# Connecting E3SM Land Model with external models

Accessing biogeochemical, hydrological, and ecological insights from the NGEE projects

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U.S. DEPARTMENT OF ENERGY

# NGEE-E3SM Land Model Liaisons



Large-scales, coarser resolution
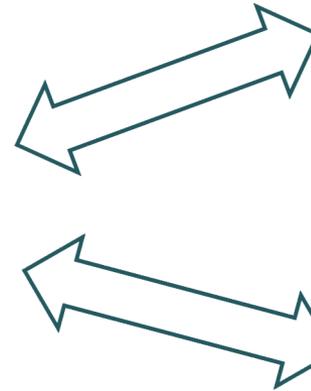
Fine scales, high process detail
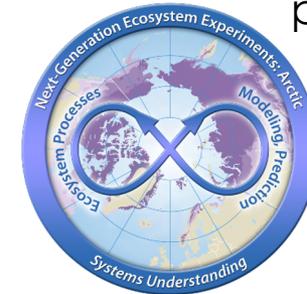
- Currently supported by CMDV-Land project

- Goal: Facilitate interactions and collaborations on land surface model development activities among NGEE-Arctic, NGEE-Tropics, and E3SM

- Main E3SM Science Questions (for liaisons): Water Cycle and Biogeochemistry
  - How does the **hydrological cycle** interact with the rest of the human-Earth system to determine water availability and water cycle extremes?
  - How does **biogeochemical cycles** interact with other Earth system components **to influence energy-sector decisions**?

- Who we are: Jennifer Holm (LBNL), Ryan Knox (LBNL), Teklu Tesfa (PNNL), Ben Sulman (ORNL)

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# E3SM-PFLOTRAN coupling via EMI



E3SM Land Model

External Model Interface

External models

ELM data structures

Interface layer

FATES
(forest demography)

VSFM
(soil hydrology)

PFLOTRAN
(Chemistry, hydrology, reactive transport)

BeTR
(Soil biogeochemistry, reactive transport)

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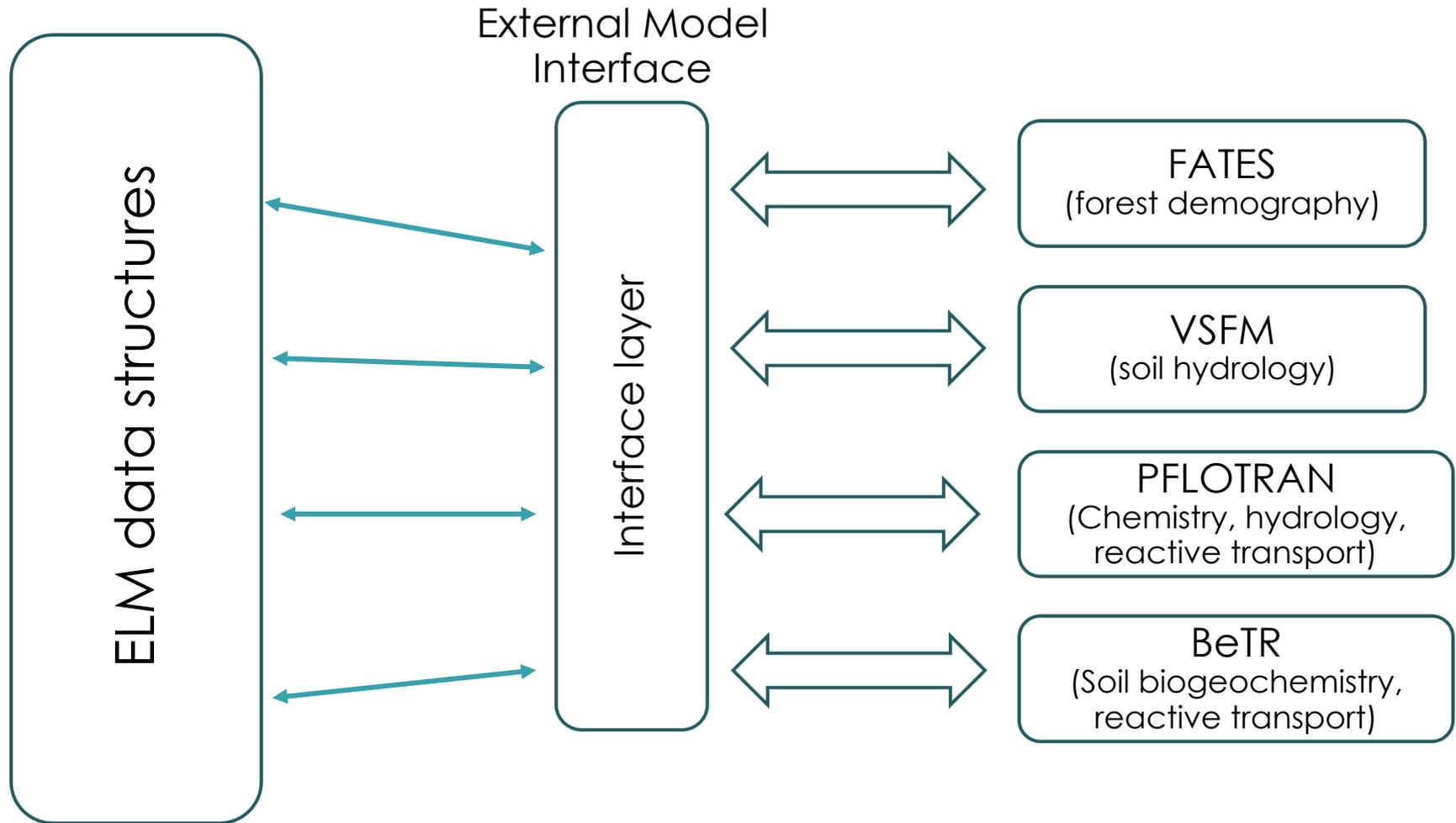
# Example: representation of soil redox processes in PFLOTRAN model

