

# **NARCCAP WRF Simulations**

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NARCCAP Users Meeting

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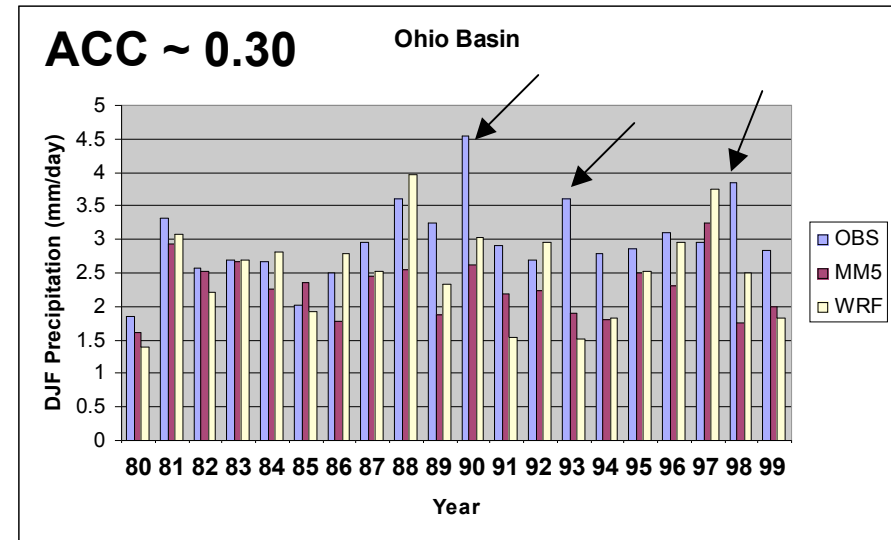
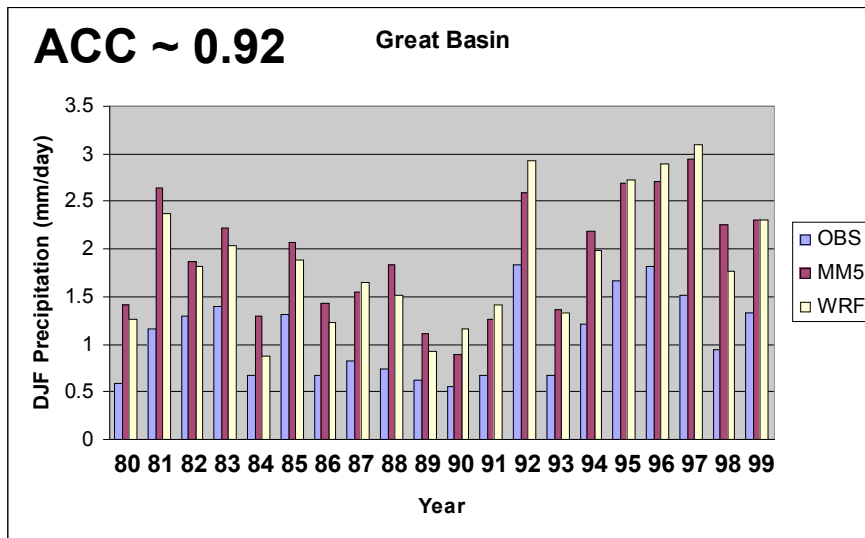
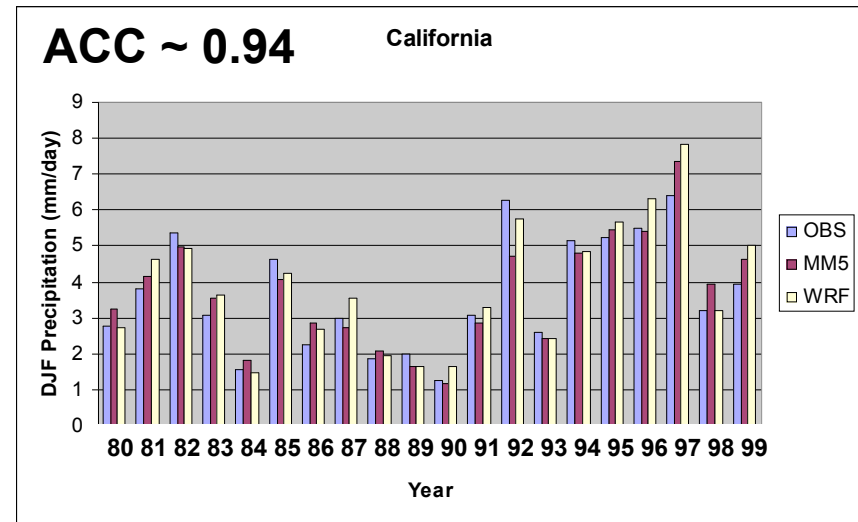
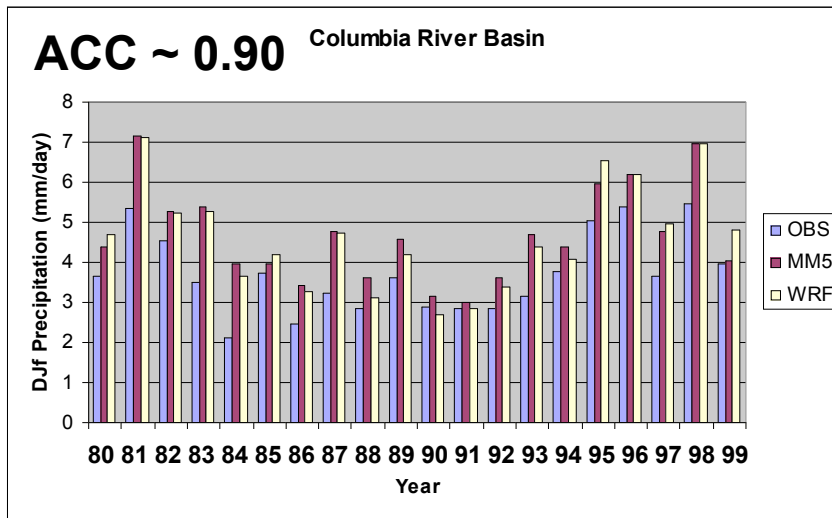
Boulder, CO

# Phase 1 Simulation

- A WRF simulation driven by the NCEP/DOE reanalysis and AMIP SST has been completed for 1979/9 - 2004/12 using the NARCCAP domain
- Physics parameterizations: CAM radiation, KF convection, WSM5 mixed phase microphysics, YSU non-local PBL, Noah LSM
- Update of SST, sea ice, vegetation fraction, surface albedo; consistent treatment of snow emissivity in Noah LSM
- Model outputs for Table 2 and zg500 have been archived at NERSC and NCAR

# Cold Season Variability

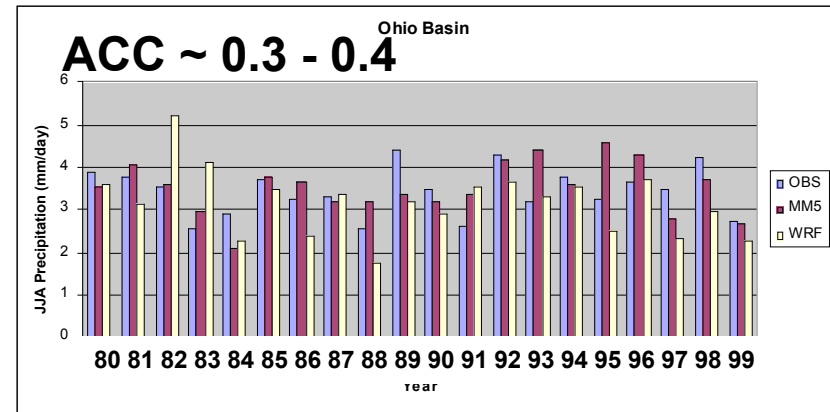
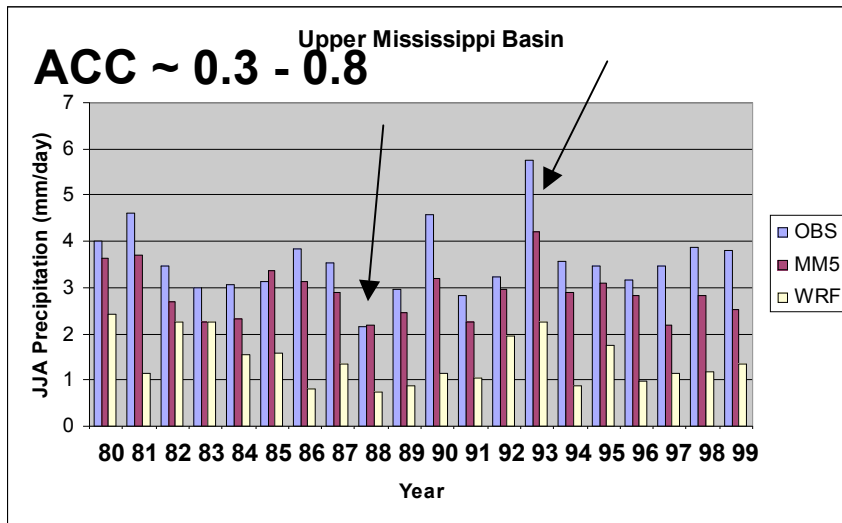
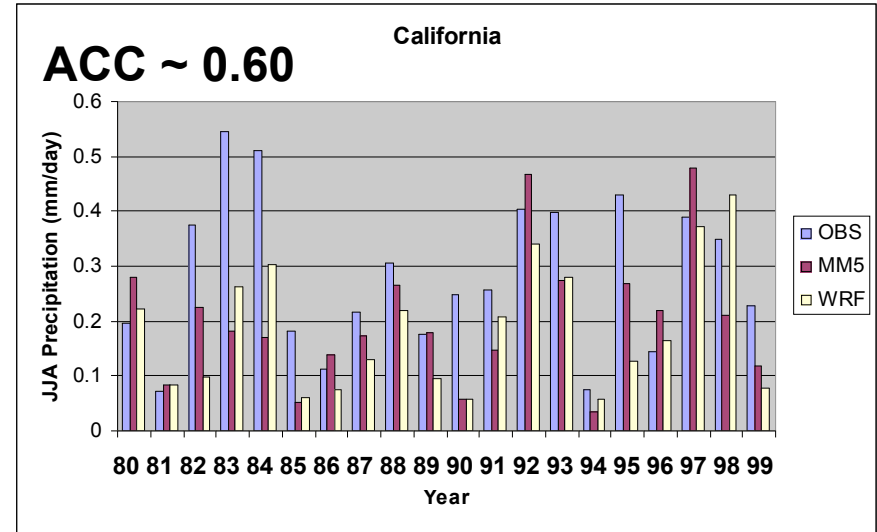
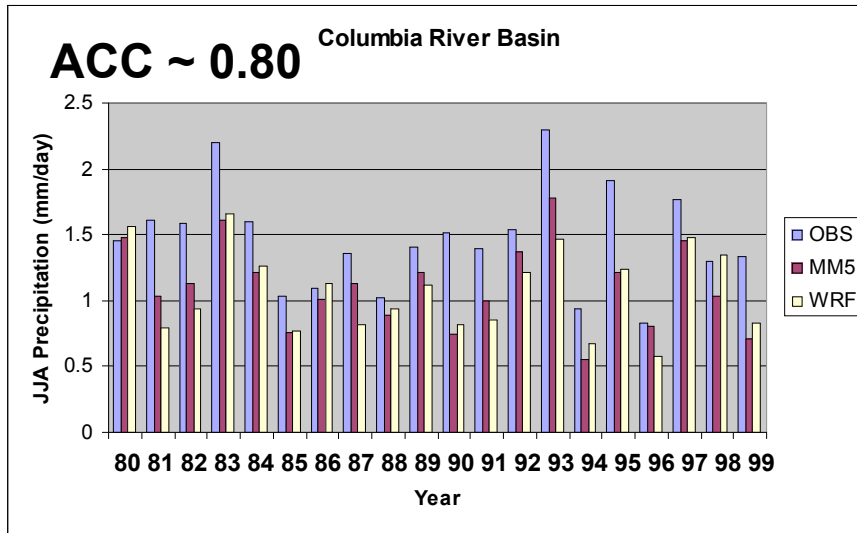
WRF and MM5 have similar skill in capturing cold season variability



