



NARR Workshop

San Diego, CA

January 11, 2005



A preliminary assessment of the water and energy budgets in the NARR

Y. Luo⁽¹⁾ , E. H. Berbery⁽¹⁾, K. E. Mitchell⁽²⁾

with contributions of the NARR Team⁽²⁾

(1) Department of Meteorology/ESSIC, University of Maryland

(2) Environmental Modeling Center, National Centers for Environmental Prediction/NOAA



Contact: berbery@atmos.umd.edu

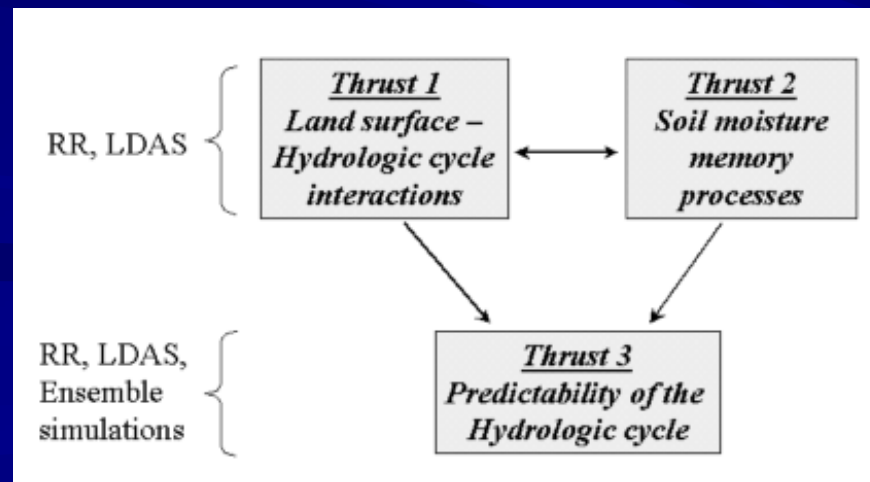
Outline

- Motivation
- Precipitation
- Surface Energy Budget
- Surface Water Budget
- Future plans

Objectives

“To understand the regional differences in the water and energy budgets and how they relate to soil moisture memory”

“To improve our understanding of the regional nature of land surface-atmosphere feedbacks, and their role in the variability and predictability of the hydrologic cycle of North American basins”

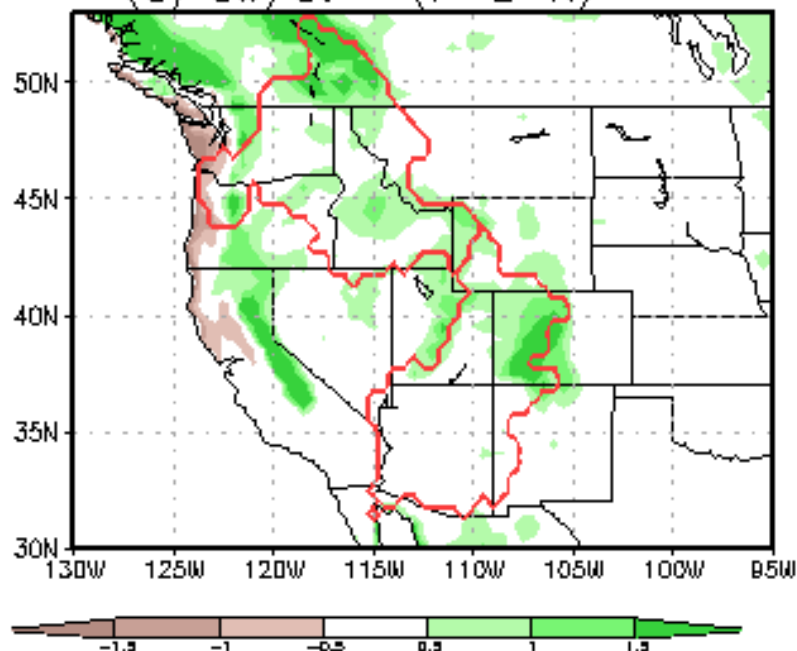


Motivation (1): Evolution of the SWB in the Op Eta

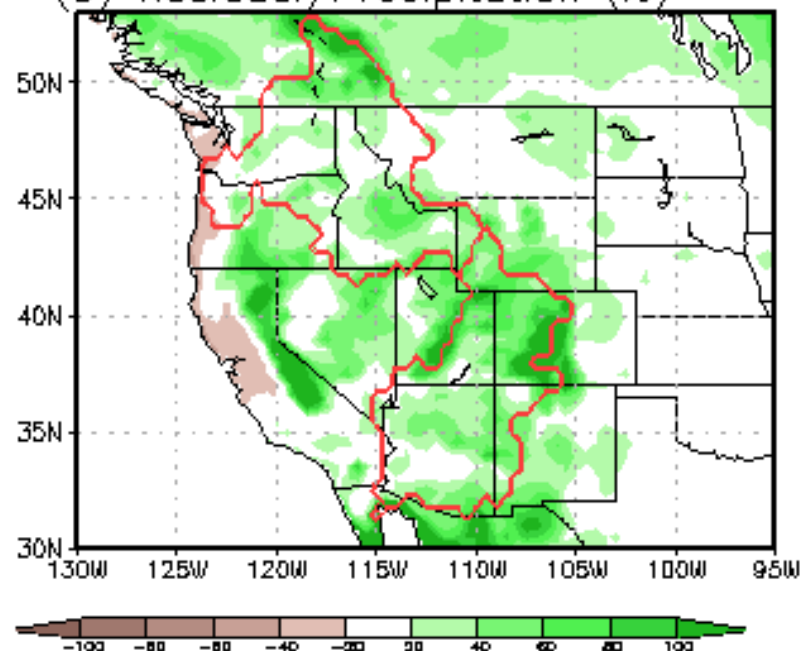
From Luo et al, 2005, JHM (in review)

