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Automated tracking of upper tropospheric cyclones on satellite images and model output for data assimilation.

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Despite steady improvements in numerical weather prediction in recent year, some cyclogenetic events are still associated with poor forecast quality. Their mechanisms have been fairly well explained at a theorical level, and forecasters are able to interpret water vapour imagery from geostationary satellite in a conceptual way using potential vorticity thinking. A satellite image processing technique has been developped for the identification and tracking of upper tropospheric features related to midlatitude synoptic scale cyclogenesis. Persistent warm radiance features are detected on water vapour images using an adaptative thresholding technique, tracked using cross-correlation of successive images and speed estimation, and then screened using both image-based and model-based criteria, taking in account that the relationship only holds in the vicinity of a jet streak. The aim is the automatic characterisation of dynamical tropopause anomalies and dry intrusions of stratospheric air into the upper troposphere. On a a selected sample of events, the resulting trajectories prove to be very consistent with the subjective identification of cyclogenesis events on imagery. In accordance with potential vorticity theory, the detected warm features are correlated with positive anomalies of potential vorticity. This identification technique can also be applied to synthetic water vapour imagery produced by a radiative transfer model. The comparison of the cells in the two imageries provides some guidance for the specification of pseudo-observations of potential vorticity, which aime to be included in a variationnal assimilation system. This suggests future applications in forecast verification and data assimilation of midlatitude cyclones.