**ACC ~ 0.60 in NCEP**

# Warm Season Variability

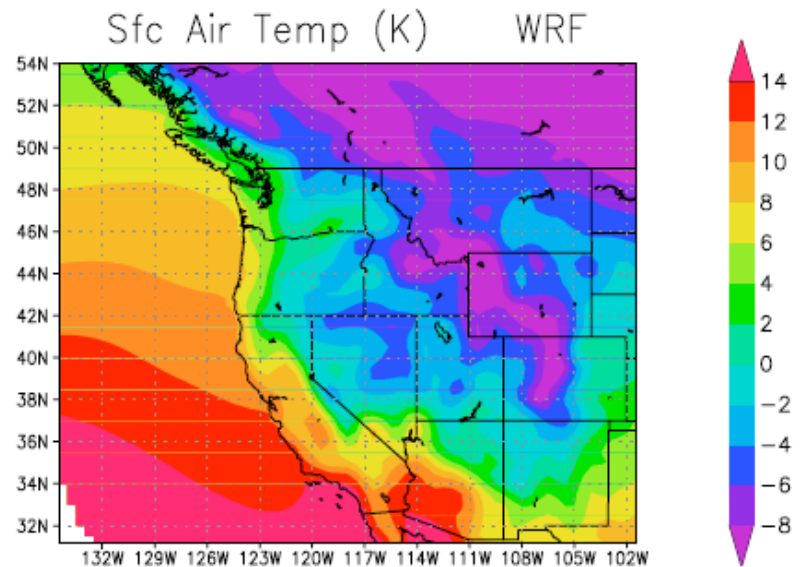
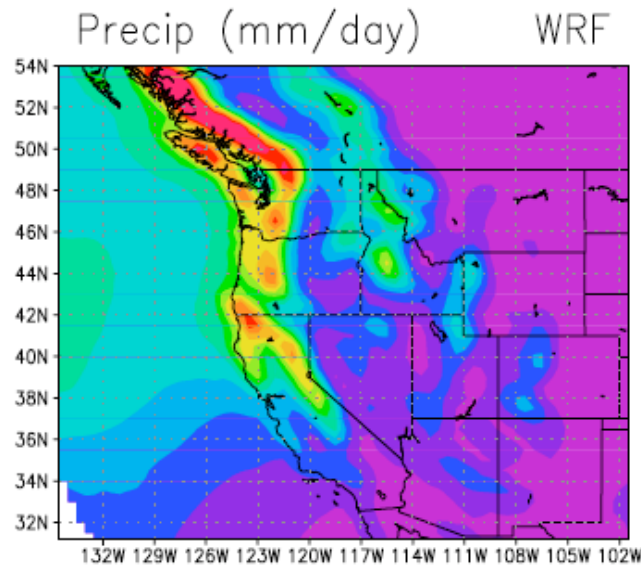
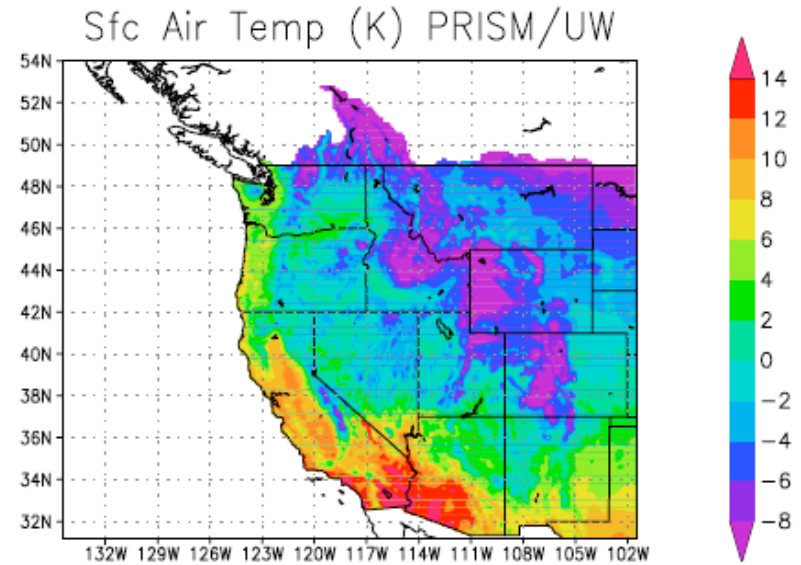
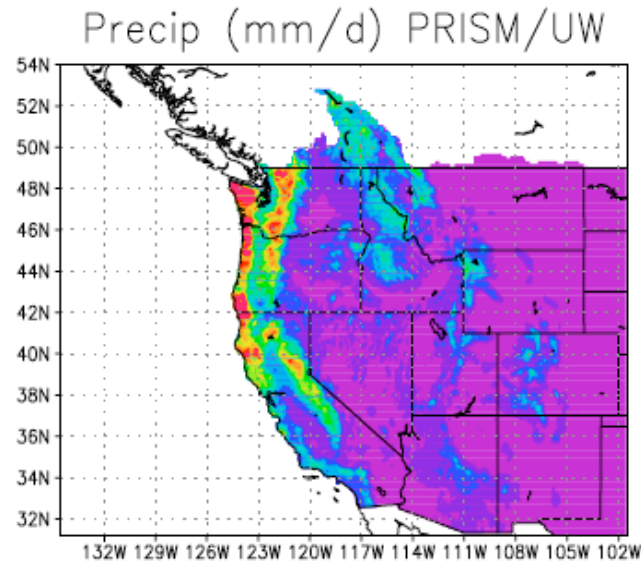
Larger differences between WRF and MM5 year-to-year variability, but generally ACCs are similar