**PFLOTRAN**

Open source reactive transport model
- Full featured chemistry, hydrology, and transport
- Flexible definitions of reaction networks using configuration files

PFLOTRAN simulation: Redox species Concentrations over time
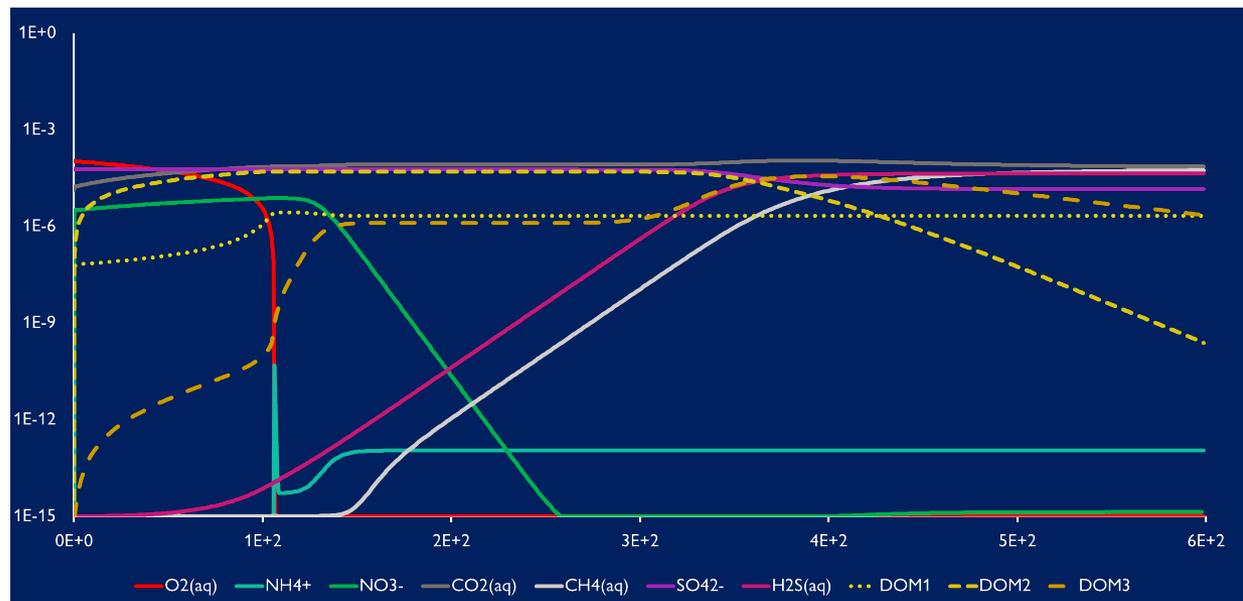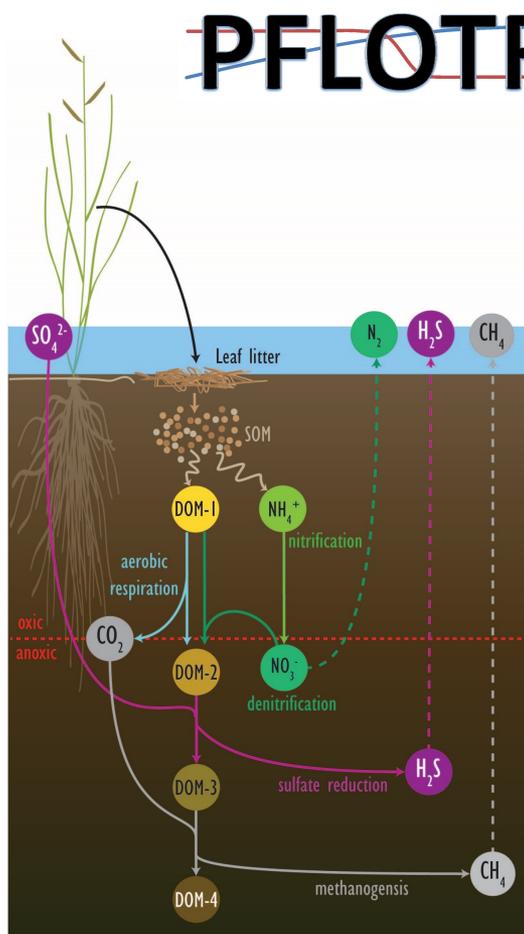


