

Fire differences between boreal North America and Eurasia: Implications for fire modeling in CLM

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Boreal forest fires important component of high-latitude (and global) climate system

- greenhouse gasses
- aerosols and black carbon
- surface biophysics

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Fire severities (and climate feedbacks) distinctly different between two continents

North America



<http://green.blogs.nytimes.com/2010/12/06/climate-change-igniting-deep-peatland-fires-study-says/>

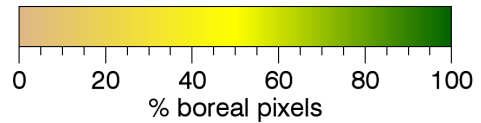
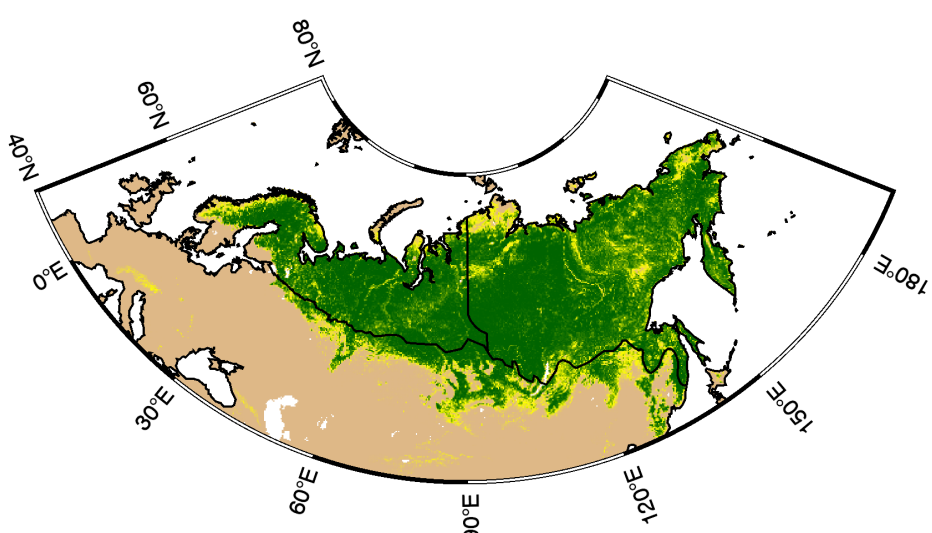
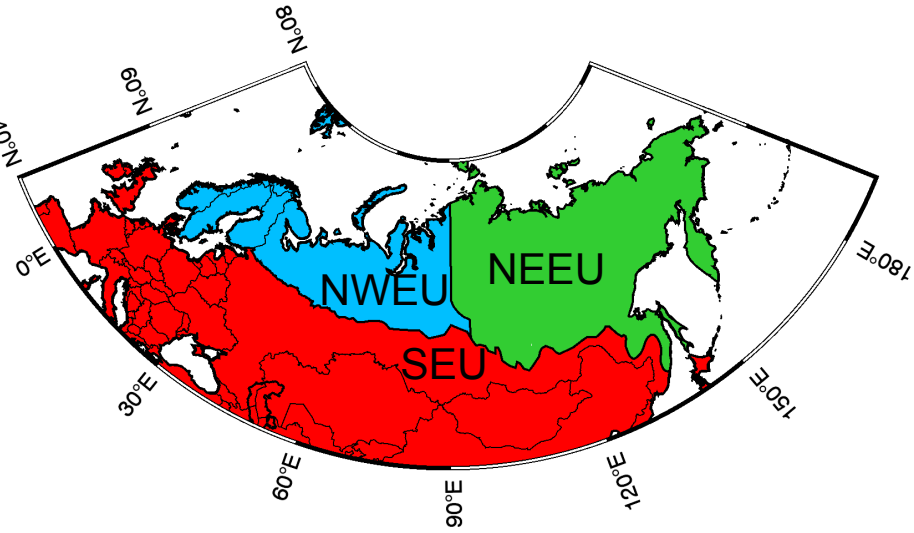
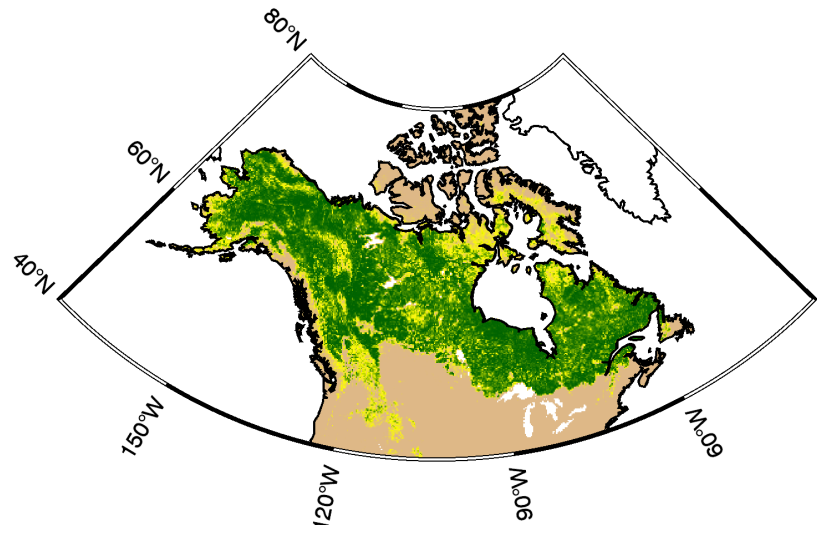
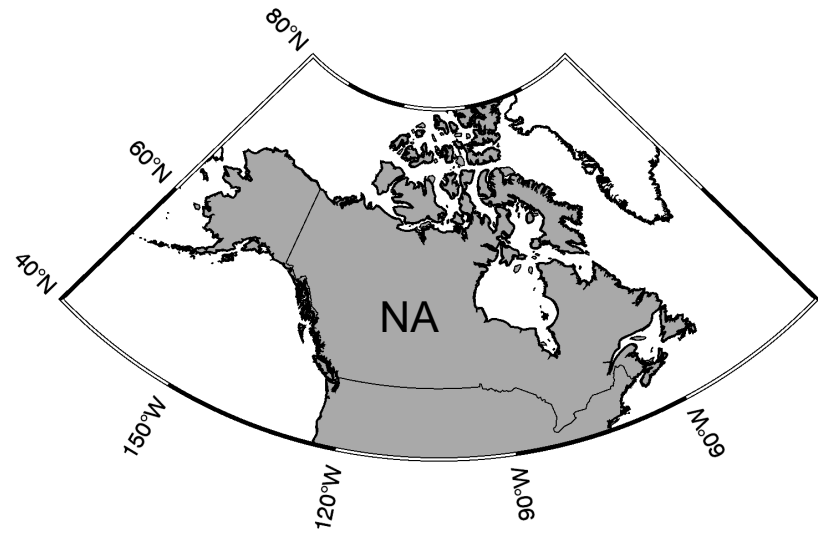


