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Linking Predictability barriers and diabatic processes

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Several case studies have tracked down large medium range NWP errors over the North Atlantic to minor errors in the representation of diabatic processes occurring in mesoscale structures. Different stages of error growth have been identified including: convective instability, the influence of divergent outflow on the tropopause position and interactions between disturbances at tropopause level and Rossby wave packet development.

The links between diabatic processes and “Predictability barriers”, defined as the rapid growth of ensemble spread and even faster growth of error growth of certain validation times (consistently across a range of lead times), are explored and identified with events during the North Atlantic Waveguide and Downstream impact Experiment (NAWDEX).

A semi-geostrophic balance tool is used to attribute the response of the 3-D ageostrophic flow to geostrophic and diabatic forcing, enabling a novel diagnostic for Diabatically-Induced Ageostrophic Advection of potential vorticity (DIAA). Finally, evidence is shown that predictability barriers are linked to events with strong diabatic influence on tropopause advection. Error growth exceeds ensemble spread rate by approximately 4/3 during strong DIAA events, showing that predictive skill is considerably lower in these situations.

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