Graphics and PFLOTRAN simulations: Teri O'Meara (ORNL)

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# E3SM-PFLOTRAN coupling via EMI

E3SM Land Model

PFLOTRAN

External Model
Interface

SOM
pools

Moisture

Temperature

Interface layer
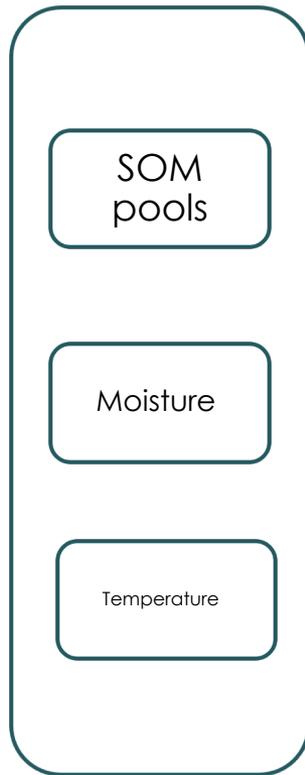
Simple process
representations
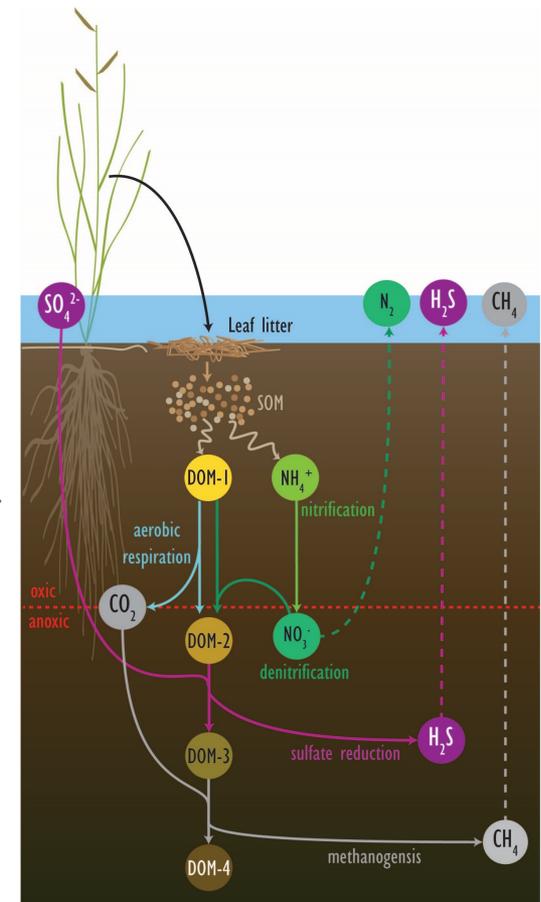
More comprehensive
process representations

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# Who is using EMI to integrate with ELM?

So far, groups are working to integrate these models with EMI:

- FATES (Forest demography)

- PFLOTRAN (Soil chemistry, hydrology, and reactive transport)

- BeTR (Soil biogeochemistry and reactive transport)

- VSFM (Soil hydrology)

- PTM (Soil heat)

- YOUR MODEL???

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