Pre-Storm Environment Low-Level Wind Shear Sensitivity to Vertical Grid Resolution

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Project Mission:

- Transition idealized high-resolution simulation research into an operational framework
- Determine if 3-4 vertical grid points adequately resolves the low-level wind field
- Explore the impact of using 7-8 vertical grid points in the lowest 500m of the model domain
- Analyze differences in thermodynamic impacts versus kinematic impacts

Experiment Process:

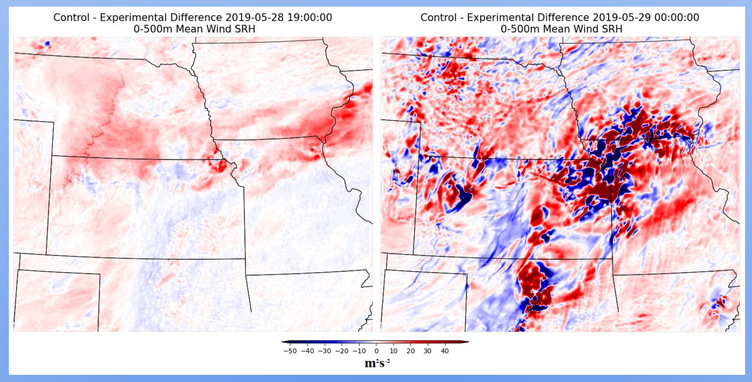
- Analysis of 6 supercell cases in the Plains and Midwest Regions
  - Both tornadic and non-tornadic cases
- Initializing WRF with HRRR as lateral boundary conditions
- Experimental Vertical Resolution: ~7-8 grid points in the lowest 500m
- Control Vertical Resolution: ~3-4 grid points in the lowest 500m
- A full physics simulation and a dry (no-convection) simulation conducted at both resolutions, for a total of 4 simulations per case
- This poster focuses on the low-level wind shear and SRH for the pre-storm and far-field environments

Results Summary:

- Large differences for the low-level wind field in the vicinity of thermodynamic boundaries, both synoptic-scale and remnant convection outflow
- Undisturbed warm-sector differences operationally insignificant
- Areas of convection also result in large differences
- Differences in dry experimental vs dry control simulations are subtle, compared to the full physics experimental vs dry simulations
- In the pre-storm environment, 3-4 vertical grid points sufficient to represent low-level wind profile below 500m

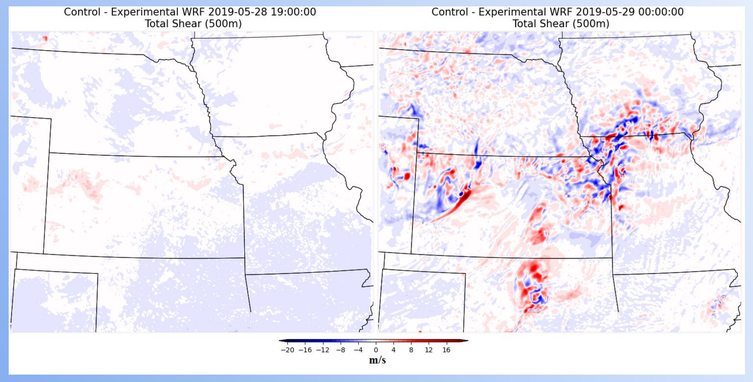
View More Details With The QR Code Link!
Contact: alex.krull@noaa.gov
Project Funded Through COMET
Project SUBAWD002620

0-500m SRH Difference Sample:



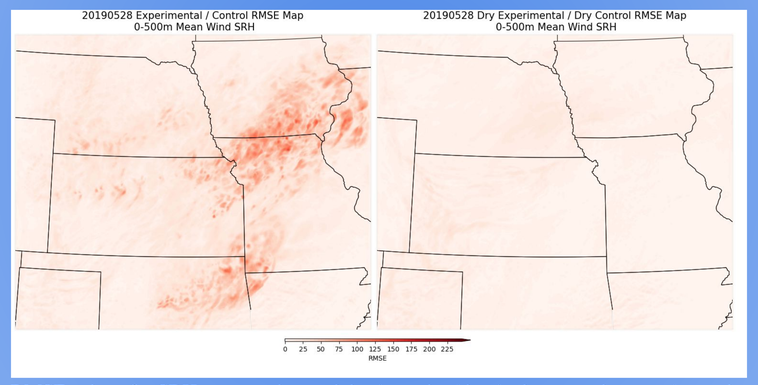
Control minus experimental SRH for full physics simulations. Red indicates control has higher SRH, blue indicates experimental has higher SRH.

