Effects of intermediate disturbances on the carbon cycle in the upper Midwest

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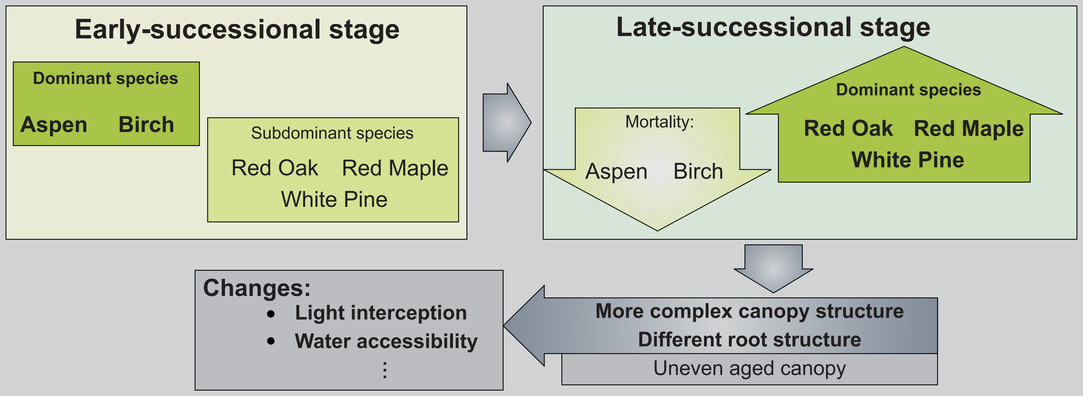
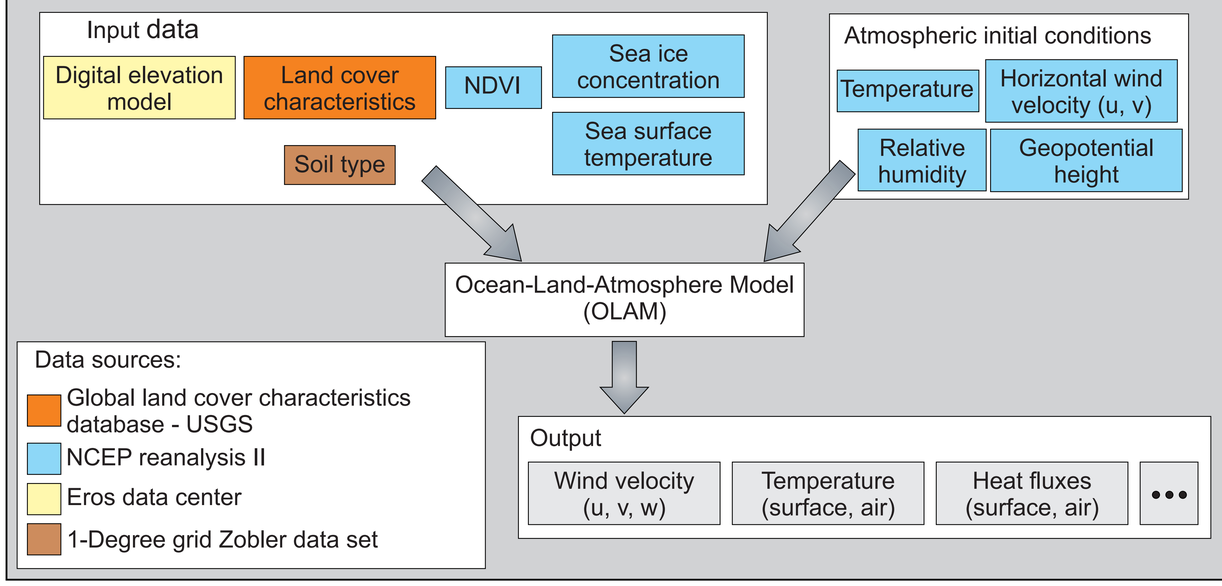
Problem Statement

Natural succession



How carbon and water fluxes respond to such changes??

2 Simulation schematics



1 Methodology

The Forest Accelerated Succession ExperimenT (FASET)

Spring 2008:
Aspen and birch girdled ~33 hectares

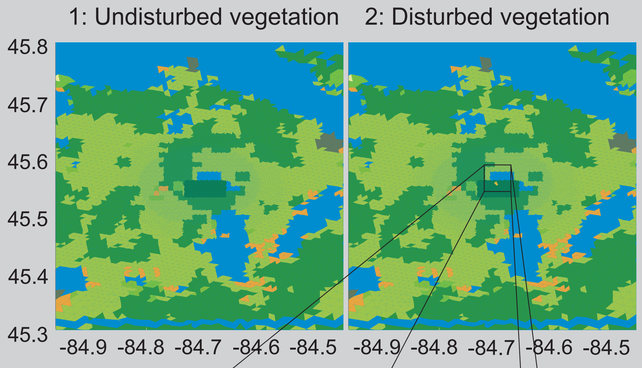
Summer 2009:

