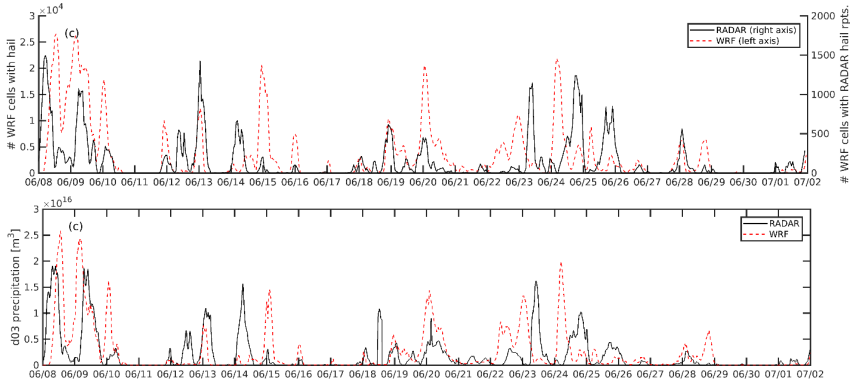
WRF Modelling of Deep Convection

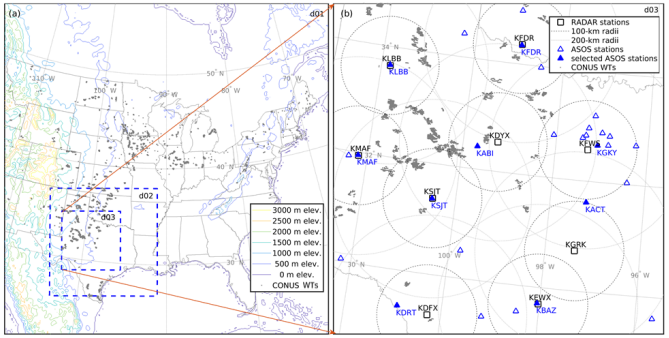
U.S. Department of Energy | Office of Science
HYPERFACETS
A Framework for Improving Analysis and Modeling of Earth System and Intersectoral Dynamics at Regional Scales

Scientific Achievement

WRF simulation of deep convection is performed and evaluated using RADAR observations of precipitation (incl. hail) and reflectivity, in situ wind speeds and wind power generation. The presence of hail is modelled with a mean proportion correct of 0.77 and an odds ratio 4.55. Hail events frequently occur during periods when wind turbines are rotating and are especially important to LEE in the SGP.



Hail and precipitation spatially aggregated over domain 3 from RADAR and WRF. Above| Number RADAR hail reports (black) in each WRF grid cell and number of WRF grid cells with simulated hail accumulation > 0 mm (red). **Below|** Domain-wide precipitation from RADAR (black) and WRF (red). Domain 3 is resolved at 1.33 by 1.33 km and covers 667 km by 667 km of the Southern Great Plains (SGP).



Letson F., Shepherd T.J., Barthelmie R.J. and Pryor S.C. (2020): WRF Modelling of Deep Convection and Hail for Wind Power Applications. *Journal of Applied Meteorology and Climatology* **59** (10): 1717–1733

Significance and Impact

Deep convection and the related occurrence of hail, intense precipitation and wind gusts represent an important hazard to a range of energy and built infrastructure. The Southern Great Plains (SGP) has widespread wind energy development, and frequent deep convection resulting in very heavy rainfall and hail that is linked to wind turbine blade damage (leading edge erosion, LEE).

Research Details

A 25-day simulation is conducted at convection-permitting resolution (1.33 km) to evaluate the effectiveness in modelling the wind and precipitation conditions relevant to wind turbine blade leading edge erosion (LEE).