Geophysical Research Abstracts
Vol. 20, EGU2018-2471, 2018
EGU General Assembly 2018

Performance Predictions for Storm-Resolving Simulations of the Climate System

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With exascale computing becoming available in the next decade, global weather prediction at the kilometer scale will be enabled. Moreover, the climate community has already begun to contemplate a new generation of high-resolution climate models.

High-resolution model development is confronted with several challenges. Scalability of the models needs to be optimal, including all relevant components such as I/O which easily becomes a bottleneck; both runtime and I/O will dictate how fine a resolution can be chosen while still being able to run the model at production level, e.g. at 1-30 years/day depending on the questions to be addressed. Moreover, given various scalability experiments from prototypical runs and additional model data, estimating performance for new simulations can become challenging. Finally, the actual forecast quality of the models at that scale is not fully understood yet.

I present results achieved in the scope of the Centre of Excellence in Simulation of Weather and Climate in Europe (ESiWACE) using the ICON model for global high-resolution simulations. I show results from multi-week global 5km simulations, I discuss current features and limits of the simulations, and I link the findings to a new intercomparison initiative DYAMOND for high-resolution predictions. Finally, I finish with work on performance prediction approaches for existing performance data.