UQAT
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EN ABITIBI-TÉMISCAMINGUE

TECHNIQUES ET RESSOURCES EN DENDROCHRONOLOGIE

Centre d'étude de la forêt

raphael.chavardes@uqat.ca

Dendrochronologie et anatomie du bois 0.0

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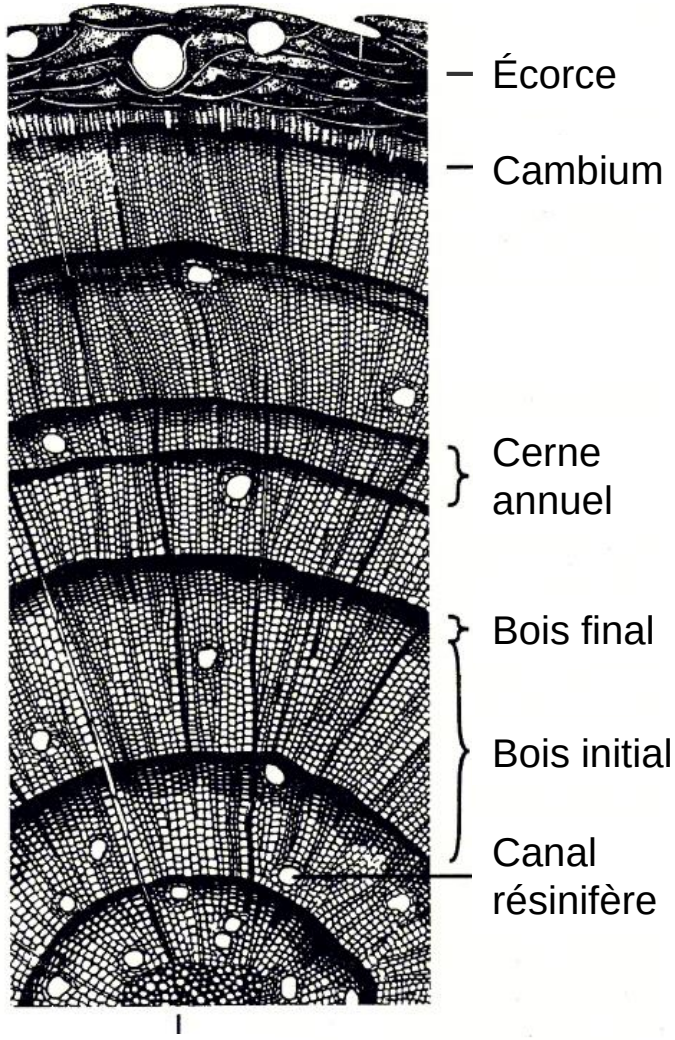
En grec ancient

δένδρον	**dendron**	**arbre**
χρόνος	**khronos**	**temps**
-λογία	**-logia**	**discours, l'étude de…**

Une méthode scientifique pour déterminer l'année de formation de cernes d'arbres.



Adapté de Fritts (1976)

Contenu de la présentation

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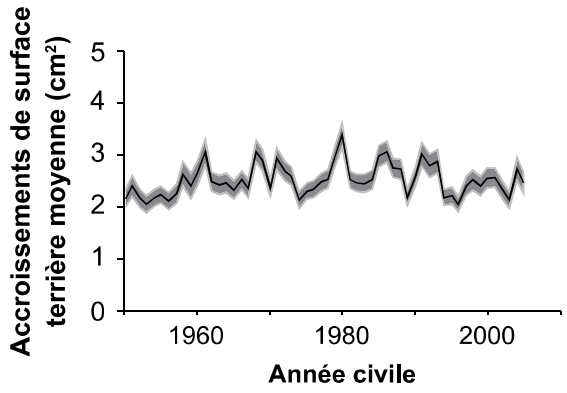
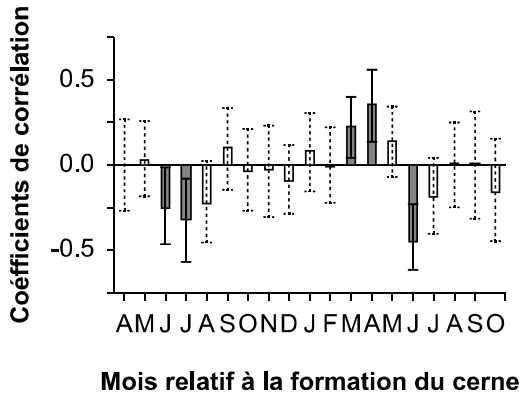
Techniques et ressources

1. Forage
2. Artisanat et menuiserie
3. Capture d'image
4. Mesure d'épaisseur de cernes
5. Interdatation
6. Standardisation
7. Données climatiques
8. Associations climat-croissance
9. 'dplR' et 'treeclim' avec [R]
10. Exemple

Photo: A. Whittier

Photo: The Spokesman-Review





Images: Centre d'étude de la forêt

1. Forage

Photo: D. Rubino

Composants principaux d'un foret (ou sonde) de Pressler:
(a) le manche
(b) la tarière
(c) l'extracteur

https://www.youtube.com/watch?v=Iwfi2HXGDJ0
Ministère des Forêts, de la Faune et des Parcs (2014)

Pour visionner d'autres vidéos veuillez suivre:
https://www.youtube.com/watch?v=OMQPDzuXYo0
https://www.youtube.com/watch?v=_uFnOSFYPuk
Dyer et al. (2013)

2. Artisanat et menuiserie

Photo: N. Zampieri

https://www.youtube.com/watch?v=qqeP8SV70rE
Dyer et al. (2013)

2. Artisanat et menuiserie

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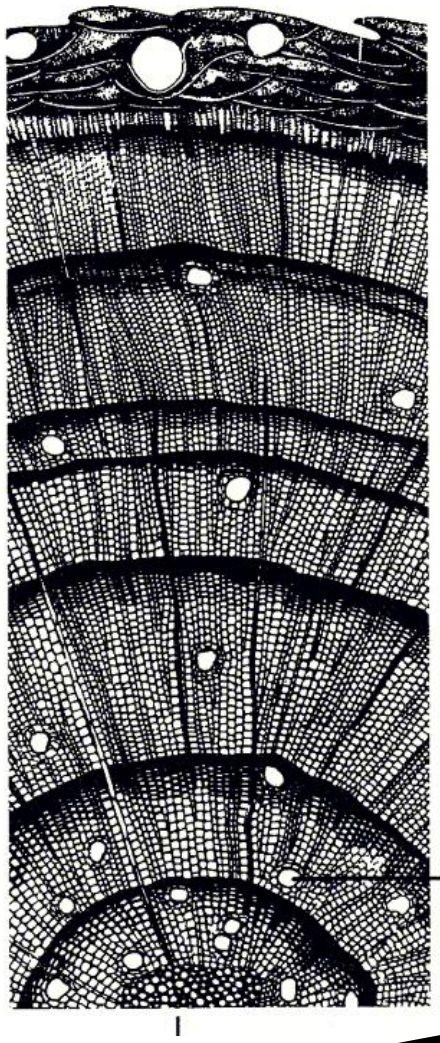
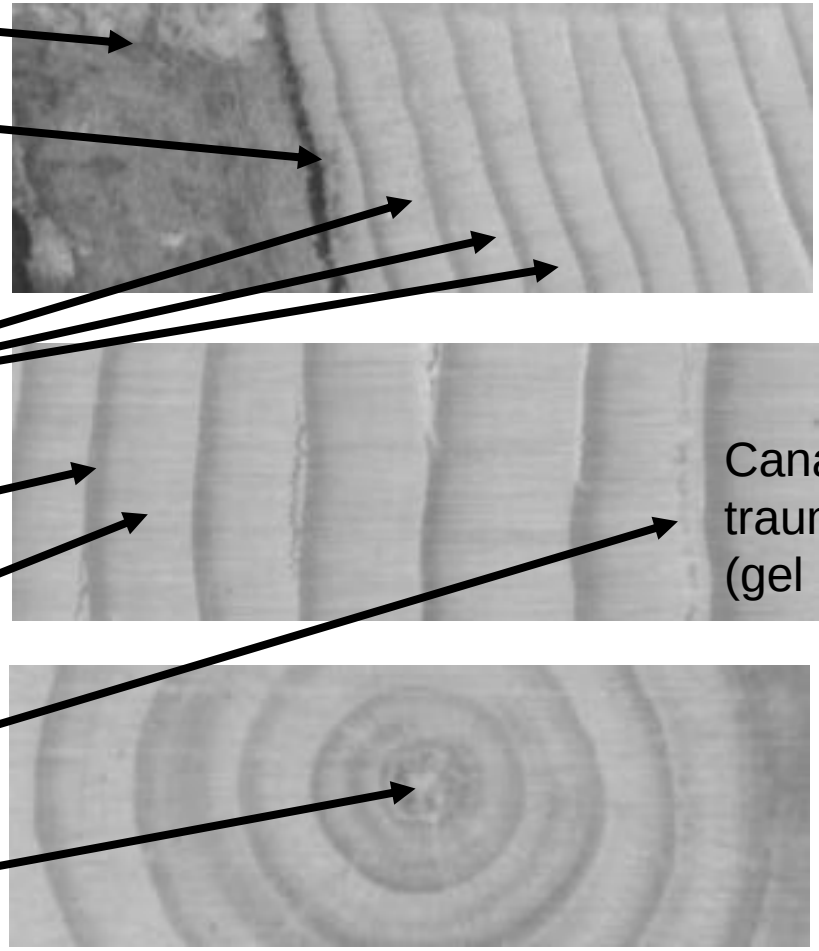
Forêt d'enseignement et de recherche du lac Duparquet (Ferld)
http://ferld.uqat.ca/

