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Adaptive Grid Refinement for Atmospheric Boundary Layer Simulations

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We validate and benchmark an adaptive mesh refinement (AMR) algorithm for numerical simulations of the atmospheric boundary layer (ABL). The AMR technique aims to distribute the computational resources efficiently over a domain by refining and coarsening the numerical grid locally and in time. This can be beneficial for studying cases in which length scales vary significantly in time and space. We present the results for a case describing the growth and decay of a convective boundary layer. The AMR results are benchmarked against two runs using a fixed, fine meshed grid. First, with the same numerical formulation as the AMR-code and second, with a code dedicated to ABL studies. Compared to the fixed and isotropic grid runs, the AMR algorithm can coarsen and refine the grid such that accurate results are obtained whilst using only a fraction of the grid cells. Performance wise, the AMR run was cheaper than the fixed and isotropic grid run with similar numerical formulations. However, for this specific case, the dedicated code outperformed both aforementioned runs.