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Forecasts of convective storms using 3-km and 1-km horizontal grid spacing: When is higher resolution needed?

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While idealized simulations of convective storms using 1-km horizontal grid spacing often possess superior realism compared to 3-km simulations, previous studies have suggested that the improvements in convective-scale structures resulting from finer horizontal grid spacing do not necessarily translate into improved convective forecasts during the next-day convective period (i.e. forecast lead times of > 12 hours).

This presentation will highlight past and ongoing research by the authors to investigate the circumstances when using 1-km horizontal grid spacing, rather than 3-km grid spacing, does produce superior next-day forecasts of high-impact convective events, and to quantify those differences. To do so, we have produced several deterministic and ensemble forecast datasets where 3-km and 1-km forecasts can be cleanly compared across a wide range of convective events and environments. This includes a recent effort to simulate multiple seasons of high-impact weather events, encompassing more than 200 cases, using a domain covering the entire continental United States. A synthesis of our findings using these datasets will be presented, including a discussion of implications for the requirements of future operational convection-allowing modeling systems in both the U.S. and Europe.