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State-of-the-art capabilities in LPJ-GUESS

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State-of-the-art capabilities in LPJ-GUESS



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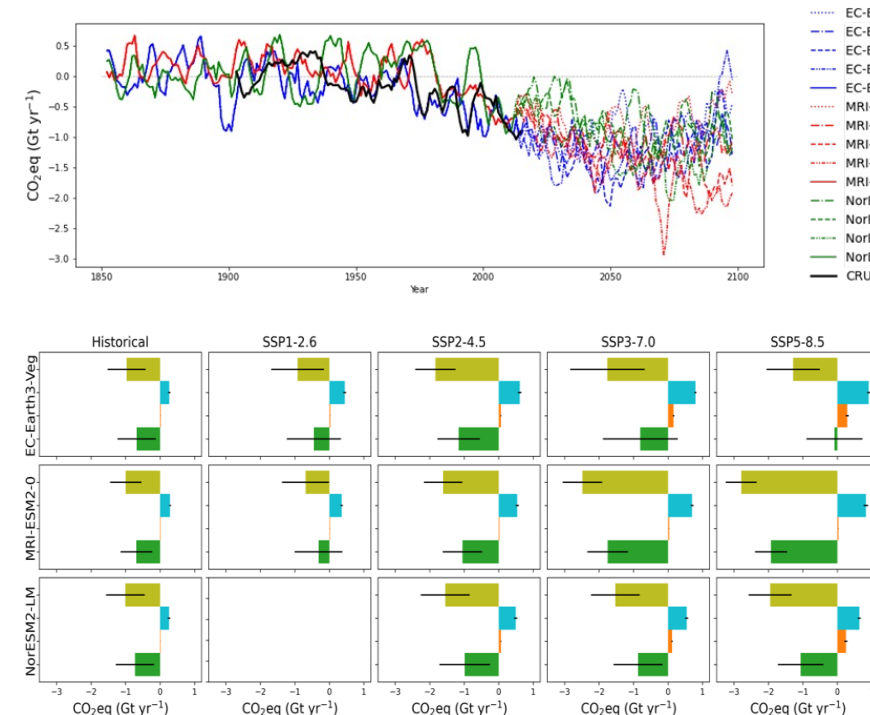
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Overview

LPJ-GUESS is an advanced DGVM including detailed forest demography and management, croplands, wetlands, specialised arctic processes, emissions of non-CO₂ GHGs and a highly flexible land-use change scheme which tracks transitions between different land-uses. It is the vegetation component of the EC-Earth CMIP6 ESM, the RCA-GUESS regional ESM, and also has a European mode operating at tree species level.

Dedicated high-latitude features

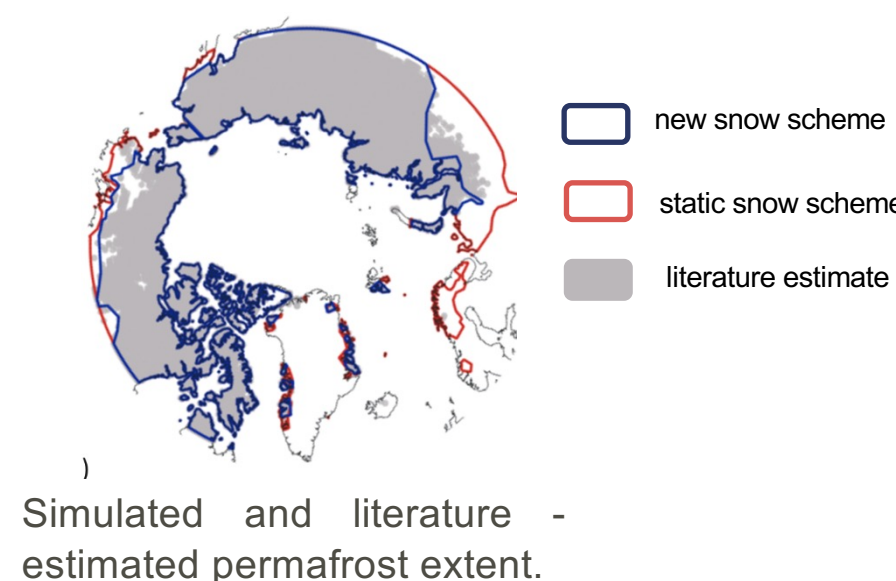
- High-latitude shrub and tundra PFTs
- Peatland PFTs and biogeochemistry, incl. CH₄
- Improved soil physics and biogeochemistry, including permafrost, wetland hydrology, soil N₂O emissions



