

Thoughts about what is needed to improve land models to better represent the terrestrial water cycle for the purpose of long-term predictions

Bill Riley

LBL

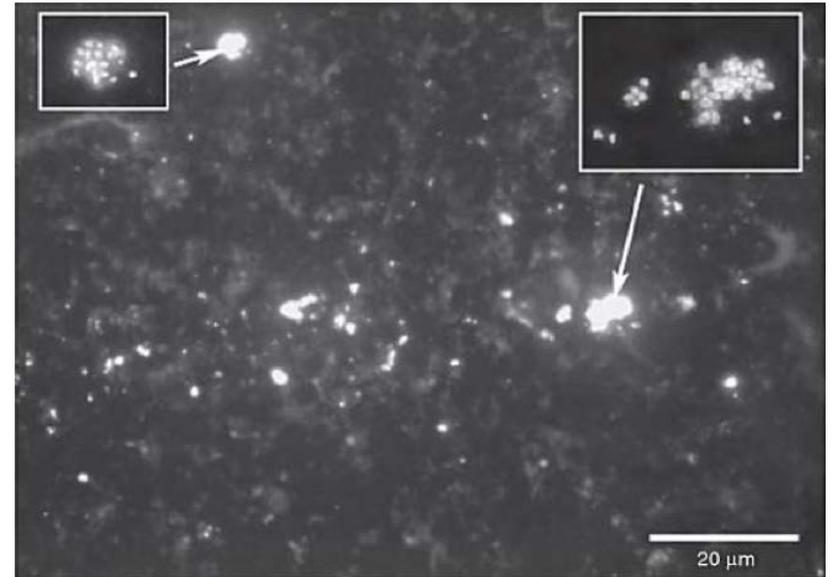
Three Points

- Spatial heterogeneity in hydrology will impact BGC in non-linear ways
 - Implies scaling methodologies must simultaneously represent hydrology and BGC across relevant scales:
 - Hydrology: m, 100 m, 10 km
 - BGC: μm , cm, m, 100 m, 10 km
- High-latitude hydrological processes not realistically included in current models
 - Thermokarst, erosion, excess ice
 - Landforms (e.g., polygonal structures)
 - NGEE-Arctic
- Increased model complexity must be accompanied by quantitative methods to evaluate relative benefits to prediction accuracy

The spatial organization of soil microbes and their activation determines the fate of C in soil

