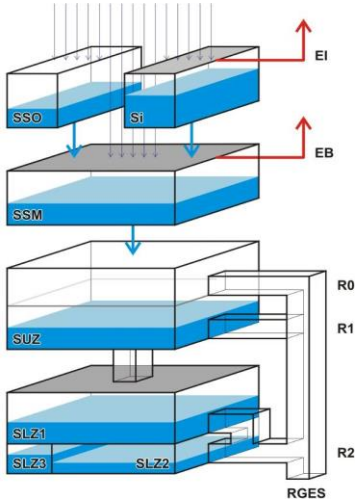

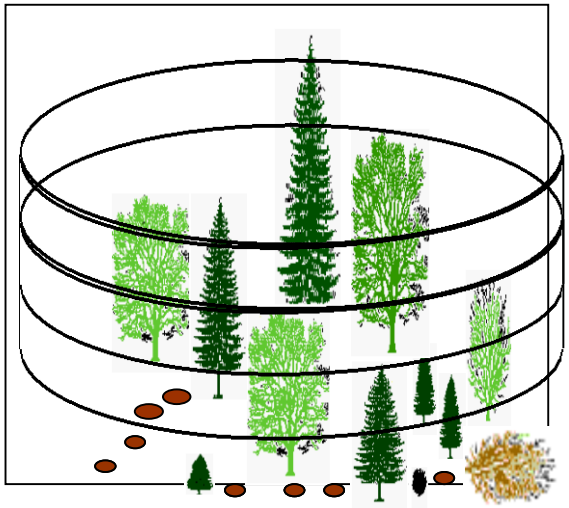

FORHYCS-ICE-2018

Forest, Glacier and Hydrology Change in Switzerland

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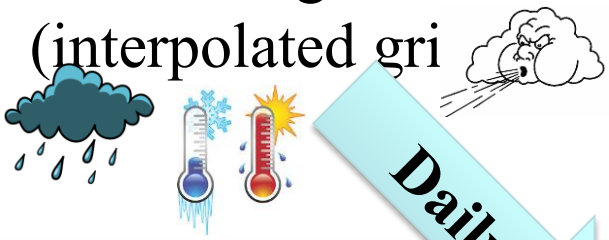
Climate change impacts on water resources in the Alps

- Different emission scenarios
- Different GCM-RCM combinations for regional impacts
- Different scenario periods
- Different post-processing and downscaling approaches
- Consideration of glaciers retreat
- Evidence of drought-stress affecting low-altitude forests
- Increasing elevation of the tree-line
- GOAL: Reduce local uncertainties

Context – Distributed hydrological modeling

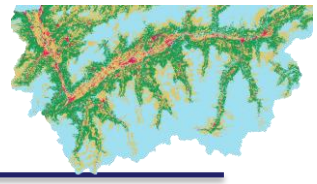
Inputs

Meteorological data (interpolated gri



Daily

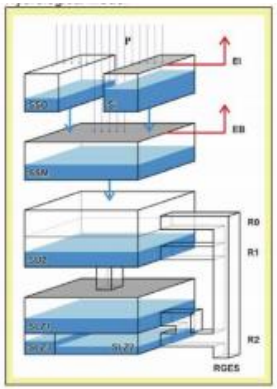
Parameter maps (e.g. DTM, vegetation prope)



Constant

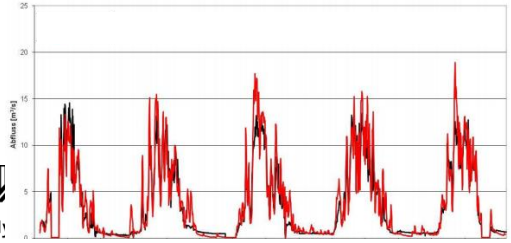
Model

Solves local water balance for each grid cell

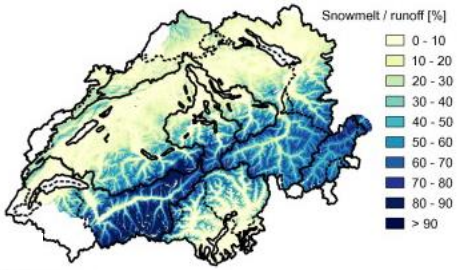


Outputs

River discharge



Maps of hydrological quantities (e.g. snow cover, index...)

