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Using ARM Data to Evaluate Convection-Permitting Simulations on the Summertime Surface Climate Over the Central United States

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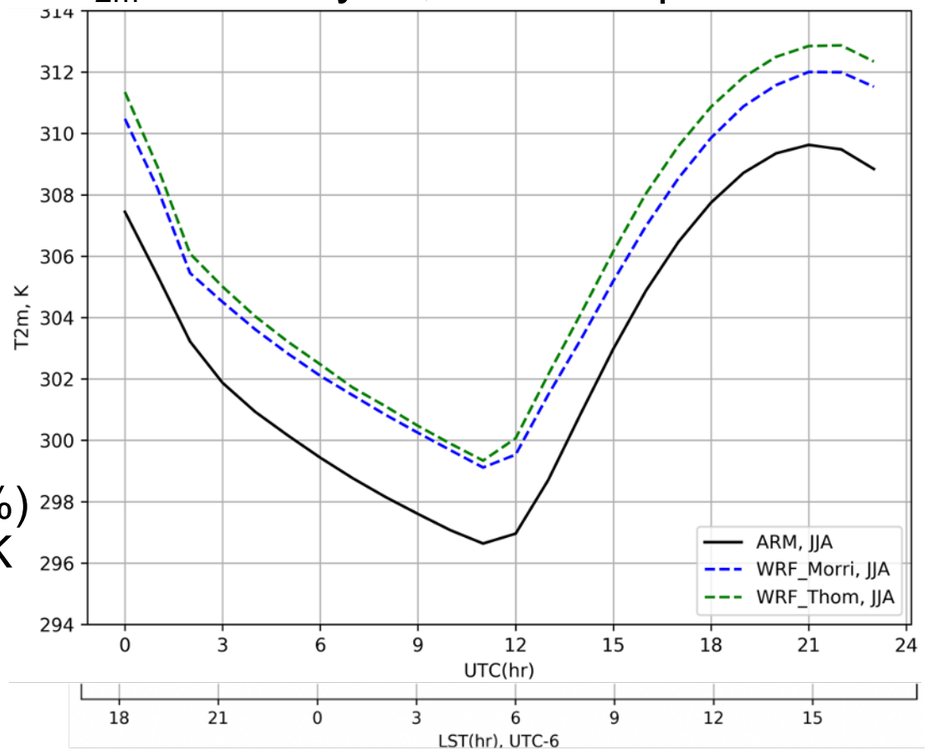
T_{2m} warm biases during summertime

- Convection-permitting (4-km horizontal, 65 vertical layers) WRF simulations with Morrison and Thompson microphysics, covering 2011 May-Aug [Feng et al. 2018].
- Biases: $WRF_{Morrison}$ < $WRF_{Thompson}$ in magnitude and spatial extent.

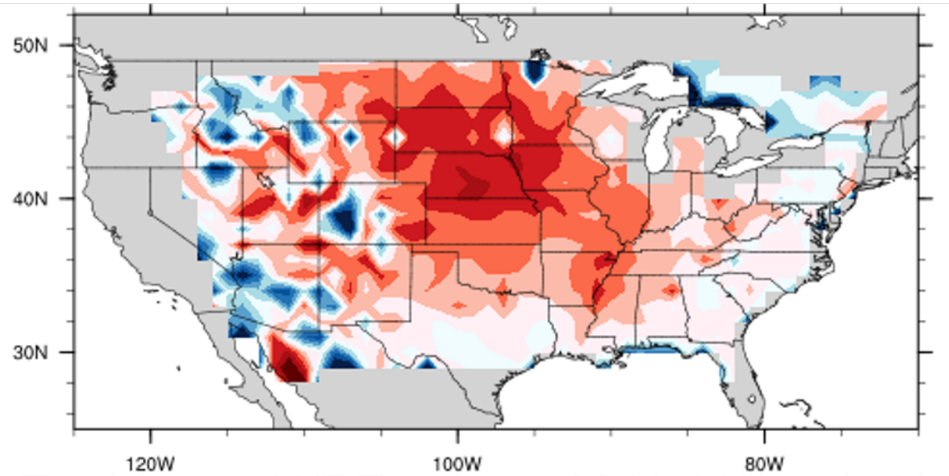
Zoom in onto the ARM SGP site:

