Kerstin Treydte, Valerie Trouet

Climate reconstruction from tree rings: Advances, developments, challenges
"The real holes in climate science“

Schiermeier 2010, *NATURE* (News Feature)

- Regional climate forecasts
- Precipitation forecasts
- Aerosols
- Paleoclimate data ("The tree ring controversy")
54 declared uncertainties:

- Absolute T amplitude
- Increasing uncertainty before 1500 (“heterogeneous” MWP?)
- seasonality
- “Divergence“ in recent period
- Extratropics
Grassroots approach:

What does climate science need from the dendroclimatological community?

Where to go from Rovaniemi?
More data

1. Longer records
More data

Torneträsk

Figure 2. Time-series plot of regional high-elevation tree-ring index from 3000 BC to AD 2002 (HI5 chronology-variance-adjusted normalized mean of five subalpine bristlecone pine chronologies). Dark thicker line smoothed with a 20-yr spline. Upper panel is total number of series in the chronology; middle panel is total number of chronologies through time.
More data

1. Longer records
   - <1500
   - Increase replication in recent times
1. Longer records
2. Southern Hemisphere/tropics
More data

Cook et al.’s Drought Atlases

Cook et al. (2010) Science
More data

More data

1. Longer records
2. Southern Hemisphere/tropics
3. New climatic variables
A 500-year record of summer near-ground solar radiation from tree-ring stable carbon isotopes

Giles H.F. Young,1 Danny McCarroll,1 Neil J. Loader1 and Andreas J. Kirchhefer2
A 500-year record of summer near-ground solar radiation from tree-ring stable carbon isotopes

Giles H.F. Young,¹ Danny McCarroll,¹ Neil J. Loader¹ and Andreas J. Kirchhefer²
1. Longer records
2. Southern Hemisphere/tropics
3. New climatic variables: isotopes
Expert knowledge
Expert knowledge

1. Preserving low-frequency variability
Expert knowledge

Preservation of low frequency: de-trending
Expert knowledge

1. Preserving low-frequency variability

2. Quantification of error
Detrending error
- Chronology error
- Calibration error

Esper et al. (2007) GRL
Expert knowledge

Probabilistic approach: Ensemble reconstruction

Frank et al. (2010) Nature
Expert knowledge

1. Preserving low-frequency variability
2. Quantification of error
Expert knowledge

1. Preserving low-frequency variability
2. Quantification of error
3. Divergence Problem
1. Preserving low-frequency variability
2. Quantification of error
3. Divergence Problem
   • Tree-ring data: ‘signal-free approach’
1. Preserving low-frequency variability

2. Quantification of error

3. Divergence Problem
   • Tree-ring data: ‘signal-free approach’
   • Instrumental data
Expert knowledge

Shooting at a moving target

A. Northern Hemisphere

Divergence between June-August and annual temperatures and proxy records.

'Better Ice Age'

'Better warming'

B. European Alps

Dalton minimum & volcanos

Vienna Conference (1873)

C. Alpine Instrumental

Glacial advances

Low and high elevation

Glacial retreat

Frank et al. 2007 QSR
Expert knowledge

Shooting at a moving target

A. Northern Hemisphere
Divergence between June-August and annual temperatures and proxy records.

'Blight Ice Age'

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Glacial advances

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Glacial retreat

Frank et al. 2007 QSR
Böhm et al. (in press) Clim. Change
Grassroots

What does climate science need from the dendroclimatological community?

1. more data
2. expert knowledge
What does climate science need from the dendroclimatological community?

1. more data
2. expert knowledge
3. ‘frontier’ research
Global-scale temperature patterns and climate forcing over the past six centuries

Michael E. Mann*, Raymond S. Bradley* & Malcolm K. Hughes†

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† Laboratory of Tree Ring Research, University of Arizona, Tucson, Arizona 85721, USA
Frontiers

1. Large-scale reconstructions
1. Large-scale reconstructions
2. Atmospheric circulation patterns
Trouet et al. (2009) Science
36 sites (Millennium & Isonet) pine, oak and others

100 years: 34 sites
400 years: 24 sites
1000 years: ca. 12 sites

Treydte et al. (forthcoming)
What does climate science need from the dendroclimatological community?

A *careful balance* between

1. more data
2. expert knowledge
3. ‘frontier’ research

**Conclusion**
Thank you

Kevin Anchukaitis
Ulf Büntgen
Jan Esper
David Frank
Neil Loader
Rob Wilson