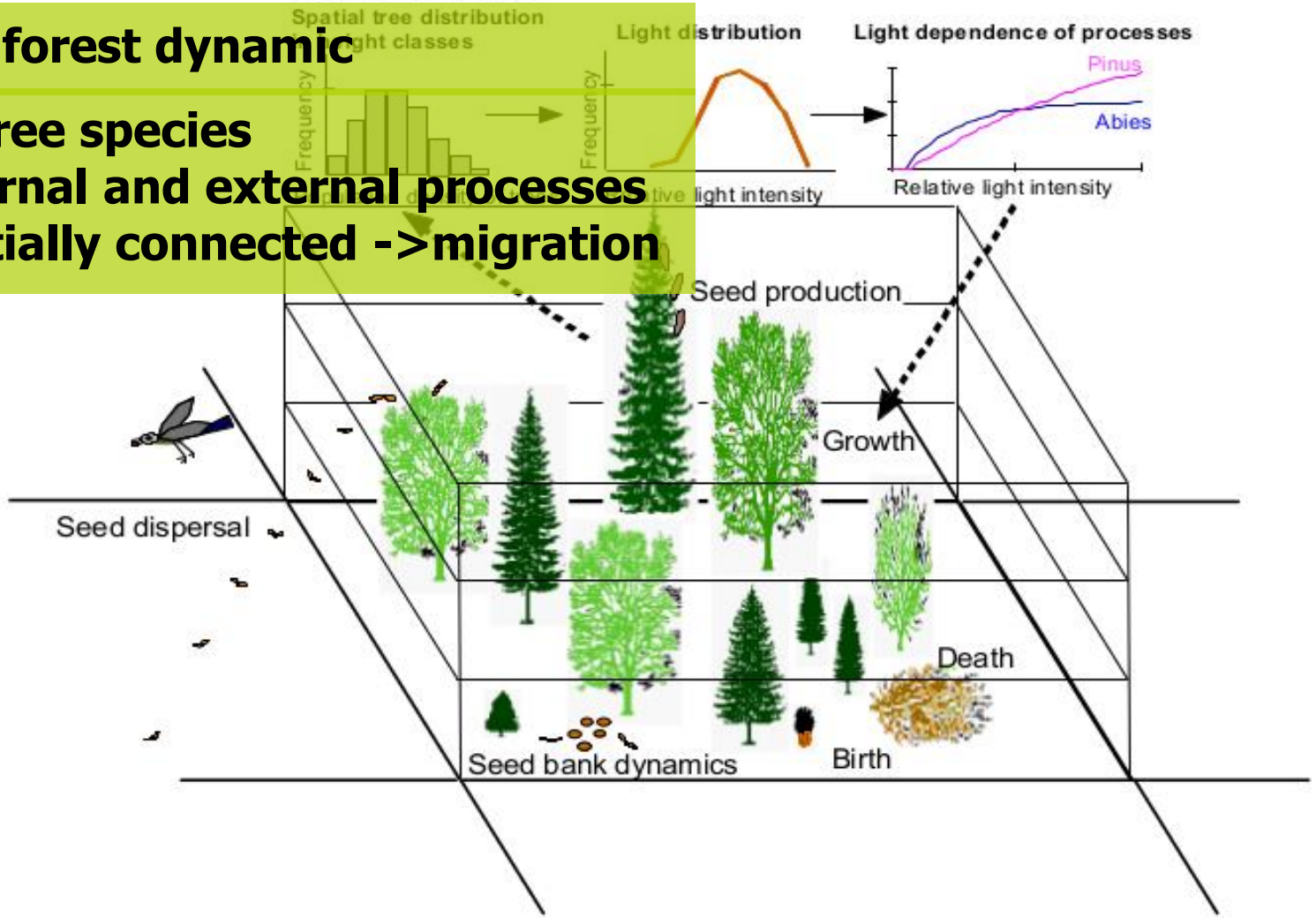


The spatio-temporal forest model TreeMig

(Lischke et al. 2006)

Natural forest dynamic

- 30 tree species
- Internal and external processes
- Spatially connected ->migration

