

CH₄ Biogeochemistry in CLM4

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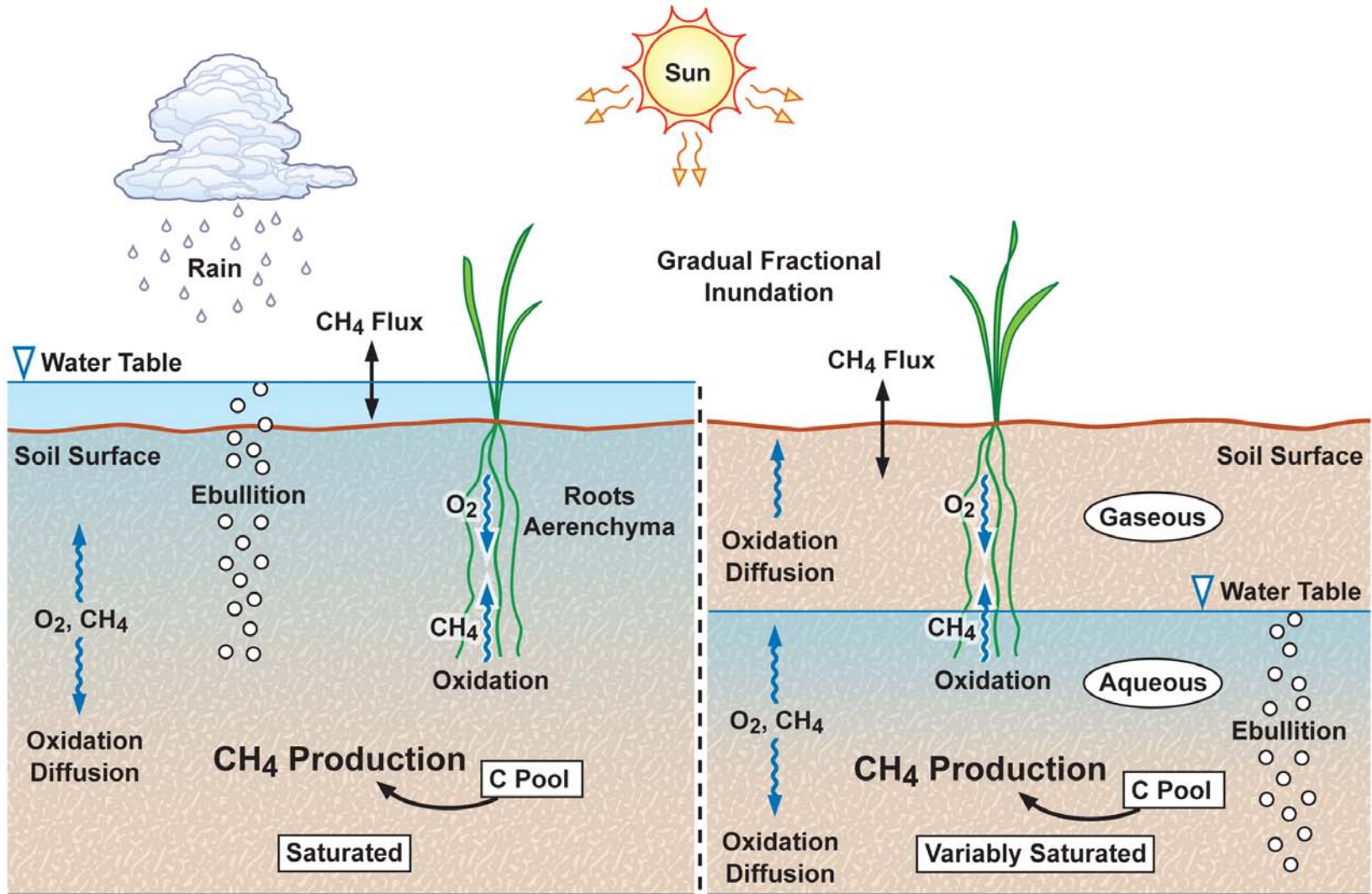
Overview

- A component of DOE IMPACTS project
 - Global methane emissions model
 - Thermokarst lake model
 - High-latitude dynamic vegetation model
 - Atmospheric coupling and feedbacks
- Collaborating with Cornell group to analyze tropical CH₄ emissions
- Feedback analyses in CCSM