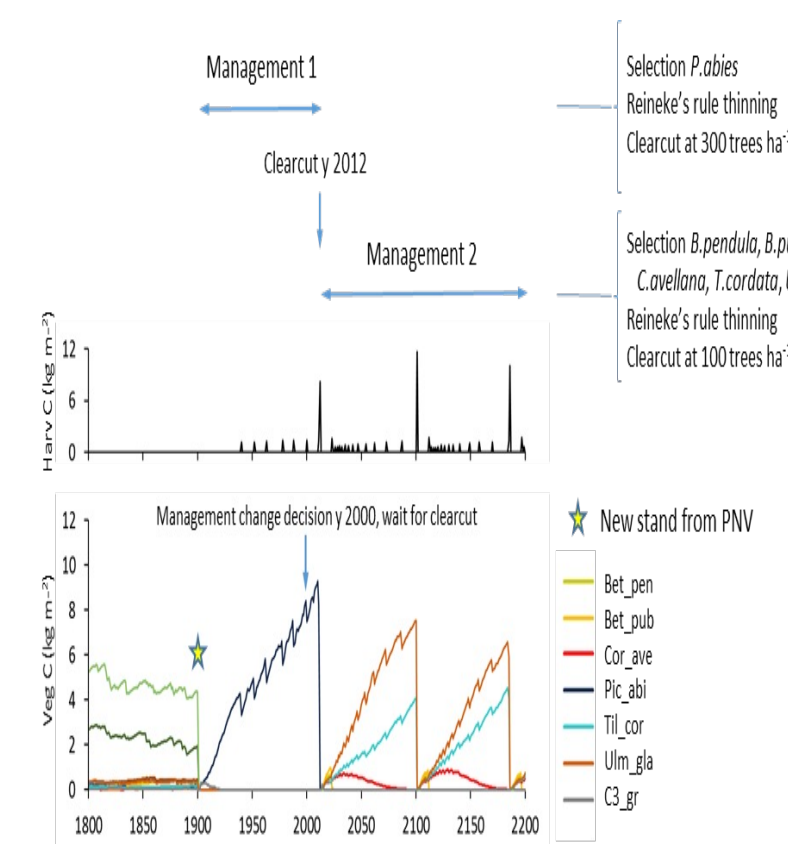
- Annual CO₂-eq estimates indicate an increased sink, with increased CO₂ uptake (treeline advance, increased tree and shrub growth) only partially counteracted by greater respiration and CH₄ and N₂O emissions

Arctic cold-season focus:

- Dynamic, multi-layer snow scheme
- Improved permafrost extent
- Improved near-surface soil temperature