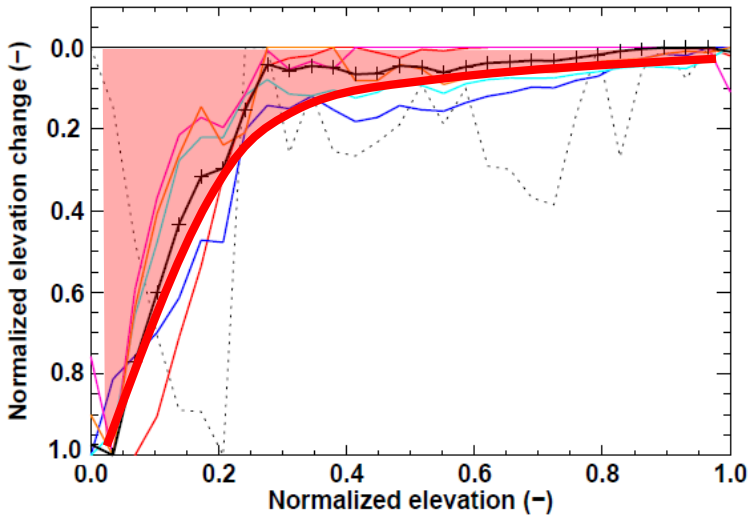


Glacier retreat routine

CCHYDRO implementation of glacier retreat in PREVAH:

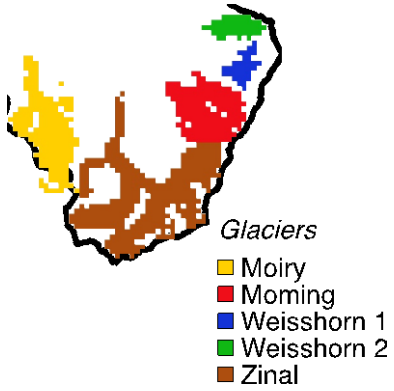
- Update of land cover class every 5 years (scenarios developed by UZH)
- For glacier cells, the model assumes an unlimited supply of ice

Adapted from Huss et al. (2010)