Photos: Centre d'étude de la forêt

3. Capture d'image



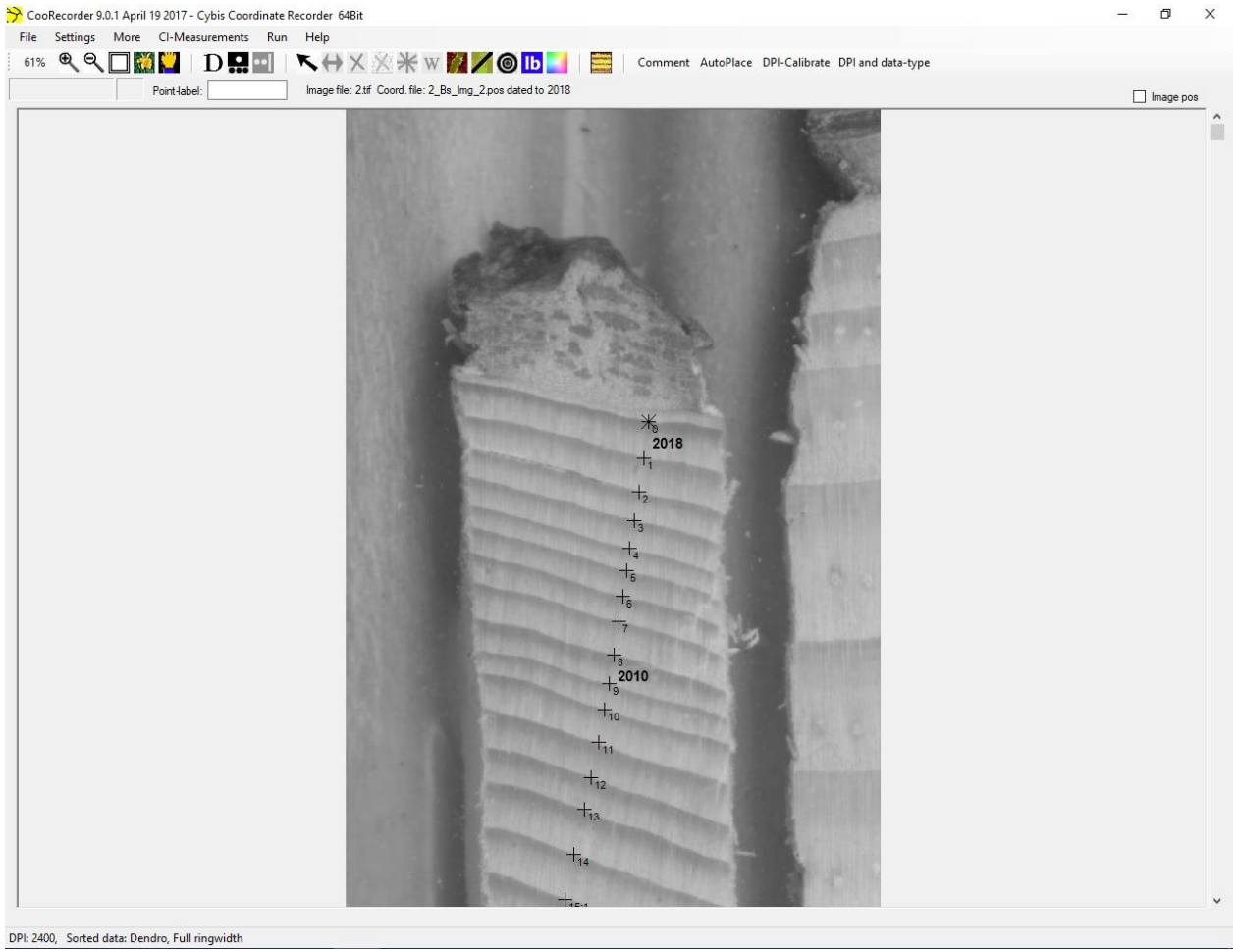
Adapté de Fritts (1976)



Canaux résinifères traumatiques (gel printanier?)

Photos: Centre d'étude de la forêt

4. Mesure d'épaisseur de cernes



https://www.cybis.se/forfun/dendro/helpcoorecorder7/index.php
https://www.cybis.se/forfun/dendro/
Larsson (2017)

Mesure de l'épaisseur (largeur) de chaque cerne :

- Travail minutieux et répétitif mais en partie automatisé

- Marquage et calcul de la distance entre deux marqueurs

- Pour chaque carotte, on obtient une serie d'épaisseurs

4. Mesure d'épaisseur de cernes

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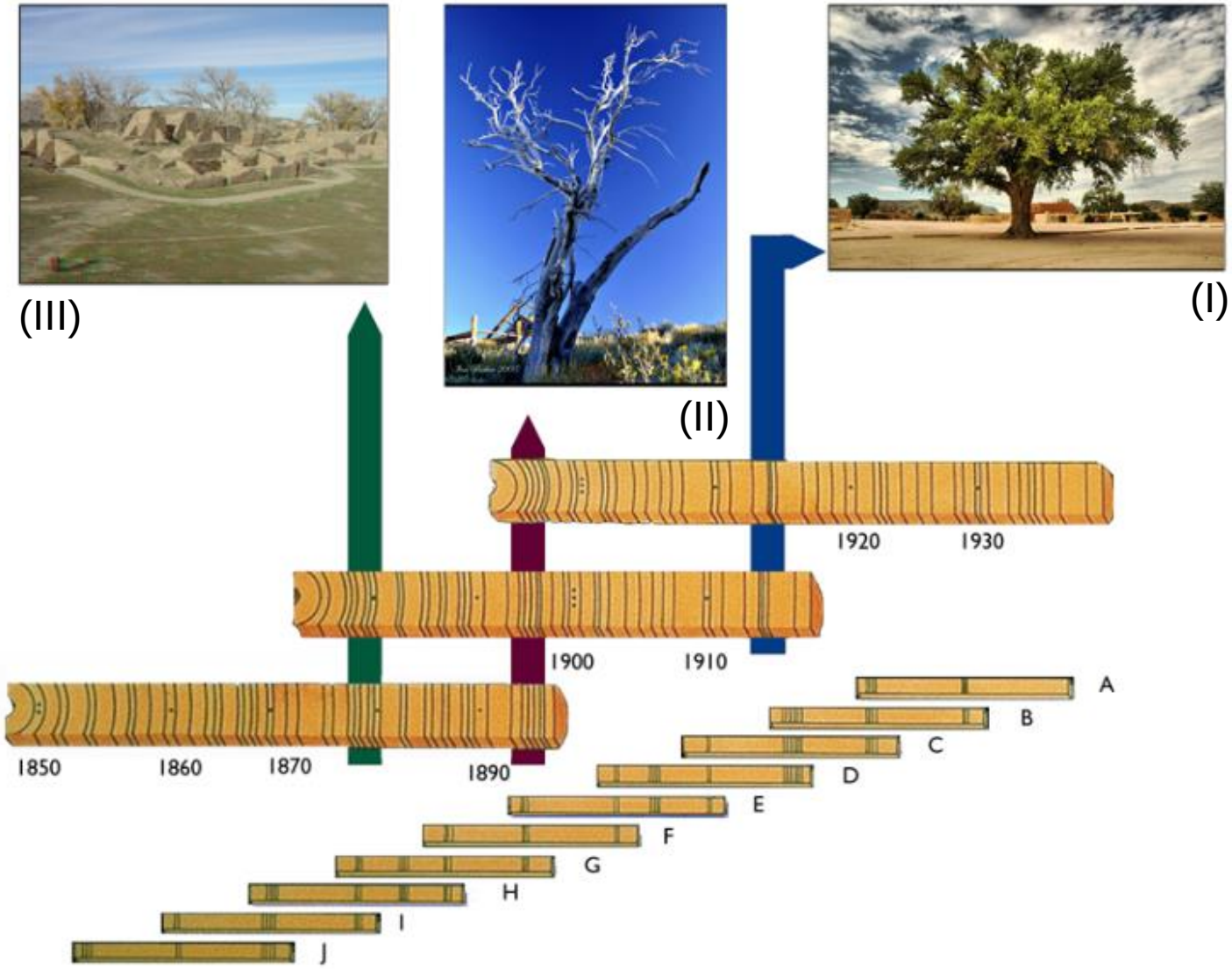
Forêt d'enseignement et de recherche du lac Duparquet (Ferld)
http://ferld.uqat.ca/laboDendro/LaboDendroF.htm

Photos: Centre d'étude de la forêt

5. Interdatation



« Comparer les patrons des cernes »

« Exemple : Datation d'une ruine

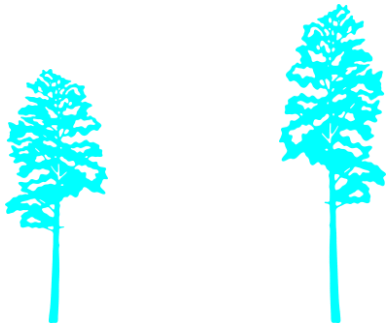
- Développer une chronologie à partir de carottes d'arbres vivants situés proche de la ruine (I)

- Étendre la chronologie en utilisant des carottes d'arbres morts situés dans la zone d'étude (II)

- Extraire des carottes des poutres de bois dans la ruine (III) et comparer les patrons des cernes.»

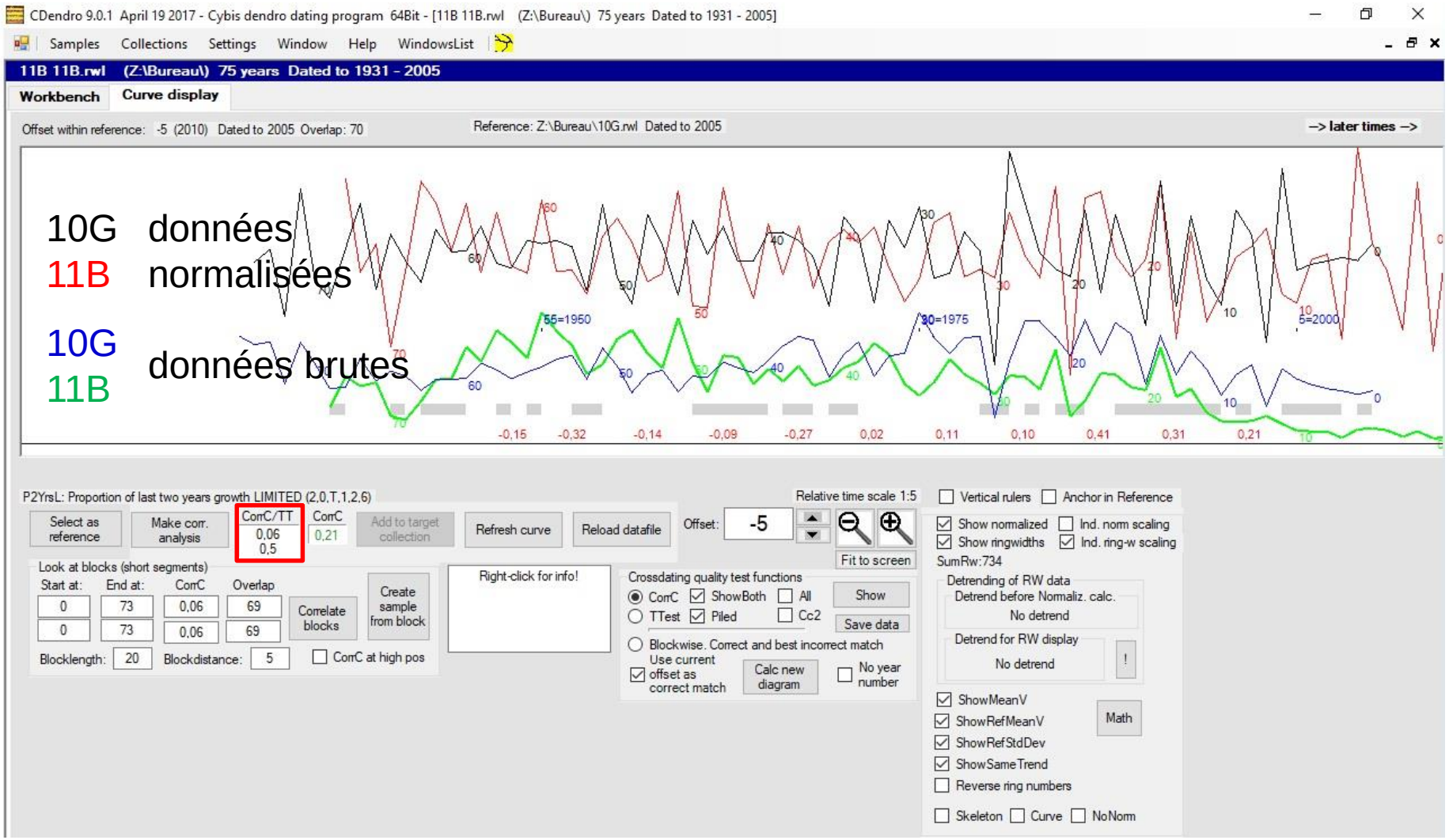
Images: Kipfmueller and Swetnam (2001)
Images et texte: Corona (2015)
http://christophe-corona.com/dendro/dendrochronology/interdatation/