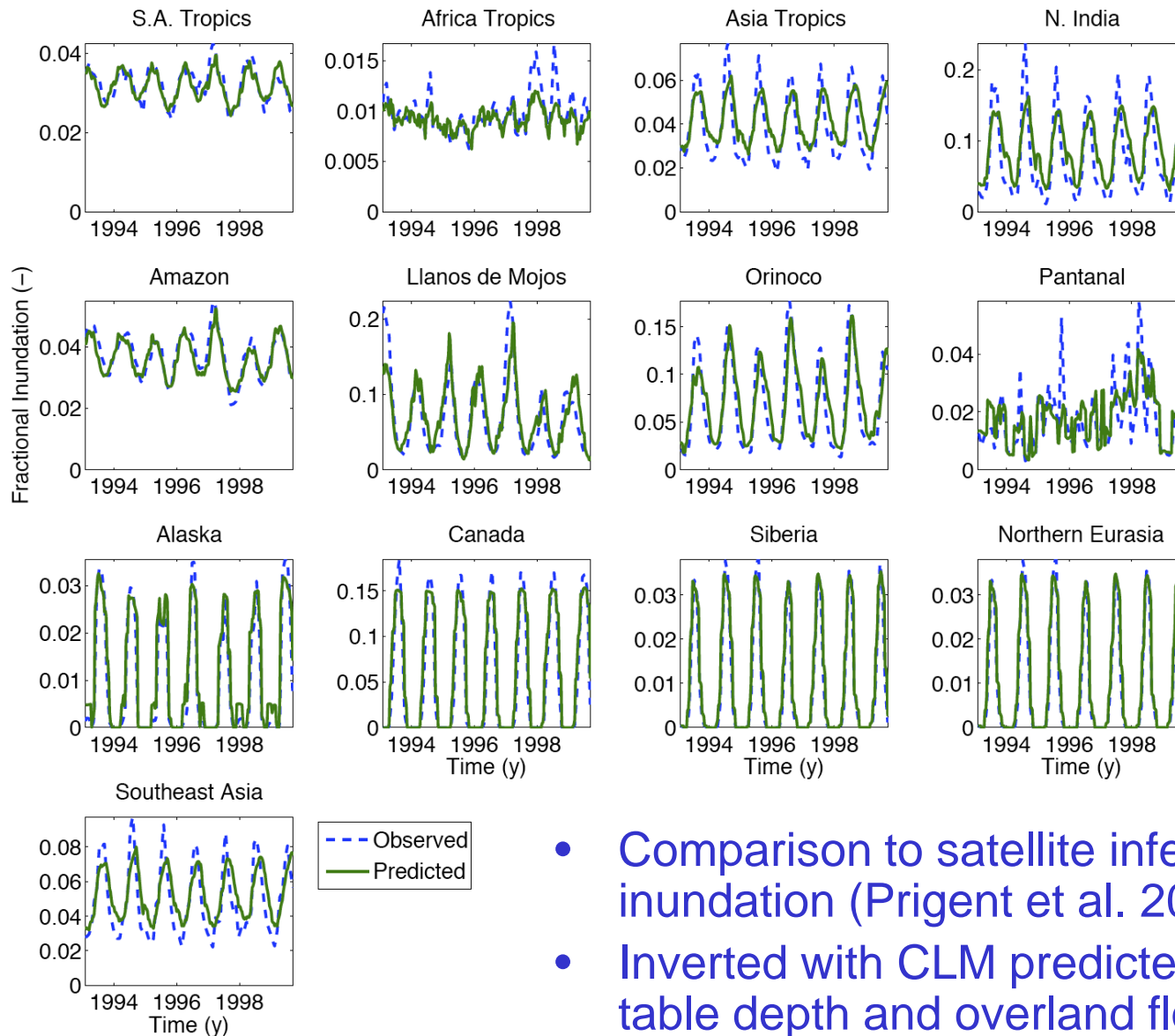
Outline

- CH₄ BGC model integrated in CLM4
- Inundated fraction
- Global spin-up with changes
- Aerenchyma effects
- Comparison to site observations
- Comparison to global inversions