<http://www.alaska-in-pictures.com/black-spruce-on-fire-4295-pictures.htm>

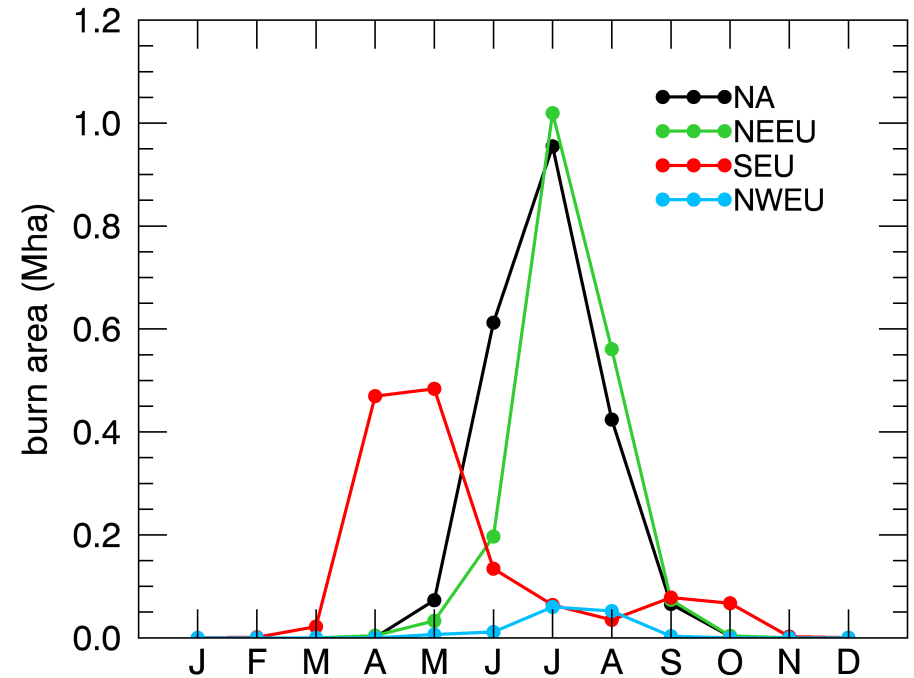
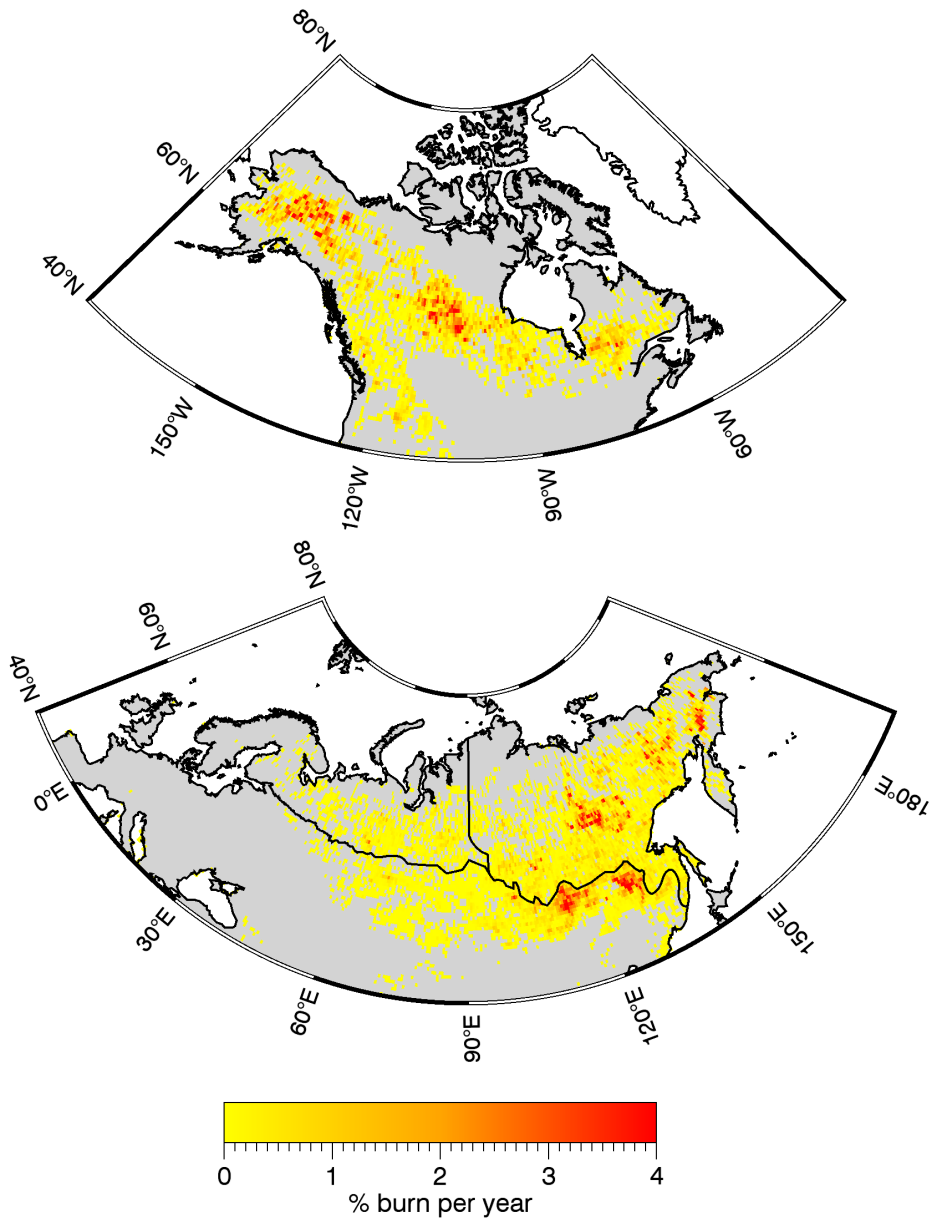
Eurasia