5. Interdatation (CDendro)



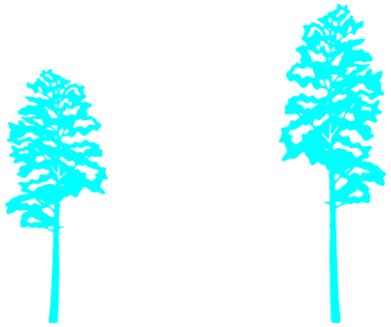
Deux carrotes = deux series (10G et 11B)

Manque de concordance entre l'épaisseur des cernes: corrélation = 0.06



http://www.cybis.se/forfun/dendro/
https://www.cybis.se/wiki/index.php?title=How_to_use_CDendro
Larsson (2017)

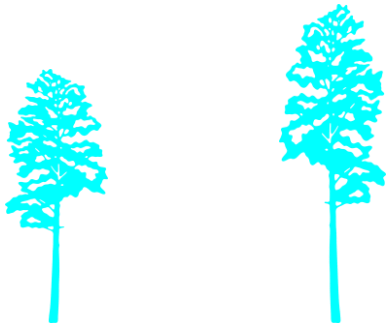
5. Interdatation (CDendro)



Manque de concordance: corrélation = -0.14

http://www.cybis.se/forfun/dendro/
https://www.cybis.se/wiki/index.php?title=How_to_use_CDendro
Larsson (2017)

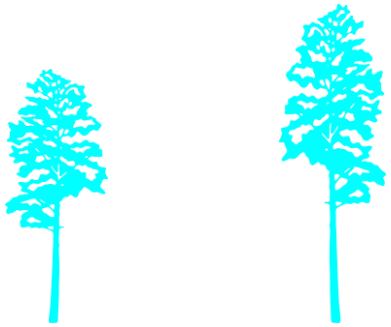
5. Interdatation (CDendro)



Peu de concordance:
corrélation = 0.15

http://www.cybis.se/forfun/dendro/
https://www.cybis.se/wiki/index.php?title=How_to_use_CDendro
Larsson (2017)

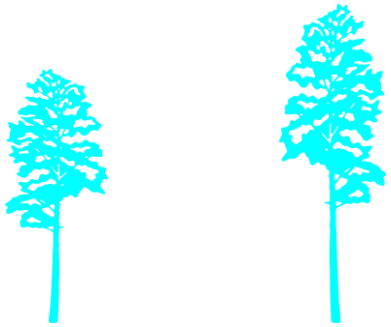
5. Interdatation (CDendro)



Manque de concordance: corrélation = -0.09

http://www.cybis.se/forfun/dendro/
https://www.cybis.se/wiki/index.php?title=How_to_use_CDendro
Larsson (2017)

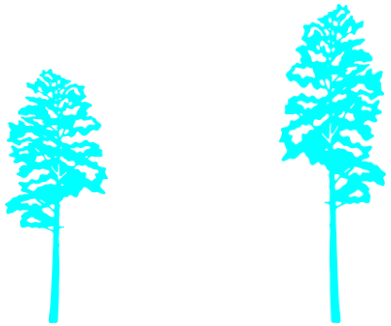
5. Interdatation (CDendro)



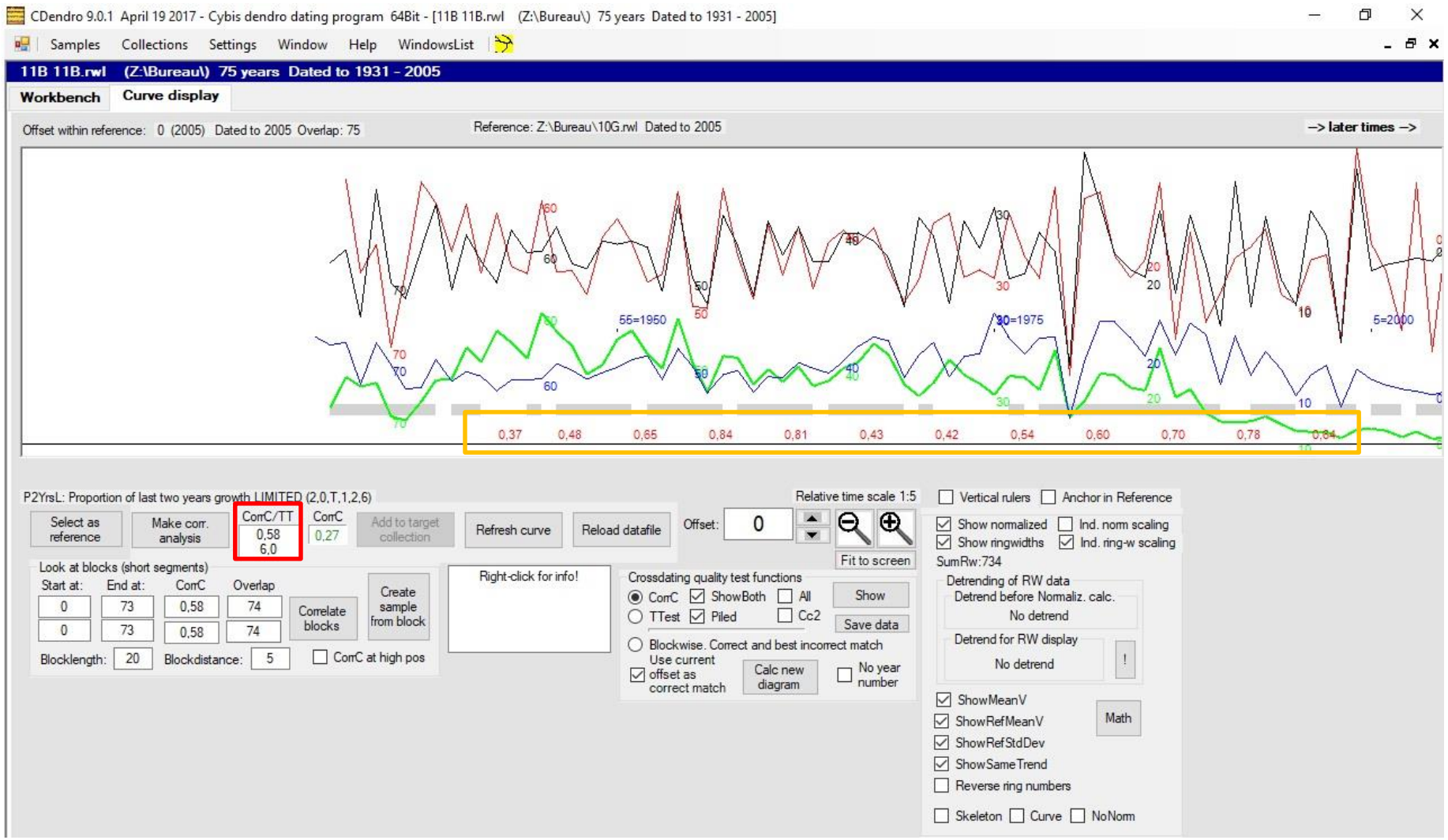
Manque de concordance: corrélation = -0.25

http://www.cybis.se/forfun/dendro/
https://www.cybis.se/wiki/index.php?title=How_to_use_CDendro
Larsson (2017)

5. Interdatation (CDendro)

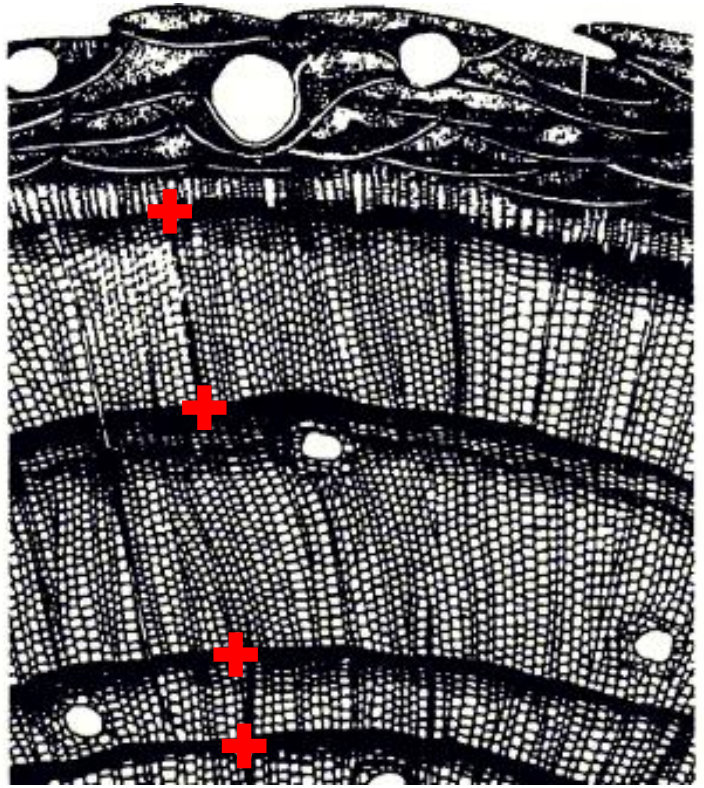


Concordance:
corrélation élevée = 0.58



http://www.cybis.se/forfun/dendro/
https://www.cybis.se/wiki/index.php?title=How_to_use_CDendro
Larsson (2017)

