Climate of the Past
An Interactive Open Access Journal of the European Geosciences Union

Clim. Past, 2, 99-113, 2006
www.clim-past.net/2/99/2006/

The origin of the European "Medieval Warm Period"

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Abstract. Proxy records and results of a three dimensional climate model show that European summer temperatures roughly a millennium ago were comparable to those of the last 25 years of the 20th century, supporting the existence of a summer "Medieval Warm Period" in Europe. Those two relatively mild periods were separated by a rather cold era, often referred to as the "Little Ice Age". Our modelling results suggest that the warm summer conditions during the early second millennium compared to the climate background state of the 13th–18th century are due to a large extent to the long term cooling induced by changes in land-use in Europe. During the last 200 years, the effect of increasing greenhouse gas concentrations, which was partly levelled off by that of sulphate aerosols, has dominated the climate history over Europe in summer. This induces a clear warming during the last 200 years, allowing summer temperature during the last 25 years to reach back the values simulated for the early second millennium. Volcanic and solar forcing plays a weaker role in this comparison between the last 25 years of the 20th century and the early second millennium. Our hypothesis appears consistent with proxy records but modelling results have to be weighted against the existing uncertainties in the external forcing factors, in particular related to land-use changes, and against the uncertainty of the regional climate sensitivity. Evidence for winter is more equivocal than for summer. The forced response in the model displays a clear temperature maximum at the end of the 20th century. However, the uncertainties are too large to state that this period is the warmest of the past millennium in Europe during winter.

Final Revised Paper (PDF, 770 KB) Discussion Paper (CPD)

Citation: Goosse, H., Arzel, O., Luterbacher, J., Mann, M. E., Renssen, H., Riedwyl, N., Timmermann, A., Xoplaki, E., and Wanner, H.: The origin of the European "Medieval Warm Period", Clim. Past, 2, 99-113, 2006. Bibtex EndNote Reference Manager