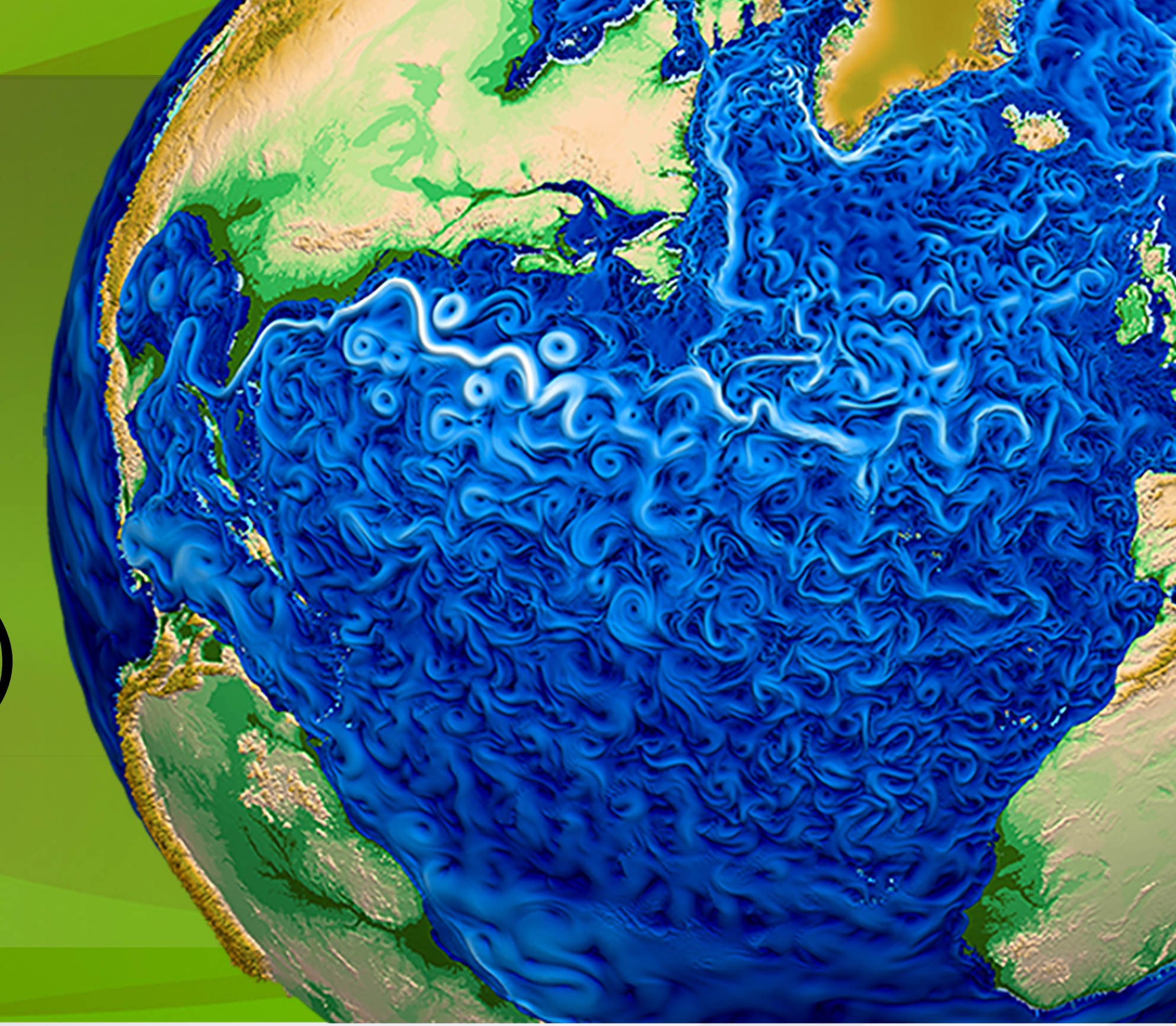


R: Implementing BeTR in ACME-v1

Jinyun Tang (jinyuntang@lbl.gov) and William J. Riley (wjriley@lbl.gov)



