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Uncertainty of deep convective clouds and precipitation: environment vs. microphysics

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Severe hailstorms have a large damage potential and cause harm to buildings and crops, for instance. However, important processes for the prediction of hailstorms
are insufficiently represented in operational weather forecast models. This project aims to identify environmental conditions and microphysical parameters such as wind shear and strength of ice multiplication which lead to large uncertainties in the prediction of deep convective clouds and precipitation.
In an idealized setup of a cloud resolving model including a double-moment microphysics scheme we use the approach of statistical emulation to allow for a Monte Carlo sampling of the parameter space which enables a comprehensive sensitivity analysis.
Furthermore, we investigate whether the sensitivities are robust for different trigger mechanisms of convection.
The uncertainties of most cloud and precipitation outputs are dominated by the potential temperature if the environment is changed. If microphysical parameters are modified, the fall velocities of graupel and hail are the main contributors to the output uncertainty. Comparing the impact of both environmental conditions and the microphysics shows that there are prevailing contributors for the uncertainty of the considered outputs. For example, the uncertainty of the precipitation output is mainly caused by microphysical parameters.
Moreover, our results show that depending on the choice of the trigger mechanism
the contribution of the input parameters to the uncertainty varies which means that studies with different trigger mechanisms might not be comparable.