P: Development of Microbe-Enabled SOM Decomposition & Methane Modules through ALM-PFLOTRAN Interface

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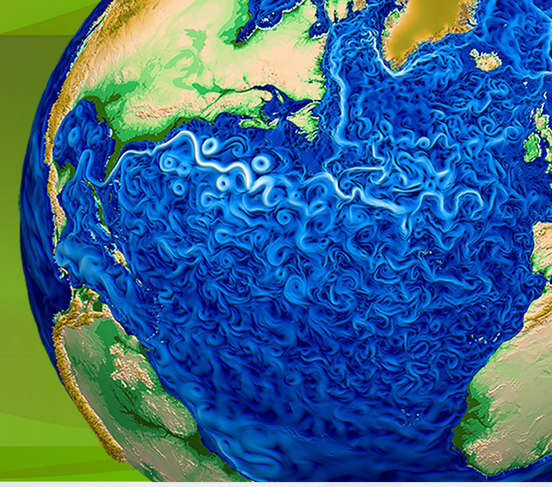
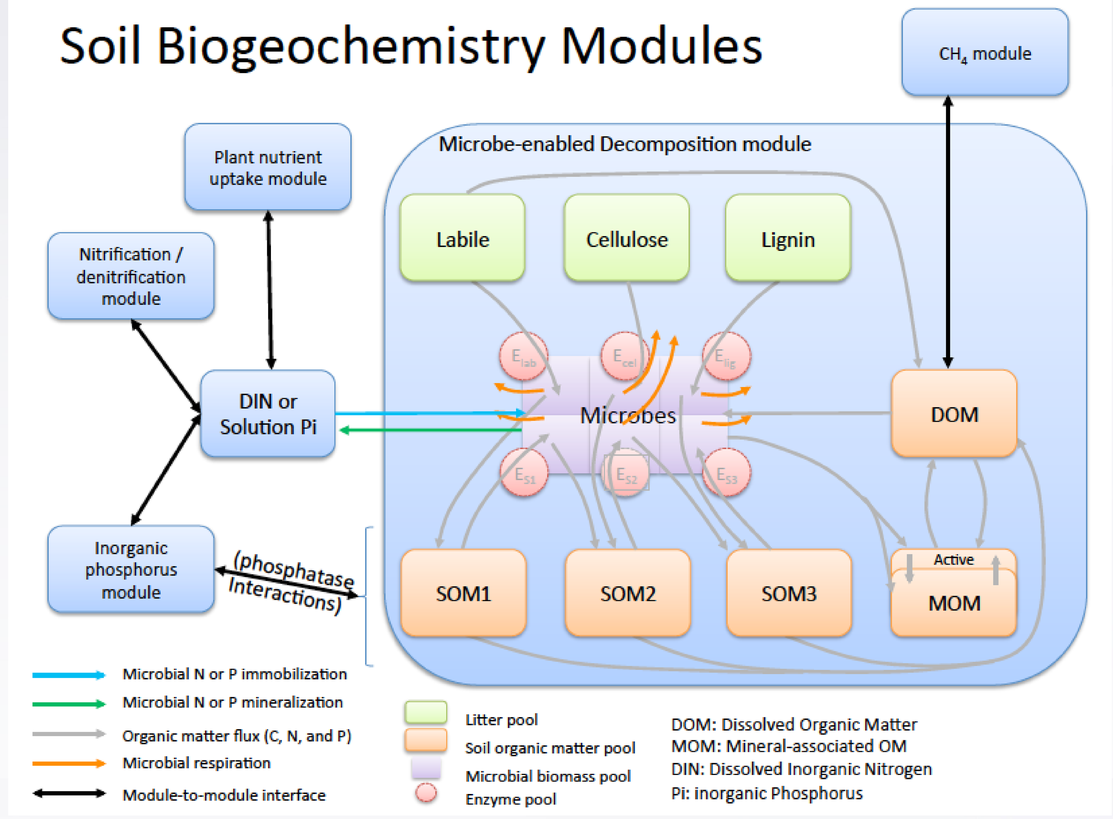