**ACC ~ 0.60 in NCEP**

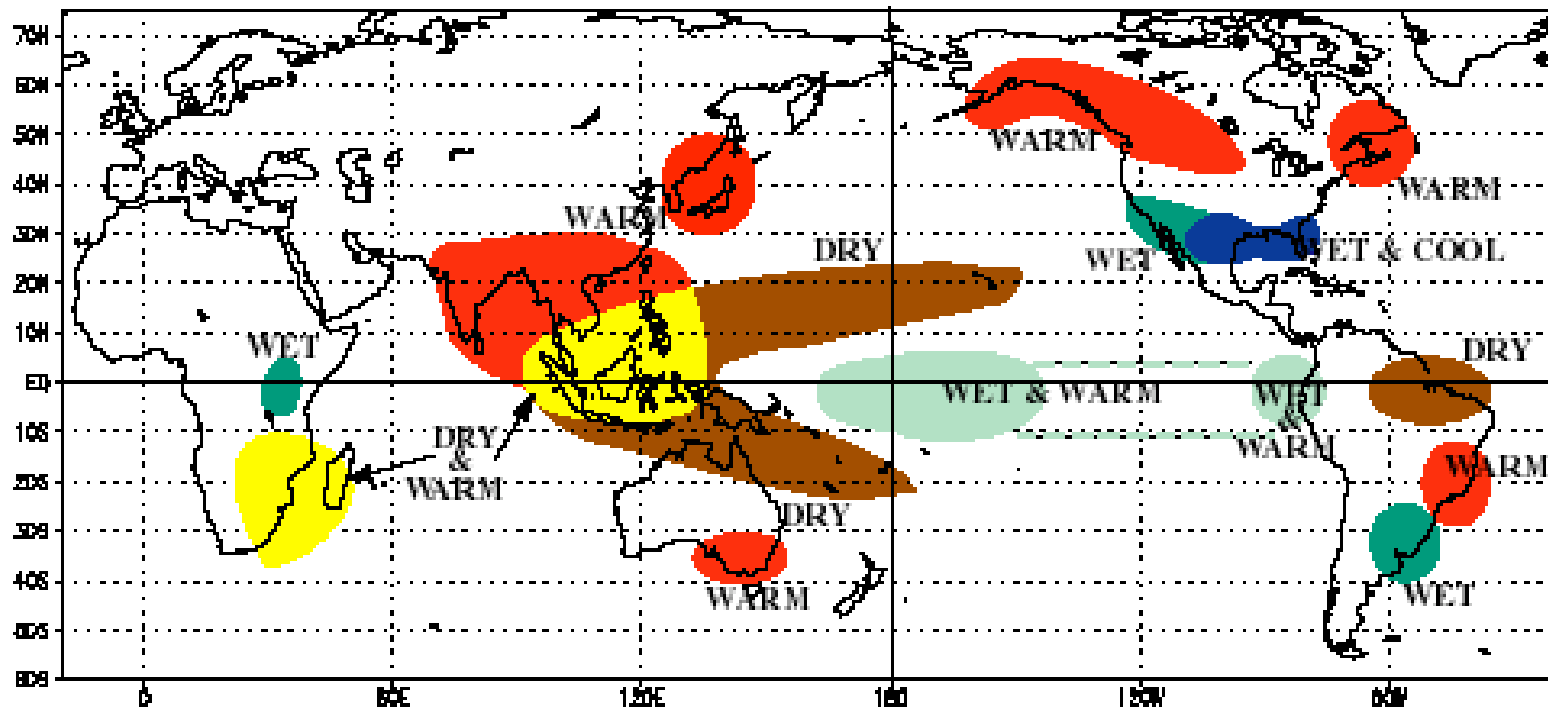
**ACC ~ 0.17 in NCEP**

# Mean Cold Season T and P



# Impacts of ENSO in the Cold Season

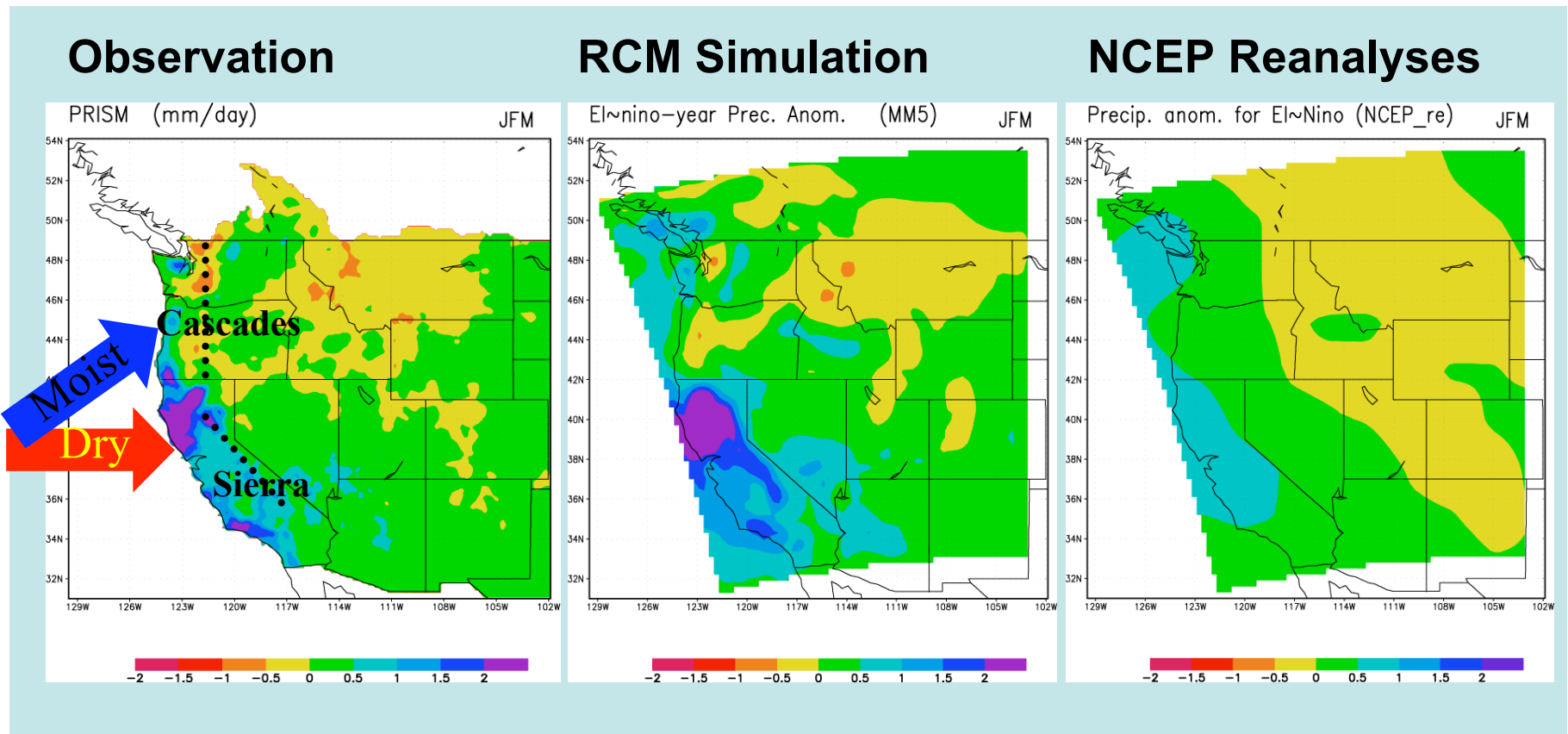
## WARM EPISODE RELATIONSHIPS DECEMBER - FEBRUARY



# ENSO Anomalies

- Regional details in the ENSO precipitation anomalies demonstrate the interactions between large scale circulation changes with the regional topography

## Composited El Nino Precipitation Anomaly

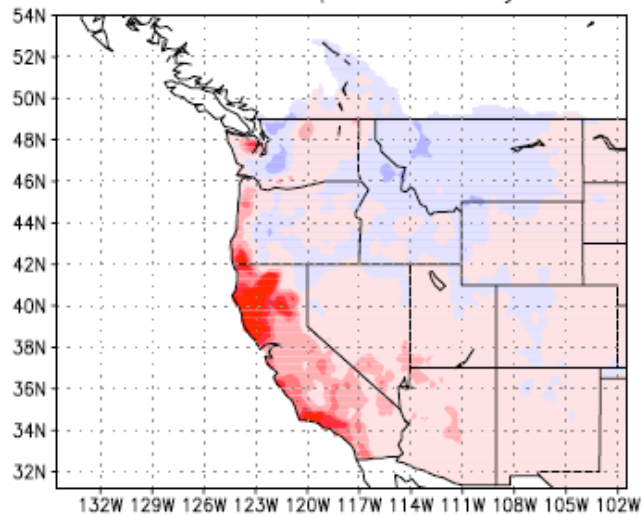


Leung et al. (2003)

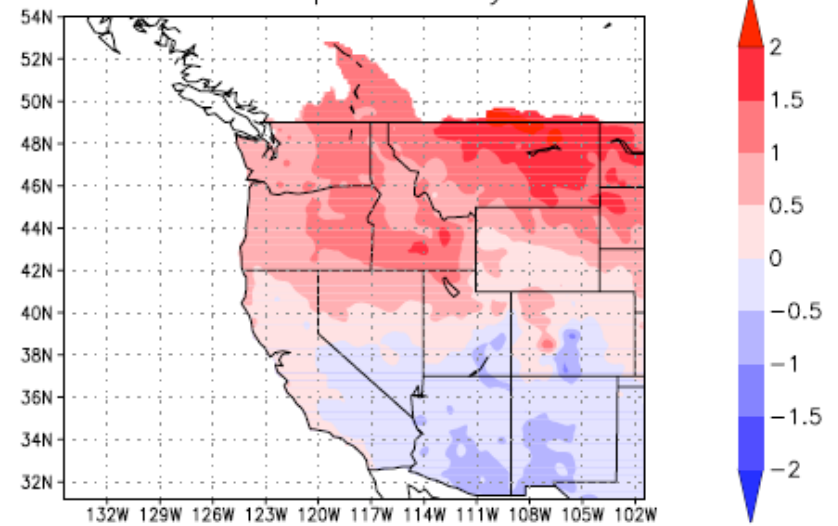
# Mean El Nino T and P Anomaly

Cool-Wet (Southwest) vs Warm-Dry (Northwest)

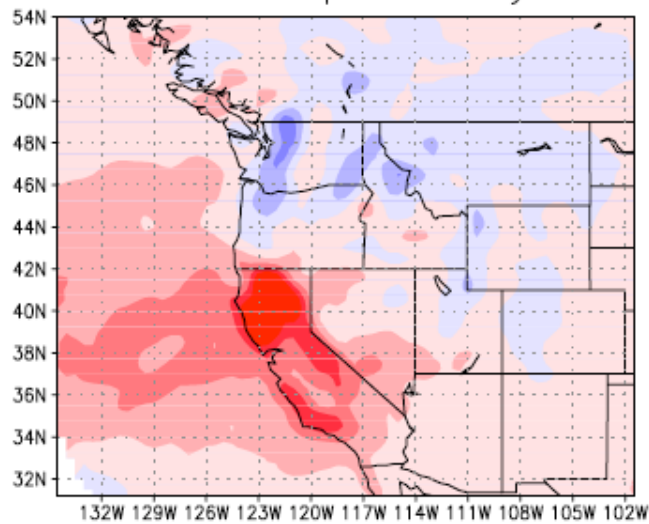
El Nino Precip Anomaly UW



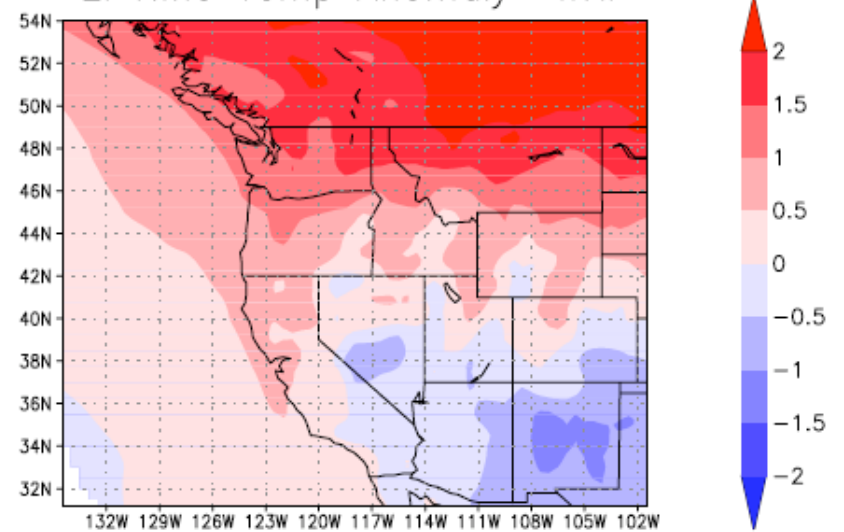
El Nino Temp Anomaly UW



El Nino Precip Anomaly WRF



El Nino Temp Anomaly WRF

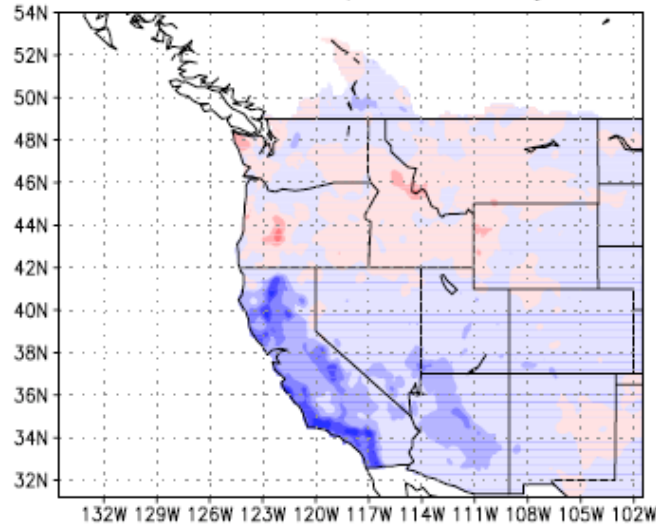




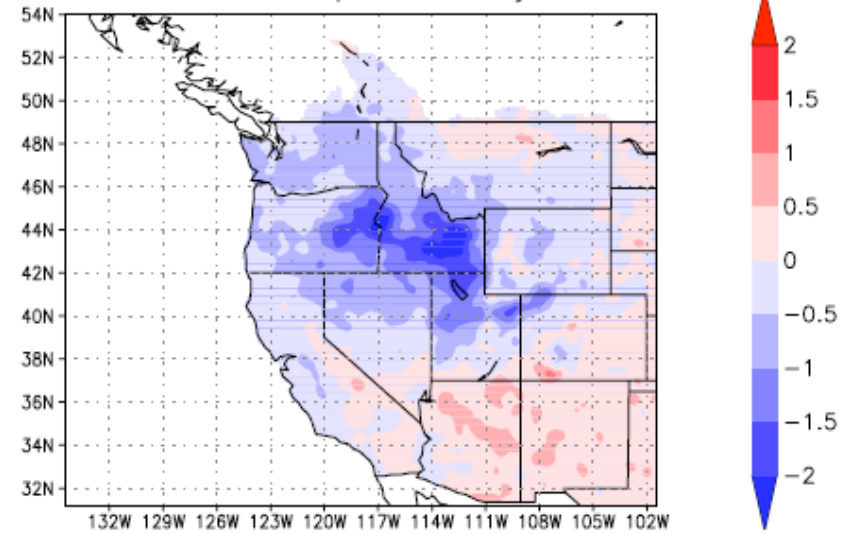
# Mean La Nina T and P Anomaly

Cool-Wet (Northwest) vs Warm-Dry (Southwest)

