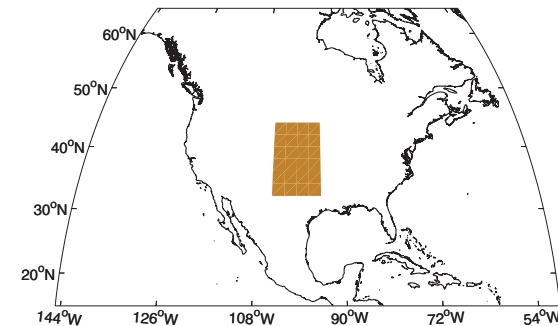
**1344–1353**



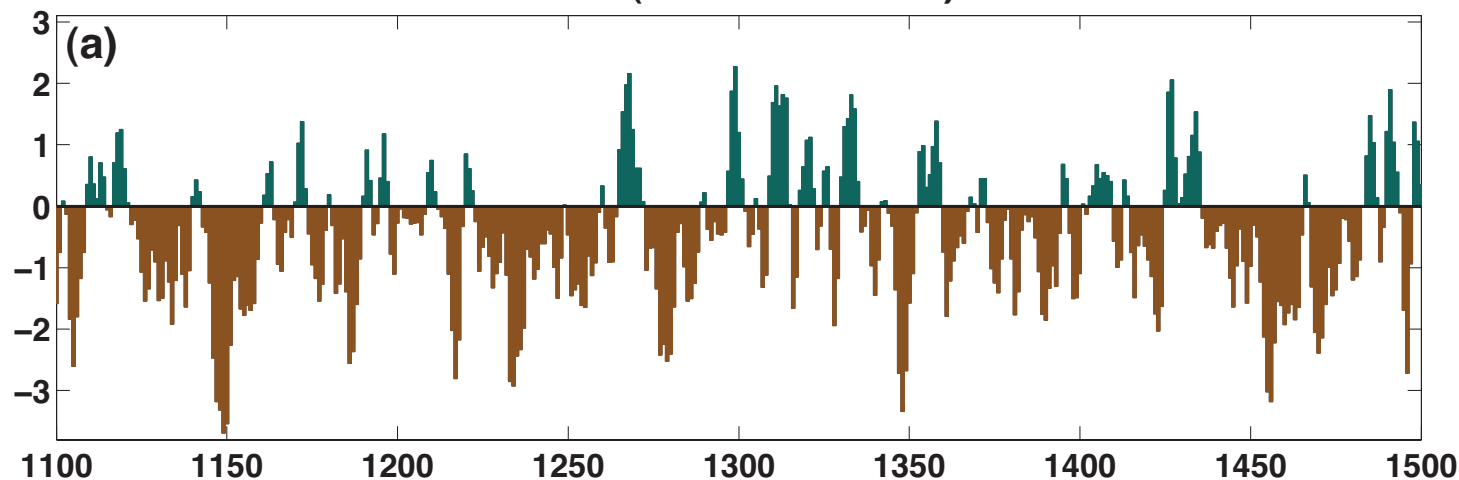
**1440–1458**



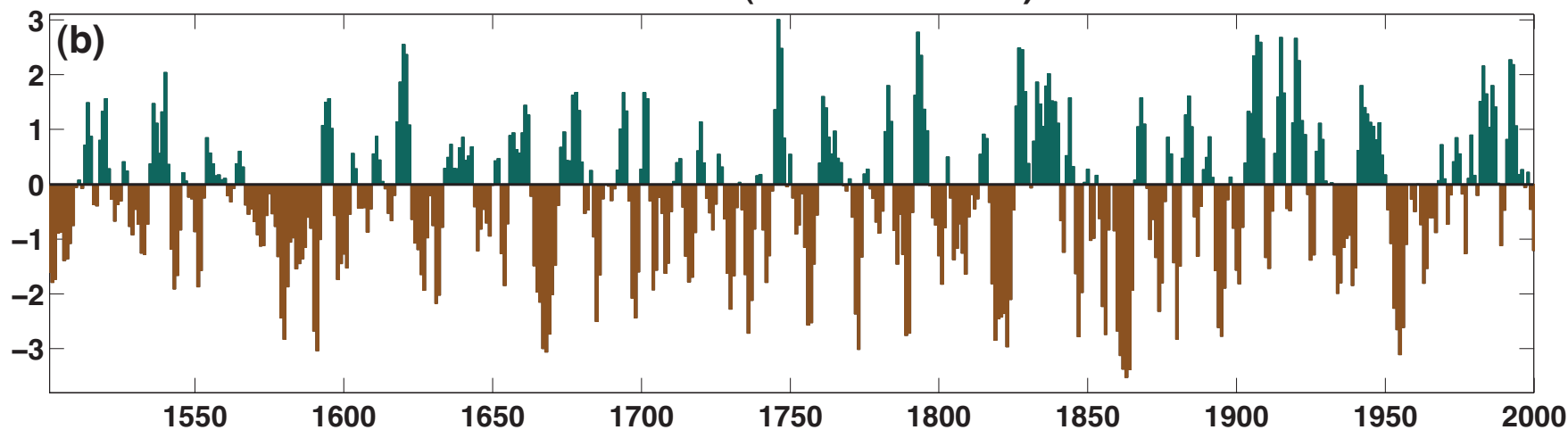
# Central Plains PDSI



MCA (1100-1500 C.E.)

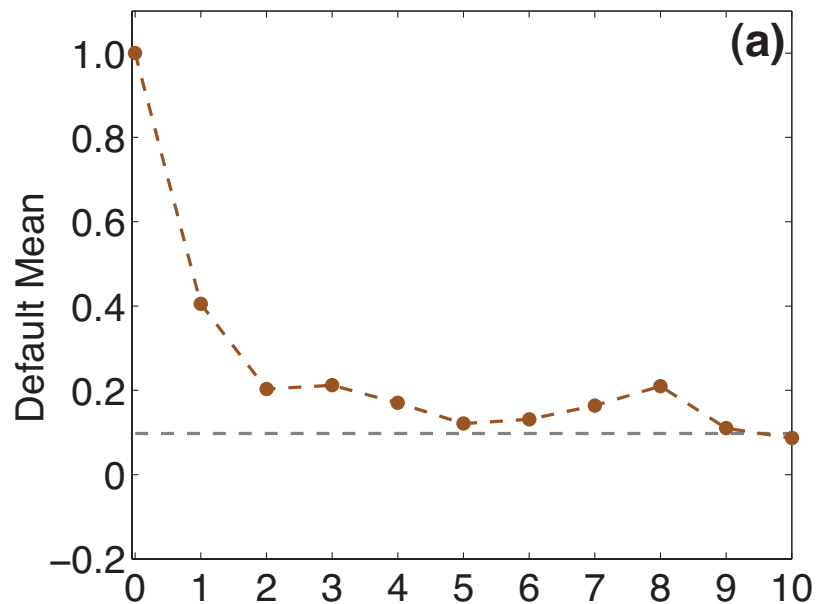


Post-MCA (1501-2000 C.E.)

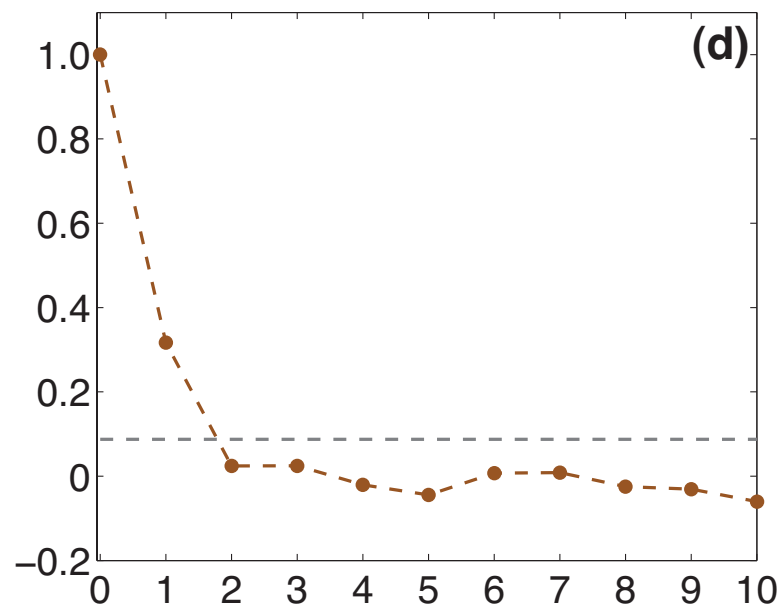
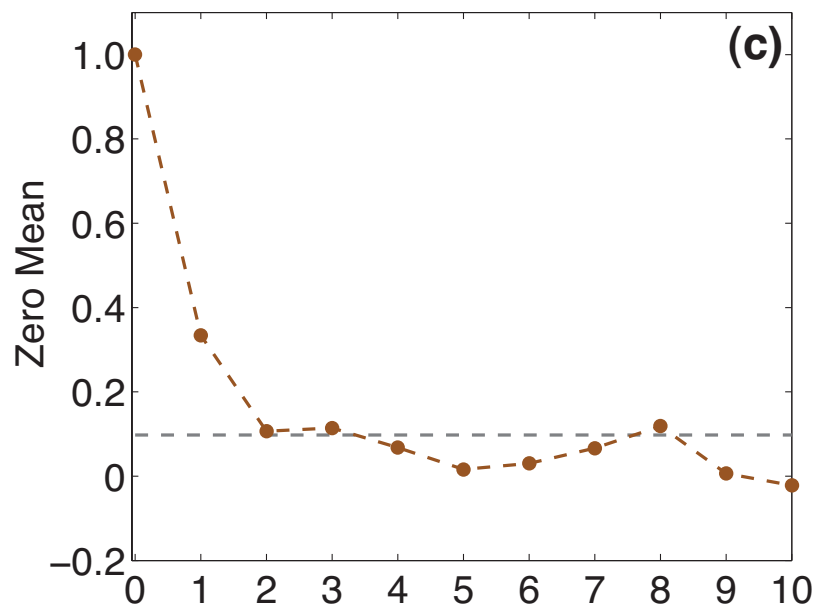
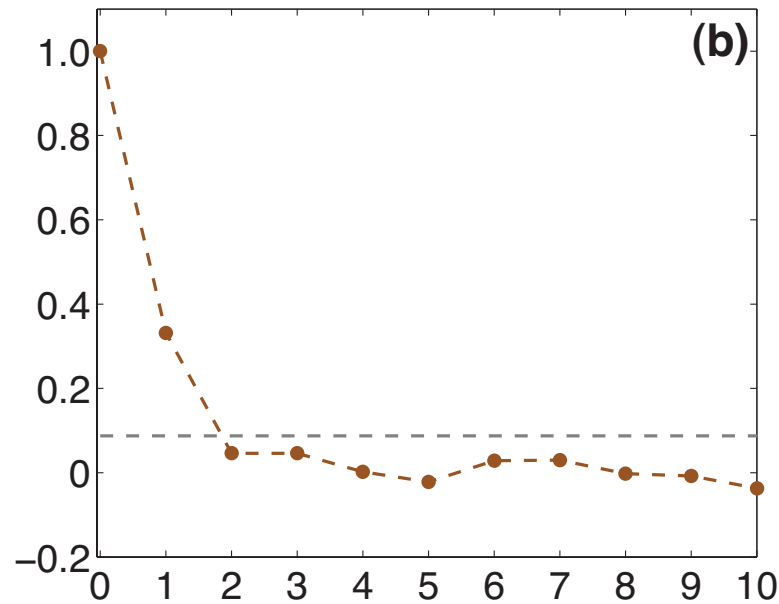


