



# The water cycle of North American basins and related Land Surface-Atmosphere Interactions in the **Regional Reanalysis** Data

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# Research Objectives

- Key questions:
  - what are the feedbacks that enhance or weaken atmospheric anomalies?
  - where are interactions strongest or weakest?

# North American Regional Reanalysis (NARR)

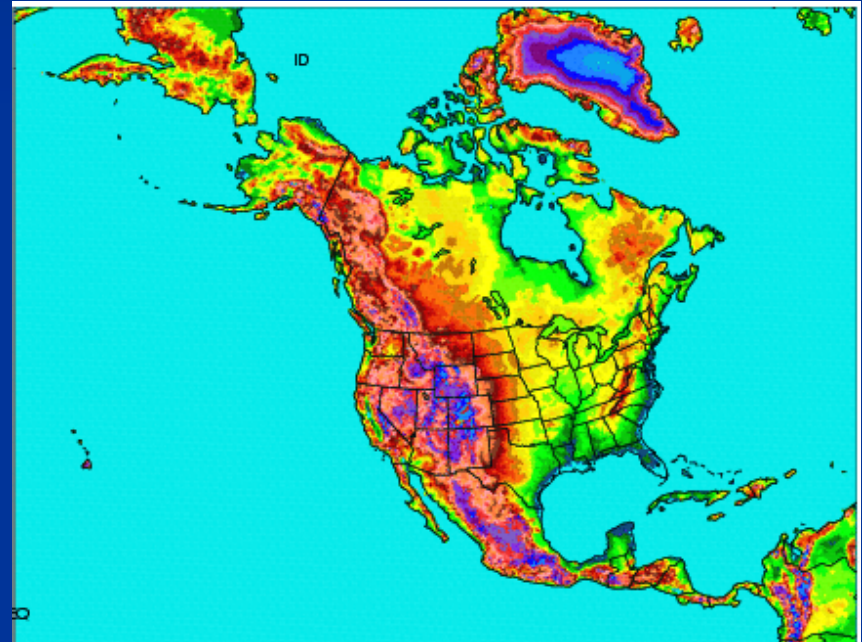
A set of long-term, high resolution, consistent, regional climate data for the North American Domain

- Diagnostics Studies
- Model Initialization and Validation

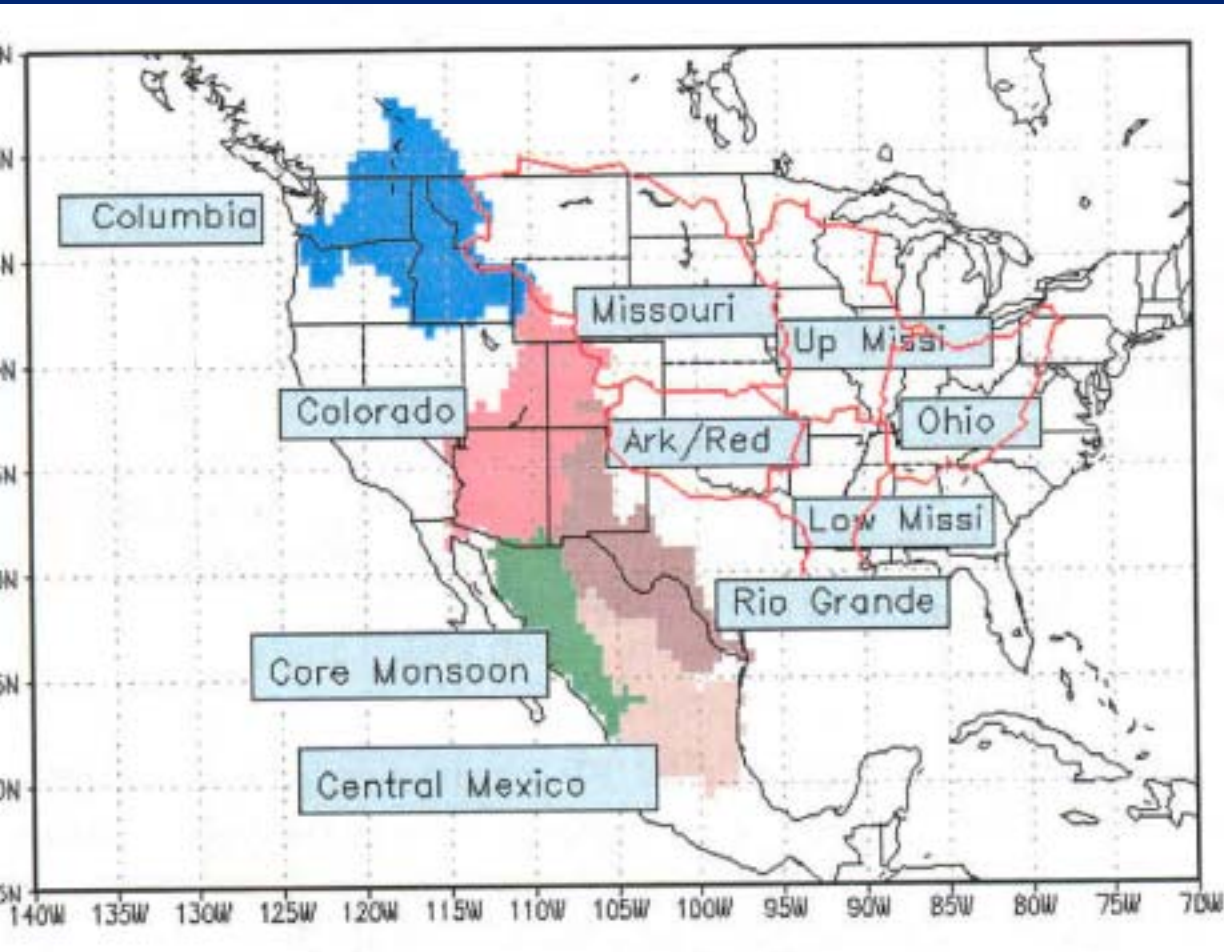
Characteristics of NARR (Mesinger et al. 2002, 2005)

- 1979 through 2002
- 32 Km Spatial Resolution/ 45 Vertical Layers
- 3 Hourly Temporal Resolution
- NCEP/ETA/EDAS based
- Assimilation of observed precipitation with PRISM

(REGIONAL REANALYSIS DOMAIN)



# Study Areas

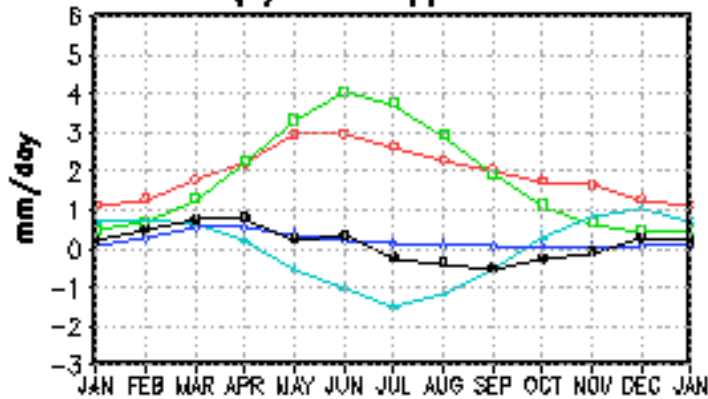


The focus of this research is on North America basins with diverse climate regimes