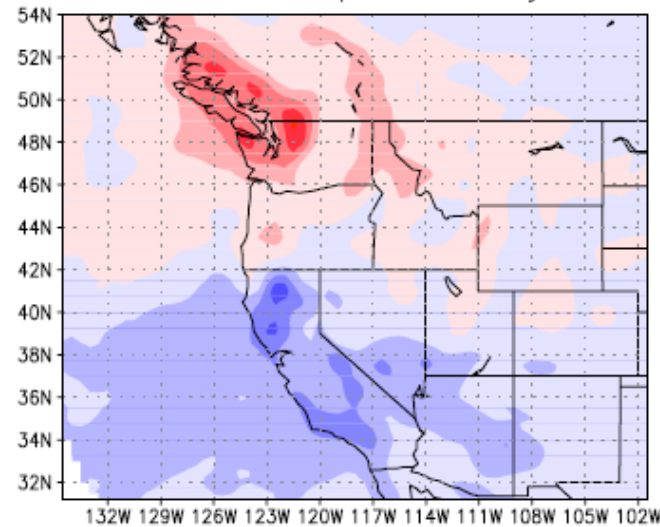
La Nina Precip Anomaly UW



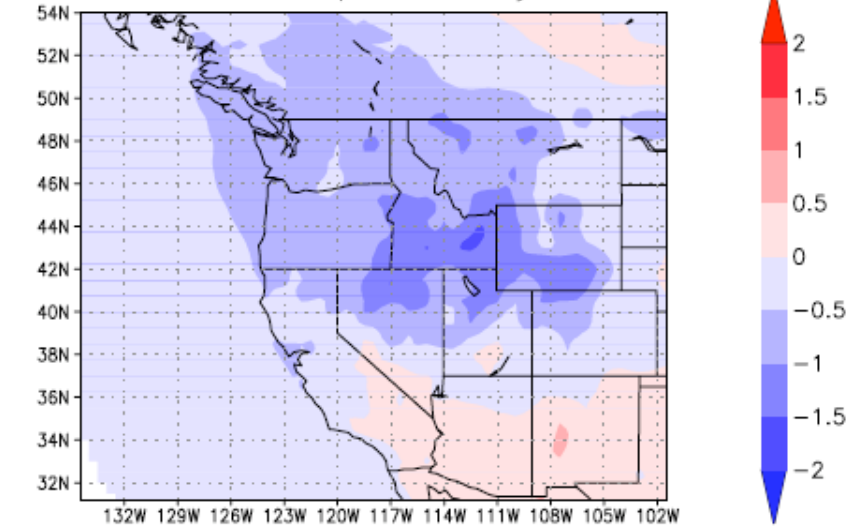
La Nina Temp Anomaly UW



La Nina Precip Anomaly WRF

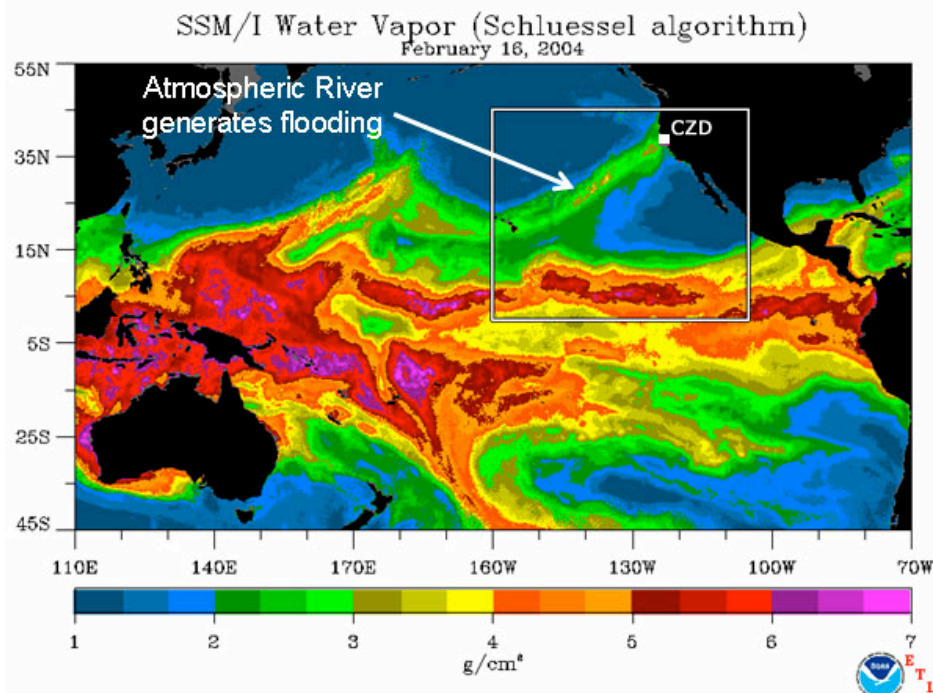


La Nina Temp Anomaly WRF

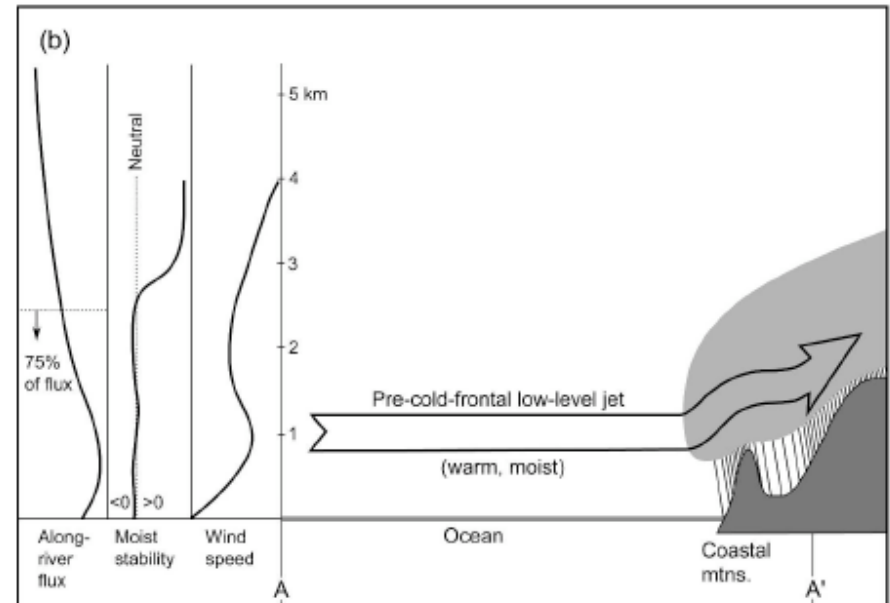


# Atmospheric Rivers and Floods

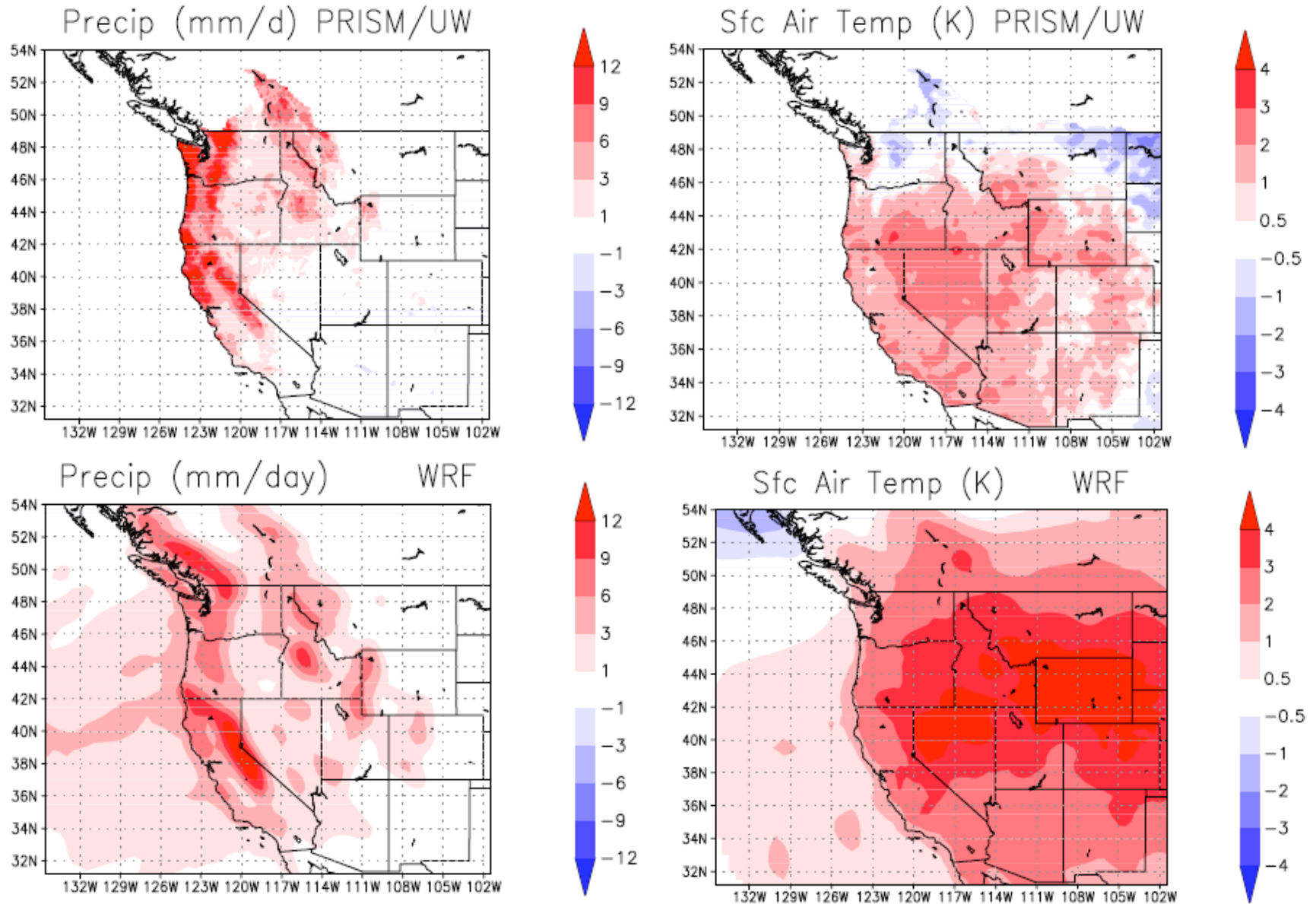
- An atmospheric river was present in all of the floods on the Russian River since 1997, though not all atmospheric rivers are flood producers
- Main ingredients for heavy orographic precipitation: LLJ, large moisture content, neutral stability
- Stratification with respect to unsaturated vs saturated conditions can produce drastically different orographic response



Ralph et al. (2005)