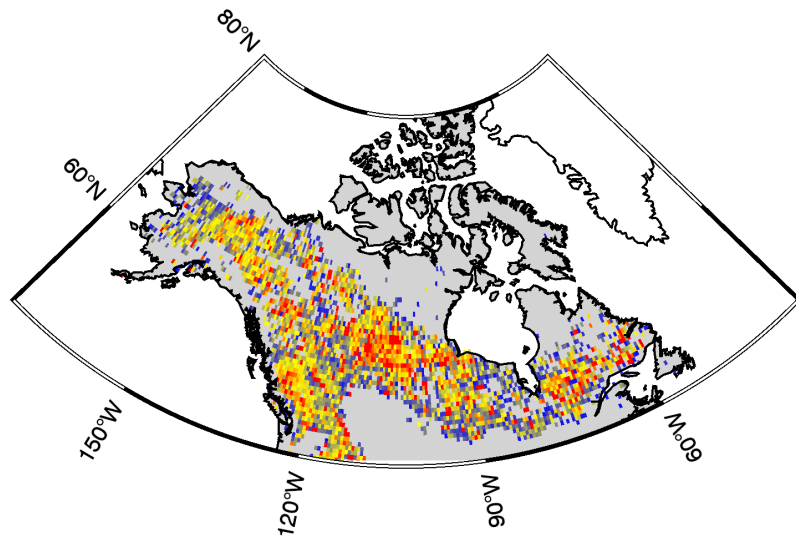
Domain



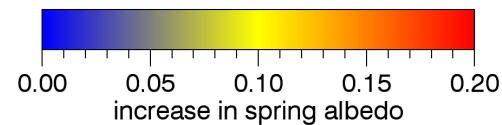
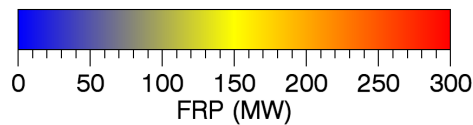
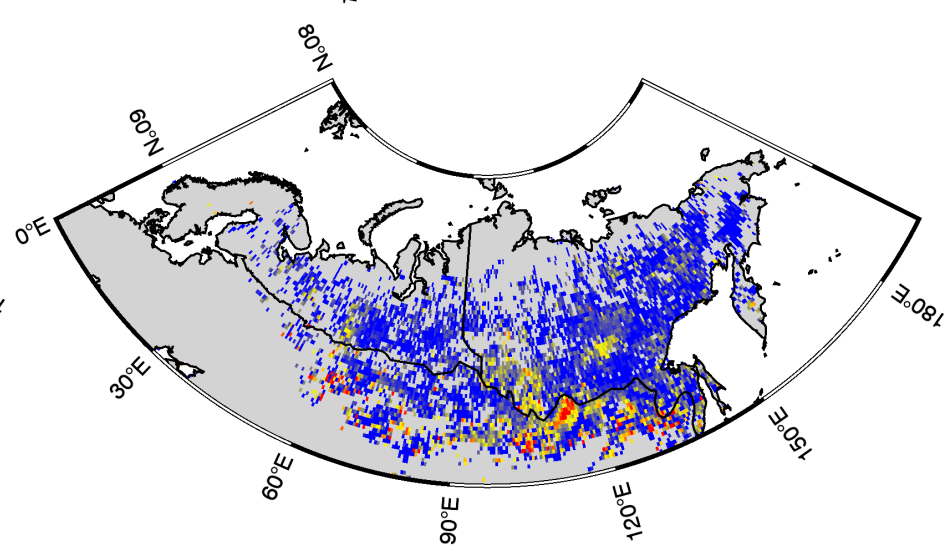
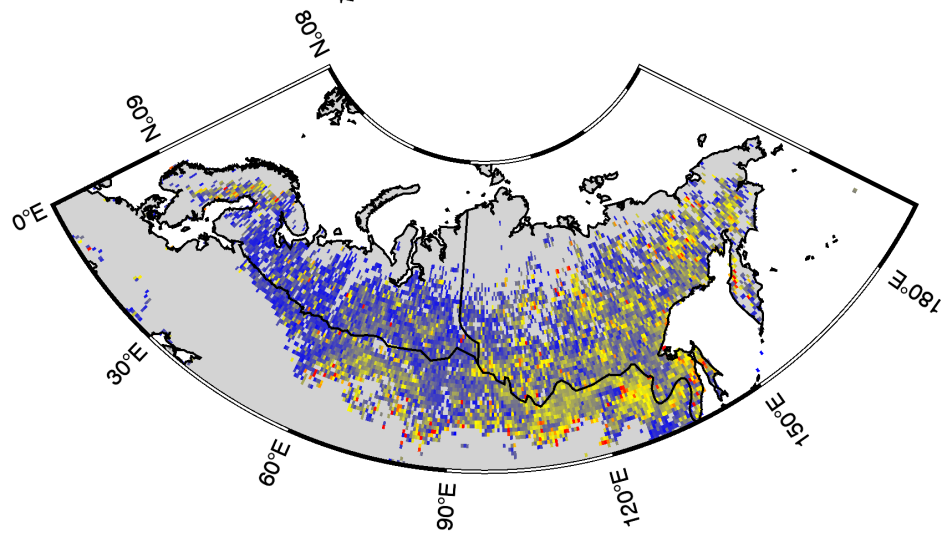
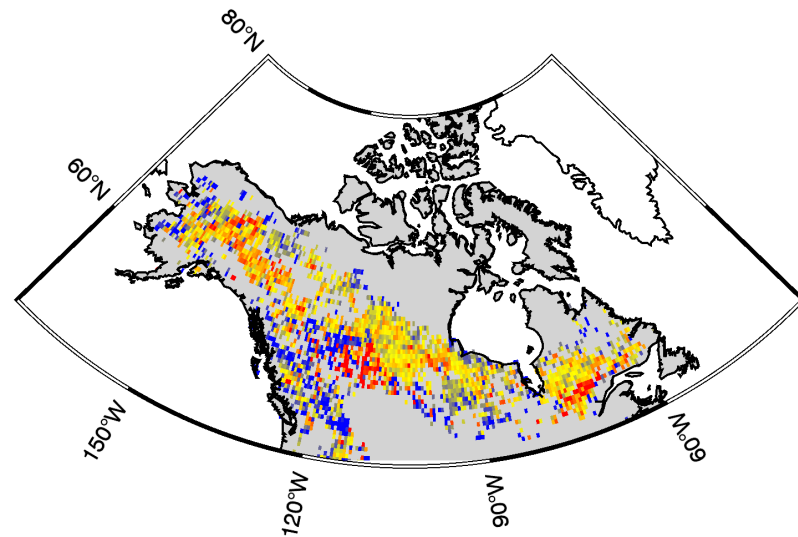
Burning Patterns (2001 – 2011)

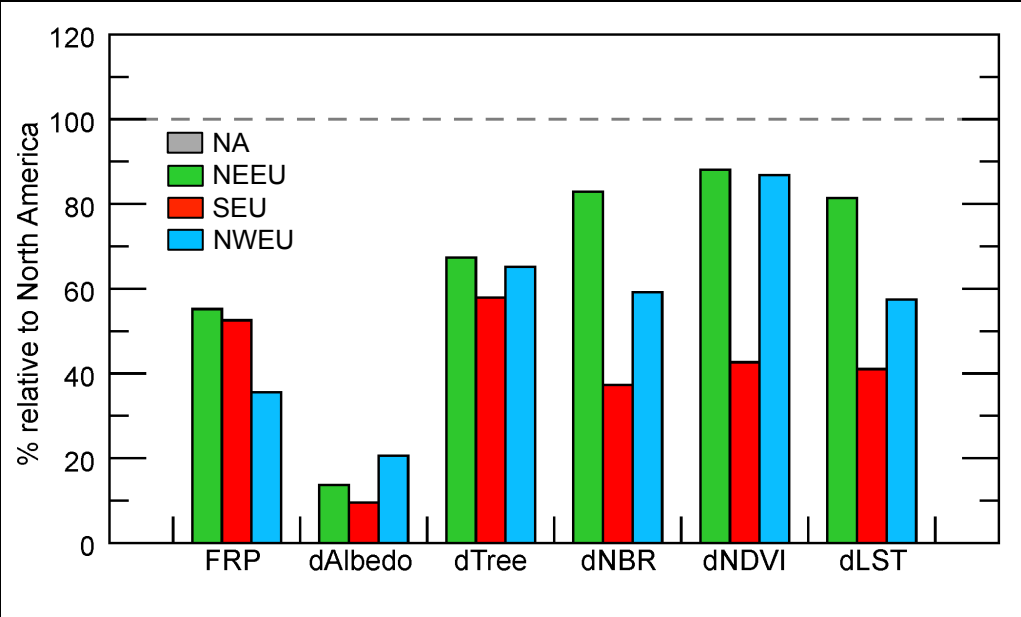


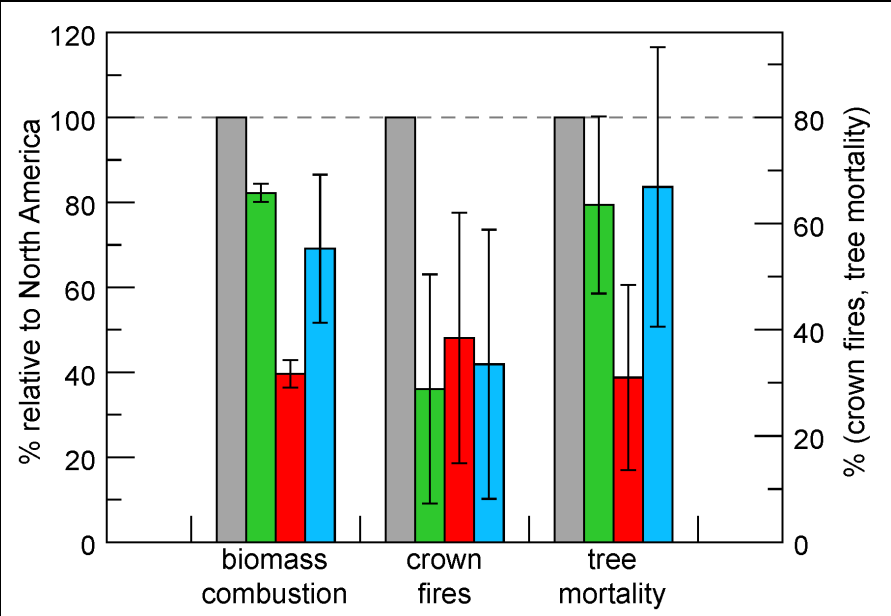
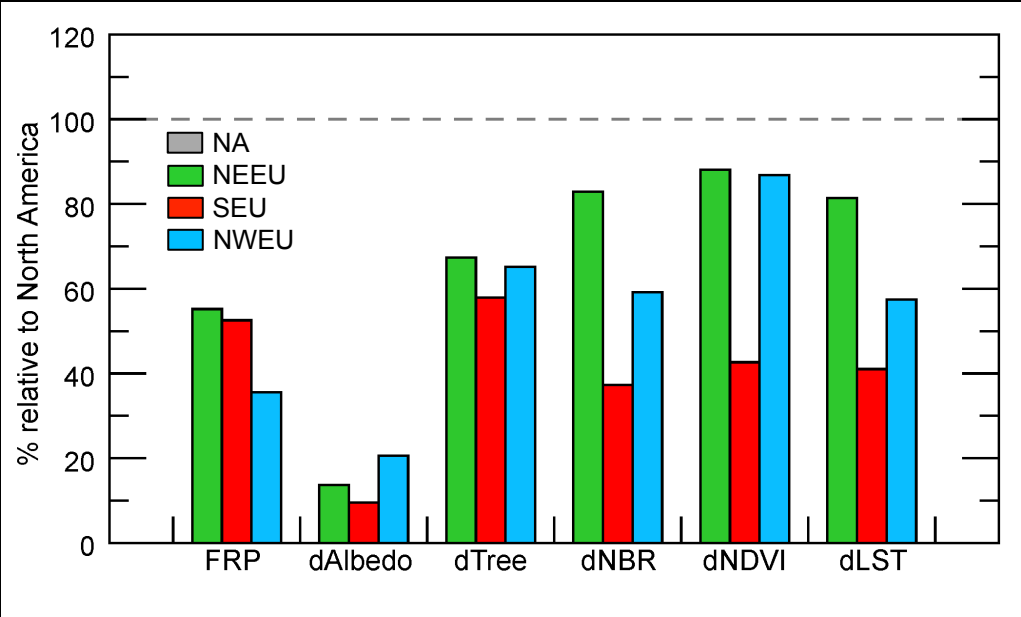
fire radiative power



