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# Comparison of WRF with MPAS-A for climate simulations of the contiguous United States.

Dr. Priscilla A. Mooney

With contributions from Dr. Cindy Bruyere, Sherrie Frederick & Dr. Andreas Prein.

17th Annual WRF Users' Workshop

29 June 2016

# WRF and MPAS - Differences

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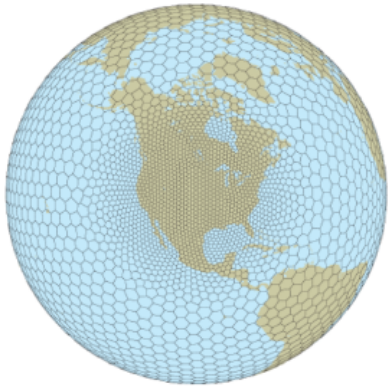
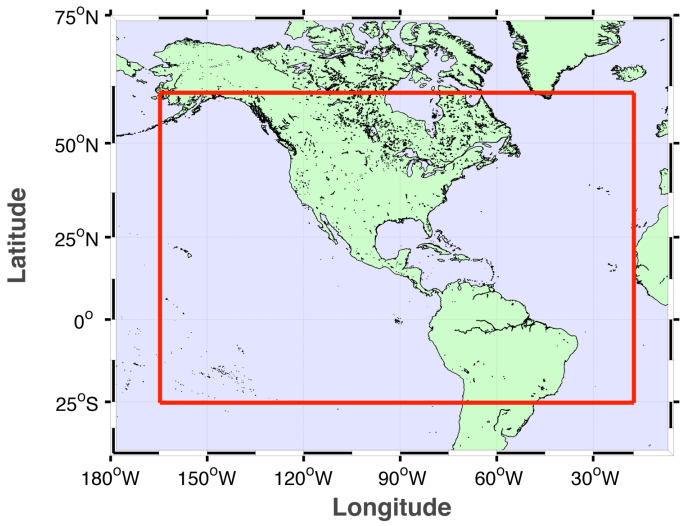
| WRF | MPAS |
| --- | --- |
| Lat-lon grid | Unstructured Voronoi grid |
| Nested in a GCM or Reanalysis | Smooth grid refinement on a conformal nest |
| Pressure based terrain following sigma vertical coordinate | Height based hybrid smoothed terrain-following vertical coordinate |

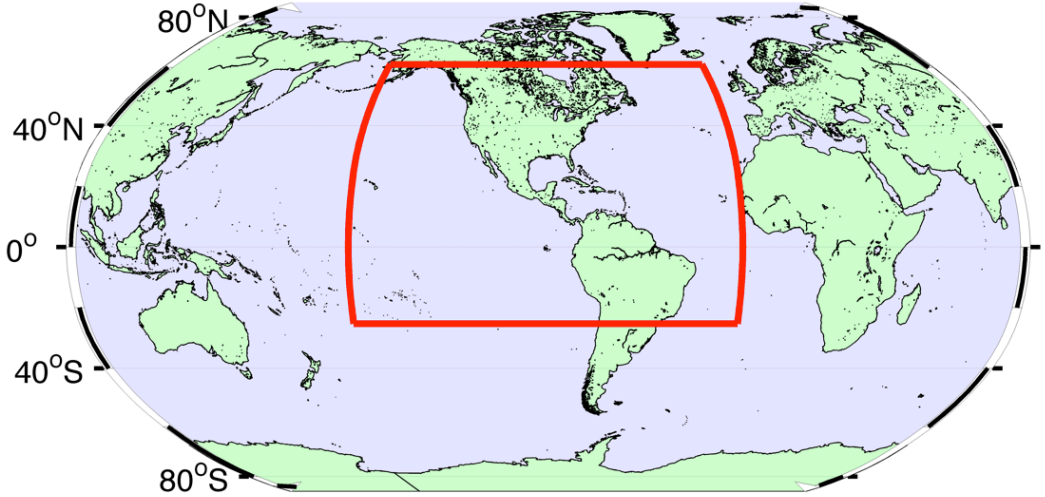


*A variable resolution MPAS Voronoi mesh*

# Model setup

| | WRF | MPAS |
|---|---|---|
| ***Years:*** | 1991-1994 | 1991-1994 |
| ***Grid spacing:*** | ~ 36km | ~ 36km |
| ***Driving Data:*** | ERA-Interim | ERA-Interim |
| ***Physics:*** | RRTMG<br>Kain-Fritsch<br>YSU<br>WSM6<br>Noah LSM | RRTMG<br>Kain-Fritsch<br>YSU<br>WSM6<br>Noah LSM |
| ***Vertical Levels:*** | 51 | 51 |
| ***Model Top:*** | 10 hPa | 30 km |



# Seasonal Biases – Temperature

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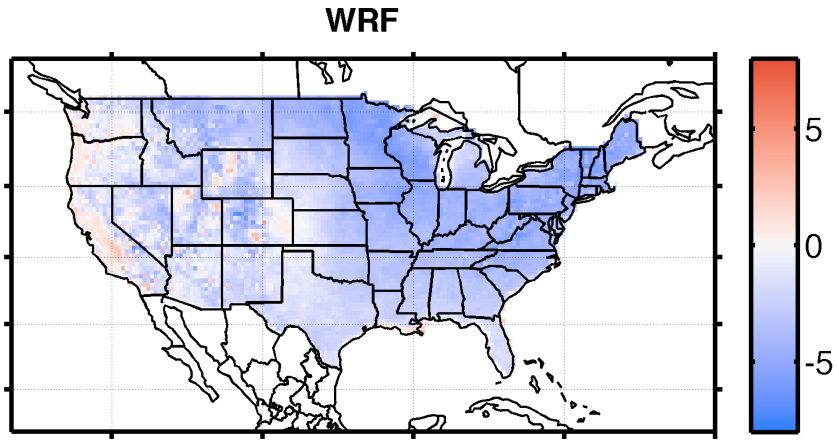
## Winter



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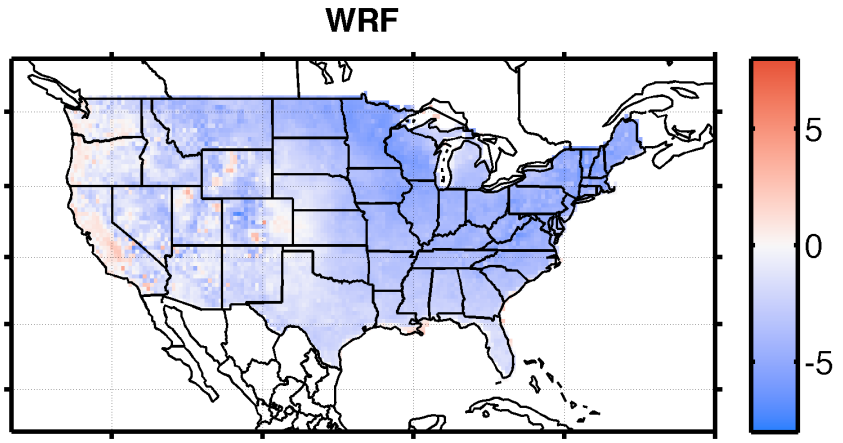