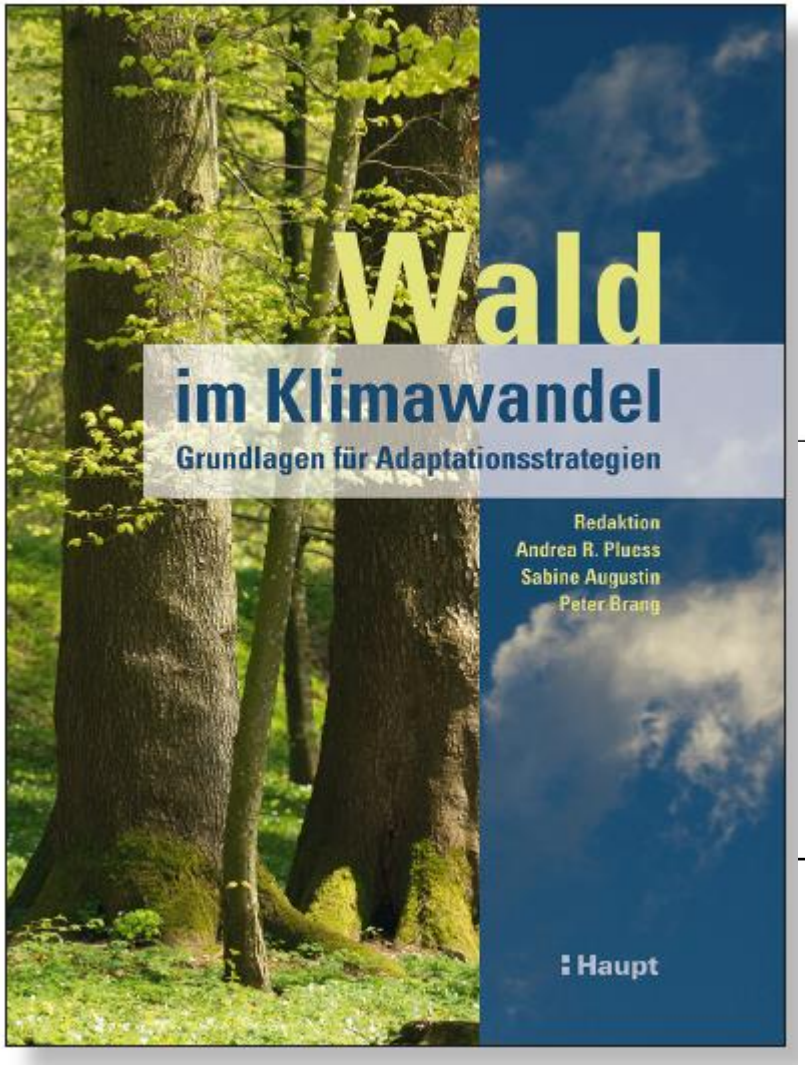


Transient glacier retreat routine (Huss et al. 2010)

- Uses empirical equations to calculate distributed ice thickness change
- Based on annual mass balance of whole glaciers
- If ice in a cell is below a threshold, this cell is no longer glaciated
- Additional data requirements:
  - Glacier outlines and initial ice thickness
  - Bedrock topography



