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ECS: Enabling Climate Simulation at Extreme Scale

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World-wide efforts to built high-performance computing (HPC) systems in the exascale range acknowledge that the requirements of many key applications can only be met by the most advanced computer systems. In particular, these exascale systems will allow the unprecedented reduction of the uncertainties in climate-change simulations via ultra-high-resolution and enhanced models. However, although current climate codes run efficiently on today's machines, these codes will fail to run efficiently at extreme scales because their parallelization cannot account for the extreme scalability requirements of those systems. To address this limitation and also to handle lower reliability, increased heterogeneity, and tighter locality requirements on future machines, it is crucial to carefully co-design future exascale systems and climate codes. This talk summarizes our effort within an international collaboration of climate and computer scientists from USA, Canada, France, Germany, Japan, and Spain. Our consortium will not only identify the main roadblocks, analyze and test initial solutions for the execution of climate codes at extreme scale but also provide guidance for the future evolution of climate codes.