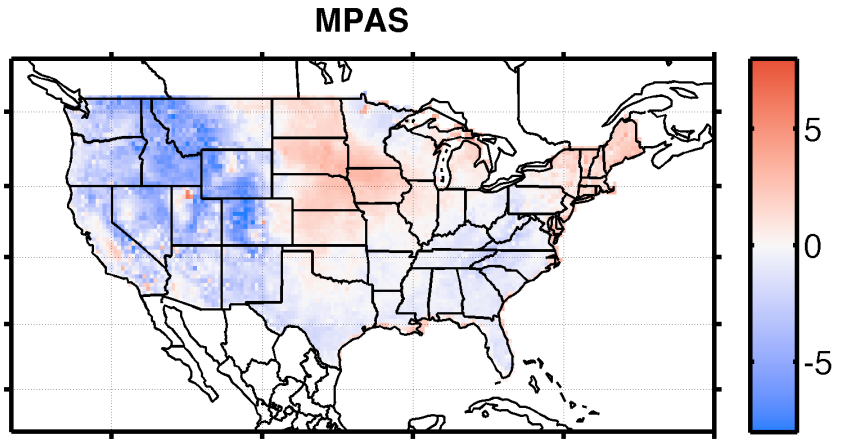

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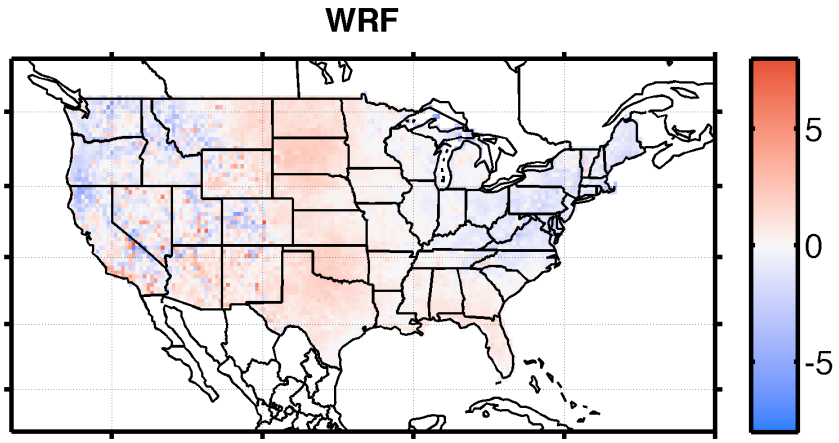

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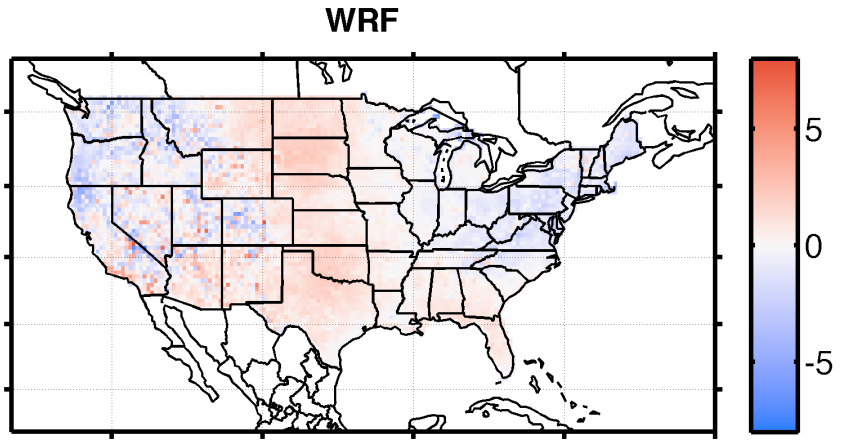


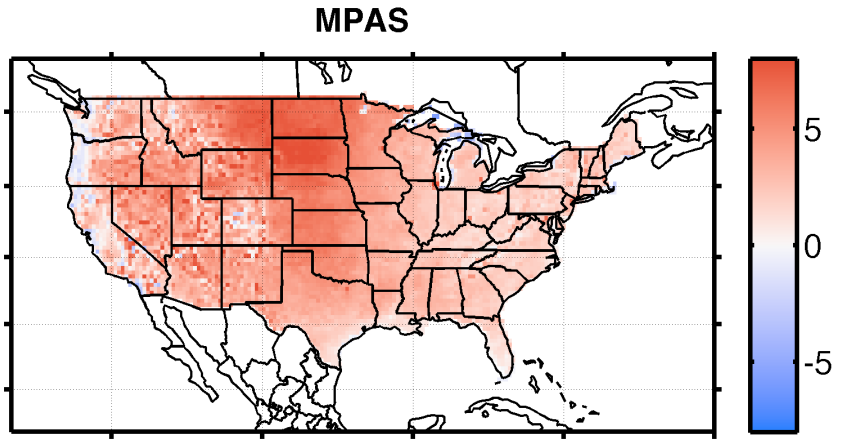

# Correlation – Temperature

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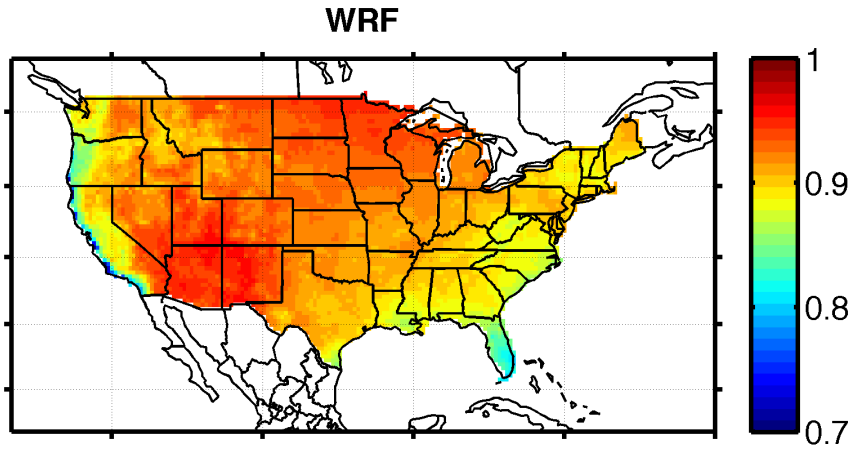

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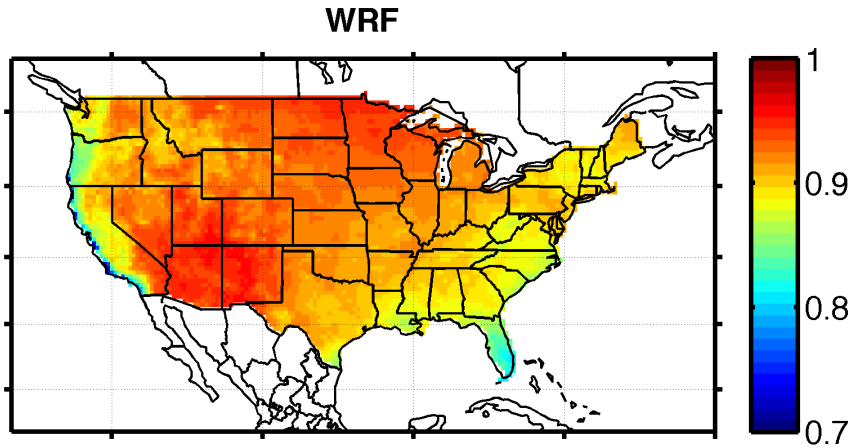


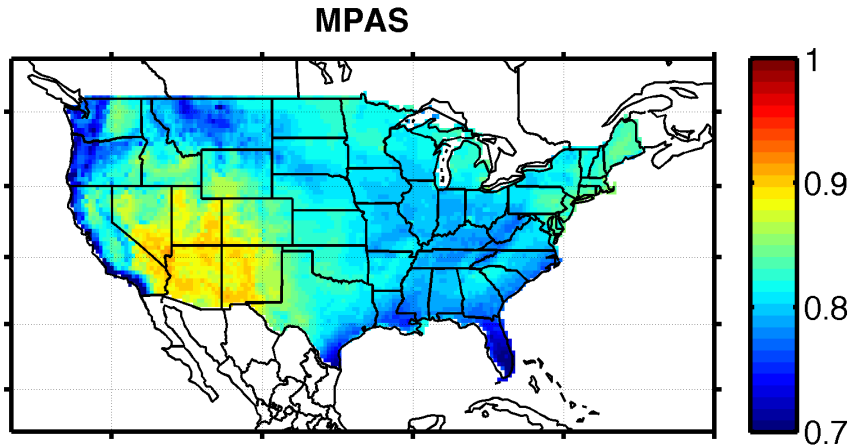

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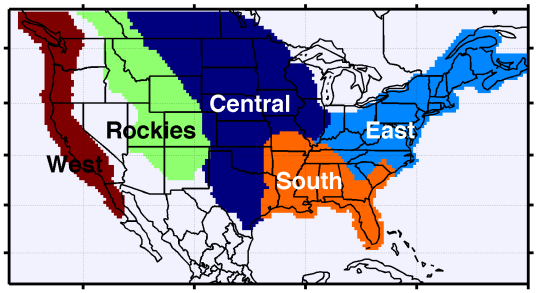