Uncoupled Models



Spatial information:
- DEM
- Land cover
- Soil

Parameters Storage modules Fluxes

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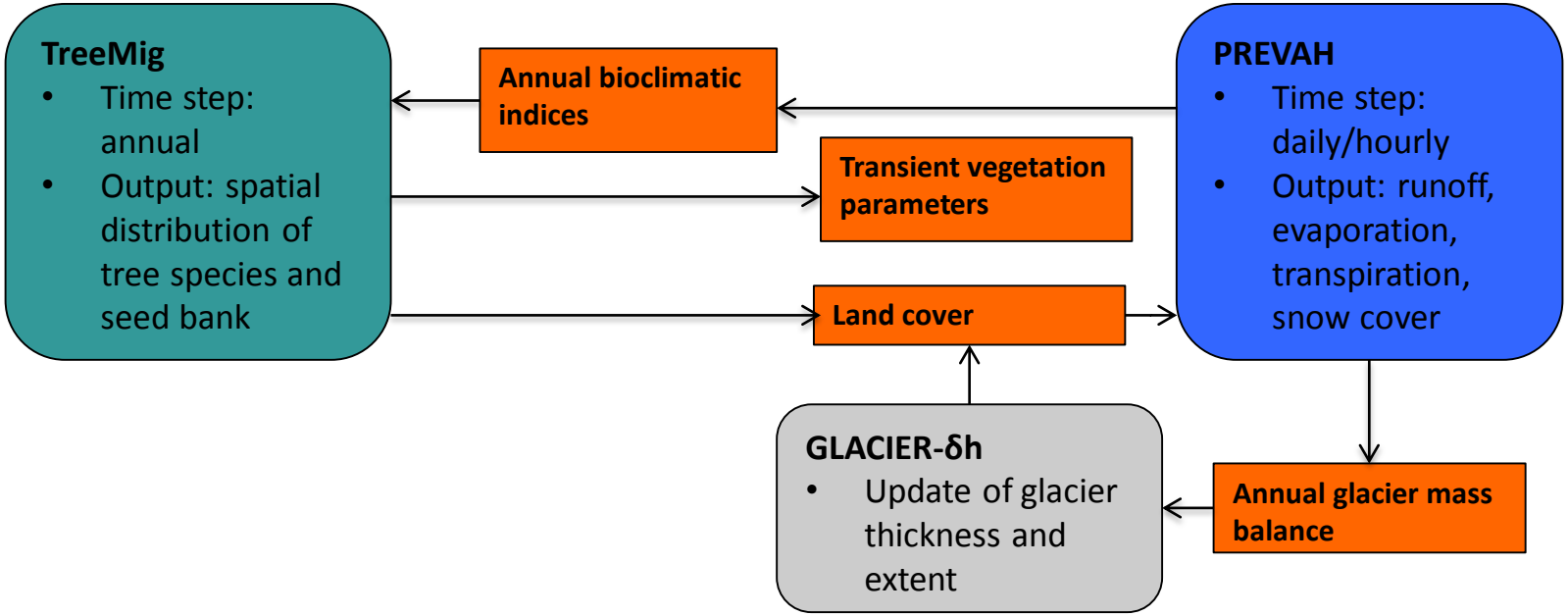
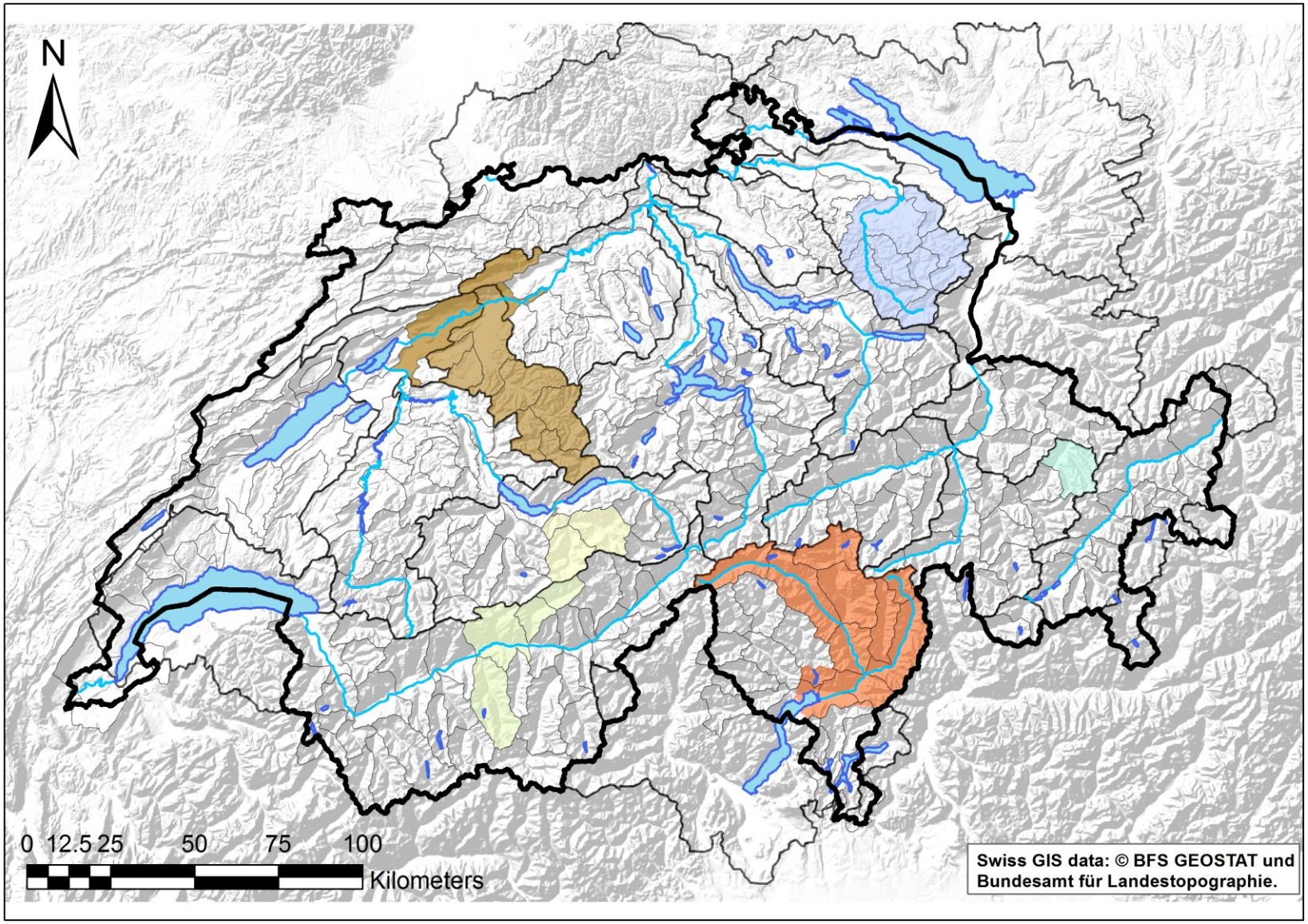