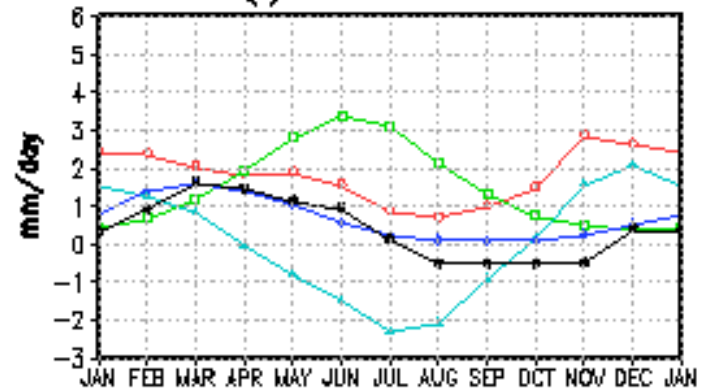
- (1) Mississippi basin : summer precipitation associated with LLJ
- (2) Western United States basins: complex topography and significant cold season snowfall and with a much larger runoff fraction
- (3) Monsoon prevalent regions: strong summer hydrologic cycle associated with North American Monsoon

# Seasonal variations in surface water budgets

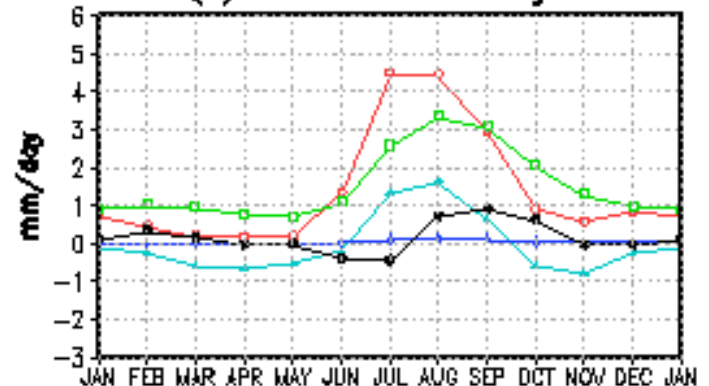
(a) Mississippi basin



(f) Columbia basin



(h) Core Monsoon Region



P—Precipitation

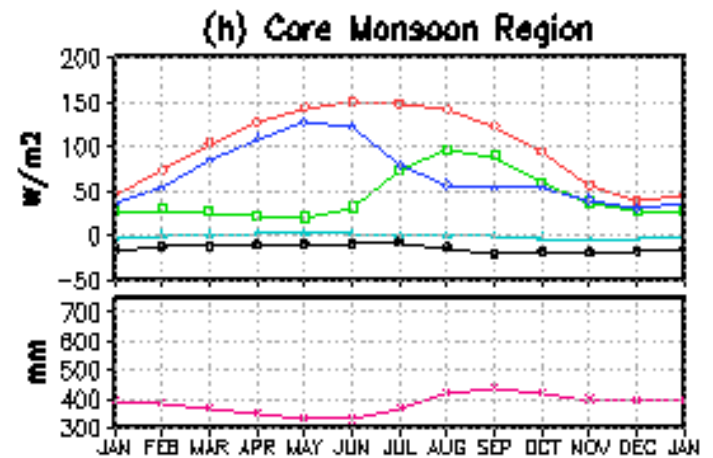
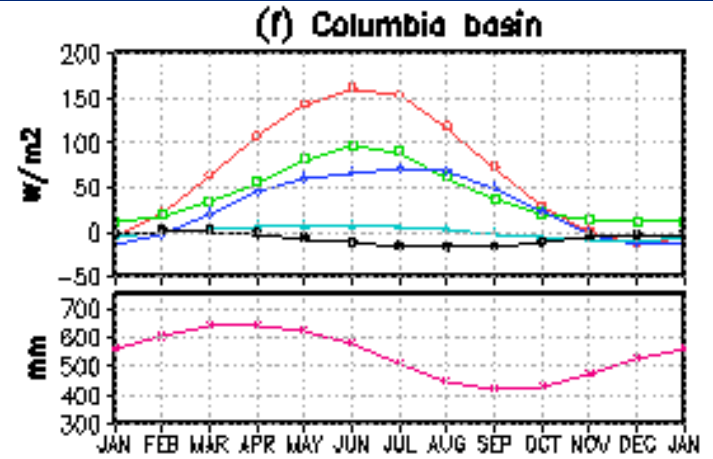
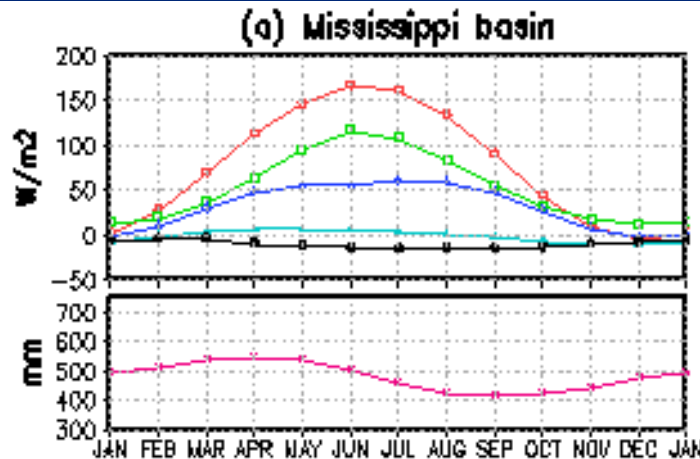
E—Evaporation

