Oberseminar der AG Numerik am 06.06.14

um: 10:00 Uhr
im: Hilbertraum

Vortragender: Dr. Stefan Vater (Universität Hamburg)

***Titel**: A Multiscale Numerical Scheme for Computing Large-Scale Atmospheric Flows at High Resolution*

Abstract:

In this talk, a multiscale semi-implicit numerical scheme is presented, which is intended for the efficient computation of large-scale atmospheric flows at high resolution. Modern high-performance computing hardware is beginning to allow modelers to use grids with horizontal spacing in the range of merely a few kilometers even for planetary-scale simulations. At this resolution, small-scale balances and large-scale wave-phenomena must be accurately computed at the same time. Thus, the new scheme aims to minimize dispersion and amplitude errors in the computation of long-wave accoustic waves. While it correctly balances short-wave solution components induced by slow forcing, the method eliminates freely propagating compressible short-wave modes, which are under-resolved in time. This is achieved through a multilevel approach borrowing ideas from multigrid schemes for elliptic equations. The scheme is second-order accurate and admits time steps depending essentially on the flow velocity. The basic scheme is developed in the context of the nonlinear shallow water equations, with a bottom topography varying in time. The latter simulates a source term which directly acts on the local divergence of the flow, such as latent heat release due to local condensation in atmospheric flow problems.
Numerical tests verify the second-order convergence of the method and address its asymptotic properties in the multiscale limit of a vanishing Froude number.