Residual of the surface water balance

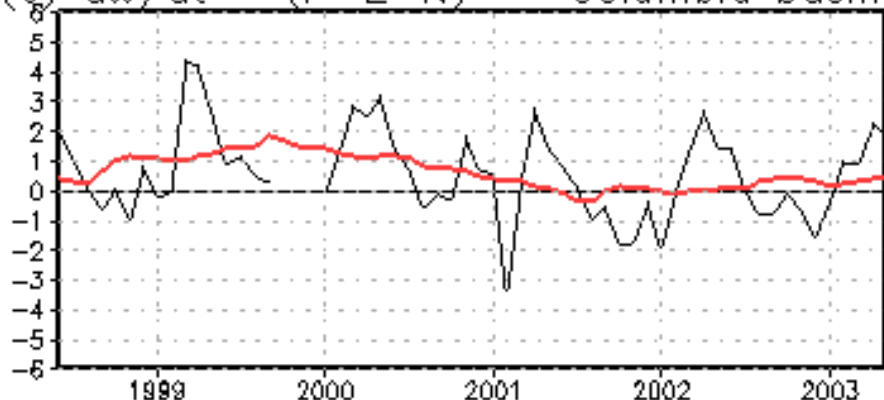
(a) $dW/dt - (P-E-N)$



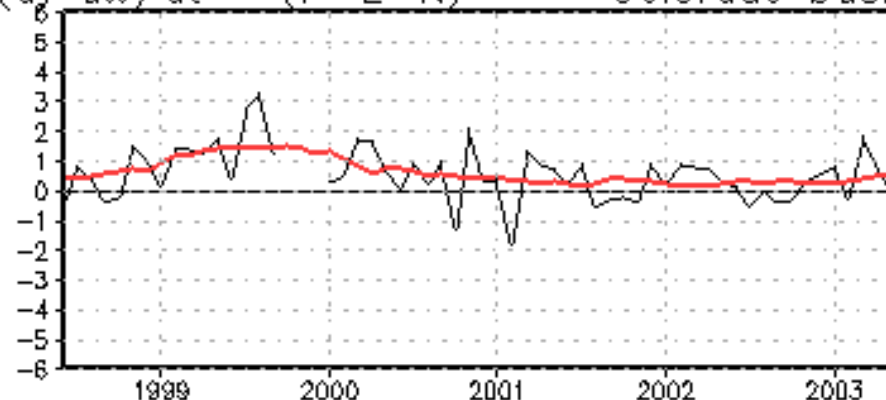
(b) Residual/Precipitation (%)



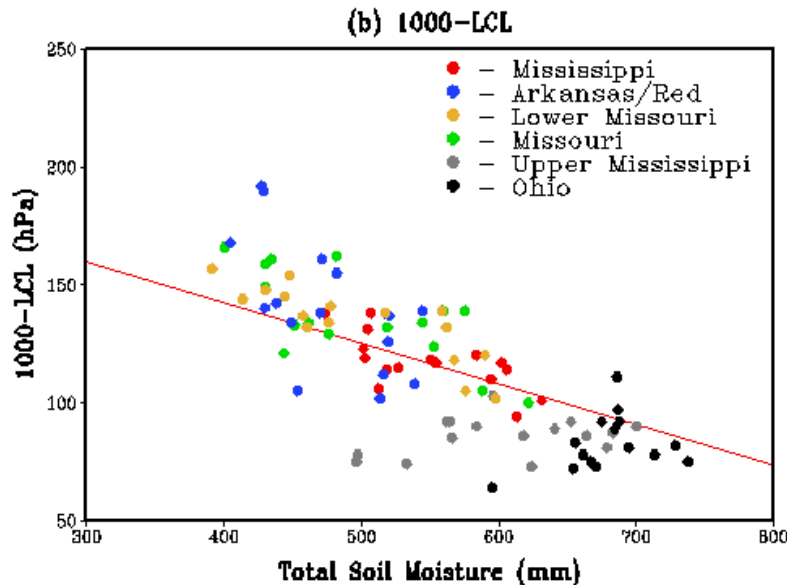
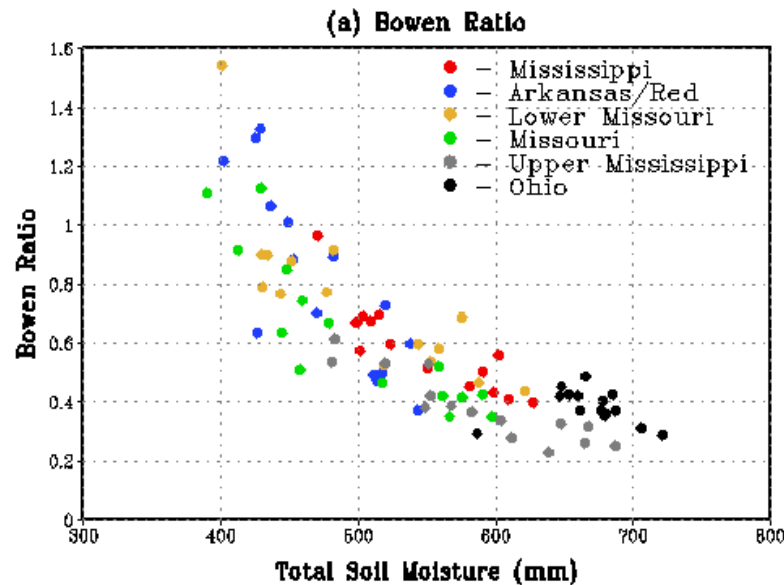
(c) $dW/dt - (P-E-N)$ Columbia basin



(d) $dW/dt - (P-E-N)$ Colorado basin



Motivation (2): Land-atmosphere interactions in Op Eta



Mississippi River Basin

From Berbery et al. (2003)

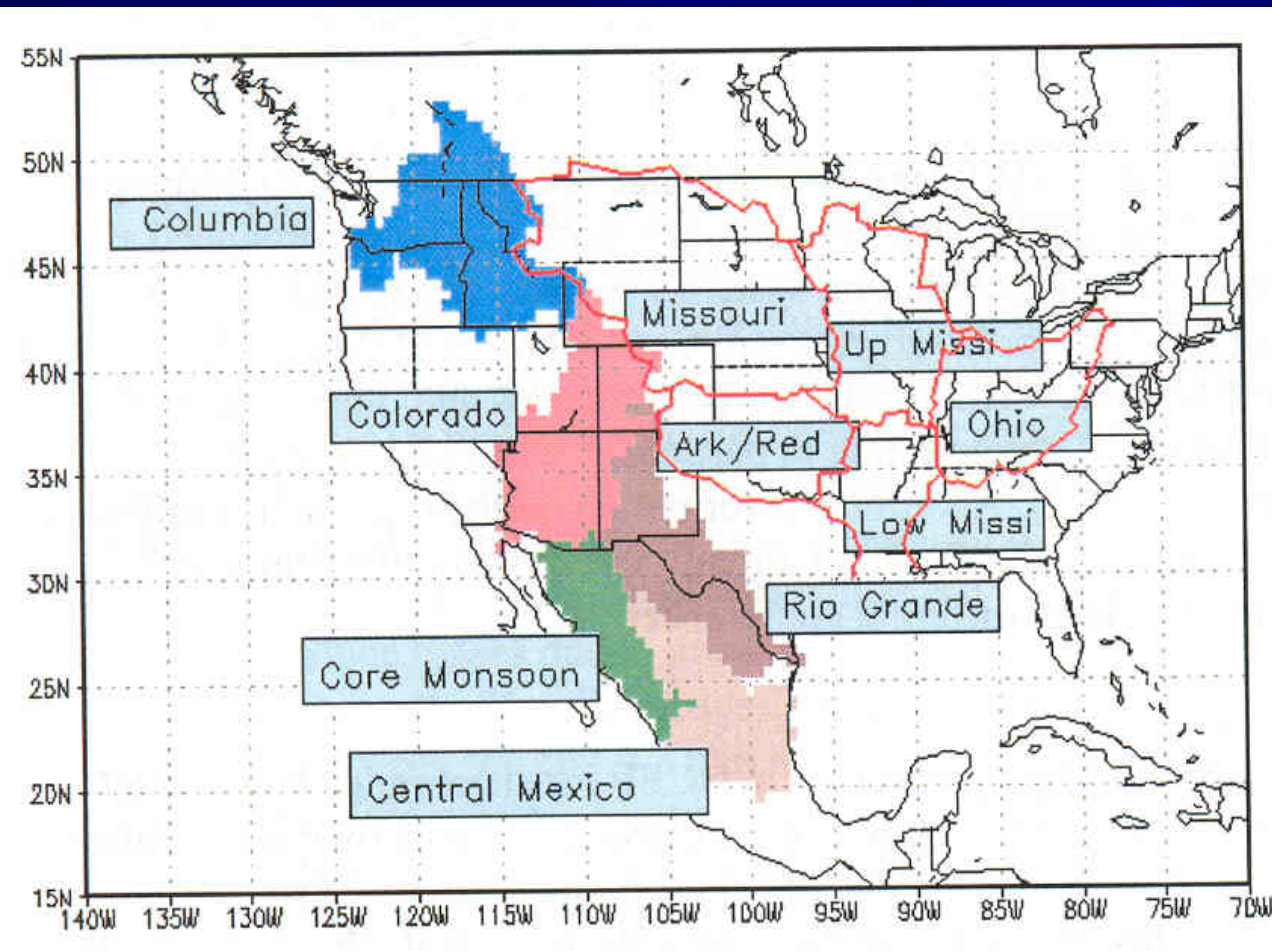
Diverse climate regimes:

