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Prediction and Identification of Flash Flood Storms in Colorado, Part II - Nowcast skill Using NWP, Blending and Heuristic Techniques

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Heavy rainfall and hail frequently occur in association with intense, summertime convective storms that form along the foothills and eastern plains of the Colorado Rocky Mountains. Heavy rainfall amounts over localized regions can result in flash flooding in mountain communities and in the dense urban areas along the Front Range, disrupting traffic, causing damage to property and in extreme events, resulting in loss of life. Various approaches have been taken over the years to provide the best possible estimations of quantitative precipitation (QPE) and nowcasts and short-term forecasts of heavy precipitation (QPN and QPF, respectively) in order to assess the potential for flash floods over the 0-6 hr time period and to accurately model and predict streamflow increases and runoff. Ten Colorado flash flood and hailstorm events that occurred during the period from 2008-2012 are examined in detail in Parts I and II of this study to benchmark our current understanding of the attributes and evolution of flash flood events and determine how to improve our prediction and identification of those storms that are likely to produce heavy rainfall of short duration over very specific regions and basins sensitive to flooding.

In Part II of this study, we document the current capabilities (strengths and weaknesses) and statistical performance of various NWP, blending and heuristic techniques in predicting these Colorado heavy rainfall events. These techniques include persistence and extrapolation of radar reflectivity (TITAN), three Numerical Weather Prediction (NWP) models (WRF, RTFDDA, RUC), two systems that blend extrapolation and NWP (CoSPA and Niwot) and the NCAR AutoNowcaster system. Lack of skill is observed in numerical models for predicting the precise timing and location of heavy rain but the NWP techniques provide some useful skill in predicting storm structure and intensity trends. Extrapolation provides skill in specifying the timing and location of the precipitation over very short time periods, but show low skill when using past precipitation trends to predict changes in storm intensity. Extrapolation techniques do not predict new storm initiation. The AutoNowcaster provides skill in initiating new precipitation and intensifying/dissipating existing convection, when boundary layer convergence lines are included in the system, and this makes the AutoNowcaster system potentially useful for increasing the lead time in prediction of heavy rainfall event. Planned efforts to blend the strengths of each technique into one enhanced, end-to-end nowcasting system for heavy rainfall will be discussed.