# Autocorrelation Function (NADA PDSI)

## MCA (1100–1500 C.E.)

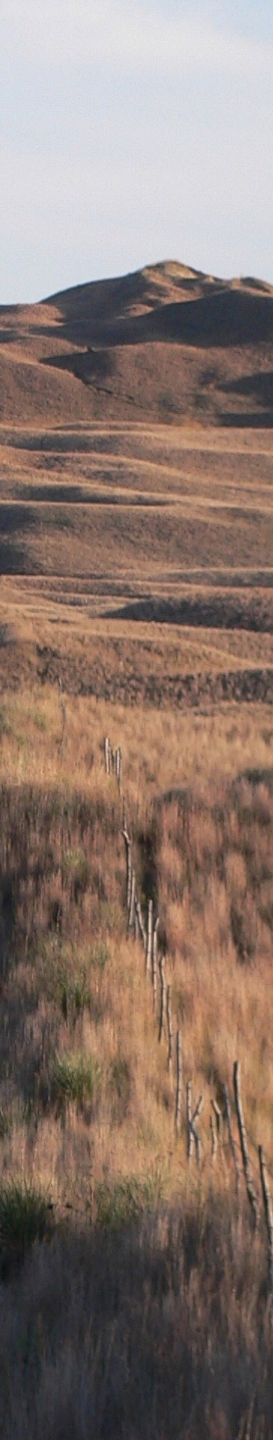


## Post-MCA (1501–2000 C.E.)



Lag

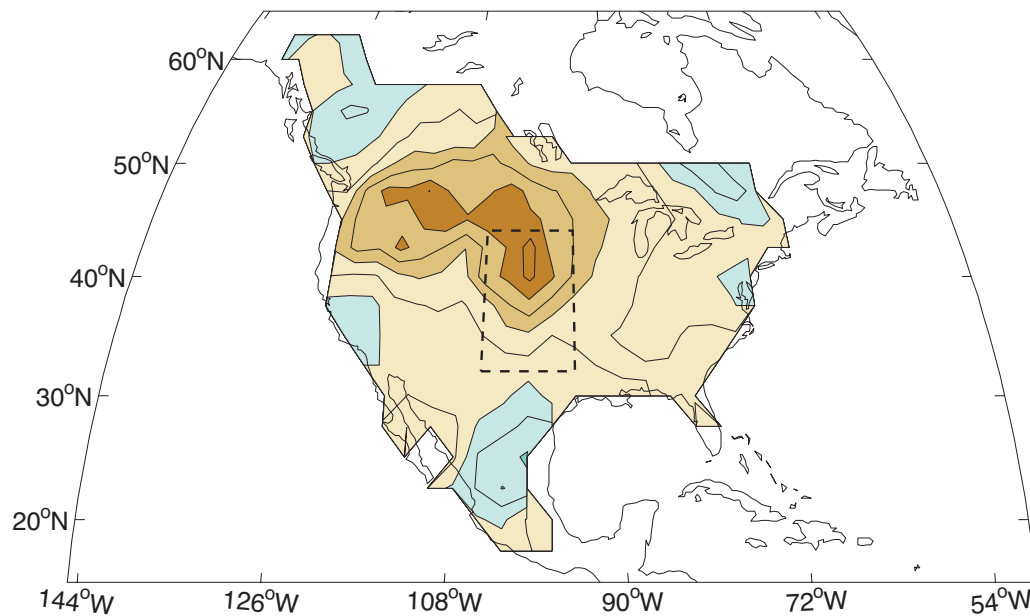




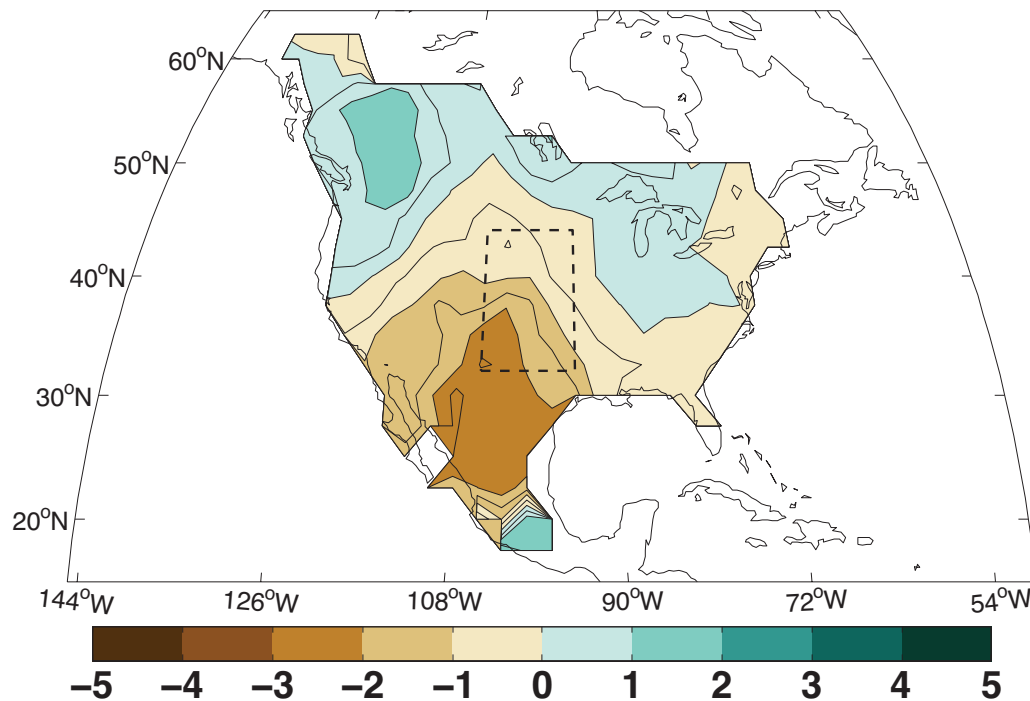
# Dust Bowl

**1950s**

**NADA PDSI: 1932–1939**

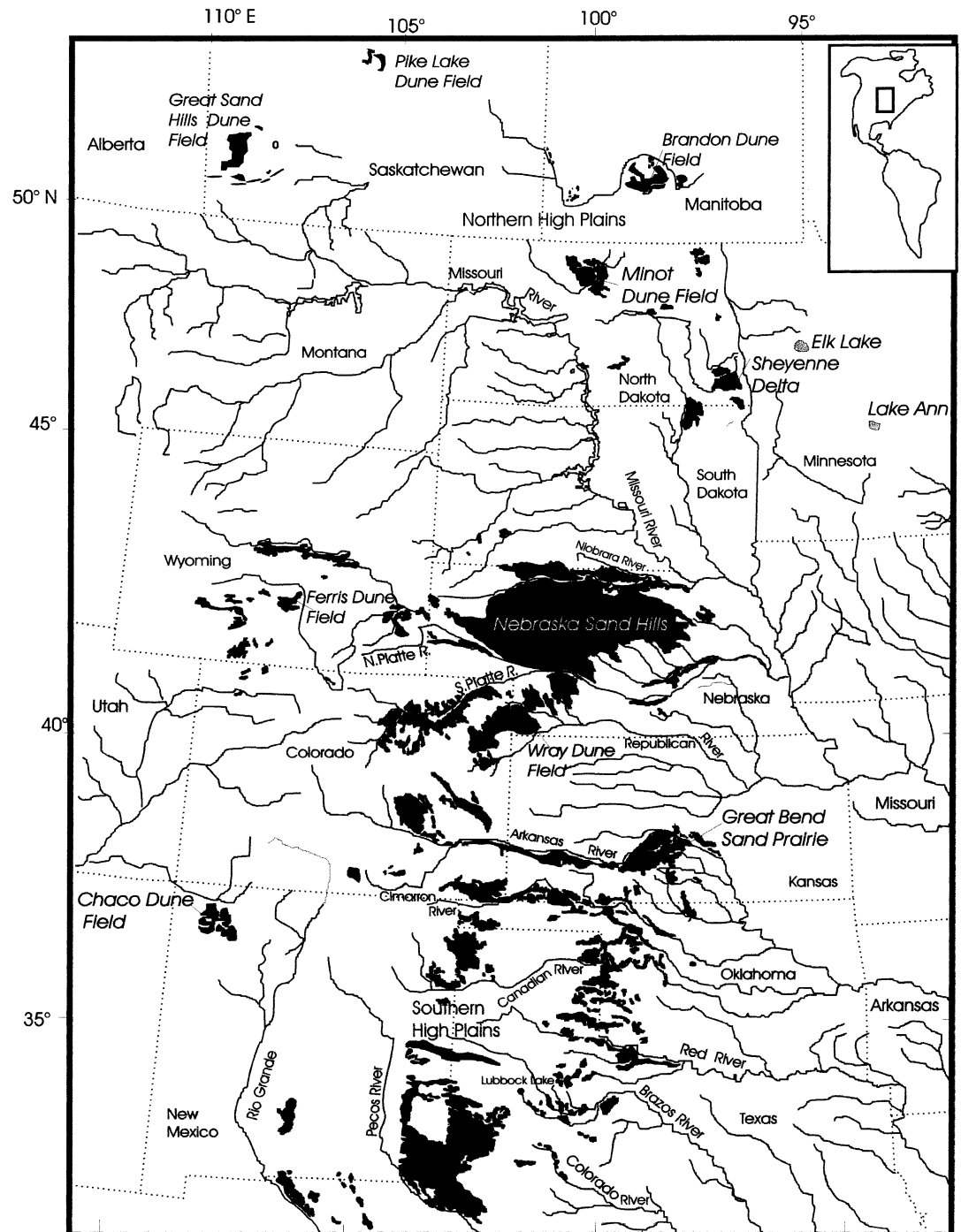


**NADA PDSI: 1948–1957**





# Dune Fields

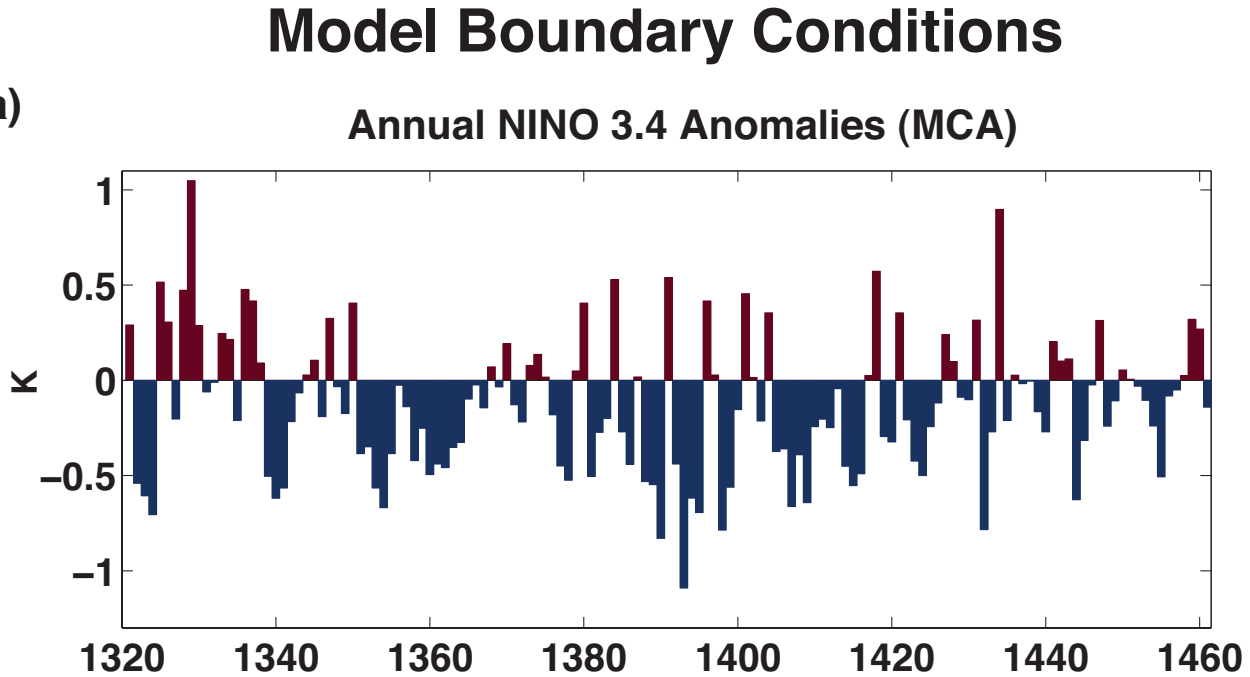


Forman et al, 2001  
(*Global and Planetary Change*)



