Development of a short range QPF algorithm based upon Optic Flow techniques

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A new rain advection based nowcast scheme has been developed for GANDOLF [1, 2]. This uses optic flow ideas [3] to improve forecasting skill. The method employed removes the need to split the radar derived rain analysis into contiguous rain areas, but uses a smoothness constraint to ensure that the diagnosed velocity field varies smoothly across the analysis. The scheme has been shown to improve nowcasts of precipitation associated with cyclonic circulation around low pressure areas, and has also demonstrated superior performance during cases of embedded convection.

Optic flow methods derive from a direct application of the Optic Flow Constraint (OFC) equation. The terms in this equation are evaluated over a square block, which is considered to move with a single velocity. This velocity is found using a least squares method [4]. Block velocities are smoothed, and an instantaneous rain rate forecast is produced.

The performance of the new nowcast scheme has been compared with that of the previous GANDOLF advection scheme (not including the object-oriented conceptual life cycle model). The performance of the two schemes was compared over a period of 3 months. The new scheme showed a general improvement in forecast skill, and also demonstrated superior performance on a number of key test cases, including two precipitation events associated with severe flooding. On the basis of this evaluation the optic flow scheme has been chosen replace the previous GANDOLF advection scheme. The benefit of the new advection scheme over the previous scheme is due mainly to the difficulty in unambiguously identifying contiguous rain areas, which

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is particularly troublesome on small domains, such as the UK. Thus it is concluded that block-based methods are likely to be superior to object-based methods in the majority of cases.

References

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