MMM SEMINAR SERIES

Advancing Snowstorm and Severe Weather Predictability using Ensemble Data Assimilation and AI

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Winter storms remain a prediction challenge, from the synoptic-scale evolution of the associated mid-latitude cyclone to the formation, location, and intensity of mesoscale snowbands, to microphysics and the transitions in precipitation type, to terrain-enhanced and lake-effect processes. The recent NASA IMPACTS field campaign, with two coordinated aircraft as well as ground observations across field operations in 2020, 2022, and 2023, provides an unprecedented dataset with which to evaluate winter storm simulations. In order to analyze the practical predictability of east coast winter storms, operational models as well as convection-allowing ensemble WRF simulations that assimilate conventional and field campaign observations are assessed for several cases during the IMPACTS period. Analyzing the predictability of NWP model simulations gives insights to the growth of forecast errors and the underlying dynamical mechanisms for these extreme events. Comparisons between simulations, conventional surface and radar observations, as well as field campaign EXRAD radar, in-situ thermodynamic conditions and hydrometeor properties are conducted.

Likewise, anticipating the timing and location of convection initiation, which can lead to severe thunderstorms, remains a challenge for both numerical modeling and observations-based approaches. A convection initiation nowcasting system using deep learning applied to GOES-16 IR satellite observations is developed. Trained on convection initiation events identified from radar images, with a storm tracking algorithm used to separate pre-existing from new convection, the technique demonstrates superior performance to a baseline logistic regression model, demonstrating that the technique can successfully use spatially encoded information in the satellite predictors. Explainable AI techniques enable the contribution of specific features in the satellite channels toward the prediction to be assessed, giving insights to important physical processes. Finally, ensemble-based deep learning techniques can help quantify the uncertainty of predictions.

Thursday, 6 June 2024, 2:00PM

Refreshments 1:45PM

Please also join colleagues for refreshments and informal discussion after the seminar until 3:30pm

NCAR-Foothills Laboratory, 3450 Mitchell Lane

FL2-1022, Large Auditorium

Seminar will also be live webcast

https://operations.ucar.edu/live-mmm

Participants may ask questions during the seminar via Slido.