**3-d cloud-radiative effects on midlatitude cyclones and their predictability**

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**Abstract:**

Diabatic heating by radiation is a main driver of the atmospheric circulation. This project addresses the dynamical impact of the representation of radiative transfer in numerical weather prediction (NWP) models, with a focus on three-dimensional (3-d) radiative effects of clouds that are currently neglected in NWP models. The work is motivated by earlier work on the impact of 3-d radiative effects on cloud organization and by the current trend towards high-resolution models, for which 3-d radiative effects might become increasingly important. The project's focus on midlatitude cyclones is motivated by the finding of Schäfer and Voigt (2018) that cloud-radiative effects can weaken idealized midlatitude cyclones. This result was achieved through baroclinic life cycle simulations with the global ICON-NWP model for horizontal resolutions of around 40 km. Yet it has remained unclear which clouds cause the dynamical impact and by which mechanisms. This calls for a more systematic study on the dynamical impact of cloud-radiative processes.

To this end, baroclinic life cycles will be simulated with the ICON-NWP model at convection-permitting resolution of 2 km, with subdomains simulated by ICON-LEM with 300 m resolution. This will allow us to consider 3-d radiative effects of grid-scale clouds using an existing 3-d radiation parameterization for ICON-LEM. By combining offline and online LEM nests we will test the mesoscale and synoptic scale impact of 3-d cloud-radiative effects. The synoptic impact of cloud-radiative effects will be further analyzed by means of a potential vorticity framework, and the life cycle results will be put into context through a NAWDEX case study. The project is performed in close collaboration with Bernhard Mayer from LMU.

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**Reference:**

Schäfer, S. A. and A. Voigt (2018): Radiation weakens idealized midlatitude cyclones. Geophys. Res. Lett., 45, 2833-2841, doi: 10.1002/2017GL076726.