Application and evaluation of a dendroclimatic process-based model (MAIDEN) during the last century in the Northern Hemisphere

EGU2020

jeanne.rezsohazy@uclouvain.be

Jeanne Rezsöhazy[1,2]
Hugues Goosse[1]
Joel Guiot[2]
Fabio Gennaretti[3]
Etienne Boucher[4]
Frédéric André[1]
Mathieu Jonard[1]

[1]UCLouvain, Earth and Life Institute, Louvain-la-Neuve, Belgium
[2]AMU, CEREGE, Aix-en-Provence, France
[3]UQAT, Institut de recherche sur les forêts, Rouyn-Noranda, Canada
[4]UQAM, Dépt. of Geography and GEOTOP, Montreal, Canada

- Tree rings = important ***proxy*** to reconstruct climate of the last millennium at high resolution

- Relationships between tree-ring proxies and climate

  ⌄

  statistical VS **process-based** approach

source “tree” and “leaf”: freepik.com

- Tree rings = important ***proxy*** to reconstruct climate of the last millennium at high resolution

- Relationships between tree-ring proxies and climate

  ⌄

  statistical VS **process-based** approach

  linearity

  stationarity

May be inadequate in a paleoclimatic context

source “tree” and “leaf”: freepik.com

- Tree rings = important ***proxy*** to reconstruct climate of the last millennium at high resolution

- Relationships between tree-ring proxies and climate

⌄

statistical VS **process-based** approach

Processes are parameterized

VS-Lite

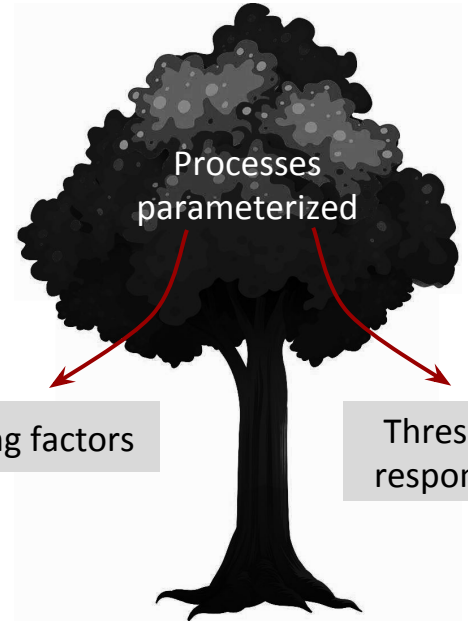
Processes are explicitly included

MAIDEN

source “tree” and “leaf”: freepik.com

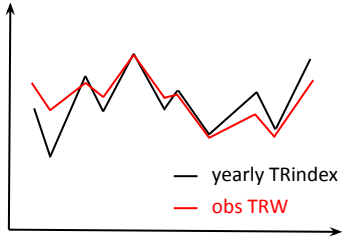
VS-Lite

Monthly T, P



Limiting factors

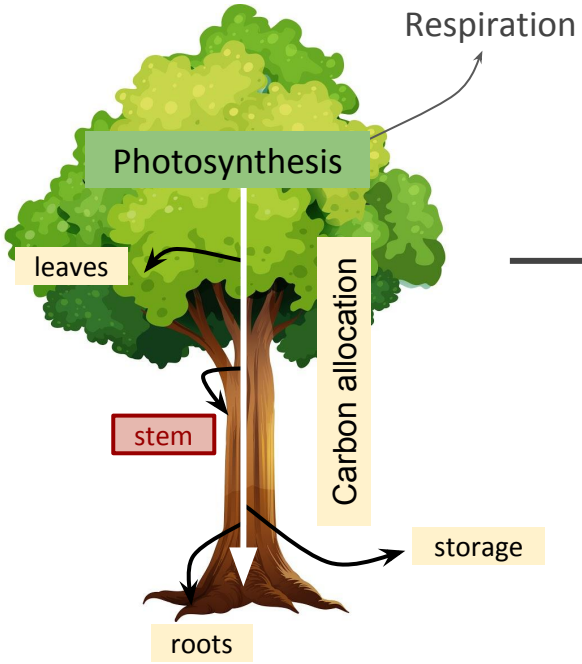
Threshold growth response functions

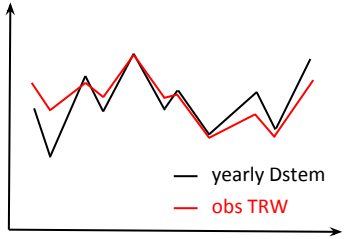


Tolwinski-Ward et al., 2011

MAIDEN

Daily Tmax, Tmin, P, [CO_2]