Objective

- Abiotic physical processes, such as transport through different pathways, significantly regulates the ecosystem biogeochemical processes.
- Current land models usually do not support active transport of various chemical species and biological agents in and out of the soil.
- Here, we implement BeTR, the **Biogeochemical Transport and Reaction** module developed in CLM4.X, in ALM to facilitate new reaction-based modeling of soil biogeochemistry.
- We show that BeTR allows a straightforward analysis of structural uncertainty in soil biogeochemistry from different model assumptions and implementation strategies.

Results

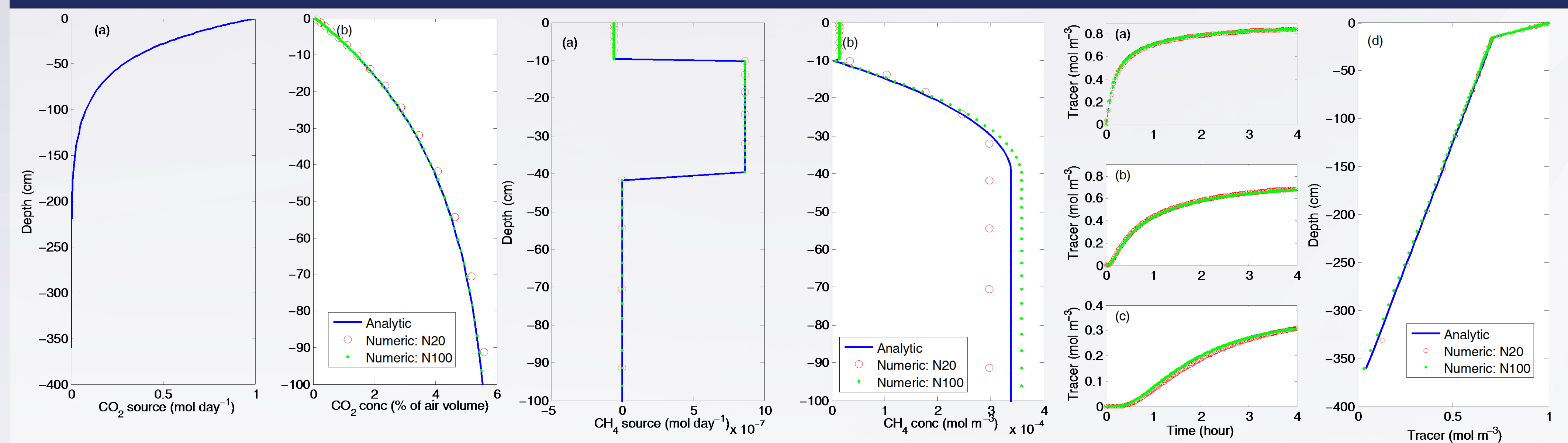


Figure 2. Analytic evaluation of the dual phase diffusion solver (Tang and Riley, 2014).

