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High resolution climatology
- towards climate change services

The structure and sensitivity of singular vectors associated with extratropical transition of tropical cyclones

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During the extratropical transition of tropical cyclones (ET) low predictability is often seen in numerical weather prediction. This reduction in skill is associated both with the ET event and the downstream midlatitude flow. Strong error growth can occur in regions of the atmosphere that are unstable to small-amplitude perturbations. Singular vectors can be used to identify such regions and indicate the structure of the fastest growing perturbations over a given time interval. Therefore, the structure of singular vectors associated with the extratropical transition of a tropical cyclone could provide valuable information on the important dynamical and physical processes during such an event. This study is an investigation of singular vectors associated with tropical cyclones and their ET.

In the operational configuration of the ensemble prediction system of the ECMWF singular vectors targeted on tropical cyclones are calculated with linearized diabatic physics and with respect to a total energy norm. They are used to construct the tropical initial condition perturbations. The calculations are performed with a resolution of T42 which is too low to represent the tropical cyclone properly.

Singular vector experiments are implemented to study the evolution of singular vectors targeted on tropical cyclones during their optimisation interval, to analyse their sensitivity to spatial resolution and diabatic processes and to investigate the mechanisms that lead to their strong growth. Therefore, so called moist and dry singular vectors are calculated with a resolution up to TL255. These high resolution singular vectors should give an improved representation of the dynamical and physical processes associated with a tropical cyclone. One major goal of this study is to assess the impact of high resolution singular vectors on the ensemble prediction system of the ECMWF.

Results of these experiments will be presented for selected ET cases.