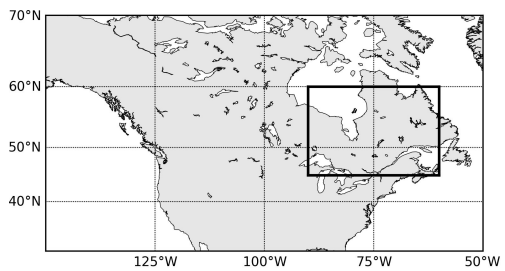


Misson, 2004; Gea-Izquierdo et al., 2015; Gennaretti et al., 2017

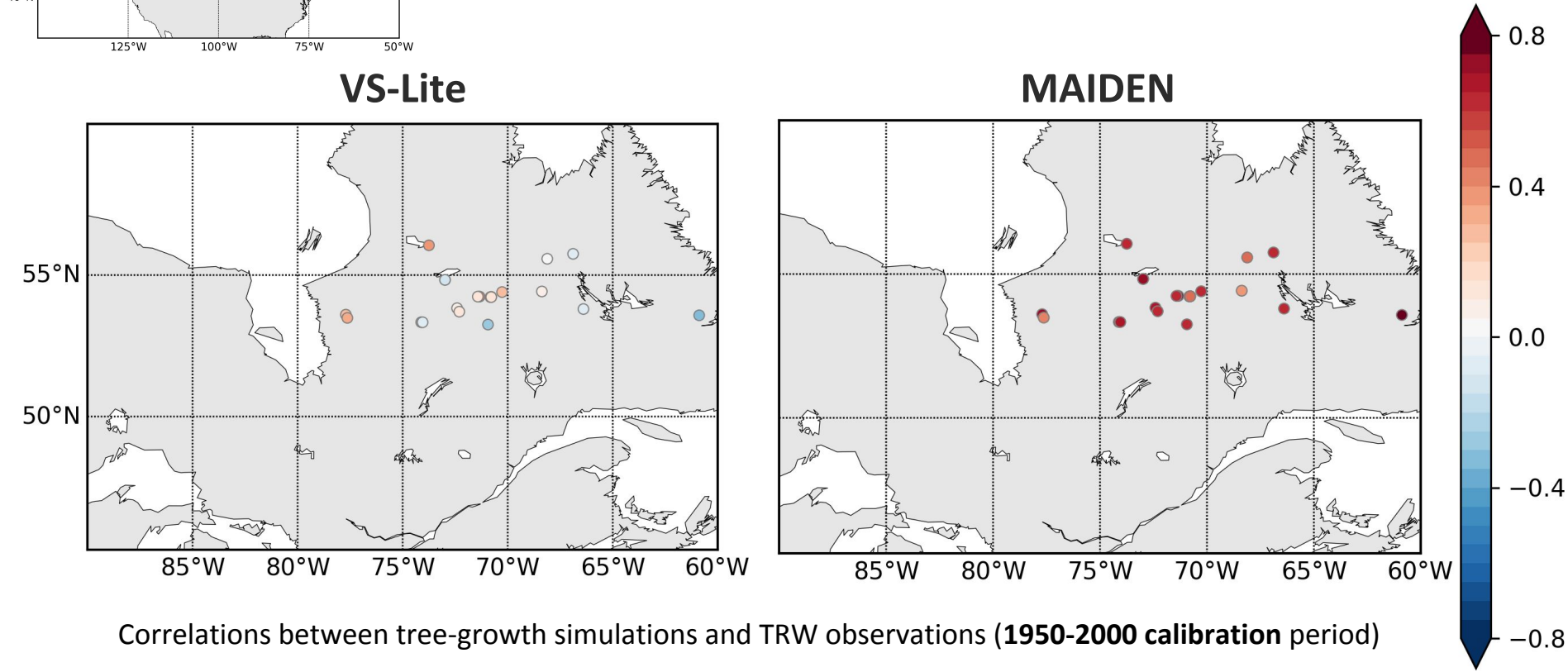
source: *brgfx* on freepik.com

*How well suited is a **complex tree growth model** such as MAIDEN for application to a large number of sites in a **paleoclimatic context**?*