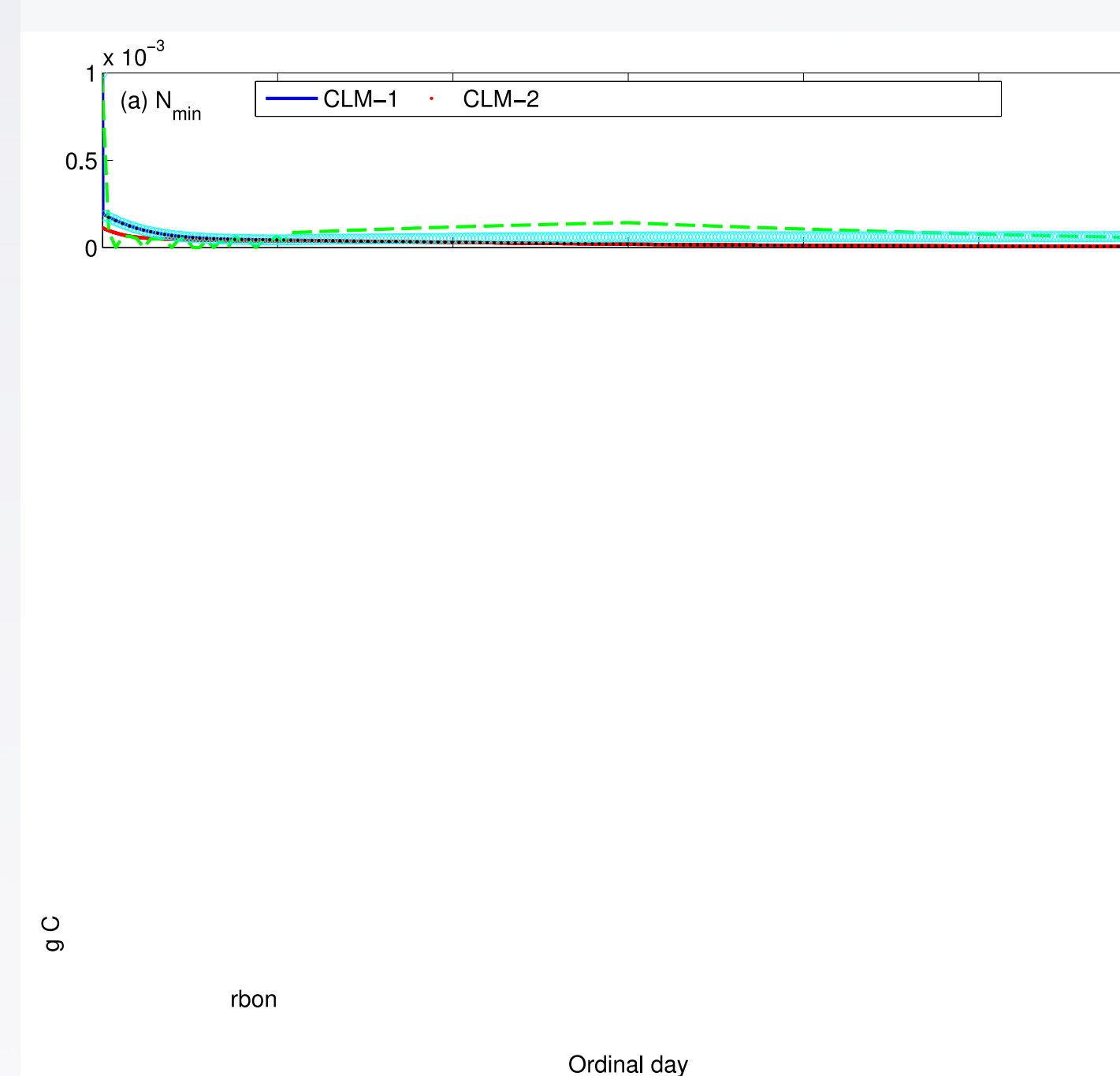


Figure 3. A demonstration of the structural uncertainty resulting from inconsistent treatment of nitrogen limitation in SOM decomposition (Tang and Riley, 2015)

