MMM SEMINAR
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Kilometer-scale climate models: Prospects and challenges

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Currently major efforts are underway towards refining the horizontal grid spacings of climate models to about 1 km, either by increasing the resolution of current GCMs, or by extending the computational domain of high-resolution RCMs. There is well-founded hope that this increase in resolution represents a quantum jump, as it enables replacing the parameterizations of moist convection and gravity-wave drag by explicit treatments. It is expected that this advance will improve the simulation of the water cycle and extreme events, and reduce uncertainties in climate projections. However, the development of such modeling strategies requires a concerted effort.

In exploring high-resolution climate models, we utilize an RCM that allows decade-long continental-scale simulations at 2 km resolution. The model employed is a version of the COSMO model that runs entirely on graphics processing units (GPUs). It is demonstrated that horizontal resolutions around 1 km enable the credible simulation of many mesoscale phenomena. Although cloud structures are not yet fully resolved, analyses suggest that there is convergence at grid resolutions around 2 km in a bulk sense.

On a technical level, it is argued that the output avalanche of high-resolution simulations will make it impractical or impossible to store the data. Rather, repeating the simulation and conducting online analyses may become more efficient. A prototype system of this type will be presented. An assessment will be provided of the potential of these novel approaches.

The presentation is largely based on a paper that is currently in review: Schär, C., O. Fuhrer, A. Arteaga, N. Ban, C. Charpilloz, S. Di Girolamo, L. Hentgen, T. Hoefler, X. Lapillonne, D. Leutwyler, K. Osterried, D. Panosetti, S. Ruedisuehli, L. Schlemmer, T. Schulthess, M. Sprenger, S. Ubbiali, H. Wernli, 2019: Kilometer-scale climate models: Prospects and challenges. Bull. American Meteorol. Soc., in review.

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