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Computational Challenges for Climate Modelling

Keynote Presentation

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Abstract. Numerical simulation of Earth's climate is one branch of computational fluid dynamics. This community faces two key challenges. Firstly, the turbulence closure problem has still not been solved. Therefore more accurate simulations require higher spatial resolution. Secondly, testing the fidelity of our climate models for a future warmer world can only be done by reproducing past warm periods. This requires much faster integrations, which also need to include Earth's full carbon biochemistry. The former requires massively parallel computing architectures and a data infrastructure that can manage rates of 1 Tb/day; the latter requires codes or chips that are an order of magnitude faster than what is currently available. I will briefly describe the evolution of the developments of climate models, show recent results with global geostrophic turbulence resolving models, and outline some ideas of how to structure the community's resources in the future.

Keywords. climate, simulation, CFD, turbulence closure, model fidelity, massively parallel, terrabyte data rate

Brief Background

Markus Jochum completed his PhD in physical oceanography in 2002 at MIT. He then worked for 8 years as ocean model developer at the National Center for Atmospheric Research, USA. Since 2012, he has been Professor for Physical Oceanography at the Niels Bohr Institute, Copenhagen.

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