CH₄ Biogeochemistry



Inundated Fraction

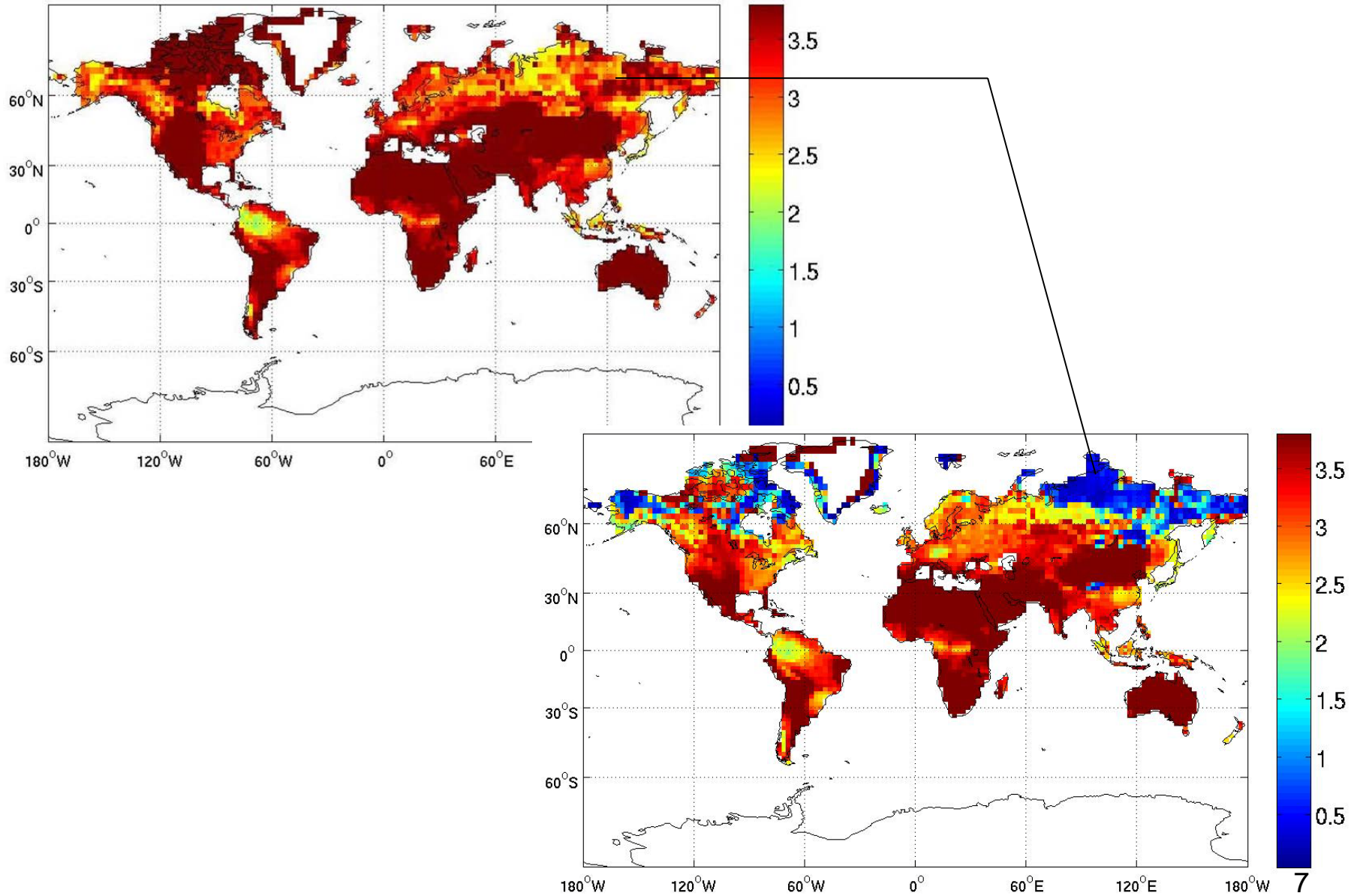


- Comparison to satellite inferred inundation (Prigent et al. 2007)
- Inverted with CLM predicted water table depth and overland flow