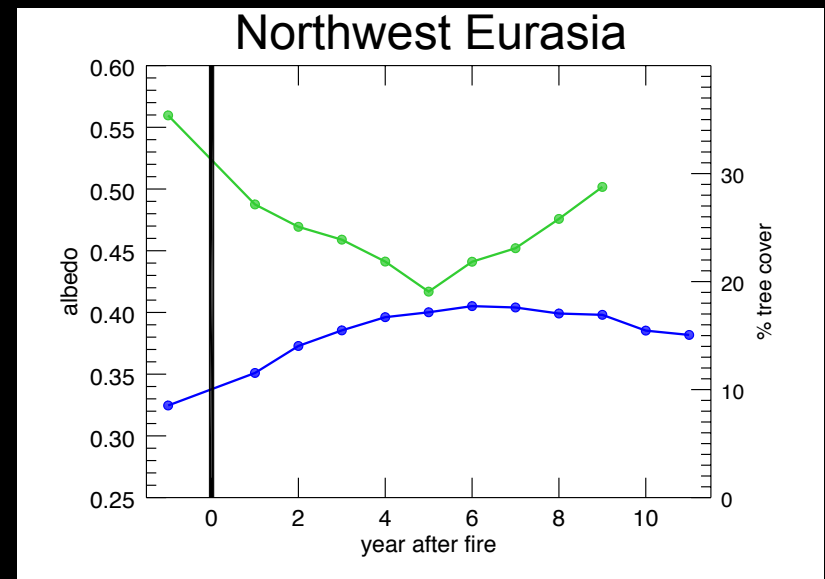
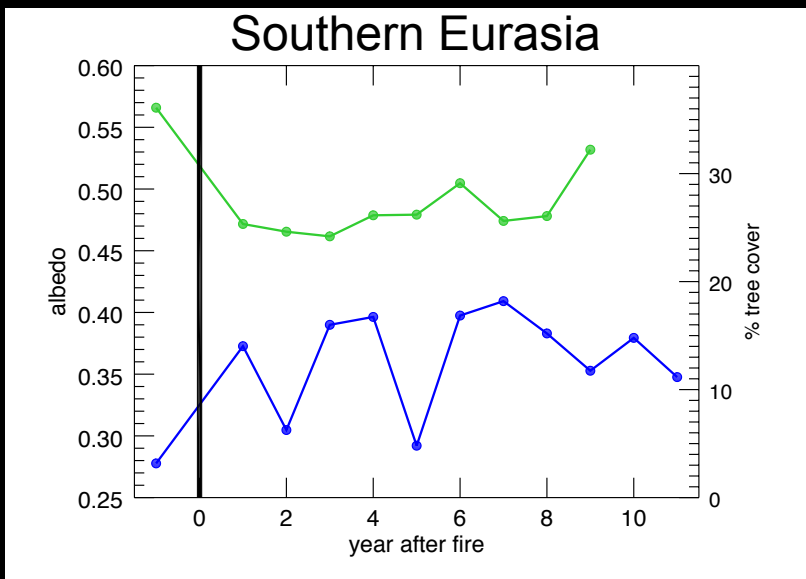
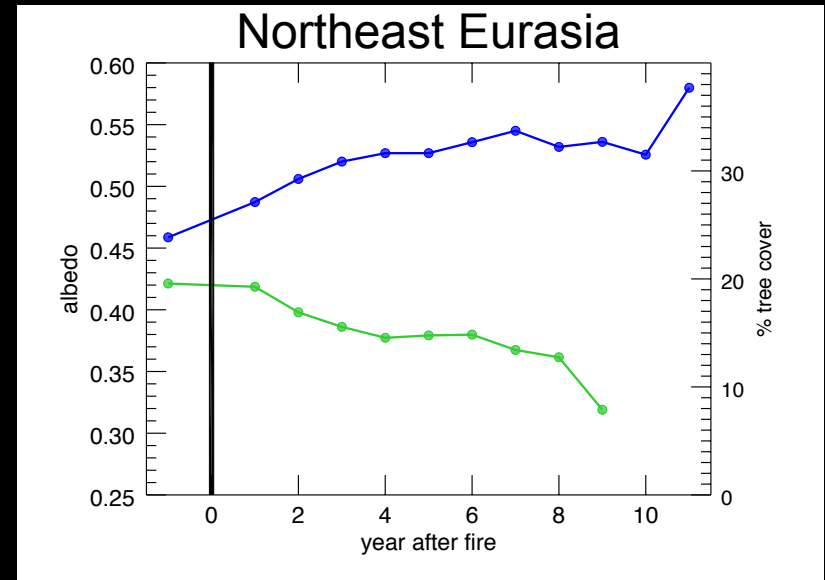
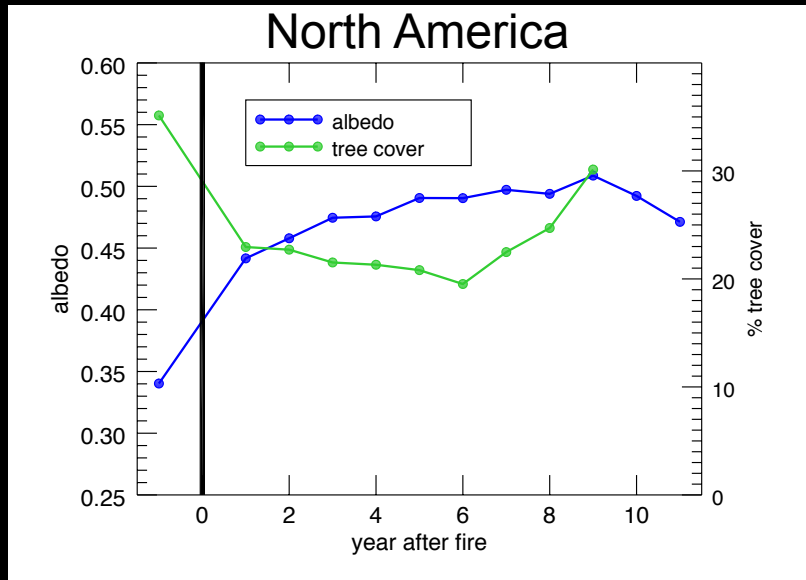
increase in spring albedo







post-fire trajectories



CLM simulations

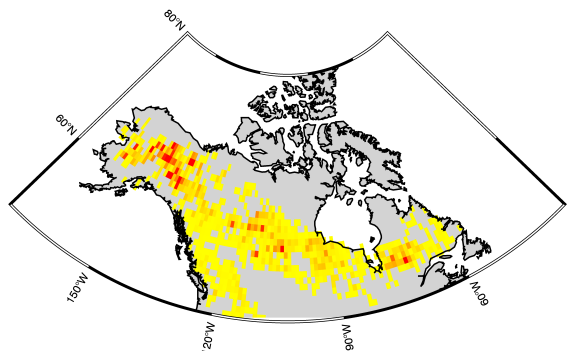
Offline CLM-CN

- 1) “clm4.0”: Thonicke et al. fire model, cesm1.0.2
- 2) “clm4.5”: Li et al. fire model, clm4.5 development version clm4_5_06