*What can we **gain** from it?*



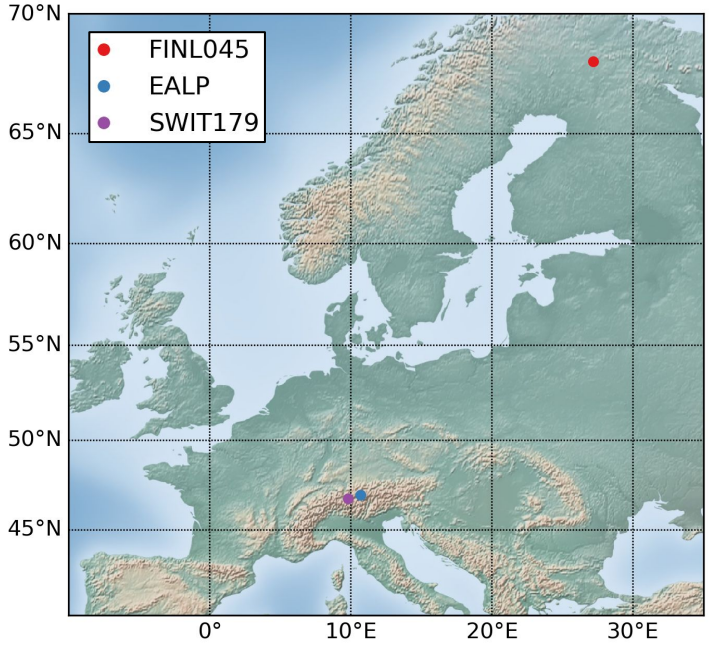
MAIDEN is **better** over the 1950-2000 **calibration** period than **VS-Lite**, at 21 Eastern Canadian taiga sites.



Correlations between tree-growth simulations and TRW observations (**1950-2000 calibration** period)

Picea mariana. Nicault et al., 2014; Boucher et al., 2017; Gennaretti et al., 2017

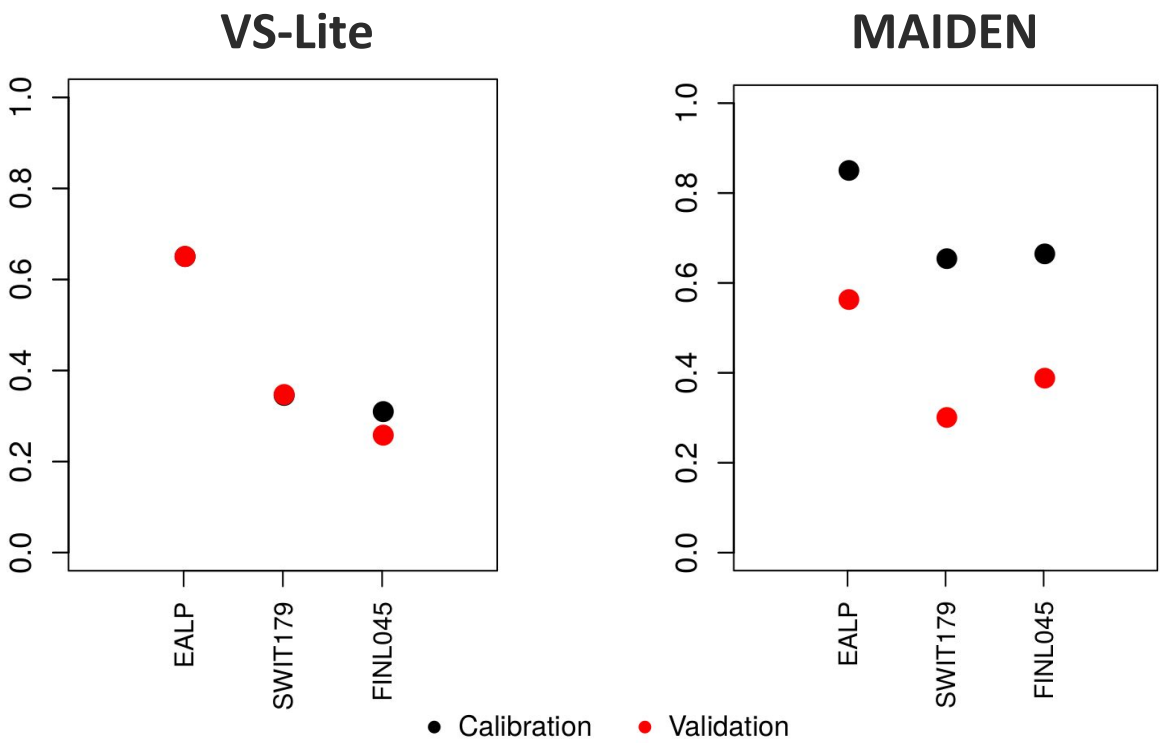
Three European sites for calibration and validation over the 1950-2000 time period



Pinus sylvestris
Pinus cembra
Picea abies

Babst et al., 2013; PAGES2k Consortium, 2017; Seftigen et al., 2018

MAIDEN has **generally higher correlations** over the 1950-2000 **calibration and validation** periods but is **less stable than VS-Lite**, at the 3 European sites.



