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A Hans Ertel Research group on clouds and convection

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Shallow and deep convective clouds are abundant in the atmosphere. They interconnect the land surface, planetary boundary layer and the deeper atmosphere and allow for a range of complex scale interactions that play a crucial role in determining the weather evolution and the climate. Despite their importance, convective clouds pose a great challenge for atmospheric modeling at all scales. As they are too small to be explicitly resolved, they need to be parameterized in climate and weather models. Even in convective-scale numerical weather prediction models that try to explicitly represent deep convective motions, the shallow boundary layer clouds and the sub-cloud layer still need to be parameterized. Such parameterizations are at the source of large uncertainties; their limited skill both reflects the complexity of the system and our poor knowledge of the involved processes and scale interactions.

Our Hans Ertel research group on clouds and convection studies the statistical behavior of clouds, convection, boundary layer and microphysical processes holistically, with the goal of improving our understanding of and ability to represent and predict such processes in atmospheric models. Our main research tool are large-eddy simulations with horizontal resolution O(100 m) as they allow an explicit representation of convective processes and provide detailed information on the cloud lifecycle. Research questions that our group is addressing include: (i) How do clouds interact with their environment including the land surface? (ii) What determines the cloud size distribution? (iii) How to formulate a parameterization that works across scales and that allows for realistic interactions between boundary layer, shallow and deep convection?