Global Spinup

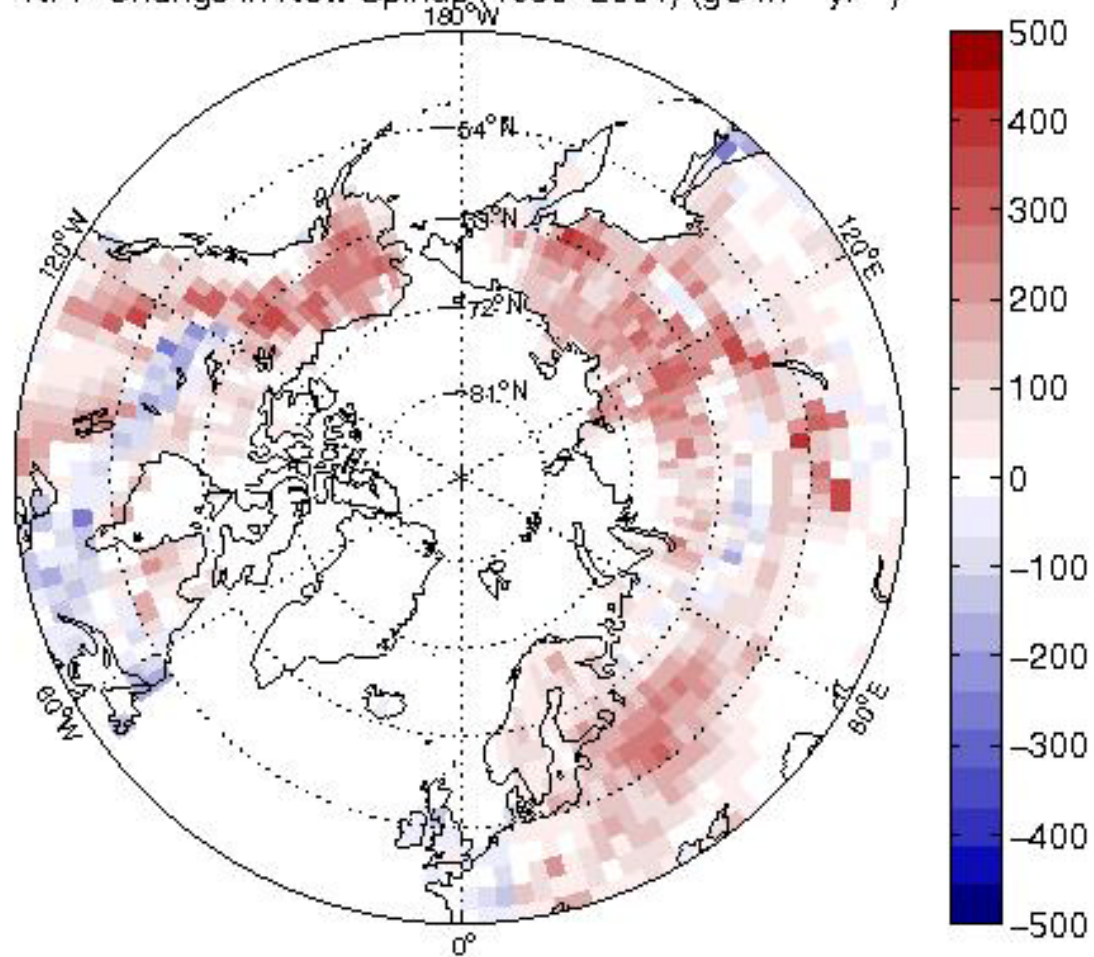
- Hydraulic changes for frozen soils
- C₃ arctic grass rooting depth
- Hydraulic and thermal property for high organic matter soil

