

## Computing Technology

# Nehalem Clusters for NASA Climate Simulations

The NASA Center for Computational Sciences (NCCS) at NASA Goddard supplies high-performance computing and data services in support of NASA's Science Mission Directorate, tailoring its services to the specialized needs of Earth and space science users. In summer and fall 2009, NCCS installed two Nehalem upgrades to the scalable Discover cluster. The two systems have been linked together to make a full 8,000 core cluster designed to run climate simulations.

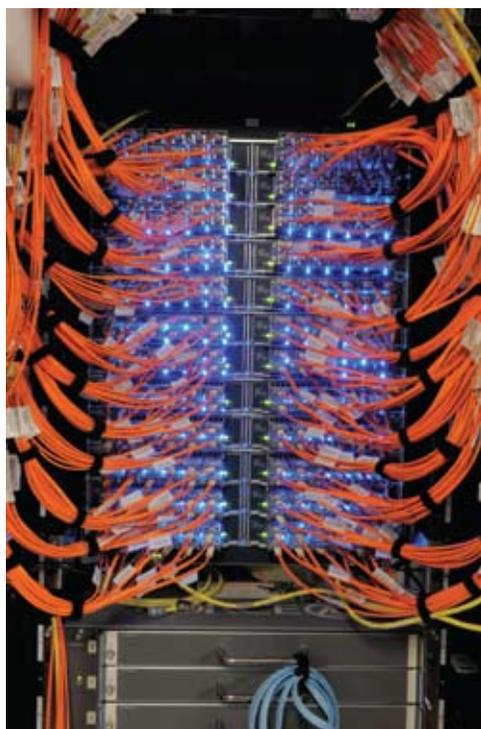
With the increased importance of understanding global climate change, NCCS designed the Nehalem upgrade to the Discover cluster to specifically support high-fidelity global climate models. This upgrade will support NASA's contributions to the Intergovernmental Panel on Climate Change (IPCC). The Global Modeling and Assimilation Office (GMAO) and the Goddard Institute for Space Studies (GISS) will generate their IPCC contributions using the new Nehalem cluster.

The cluster upgrade was designed with a large amount of memory per node/core (24 gigabytes per node/3 gigabytes per core). This large memory per core, coupled with the dramatic increase in the processor-to-memory bandwidth on the Nehalem processors, resulted in a 2x performance improvement over the previous generation of processors for most of the Earth science applications. This upgrade has allowed some of NASA's global climate models to increase the fidelity of their simulations to unprecedented levels. Large-scale global models are being run down to a 3.5-kilometer resolution, allowing scientists to see very fine-grain details in their models that have been previously unresolved.

Nehalem and IBM's iDataPlex cluster are among the most energy-efficient computing solutions available today, and this efficiency was a major factor in choosing them. Goddard's iDataPlex ranks #21 on the Green500 list and is rated by IBM at 271.52 megaflops per watt and 143.60 kilowatts of power.



*The NASA Center for Computational Sciences (NCCS) recently expanded its Discover cluster with an additional 8,256 Nehalem processor-cores. This photograph shows one of two new 4,128-processor "scalable units."*



*This tiered interconnect switch on the NCCS Discover cluster manages data traffic over the 20 gigabit-per-second (Gbps) InfiniBand internal network.*

For more information: <http://www.nccs.nasa.gov>

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