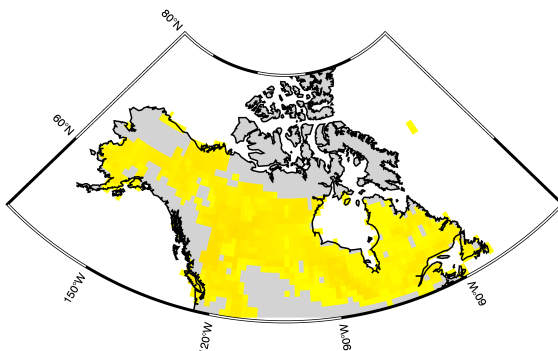
- a) natural burning: transient 1980 – 2004 forcings
- b) control: repeated year 2000 forcings, fire off
- c) 5% burn: repeated year 2000 forcings, one-time 5% burn
- d) 50% burn: repeated year 2000 forcings, one-time 50% burn

Burning Patterns (2001 – 2004)

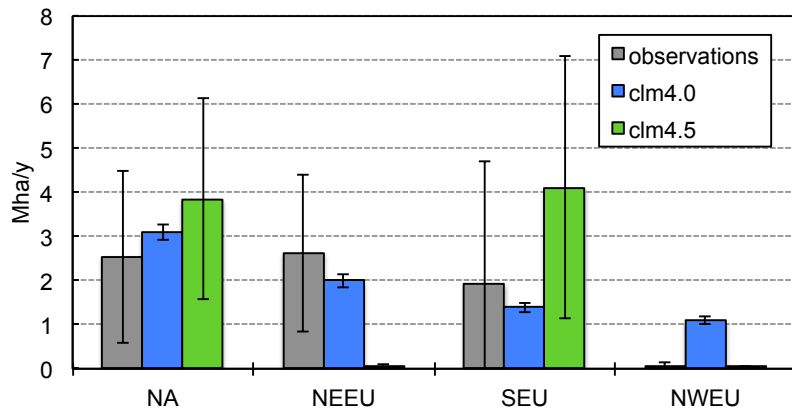
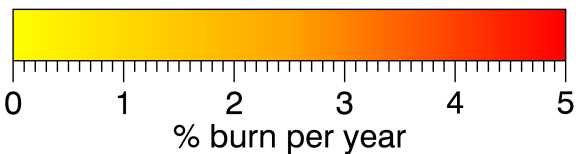
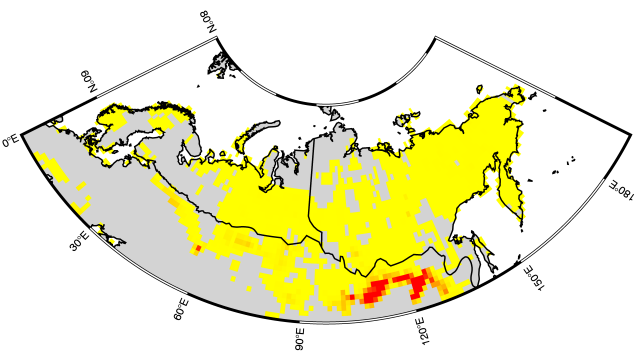
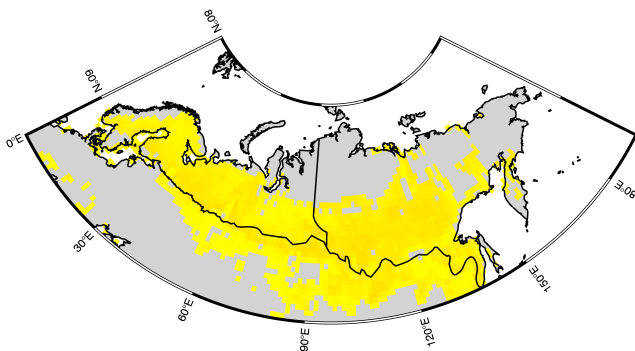
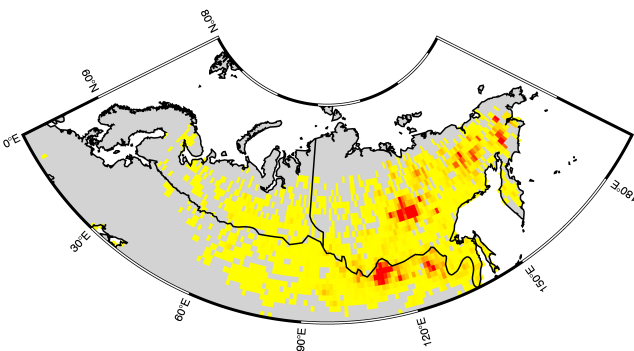
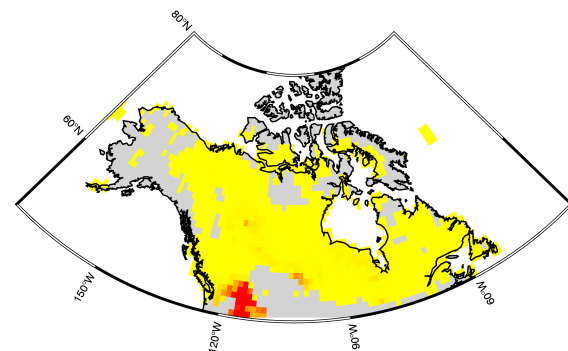
observations



