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Numerical Methods for Multiscale Problems in Geophysical Fluid Dynamics

Tuesday, 28 January 2020 12:00 (30 minutes)

Many geophysical phenomena, in particular in the ocean, exhibit a large range of spatial and temporal scales interacting with each other. Often the scale range of several orders of magnitude reaches far beyond resolution capacities of numerical algorithms and demands for approximations or parameterizations to account for the influence of processes outside of the computational resolution.

In this presentation we will focus on spatial scale gaps and numerical methods to bridge those. In order to *downscale* the influence of large-scale processes on small-scale features, adaptive mesh refinement (AMR) has proven efficient and successful. Its application, however, is still not widely accepted due to several constraints. We will describe a few and demonstrate possible solutions. The representation of small-scale influences in large-scale processes can be described as *upscaling*. Usually, this is performed by appropriate parameterizations, using somewhat averaged modifications to the governing equations to account for the small-scale influence. An alternative method that is capable of preserving subgrid-scale structure is provided by modern numerical multiscale Galerkin methods. We will present such a method that is tailored to situations with dominant transport terms.

The combination of AMR and multiscale numerical methods may allow for mathematically and physically consistent discretization methods for scale interactions.

Do you need an official invitation letter?

No

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