5. Interdatation (faux cernes er cernes manquants)

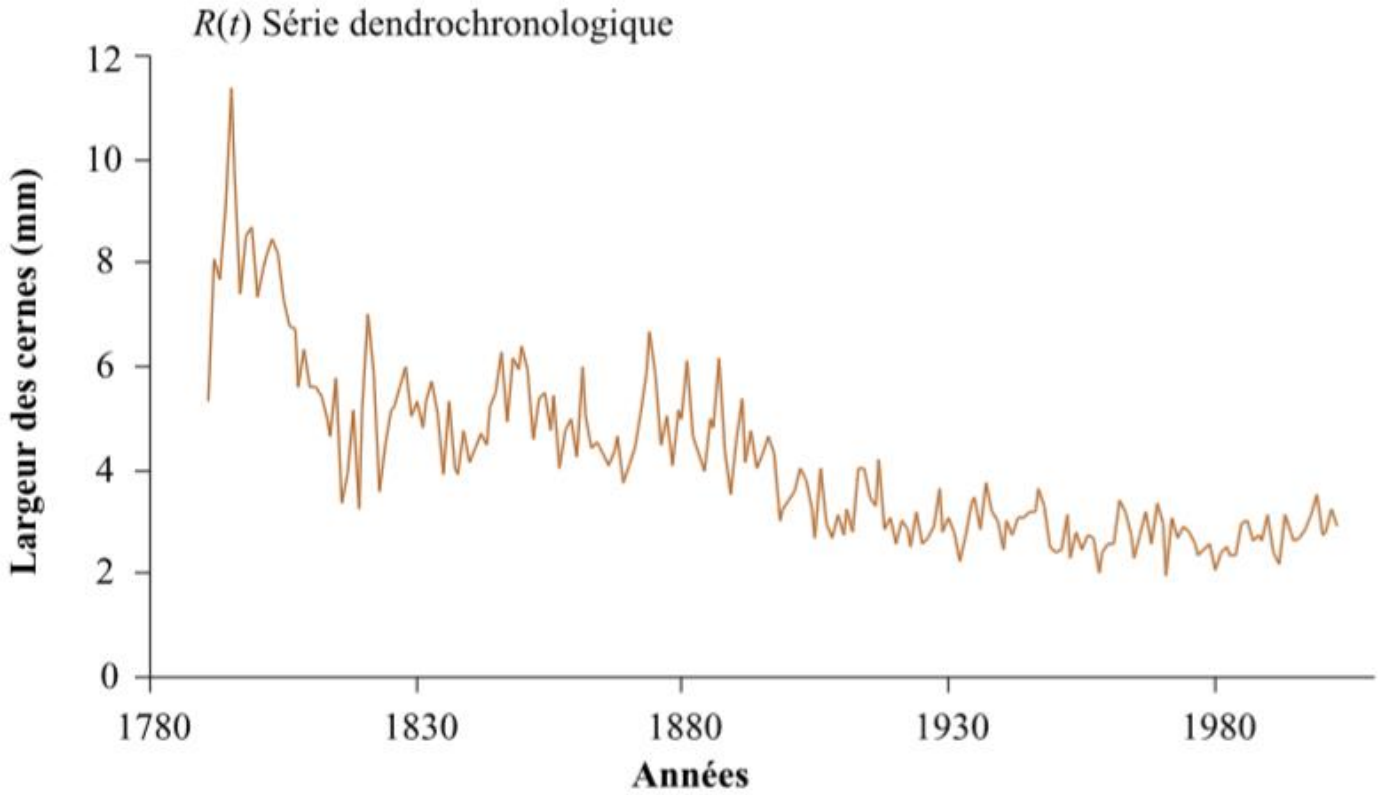


Faux cerne

Adapté de Fritts (1976)

6. Standardisation

R_t = la série de cernes observée



Nicault et al. (2010)

6. Standardisation

$$R_t = A_t + C_t + \delta D1_t + \delta D2_t + E_t$$

R_t = la série de cernes observée,
A_t = la tendance reliée à l'âge,
C_t = le signal climatique,
$\delta D1_t$ = les perturbations endogènes et les perturbations locales,
$\delta D2_t$ = les perturbations exogènes à l'échelle du site et
E_t = l'ensemble de la variabilité interannuelle non expliquée et non reliée aux autres signaux.

Cook (1985)
Nicault et al. (2010)

"Courbe montrant un signal de type *D2*;
la flèche montre le passage d'un incendie"

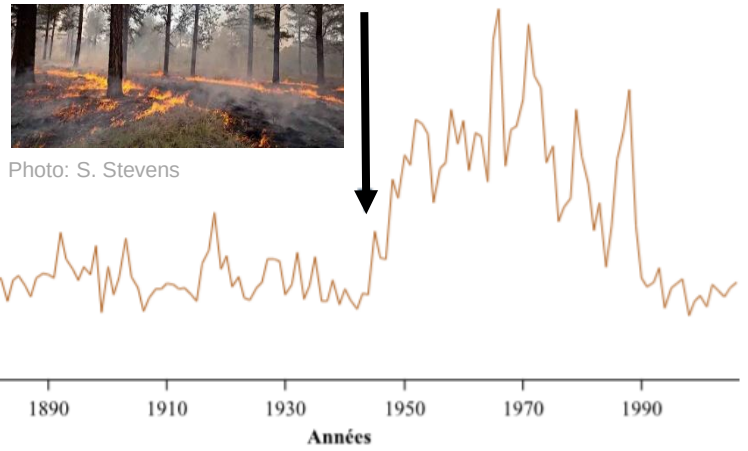
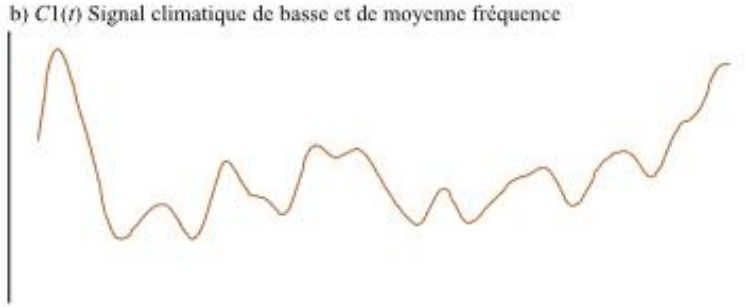
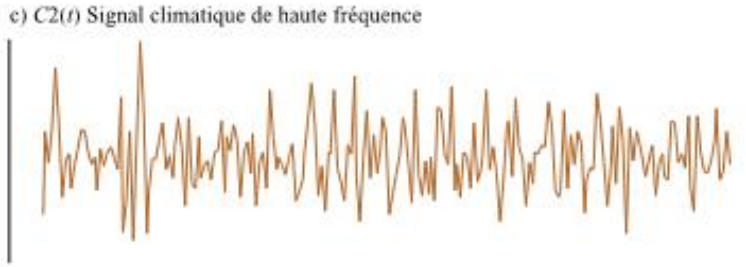
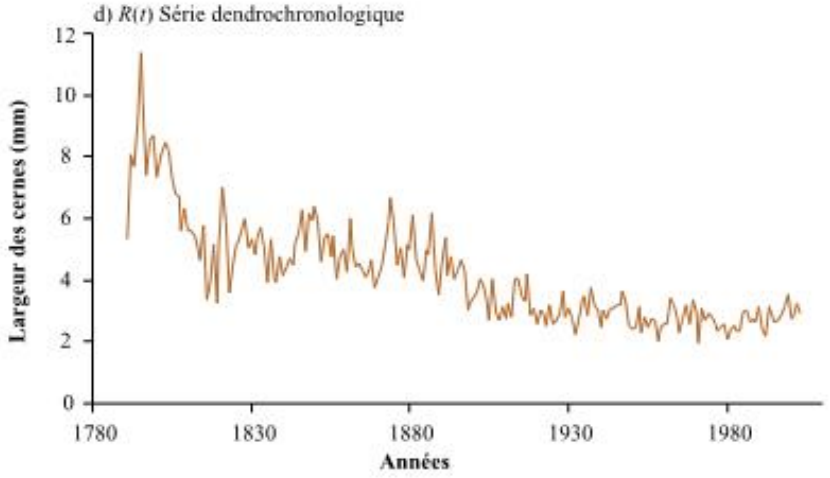


Photo: S. Stevens

Nicault et al. (2010)