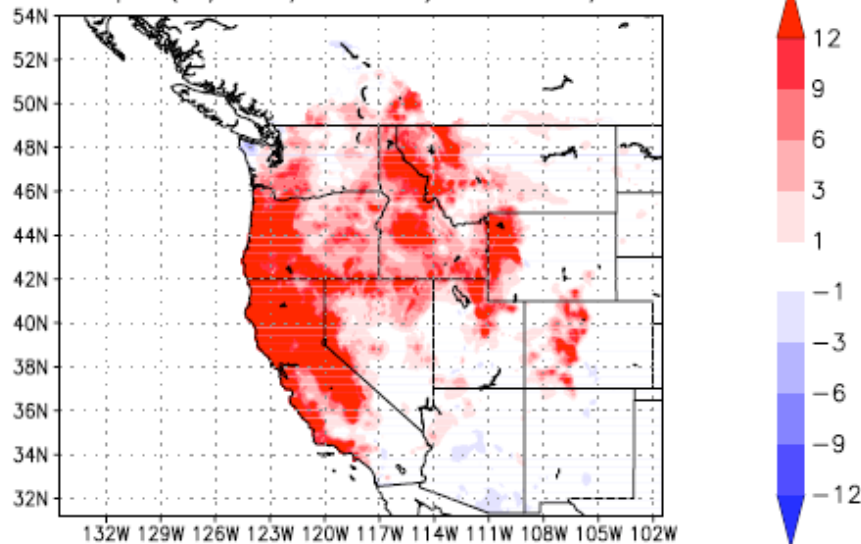


# Mean T and P Anomaly Averaged Over 143 Days During Pineapple Express Events (1980 - 1999)

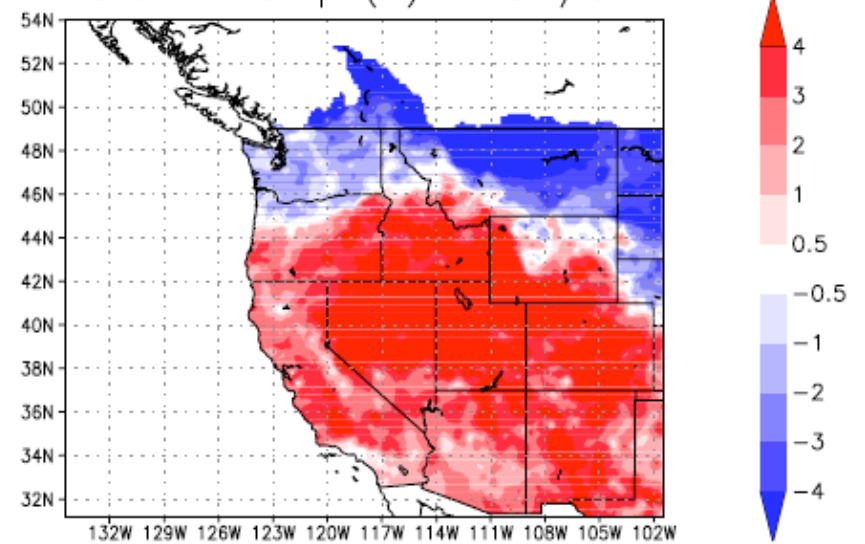


# The 1986 President Day Event (Anomaly)

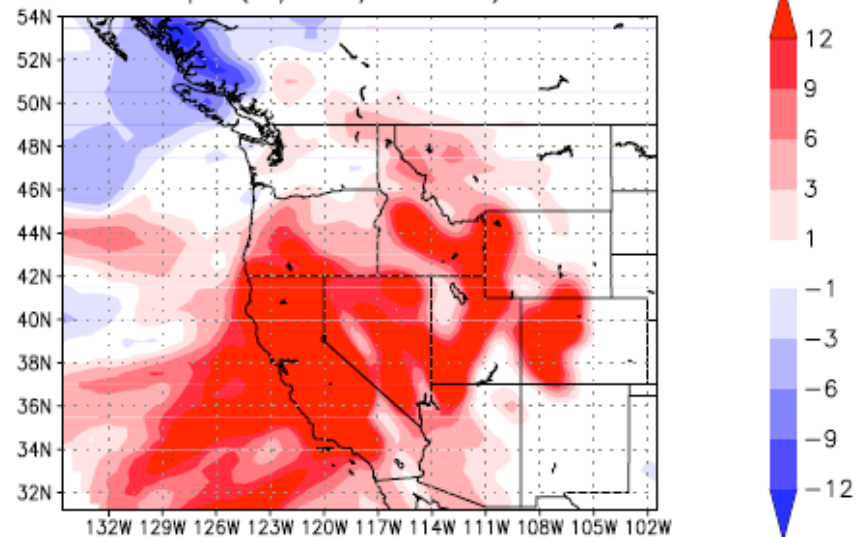
Prcp (2/17/1986) PRISM/UW



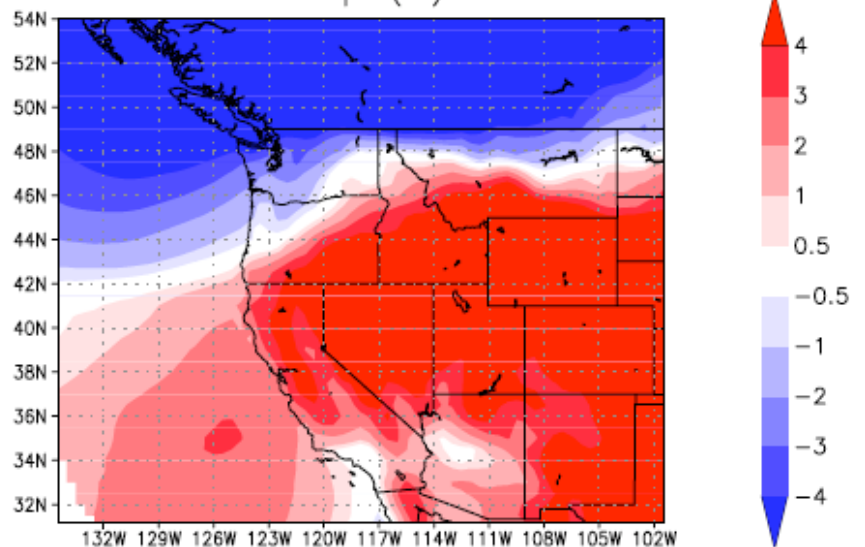
Sfc Air Temp (K) PRISM/UW



Precip (2/17/1986) WRF

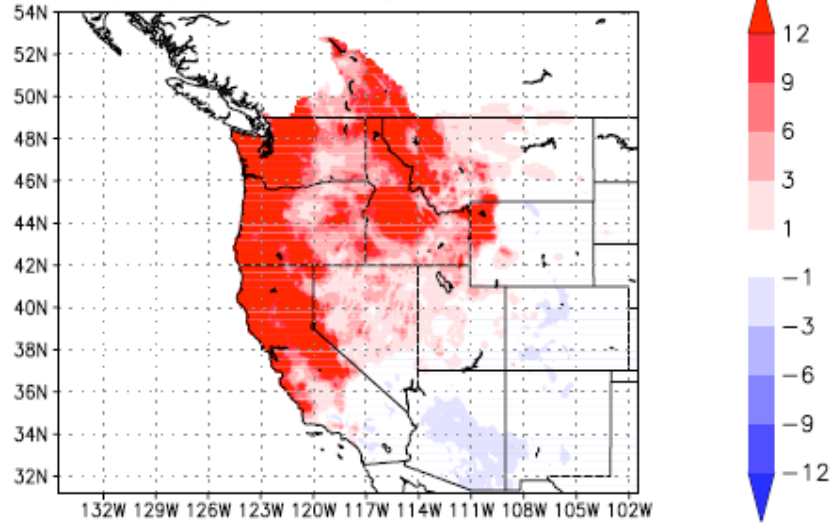


Sfc Air Temp (K) WRF

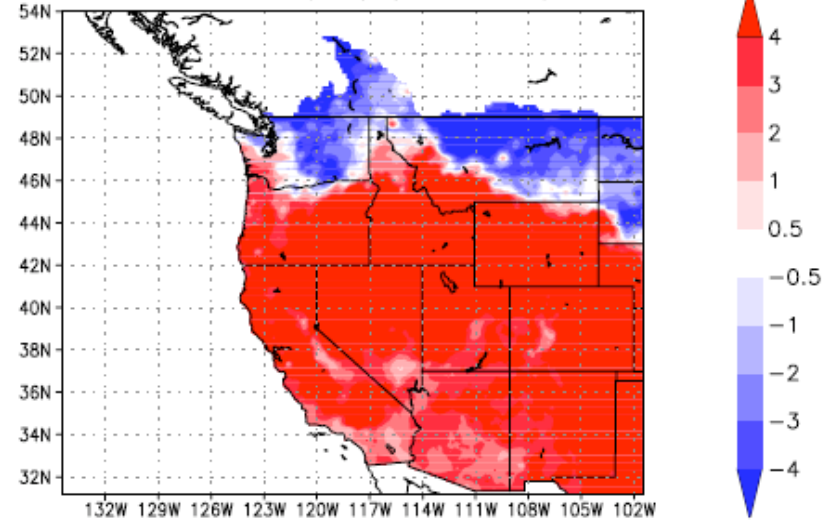


