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**Sensitivity of the representation of Diabatic Outflow in numerical models:**

**A case study**

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Despite significant progress made in weather prediction in the last decades, state-of-the-art numerical weather models still occasionally experience severe forecast errors. In Europe, such “forecast busts” are typically associated with a misforecast of the onset of or transitions between quasi-stationary, large-scale circulation patterns, so-called weather regimes.

Numerous studies point towards the crucial role of latent heating in extratropical cyclones in modulating the large-scale extratropical circulation. This latent heating is predominantly confined to the ascending warm conveyor belt (WCB). Diabatically enhanced WCB outflow can interact with the upper-level wave guide, resulting in a modification of the Rossby wave pattern and thus of the large-scale flow, and might ultimately affect the prevailing weather regime. Hence, the misrepresentation of cloud-diabatic processes in numerical weather prediction models might be involved in occasional forecast busts for Europe.

In this study, the sensitivity of the representation of diabatically driven outflow in numerical models and its potential to alter the large-scale circulation is investigated during a particularly severe European forecast bust in March 2016. Characteristics of the diabatic WCB outflow (e.g. location, height, intensity) and the representation of the large-scale circulation are analyzed for different numerical model setups with a particular focus on the effect of stochastic physics perturbation tendencies in ensemble forecasts.