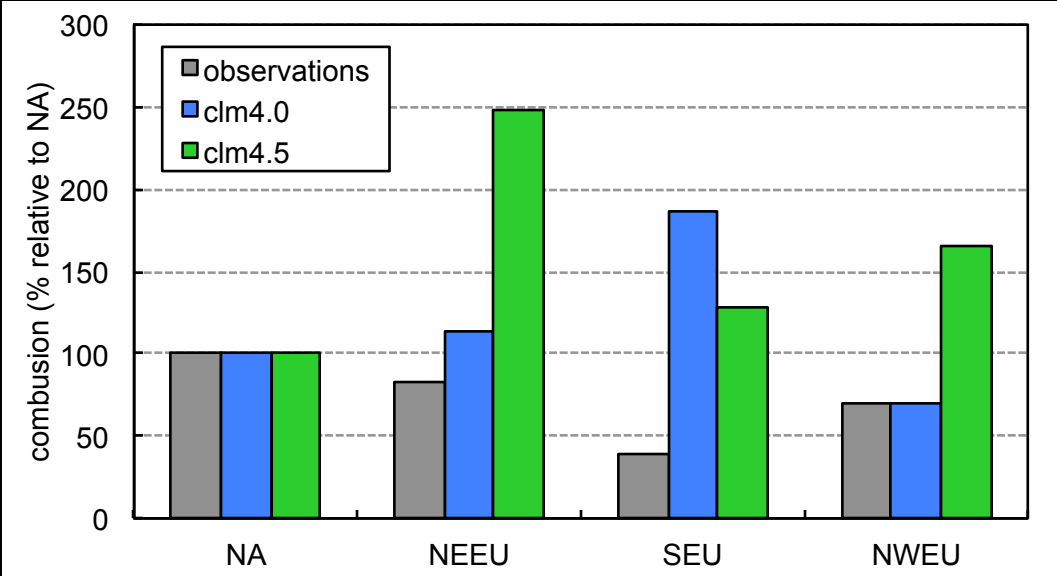
clm4.0



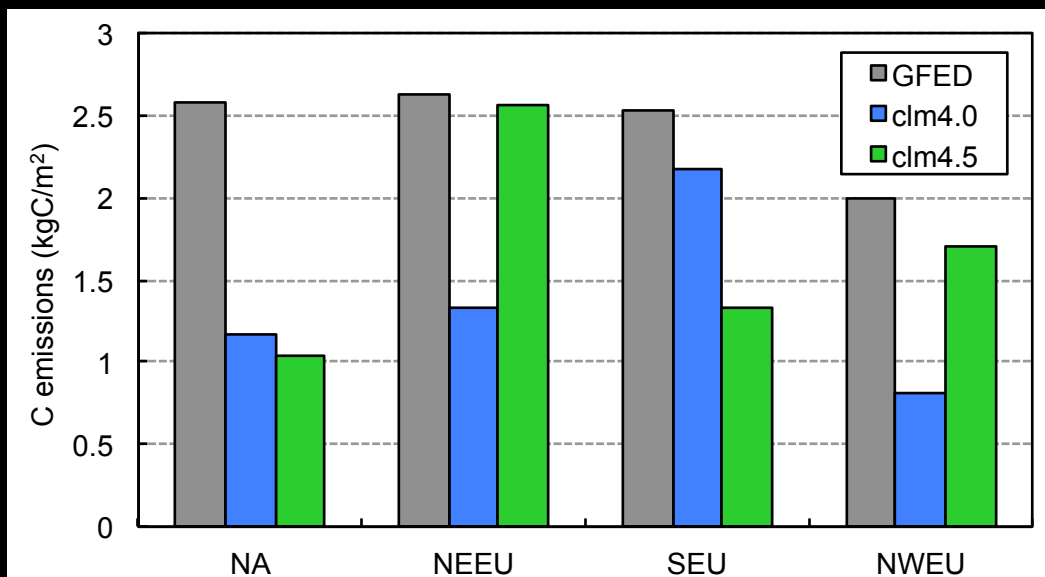
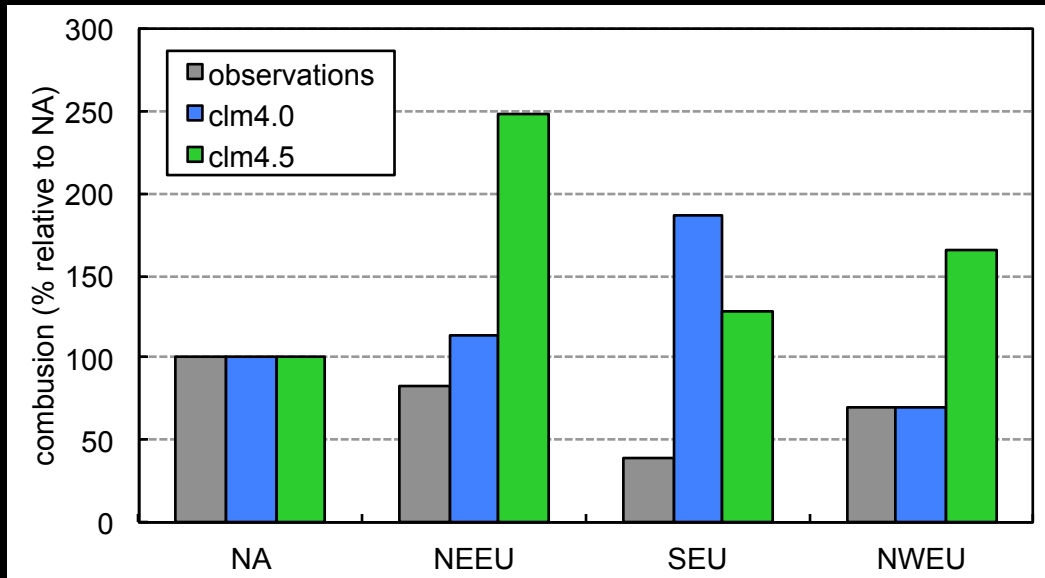
clm4.5



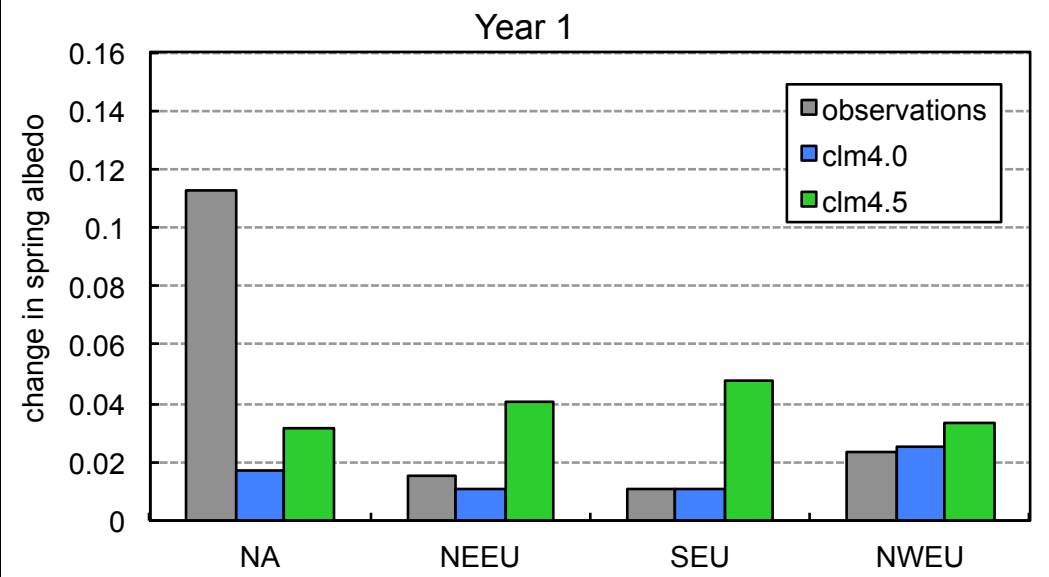
carbon emissions



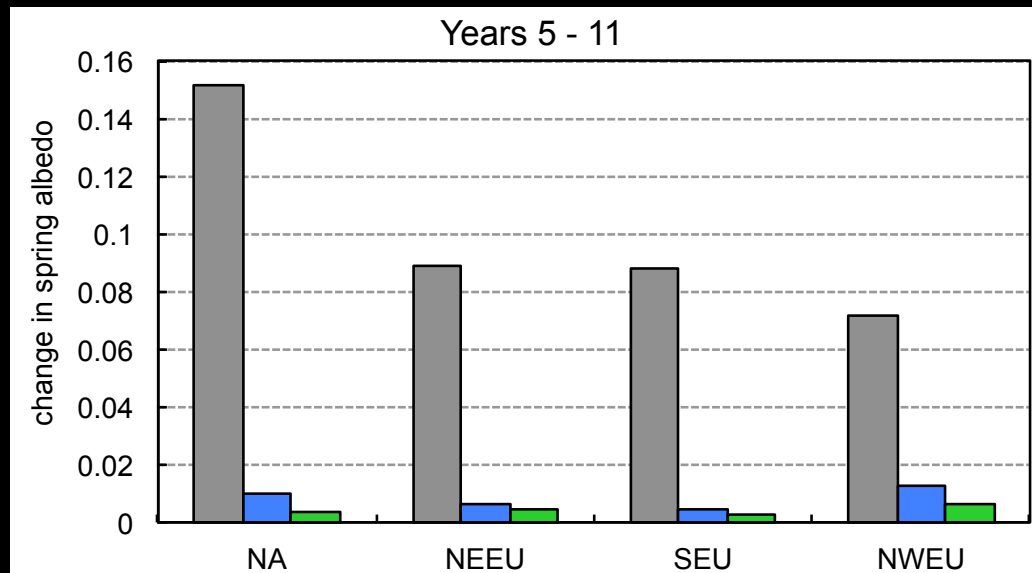
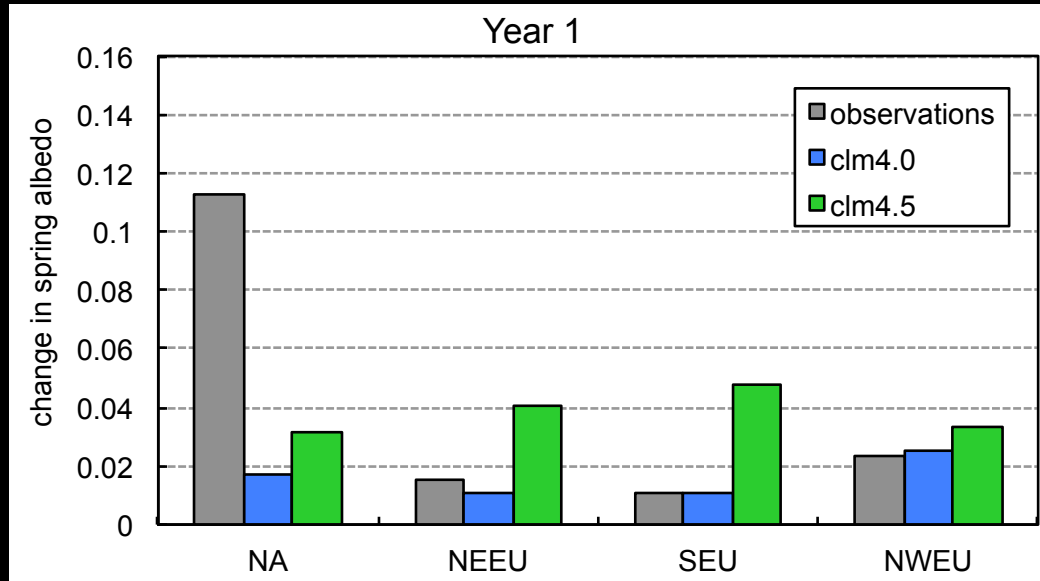
carbon emissions