# The 1997 New Year Event (Anomaly)

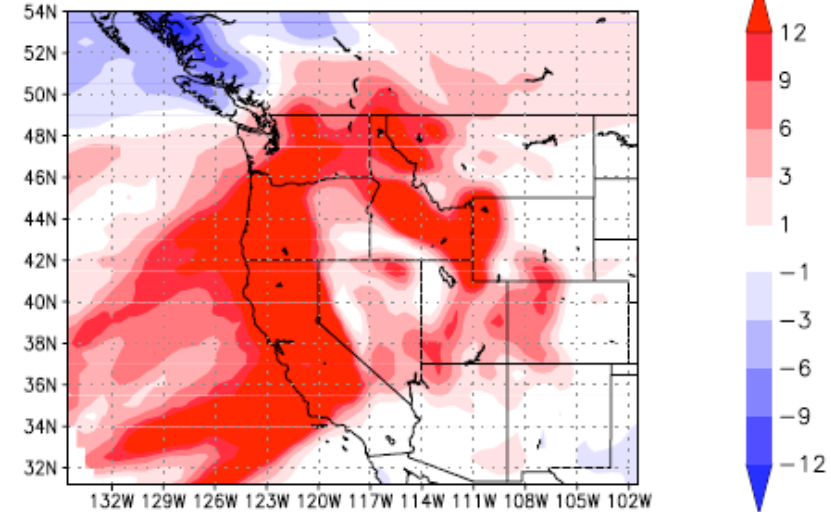
Prcp (1/1/1997) PRISM/UW



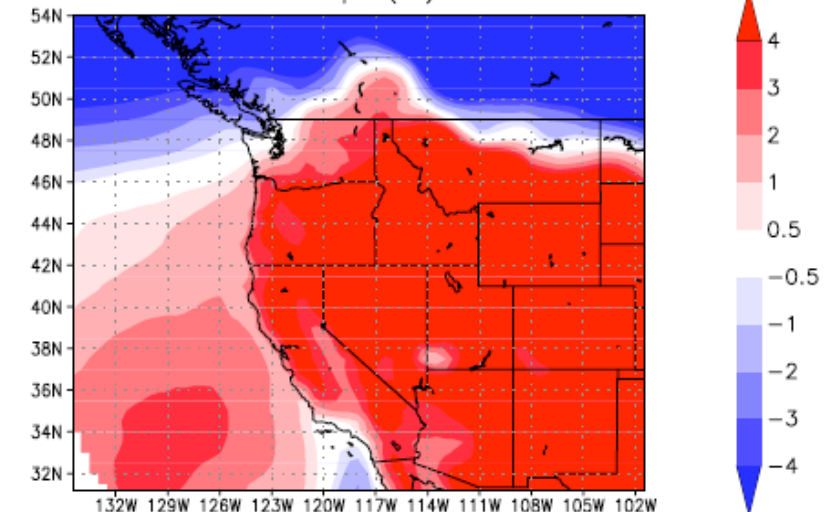
Sfc Air Temp (K) PRISM/UW



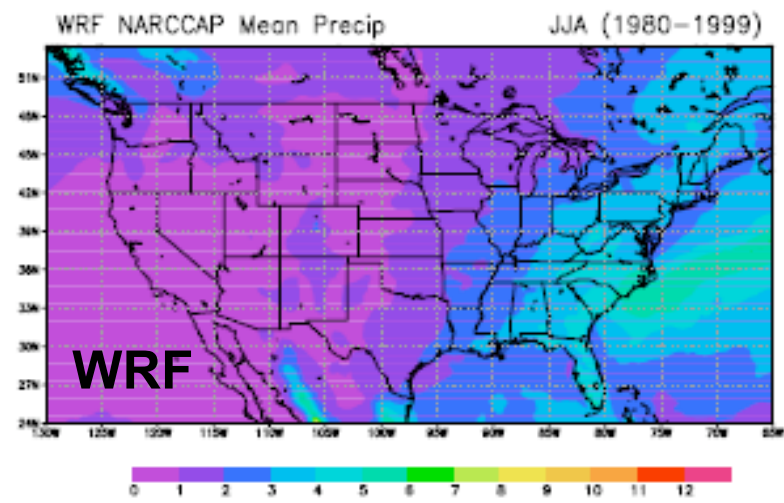
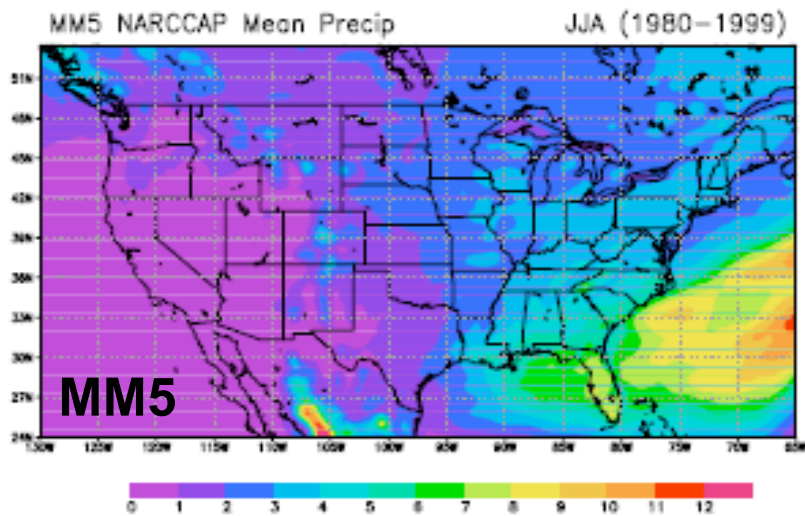
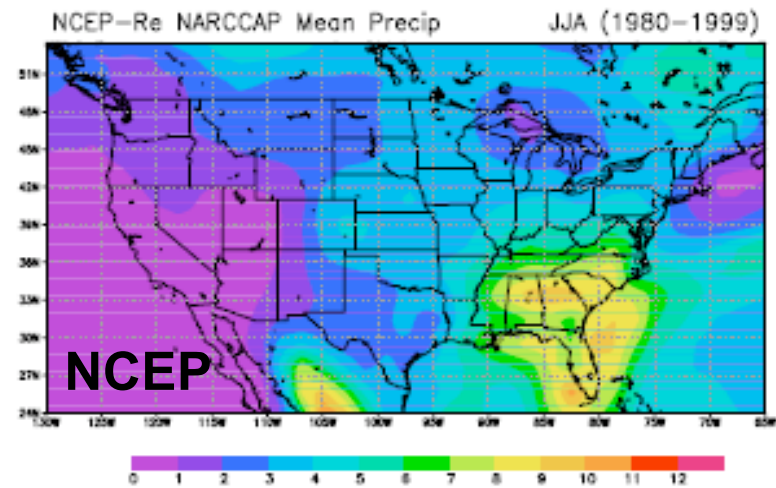
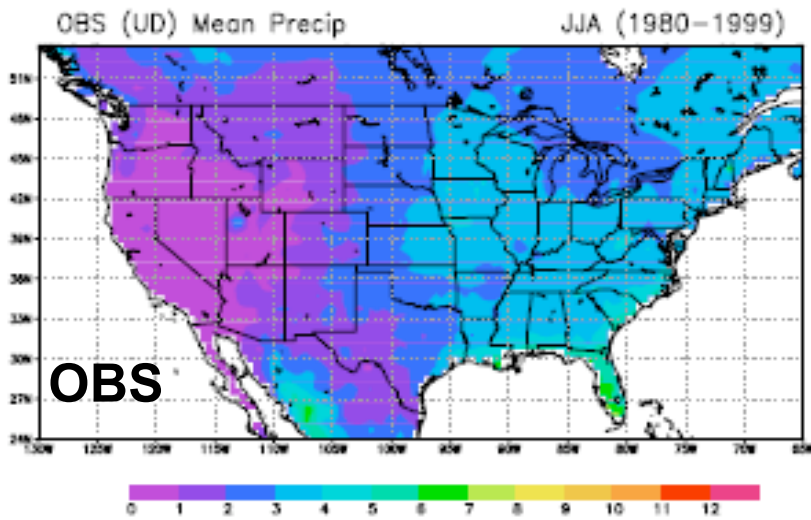
Precip (1/1/1997) WRF



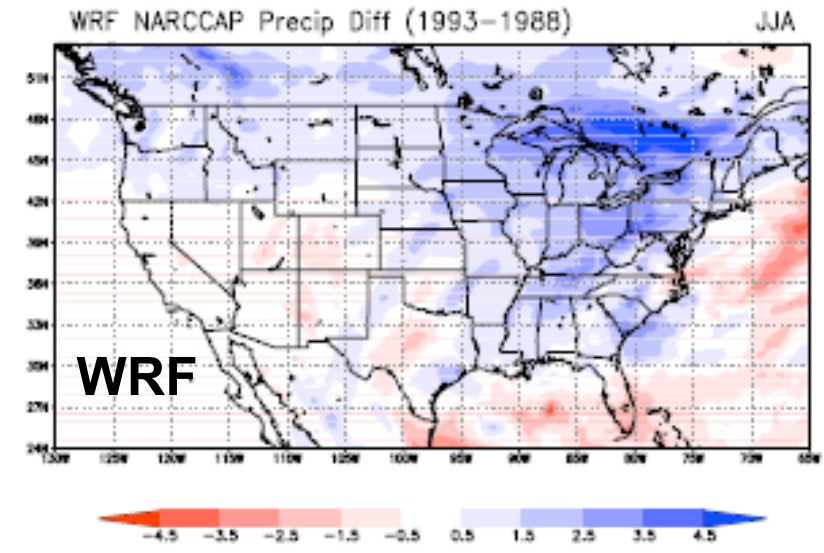
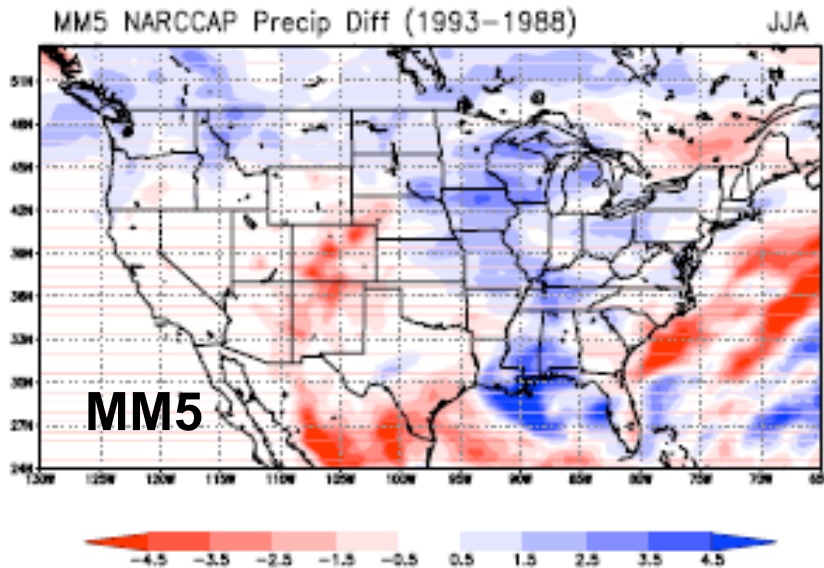
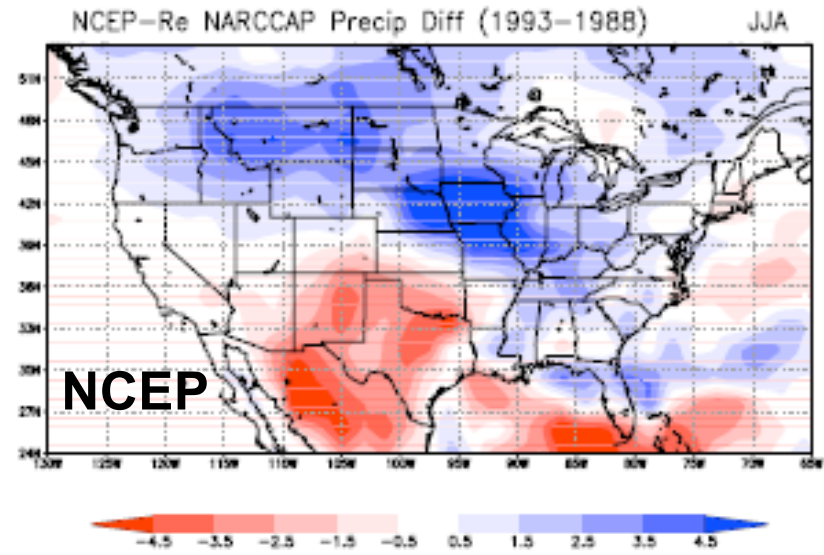
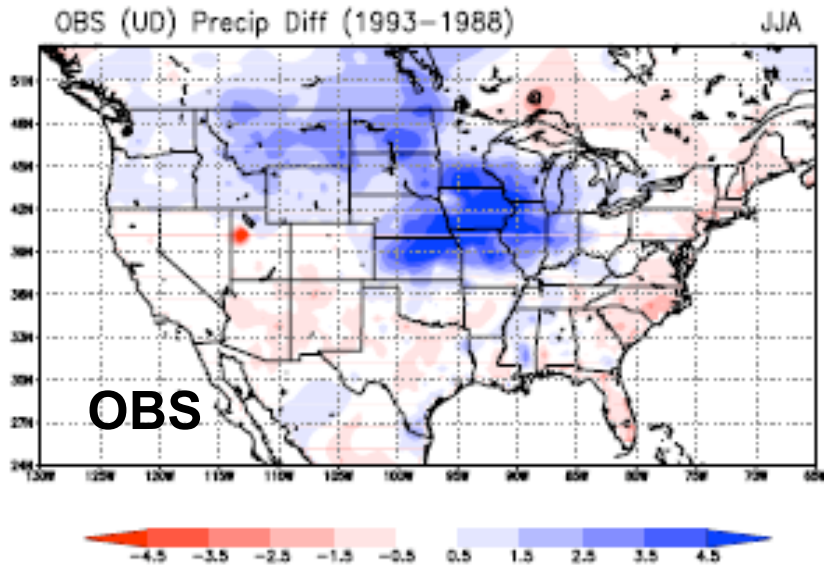
Sfc Air Temp (K) WRF