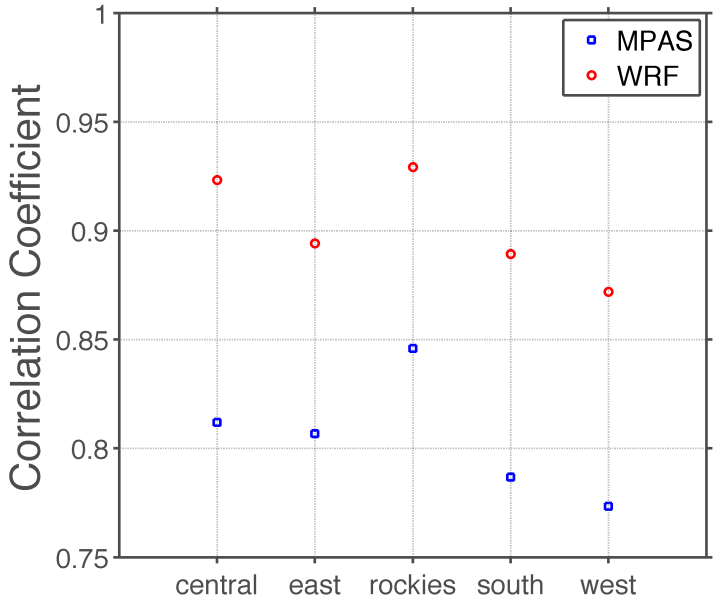

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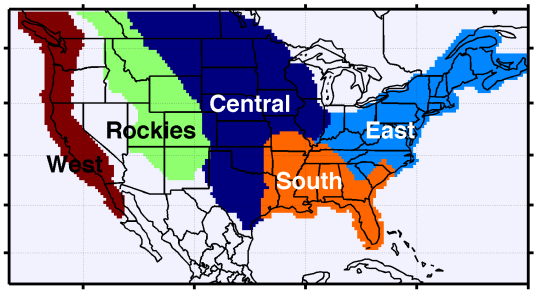


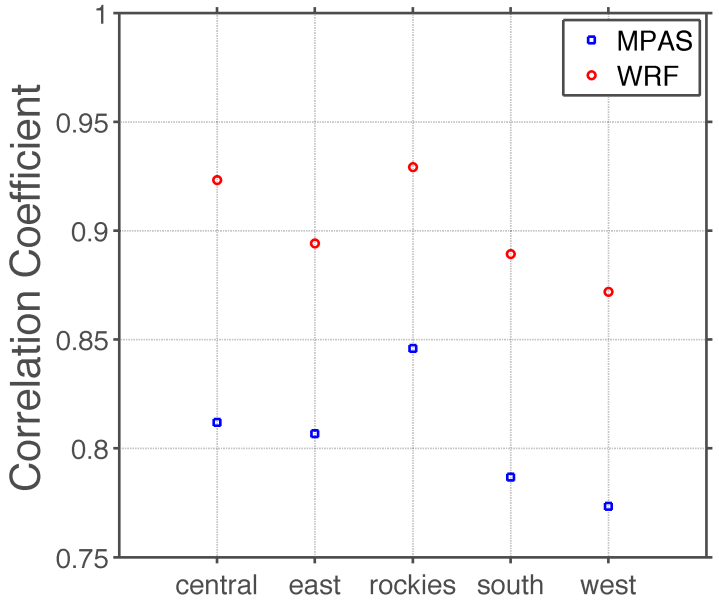


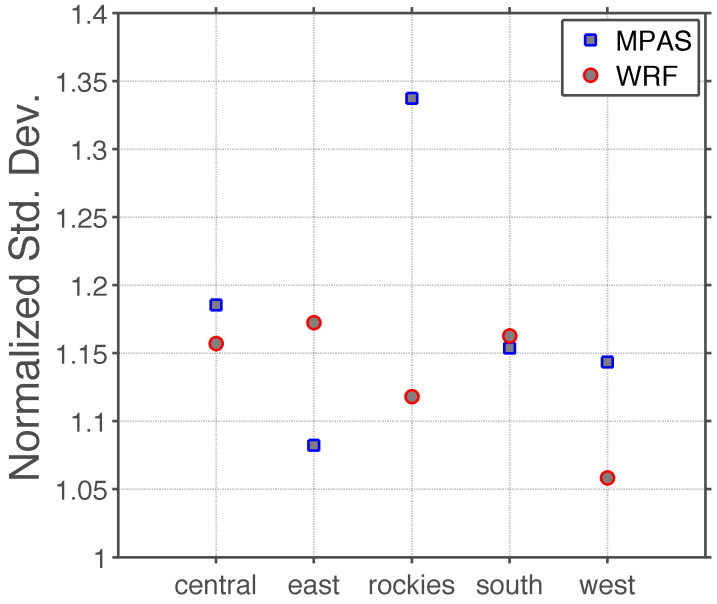

# Seasonal Biases – Precipitation Amount

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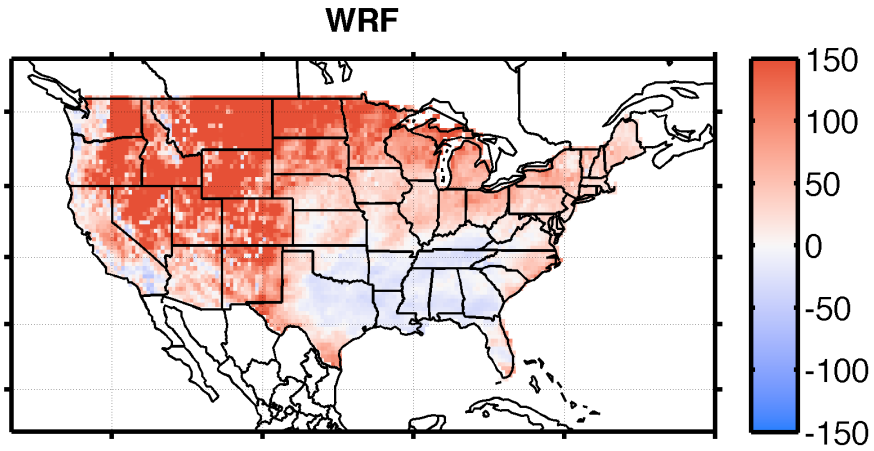

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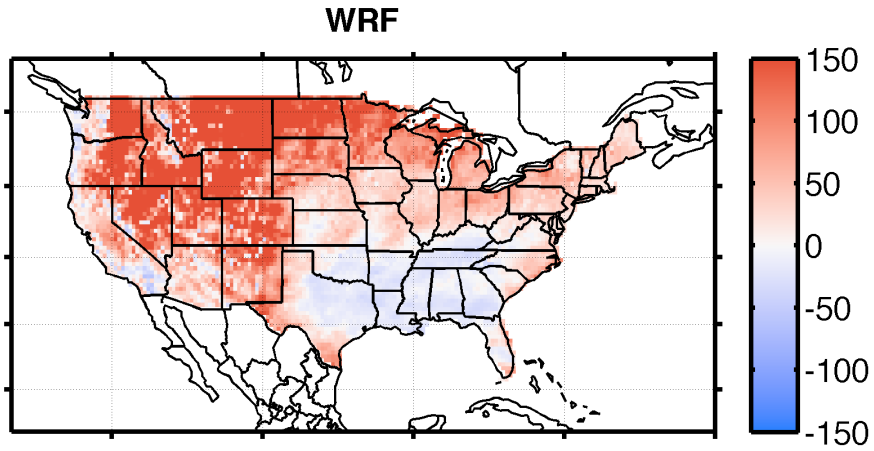


