

## Climate simulation of the last millennium: some notes on comparison with proxy-based reconstructions

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Coordinated simulations of the last millennium climate are being organized in the WCRP-CMIP5/PMIP3 framework for coupled atmosphere-ocean general circulation models and in a community-based framework for earth system models of intermediate complexity. The authors participate in both, and carried out several experiments. An increasing number of model output becomes available widely to the community. While the direct comparison between reconstructions and model simulations is tempting immediately after the data become available, there are several issues that have to be considered. Difficulties arise from the relatively weak forcing and consequent small ratio between externally-forced climate change and unforced (time-invariant forcing) internal variability. We argue that useful comparisons can be made by 1) first distinguishing externally-forced "signal" and internally-generated "noise" using both forced and unforced simulations; 2) extracting the "signal" with ensemble simulation; and 3) running the model separately with individual forcings. Examples will be presented for variations in the Northern Hemisphere and Greenland temperature.

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