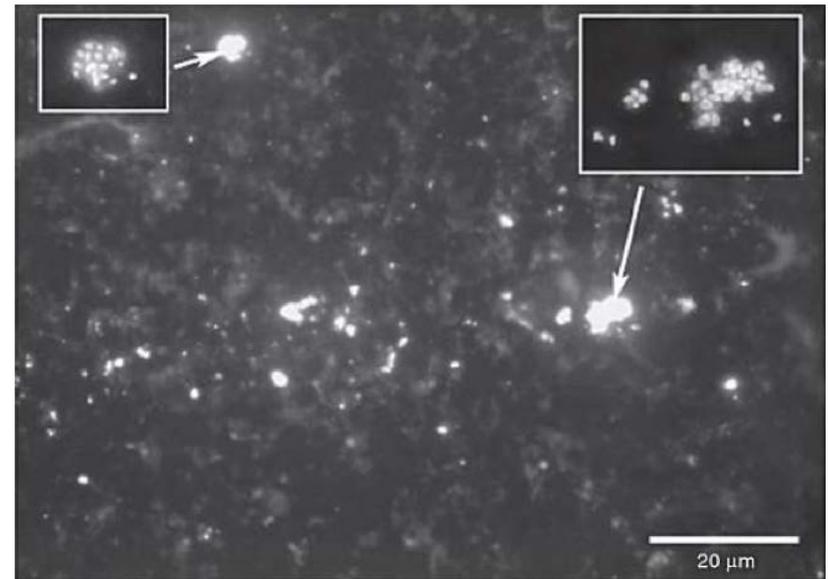
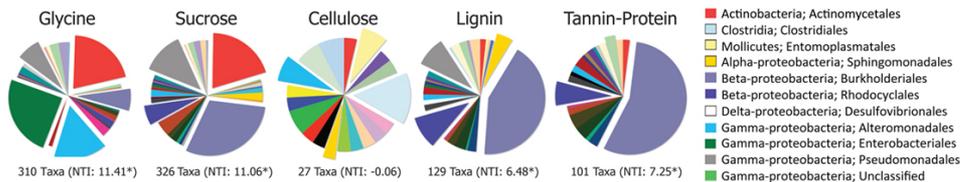
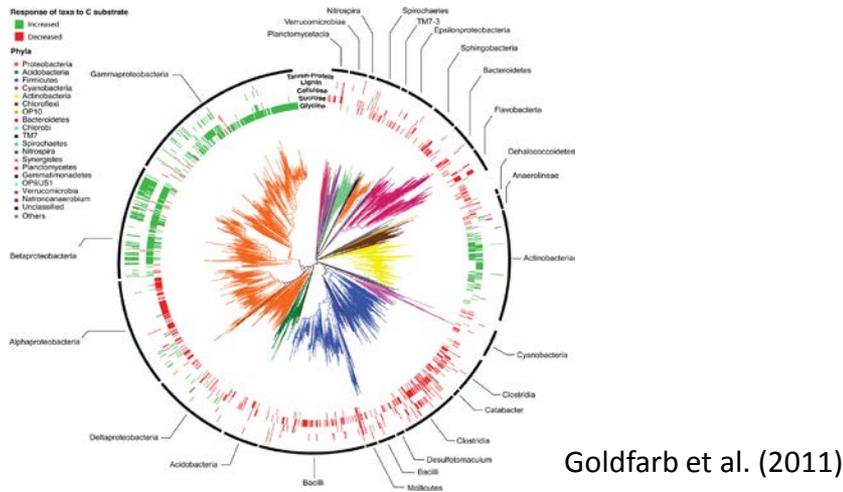


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The Architecture and Biology of Soils, Ritz and Young (Eds).

The spatial organization of soil microbes and their activation determines the fate of C in soil

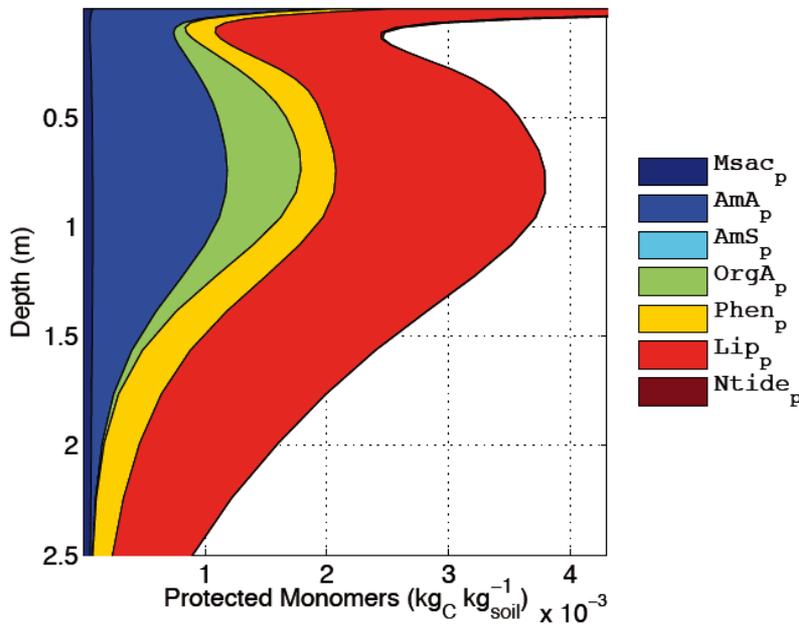
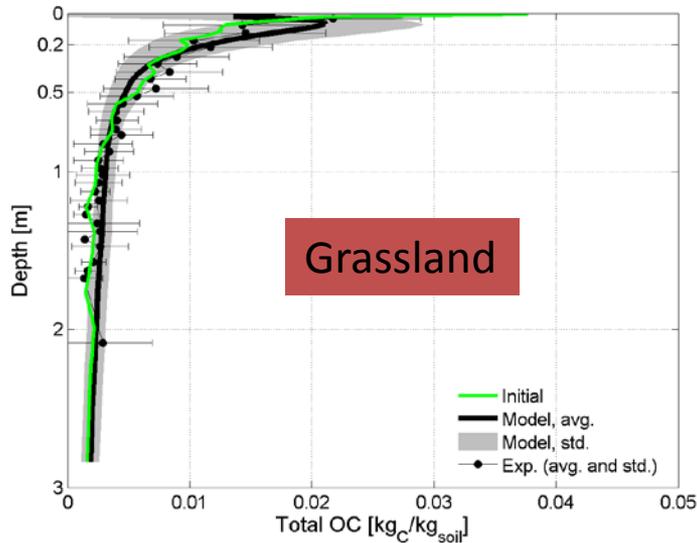