- T_{2m} warm biases occur throughout the diurnal cycle, and $WRF_{Morrison}$ performs a bit better than $WRF_{Thompson}$.
- T_{2m} bias is 2.5 K for $WRF_{Morrison}$ and 3.2 K for $WRF_{Thompson}$.
- Contribution from the Evaporative Fraction (EF) term is 1.0 K (40%) in $WRF_{Morrison}$ and 2.1 K (66%) in $WRF_{Thompson}$ respectively.

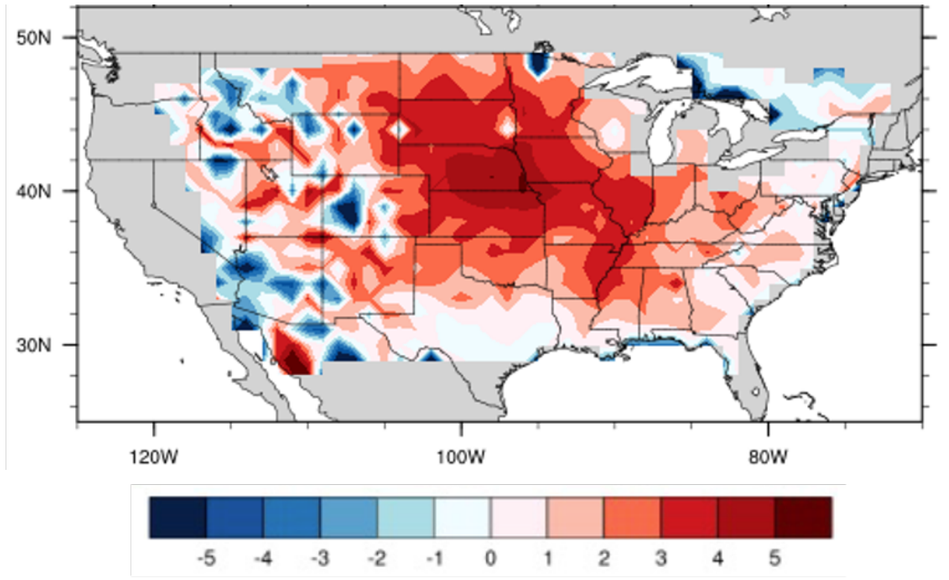
T_{2m} diurnal cycle, 2011 JJA | ARM SGP



