

Discontinuous Galerkin method for numerical weather prediction

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Turbulence, convection and clouds are very important processes for numerical weather prediction (NWP) and climate models. However, the coarse grid of these models resolve these processes that are smaller than the grid size. Therefore, these sub-grid processes are parametrized in the NWP and climate models.

For parametrisation development, these processes are simulated in a model with a higher resolution. At the Royal Netherlands Meteorological Institute (KNMI), the Dutch Atmospheric Large-Eddy Simulation model, also known as DALES, is used.

On top of that, DALES can be used to predict weather on a smaller domain with a higher resolution, for example to provide short-range forecasts for near surface wind and solar power for renewable energy sector.

DALES can still be improved, especially the implemented advection schemes are too diffusive, dispersive and not monotonic when steep gradients are present.

In this project, a discontinuous Galerkin (DG) method is implemented for the advection equation of temperature, moisture and momentum in the DALES model on a staggered grid. DG is an attractive method, because it allows discontinuities and has a high parallel-scalability (compact stencil). However, it is known that unphysical oscillations are generated with DG. Therefore, a limiter has to be added, which can be either algebraic or physical. This also has to be investigated.

The question is if DG has a faster computation or a higher accuracy, without increasing the running time too much, than the already implemented schemes in DALES.