Study Areas

(1) *Mississippi basin:*
summer precipitation
associated with LLJ

(2) *Western US basins:*
complex topography and
significant cold season
snowfall and with a
much larger runoff
fraction

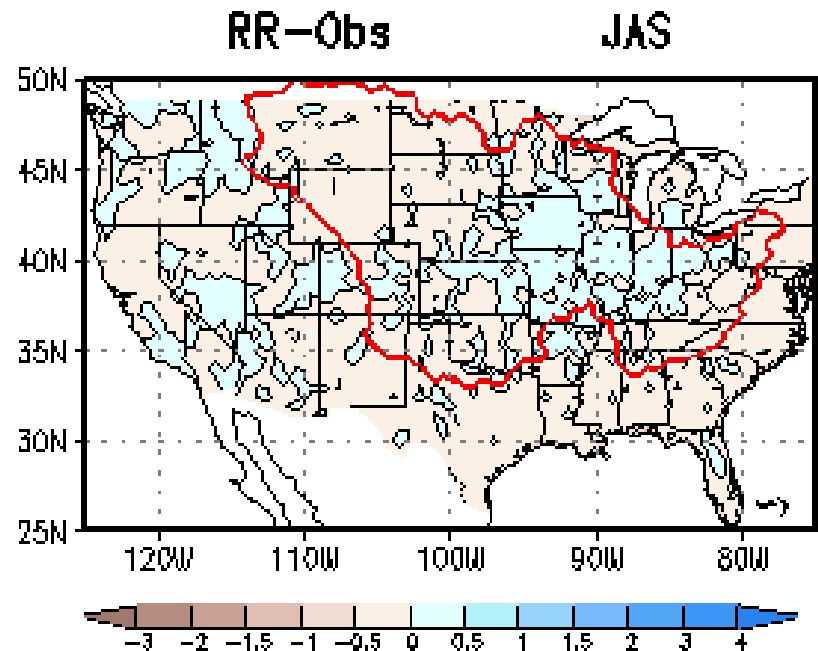
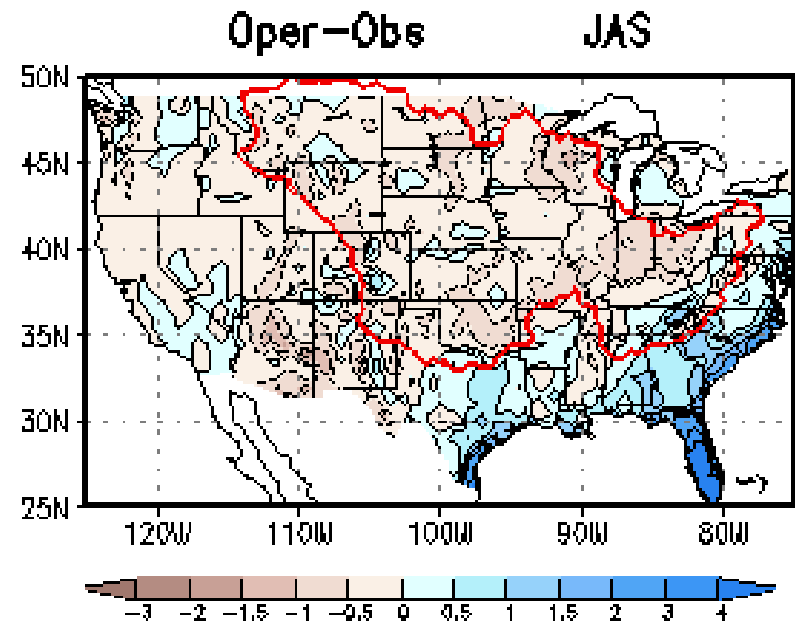
(3) *Monsoon prevalent
regions:* strong summer
hydrologic cycle
associated with North
American Monsoon