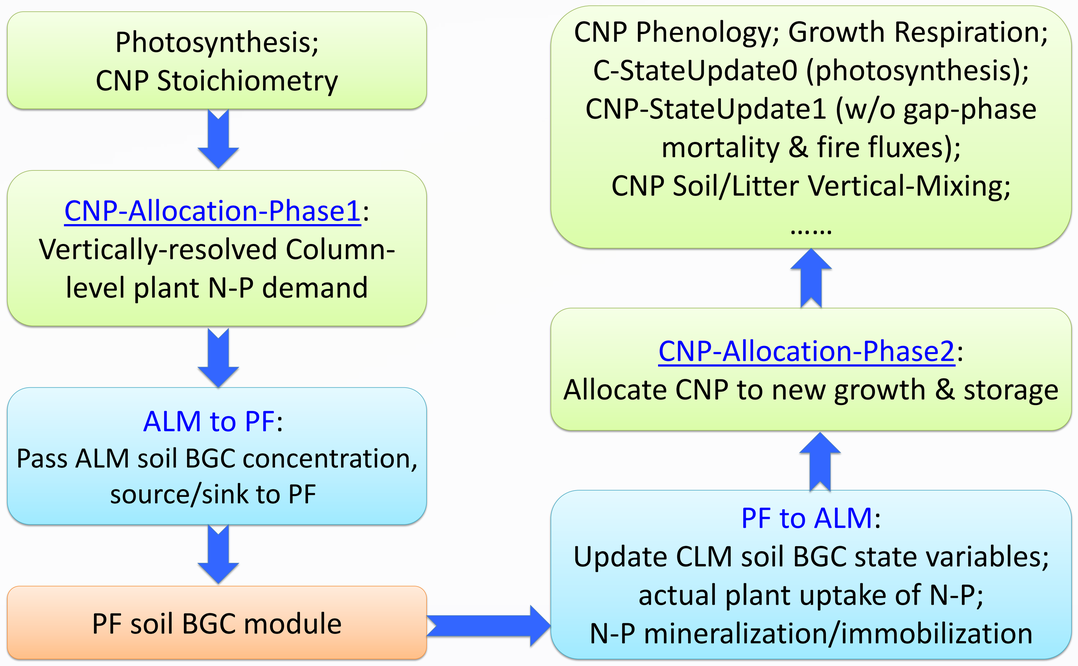
Issue

Microbial assimilation of soil organic matter (SOM) and the physicochemical protection of SOM play fundamental roles in regulating land-atmosphere interactions. However, these microbial and physicochemical processes are not explicitly represented in most regional/global terrestrial ecosystem models, e.g., the ACME Land Model (ALM). In the ACME Land Task M3.8 and M3.11, we are developing the microbe-enabled SOM decomposition and methane cycle modules based on the Convergent Trophic Cascade (CTC) model to include explicit treatment of microbial dynamics and organic-mineral interactions. These modules will be implemented in PFLOTRAN (PF), which is capable of solving a system of nonlinear partial differential equations describing multi-phase, multi-component and multi-scale 3-D flow and reactive-transport in porous media. For this purpose we need to develop an ALM-PF biogeochemistry (BGC) interface to facilitate the communication between ALM and PF BGC modules. The ultimate objective of this interface is to enable flexible and fast development and evaluation of soil BGC modules through the coupled ALM-PF framework.



Solution Attempts

ALM-PF BGC INTERFACE (major BGC modules):



Ideas

Future Plan:

- Develop microbe-enabled SOM decomposition and methane modules in PF.
- Test the coupled ALM-PF model at site-level.
- Model comparison (ALM vs. ALM-PF) and parameterization.
- Test the coupled ALM-PF model at the global scale.
- Develop ALM-PF thermohydrology (TH) interface in coordination with the development of PF-TH.

ACME Accelerated Climate Modeling for Energy

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