R&D field: Earth science

Nonhydrostatic ICosahedral Atmospheric Model (NICAM) for Global-Cloud Resolving Simulations

- Program name: NICAM
- Developer
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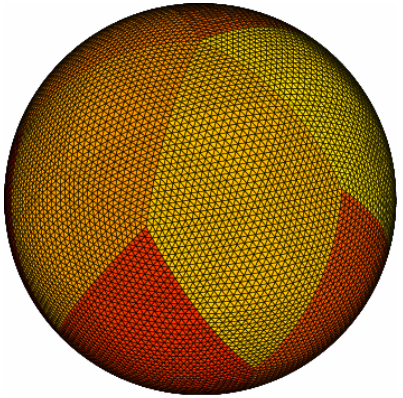
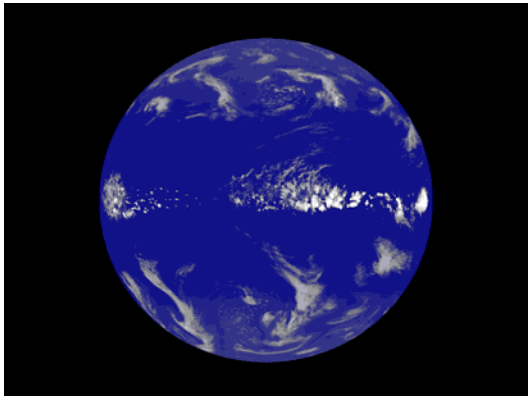
- Abstract
  - Icosahedral grid and the equation system with no approximation (nonhydrostatic equation system)
  - Global cloud-resolving simulation (mesh size is a few kilometers or less).
  - Explicit cloud physics without cumulus parameterization.
- Algorithm
  - Two-dimensional domain decomposition with icosahedral grid.
  - Explicit time difference for horizontally propagating acoustic waves, and implicit for vertical propagating acoustic waves.
  - MPI parallelization.
- Current computation size
  - Grid points 2048x2048x54x10, with mesh size 3.5km.
  - Sustained performance 7.7 TFLOPS and memory 4.8 TB (320 nodes of Earth Simulator).
- Future computation size in 2010
  - Mesh size 400m both for horizontal and vertical directions for several days time integration (grid points 8x8 times horizontally and 2 times vertically; time step 1/8 times).
  - 10 years Integration with the current mesh model of 3.5km.



Icosahedral grid



Global cloud image of aqua-planet experiment with 3.5km mesh global cloud-resolving simulation

- Expected results
  - NICAM will estimate more precise global cloud properties and lead to more reliable climate prediction.
  - NICAM will resolve clouds raging from deep cumulonimbus (10 km high) to shallow cumulus (1 km high) with resolution of isotropic grid spacing 400m.
  - NICAM will provide information of extreme phenomena such as typhoon and heavy rains associated with climate change based on global simulation with super high resolution (km scale).
- Reference
  - http://www.ccsr.u-tokyo.ac.jp/~satoh/nicam/