Precipitation differences

Operational Eta – Obs

Regional Reanalysis - Obs



Seasonal variability of precipitation

P_{RR}

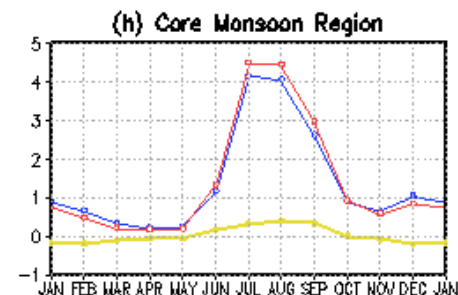
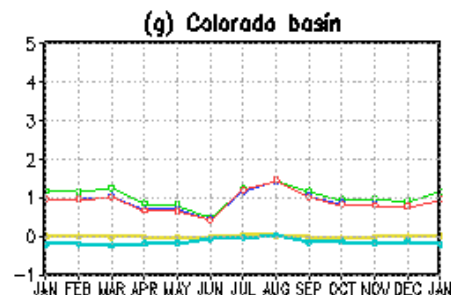
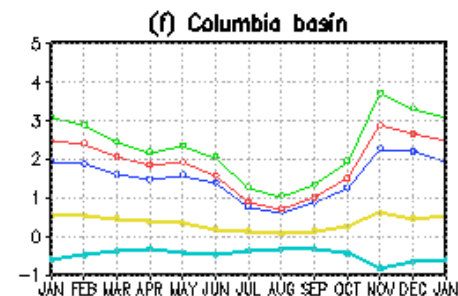
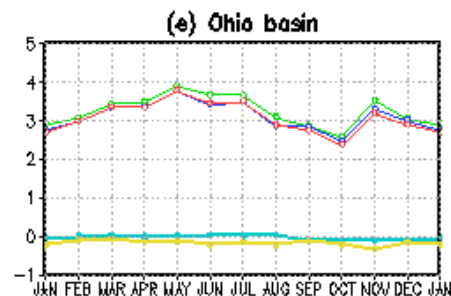
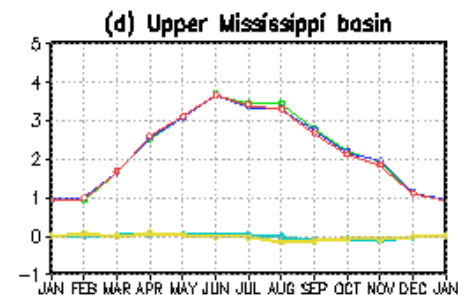
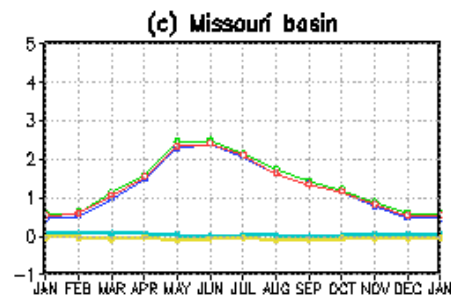
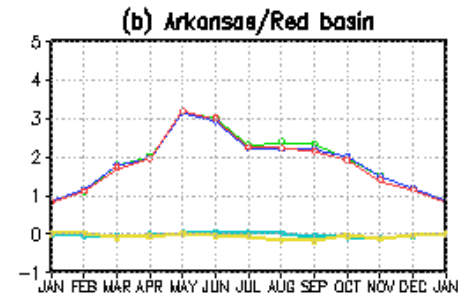
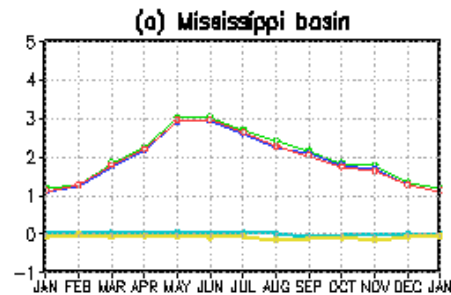
P_{CPC}

P_{UW}

$P_{RR} - P_{CPC}$

$P_{RR} - P_{UW}$

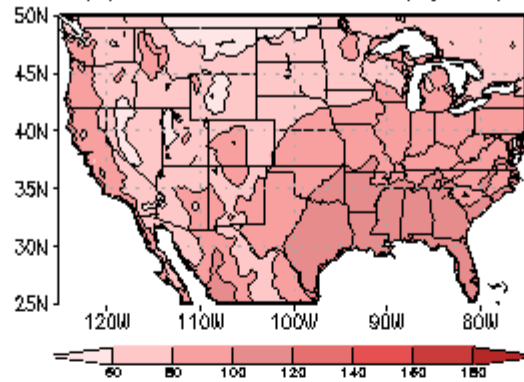
— Prr — PcpC — Pvic — Prr-PcpC — Prr-Pvic



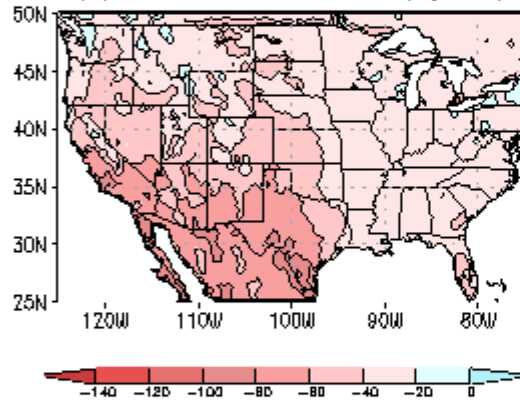
NARR

The surface energy budget

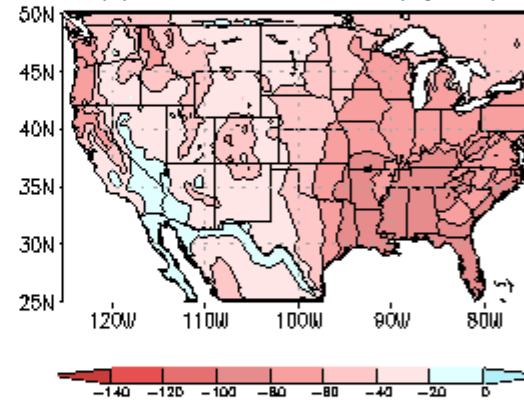
(a) Net radiation flux (W/m^2)



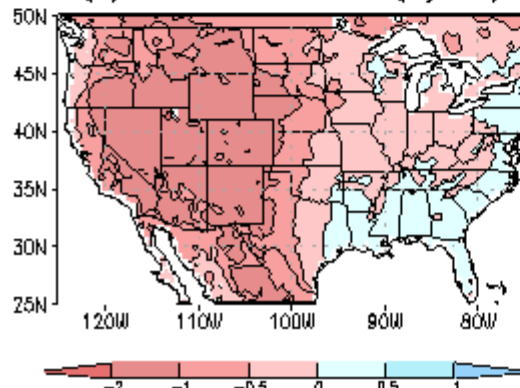
(b) Sensible heat flux (W/m^2)



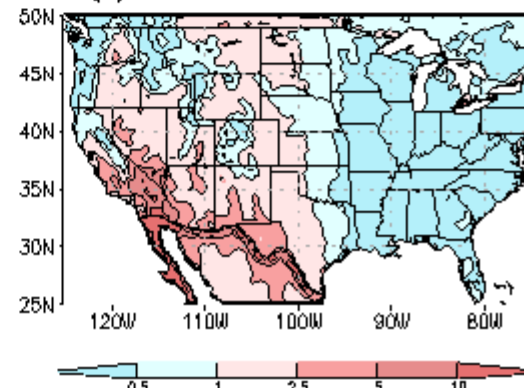
(c) Latent heat flux (W/m^2)



(d) Ground heat flux (W/m^2)