# Mean JJA Precipitation

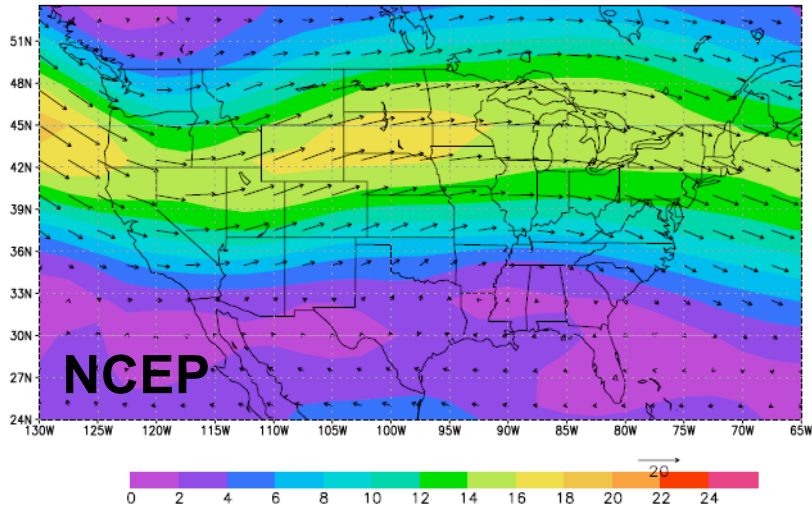


# 1993 - 1988 JJA Precip Anomaly

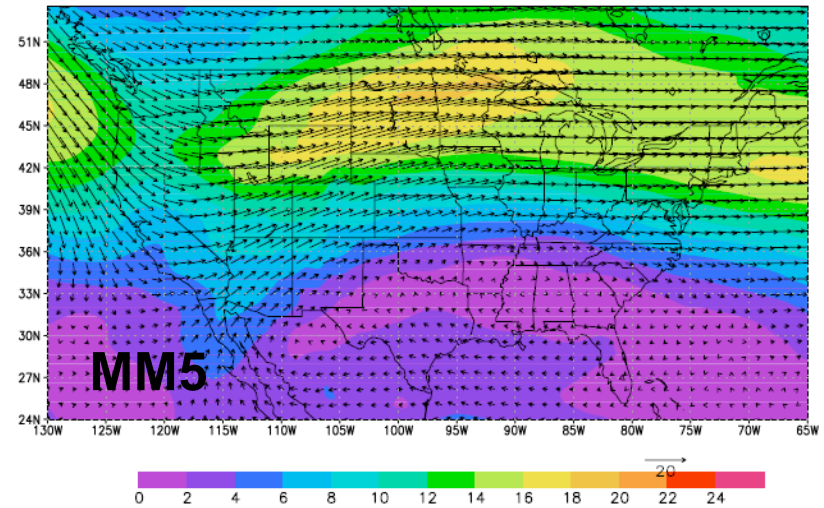


# July 1993: 500mb Winds

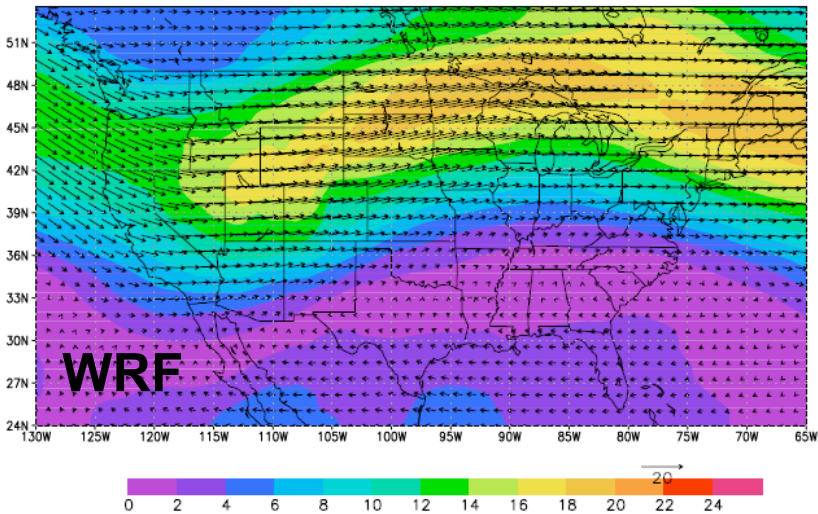
NCEP\_RE 500hPa Wind 1993 (July)



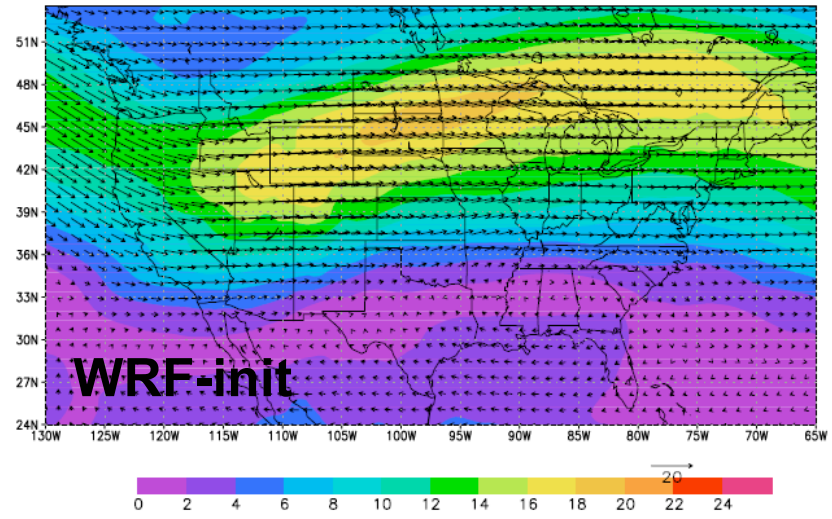
MM5 500hPa Wind 1993 (July)



WRF 500hPa Wind 1993 (July)



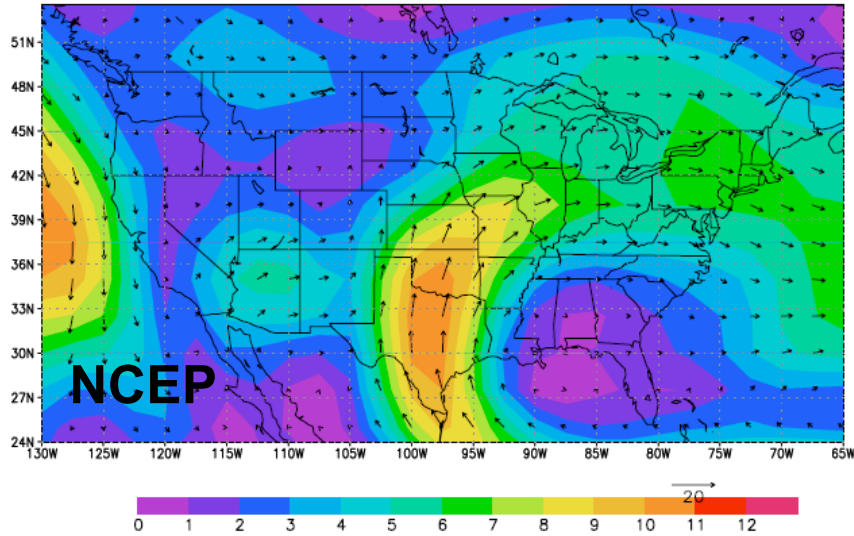
WRF\_init 500hPa Wind 1993 (July)



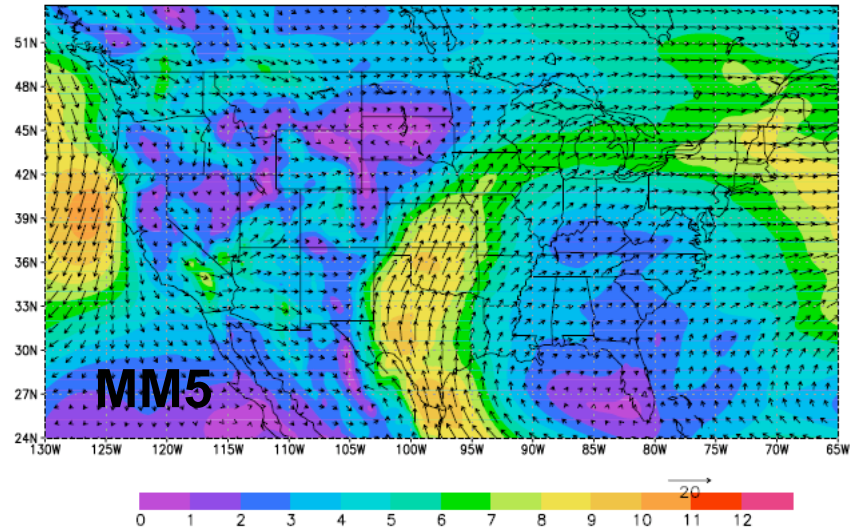


# July 1993: 850mb Winds

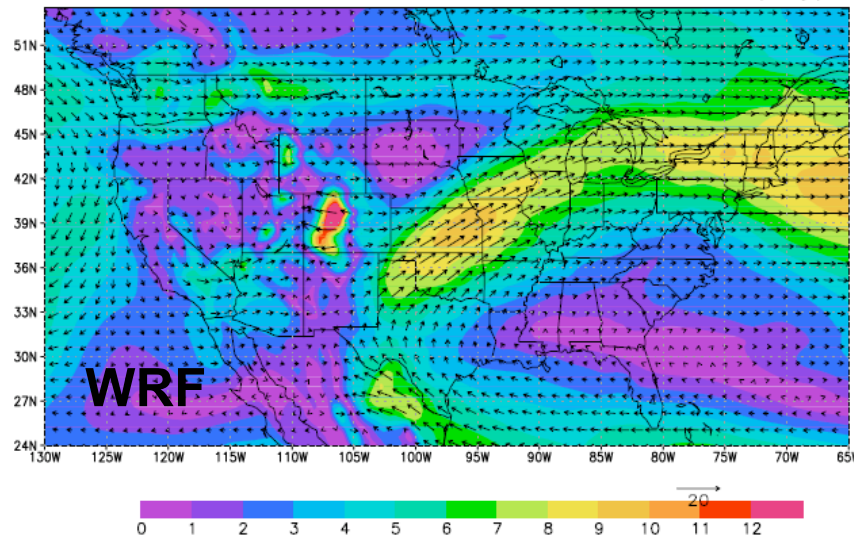
NCEP\_RE 850hPa Wind 1993 (July)



