FASTER: a New DOE Effort to Bridge ESM and ASR Sciences

Yangang Liu (lyg@bnl.gov) and Team Members

What is FASTER?

- FASTER = FAs-Physics System TEStbed and Research
- Result from ESM proposal “Continuous Evaluation of Fast Processes in Climate Models Using ARM Measurements”
- 21 investigators from 10 institutions (+ post docs and students)
- Co-managed by ASR (Atmospheric System Research) manager (Dr. Kiran Alapaty) and ESM (Earth System Modeling) program manager (TBD)

FASTER is a major ESM effort to bridge ESM and ASR Sciences by fully utilizing ARM measurements to evaluate GCM parameterizations of fast processes such as clouds.

Goal and Objectives

One Goal

Fully utilize continuous long-term ARM measurements to enhance/accelerate evaluation and improvement of parameterizations of cloud-related fast processes and narrow GCM uncertainties and biases.

Six Objectives

- Construction of a fast-physics testbed
- Execution of a suite of CRM/LES simulations
- Evaluation of model performance
- Examination and improvement of parameterizations
- Assessment and development of evaluation metrics
- Incorporation of acquired knowledge into the full GCMs

Eight Tasks and Major Fast Processes

Eight Tasks:
- Fast-physics testbed (NWP, testbed & CRM-tested)
- A suite of high-resolution model simulations
- Model evaluation against observations
- Model error
- Error sources
- Evaluation metrics
- Statistical measures
- Forecast skill
- Theory and parameterization
- Data assimilation
- Full GCM assessment
- Data integration

Major Fast Processes:
- Microphysics
- Warm clouds
- Ice clouds
- Mixed phase clouds
- Micro vs. multi-moment schemes
- Aerosol-cloud interactions
- Radiation
- Shallow convection
- Deep convection
- Entrainment/Detrainment
- Boundary processes
- Subgrid turbulence
- Cloud fraction
- Land-surface-atmosphere interaction

Scientific Management

The sheer complexity of the problem are certainly a reason for the slow progress.

Complexity:
- Scientific
  - 3M (multibody/multiphase/multiscale interactions)
  - Conceptual
  - Numerical
  - Coupling
  - Engineering
- Inner field interactions: Para. impl. in GCMs

Rindfleisch et al. (BAMS, 2003): “A model evaluation project is complicated in at least two distinctive ways. The technical complexities are obvious and daunting; Data must collected and analyzed… An additional and equally complex task is to foster communication and fruitful interactions...”

Some even considers the complexity as a valley of death for GCMs.

Project Gateway – Website

http://www.bnl.gov/essm/