T_{2m} biases, $WRF_{Morrison}$, 2011 JJA, unit: K



T_{2m} biases, $WRF_{Thompson}$, 2011 JJA, unit: K



T2m benchmark: NOAA QCLCD. SGP obs. comes from ARMBE2DGRID

Rainfall from MCSs, soil moisture and the EF pathway

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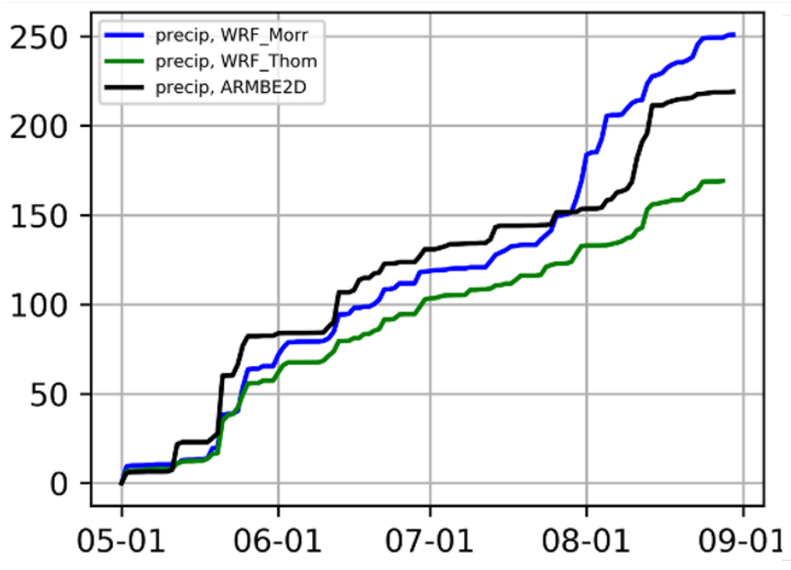
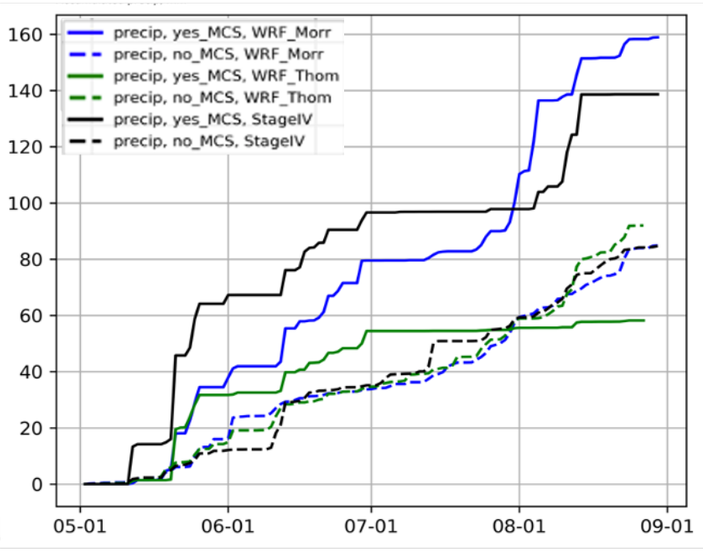
- From May to late July, both simulations underestimate accumulated rainfall. ($WRF_{Thompson}$ is worse than $WRF_{Morrison}$).
- Categorical decomposition: differences in the accumulated precip are driven by rainfall from MCSs.
- Both simulations tend to have soil moisture deficit ($WRF_{Thompson}$ is dryer than $WRF_{Morrison}$ during Jul-Aug).
- Comparing to $WRF_{Morrison}$, $WRF_{Thompson}$ has less accumulated precip, lower EF values (not shown) and larger T_{2m} warm biases.

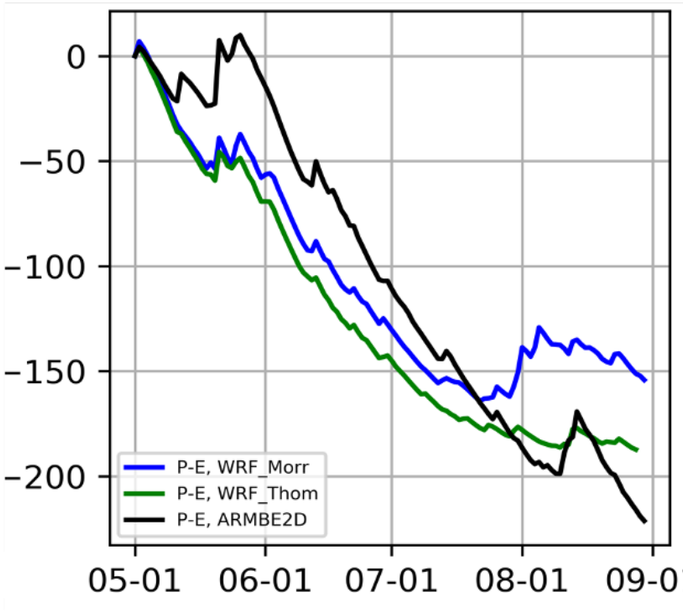
Accumulated precip, mm | ARM SGP



Accumulated precip decomposition, mm | ARM SGP



P-E, accumulated, mm | ARM SGP



Soil moisture, m^3/m^3 | ARM SGP