

# Geophysical Fluid Dynamics Laboratory Review

June 30 - July 2, 2009



# Carbon, Biogeochemistry and Climate: Synthesis and Future Plans

Presented by  
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# Accomplishments

- We have incorporated new vegetation dynamics, soil hydrology, river transport, ocean biogeochemistry and physics into our ESMs
- We have successful pre-industrial control and climate change integrations using ESM2.1
- We have shown that the AR4 models have skill in simulation of water-availability trends

# Accomplishments

- We have quantified the physical impact of land cover changes on climate
- We have assessed the uncertainty related to CO<sub>2</sub> fertilization of land plants
- We have assessed ocean acidification and ecological responses to increasing CO<sub>2</sub> and climate change forcing

# Synthesis and Assessment

- ESM2M and ESM2G are almost ready for AR5
- The new vegetation component of LM3 allows us to investigate land use impacts and movement of biomes
- The new hydrologic component of LM3 treats a greatly expanded range of continental hydrologic processes

# Synthesis and Assessment

- Our new ocean biogeochemistry model (TOPAZ) allows us to assess controls on ocean habitat, productivity and their response to anthropogenic forcings
- We are improving our ability to represent ocean upper trophic levels to allow connections to a broader range of marine resource applications

# Research plans include a suite of investigations of the earth system

- Land use impact on carbon changes
- Increasing CO<sub>2</sub> impacts on ecosystems
- Oceanic heat and carbon uptake
- Carbon cycle feedbacks
- Climate – Fisheries interactions
- Water availability changes
- Paleo-climate



# Improving earth system model realism

- **Close additional biogeochemical cycles**
  - N, P, CH<sub>4</sub>, Fe, etc.
- **Improve representation of biodiversity**
- **Improve components**
  - Dust, sea salt, fire, land use
- **Migrate to CM3-based ESM**
- **Investigation of high resolution**
  - Coastal processes
  - Seasonal-decadal scale variability analysis/prediction



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