(e) Bowen Ratio



SEB Seasonal variability

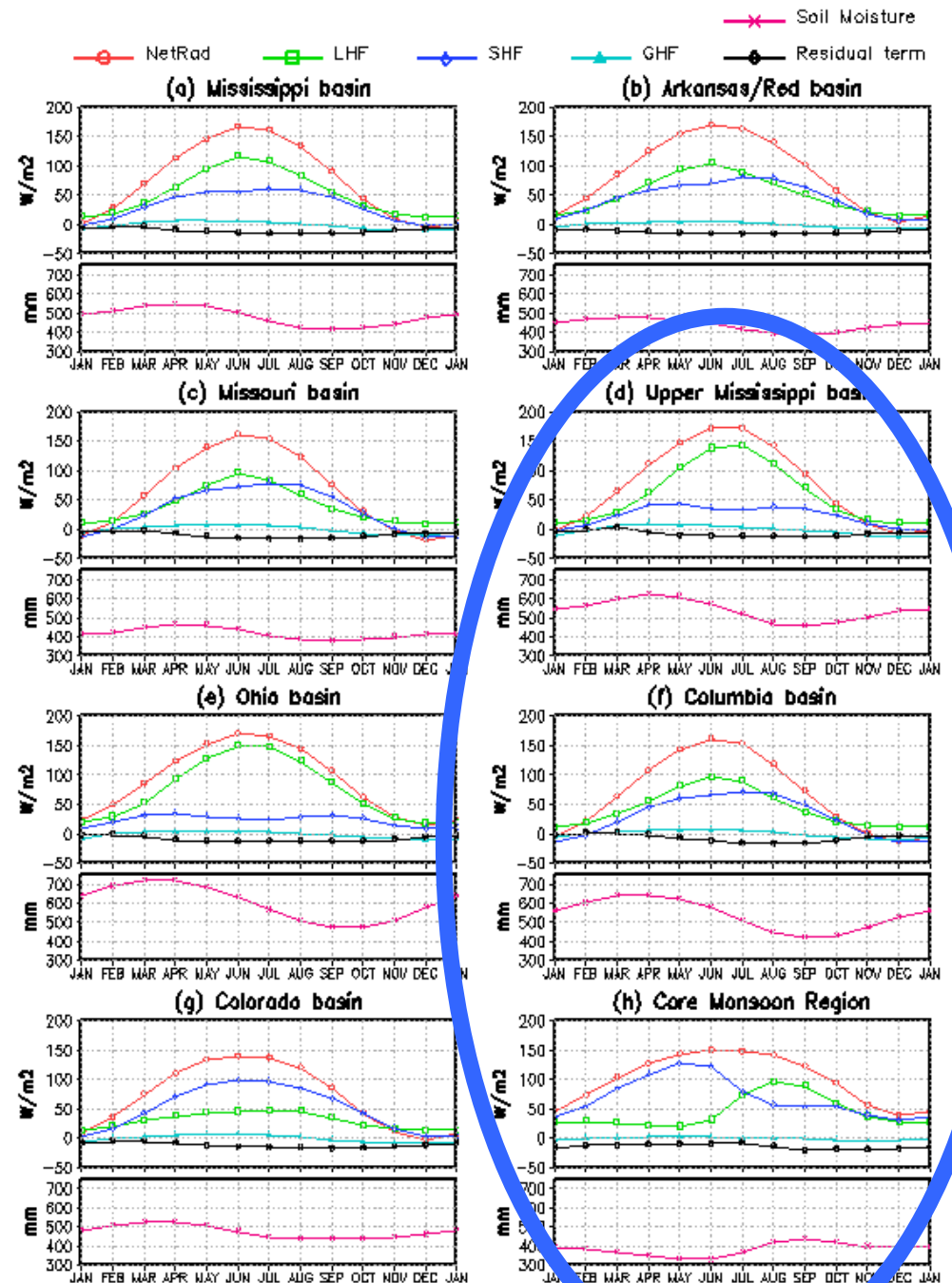
Net Rad

SHF

LHF

GHF

Res



SEB Multi-year time series

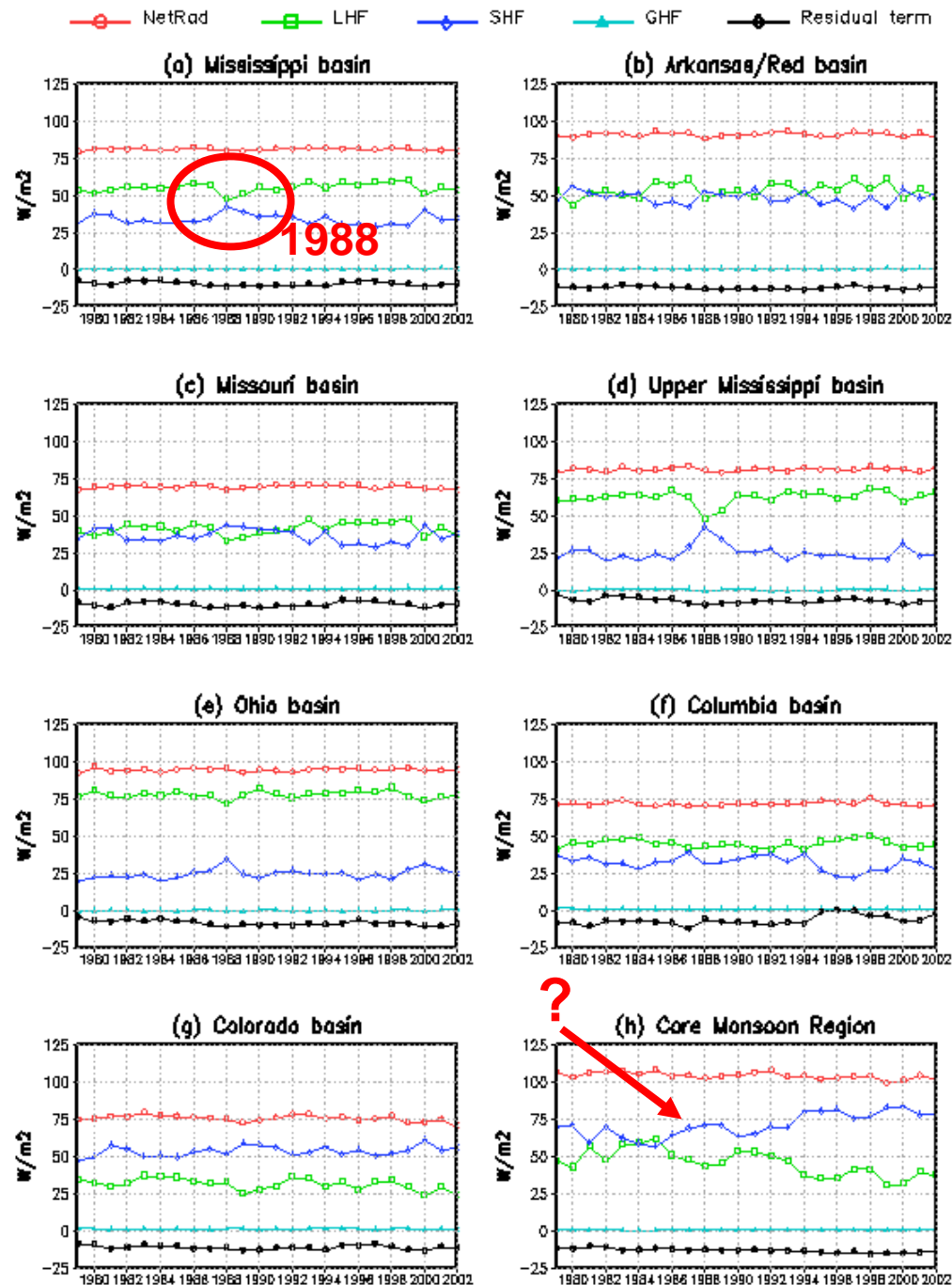