N—Runoff

dW/dt—Change in water content

dW/dt-(P-E-N)—

# Seasonal variations in surface energy budgets

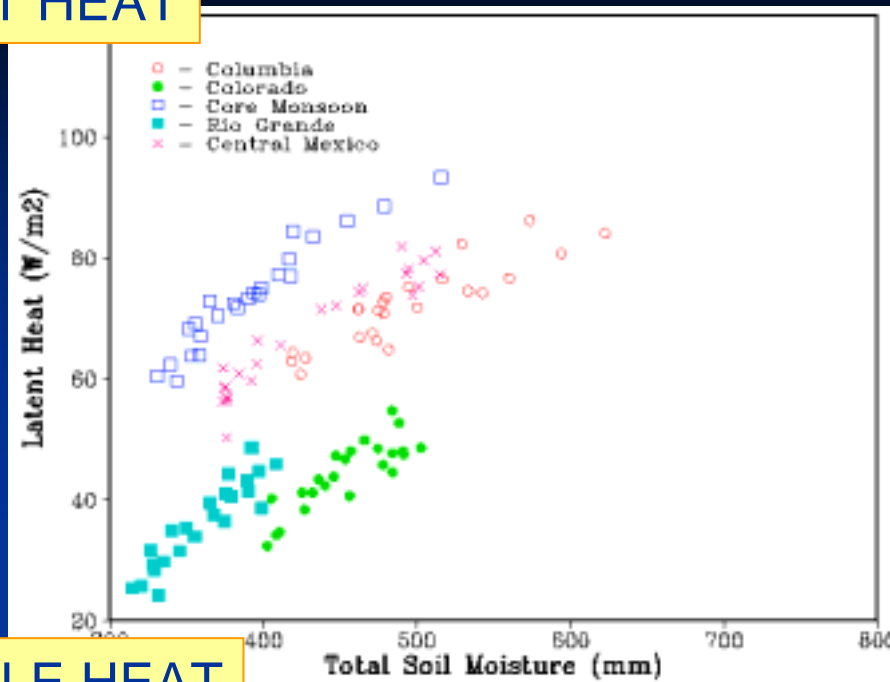
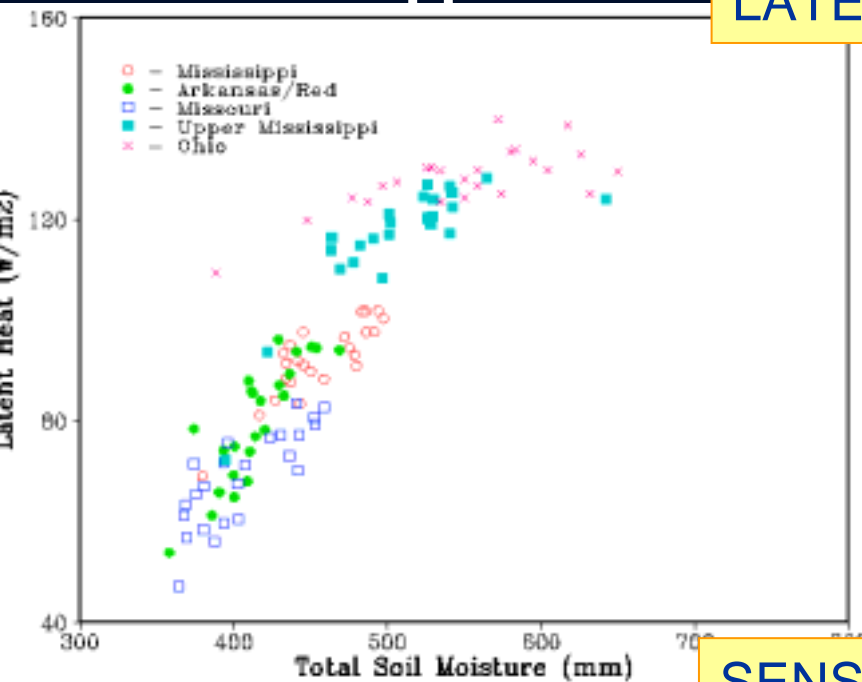


- NR — Net Radiation
- LHF — Latent Heat Flux
- SHF — Sensible Heat Flux
- GHF — Ground Heat Flux
- Residual Term
- Soil Moisture

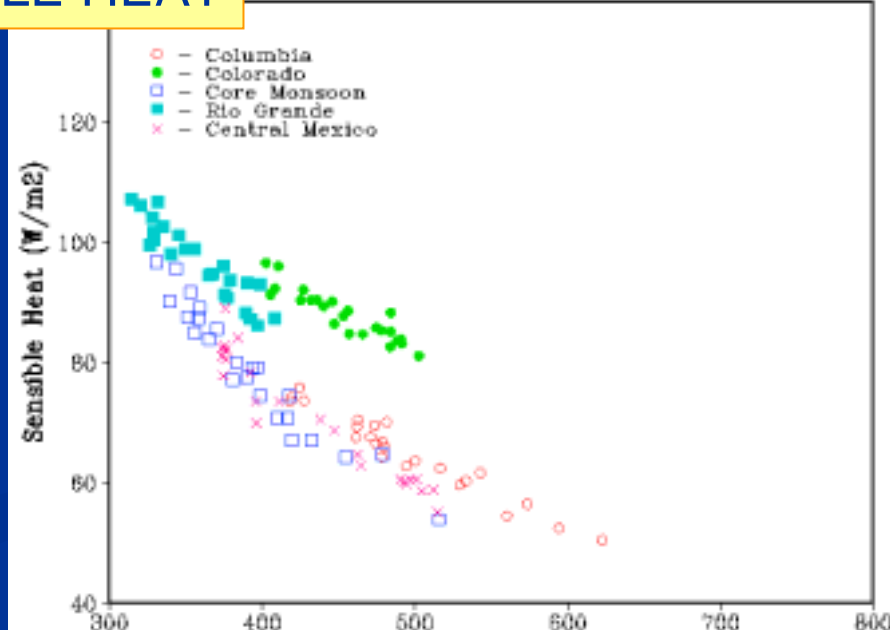
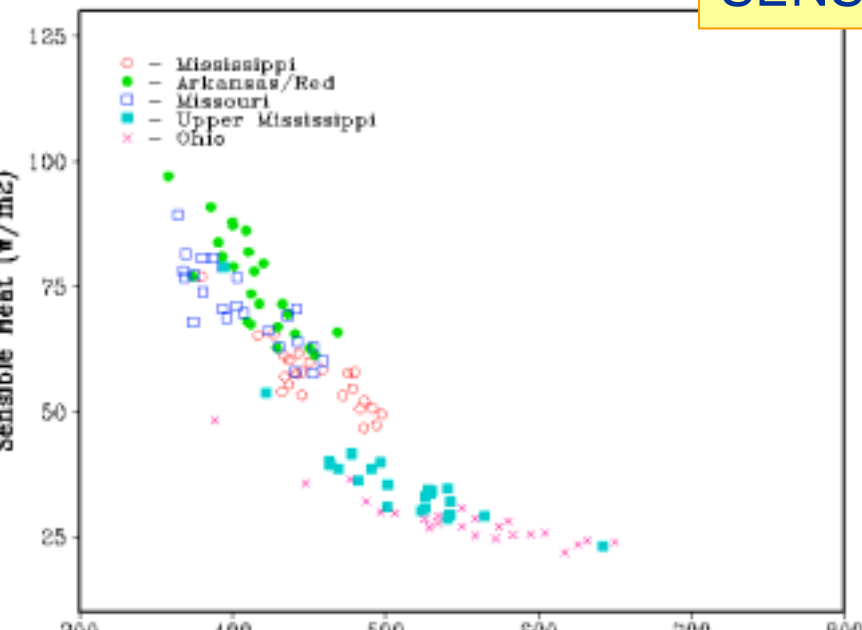
# Mississippi Basin