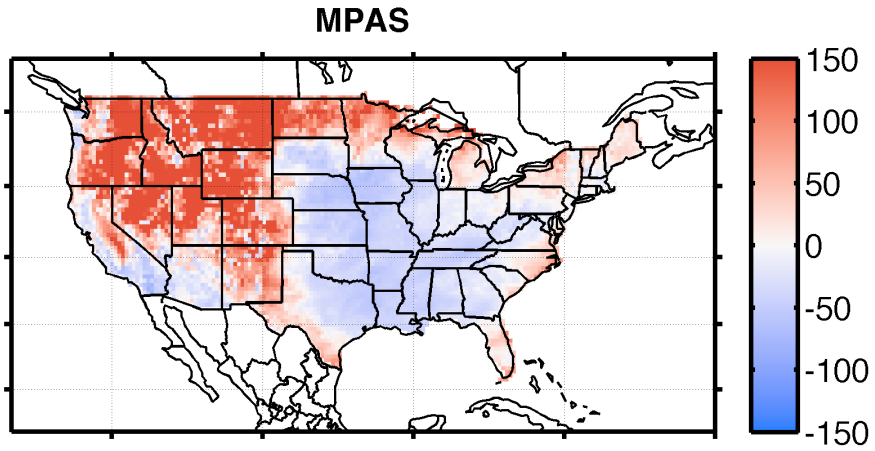

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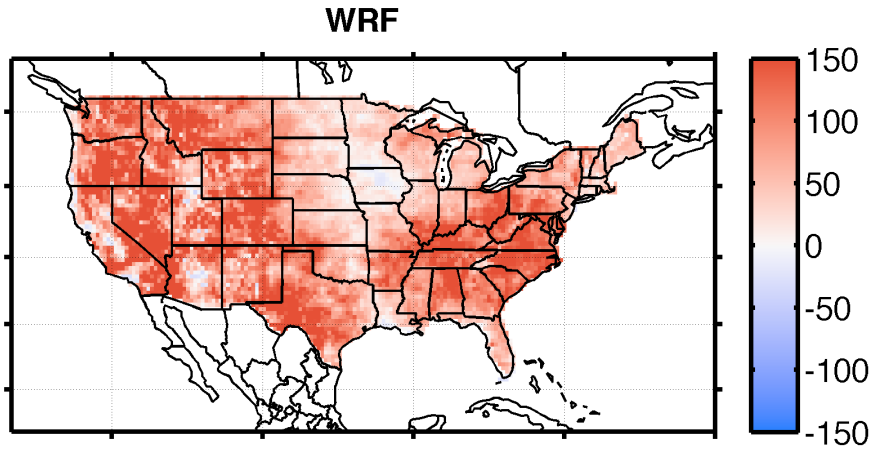

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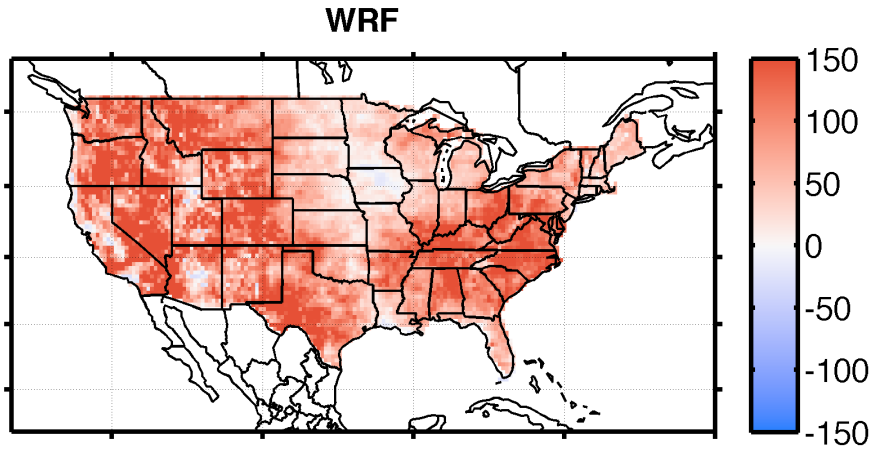
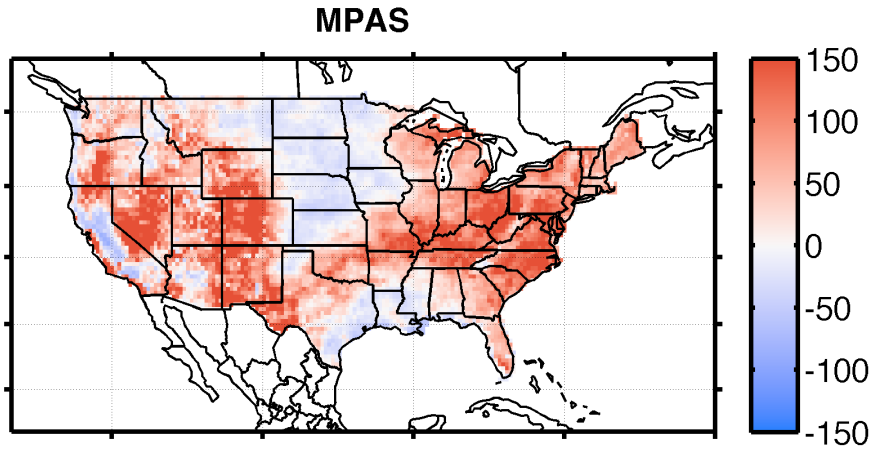
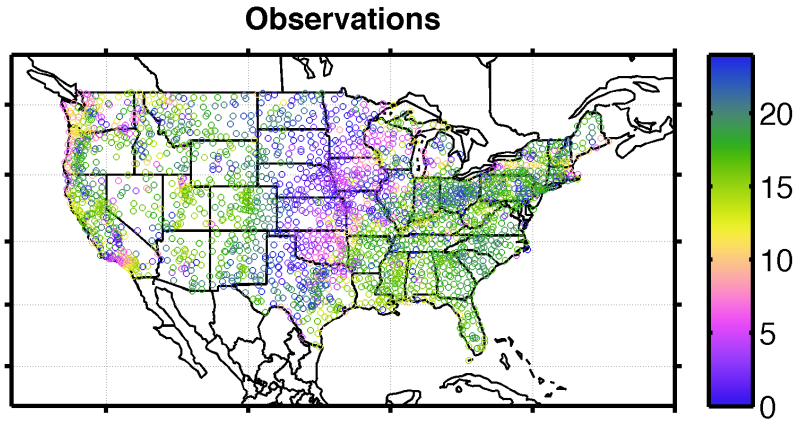


# Diurnal Cycle – Precipitation Amount



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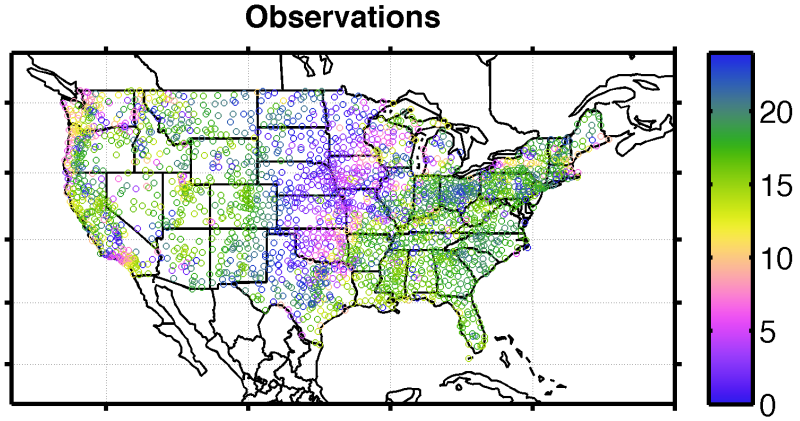