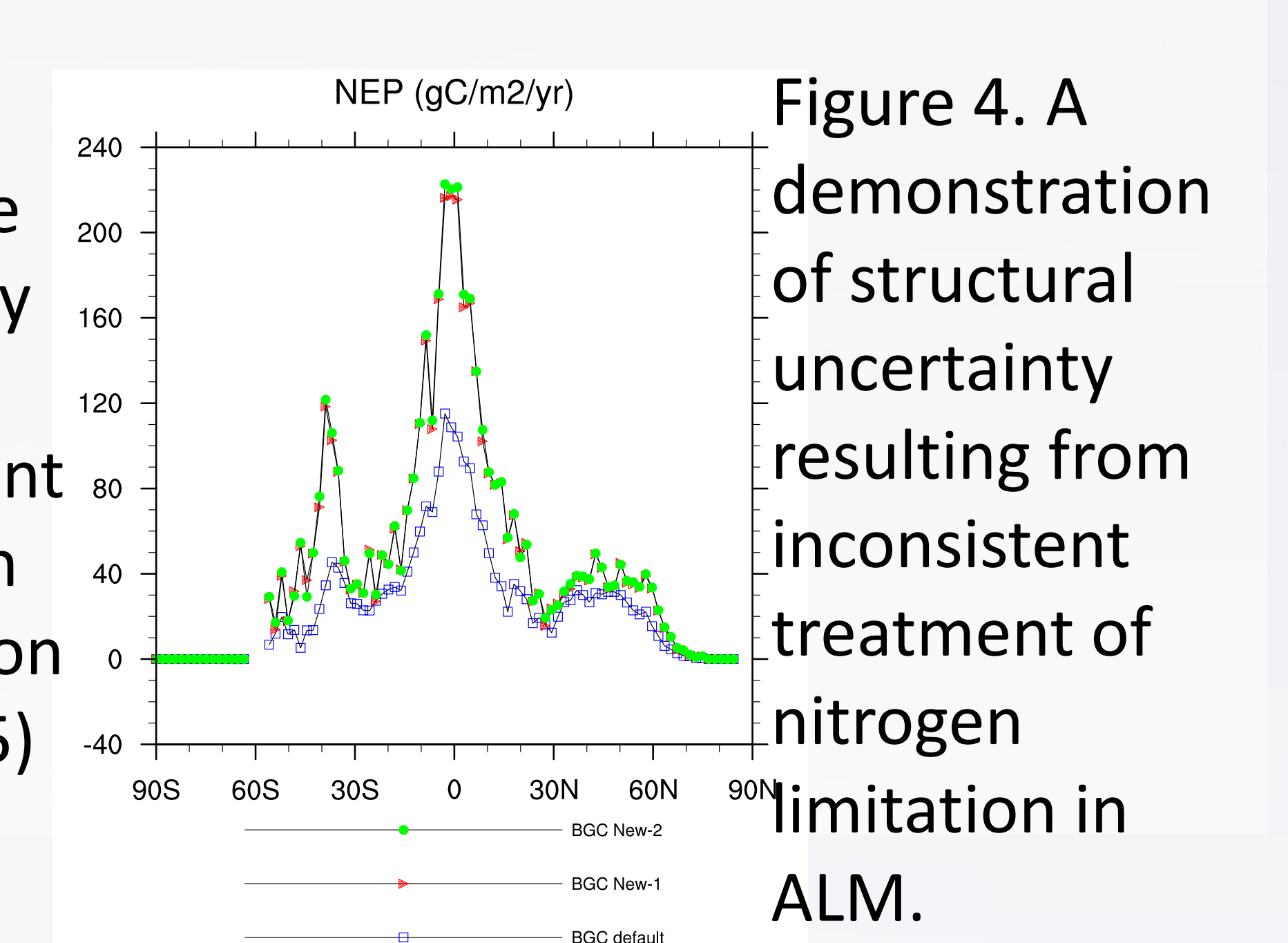


Figure 4. A demonstration of structural uncertainty resulting from inconsistent treatment of nitrogen limitation in ALM.