# LATENT HEAT

# Western Basins



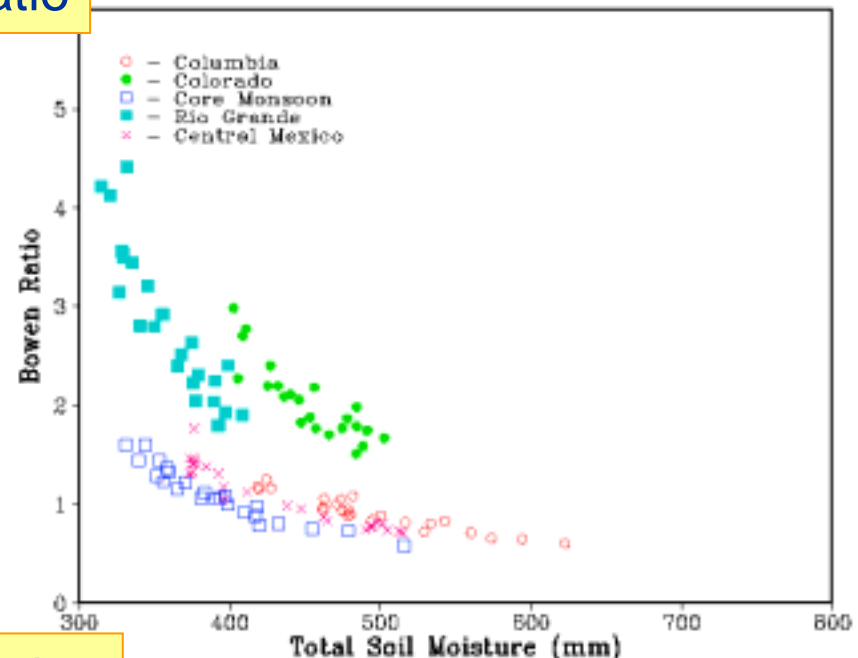
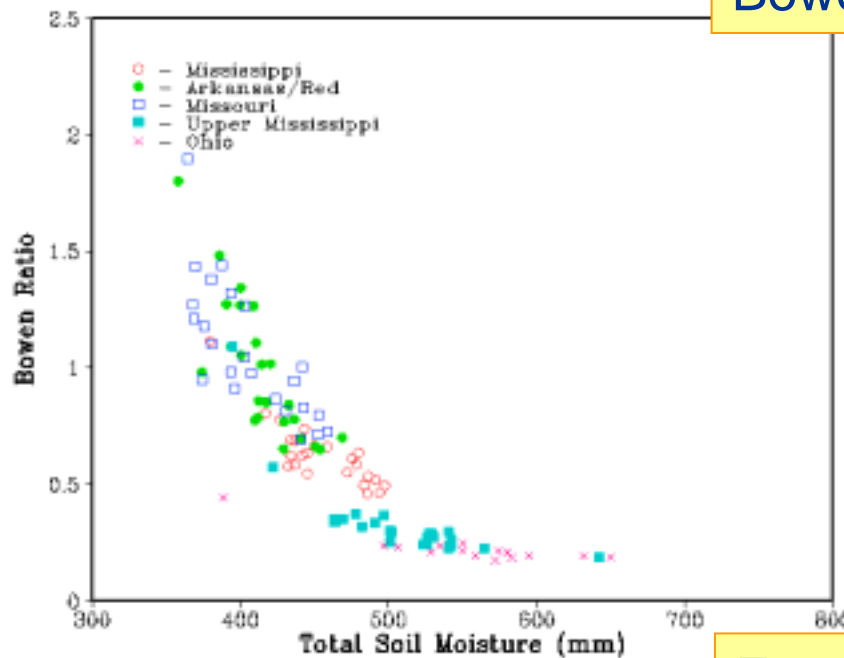
# SENSIBLE HEAT



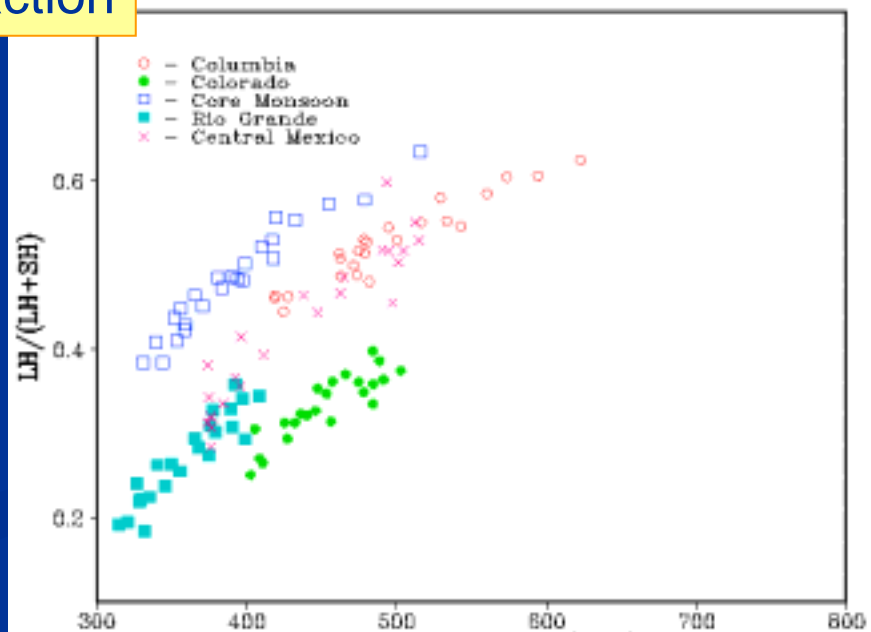
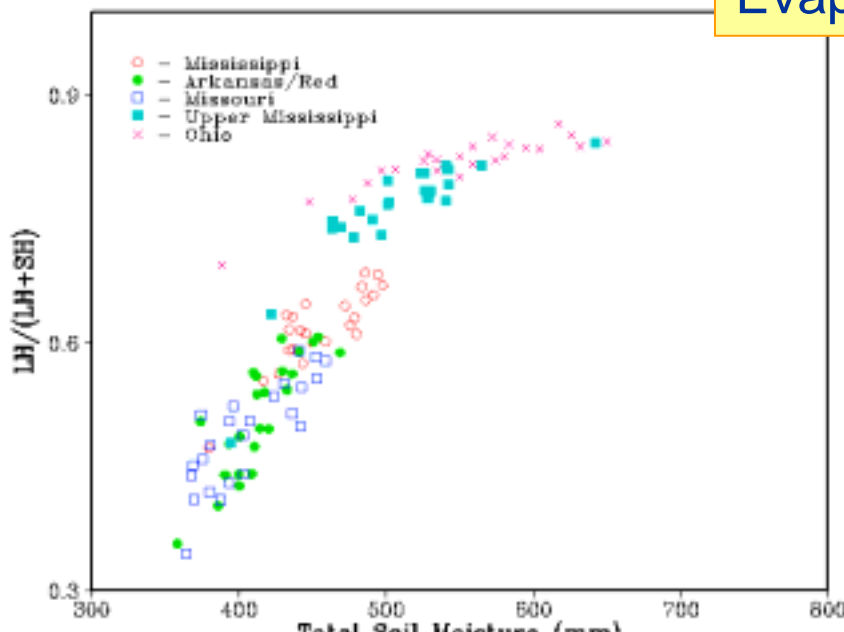
# Mississippi Basin

