

High-Resolution Climate Experiments

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- Coupled Model Experiments:

$\frac{1}{2}^{\circ}$ (50km) atmosphere – $\frac{1}{4}^{\circ}$ (25km) ocean almost in production total experiment: 200 years; computational: 1 model year/day on 2400 cores; 70 GB/model year

$\frac{1}{2}^{\circ}$ (50km) atmosphere – $\frac{1}{10}^{\circ}$ (10km) ocean in development total experiment: 200 years; computational: 1 model year/day

- Standalone Atmospheric Model Experiments:

$\frac{1}{2}^{\circ}$ (50km) in production; total experiment: 100 years;
computational: 4 model year/day on 1,400 cores;
100 GB/model year

$\frac{1}{4}^{\circ}$ (25km) in production; total experiment: 300 years;
computational: 2 model year/day on 2,000 cores;
300 GB/model year

$\frac{1}{8}^{\circ}$ (13km) in development; runs on 10,000 cores

Current HPC Requirements

- Codes run on CRAY-XT (NERSC and ORNL) and IBM-BGP (ANL)
- 2 GB memory per MPI task
- Data read/written: Depends on the experiment and configuration
- Programming environment: Fortran 90, C, MPI and OpenMP
- Shared Flexible Model Infrastructure

HPC Usage and Methods for the Next 1-3 Years

- Computational hours requested: 150M hours/year on CRAY-XT and 150 M hours on IBM-BGP. Minimum 3-year commitment.
- Current model configurations (50km, 25km) run on 2400 cores. Implementation of OpenMP models will run on 20,000 cores.
- Next model configuration <13km will run on >80,000 cores
- Move towards hybrid programming model (MPI-OpenMP)
- Conversion of software from GFDL to DOE compute environments

- Software improvements to compute, memory, and IO scaling
- Improve performance and reliability of data transfers between DOE and GFDL

Summary

- Production computing (high-availability, storage, and archive)
- Improve job turn-around. Jobs run 12 hours/day on GFDL systems
- Culture difference between GFDL and DOE computing centers
- Scalable software (compute, memory, and I/O)
- Software runs on different platforms (CRAY-XT and IBM-BGP)

- Post processing: end-to-end solution (compute, storage, where)
- Secure and stable data transfers between DOE sites and GFDL