4B.8 PREDICTABILITY OF PRECIPITATION AS A FUNCTION OF SCALE FROM LARGE-SCALE RADAR COMPOSITES


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## 1 ABSTRACT


Eulerian and Lagrangian persistence of precipitation patterns derived from continental scale radar composite images is used as a measure of predictability and for nowcasting. A three-step procedure is proposed: First, the motion field of precipitation is determined by variational radar echo tracking (examples can be found in Fig. 2). Second, radar echo patterns are advected following the motion field in order to obtain Lagrangian persistence forecasts. Third, the Eulerian and Lagrangian persistence forecasts are compared to observations, and the lifetime and other measures of predictability are calculated. The procedure is repeated with images that have been decomposed according to scales to describe the scale-dependence of predictability.

Fig. 1 depicts a simple example of Eulerian versus Lagrangian persistence. Taking the forecast time where the correlation drops below 1/e as an upper limit of predictability, we roughly get 4, 7 and 8 hours for Eulerian, Lagrangian, and low-pass-filtered Lagrangian persistence, respectively.

The methodology has been developed and initially tested with radar composite images of relatively flat eastern North-America. It is now applied in a more complex environment: the European Alps. Here, the steep orography influences both evolution and motion of precipitation systems and the quality of radar data.

The analysis has a threefold application: i) determine the scale-dependence of predictability, ii) set a scale-dependent standard against which the skill for quantitative precipitation forecasting by numerical modeling can be evaluated, and iii) extended, partly probabilistic nowcasting by optimal extrapolation of radar precipitation patterns. Lagrangian persistence on large scales was found to have significant forecast skill up to lead times of several hours.

For more details the reader is referred to Germann and Zawadzki (2002, 2003); Turner et al. (2003) and Laroche and Zawadzki (1995).



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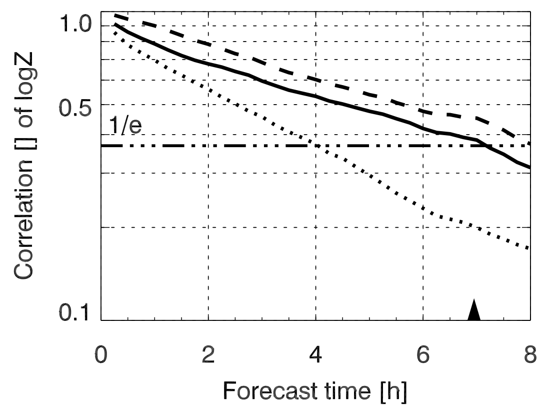


**Figure 1:** *Correlation between forecast and observation for Eulerian persistence (dotted), Lagrangian persistence (solid), and for Lagrangian persistence of low-pass filtered images with cutoff wavelength of 64km (dashed). Data is from 8-hour forecast starting at 1100 UTC 30 July 1998. The considered domain has a side length of 2720km. The precipitation area is about* $6 \times 10^5 km^2$. *The triangle marks the lifetime of Lagrangian persistence (solid) defined as the integral of the correlation function over forecast time.*

## References


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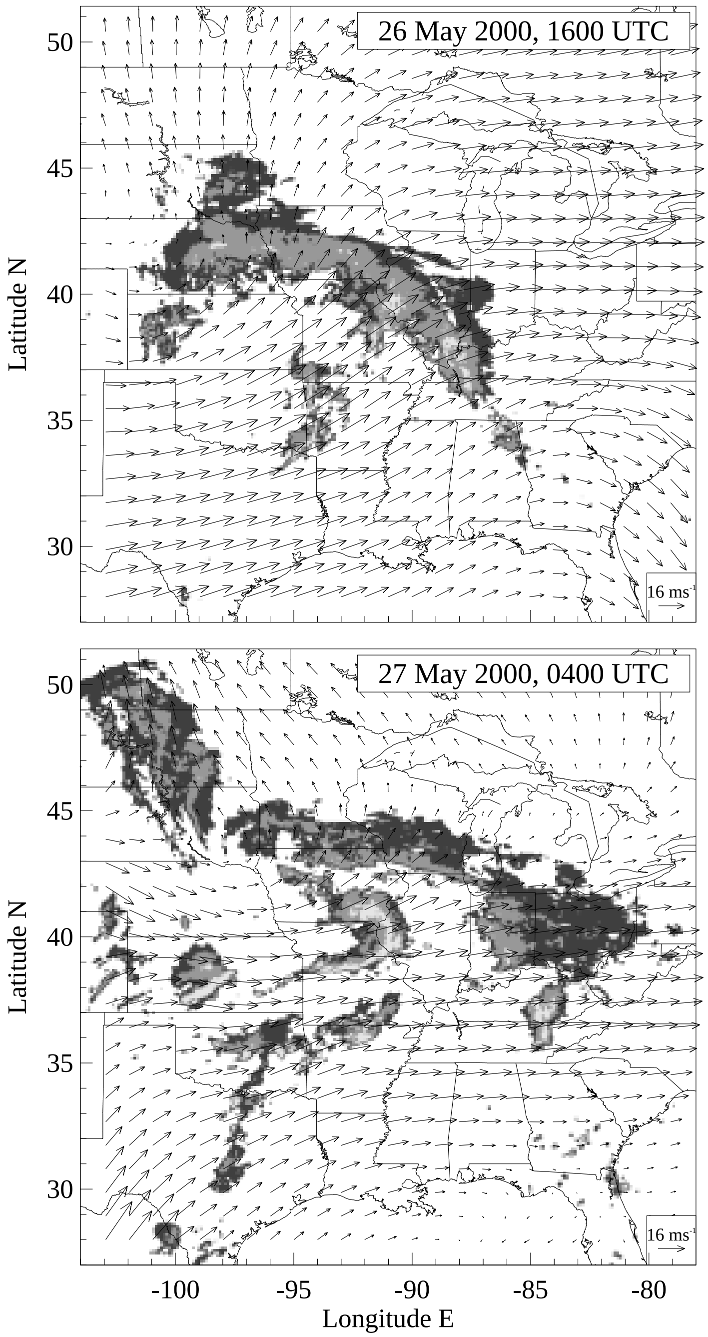


**Figure 2:** *Radar composite image and corresponding echo motion field obtained by variational echo tracking of 1600 UTC 26 May 2000 (upper), and 12 hours later (lower panel). Levels of shading correspond to reflectivity between 10–25dBZ, 25–40dBZ, and larger than 40dBZ, respectively.*