## Bowen ratio

# Western Basins



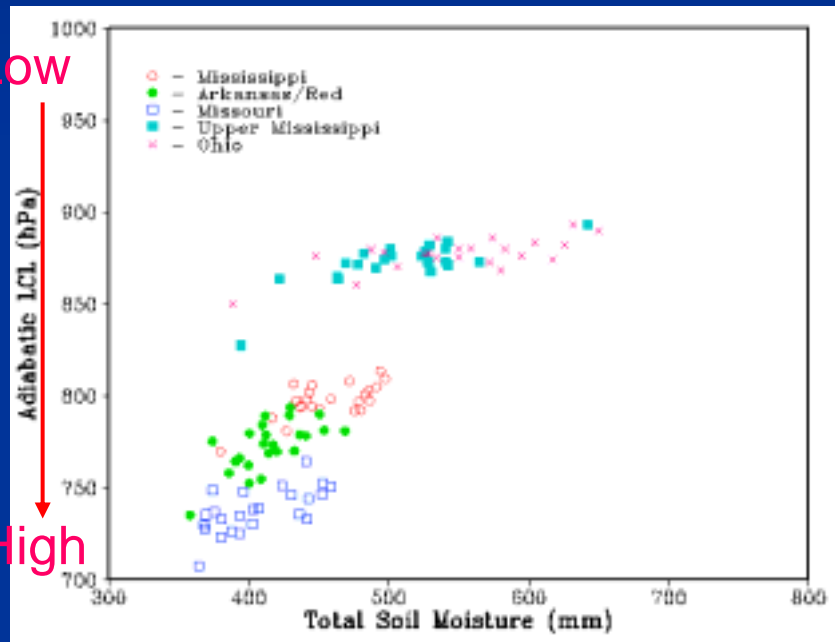
## Evap fraction



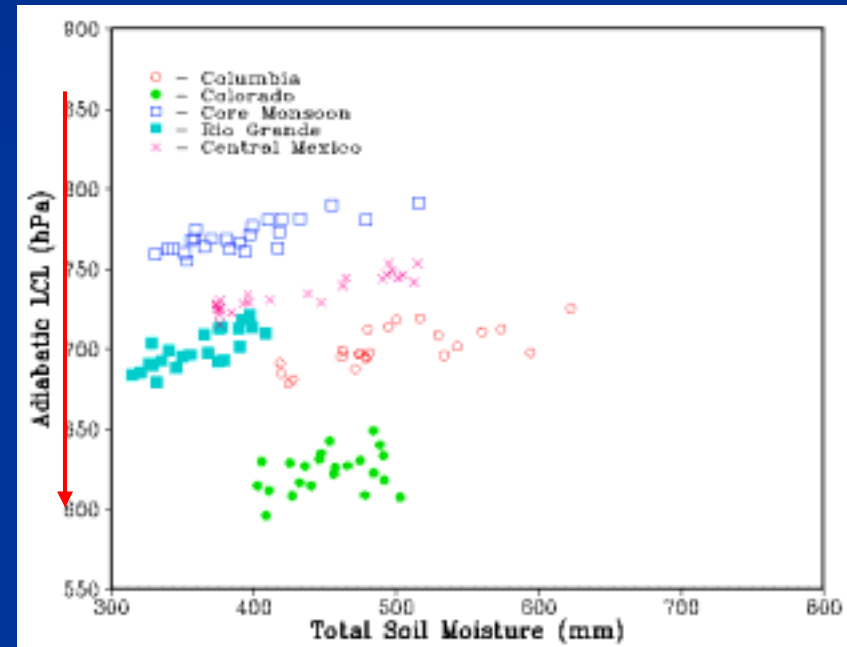


# Adiabatic LCL

## Mississippi Basin



## Western Basins

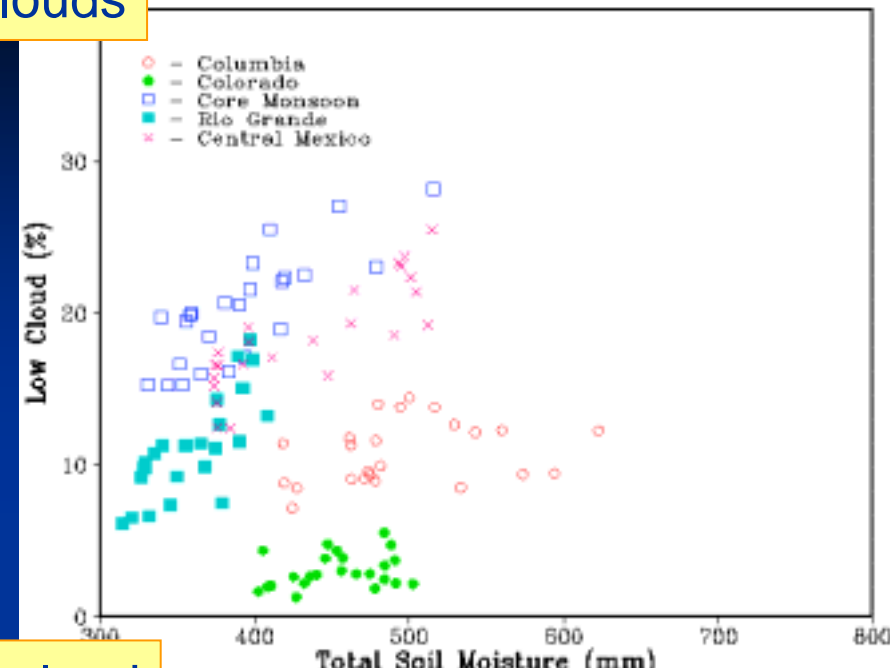
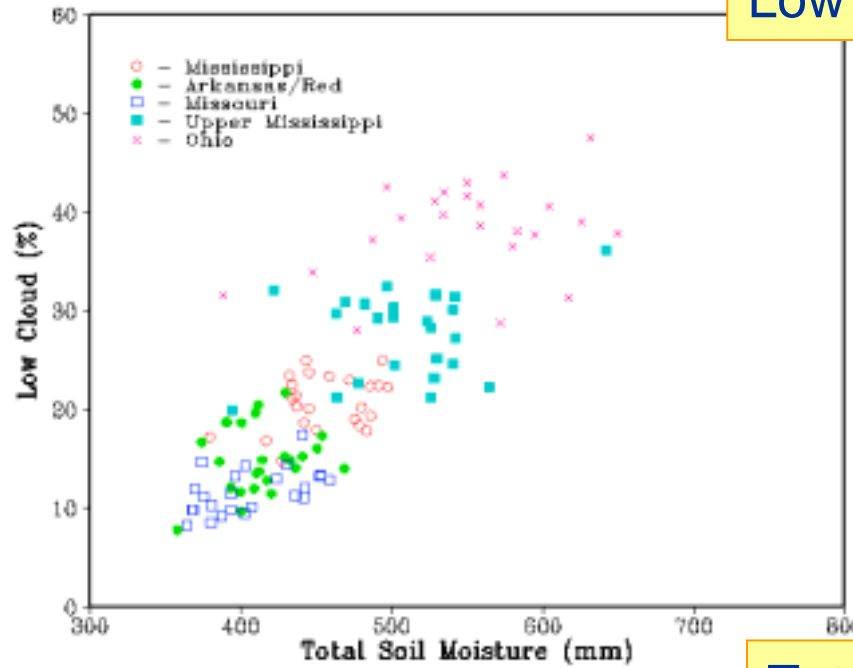


(The wetter the soil, the lower the LCL)