Forest management



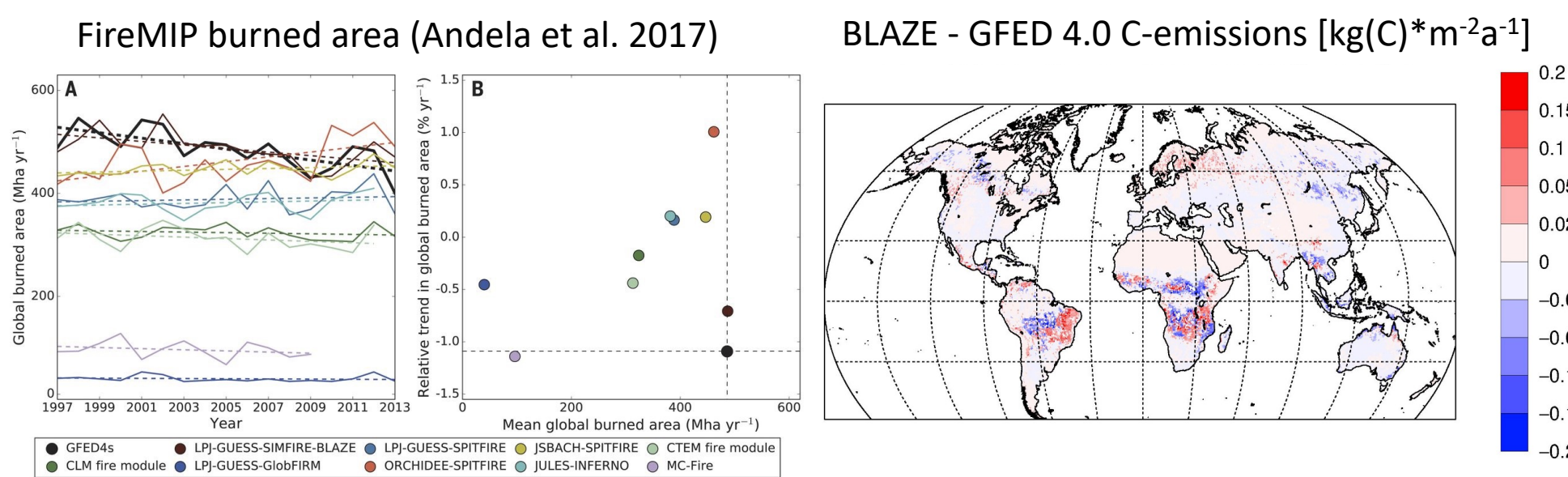
Automated harvest examples and management changes.

- Forest initialization: Land-use history, species & age structure
- Harvest alternatives: Clearcut w. thinnings/ continuous Automated/ fixed (detailed)
- Management change

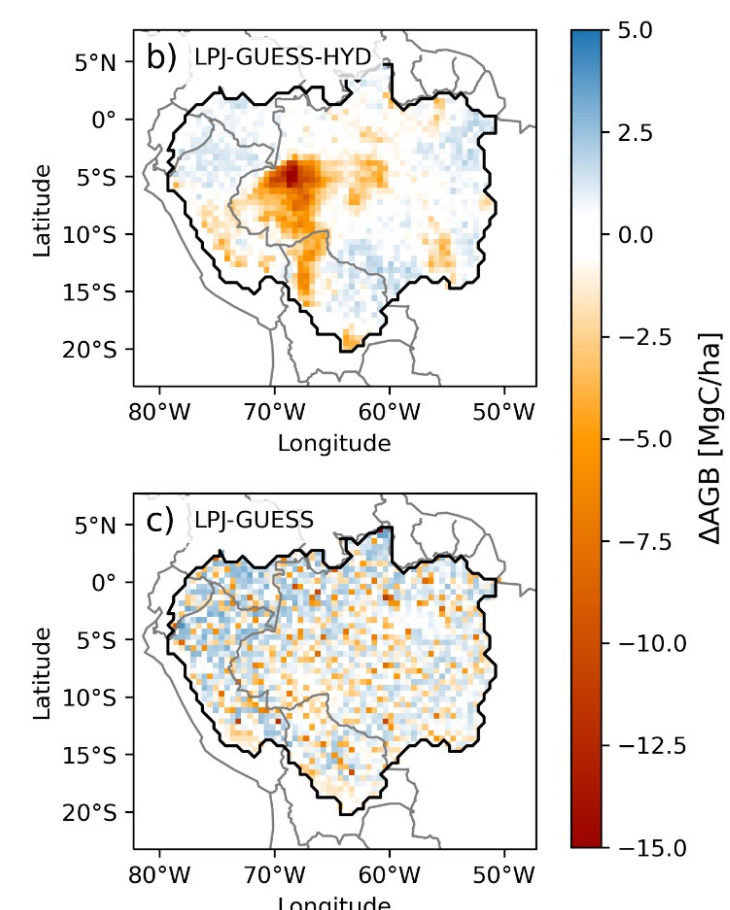
Fire dynamics

The wildfire model SIMFIRE-BLAZE provides

- Daily burned-area and C,N turnover
- Fire-line Intensity (FLI) based on fuels and fire-weather
- Biome specific tree-mortality based on allometry and FLI
- Combustion completeness depending on FLI



