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Stochastic Nowcasting of Winter Precipitation in Finland

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Reliable forecasts of snowfall are critical for air traffic, as winter storms can cause major disruptions and economic impacts. Aiming at aviation applications, we develop a probabilistic radar-based nowcasting method for snowfall and associated phenomena. Our approach is an extension of the Stochastic Ensemble Prediction System (STEPS).

The so-called lake effect (snowfall induced by open water) is a common triggering mechanism of snowfall in the Baltic Sea region. Whereas stratiform snowfall is relatively easy to forecast by using the existing methods based on radar and numerical weather prediction models, they are insufficient for predicting lake effect snowfall. This is because growth and decay of snowfall are highly dependent on the underlying surface (cold land areas vs. warm bodies of water) and on variations in the steering wind direction. In addition, the motion of snowfall patterns is highly scale-dependent; larger patterns can be quasi-stationary, and smaller patterns can be embedded into larger ones. Therefore, in this study we incorporate the geographic, flow- and scale-dependency of snowfall growth and decay patterns into the STEPS model.

We have validated the proposed method by using the C-band dual-polarization radar located in Vantaa, Finland. The dataset consists of lake effect snowfall events between December and March during 2014-2017. Our focus is on the the near range (<50 km), where the effect of horizontal drift (advection) and slow vertical velocity of snowfall are less severe. The extended version of STEPS gives promising results in nowcasting of lake effect snowfall.