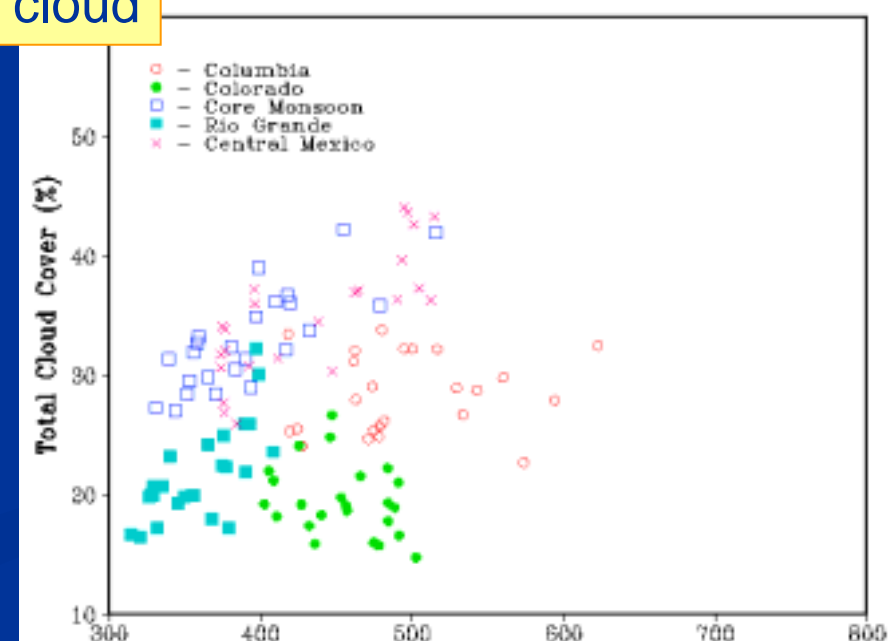
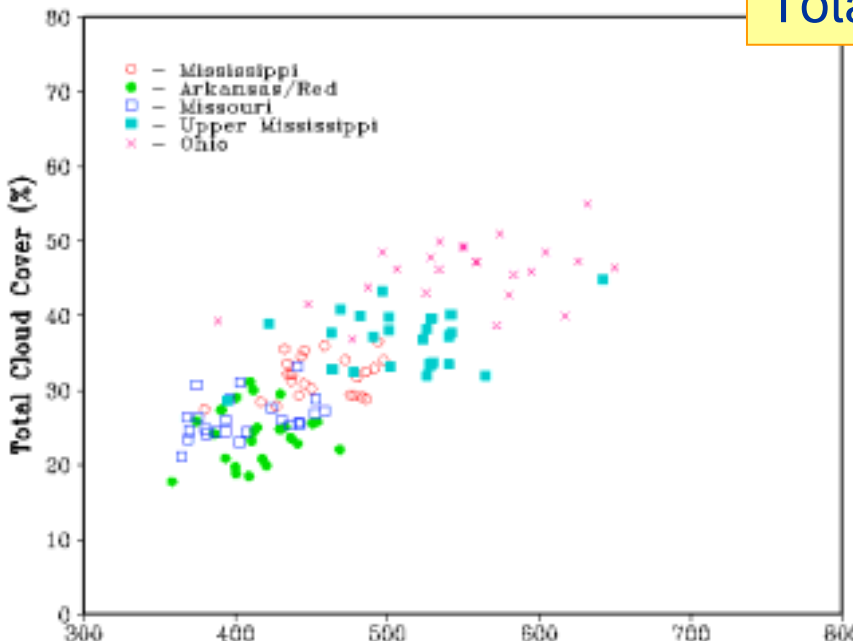
# Mississippi Basin

## Low clouds

# Western Basins



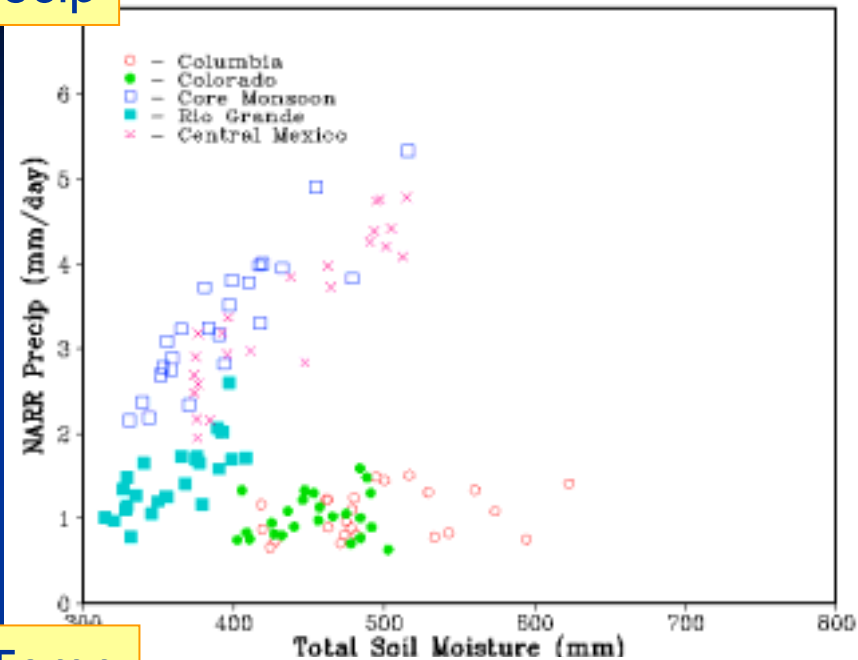
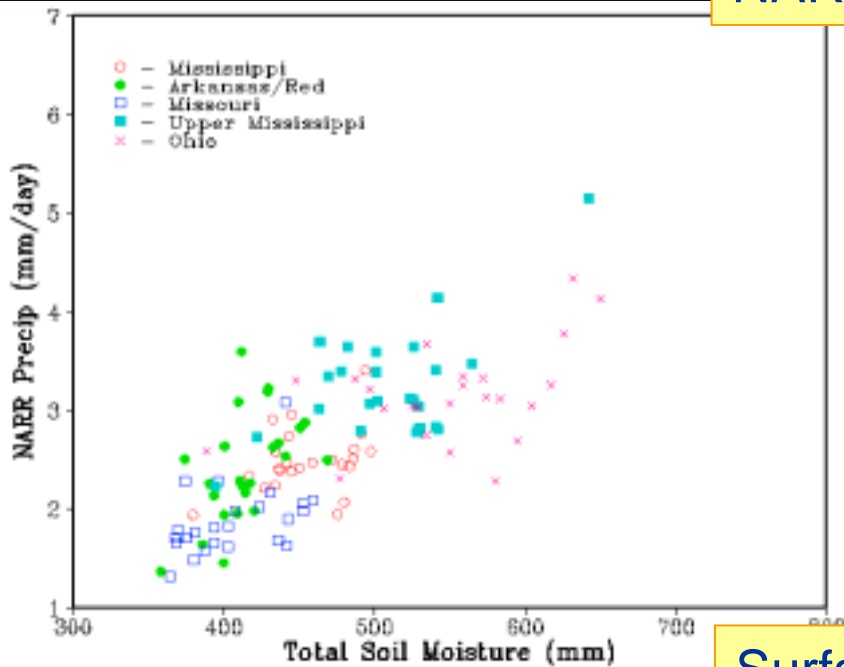
## Total cloud