Approach

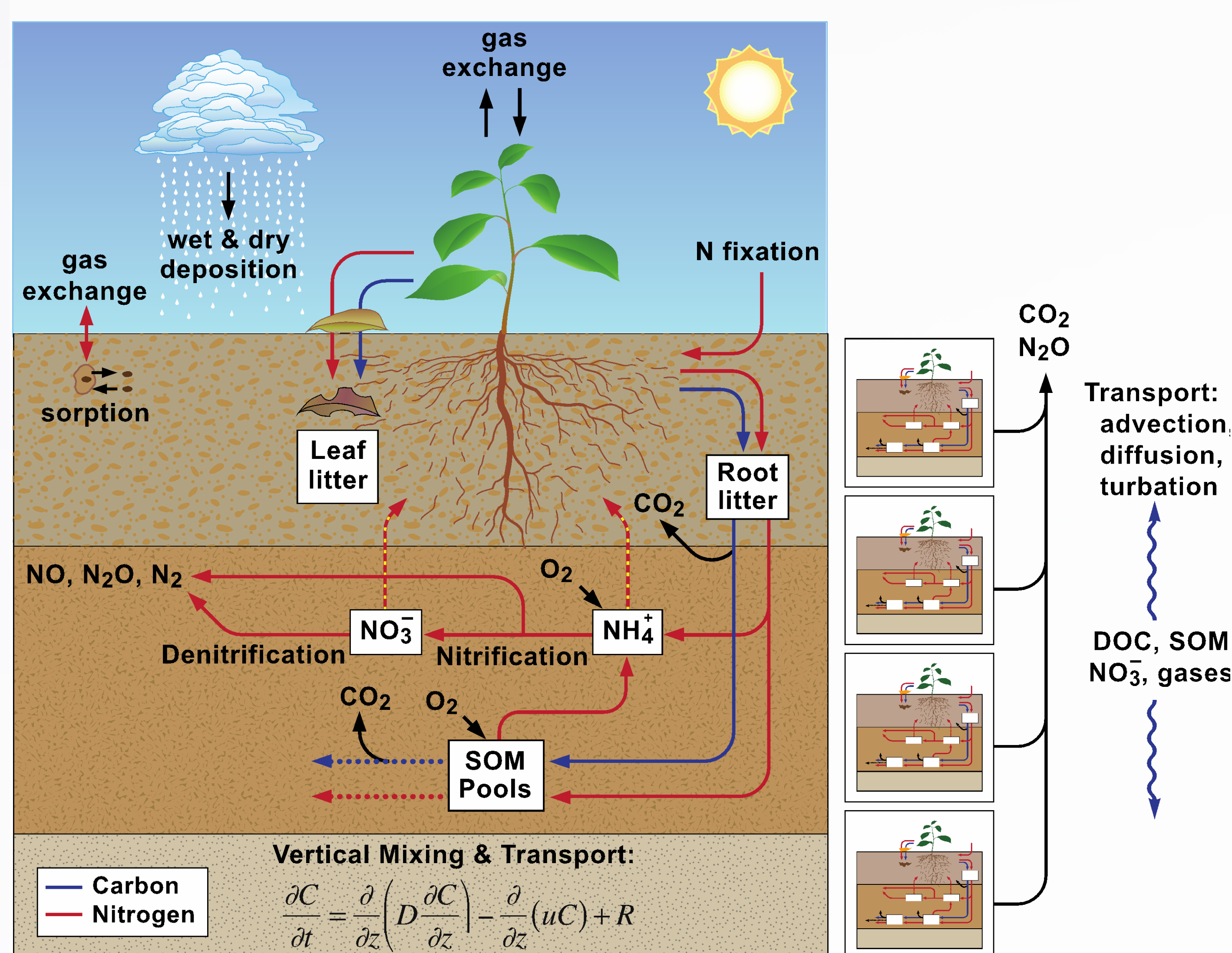


Figure 1. Schematic of the BeTR module (Tang et al., 2013)

BeTR implementation:

- Solves the governing equations using the operator splitting approach.
- Implicit solver for dual-phase diffusion.
- Semi-lagrangian scheme for aqueous advection.
- Pressure adjustment scheme for ebullition.
- Tracer transport by groups.

Impact

- ❖ BeTR enables consistent treatment of multiphase transport for different chemical tracers.
- ❖ BeTR allows a consistent numerical coupling of bioavailability of multiple substrates.
- ❖ BeTR facilitates easy analyses of structural uncertainty from different soil biogeochemical formulations.
- ❖ BeTR is expected to help accelerate the development of microbe enabled soil biogeochemical models.

Tang et al.(2013), GMD.

Tang and Riley (2014), Biogeosciences.

Tang and Riley (2015), Biogeosciences Discussion.