Climate
of the Past

Supplement of

Insights into Atlantic multidecadal variability using the Last Millennium Reanalysis framework

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1 Introduction

In this document, we provide supplemental information on the statistics of the CCSM4 model prior used in the LMR (Appendix A), and further multitaper spectral estimation of the AMO index as reconstructed by the LMR (Appendix B).

2 Appendix A: Statistics of the Model Prior

In the LMR framework, the CCSM4 Last Millennium run (from CMIP5) is sampled to provide a background state for the reconstruction. The mean (Fig 1a) and standard deviation (Fig 1b) of this background ensemble are shown in Figure 1.

3 Appendix B: Spectral Estimation

To assess the robustness of the wavelet-based spectra of section 3.4 in the main text, we perform multitaper spectral analysis (Thomson, 1982) on the AMO indices from six LMR experiments (Fig 2). The results show spectra compatible with a fractal scaling ($S(f) \propto 1/f^\alpha$, $\alpha > 1$), with spectral peaks hardly detectable against a relatively permissive null (AR(1) model fitted to the dataset, as per the suggestion of Ghil et al., 2002). This confirms that the reconstructed AMO indices are consistent with stationary processes without clear periodic behavior - remarkably, no multidecadal periodicity is detected in all reconstructions, though the CRU-based reconstructions (Fig 2, top row) display a relatively pronounced variability in the 30-40y range.
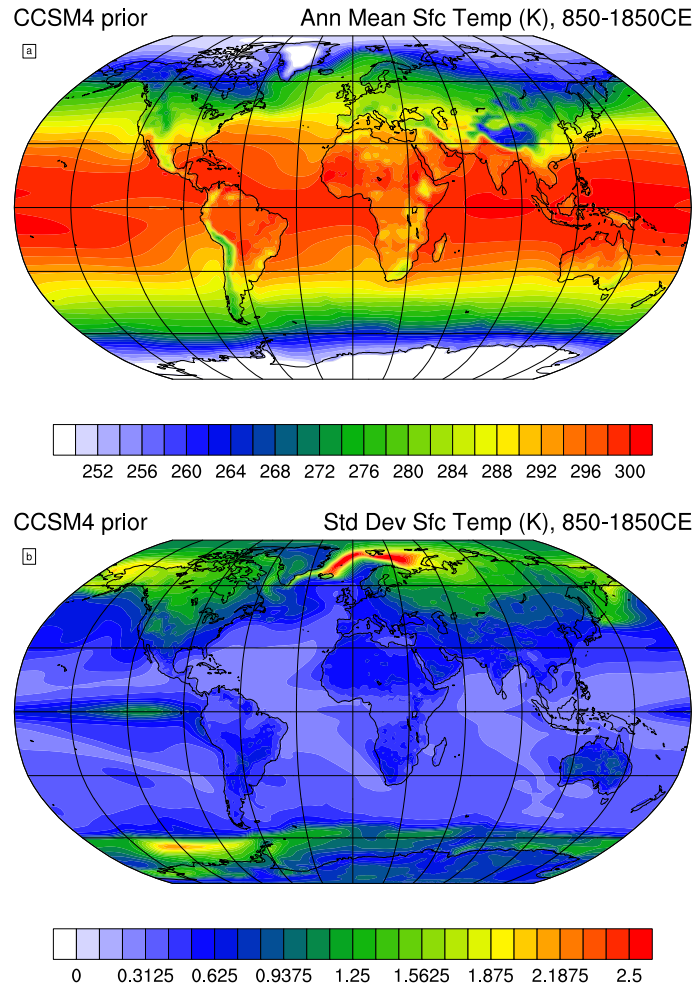
Figure 1. Statistics of the CCSM4 Last Millennium run surface temperature (in K), used as the background ensemble for the LMR reconstruction: (a) mean, and (b) standard deviation.
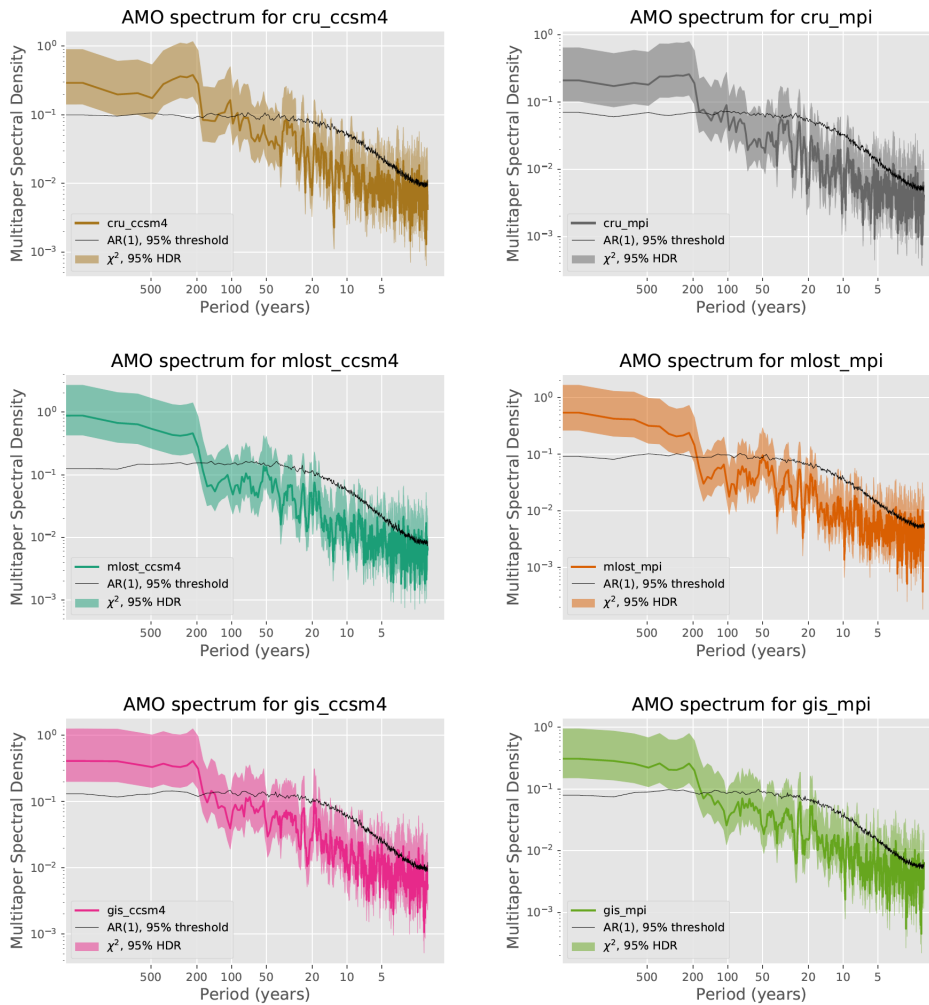
Figure 2. Spectra of reconstructed AMO index for 2 priors (CCSM4, left; MPI, right) and 3 instrumental calibrations (HadCRUT4, top; MLOST, middle; GISS, bottom). The calculation excludes the 20th century due to a very strong trend; the absence of spectral peaks is insensitive to this choice.

References

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Thomson, D.: Spectrum Estimation and Harmonic Analysis, Proc. IEEE, 70, 1055–1096, 1982.