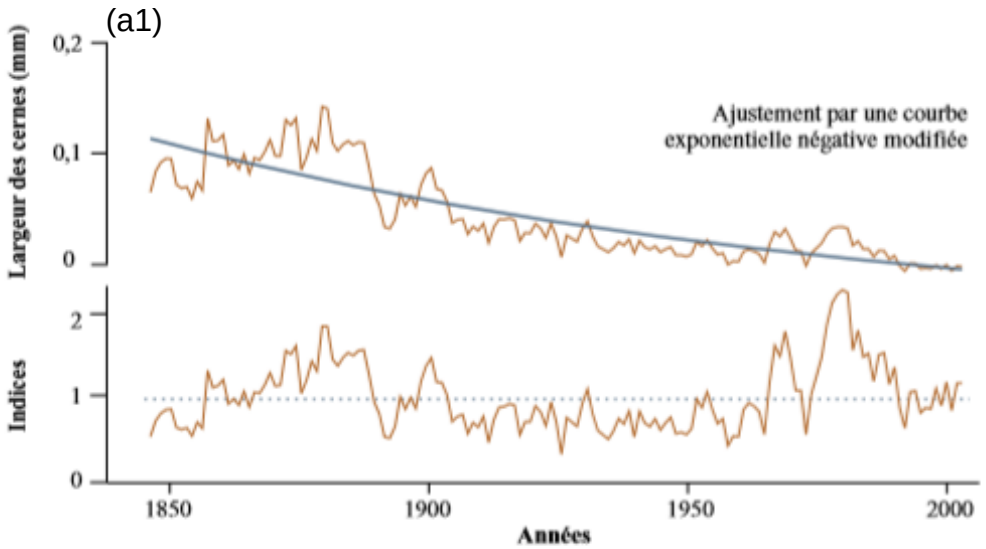


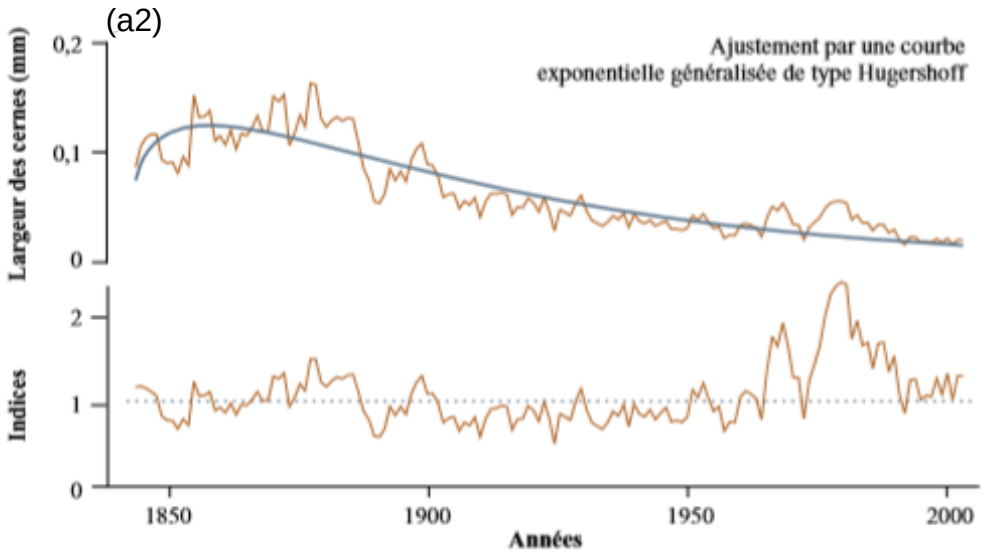


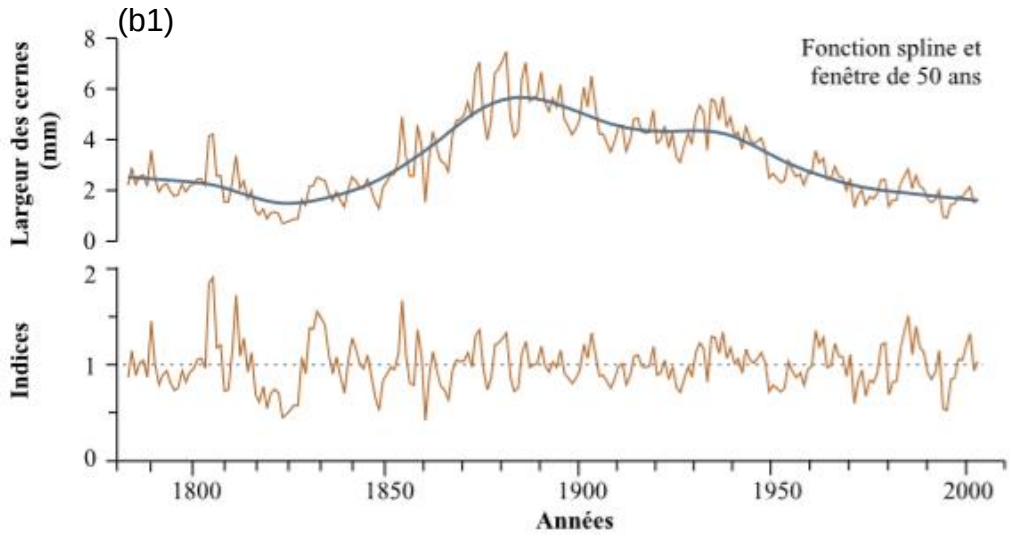


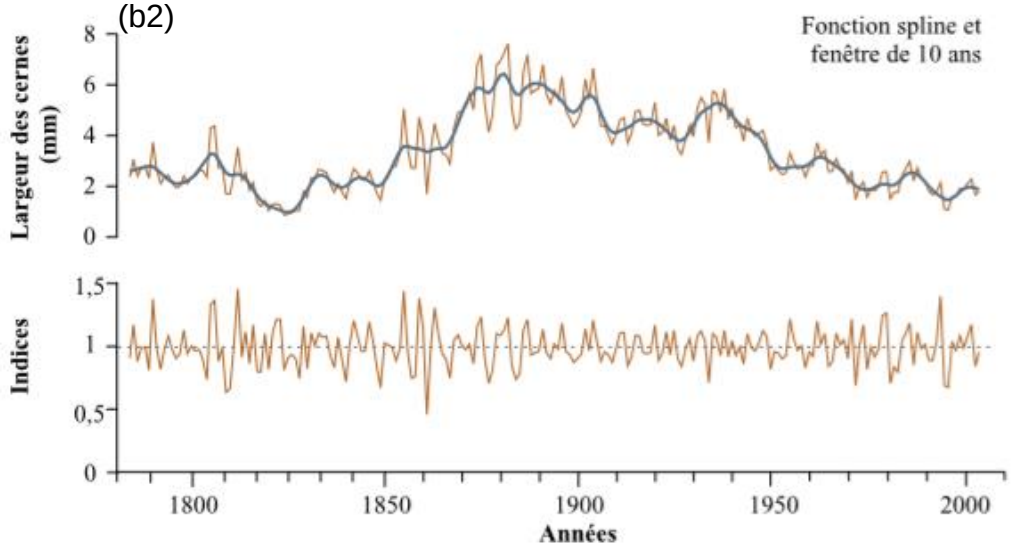
Nicault et al. (2010)

6. Standardisation



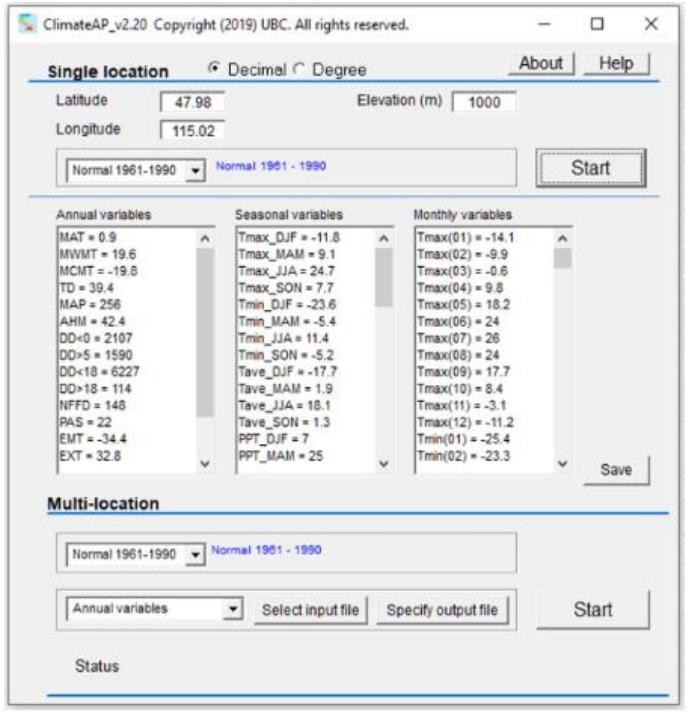


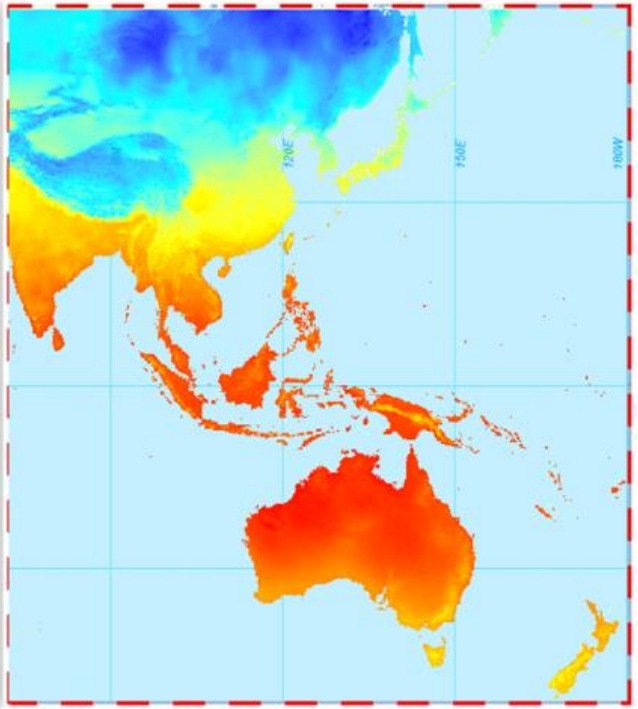


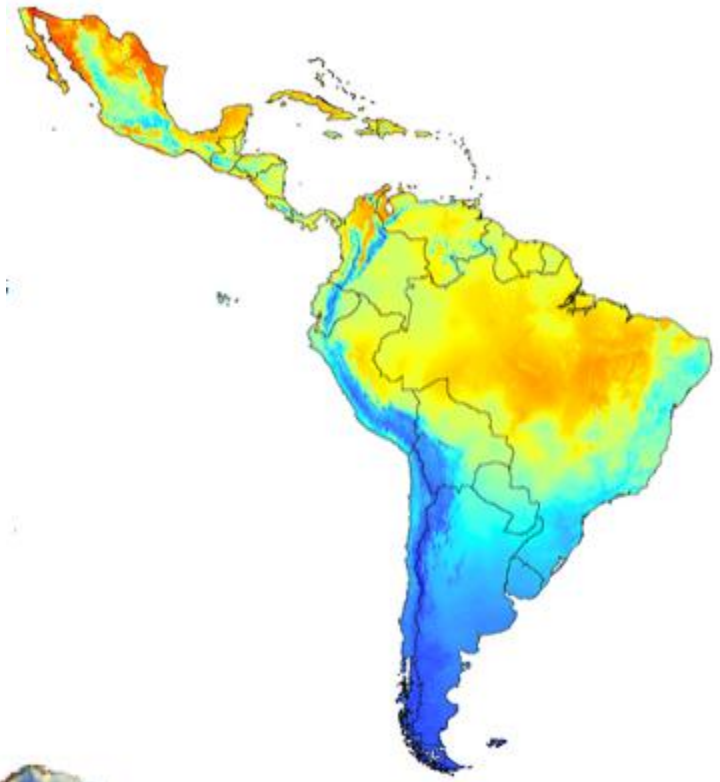


Nicault et al. (2010)

7. Données climatiques







http://web.climateap.net/

https://sites.ualberta.ca/~ahamann/data/climatesa.html

https://sites.ualberta.ca/~ahamann/data/climateeu.html

Hamann et al. (2013); Wang et al. (2016, 2017)

7. Données climatiques (ClimateNA)

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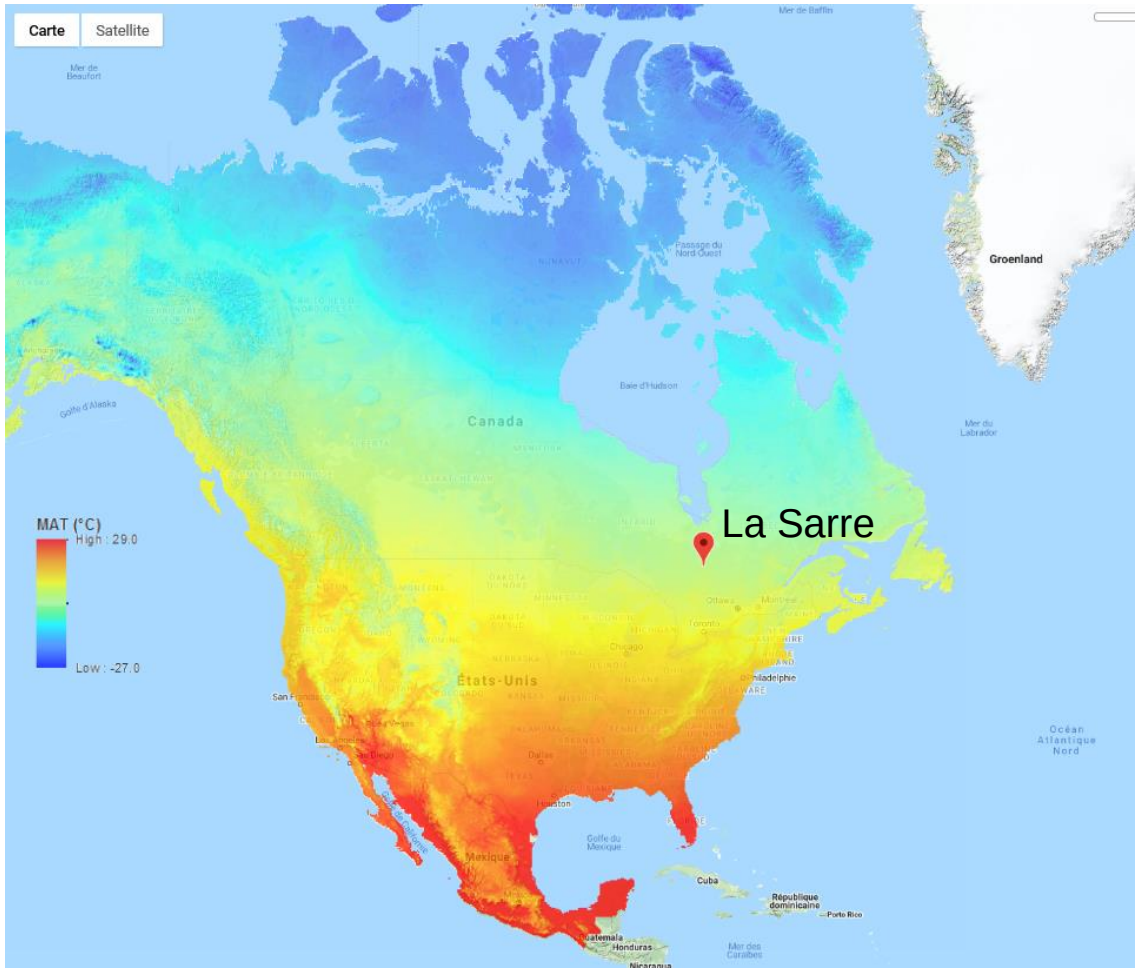


http://www.climatewna.com/default.aspx
http://climatena.ca/
Wang et al. (2016)