Net Rad

SHF

LHF

GHF

Res

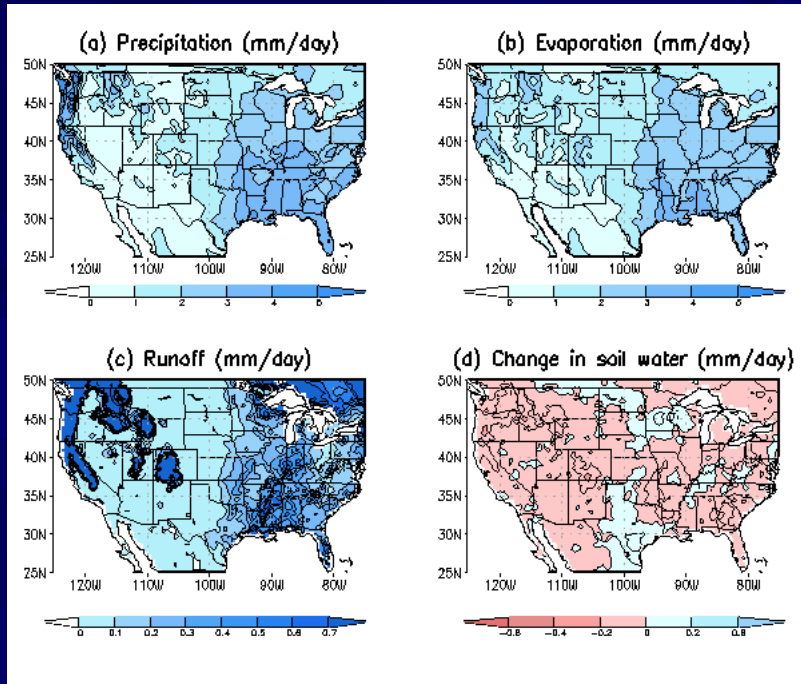


NARR

The surface water budget

SWB

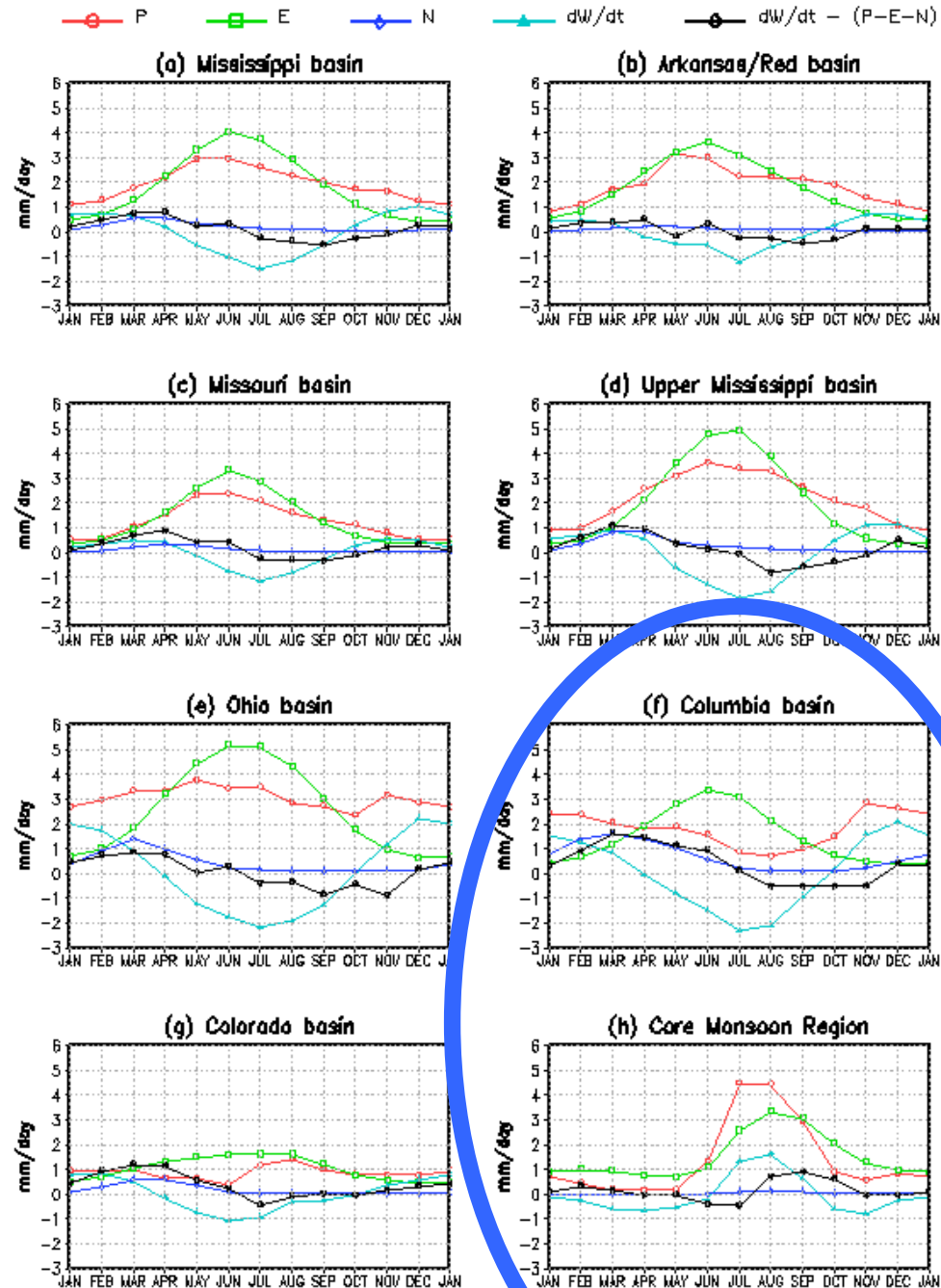
