Importance of cloud microphysics for extra-tropical dynamics

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Abstract:
In this presentation, we show in detail how the manifold microphysical processes acting during the formation of liquid, mixed phase and ice clouds in extra-tropical cyclones modify the potential vorticity and thus the atmospheric dynamics. The link between latent heat release occurring during cloud formation and the modification of the atmospheric flow can be described by the diabatic modification of potential vorticity (PV). We investigate this modification by performing simulations with the IFS (ECMWF global Model) where all diabatic heating rates (DHR) occurring during cloud formation and radiation are output hourly. Based on the DHRs we can then investigate the impact of each microphysical process on the modification of PV, and thus the dynamics, separately. We use a Lagrangian technique where all DHR and associated diabatic PV rates (DPVR) are traced along trajectories. Based on case studies it will be shown that warm and ice phase as well as below-cloud processes strongly modify the PV and are of great importance for the formation of low-level PV anomalies as well as the modification of the upper tropospheric flow.