Plant hydraulics*

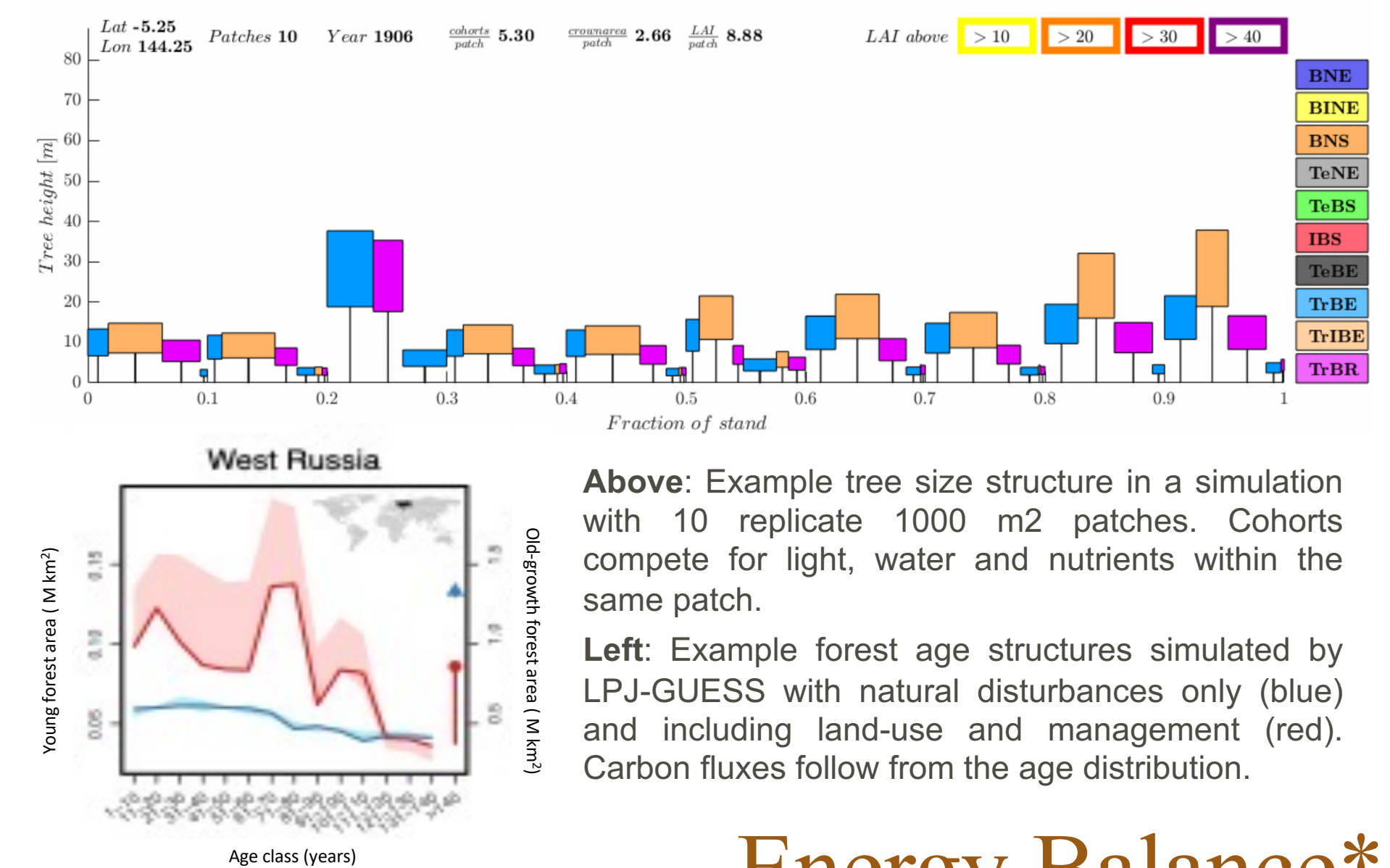


- Based on Darcy's law and the water supply-demand principle
- Simulates different plant hydraulic behavior (e.g., early vs late stomatal closure) under drought stress
- New mechanistic drought induced tree mortality based on hydraulic failure

* Not included in release 4.1.

