NARCCAP WRF Simulations

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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• Model outputs for Table 2 and zg500 have been archived at NERSC and NCAR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.
Warm Season Variability

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

Columbia River Basin
ACC ~ 0.80

California
ACC ~ 0.60

Upper Mississippi Basin
ACC ~ 0.3 - 0.8

Ohio Basin
ACC ~ 0.3 - 0.4

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)
Mean La Nina T and P Anomaly

Cool-Wet (Northwest) vs Warm-Dry (Southwest)
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)
The 1997 New Year Event (Anomaly)
Mean JJA Precipitation

- **OBS**
- **NCEP**
- **MM5**
- **WRF**
1993 - 1988 JJA Precip Anomaly
July 1993: 500mb Winds

NCEP

MM5

WRF

WRF-init
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)