Target Areas



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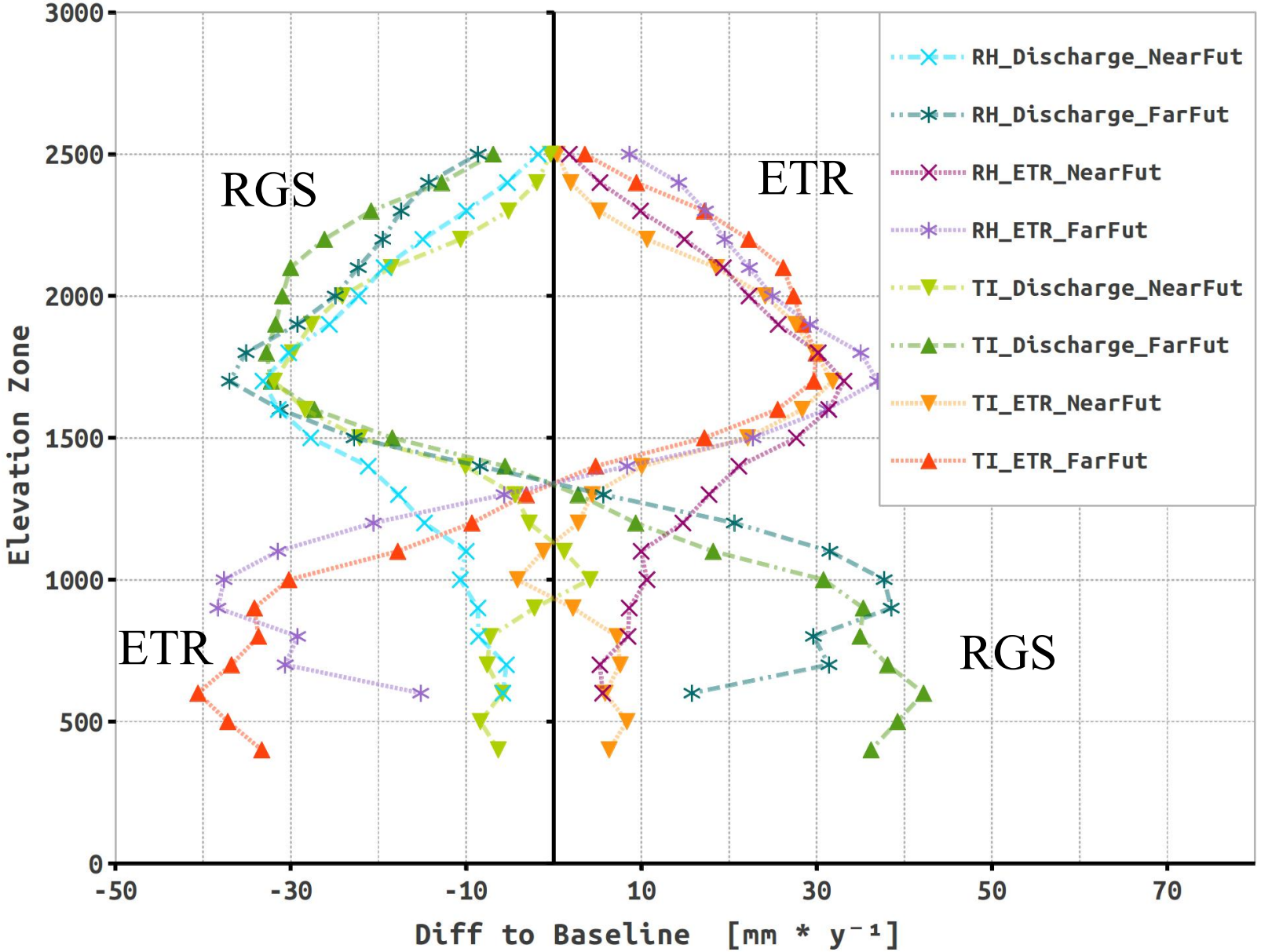
Expected results

- First fully coupled simulations of climate impacts (CH2018 scenarios) on **water resources, glaciers and forests**.
- Set of predictions of catchment-integrated streamflow, spatially distributed evaporation and transpiration, as well as forest structure and species composition for selected Swiss catchments.
- Comparison to previous climate impact studies in Switzerland, i.e. the hydrological simulations of the CCHydro project (BAFU, 2012; Speich et al., 2015) and the forest dynamics simulations of the CH2014 project (CH2014-Impacts, 2014).
- This project will also allow us to validate the newly implemented glacier retreat module.