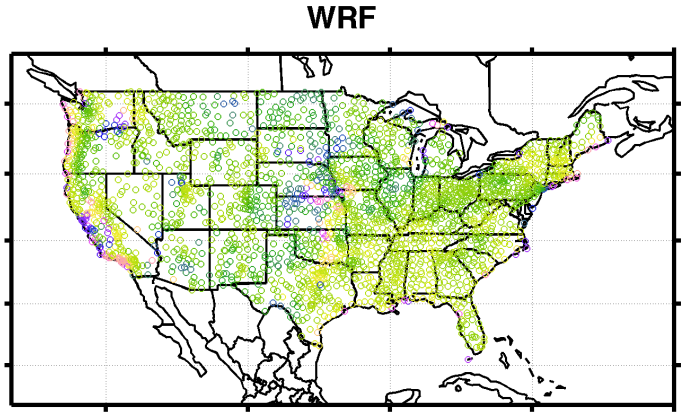

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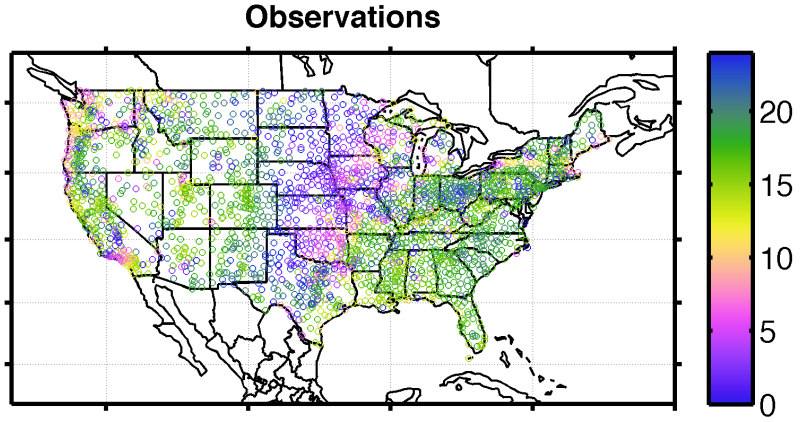


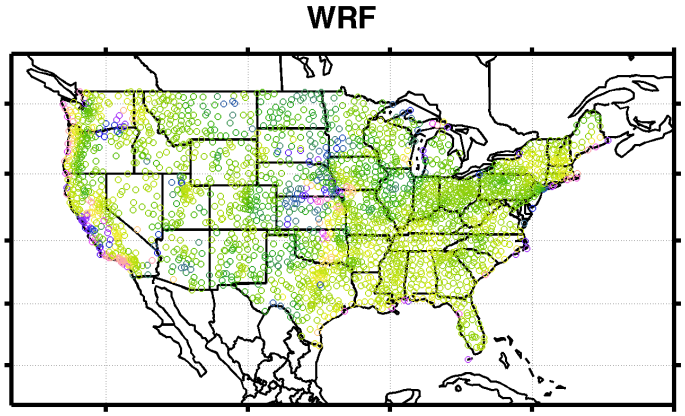


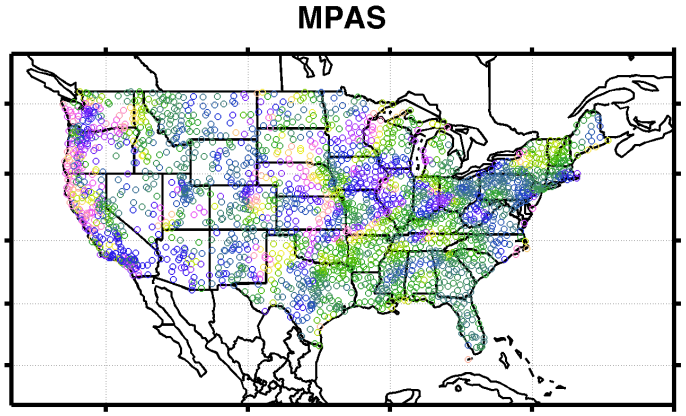

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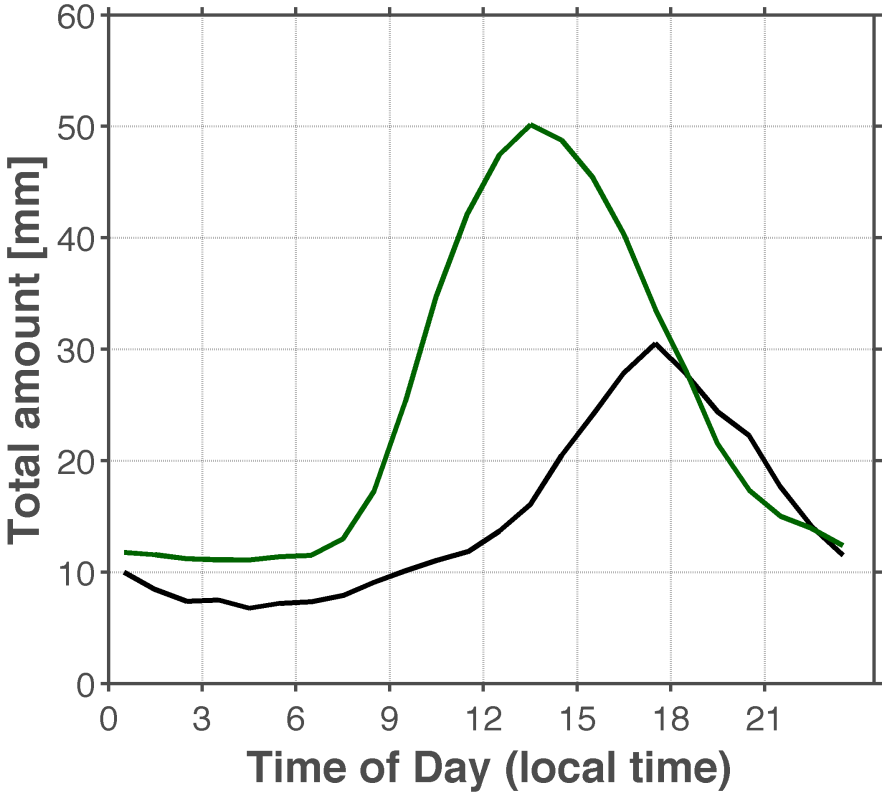


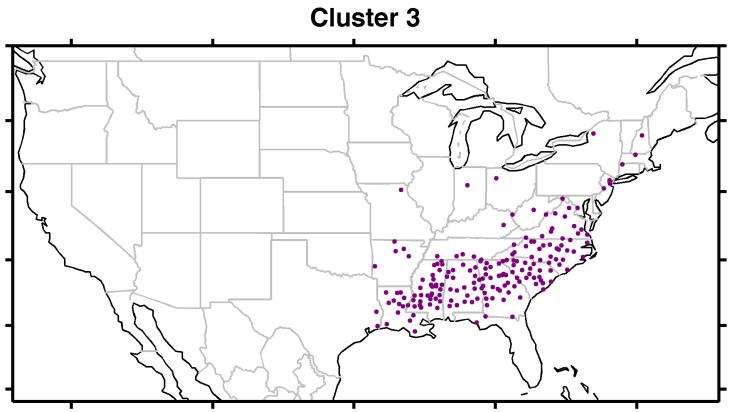


-- OBS

-- WRF

-- MPAS

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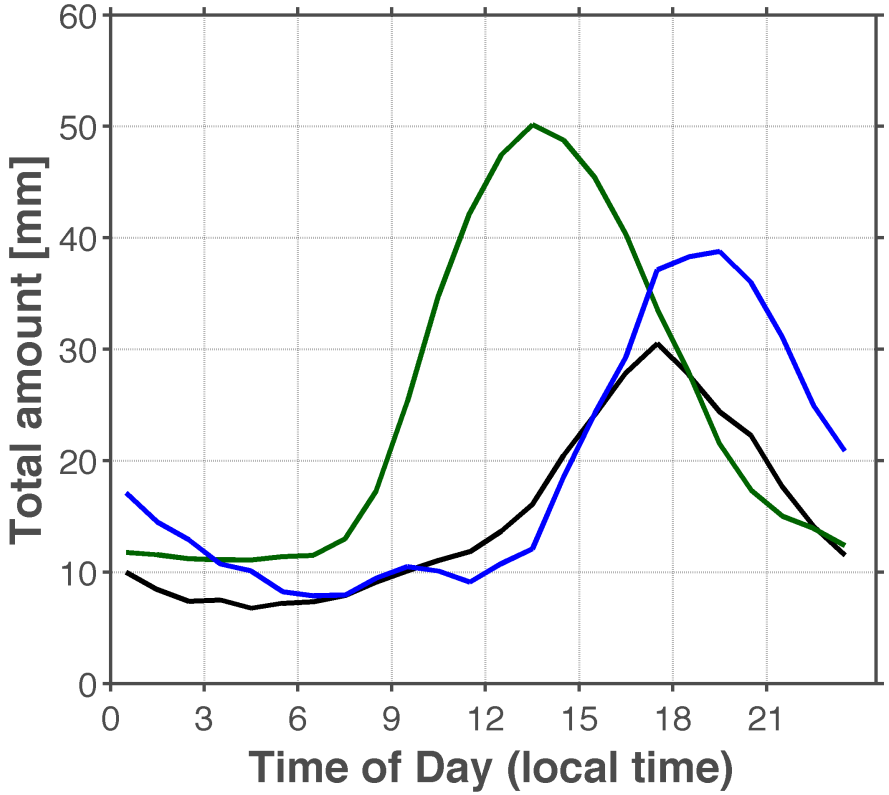