Ice Hydraulic Impedance, Perched Water Table



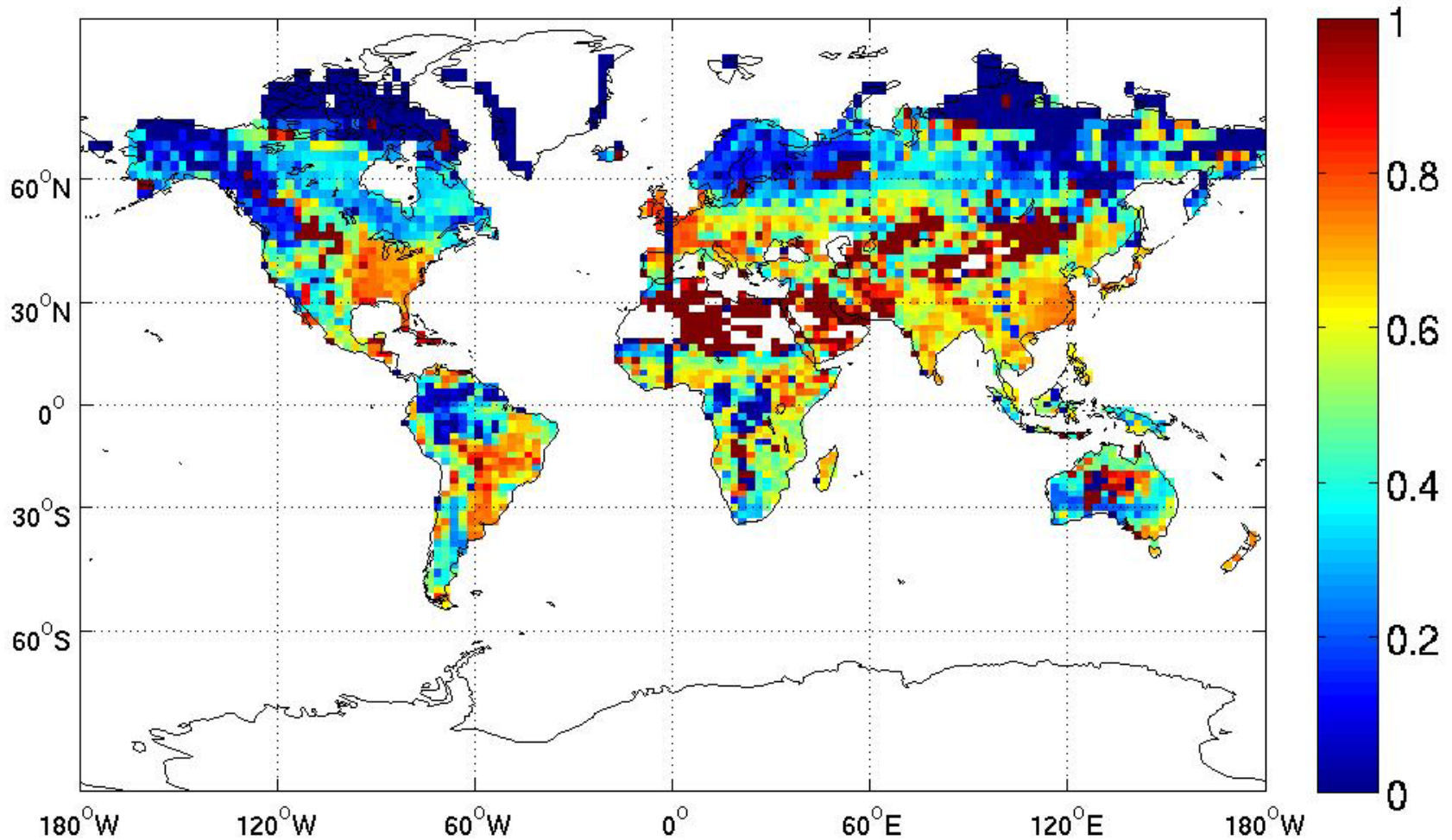
Change in NPP

NPP Change in New Spinup (1980–2004) ($\text{gC m}^{-2} \text{yr}^{-1}$)

