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Climate of the Past Discussions

Interactive comment on "The origin of the European "Medieval Warm Period"" *by* H. Goosse et al.

Anonymous Referee #1

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GENERAL COMMENTS

The study by Goosse et al. investigates the temperature anomalies over Europe during the past millennium. The issue of the Medieval Warm Period (MWP) over Europe has been addressed already in two previous papers by the first author (Goosse et al. in 2005, Quat. Science Rev. and Goosse et al., 2006 in Climate Dyn.) and the title of the present study suggests that an explanation for the origin of the MWP will be presented. A new element in the present study is the use of the multiproxy reconstruction of the summer temperatures in western Europe over the last millennium by Guiot et al. (2005). However, the authors mainly describe the positive temperature anomalies during the MWP, their differences in different regions of Europe and their seasonal differences relative to the temperature anomalies in the late 20th century as obtained

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from forced millennium simulations and proxy records. In this context, the terms "late 20th century" and "at the end of the 20th century" are used in a very unspecific manner. Does the late 20th century end in 1980? This could be inferred from the specified reference period 1500 - 1980 and from the time series displayed in Figures 2, 3 and 4 which seem to end in 1980. Or does late 20th century involve an average over 10 years (seasons) or even 25 years as suggested, for instance from page 296, line 21?

In the end, the reader is left with a vague picture whether the MWP has its origin in internal or forced climate variability. The overall presentation lacks of clarity and requires major revision. Some more specific comments are given below.

SPECIFIC COMMENTS

p 288, l 27: A reference for the "observed evolution of greenhouse gases" used in the simulations is needed.

p 289, l 23: A reference for the land use scenario should be given to indicate possible differences from the land use scenario used in Brovkin et al. (1999) and in Bauer et al. (2003).

p 290, l 23: The weak climate sensitivity of ECBILT-CLIO-VECODE (1.8 C for doubling of CO2) implies less climate warming through the increase in greenhouse gas concentrations at the end of the late millennium. This aspect needs to be discussed.

p 291, l 22: How can the internal variability "be evaluated by plotting the range of the ensemble simulation"? Is the message of the sentence that statistical properties of the temperature anomalies from the ensemble of simulations can provide an appropriate measure of the internal variability of the temperature? The evaluation of internal variability is complicated as temperatures from forced simulations contain variability caused by the external factors and by internal interactions. Since the simulation of the response to external factors, the external factors themselves and the internal interactions are associated with uncertainties it should be clearly stated that compatibility of

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a simulated temperature with a reconstructed temperature does not prove the validity of simulated temperature anomalies. See also the detailed analysis in a recent paper by Hunt, 2006: The Medieval Warm Period, the Little Ice Age and simulated climatic variability, Climate Dyn., DOI: 10.1007/s00382-006-0153-5.

p 294, l 20: Be more specific which of the "reconstructions document warm climate conditions in Europe around 1000 AD that were similar to the late 20th century".

p 294, l 24: Is the reconstruction of Luterbacher et al. (2004) based on proxy records different from the proxy recods used here for finding the best pseudo-simulation?

p 295, l 26: Specify the time intervals for which the "simulated European temperature has decreased by 0.5 C in summer and 0.4 C in winter".

p 296, l 9: How can the volcanic forcing reinforce the effect of greenhouse gas forcing? Do the authors mean that the volcanic activity in the model simulation was less strong between 1976 and 2000 than between 1801 and 1825.

p 297, l 7: Why not name these "several forcings"?

p 299, l 24: Temperature changes due to changes in orbital parameters depend on season (better daily changes of insolation) and the latitudinal belt. Which temporal resolution was used for orbital forcing and for which regions temperature changes were found to be smaller than 0.15 C. The decrease in the seasonal contrast in northern mid-latitudes evident during most of the Holocene is expected to reverse during the last millennium as the occurrence of perihelion moved from December to January. In consequence the insolation will decrease in December and increase in June.

Figure 6: Figure 6 is very informative but could be improved. The y-scale in panel a) and b) should be adjusted. The error bars indicating internal variability should be colored. Why is the warming due to greenhouse gas forcing larger in panel a) than in panel b)? Can Figure 6 be extended by showing the temporal temperature changes from the fully forced simulation?

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TECHNICAL CORRECTIONS

In Figure caption 3c the seasonal range is presumably incorrectly indicated as "winter minus summer".

Some typing errors are not listed here.

Interactive comment on Clim. Past Discuss., 2, 285, 2006.