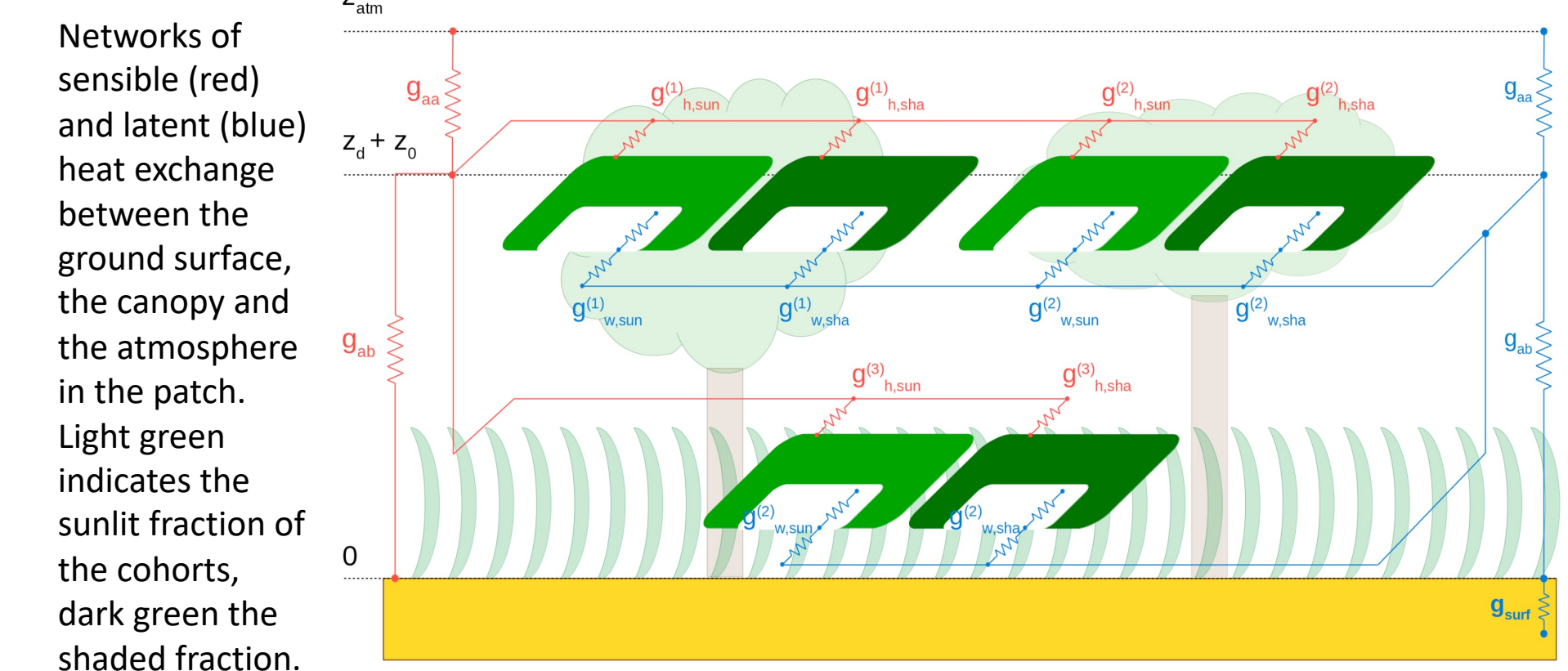
Detailed forest demography

- Direct competition between tree cohorts of different sizes and functional type
- Explicit representation of stand age due to disturbance. (fire, wind, beetle) or land-use change



Energy Balance*

- New surface energy balance feature allows use as full Land surface model



Other developments, usage and collaboration

Full Atm-Canopy-Surface energy balance closure, coupling to regional climate model, BVOCs, P cycling, daily plant carbon allocation, flexible multi-layer OM-scheme.

We welcome collaborations for application of features under active development or new feature development. Please contact lpj-guess@nateko.lu.se



References & Model-access