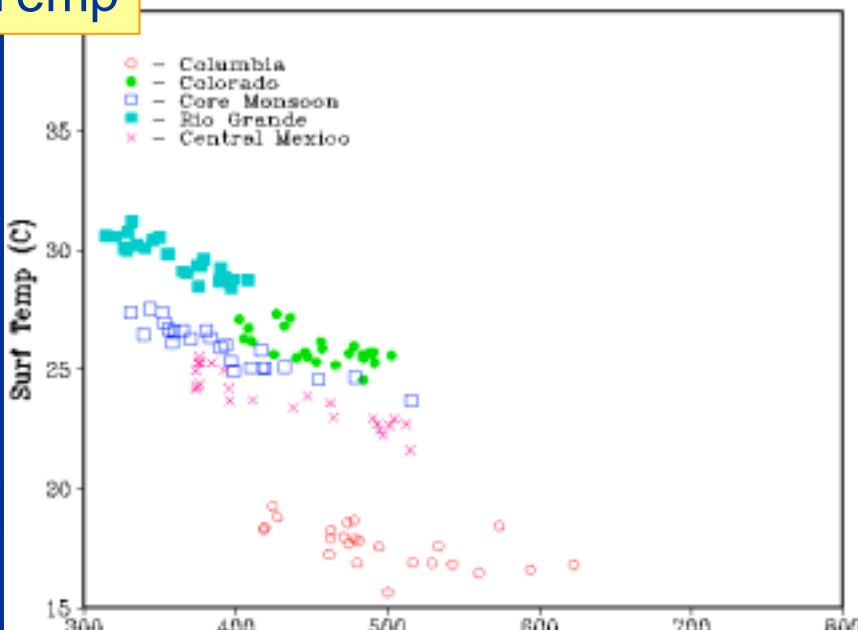
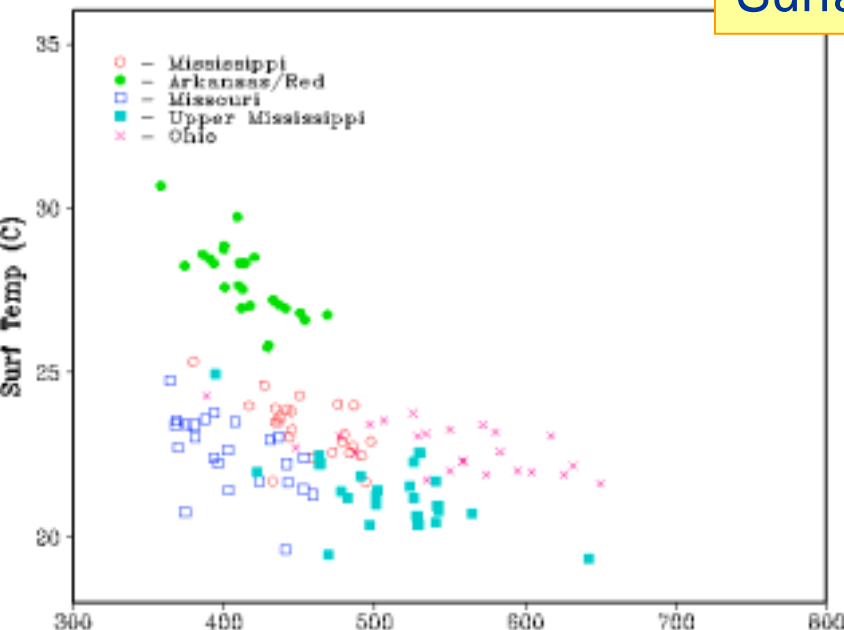
# Mississippi Basin

# NARR Precip

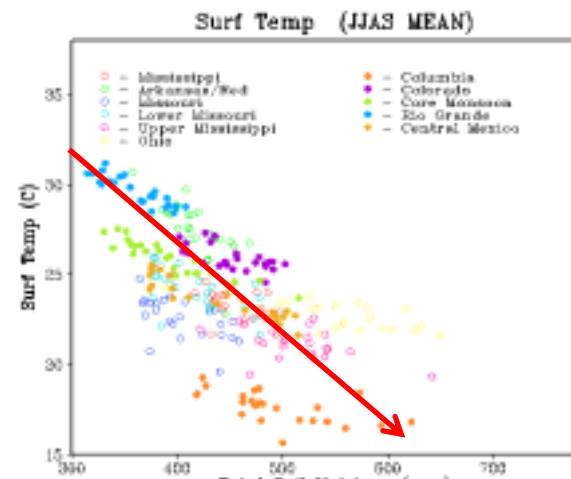
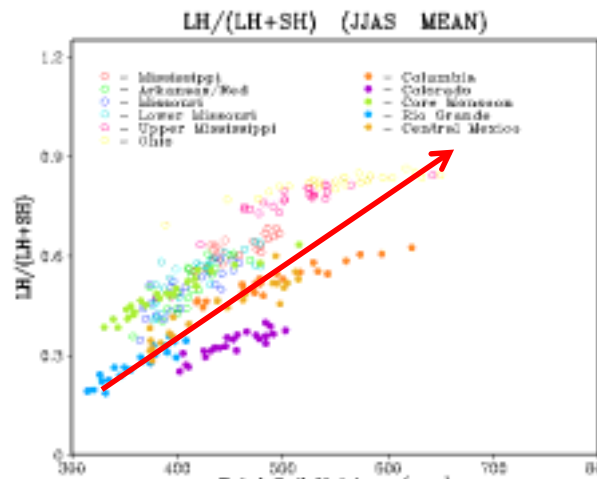
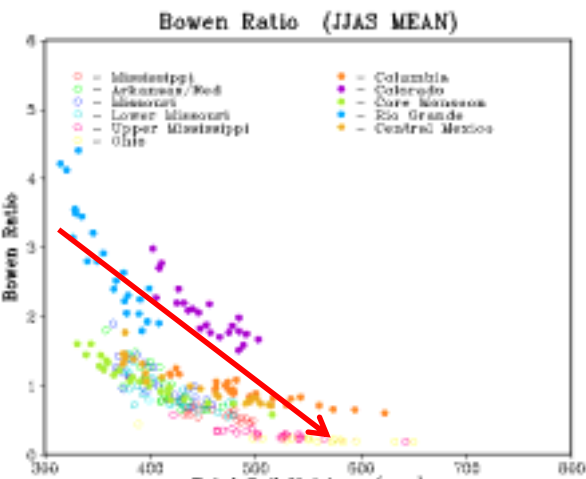
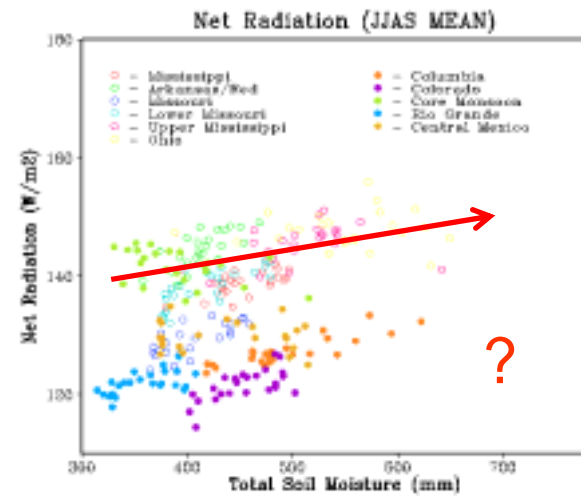
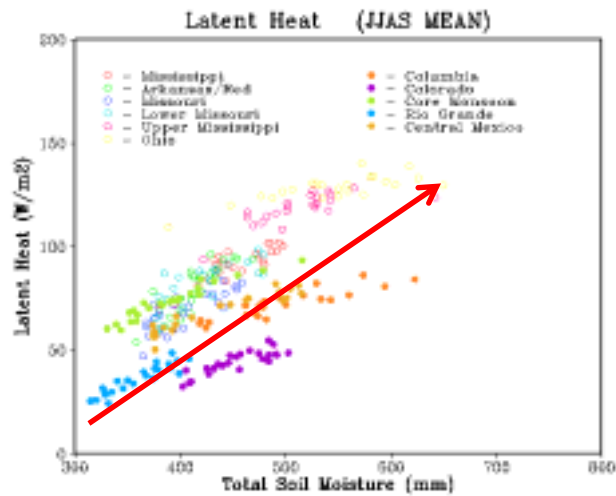
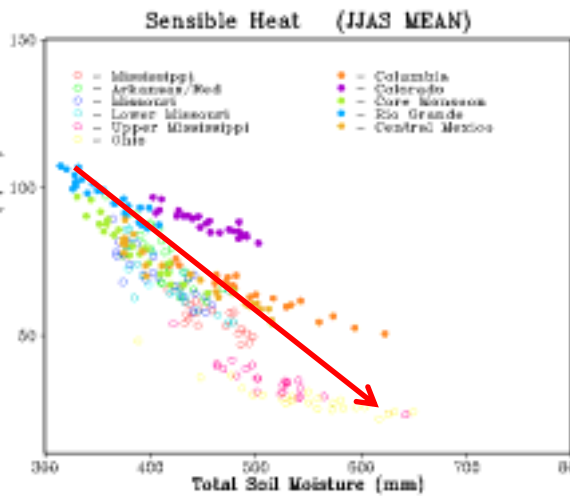
# Western Basins



