A climatology of mesoscale motions of precipitation patterns

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The experience of nowcasting of precipitation leads to the conclusion that all characteristics of precipitation patterns at the mesoscale are extremely variable in time and space to the point of resembling very closely correlated noise. The correlation time and correlation distance of all measures of the patterns, such as intensity, size, etc., are scale-dependent, but even meso-alpha scales have short memory. There is one exception to this assertion: the motion fields of the patterns are sufficiently persistent so that Lagrangian Persistence is clearly superior to Eulerian Persistence as nowcasting method. The persistence of motions is likely due to the synoptic scale pressure patters that are strongly conditioned by the deterministic solar cycle and earth rotation. The question is then posed as to the possibility of separating the deterministic component from the purely turbulent component of echo motions. Consequently, a study of 18 years of radar data is done to determine the climatology of echo motions at scales of 120 km and larger. The Variational Echo Tracking method is used to obtain fields of echo motion vectors over the continental US radar coverage. The resulting motion patterns are averaged over the entire data set and over seasons of distinct average motions. Only pixels with a 40% echo coverage and a count of 1000 vectors are retained for the average. The space-time stochastic properties of the residuals of these mean motions are then studied.