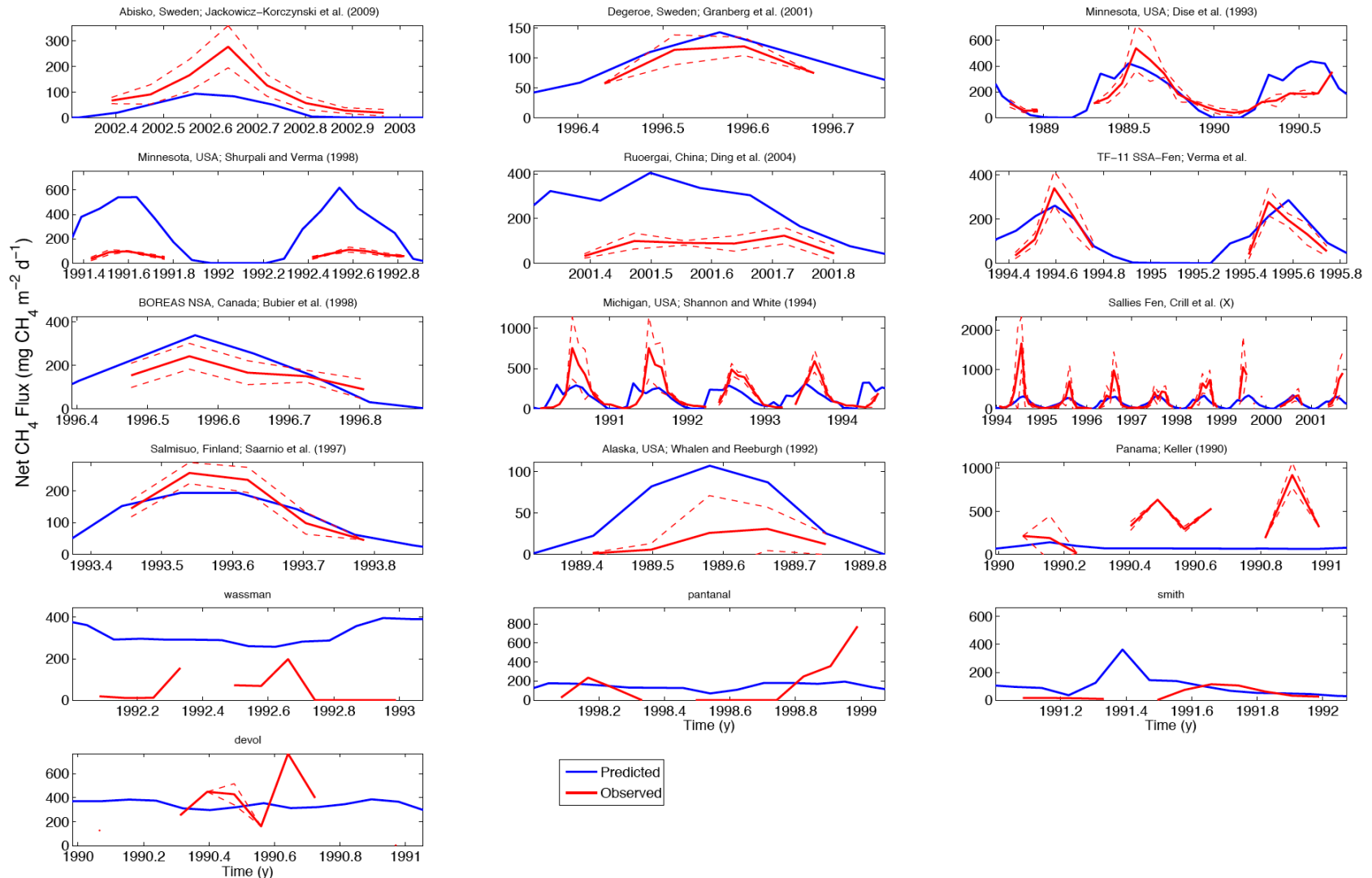


Aerenchyma

Prognostic Aerenchyma Oxidation Fraction

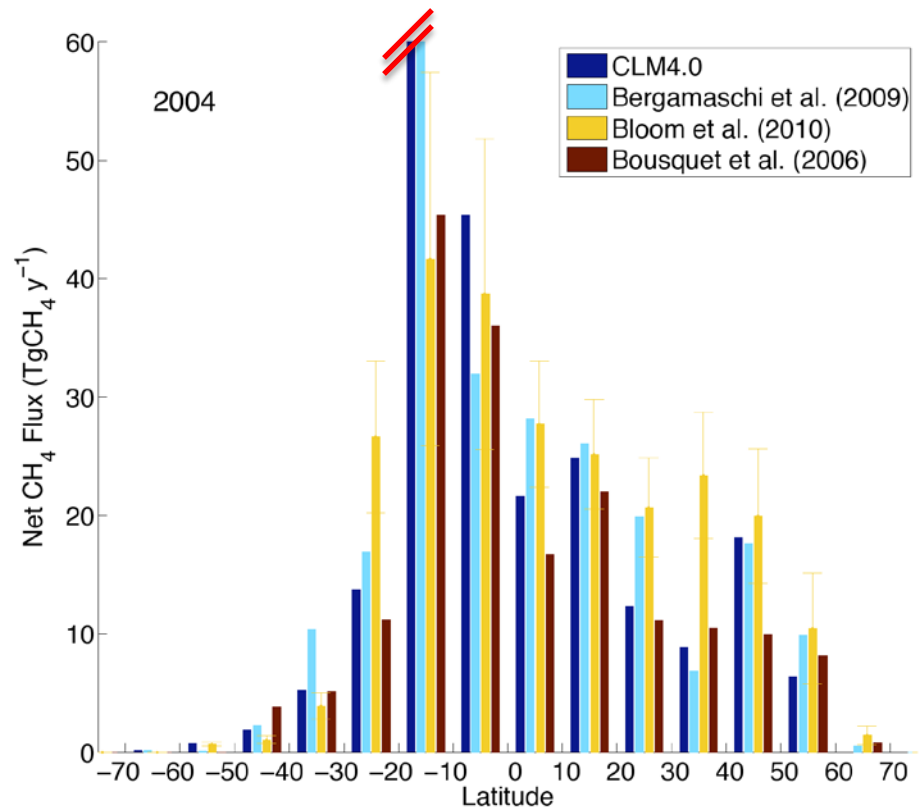


(Preliminary) Comparison to Site Data



Comparison to Global Inversions

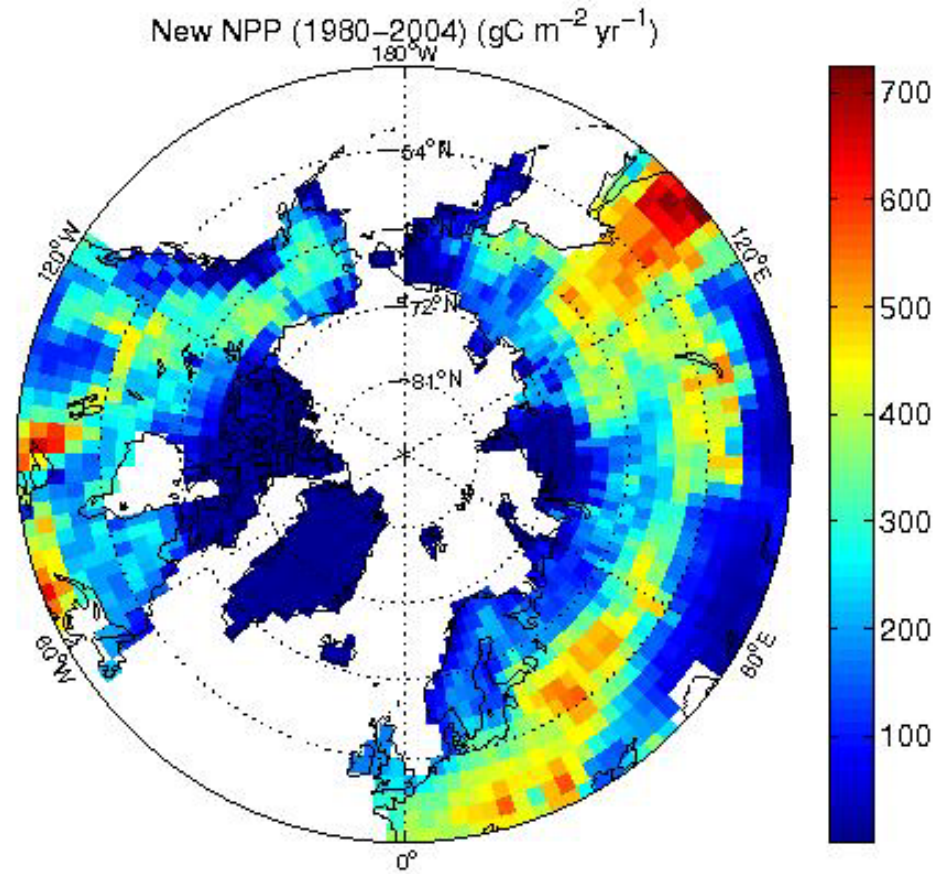
- Model broadly matches inversion estimates of zonal CH_4 emissions
- Southern Tropics discrepancy
 - Analysis underway to better understand discrepancies



Next Steps

- Finalize sensitivity analysis and model parameters
- Improvements in next phase
 - Proper treatment of inundated C cycle
 - Depth and vegetation representation
 - Permafrost soil C
 - Inundated fraction
 - Redox and pH prediction and effects on CH₄ emissions

NPP



Global CH₄ Emission Prediction