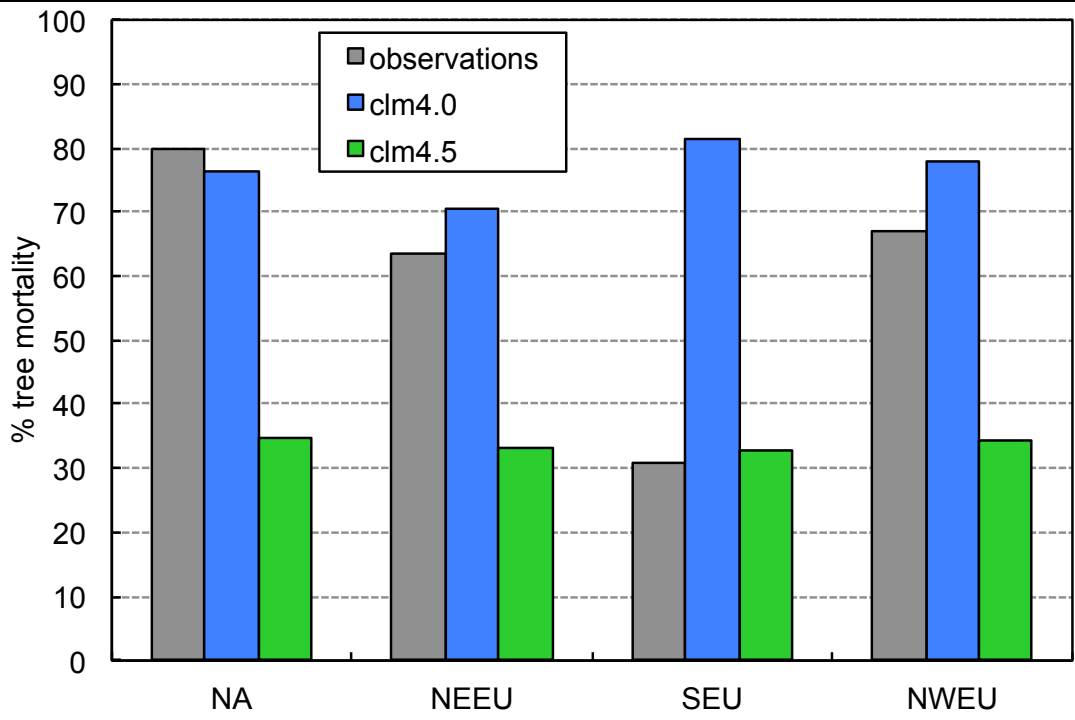
spring albedo



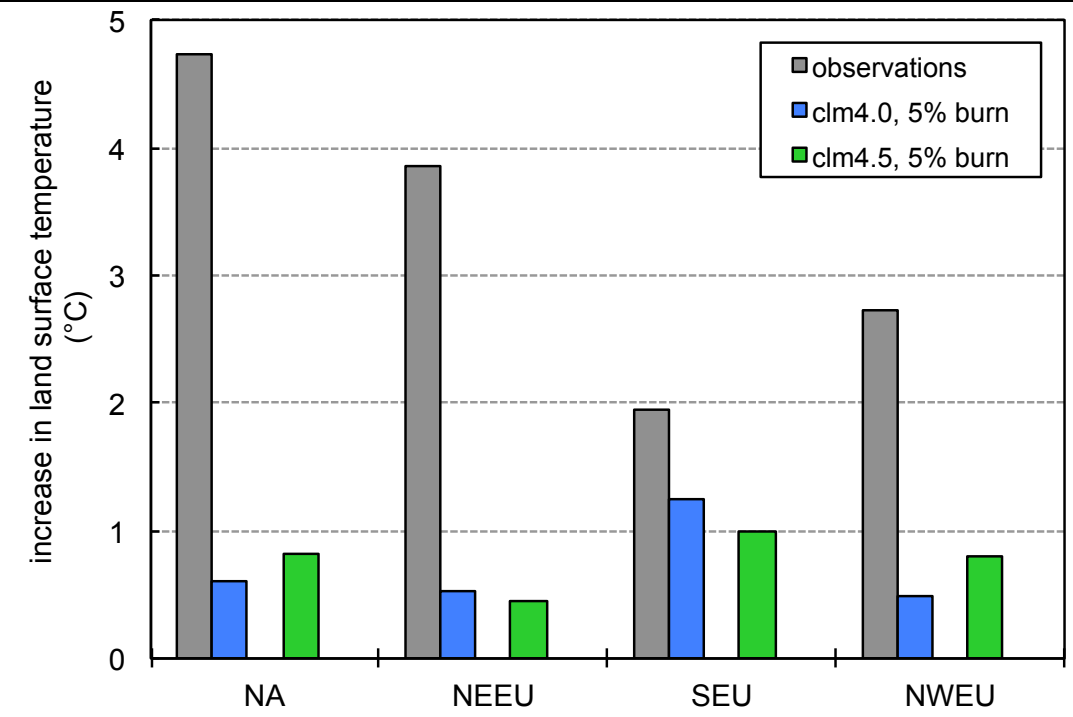
spring albedo



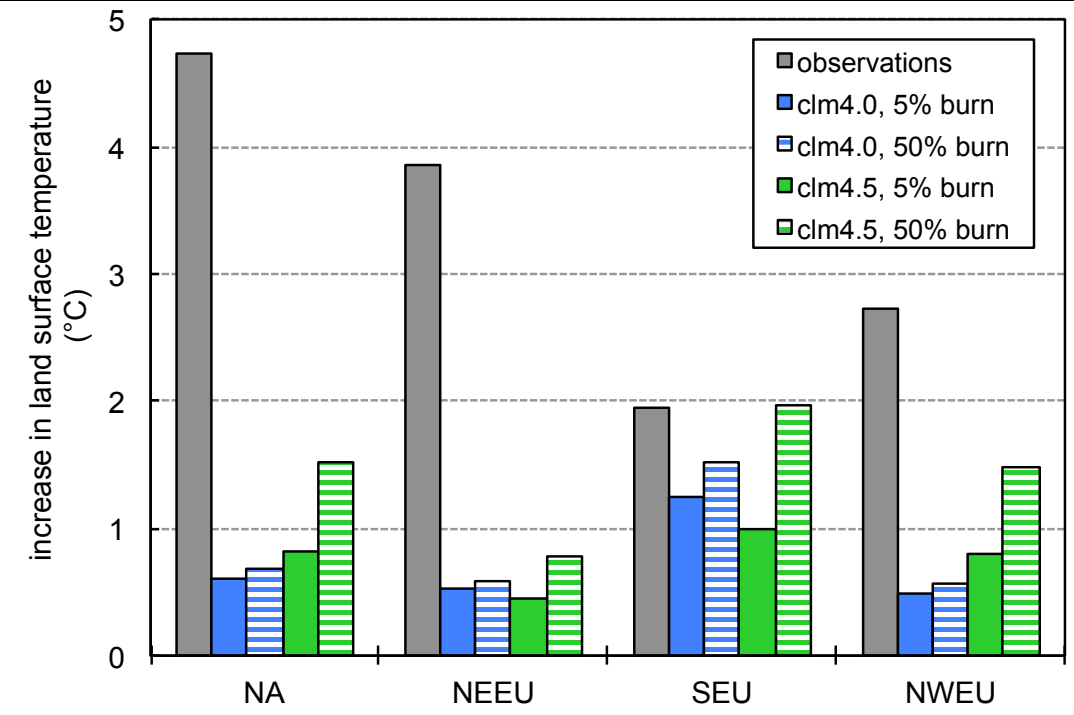
tree mortality



land surface temperature



land surface temperature



Conclusions

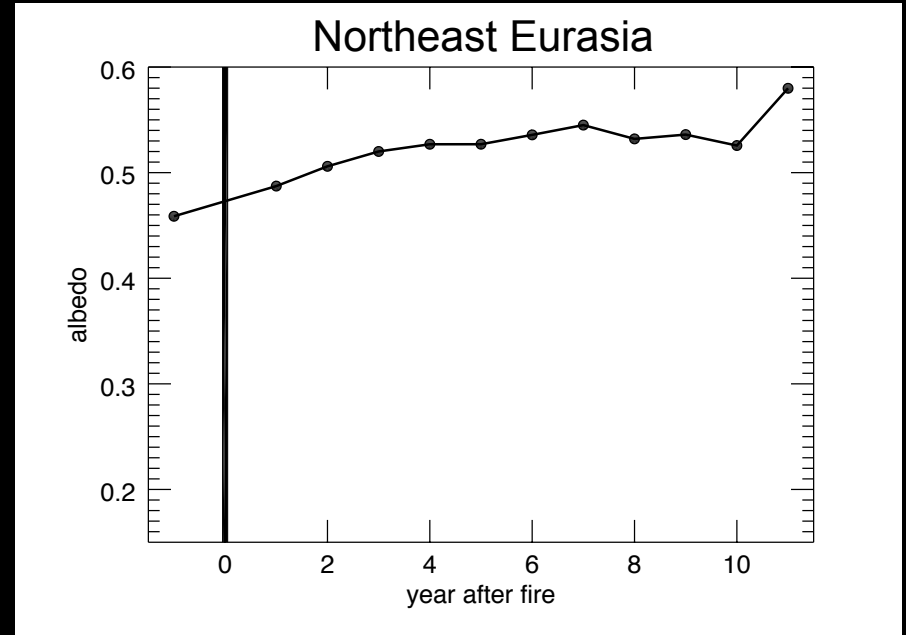
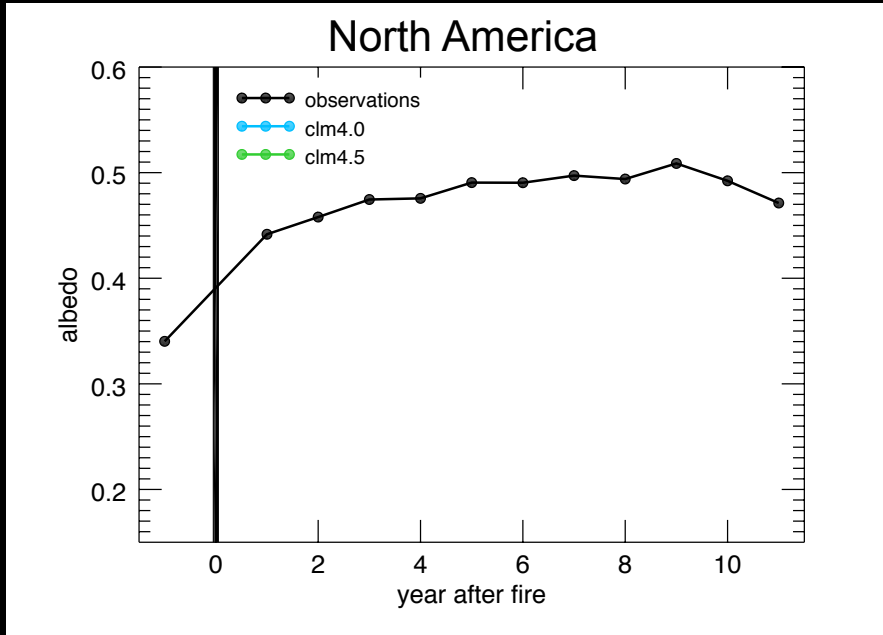
Data Analyses

- Eurasian boreal forests:
 - lower intensity surface fires vs. North America
 - lower % tree mortality and combustion
- implications for fire-climate feedbacks
- due to fuel continuity, leaf moisture, and species' evolutionary history

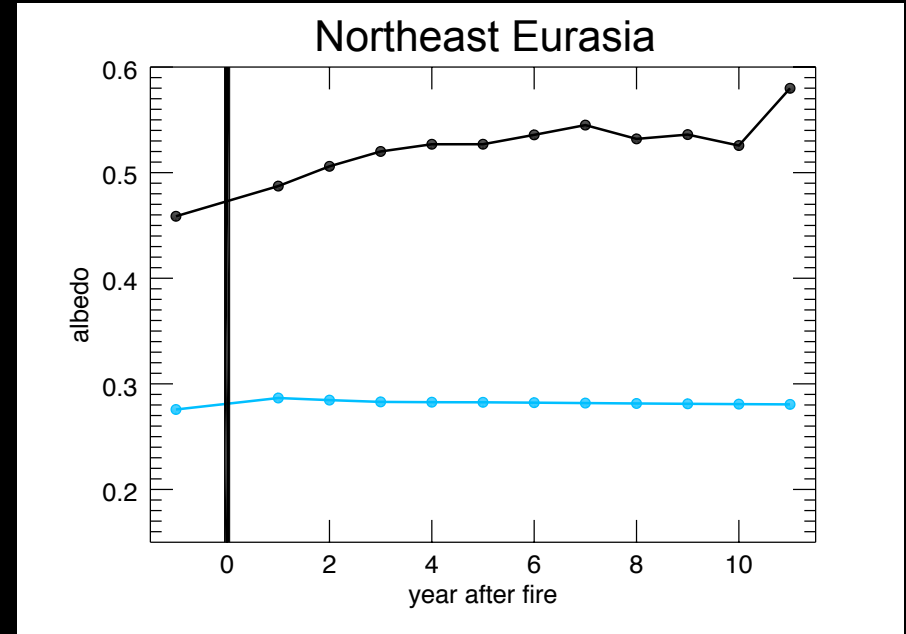