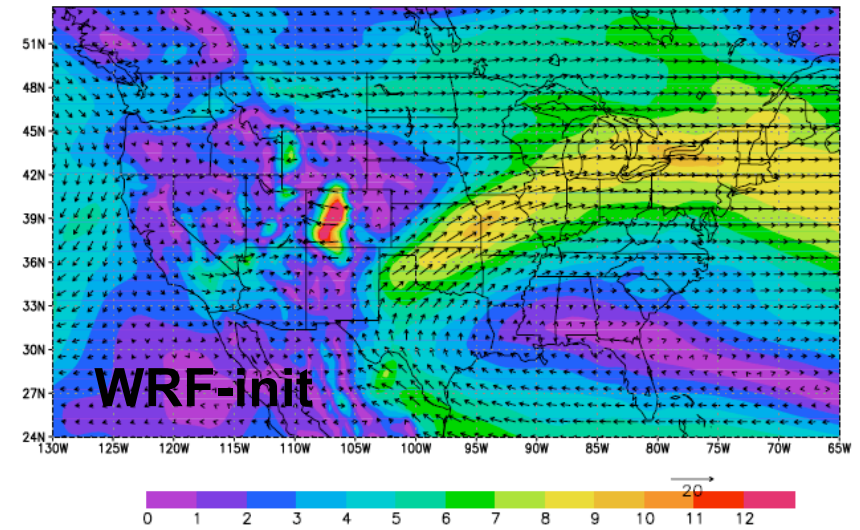
MM5 850hPa Wind 1993 (July)



WRF 850hPa Wind 1993 (July)

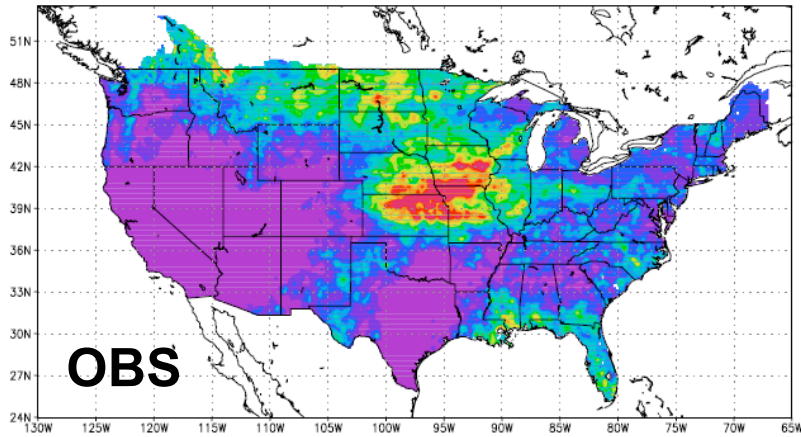


WRF\_init 850hPa Wind 1993 (July)

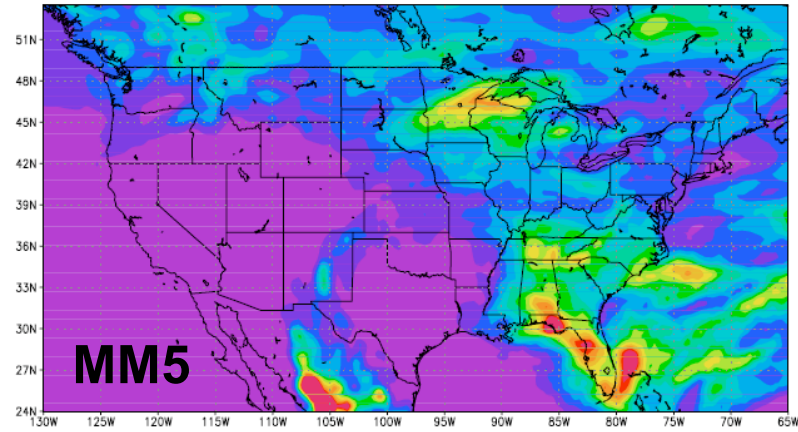


# July 1993: Rainfall

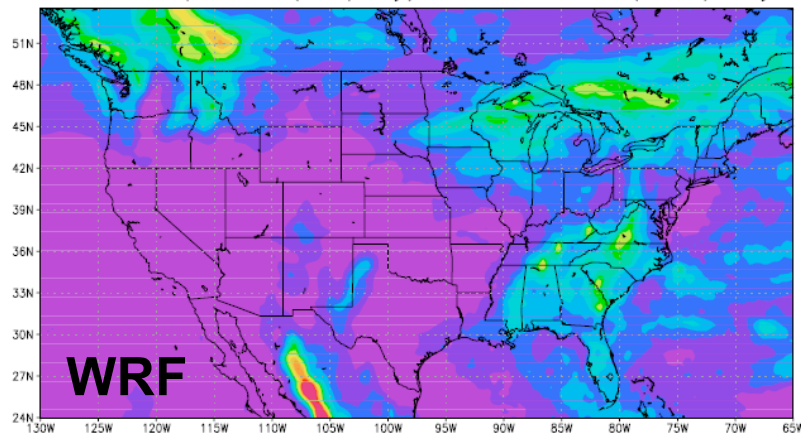
OBS/UW Precipitation (mm/day) (1993) July



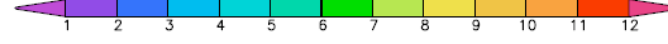
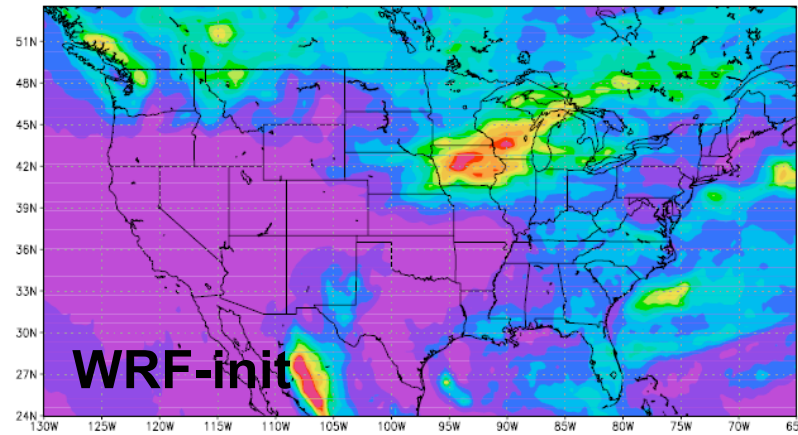
MM5 Precipitation (mm/day) (1993) July



WRF Precipitation (mm/day) (1993) July

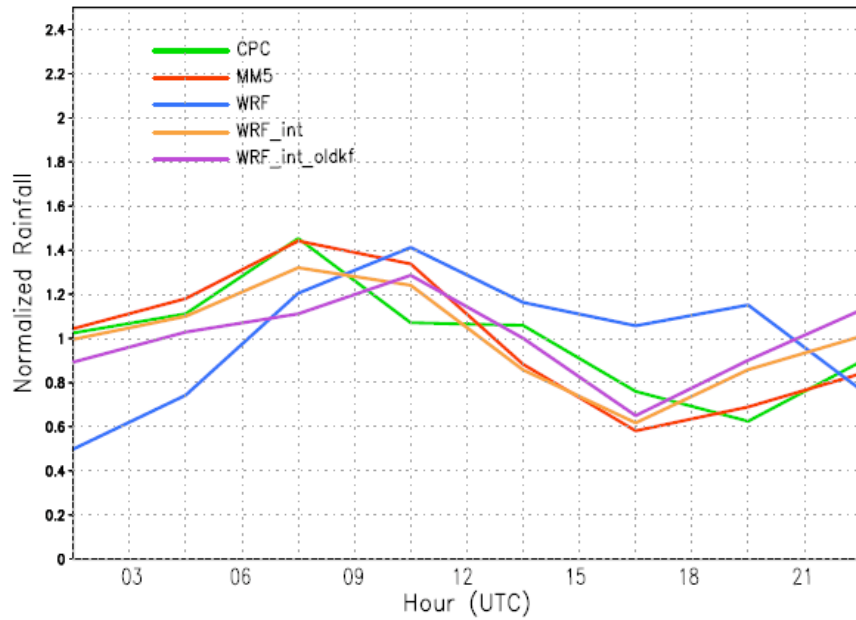


WRF\_init Precipitation (mm/day) (1993) July

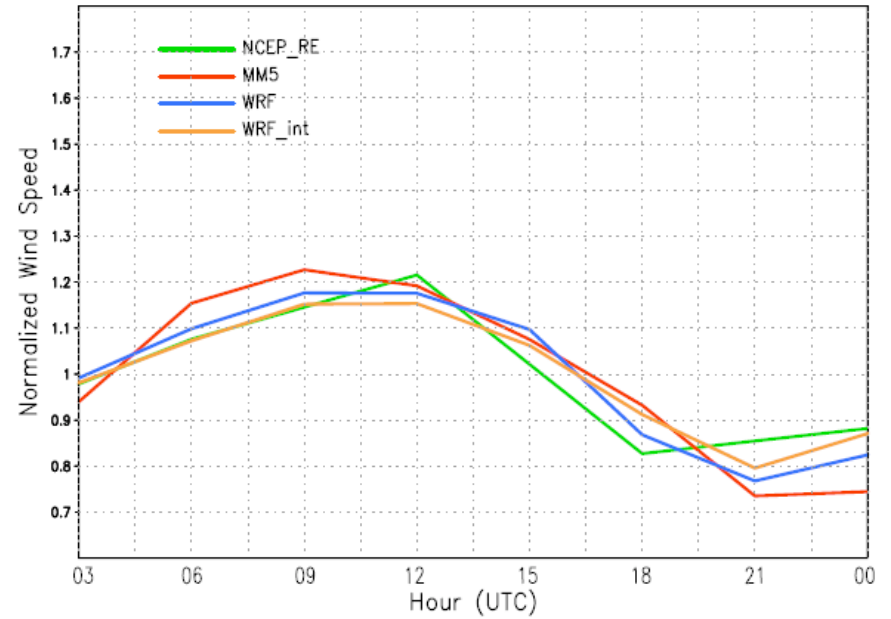


# Diurnal Cycle of Rainfall and 850mb Winds

## Rainfall



## 850mb Winds



# Ongoing and Future Work

- Evaluation of the global reanalysis driven WRF simulation
- Processing of model outputs for archiving (Table 3 and Table 5)
- Phase 2 simulations:
  - Currently downscaling CCSM for 1968-2000 (completed 8 years)
  - Will begin downscaling CCSM future climate (2038-2070)
  - Downscaling of other GCM scenarios (GFDL)