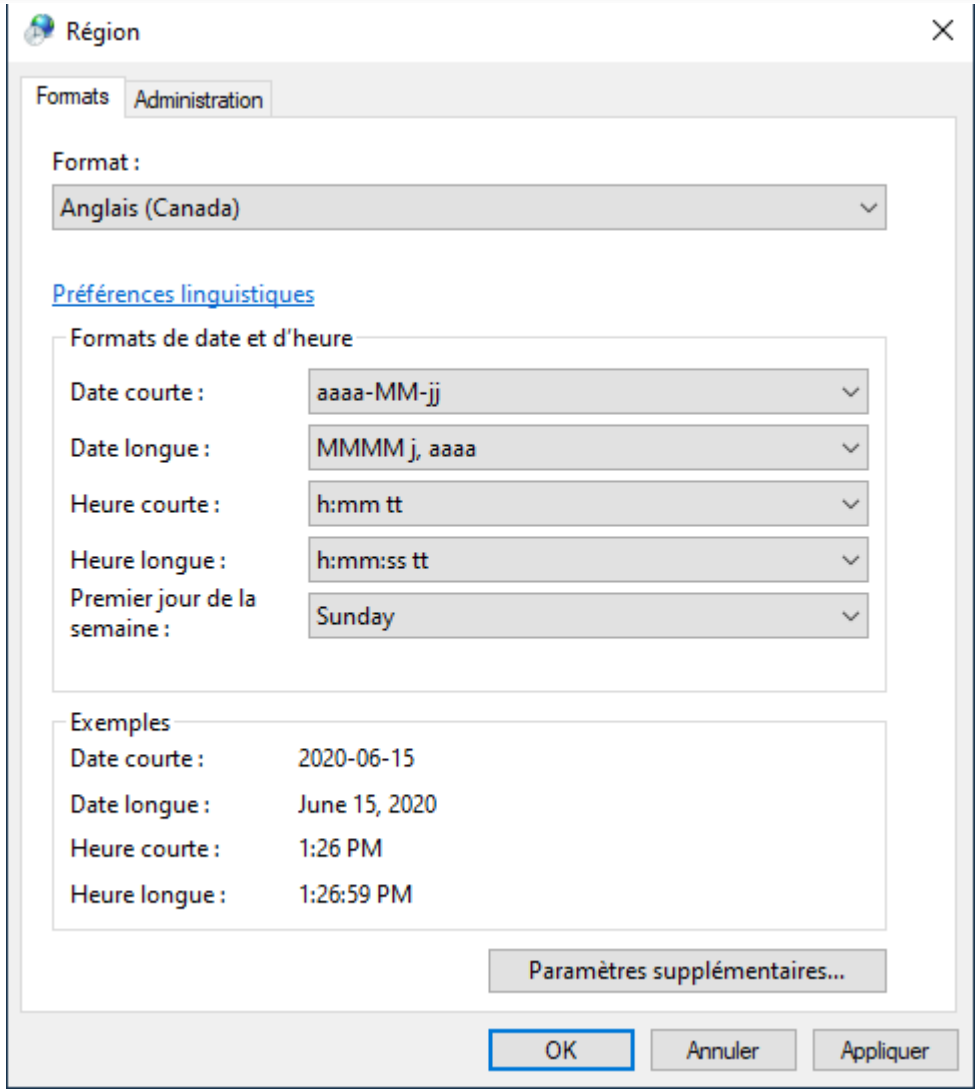


Image: Microsoft Windows (2020)

8. Associations climat-croissance

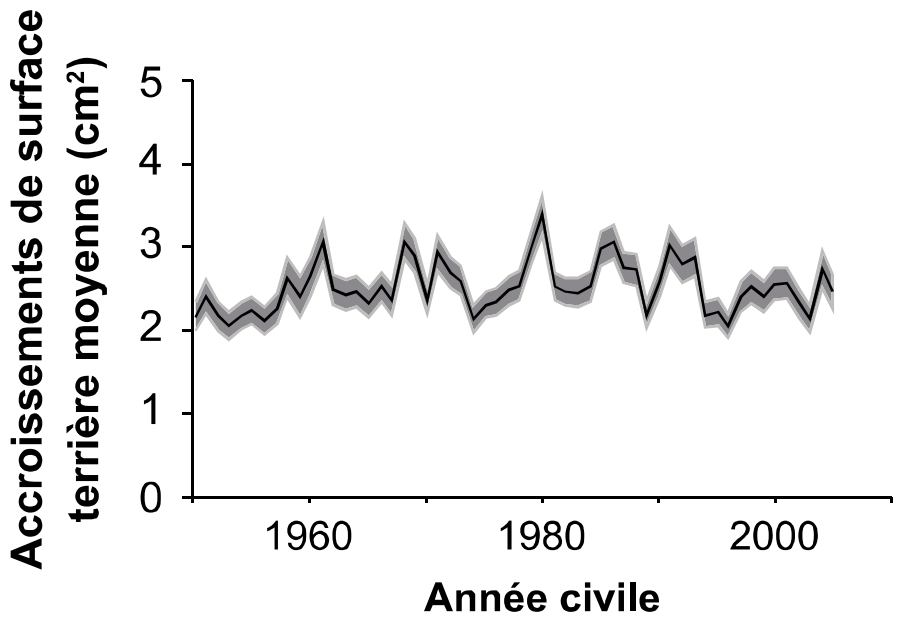
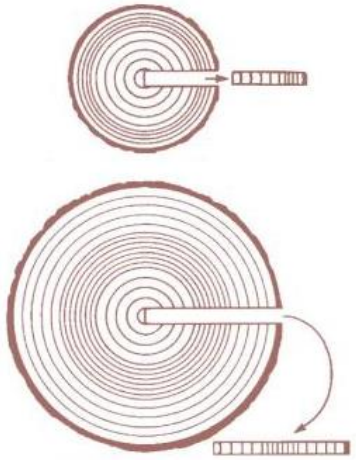


Image: Centre d'étude de la forêt



Images: M. Megalos

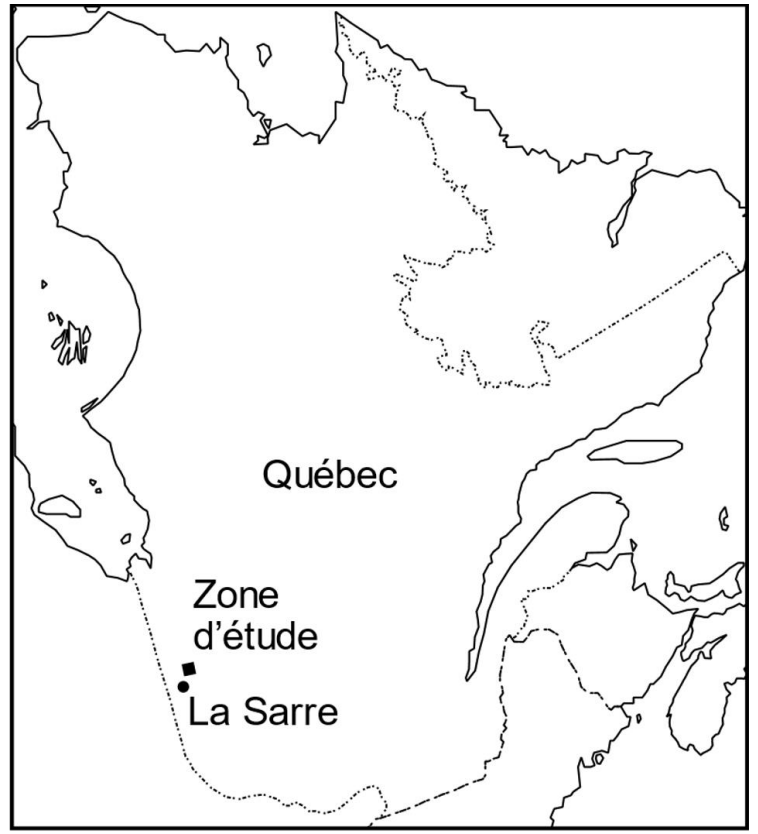


Image: R. Chavardès

Photo: R. Chavardès

Peuplements de *P. mariana*
(n = 8)

8. Associations climat-croissance

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Fonctions de corrélation entre les températures moyennes mensuelles (La Sarre) et une chronologie d'accroissement de la surface terrière de *P. mariana* dans des peuplements purs.

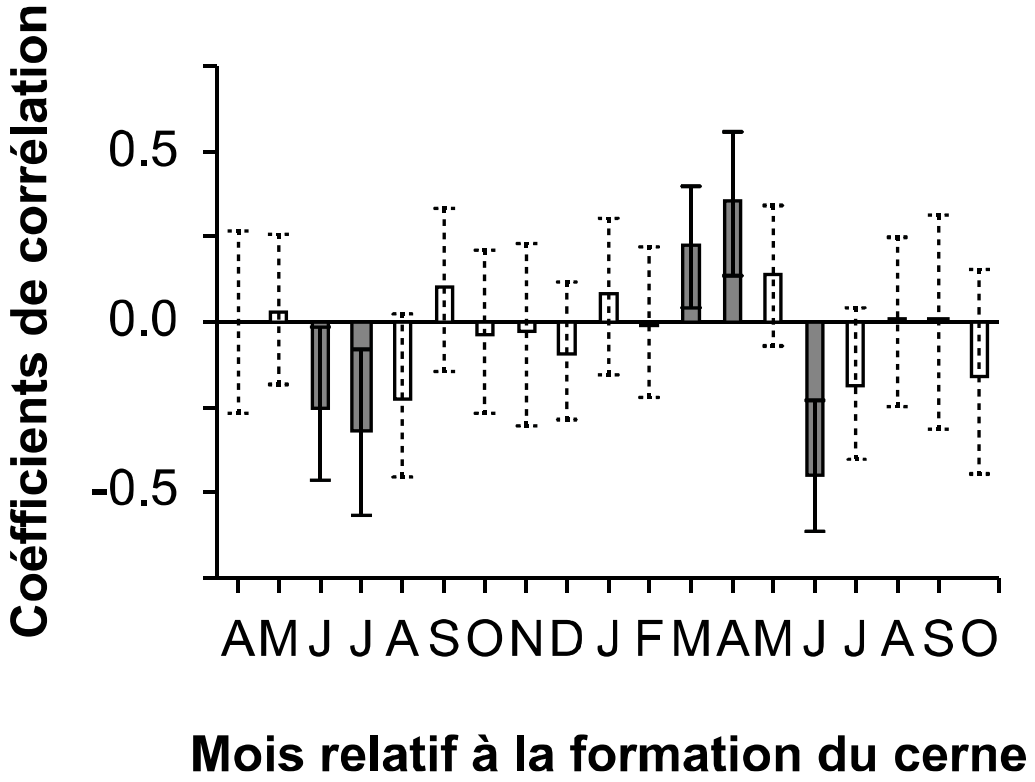

Image: Centre d'étude de la forêt

9. ‘dplR’ et ‘treeclim’ avec [R]

