Geophysical Research Abstracts
Vol. 20, EGU2018-4865, 2018
EGU General Assembly 2018

A Bayesian framework based on the ensemble Kalman filter for flow-dependent integration of weather radar extrapolation nowcasts and NWP precipitation fields

Daniele Nerini (1,2), Urs Germann (1), and Loris Foresti (1)

(1) Swiss Federal Office of Meteorology and Climatology, MeteoSwiss, Switzerland, (2) Institute for Atmospheric and Climate Science, ETH, Zürich, Switzerland

Convection-resolving numerical weather prediction (NWP) models are becoming increasingly attractive for quantitative precipitation forecasting. However, the advances in radar data assimilation and rapid update cycles do not yet fully solve the problem of forecasting precipitation in the nowcasting range (0 to 2 hours), particularly in case of severe convection. In such cases, an extrapolation nowcast can be produced by exploiting the persistence of precipitation echoes derived from weather radar observations. The end-user is thus confronted with two separate forecasting systems that provide complementary skill depending on the lead-time and weather situation.

This study introduces a Bayesian framework based on the ensemble Kalman filter for flow-dependent integration of weather radar extrapolation nowcasts and NWP precipitation fields. Based on existing work on probabilistic radar-based nowcasting, a stochastic error model for the persistence forecast is built into the prediction step of the Kalman filter. The resulting spread of the radar ensemble is then used to seamlessly blend the radar nowcasts with the ensemble NWP precipitation forecasts.

A number of implementation issues is discussed. These include the need for dimensionality reduction techniques in order to reduce the cost of storing and inverting the error covariance matrix, as well as the need of dealing with a highly non-Gaussian variable such as precipitation. The proposed framework is tested and verified for a number of precipitation events over the Swiss Alps. Operational NWP forecasts from the COSMO-E model and composite radar precipitation fields are used.