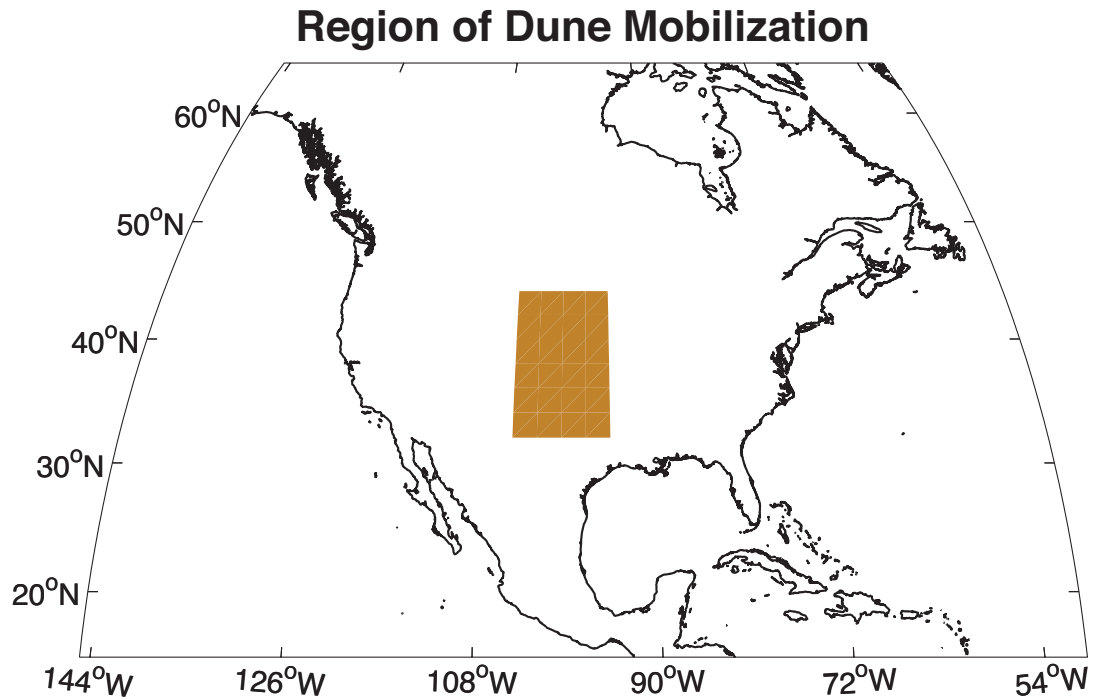
# SST Forcing

(a)



# Dune/Dust Forcing

(b)