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Distributions of people and microbes are heterogeneous but related to resource availability, including water

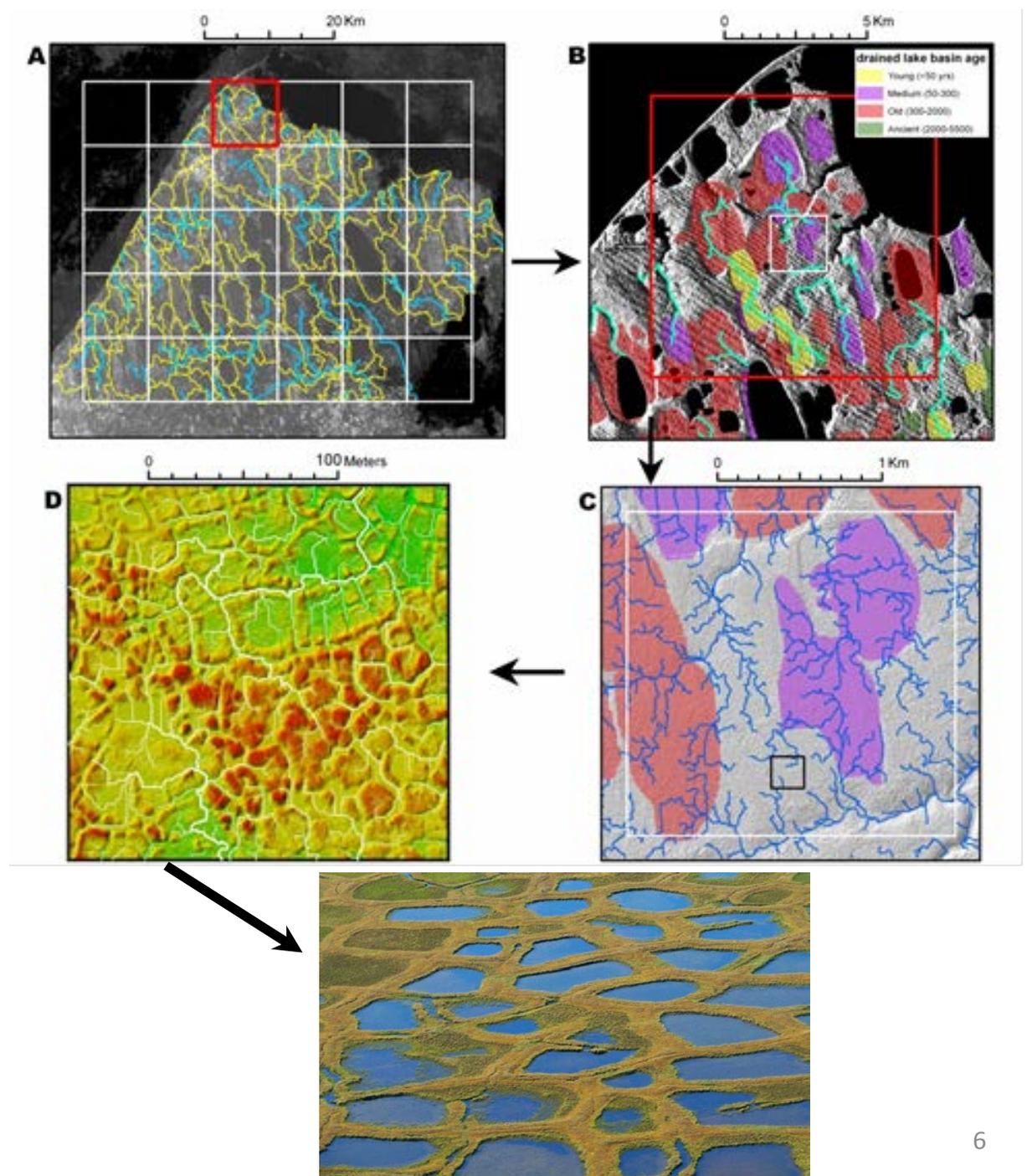
What are the rules governing these distributions and their impacts on BGC dynamics?