Correlations between tree-growth simulations and TRW observations (**1950-2000 calibration** and **validation** periods)

Main conclusions of the study

- sensitivity of MAIDEN to the quality of climatic inputs
  - MAIDEN needs high-resolution climate data inputs for a good performance
  - Simple **bias-correction** and **downscaling techniques** improve its performance

source: *brgfx* on freepik.com

Main conclusions of the study

- sensitivity of MAIDEN to the quality of climatic inputs
- promising calibration results for MAIDEN

source: *brgfx* on freepik.com

Main conclusions of the study

- sensitivity of MAIDEN to the quality of climatic inputs
- promising calibration results for MAIDEN
- required long time-period validation step
  - MAIDEN needs around 100 years for split-sample validation
  - Validation is required to avoid overfitting

source: *brgfx* on freepik.com

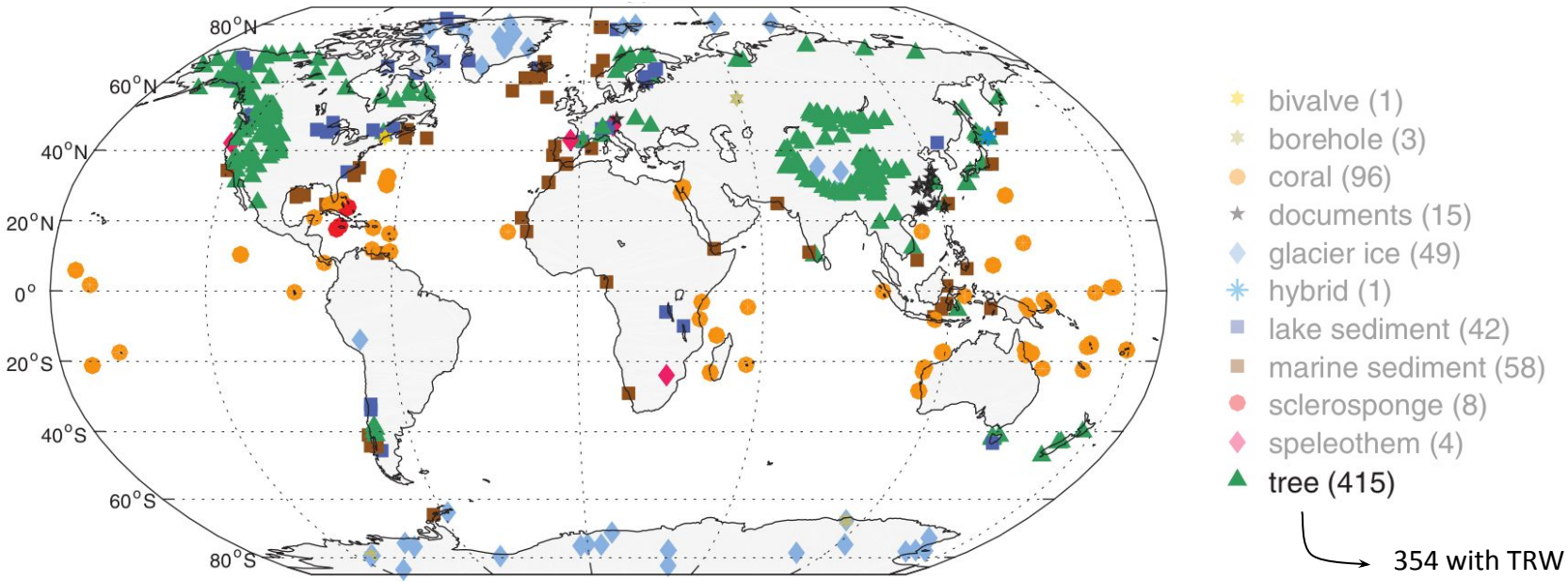
Main conclusions of the study

- sensitivity of MAIDEN to the quality of climatic inputs
- promising calibration results for MAIDEN
- required long time-period validation step
- VS-Lite · lower but more stable correlations

source: *brgfx* on freepik.com

PAGES2k 2.0.0 (692 records from 648 sites)

PAGES2k Consortium, 2017.



We are currently applying the MAIDEN model to a wider range of environmentally different sites, through the PAGES2k database

Want more info?

 Rezsöhazy, J., Goosse, H., Guiot, J., Gennaretti, F., Boucher, E., André, F., and Jonard, M.: Application and evaluation of the dendroclimatic process-based model MAIDEN during the last century in Canada and Europe, Clim. Past Discuss., **https://doi.org/10.5194/cp-2019-140**, in review, 2019.

✉@ jeanne.rezsohazy@uclouvain.be