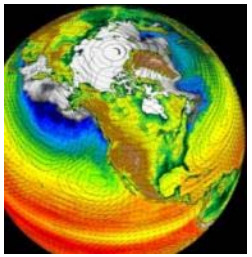

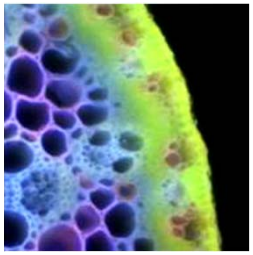

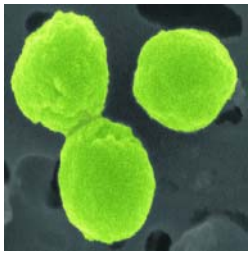

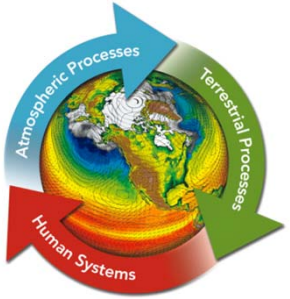

Community Modeling and Long-term Predictions of the Integrated Water Cycle

Topical Breakout Templates

Washington DC

September 24-26, 2012

Terminology for Templates

Topical Breakouts

- Priority Research Direction (PRD) - A high-priority research direction with high potential for producing revolutionary scientific breakthroughs that could dramatically advance the use of models for decision support.
  - Scientific Needs/Opportunities
  - Research Approaches
  - Scientific Impacts
  - User Impacts

Topic 3: Challenges for land surface/hydrologic modeling

- Martyn Clark
- Wade Crow
- Mauro DiLuzio
- Chris Duffy
- Inez Fung
- Dave Gochis
- Forrest Hoffman
- Randy Koster
- Praveen Kumar
- **Dave Lawrence**
- Ruby Leung
- **Reed Maxwell**
- Taikan Oki
- Steve Regan
- Bill Riley
- Guido Salvucci
- Sean Swenson
- Peter Thornton
- Cathy Wilson
- Xubin Zeng

Topic 3: Land surface/hydrology modeling

Priority Research Directions

3.1 Diagnose and understand scaling (sub-grid parameterization, scale dependence and scale behavior, heterogeneity)

3.2 Represent human water management of and vulnerability to water cycle (including impact of disturbance – LCC, fire - on hydrologic cycle)

3.3 Improve data synthesis, distribution, and accessibility (benchmark/metrics)

3.4 Improve terrestrial hydrologic cycle process representation with goal of addressing existing biases

Topic 3: Land surface/hydrology modeling

Priority Research Direction 3.1

Diagnose and understand scaling (sub-grid parameterization, scale dependence and scale behavior, heterogeneity)

Scientific Needs/Opportunities

A. When/where does heterogeneity, surface vs sub-surface matter?
B. 1km, scale that hydrologists and ESMers can come together?
C. Or, multi-scale / nested models
D. High priority – subgrid representation of topography

Research Approaches

A. Multiple models, coupling infrastructure
B. ….
C. ….

Scientific Impacts

A. ….
B. ….
C. ….

User Impacts

A. ….
B. ….
C. ….

Topic 3: Land surface/hydrology modeling

Priority Research Direction 3.2

Represent human water management of and vulnerability to water cycle (including impact of disturbance – LCC, fire - on hydrologic cycle)

Scientific Needs/Opportunities

A. Reservoirs / river operations … in global models?
B. Irrigation / groundwater pumping, aquifer recharge
C. Estuaries
D. Crop modeling
E. Identify which human impacts can be dealt with using existing physical modeling approaches and projections (e.g. irrigation impacts, land use change) and which need a much more direct involvement of "social engineers" (e.g. human adaptability, impacts of population dynamics on water demand)

Research Approaches

A. Improve modeling of seasonal cycle of river discharge (role of humans)
B. What is correct/reasonable approach to model reservoirs?
C. Assess human vulnerability/adaptability to changes in water resources
D. Stochastic versus super model

Scientific Impacts

A. ….
B. ….
C. ….

User Impacts

A. ….
B. ….
C. ….

Topic 3: Land surface/hydrology modeling

Priority Research Direction 3.3

Improve data synthesis, distribution, and accessibility (benchmark/metrics)

Scientific Needs/Opportunities

A. Targeted data needs
B. Improved data accessibility for model validation / model input
C. Improved resolution (multiscale)
D. Improved quality control
E. Target structure and interaction with data collection

Research Approaches

A. ….
B. ….
C. ….

Scientific Impacts

A. ….
B. ….
C. ….

User Impacts

A. ….
B. ….
C. ….

Topic 3: Land surface/hydrology modeling

Priority Research Direction 3.4

Improve terrestrial hydrologic cycle process representation with goal of addressing existing biases

Scientific Needs/Opportunities

A. Fluxes (including PDFs) for atm models
B. Q/P, E/Rnet diagnostics
C. Given inconsistent levels of complexity in different land model components, determine the weakest link in the 'holistic' system (could be runoff component)
D. Seasonal snowpack modeling
E. Natural wetlands and lakes
F. Megafires and impact on water resources
G. Improve carbon/water interactions (nutrients)
H. Interactions between surface/sub-surface

Scientific Impacts

A. ….
B. ….

Research Approaches

A. Fully descriptive observations (P, runoff, ET to fully constrain model)
B. Water, carbon, nitrogen isotopes (tracers to evaluate model)
C. Develop method to objectively evaluate accuracy and impacts of different model components; focus model development work on achieving appropriate (and currently missing) balance in component complexity.
D. Parameter estimation / uncertainty quantification (what fraction of biases can be corrected by parameter estimation)
E. Reactive transport modeling

User Impacts

A. ….
B. …