Ensemble-Based Analysis of a Colorado Rain and Hailstorm: Forecast Uncertainty and Understanding of Weather Information by Front Range Decision-Makers

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Abstract. On the evening of 6 June 2012, a severe thunderstorm caused significant damage within the city of Colorado Springs, Colorado. The aftermath included flooded homes, stranded motorists, and debris-filled streets as the storm produced more than four inches of heavy rain and hail. Such a localized, high impact precipitation event motivated this study into assessing how well this warm-season convection may be predicted using ensemble forecasts with parameterized and explicit convection. Herein, an in-depth case study of the Colorado Springs rain and hail storm event is presented. Meteorological observations were used to investigate the conditions favorable to the development of the convection and its associated precipitation. In addition, the ensemble forecasts were evaluated in terms of the predictability of the event and forecast uncertainty. Results show that a convergence boundary served as a lifting mechanism for the convection, given sufficient moisture and instability. Comparing the convection-permitting and parameterized-convection ensembles illustrated differences in the processes related to the initiation and evolution of the convection. This case was also used as a hypothetical weather scenario in order to examine how Front Range decision makers gathered and understood various representations of precipitation forecasts. Examples included weather icons and text, modeled probabilities of precipitation, and simulated radar reflectivity. It was found that these decision makers work closely with the National Weather Service to retrieve and understand hazardous weather information. Forecast uncertainty was described in terms of the probability and unpredictability of weather events. In addition to the forecasts, many of the participants would rely on situational awareness and past experience with major weather events to guide their emergency preparation and response. Overall, this study hopes to address the needs of decision-makers in relation to improving hazardous weather communication, understanding, and response.