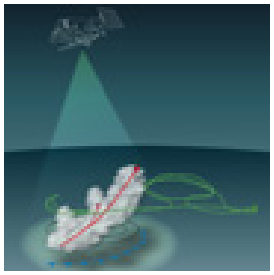

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The role of cloud diabatic processes in the life cycle of Atlantic-European weather regimes

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Weather regimes are quasi-stationary, persistent, and recurrent states of the large-scale extratropical circulation. In the Atlantic-European region these explain most of the atmospheric variability on sub-seasonal time scales. However, current numerical weather prediction (NWP) systems struggle in correctly predicting weather regime life cycles. Latent heat release in ascending air streams injects air into the upper troposphere, which might ultimately result in blocking. Such diabatic outflow is often linked to warm conveyor belt (WCB) activity and has been shown to be involved in upscale error growth up to the regime scale. This study systematically investigates the role of diabatic outflow in the life cycle of Atlantic-European weather regimes.
An extended definition of 7 year-round Atlantic-European weather regimes from 37 years of ERA-Interim reanalysis is used. This is based on an EOF analysis and k-means clustering of normalized low-pass-filtered 500hPa geopotential height anomalies. Furthermore an objective regime life cycle is derived. The role of cloud-diabatic processes in European weather regimes is assessed based on time lag analysis of WCB activity at specific life cycle stages.
Results indicate that the period prior to regime onset is characterized by important changes in location and frequency of WCB occurrence. Most importantly, prior to the onset of regimes characterized by blocking, WCB activity increases significantly upstream of the incipient blocking even before blocking is detectable and persists over the blocked region later. This suggests that diabatic WCB outflow helps to establish and maintain blocked regimes. Thus it is important to correctly represent cloud-diabatic processes in NWP models across multiple scales in order to predict the large-scale circulation accurately. Ongoing work now systematically investigates the representation of WCB activity in current NWP systems and how this relates to the forecast skill for weather regimes.

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