# Experiments

## **SST-MOD**

**Kaplan SSTs, 1857-2005 forcings**

## **SST-Only**

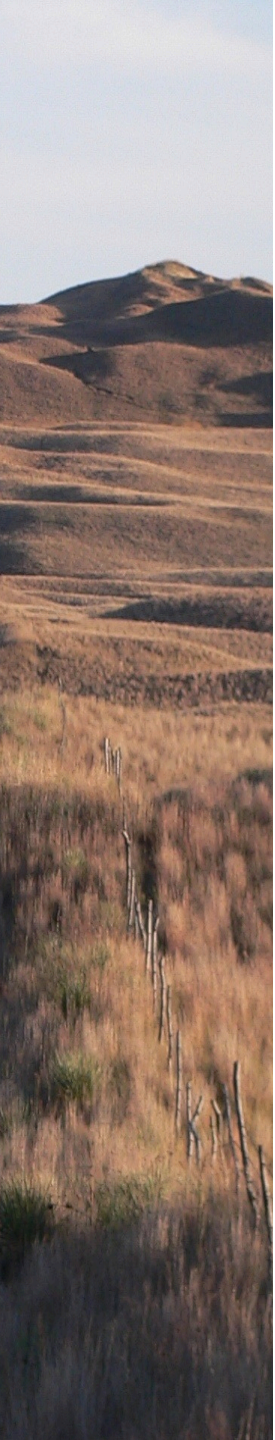
**Cobb SST recon, 1321-1461 forcings**

## **SST+BSOIL**

**As SST-Only + increased bare soil**

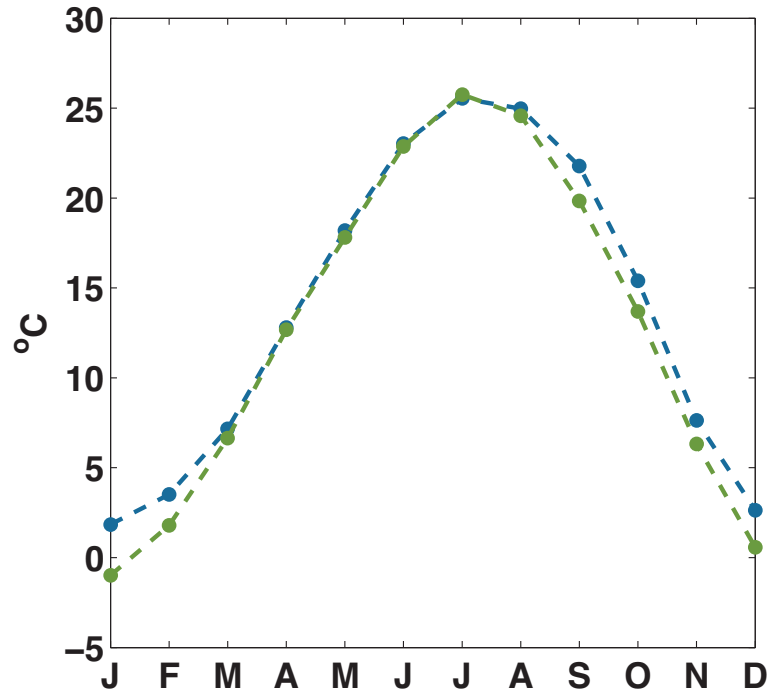
## **SST+BSOIL+DUST**

**As SST+BSOIL + dust aerosol source**

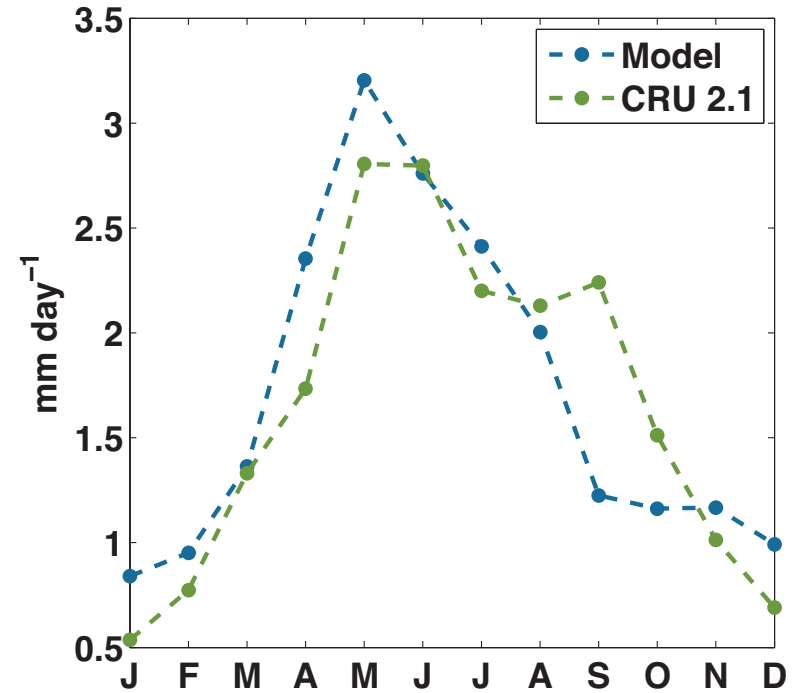


## Central Plains Climatology (1961-1990)

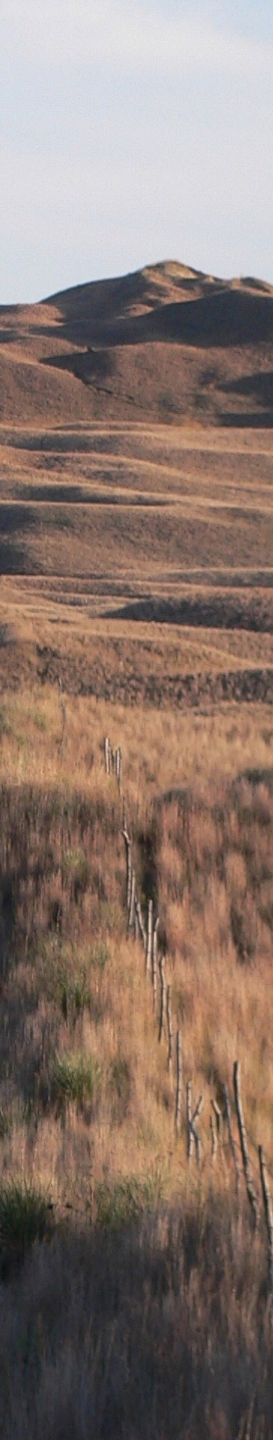
Surface Temperature



Precipitation

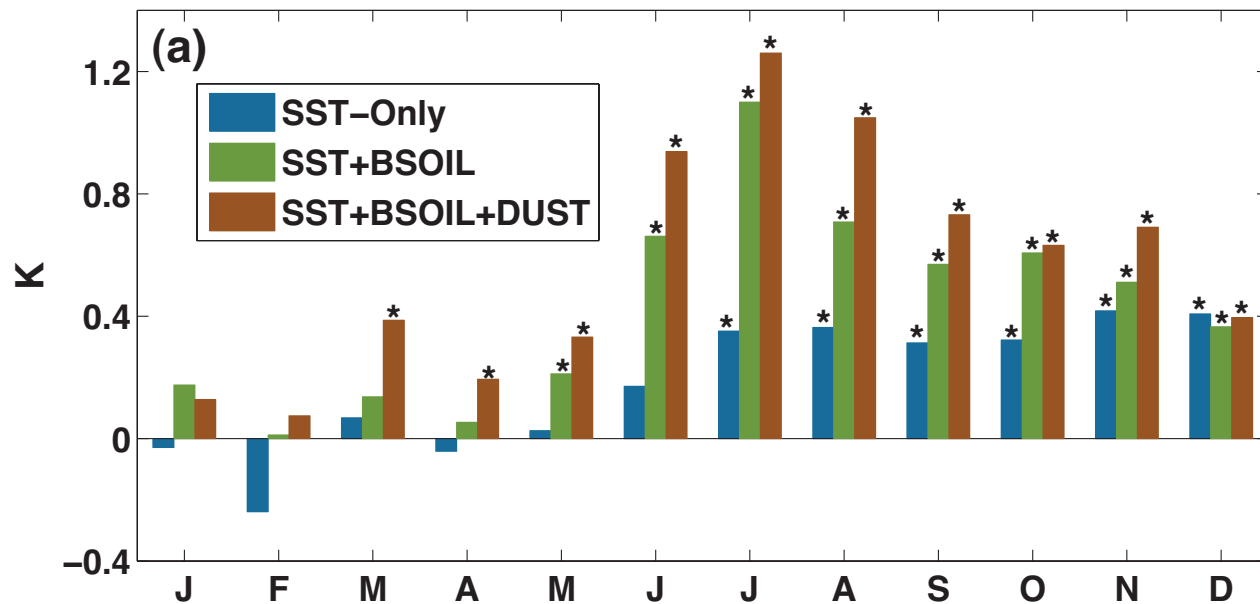




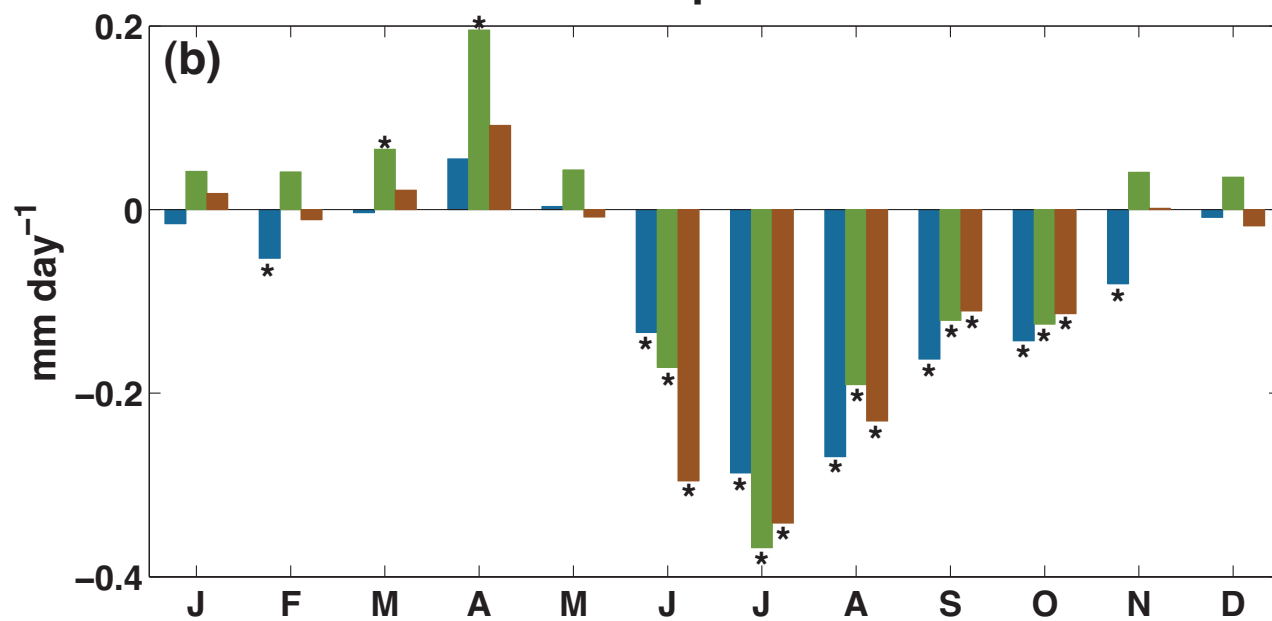


# Central Plains $\Delta T$ and $\Delta P$ , vs SST-MOD

## Surface Temperature

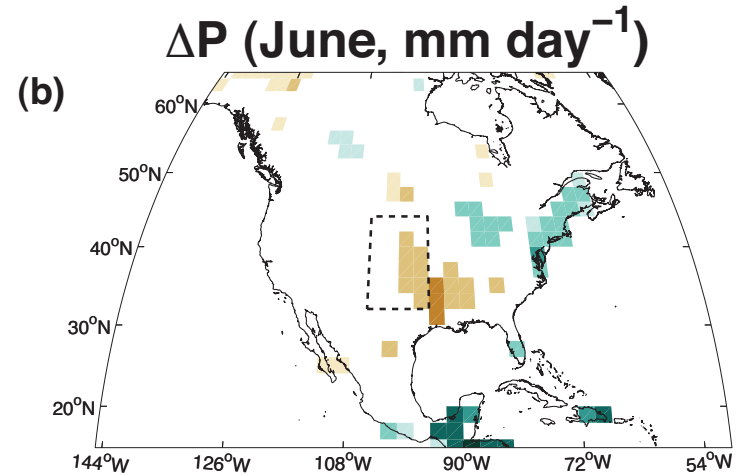
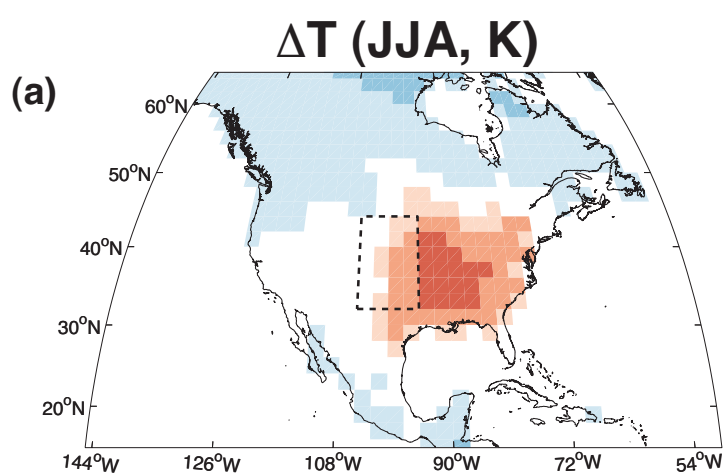


## Precipitation

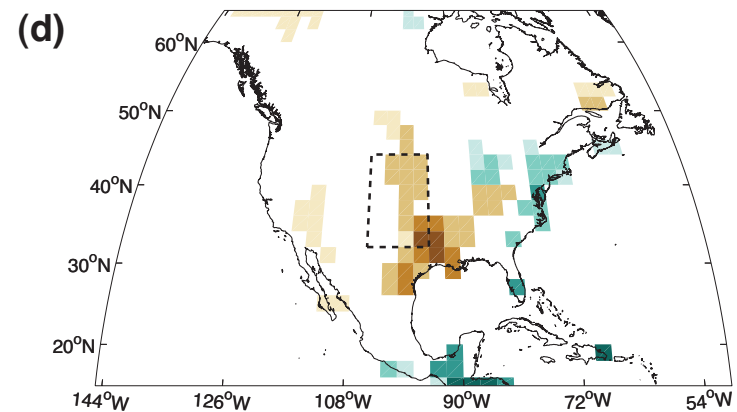
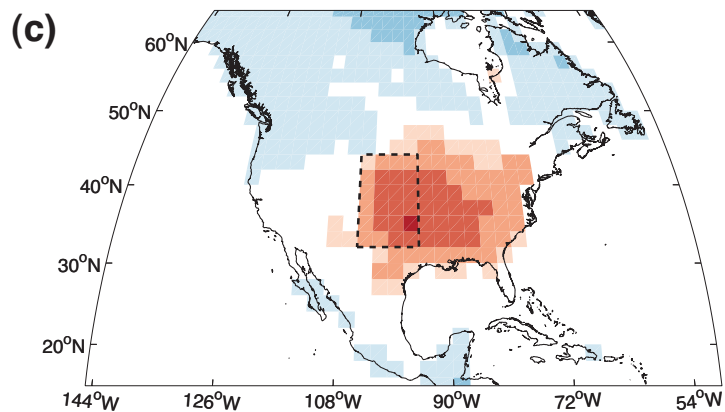




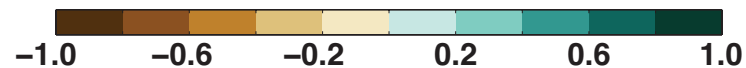
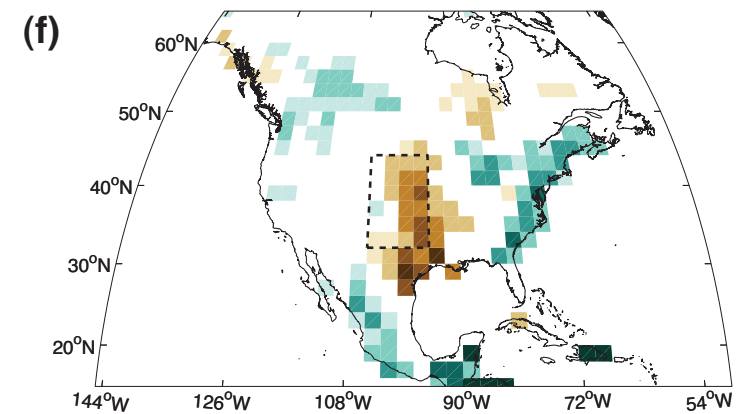
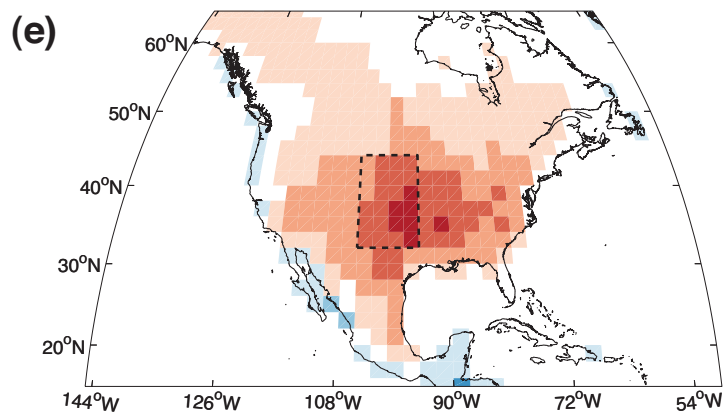
SST-Only

