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CASA Hail Nowcast System over Dallas Fort Worth Urban network

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The objective of this study is to demonstrate the assimilation of radar extrapolated observations into high-resolution Numerical Weather Prediction (NWP) model, to improve the CASA hail nowcast system. The CASA deployed a dense X-band radar network and developed the end-to-end warning system for severe weather events like floods, hails, and tornadoes for Dallas Fort Worth (DFW) urban area. This study used the Weather Research and Forecasting (WRF) model to predict the hail storm that occurred on June 06 2018 over DFW. The High-Resolution Rapid Refresh (HRRR) model analysis is used as initial and boundary conditions. The model domain covers 301 x 301 km2 area over DFW urban region with 1 km grid resolution. The maximum surface hail size is estimated from one-dimensional HAILCAST model. The Understory hail sensor network measurements are used to validate the WRF-HAILCAST model estimated hail size. In the first part of this study, hail storm is simulated with four double-moment microphysics parameterization schemes that are available in the WRF model. The results from the sensitivity study showed that in control (without assimilating CASA X-band radar observations) simulations none of the schemes predicts the hail. Whereas all the simulations showed the hail when the high spatial and temporal CASA X-band radar observations are assimilated into the WRF model. The maximum hail size estimated from WRF-HAILCAST model after radar data assimilation is 1.14 inches which is closer to the hail size measured by sensors. This result shows that infusion of the high-resolution radar observations into WRF model could improve the WRF-HAILCAST hail size estimation. The CASA provides high-resolution reflectivity nowcast in real time. The primary objective of this research is to assimilate the CASA 1-hour nowcasted reflectivity fields into the WRF model to correct the 1-hour model prediction. The HAILCAST model is executed with corrected WRF predictions to estimate the maximum surface hail size. A machine learning based algorithm will be developed to estimate the surface hail size from corrected WRF predictions and compared with HAILCAST estimated hail size. The Understory hail sensor network measurements will be used to develop the machine learning based hail size estimation algorithm. The procedure for assimilating radar extrapolation nowcast into WRF model, the machine learning algorithm and the results will be presented in the conference.