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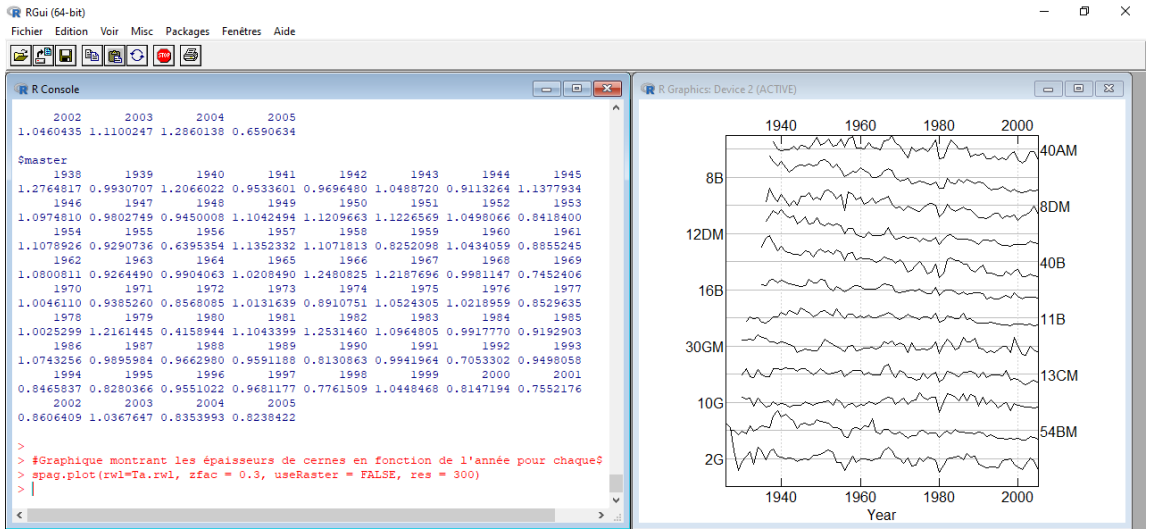
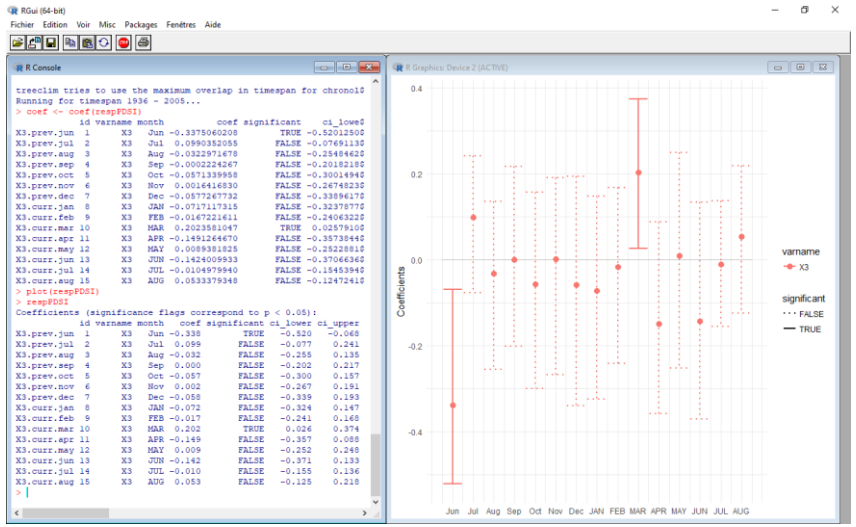


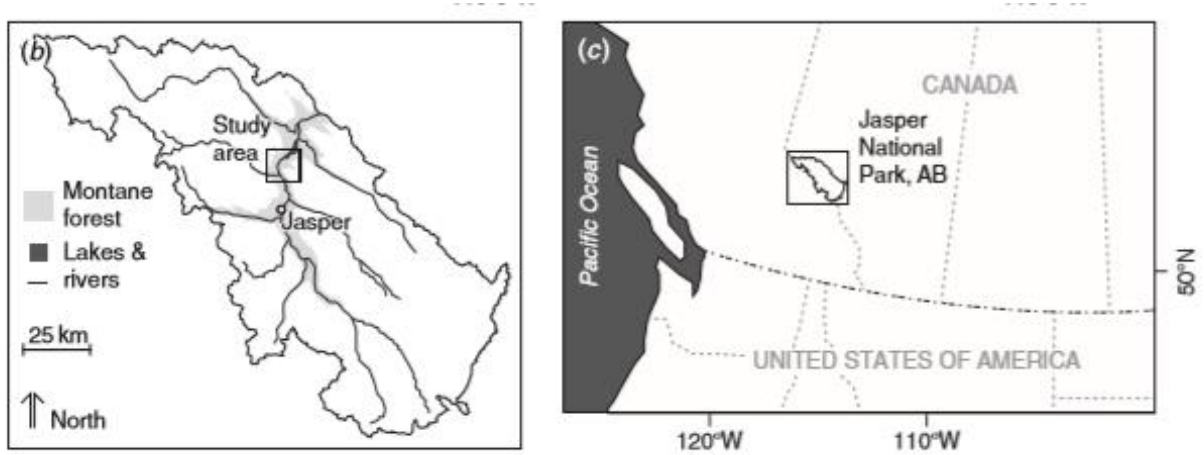
https://cran.r-project.org/web/packages/dplR/index.html
R Core Team (2018)
Bunn and Korpela (2020)



https://cran.r-project.org/web/packages/treeclim/treeclim.pdf
Zang and Biondi (2019)

Ressources (An introduction to dplR; Chronology building in dplR; Crossdating in dplR; A dendrochronology program library in R (dplR); Statistical and visual crossdating in R using the dplR library; Time series analysis in dplR)
https://cran.r-project.org/web/packages/dplR/vignettes/intro-dplR.pdf
https://cran.r-project.org/web/packages/dplR/vignettes/chron-dplR.pdf
https://cran.r-project.org/web/packages/dplR/vignettes/xdate-dplR.pdf
https://www.sciencedirect.com/science/article/pii/S1125786508000350?via%3Dihub
https://www.sciencedirect.com/science/article/pii/S1125786510000172?via%3Dihub
https://cran.r-project.org/web/packages/dplR/vignettes/timeseries-dplR.pdf

9. ‘dplR’ et ‘treeclim’ avec [R]



Chavardès and Daniels (2016)

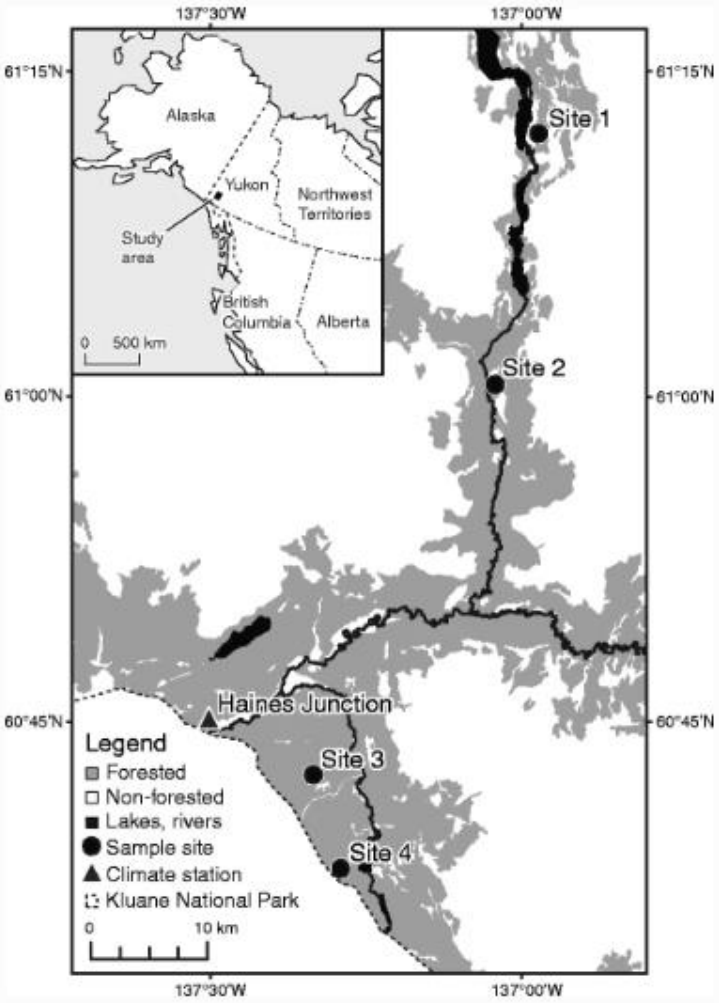
Photos: Tree-Ring Lab @ UBC (2013)

Photos: fRI Research

Photo: S. Stevens

Photo: B. Stocks

10. Exemple



Sites 1, 2, 3 and 4 near Haines Junction in the Champagne and Aishihik Traditional Territory, southwest Yukon

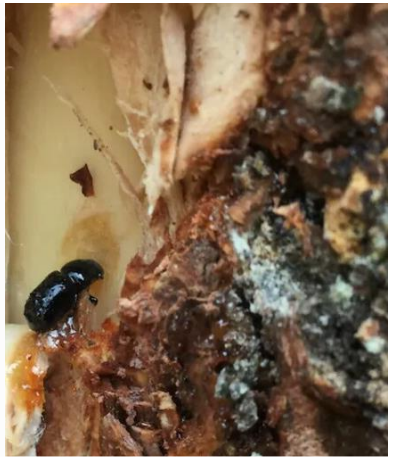


Photo: J. Robert

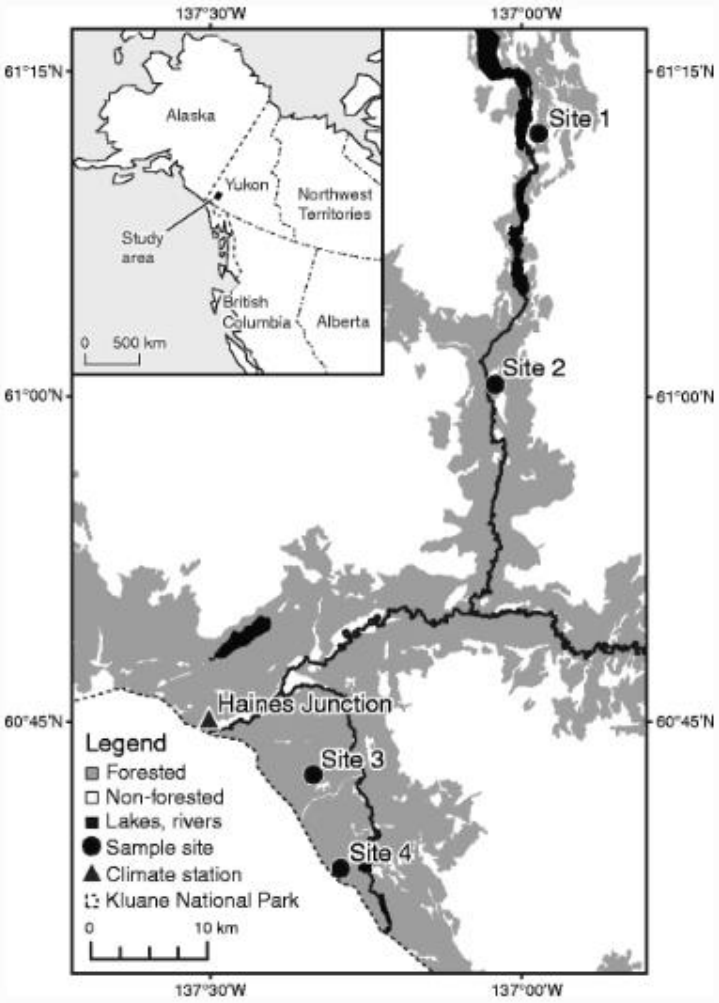
Photo: Radio-Canada

Photo: P. Waeber

The same standardization procedure was applied to all four sites. First, to account for the non-climatic, age-related trend in ring widths of our relatively young trees, we fit a negative exponential curve or linear regression through each ring-width series.

