Turbulence resolving simulation of atmospheric boundary layer processes

The parametrization of Atmospheric Boundary Layer (ABL) processes is an essential component of weather and climate model development. With the increase of the available computing power, and the need to understand atmospheric processes in greater detail, the resolution of numerical weather and climate models has seen a steady increase in recent decades. However, increasing resolution is no longer straightforward with regard to the ABL parameterization, because part of the previously sub-grid ABL processes become resolved, resulting in the so-called gray zone problem (Honnert, 2016). Additionally, surface heterogeneity as well as topography is captured with higher resolution. This offers an opportunity to improve the parametrization of the interaction between the ABL flow and the lower boundary (Schmidli, 2013; Schmidli et al., 2018). Both aspects fuel the need to develop new or improved ABL parametrizations. For this purpose, a good understanding of and detailed information on the ABL processes is essential. Turbulence resolving simulations, such as Large Eddy Simulations (LES) and Direct Numerical Simulations (DNS), are an essential tool for guiding NWP parameterization development.

Resources at DKRZ are requested for the project "The Atmospheric Boundary Layer in Numerical Weather Prediction (ABL-NWP)" to be officially started in January 2019. This externally reviewed HErZ (Hans Ertel Centre for Weather Research) proposal is funded by BMVI and includes an outline of the planned simulations and scientific justifications. The goal of the project is to improve the representation of the ABL in weather and climate models with a focus on: 1) **scale-adaptivity**, and 2) **complex-terrain boundary layers**.

For this, existing turbulence parameterizations are to be improved and new parameterizations for the impact of subgrid-scale coherent motions on the ABL are to be developed. The proposed simulations are central for guiding the parameterization development.