TEASER 1 – One Way Coupling (Schattan et al., 2013)
Impact at different elevation bands
(as difference from model run WITHOUT forest change)



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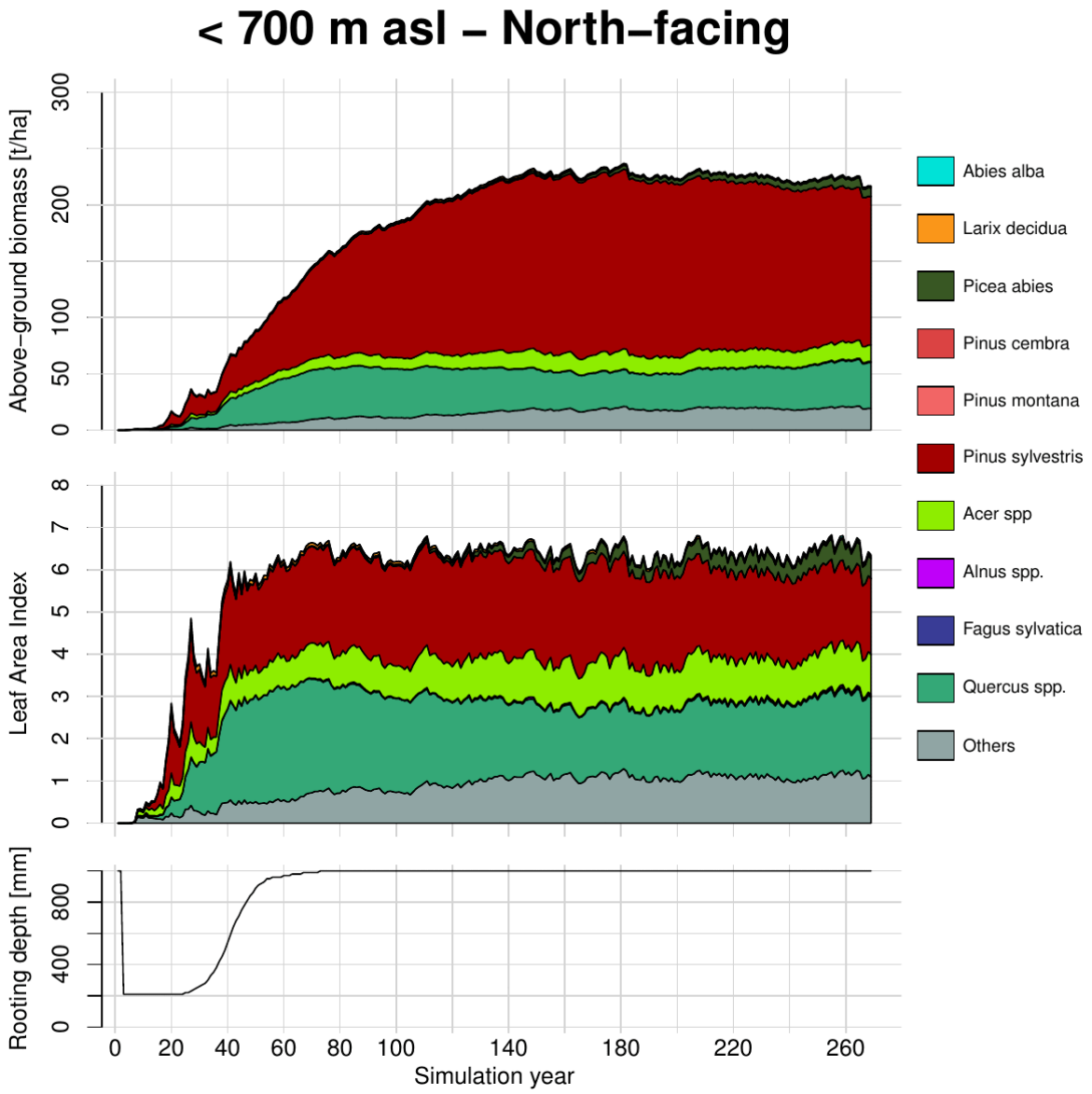
TEASER 2 – Let forest grow from scratch during 300 years. Compositions of tree species according to elevation and exposition



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And: Comparison to a state-of-the-art ice flow model

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GLcfsFlow (Jouvet et al., 2008)