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C20C - Climate of the 20th Century: Revolutionizing climate modeling - Impacts of high spatial resolution

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A collaboration, bringing together an international team of over 30 people, from nine institutions on three continents, including climate and weather scientists and modelers and experts in high-performance computing (HPC), has demonstrated the feasibility of using dedicated HPC resources to rapidly accelerate progress in addressing one of the most critical problems facing the global community, namely, global climate change. The scientific basis for undertaking this project was established in the May 2008 World Modeling Summit. In this project, called Project Athena for the dedicated supercomputer that was used, two sets of numerical experiments were conducted with two different models. One was an experimental version of the European Centre for Medium-range Weather Forecasts (ECMWF) Integrated Forecast System (IFS), a global atmospheric general circulation model, which is used operationally every day to produce 10-day weather forecasts. The IFS was run at several resolutions down to 10-km grid spacing to evaluate the statistical distribution and nature of high-impact and extreme events in 20th and 21st century simulations. The other was the NICAM global atmospheric model from the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), which was run at 7-km, cloud-system-resolving grid resolution to simulate the boreal summer climate, over many years, focusing on tropical cyclones, monsoon systems, and summer flood and drought situations. Both models were run in long simulations for the first time in the U.S. These computationally-intensive experiments addressed the question of whether or not increasing weather and climate model resolution to accurately resolve mesoscale phenomena in the atmosphere can improve the fidelity of the models in simulating the mean climate and the distribution of variances, covariances and extreme events. Sample results from the Project Athena simulations are illustrated and described.