0-500m Total Shear Difference Sample:



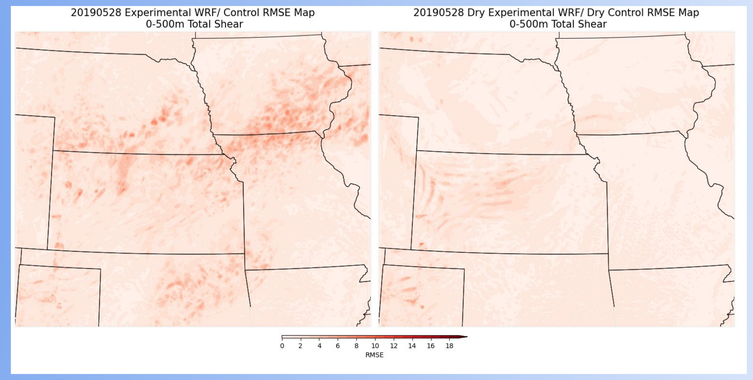
Control minus experimental total shear for full physics simulations. Red indicates control has greater total shear, blue indicates experimental has greater total shear.

0-500m SRH RMSE:



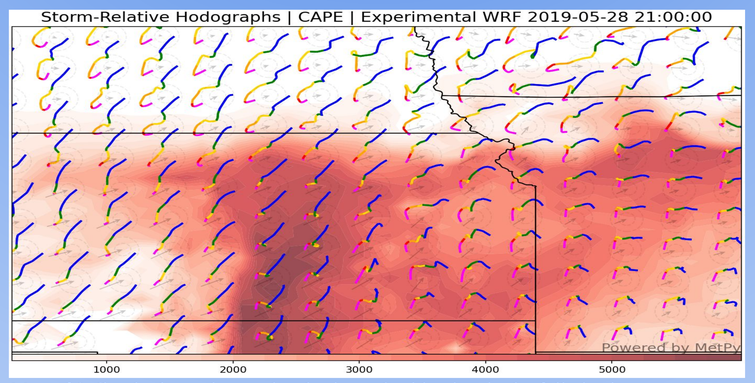
RMSE values for SRH computed at each horizontal grid point between the experimental and control resolutions. Full physics simulation is on the left, dry simulation is on the right.

0-500m Total Shear RMSE:



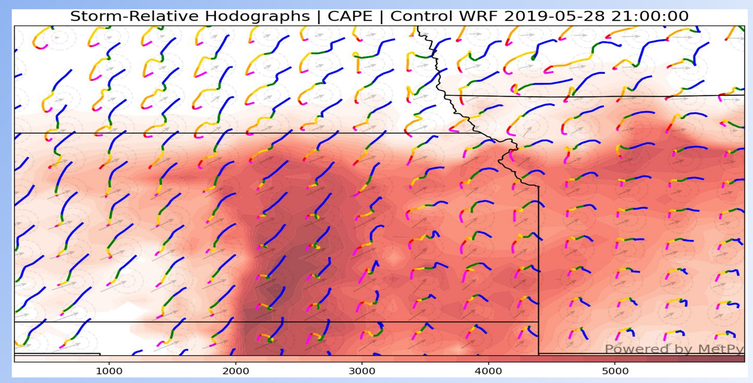
RMSE values for total shear computed at each horizontal grid point between the experimental and control resolutions. Full physics simulation is on the left, dry simulation is on the right.

Experimental 0-6km Hodographs:



Map of 0-6km hodographs at select horizontal grid points in the full physics experimental resolution simulation. Compare and contrast differences with the map to the right side of the poster, particularly with respect to storm location and boundary placement.

Control 0-6km Hodographs:



Map of 0-6km hodographs at select horizontal grid points in the full physics control resolution simulation. Compare and contrast differences with the map to the left side of the poster, particularly with respect to storm location and boundary placement.