EXTENDING HIGHLY RESOLVED NAOI RECONSTRUCTIONS BACK TO AD 1500

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Objectives

The NORTHERN ATLANTIC OSCILLATION (NAO) is one of the most prominent circulation patterns in the Northern Hemisphere [1,2,3]. The reconstruction of this pattern is important, not only for improving our understanding of the climate variability, but also for testing climate models. Our study aims to construct a winter NAO index back to AD 1500 using documentary data in southern Spain.

Data and Methods

- The NAO is defined as the standardised difference between the SLP average of 45°N, 0° and 45°N, 10°W.
- The predictors include early instrumental station series and proxy data, reconstructed temperature, precipitation and paleoenvironmental indices.
- The CCA model performance was evaluated using the reliability of the 500-year reconstructions.

Results

- Figure 2 indicates reliable winter and summer NAOI reconstructions for the whole 500 years.
- The study shows that the reconstructed NAO indices are closely correlated with the instrumental data.
- The wavelet spectrum analysis reveals significant power at the interdecadal scale (8-12 years).

Conclusion

- The early instrumental data from Eurasia reflect the ability to construct reliable winter and summer NAOI reconstructions.
- The period with the highest positive NAOI values is known to be cold (warm) over Eurasia supported by data not included in the reconstructions.
- No single persistent mode of oscillation of the winter NAOI has been found.

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References


Figure 1: (a) Spatial distribution of the predictors and location of the reconstructed NAOI. Circles indicate instrumental stations (pressure, temperature, and precipitation), triangles mark series estimated from documentary evidence. Red triangles indicate reconstructions from [286-99], and (b) Temporal development of the number of predictors.

Figure 2: CCA model performance of the reconstructed NAOI from 1500 to 1990. Seasonal fits from 1500 to 1990 are based on monthly values, while the 1659-1990 are based on seasonal values. RE < 1 indicates a perfect agreement between reconstructions and observations. RE > 1 indicates skillful reconstructions. RE = 1 indicates no useful information in the reconstruction.

Figure 3: Normalized times series of the reconstructed winter NAOI from 1500-1990. The most recent 9 values have been evaluated to determine and to compare the winter NAOI. DJF: January-February-March; JFM: January-February-March; FMA: February-March-April; MJJ: May-June-July; JAS: June-July-August; MSN: May-June-July;

Figure 4: Wavelet spectrum of the winter NAOI from 1500-1990. Winter NAOI 1500-1990 were reconstructed using the Morlet wavelet. A significant correlation with winter NAOI reconstructions for the whole 500 years. The period with the highest positive NAOI values is known to be cold (warm) over Eurasia supported by data not included in the reconstructions. No single persistent mode of temporal oscillation of the winter NAOI has been found.

This new continuous 500-year NAOI time series might be useful for modeling studies and paleoclimatologists for validating proxy data.