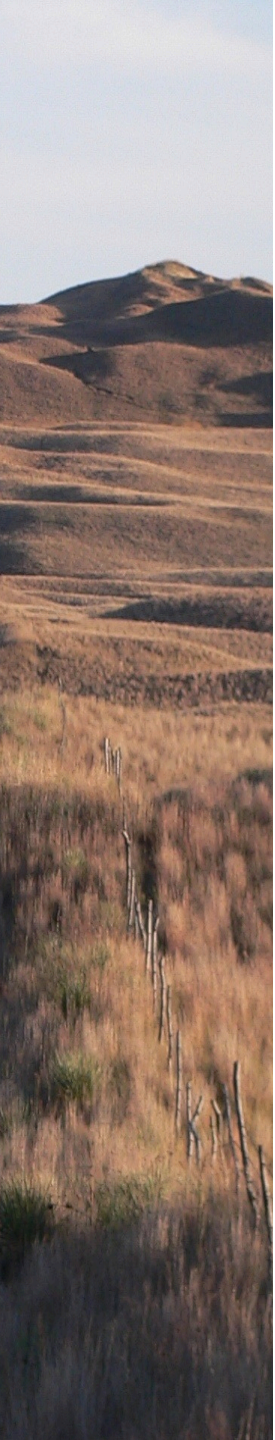


SST+BSOIL



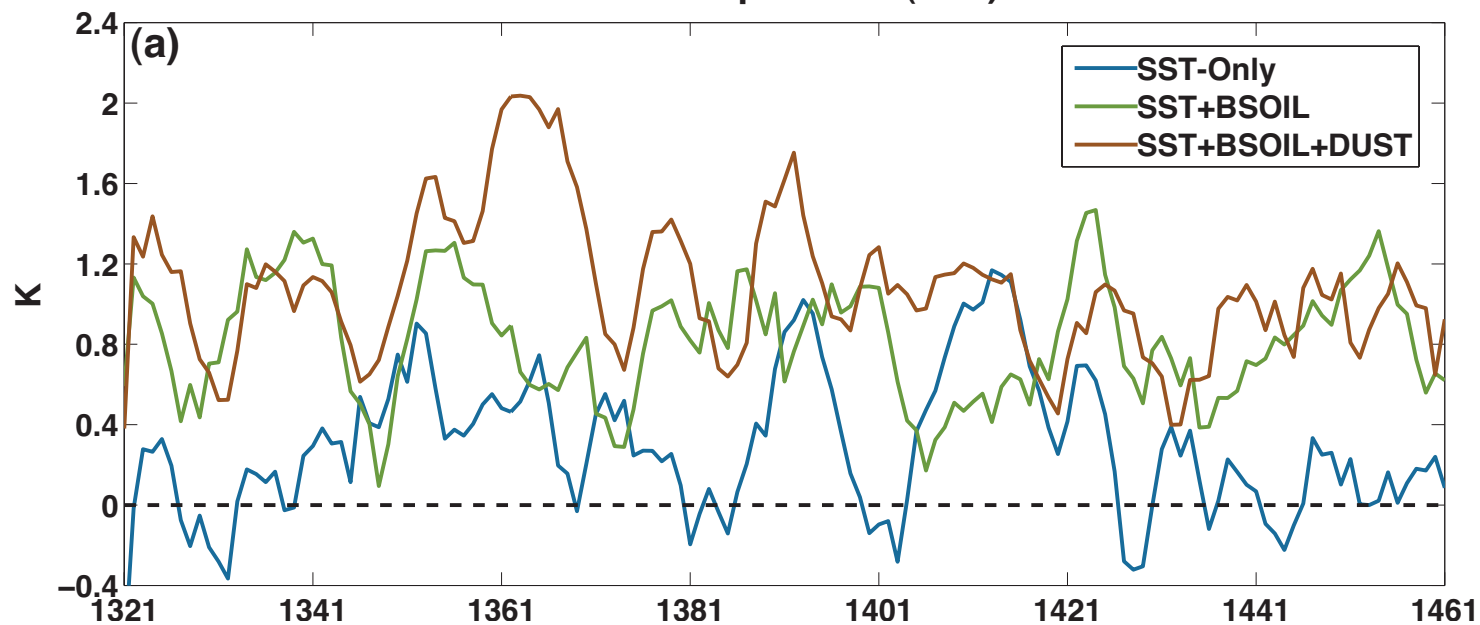
SST+BSOIL+DUST



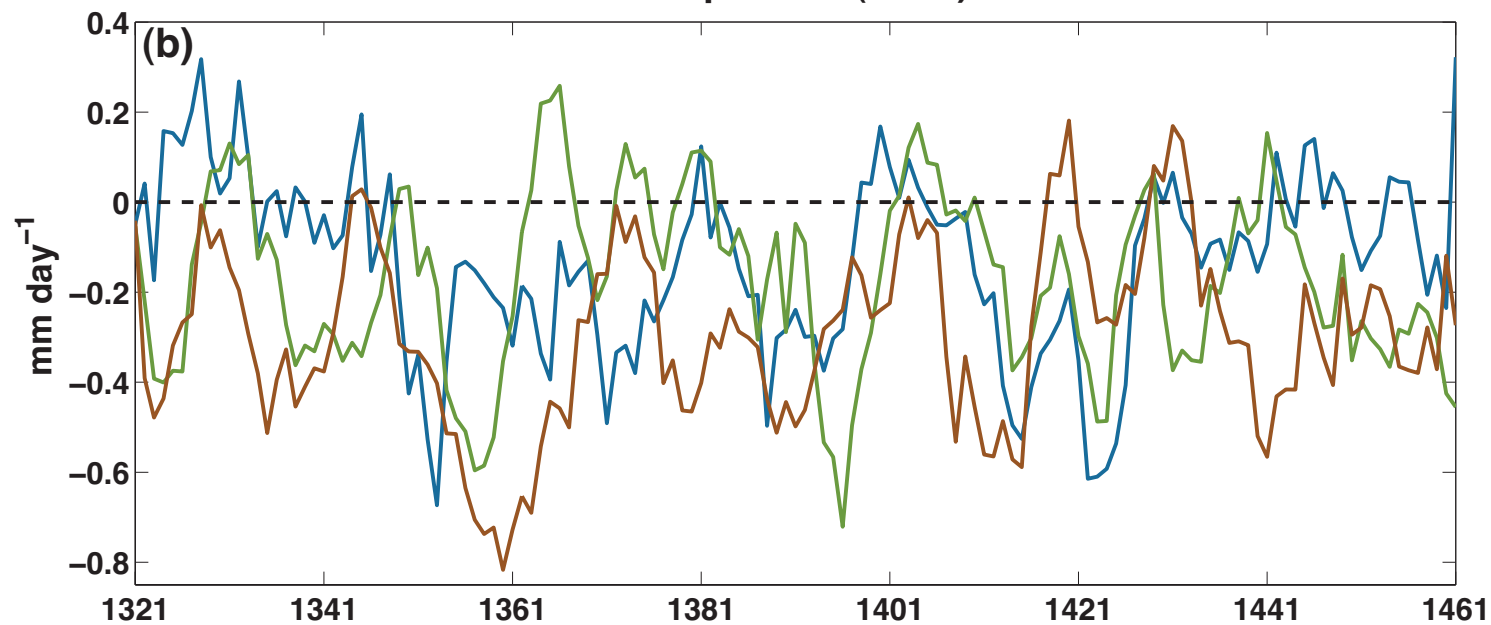


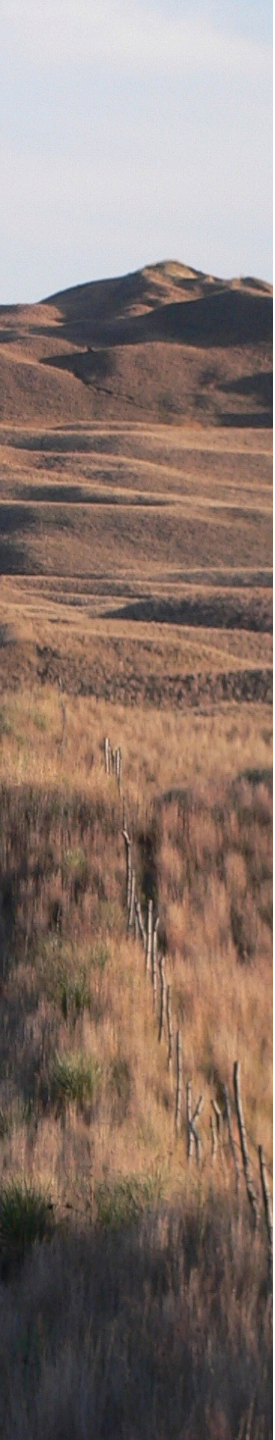
# Central Plains Climate Anomalies

## Surface Temperature (JJA)

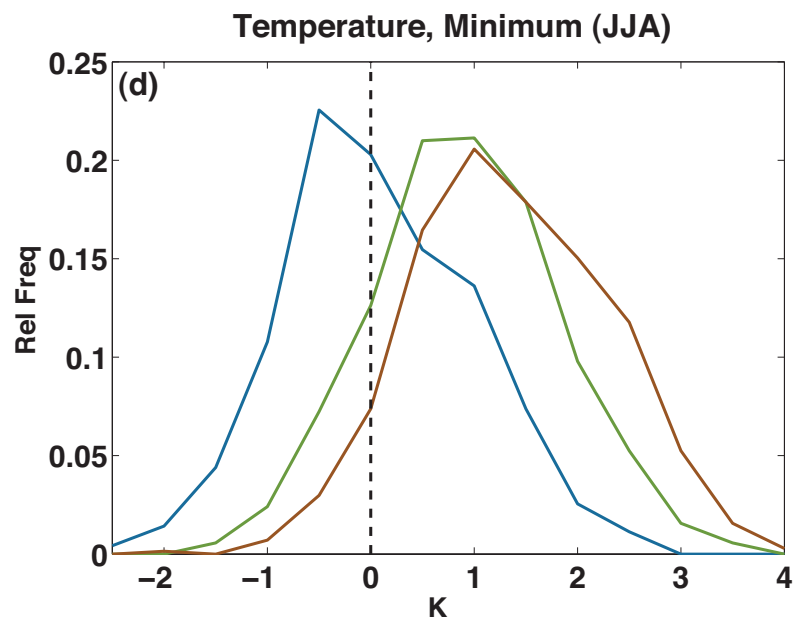
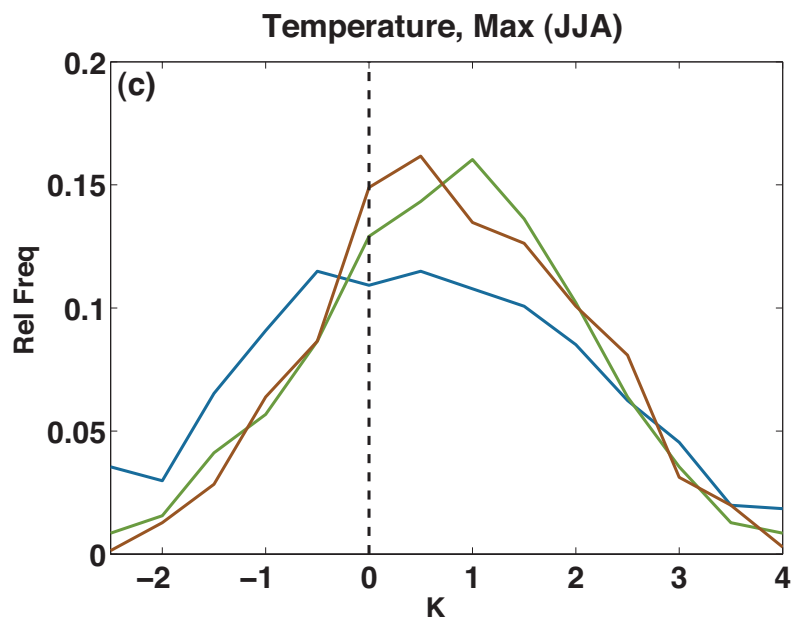
