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# Multiscale Problems in Fluid Dynamics and Meteorology: The DFG Priority Programme MetStroem

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One of the most important challenges in meteorological modelling is the simulation of local disasters with high attention to detail. Examples are the development and growth of severe weather storms like cyclones, or extreme weather events with high flooding potential. Such events are most often associated with processes on multiple spatio-temporal scales. Representing such multiscale interactions accurately and efficiently given limited computational resources is one of the major arising difficulties.

A promising approach in this context in Meteorology and Fluid Dynamics is the use of variable, dynamically adaptive spatio-temporal grid resolution. While adaptive dynamic kernels for meteorological models and adaptive flow solvers exist today, some severe open issues remain. For example:

a) Systematic formulations of closure models or parameterizations for small scale, non-solved processes applicable on dynamically adaptive grids are practically non-existent today, although there are promising developments in the area of Large Eddy Simulation.

b) Parameterizations will have to depend on the type of numerical scheme adopted in the dynamic kernel, i.e., they will differ for finite difference, finite volume, finite element, and spectral schemes. How do flow solvers and subgrid-scale closures interact, and how do numerical and subgrid-scale modelling errors conspire to perturb the accuracy of a simulation?

**MetStroem** covers the expertise of Meteorology, Fluid Dynamics, and Applied Mathematics to develop model- as well as grid-adaptive numerical simulation concepts in multidisciplinary projects. The goal is to provide simulation models which combine scale-dependent (mathematical) descriptions of key physical processes with adaptive flow discretization schemes. Deterministic continuous approaches and discrete and/or stochastic closures and their possible interplay are taken into consideration. Research focuses on the theory and methodology of multiscale meteorological-fluid mechanics modelling. Accompanying reference experiments support model validation.

Here, we provide an overview of the overall targets of the priority programme, which became operational in Fall of 2007. Individual projects will be presented in separate contributions.