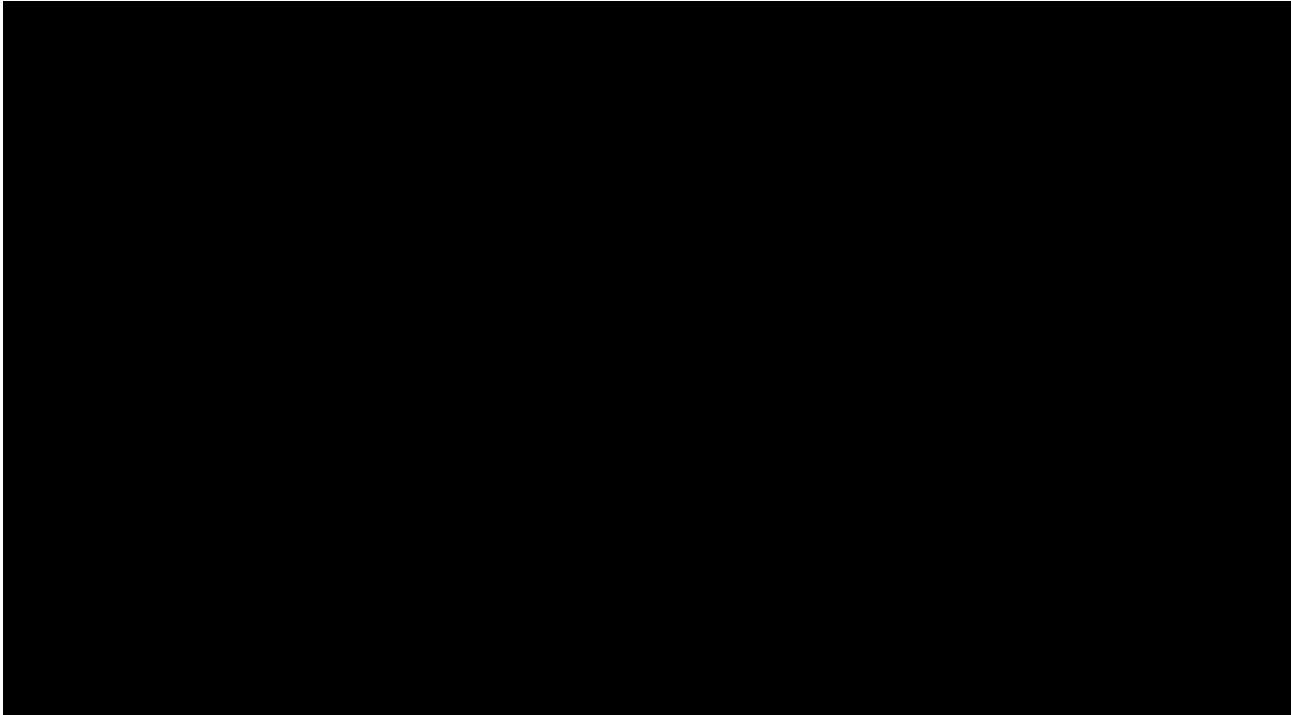
Vertical Heterogeneity in SOM Dynamics



- Much of the world's SOM is below the rooting zone
- Hydrological transport of nutrients, etc., is critical