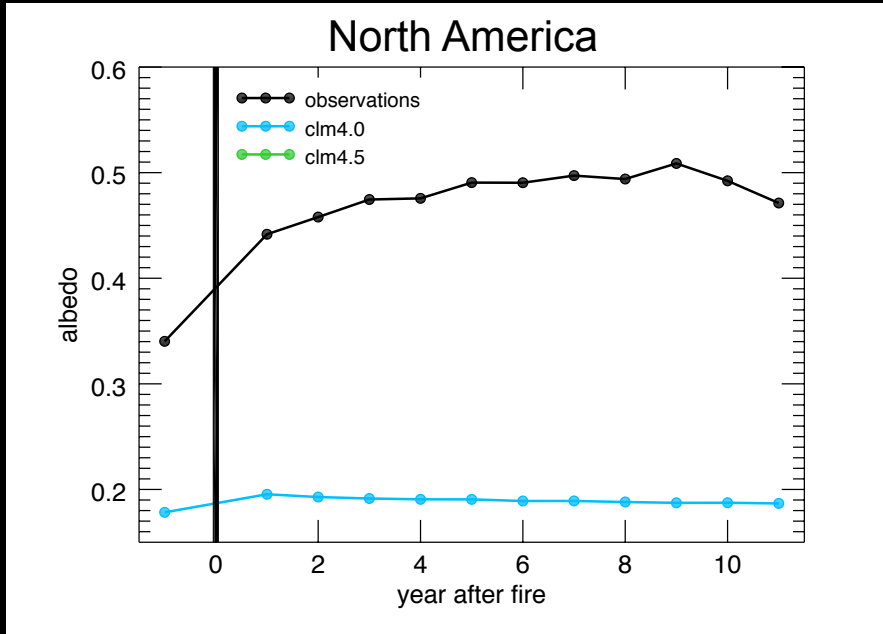
CLM Fire Modeling

- Not capturing:
 - boreal forest burning patterns
 - different severities between North America and Eurasia
 - magnitudes and trajectories of biophysical feedbacks
 - relative scale-independence of disturbance
- Future work
 - tune fire model for boreal dynamics
 - combust soil organic matter
 - compare to CNDV, CLM-ED
 - change mortality/combustion parameters for Boreal Deciduous Needleleaf
 - consider continent-specific fire parameterizations
 - use CLM-ED to capture post-fire stand dynamics
 - post-fire char parameterization

spring albedo



spring albedo



spring albedo