Chavardès et al. (2013)

10. Exemple



Sites 1, 2, 3 and 4 near Haines Junction in the Champagne and Aishihik Traditional Territory, southwest Yukon

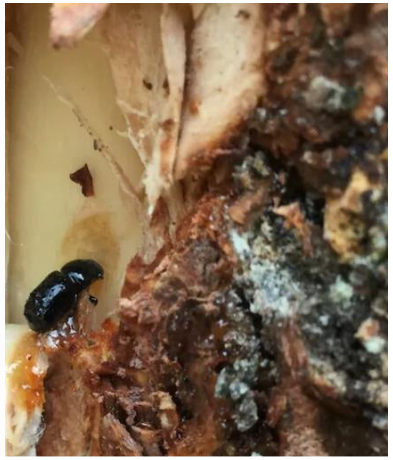


Photo: J. Robert

Photo: Radio-Canada

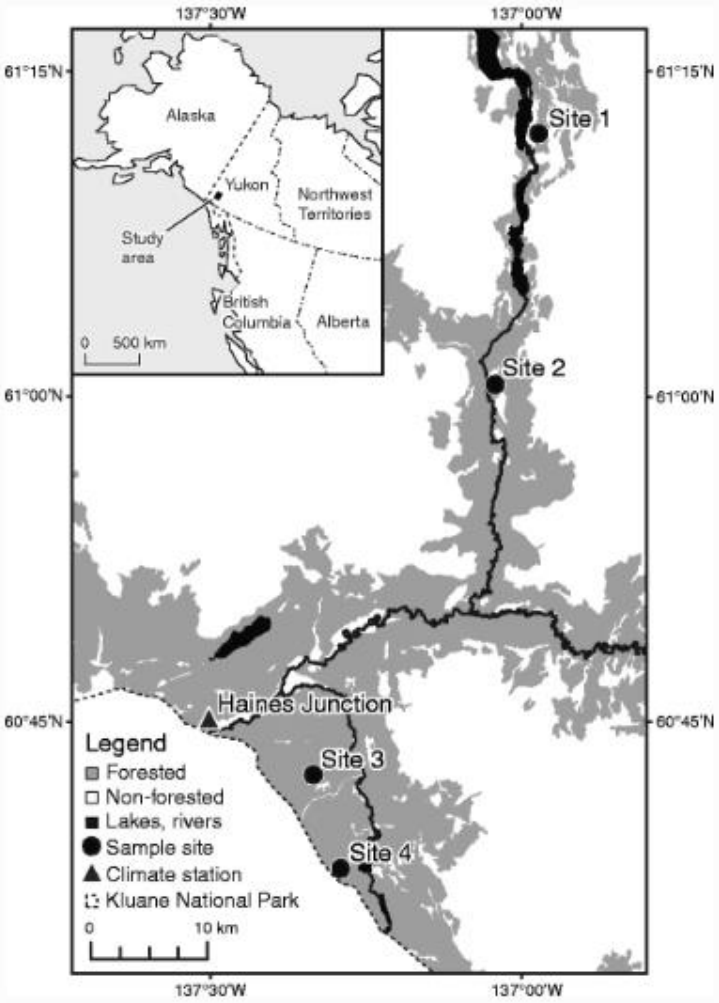
Photo: P. Waeber

The same standardization procedure was applied to all four sites. First, to account for the non-climatic, age-related trend in ring widths of our relatively young trees, we fit a negative exponential curve or linear regression through each ring-width series. We applied a second detrending to account for potential variation due to stand-level disturbance from spruce bark beetle by using a 60-year spline with a 50 % frequency response.

Chavardès et al. (2013)

Photo: R. Bowmer, Associated Press

10. Exemple



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Chavardès et al. (2013)

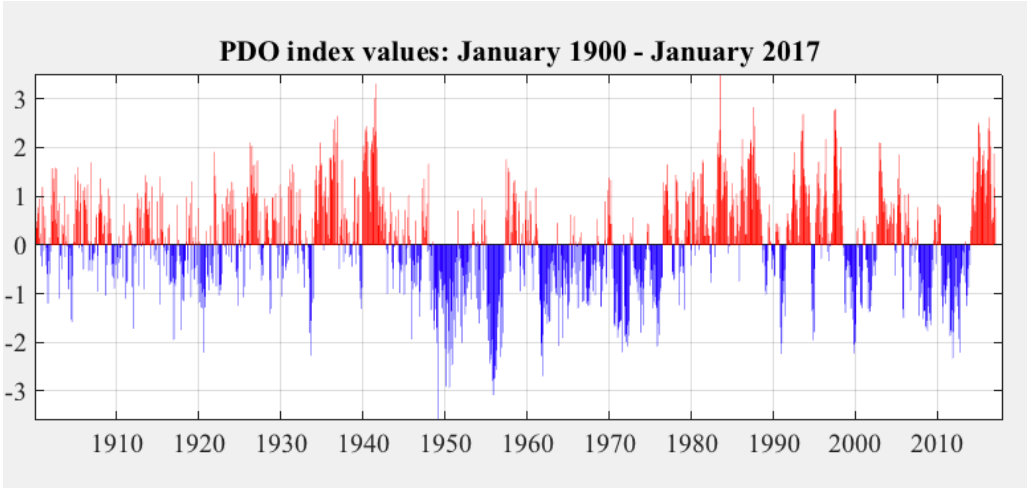
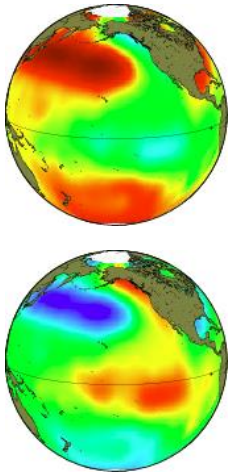


Image: Joint Institute for the Study of the Atmosphere and Ocean; University of Washington



Images: N. Mantua

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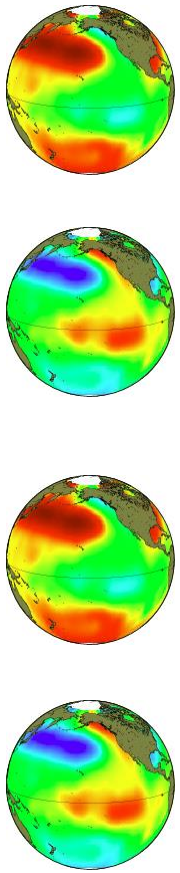
Photo: R. Bowmer, Associated Press

10. Exemple



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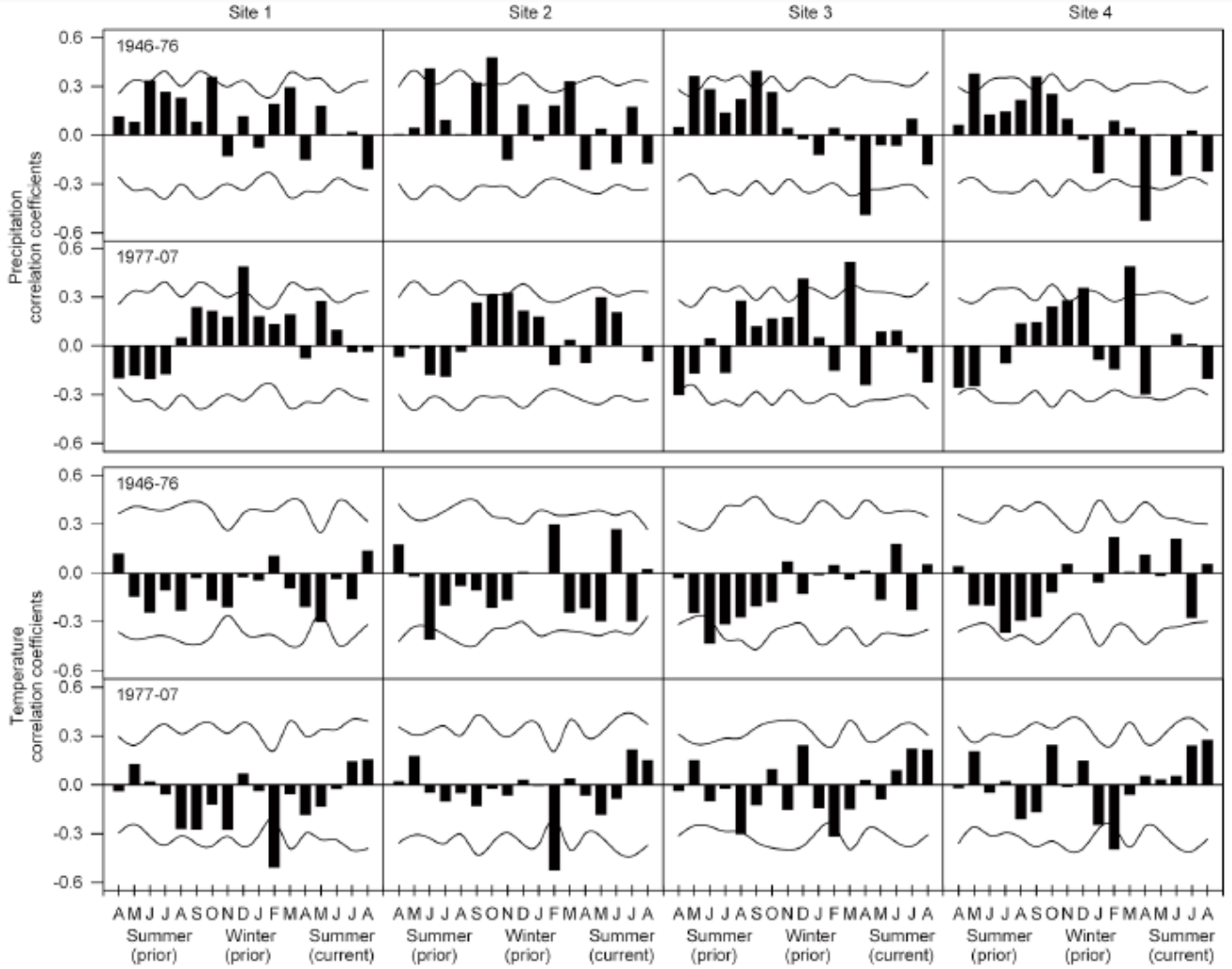

Fig. 1. Comparison of correlation functions for monthly total precipitation (top) and monthly maximum temperature (bottom) and the residual chronologies for Sites 1–4 (left to right) between the negative (1946–1976) and positive (1977–2007) phases of the PDO. Bars are the correlation function coefficients and lines are the 95% confidence intervals.

Chavardès et al. (2012)

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Questions

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