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The Vaisala Radar-Based Nowcasting System: Updates and Applications

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The Vaisala radar-based nowcasting system is presented and described. The system, based on the Lagrangian persistence paradigm, is designed to provide targeted quantitative forecasts over the 0–1 h time frame for applications such as aviation, roads, and renewable energy. The Lagrangian persistence paradigm, where extrapolation is performed via motion vectors estimated from past radar observations held constant over the lead time period, is a useful approach for many nowcasting applications. This method has shown effectiveness in estimating translation of a variety of precipitation patterns. Previous research has shown that nowcasting performance can be improved by spatially filtering radar observations and considering only those precipitation scales most representative of pattern motion for prediction or filtering those scales from predicted fields deemed unpredictable by remaining past their lifetimes. Thus, a modular framework capable of assimilating a variety of radar data and leveraging appropriate combinations of data processing features is adopted to provide targeted decision support to end-users. In this regard, the system combines several features previously used separately to enhance performance. A recent update to the system includes a Fourier-based least squares motion estimation method that replaced the cross correlation-based method previously used. This update has shown to provide improvements to skill and runtime for the 0–1 h nowcast horizon using WSR-88D and Vaisala WRM200 C-band radar data for a variety of precipitation events. Operation and favorable performance of the nowcasting system is shown in the context of the Vaisala AviCast product, which uses WSR-88D Level III and surface observations to provide operational nowcasts of liquid water equivalent values to support deicing decision-making at airports. Extrapolated WSR-88D Level III base reflectivity values are converted to liquid water equivalent estimates using a Z-R or Z-S relationship calibrated by previous radar observations and surface observations. Concepts for future applications are also presented.