~30% decrease in LAI
slight decrease in Albedo

The simulation scenarios

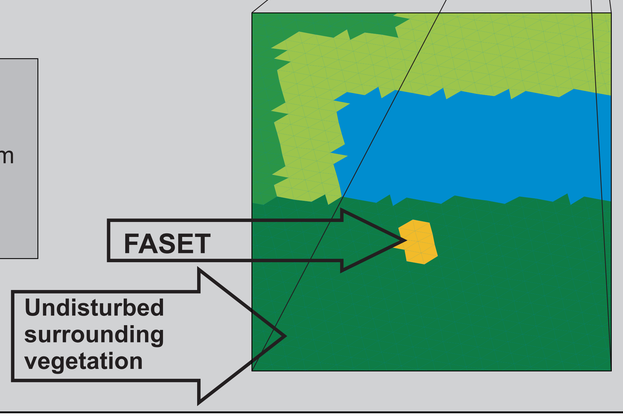
Case 1 - Undisturbed:
Based on deciduous broadleaf tree class:
Albedo: 0.17
TAI max: 7.0
SAI: 1.0

Case 2 - Disturbed vegetation:
Albedo: 0.15
TAI max: 4.9
SAI: 0.7

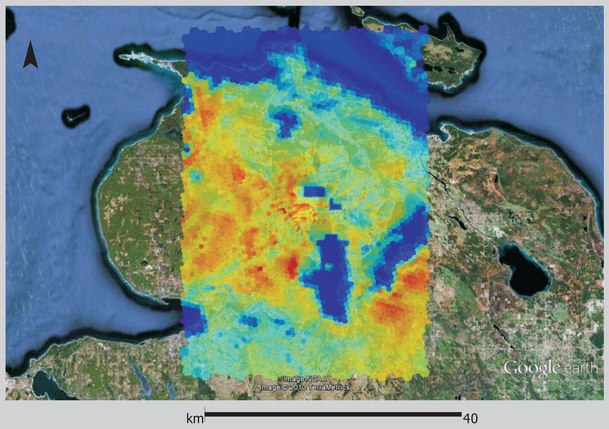


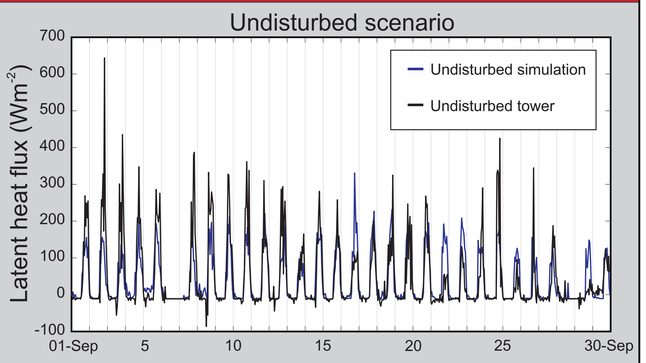
Mesh characteristics:
Hexagonal polygons
Maximum mesh refinement level: 12
Maximum horizontal resolution ~ 100m
Maximum vertical resolution = 30m

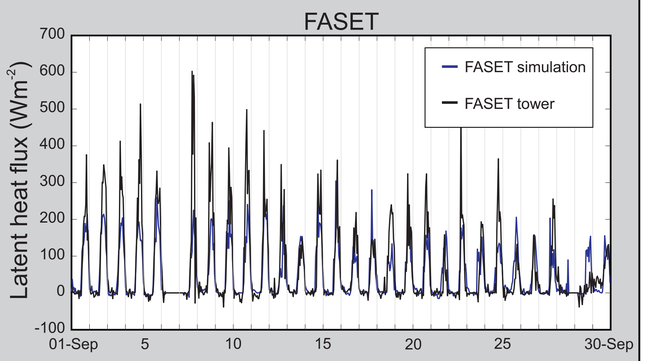
Time step: 0.5 s

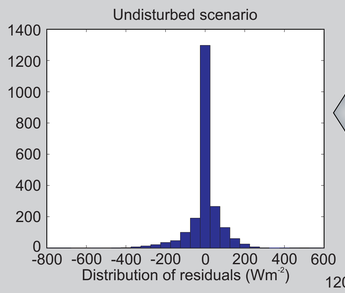


3 Results







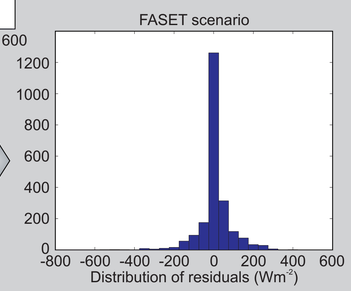


Statistics:

Average: -0.16 Wm^{-2}
Standard deviation: 77.9 Wm^{-2}
Skewness: -1.32 $(Wm^{-2})^3$

Statistics:

Average: 8.2 Wm^{-2}
Standard deviation: 78.2 Wm^{-2}
Skewness: -1.32 $(Wm^{-2})^3$



	Total heat flux (kJm^{-2})	Bias %
Undisturbed	148.68	-0.2%
Tower	149.03	-
FASET	164.52	+12%
Tower	146.38	-

Conclusions

- **FASET** simulation showed a larger bias (**12% overestimation of latent heat flux**) than the **Undisturbed simulation** (**0.3% underestimation** of latent heat flux) when contrasted to tower data.
- The current **undisturbed parameterization** seems adequate for **monthly heat flux** calculations, despite simplicity of the big leaf model.
- Study of the effects of **disturbances** requires a **more sophisticated** model. Future research will incorporate Ecology Demographics 2.