Implementation Techniques for Discontinuous Galerkin Methods for Atmospheric Models

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Development of higher order Discontinuous Galerkin (DG) methods for hydrostatic and nonhydrostatic atmospheric models has been an ongoing task for nearly a decade [1, 2]. In this talk we emphasize numerical as well as implementation techniques to deal with the arising computational cost of these models. We will discuss numerical techniques such as time stepping and local grid adaptivity when applied to nonhydrostatic models. When using local grid adaptivity in parallel environments the dynamic balancing of work load becomes an issue. We will comment on implementation strategies for the use on many core systems. Careful implementation of DG methods usually results in scalable solvers for the use on today's many core systems. The talk highlights two, the implementation of asynchronous communication as well as the efficient implementation of numerical kernels. The presentation will be accompanied with numerical examples as well as a comparison with a limited area model based on a traditional Finite Difference approach [2].

References

[1] R.D. Nair and H.M. Tufo. Petascale atmospheric general circulation models. Journal of Physics: Conference Series, Vol.78, 2007.

[2] S. Brdar, M. Baldauf, A. Dedner, and R. Klöfkorn. Comparison of dynamical cores for NWP models: comparison of COSMO and Dune . *Theoretical and Computational Fluid Dynamics*, 27(3-4):453–472, 2013.