NGEE-Arctic Barrow site





Hierarchical Ngee Simulation Framework

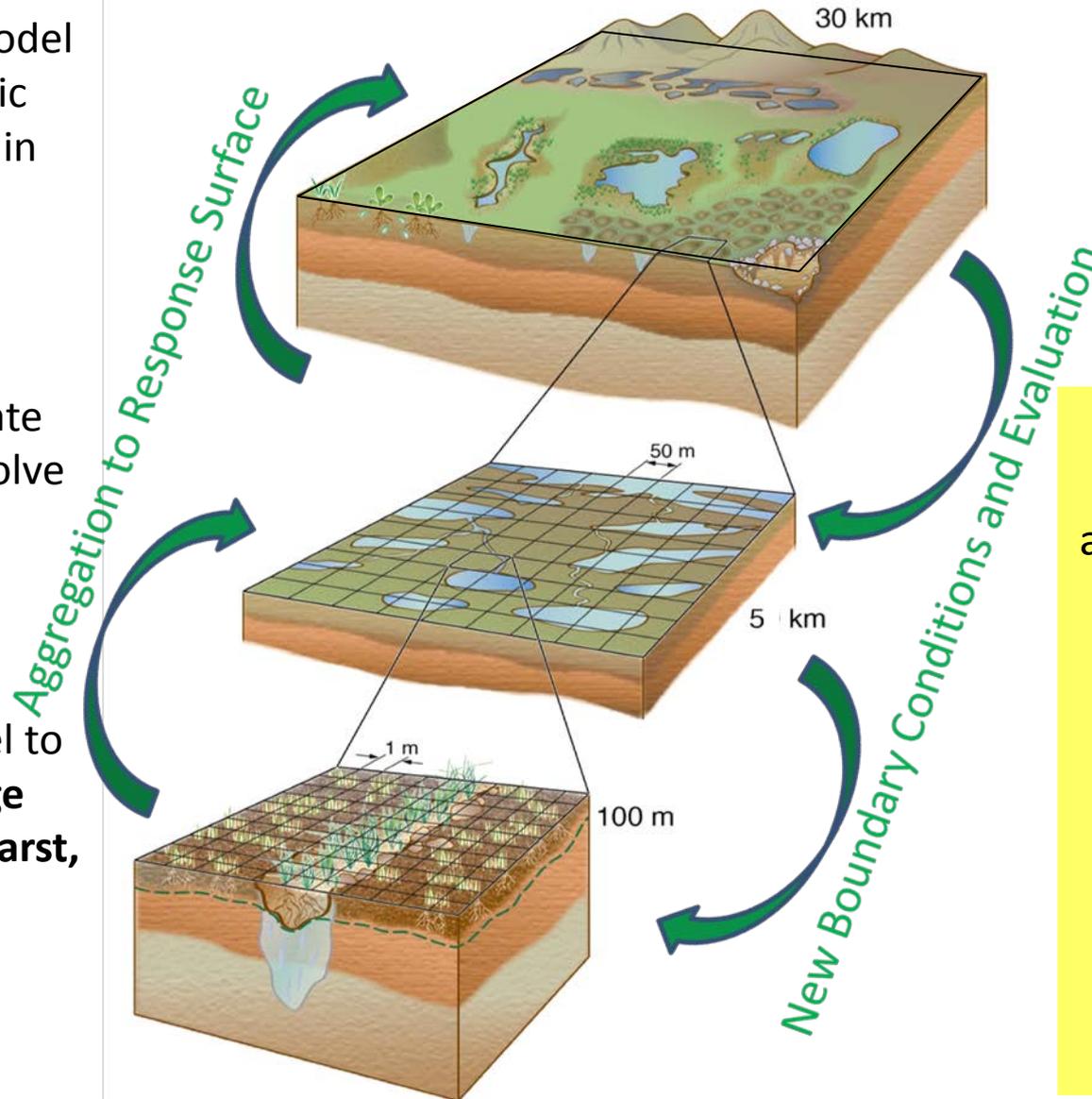
Cross-scale iterative solutions

required to honor energy, mass and momentum conservation

1D Climate scale model
to represent arctic
tundra processes in
**climate change
predictions**

2D/3D Intermediate
Scale model to resolve
**hydrological
connectivity**

3D fine scale model to
**resolve ice wedge
dynamics, thermokarst,
and BGC**



Transfer of
information up
and down scales
organized
around
**geomorphic
units**
(such as thaw
lakes and
polygonal
ground)