Seasonal variability



P E

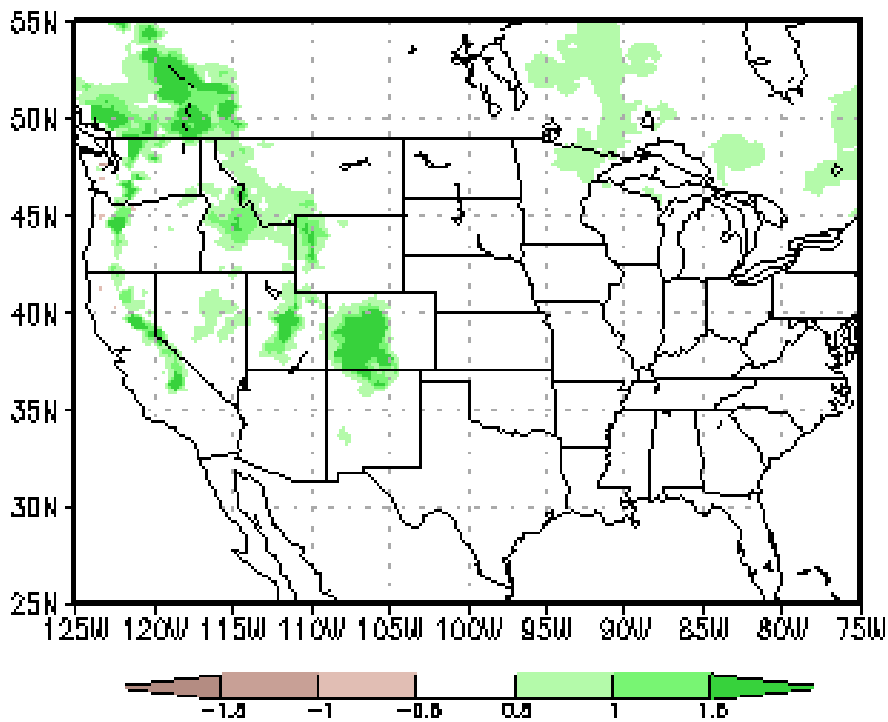
N dW/dt

Res



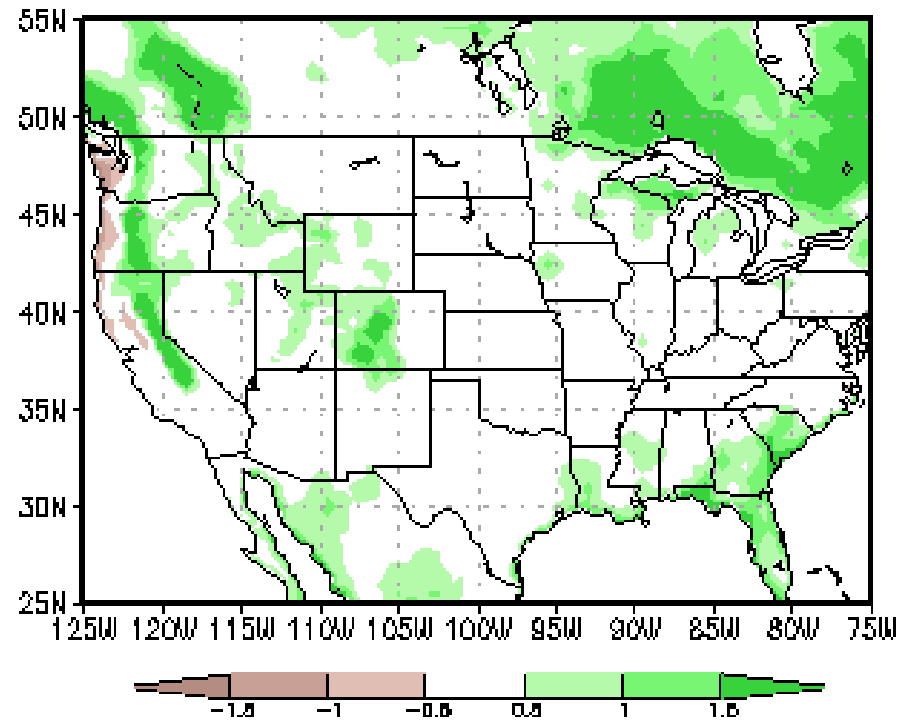
RR (1998-2002) Annual mean Residual Field

