Simulations of Global Climate With a High-Resolution Atmospheric Model


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With help from J. J. Hack, NCAR
Eight High-Resolution Global Climate Simulations are Complete or in Progress

- We have performed simulations of
  - Present climate at T42, T170, and T239
  - Effects of increased greenhouse gases ("global warming") at T42, T170, and T239
- All use prescribed SSTs.
- Simulations cover 6 - 12 simulated years.
- Model used is NCAR CCM3.6.6
- We performed a first-order retuning of model physics at T170.
- Latest T170 present climate simulation is saving 6-hourly output to drive regional models.
We Have Performed a Comprehensive Analysis...

- PCMDI has performed a comprehensive analysis of the high resolution model results
  - Compared to observations and results of same model at coarse-resolution
    - Comparison performed on T42 grid.
- Increased resolution brings significant improvement in agreement between model results and observations.
- The improvements are seen in nearly all seasons, latitude bands, and meteorological quantities.
- The degree of improvement is often much more than is obtained from trying to improve model physics, etc.
Selected Results From Simulations of Present Climate
Winter Precipitation Over USA

CCM3@ 300 km

CCM3@ 75 km

CCM3@ 50 km

VEMAP observations

(mm/day)
Precipitation Near Antarctic Peninsula

CCM3 model 300 km

CCM3 model 50 km

Data courtesy John King, British Antarctic Survey
Simulated Water-Equivalent Snow Depth

T239 ->

<- T42
Surface Elevations in California and Environs

300 km model

50 km model

20 km

Elevation (m)
Effects of Increased Greenhouse Gases
Predicted Regional Climate Changes Can be Very Different at High Resolution

Predicted DJF Temperature Change, 2100 - 2000

300 km resolution

75 km resolution
Precipitation Changes Due to Global Warming

T170 ->

<- T42
Our Results Are Available!

- We will provide selected model output to interested parties.
- Ultimately, all model output will be freely available via Internet.
- In some cases we can perform “custom” simulations (special output, etc.)
How Can This Capability Be Used?

- We can do global downscaling of scenario simulations performed with coarse-resolution coupled models.

- We can save output to drive super high resolution regional model (if even higher resolution is needed in specific regions).

- We could use seasonal SST forecasts to perform ensemble predictions of e.g. effects of ENSO.