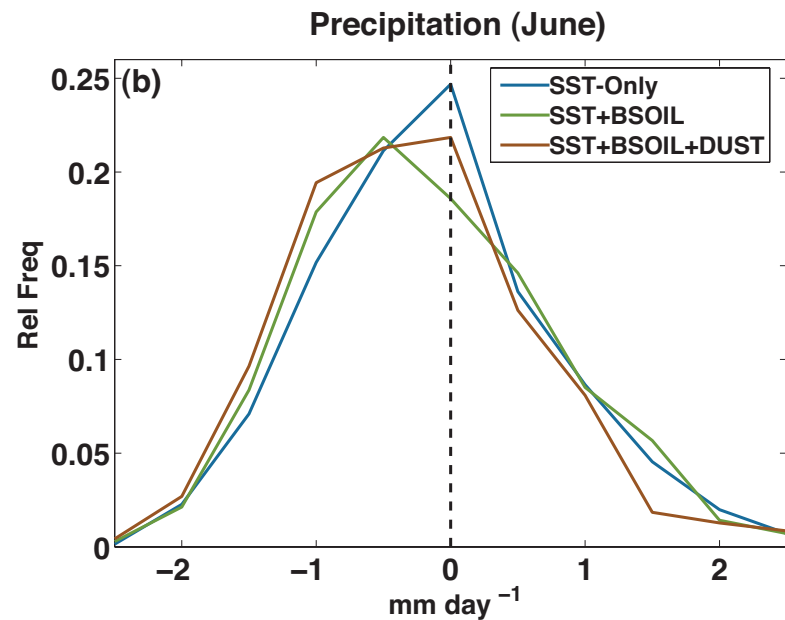
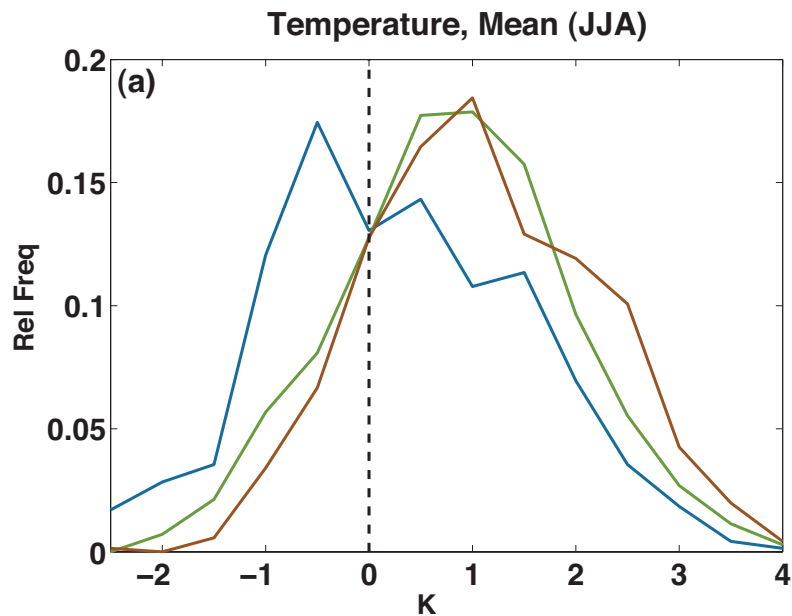


## Precipitation (June)

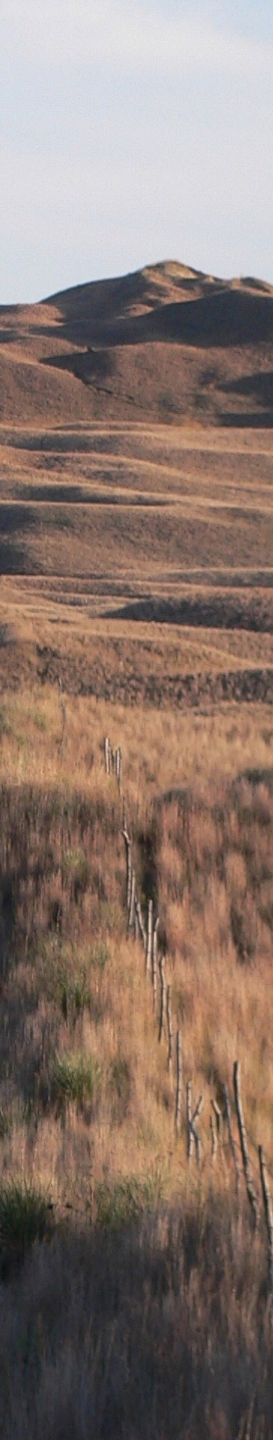




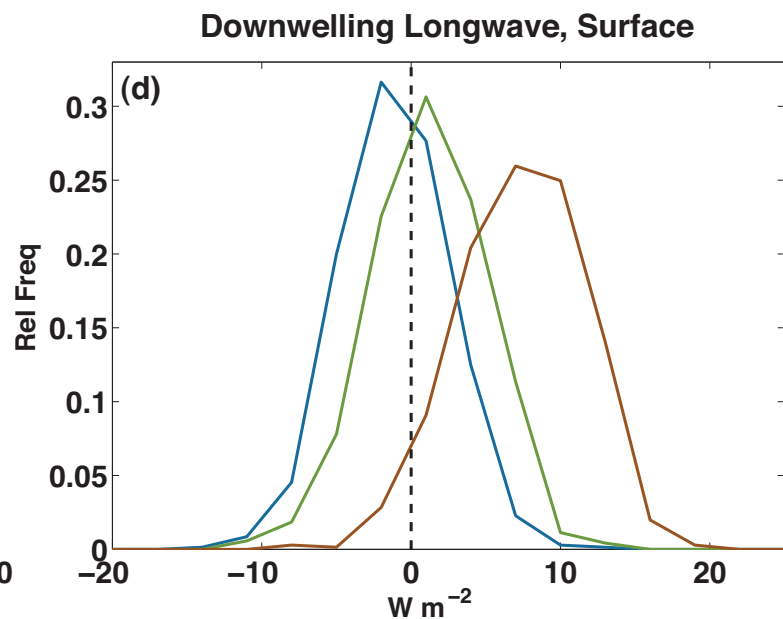
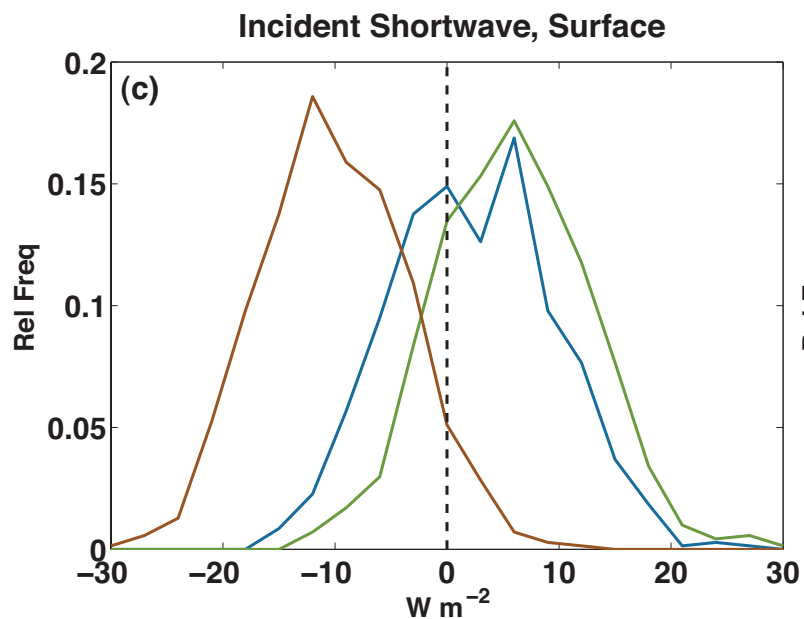
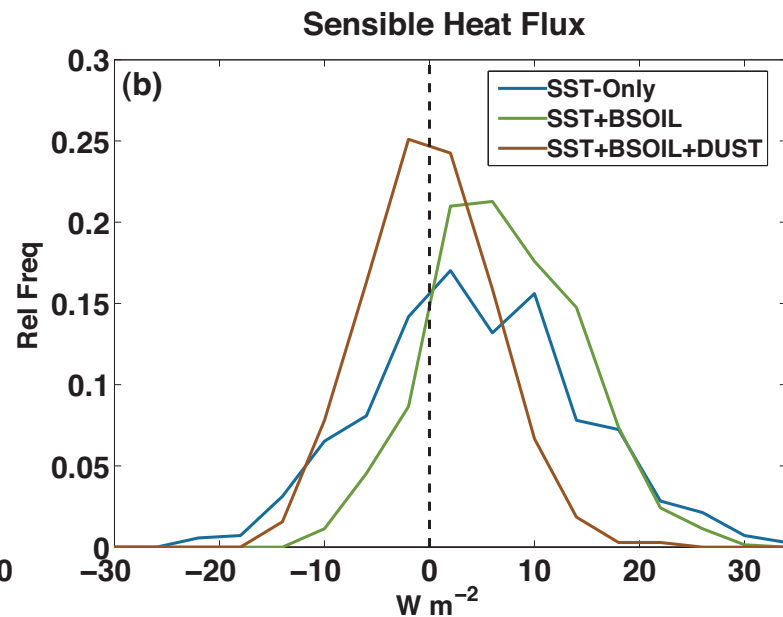
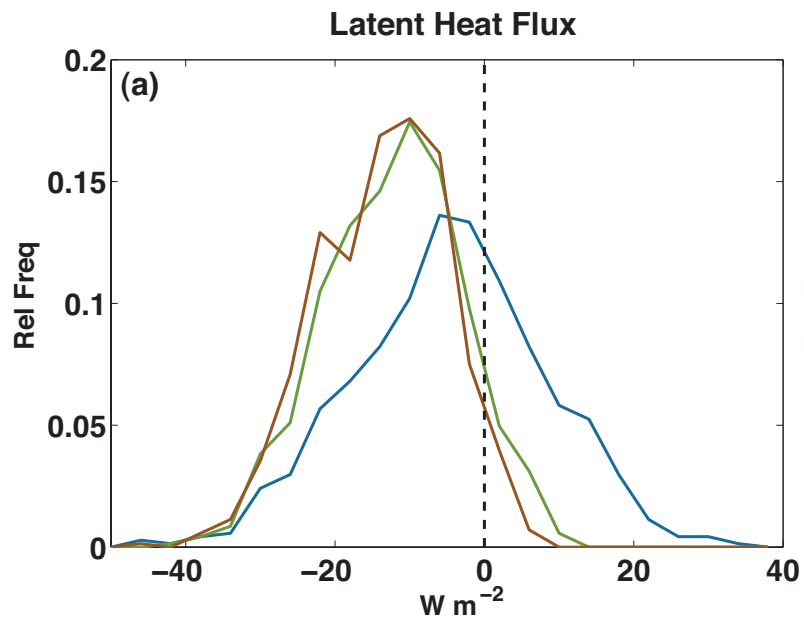
# Temperature and Precipitation Anomalies

