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Climate Opening Workshop
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Lecture: *Computational and Mathematical Challenges in Climate Modeling*

Speaker: Michael Wehner

Abstract:

We present a survey of computational and applied mathematical techniques that have the potential to contribute to the next generation of high-fidelity, multi-scale climate simulations. Examples of the climate science problems that can be investigated with more depth with these computational improvements include the capture of remote forcings of localized hydrological extreme events, an accurate representation of cloud features over a range of spatial and temporal scales, and parallel, large ensembles of simulations to more effectively explore model sensitivities and uncertainties.

Numerical techniques, such as adaptive mesh refinement, implicit time integration, and separate treatment of fast physical time scales are enabling improved accuracy and fidelity in simulation of dynamics and allowing more complete representations of climate features at the global scale. At the same time, partnerships with computer science teams have focused on taking advantage of evolving computer architectures such as many-core processors and GPUs. As a result, approaches which were previously considered prohibitively costly have become both more efficient and scalable. In combination, progress in these three critical areas is poised to transform climate modeling in the coming decades.