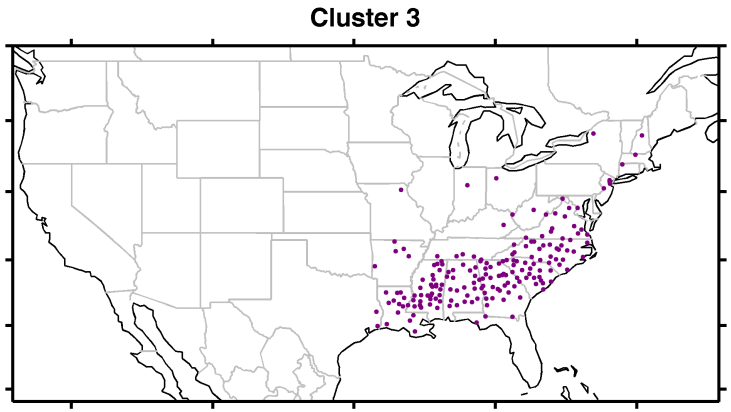


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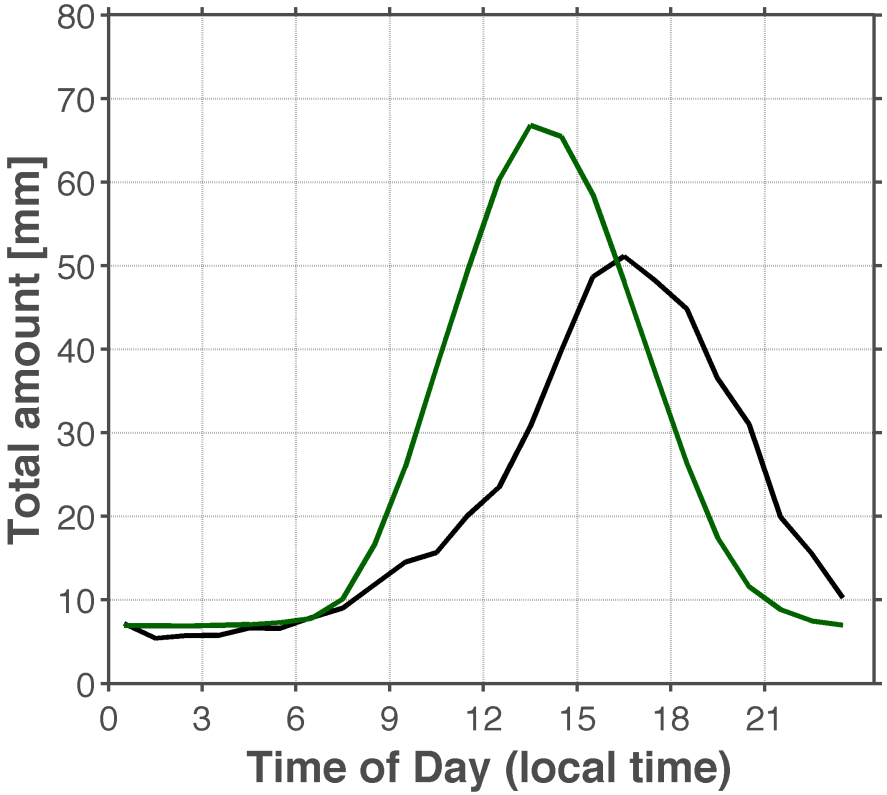


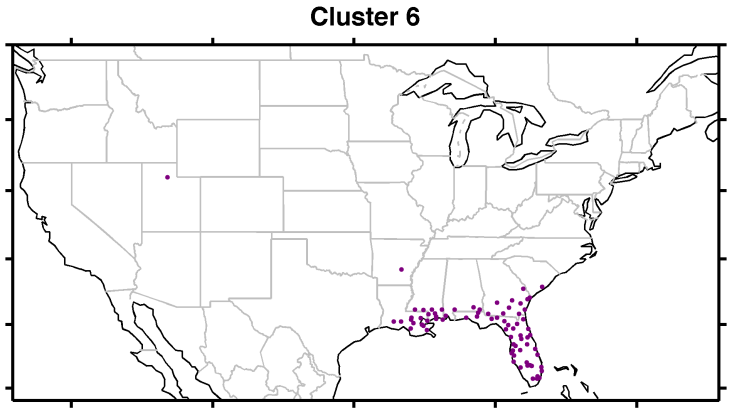


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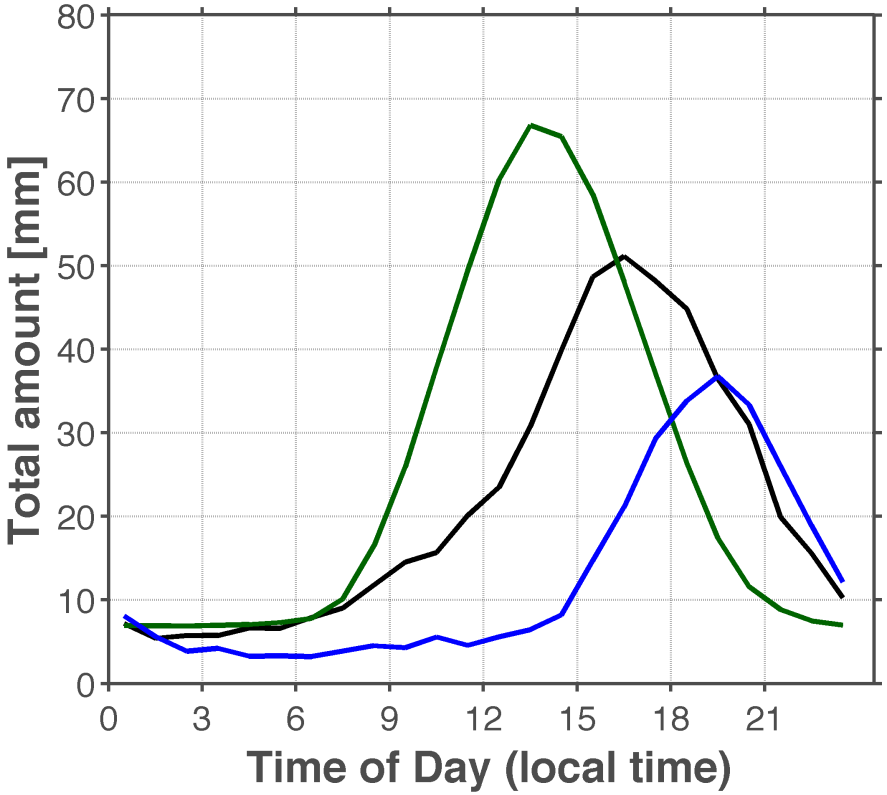


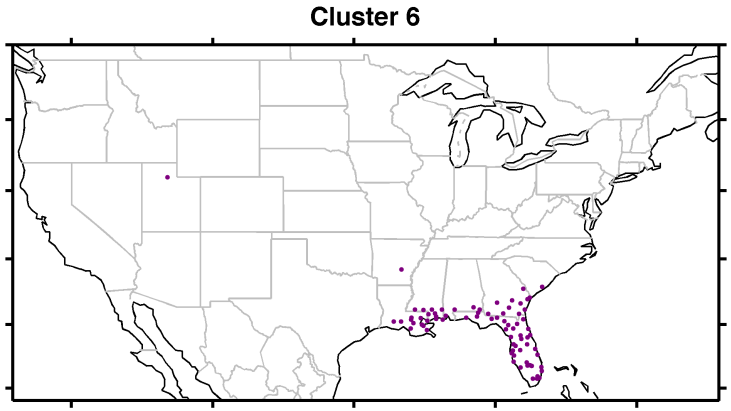


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# Summary – Preliminary Results

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Compared to WRF

- MPAS is warmer and dryer;
- Diurnal cycle of precipitation amount is better represented in MPAS;
- Difficult to determine differences in the amplitude of the variability;

Both MPAS and WRF overestimate the amplitude of the variability.