(a) Residual of the surface water balance



Eta/EDAS (1998-2002) Annual mean Residual Field

(a) Residual of the surface water balance



SWB

Multi-year time series

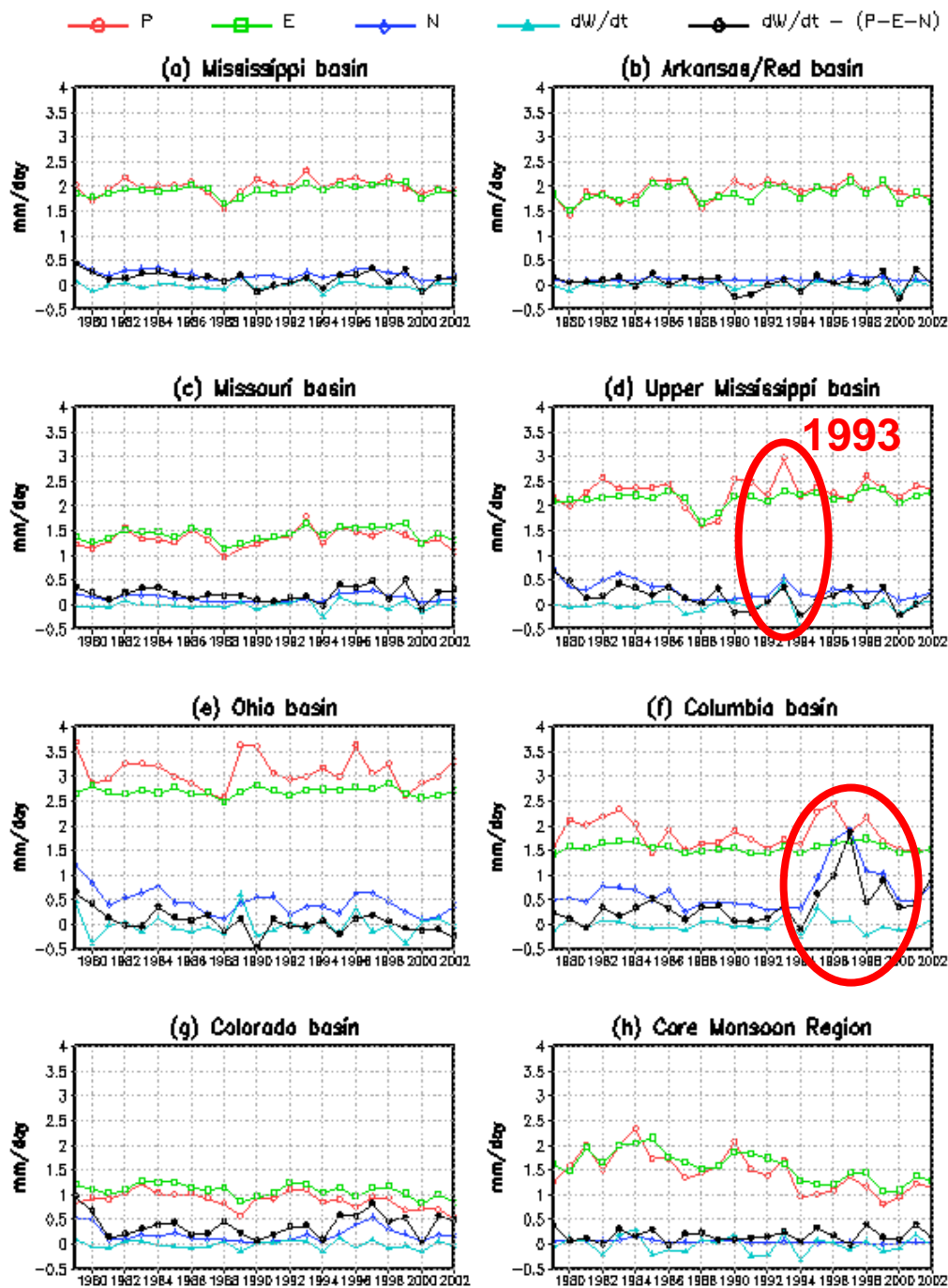
P

E

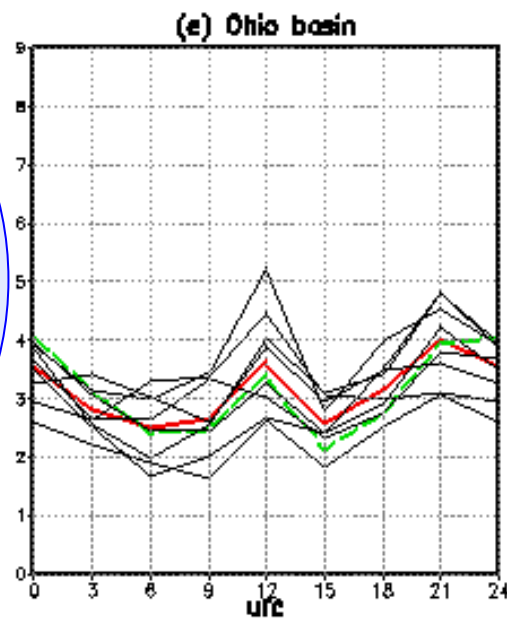
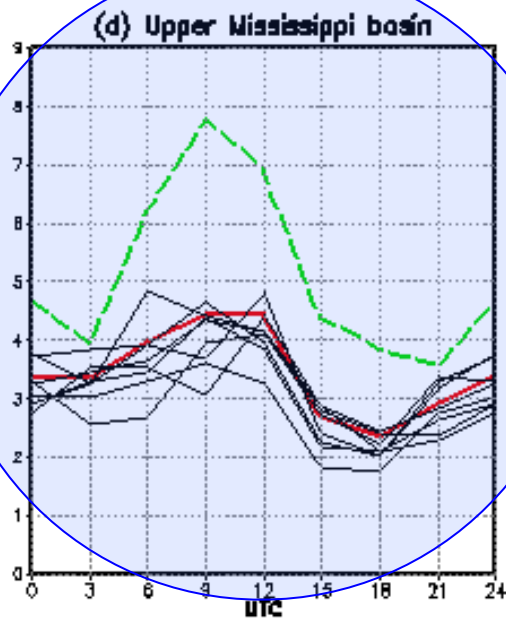
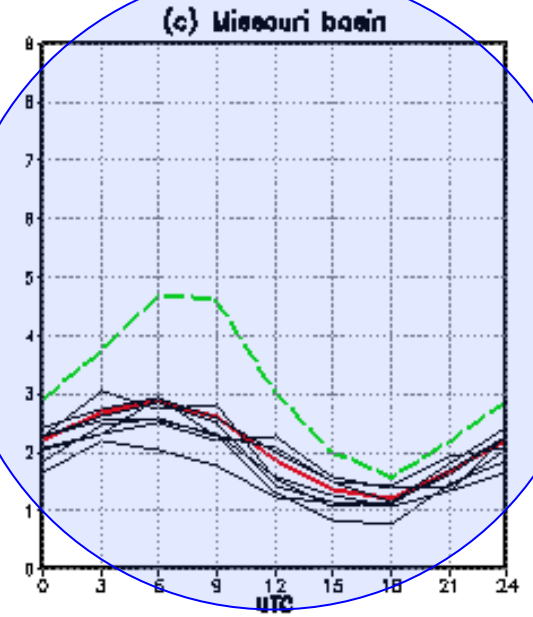
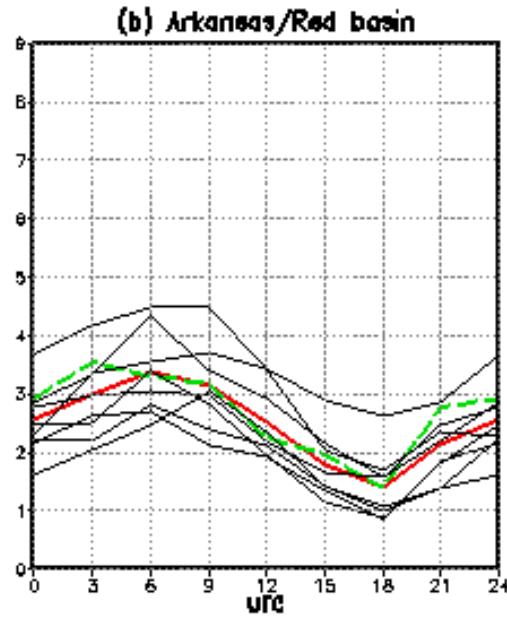
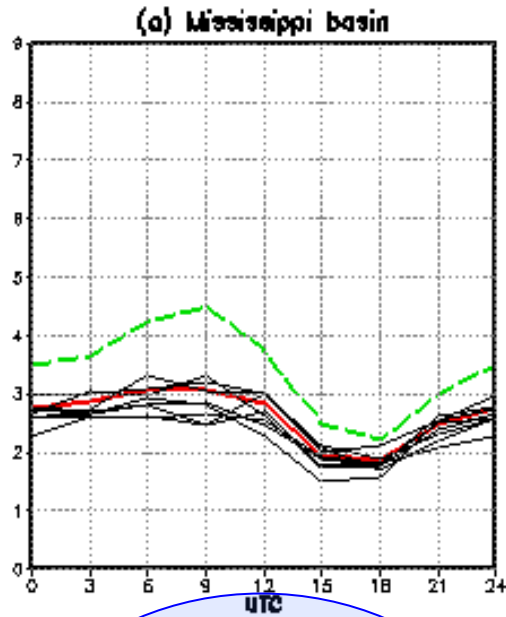
N

dW/dt

Res



The interannual variability of the summer diurnal cycle of precipitation



— Average
- - - 1993

LS-A interactions results:

19th Conference on Hydrology
Session 4: Land Atmosphere Interactions
II

Tomorrow, 2 pm, Room 6D

4.5 Regional Aspects of the North American Land
Surface-Atmosphere Interactions: Analysis of NCEP
Regional Reanalysis Data

Yan Luo, Hugo Berbery, and Ken Mitchell