

# MultiScale Land-Atmosphere Interactions

# Science Motivation

- Organized interactions at sub-grid scale (e.g., mesoscale circ, “preconditioning”)
- Fine-scale hydrology (e.g., riparian veg, wetlands)
- 21st-Century land-use & land-cover change
- Diurnal variability, topographic effects

# Objectives

- Improved understanding of role of land-atmosphere coupling in current climate, hydrology, and carbon cycle
- Quantitative treatment of changing roles of biogeochemistry and land-use in 21-st Century climate

# Model platforms

- SiB3-SAM
- CLM-CCSM
- SiB-SAM-CAM (prototype MMF)
- Future:
  - Giga-LES over land
  - GCRM
  - Q3D MMF

# Major Challenges

- Topography (not in SAM)
- Representation of time-varying heterogeneous 2D land in a non-spatially explicit CRM (covariance & “clumpiness”)
- Cyclic boundary conditions in proto-MMF (esp wrt topography & veg gradients)
- Dynamic vegetation, land-use, C & N

# Opportunities w/CCSM

- Land-use change (historical & future)
  - Downscaling from IMAGE model to GCRM, proto-MMF, and Q3D MMF
- Carbon & nitrogen cycles
- Technology transfer into community model

# Actions

- Add variable (periodic?) topography to SAM and proto-MMF
- Develop a system for statistical representation of sub-grid scale variations of topography, vegetation, land-use, and soil hydrology in MMF
- Study impacts of past and future land-use change on climate system
- Contribute to “academic” CMIP/IPCC exps

# Metrics

- Fluxes, phenology, trace gases
- Circulation
- Precipitation patterns
- Climate variability
- Climate sensitivity