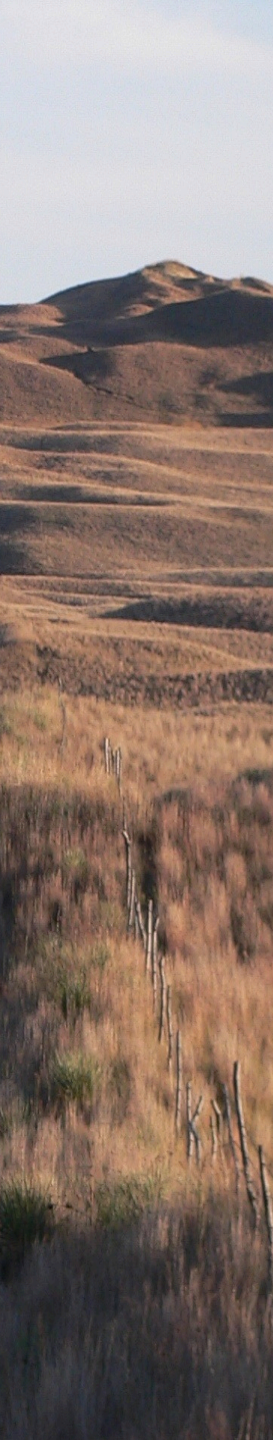




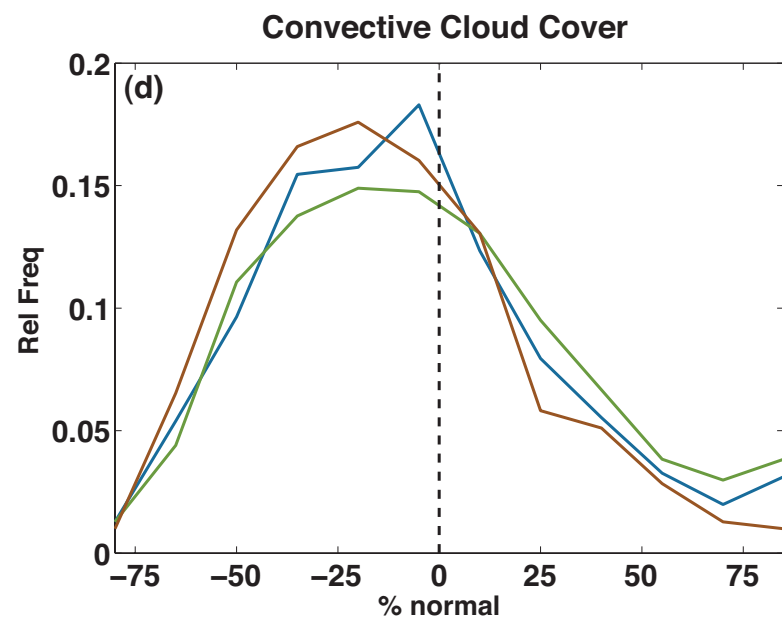
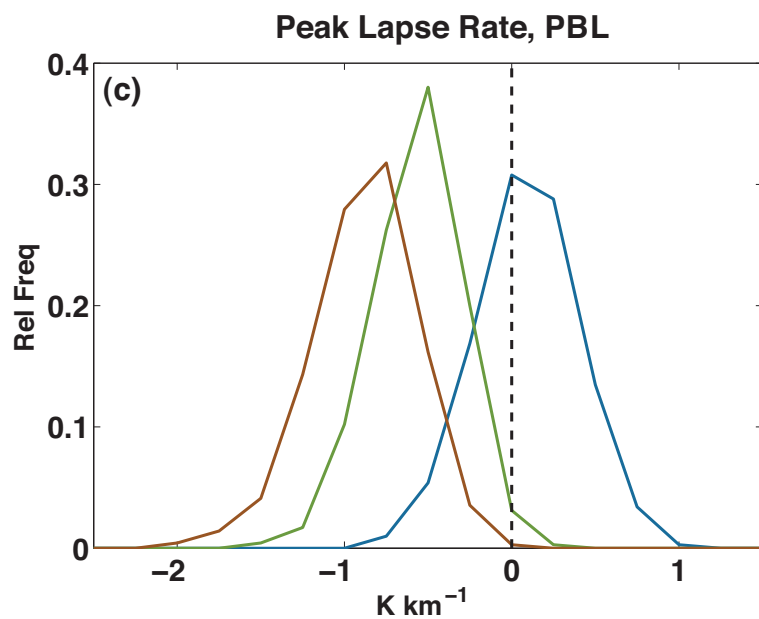
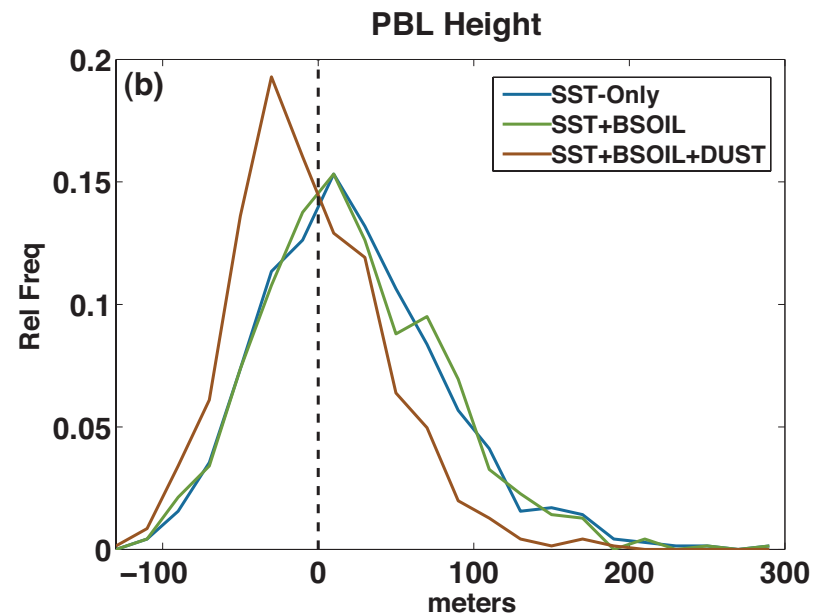
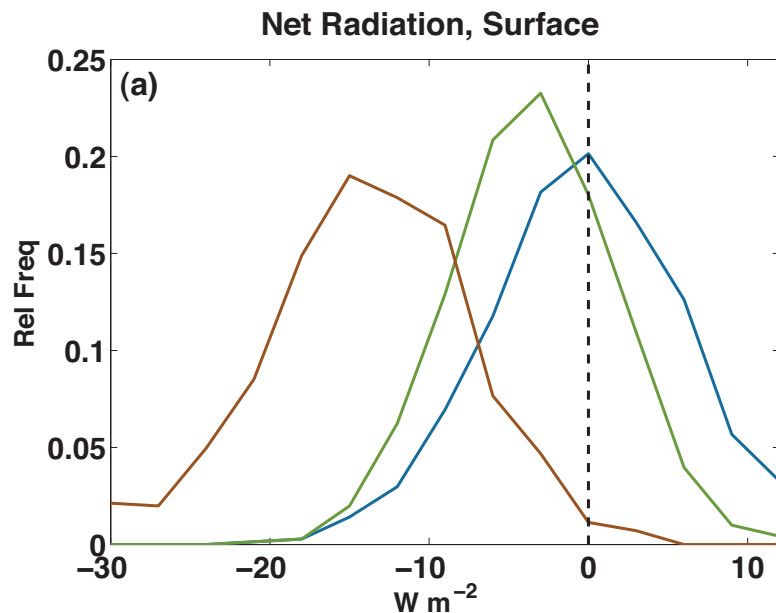


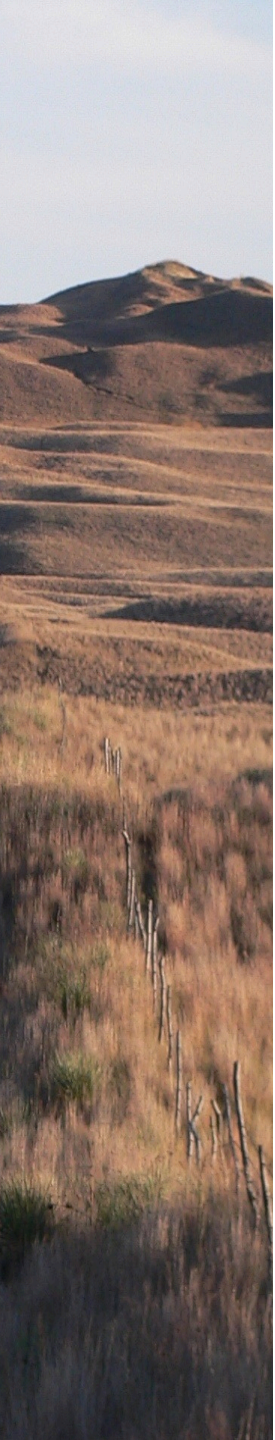
# Surface Fluxes (JJA)





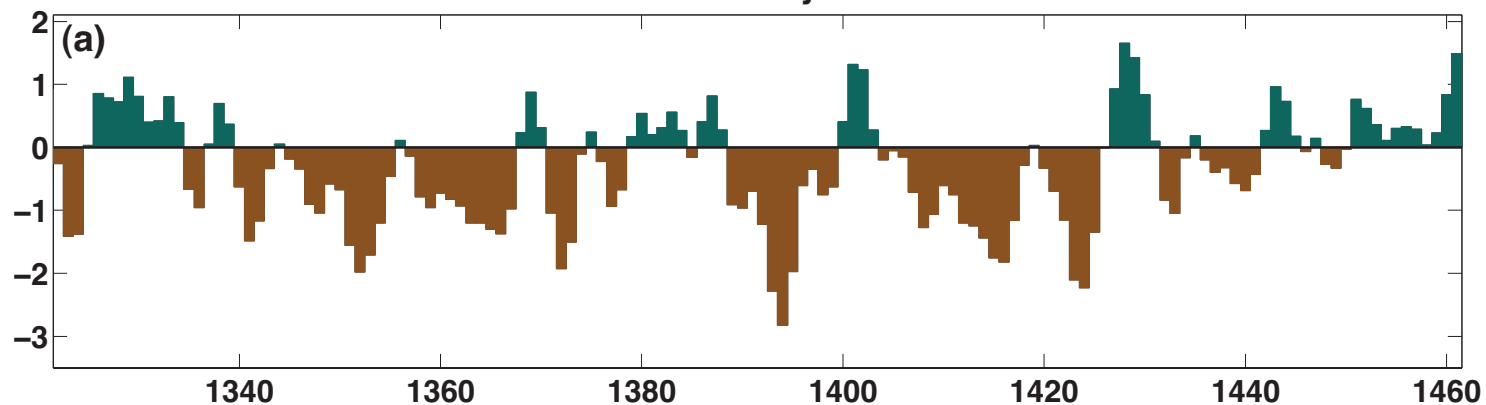
# Surface Response (June)



