Applications of High-Resolution AGCMs to Climate and Weather Studies

Presented by
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GFDL Contribution to North American Regional Climate Change Assessment Program

Precipitation Response

Winter

Summer

Couple Model (CM2.1) with 2° resolution

Atmospheric GCM (AM2.1 M180) with 0.5° resolution

Wyman and Held
Climatological Precipitation and Circulation Patterns Associated With Plum Rain (Meiyu) Over East Asia

M180 Model

mid June

Observation

end June

mm/day

Geophysical Fluid Dynamics Laboratory Review
June 30 - July 2, 2009
Precipitation and Circulation Patterns During an Outstanding Episode of “Meiyu” Development
Cross-Section Perpendicular to “Meiyu” Rainband During Outstanding Episode

M180 Model
Specific Humidity/Streamflow

Rainband Axis
distance from axis of Meiyu rainband (km)

Northwest

Southeast

Geophysical Fluid Dynamics Laboratory Review
June 30 - July 2, 2009
24-Hour Surface Temperature Change During an Intense Cold Air Outbreak
3-Hour Surface Temperature Change During an Intense Cold Air Outbreak

M180 Model
Year 6 December 16 00Z

°C/3hr

-15 -10 -8 -6 -4 -2 -1 1 2 4 6 8 10 15
3-Hour Surface Temperature Change During an Intense Cold Air Outbreak Over the Eastern US

C360 Model
Year 9 February 26 00Z
Diurnal Cycle of Precipitation Over India / Bay of Bengal in Summer

M180 MODEL

05 PM

Observation

Departure from Daily Mean

mm/day

Geophysical Fluid Dynamics Laboratory Review
June 30 - July 2, 2009
• Small-scale atmospheric phenomena and extreme weather events are important considerations for the mean and changing climates in many geographical regions

• High-resolution global GCMs are powerful tools for understanding and projecting regional details of climate variations by virtue of their capability to simulate the prevalent local mesoscale weather systems

• It is demonstrated that the current high-resolution AGCMs at GFDL can reproduce the fine structures of various synoptic features, such as
  • Plum Rain (Meiyu) fronts over East Asia
  • Intense cold air outbreaks over East Asia and North America
  • Diurnal cycle of convection over South Asian monsoon region