**Both good models but choose which model based on your application and available resources.**

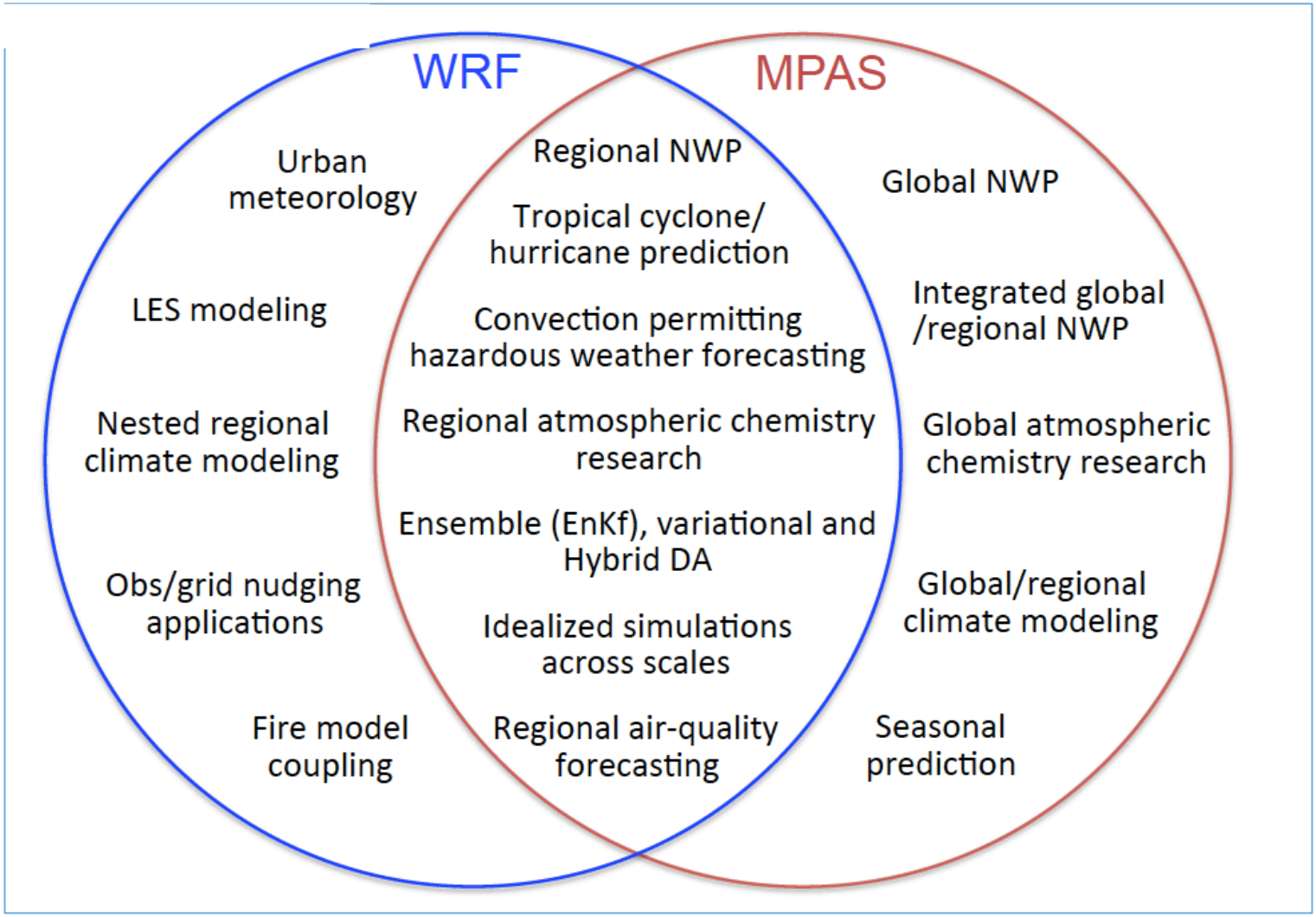
# Future Work

- Complete 10 year MPAS simulation
- Evaluate:
  - other variables
  - use other metrics
  - use other reference datasets
- Compare 10 year MPAS simulation with a WRF multiphysics ensemble
- Complete a 10 year variable resolution mesh with refinement over North America

# MPAS and WRF

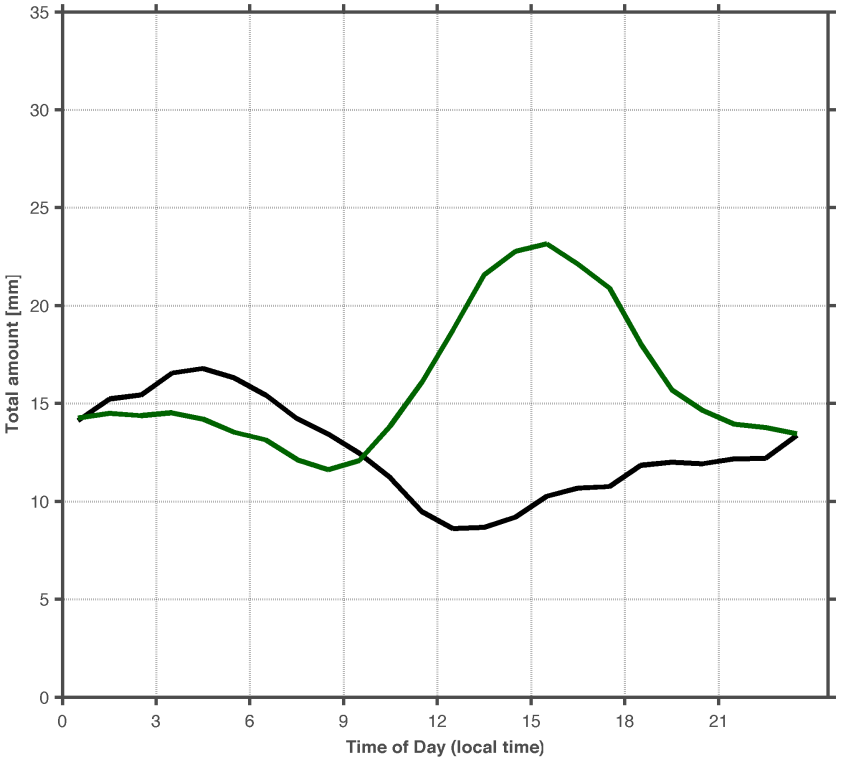
- WRF may be preferable for computationally demanding studies e.g. convection permitting studies;
- WRF may be preferable for studies over small domains;
- WRF has been rigourously tested by the community compared to the relatively new MPAS model;
- MPAS is better suited to address certain research questions e.g. scale interactions in the atmosphere;