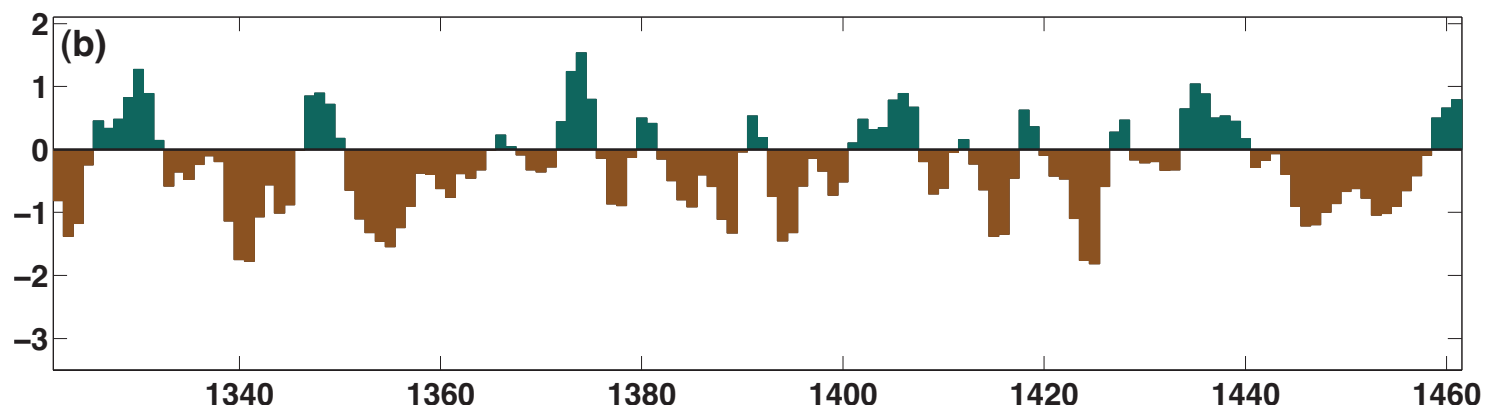


# Central Plains PDSI (JJA, MCA Model Runs)

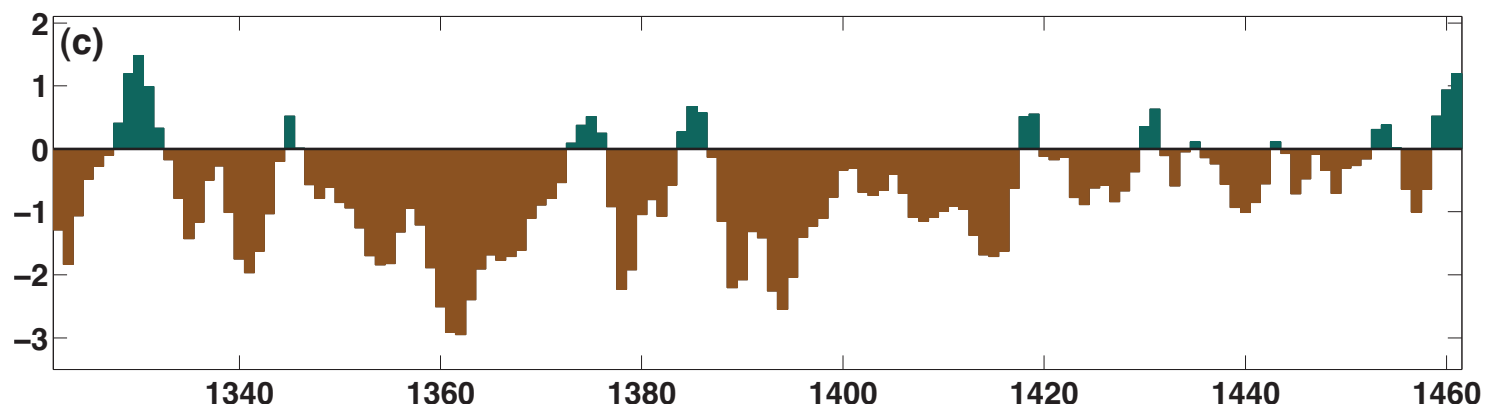
SST-Only



SST+BSOIL

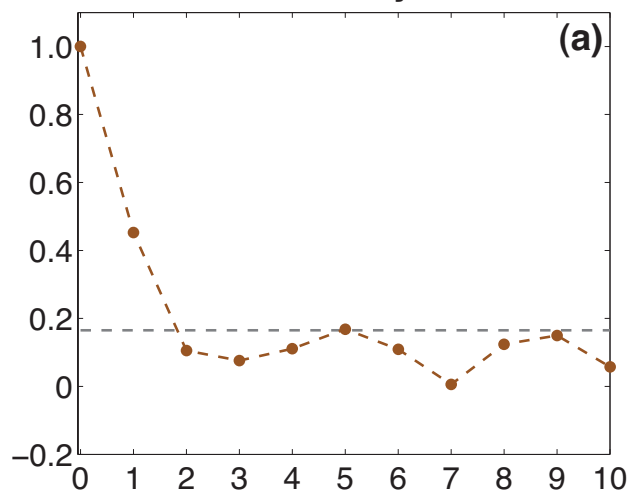


SST+BSOIL+DUST

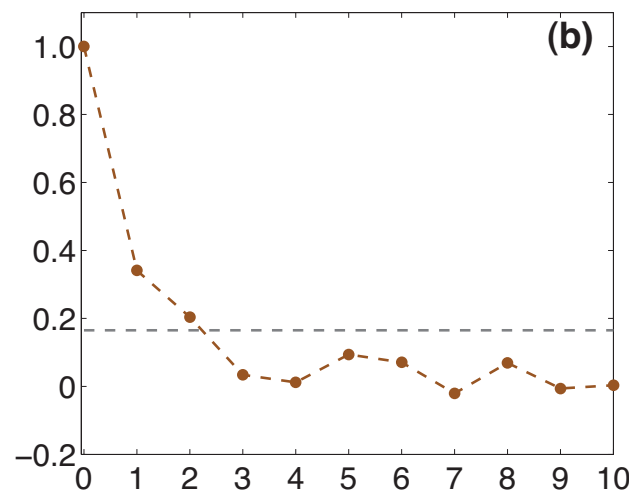


# Autocorrelation Function, Model PDSI (Ensemble Mean)

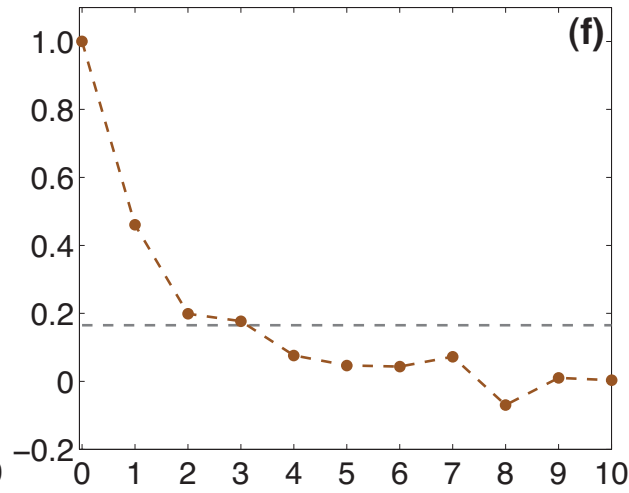
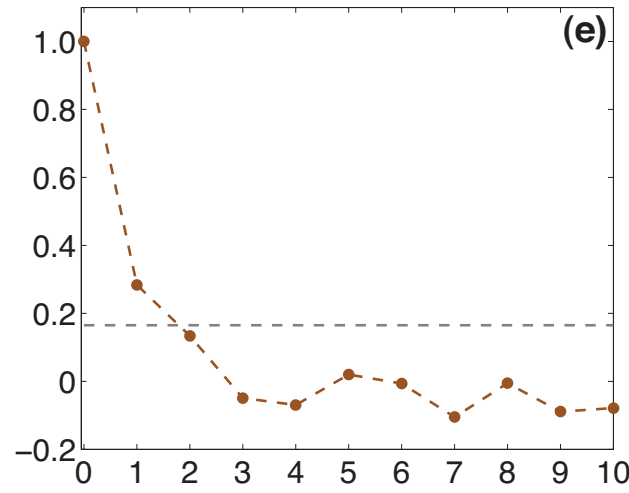
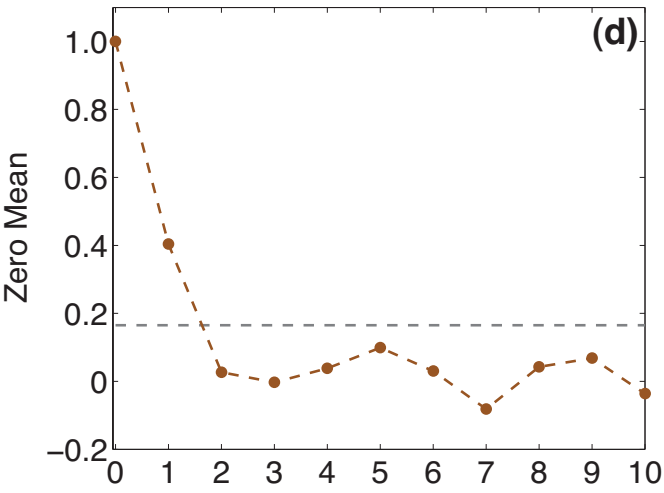
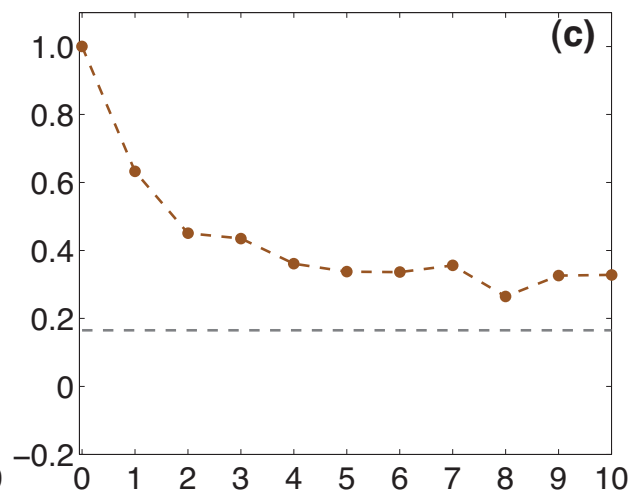
## SST-Only



## SST+BSOIL

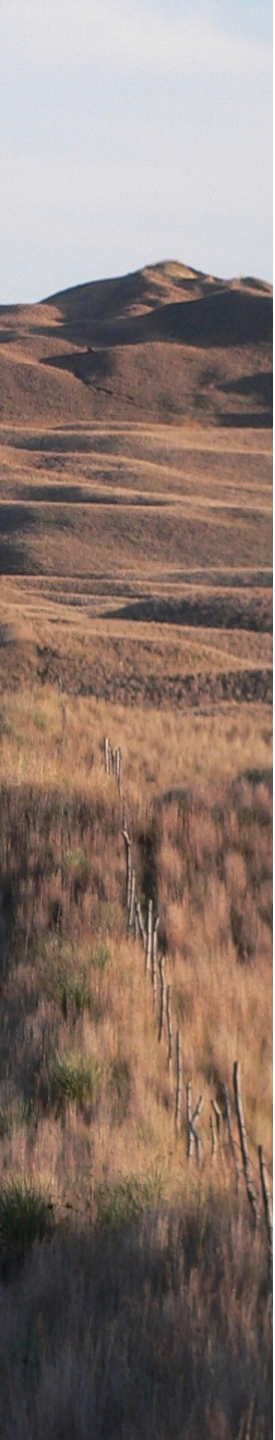


## SST+BSOIL+DUST



Lag





# **Discussion**

**Dust aerosols increase drought persistence**

**Uncertainties in boundary conditions?**

**Dynamical Interactions?**