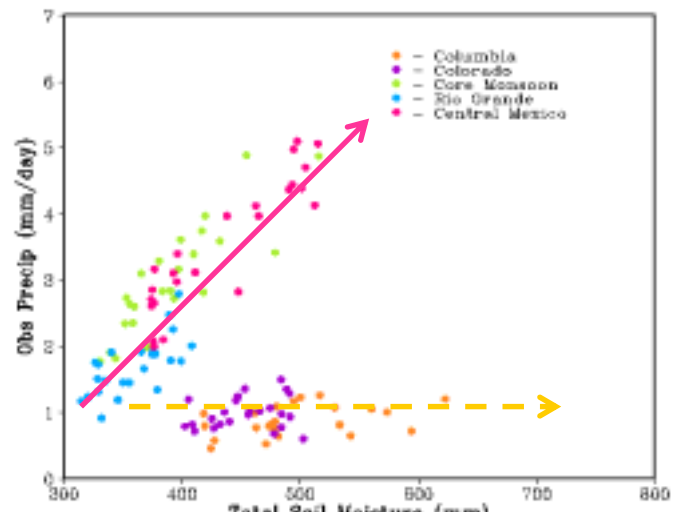
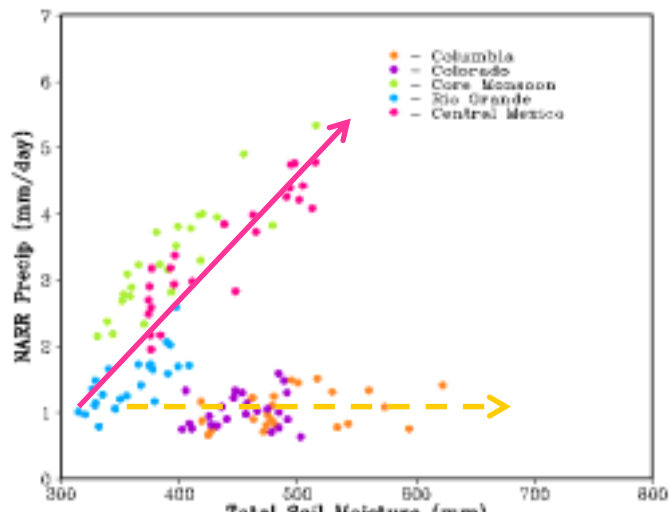
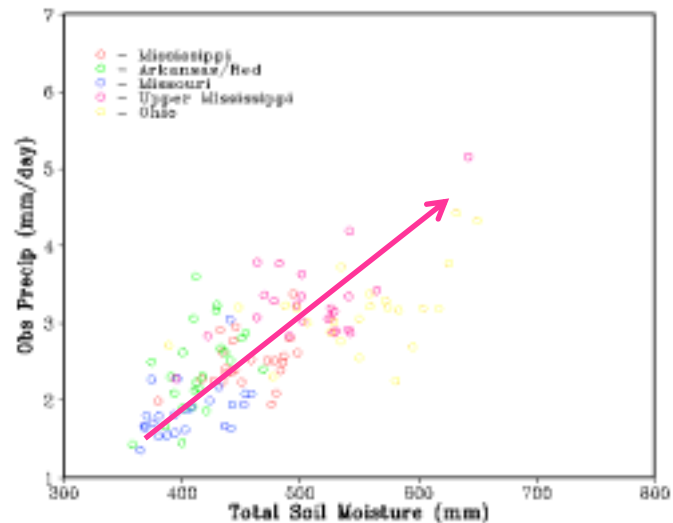
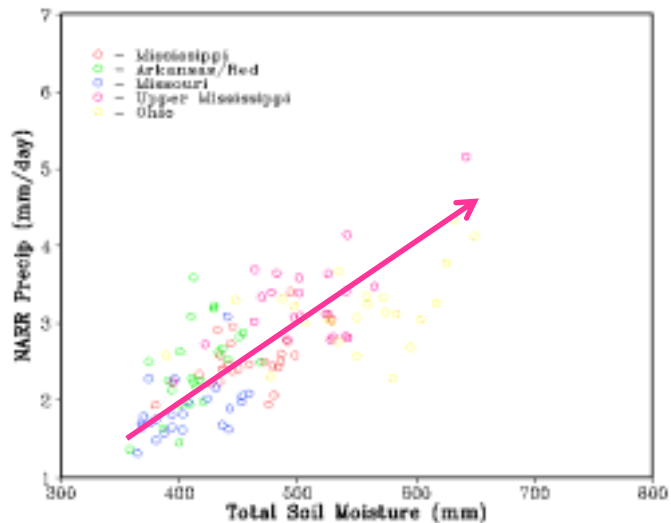
# Surface Temp



In summary,  
An increase in soil moisture is associated with ...



# An increase in soil moisture is associated with ...



# Regional Categorization