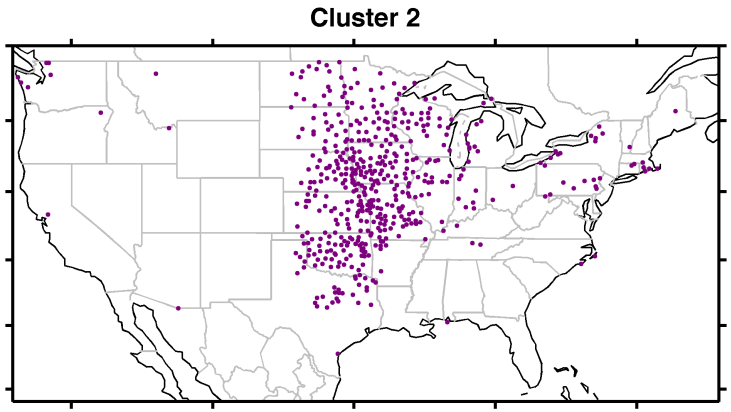
# MPAS and WRF applications




From Skamarock *et al.* – 15th Annual WRF Users' Workshop

# Diurnal Cycle – Precipitation Occurrence

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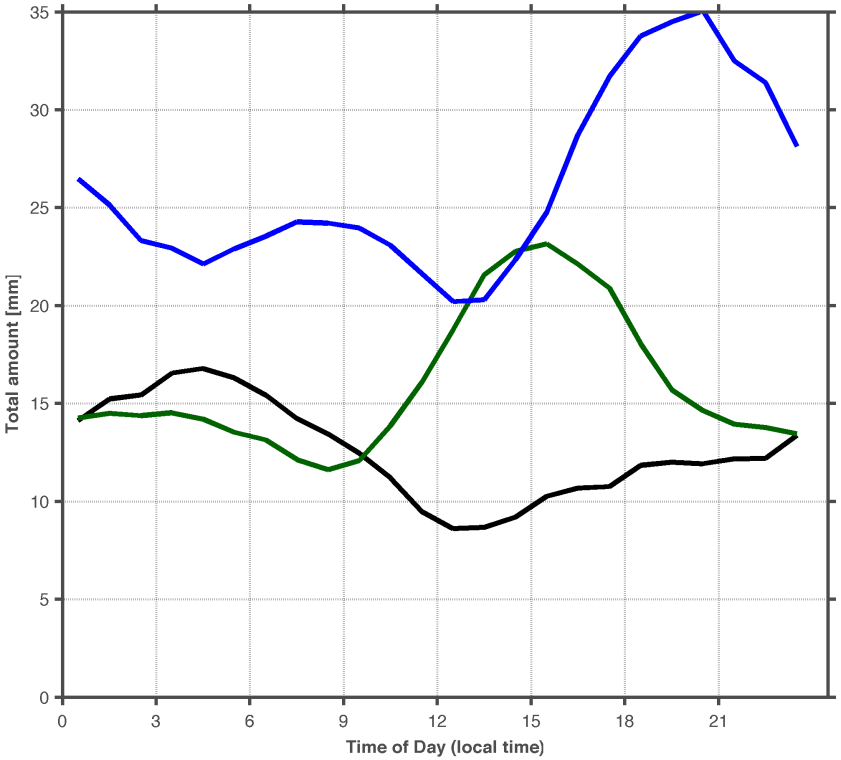


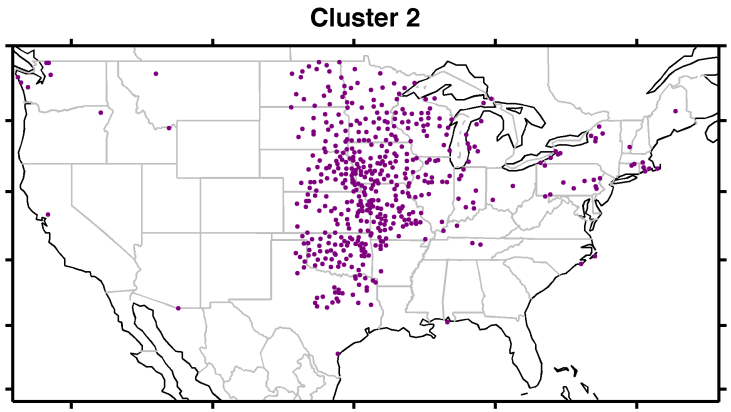


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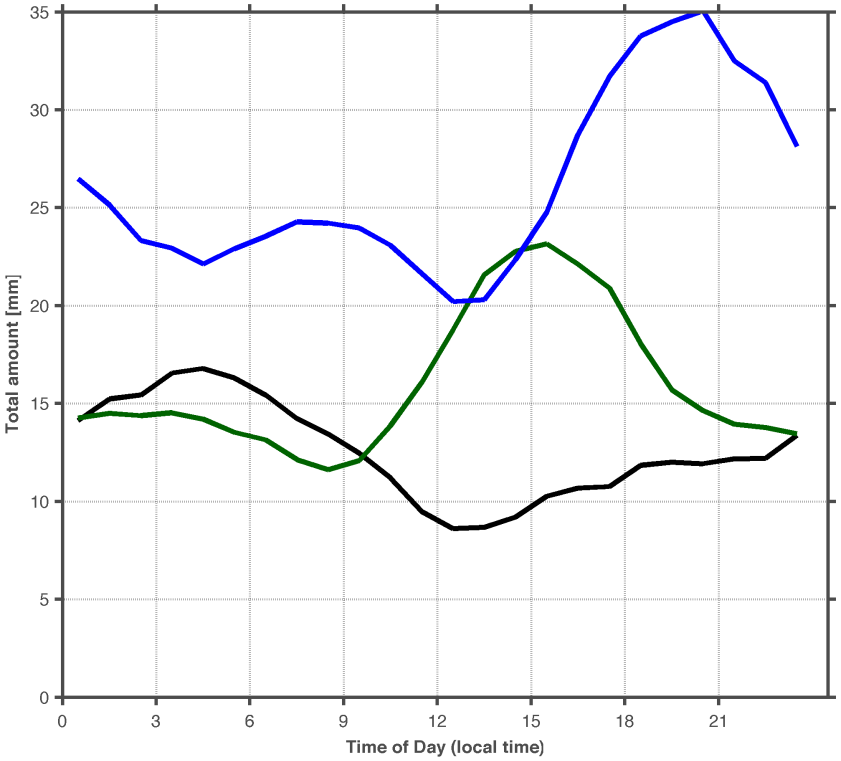

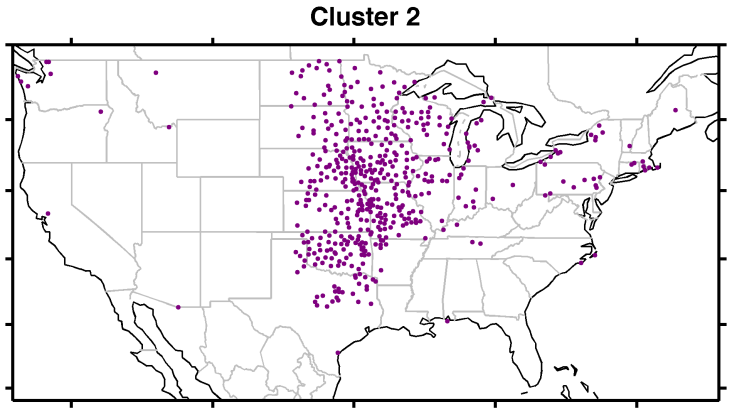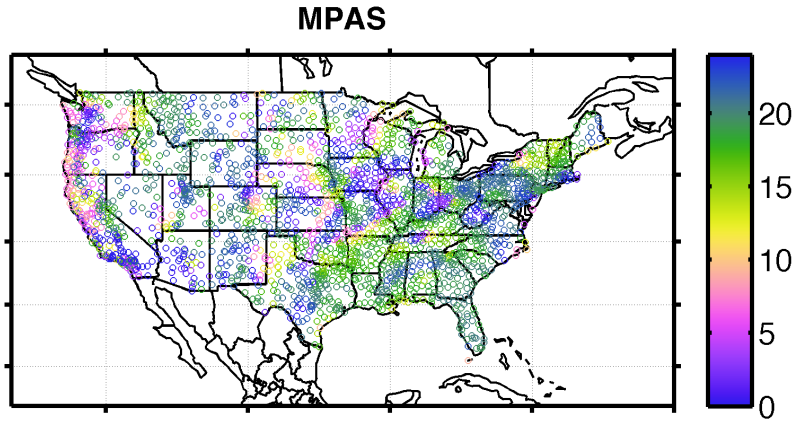
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