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Solutions to Long-standing Problems in Objectively Identifying and Tracking Synoptic-scale Cyclonic Features

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All published methods for tracking cyclonic features can have problems in certain situations. Some techniques fail to track short-lived, intense features. Others cannot identify the early stages in a cyclone's life-cycle. Fast-moving features that lead to windstorms over Europe can cause difficulties too. Translation across topography is also a common problem area. In addition, mis-association is an important tracking issue. This presentation will describe a new set of identification and tracking techniques and specifically highlight how the aforementioned issues and others are successfully addressed. This new methodology has its roots in feature tracking on synoptic charts, and has been developed over the last 10 years, in conjunction with forecasters.

One key feature of the identification methodology is that it is a hybrid system, utilising both pressure minima and vorticity maxima; furthermore the vorticity is decomposed into two components relating to frontal orientation to overcome the problem of elongated (strip-like) maxima. One key feature of the tracking is that feature association at different times uses 'half-time' position estimates (i.e. both forward and backward extrapolation are used). It will be shown that for realistic cases involving feature acceleration and turning such a method can, theoretically, give more reliable association than the much more commonly used 'full-time' position estimates (i.e. forward extrapolation only). Remarkably, this holds true even if the time interval between frames in the 'full-time' scenario is halved. This has positive implications for computational speed and data storage - an especially important consideration for ensemble and climate run applications.

The acid test of a tracking technique is whether practising forecasters would rely on any related output. Wide-ranging products based on the new techniques have been used operationally by UK forecasters since 2007, and also during the T-PARC experiment. Illustrations during the talk will be based on these products.