

ABSTRACT

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TOPIC: Graphics Processing Unit (GPU) Acceleration of the Goddard Earth Observing System
Atmospheric Model

The Goddard Earth Observing System 5 (GEOS-5) is the atmospheric model used by the Global Modeling and Assimilation Office (GMAO) for a variety of applications, from long-term climate prediction at relatively coarse resolution, to data assimilation and numerical weather prediction, to very high-resolution cloud-resolving simulations.

GEOS-5 is being ported to a graphics processing unit (GPU) cluster at the NASA Center for Climate Simulation (NCCS). By utilizing GPU co-processor technology, we expect to increase the throughput of GEOS-5 by at least an order of magnitude, and accelerate the process of scientific exploration across all scales of global modeling, including:

- The large-scale, high-end application of non-hydrostatic, global, cloud-resolving modeling at 10- to 1-kilometer (km) global resolutions
- Intermediate-resolution seasonal climate and weather prediction at 50- to 25-km on small clusters of GPUs
- Long-range, coarse-resolution climate modeling, enabled on a small box of GPUs for the individual researcher

After being ported to the GPU cluster, the primary physics components and the dynamical core of GEOS-5 have demonstrated a potential speedup of 15–40 times over conventional processor cores. Performance improvements of this magnitude reduce the required scalability of 1-km, global, cloud-resolving models from an unfathomable 6 million cores to an attainable 200,000 GPU-enabled cores.