



High Resolution Weather to Climate Simulations with a Variable-Resolution Community Model

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The ability consistently span scales from weather to climate in complex coupled models that run efficiently on parallel machines is critical for advancing prediction from sub-seasonal to climate scale. High resolution model simulations with a variable resolution global dynamical core and complex physics for weather scales in the Community Earth System Model version 2 (part of CMIP6 and HighResMIP) are presented to illustrate that regional climate and even weather extremes can be reproduced in global models that are computationally efficient on massively parallel architectures. Such simulations pose extreme challenges for simulating atmospheric processes across scales, conducting analysis of such models and even in finding the appropriate scale of observations to compare to. Simulations demonstrate that variable resolution mesh simulations down to 14km scale or finer can reproduce uniform high resolution results: providing accurate regional climate and weather extremes in a coupled framework for a fraction of the cost of uniform high resolution. In some cases, the variable resolution framework is better than the uniform high resolution framework because the overall global climate corresponds better to observations. Resolutions at 3km are also being explored to consistently span the range from weather to climate. NCAR is working to such models available to the community for analysis and simulation, and to expand analysis tools for high resolution models.