



## **Reconstruction of Late Glacial and Early Holocene near surface temperature anomalies in Europe and their statistical interpretation**

A. Hense (1), D. Simonis (1,2), B. Thoma (1), and T. Litt (3)

(1) Universität Bonn, Meteorologisches Institut, Auf dem Hügel 20, 53121 Bonn, Germany, (2) WetterOnline GmbH, Am Rheindorfer Ufer 2, 53117 Bonn, Germany, (3) Steinmann Institute of Geology, Mineralogy and Palaeontology, University of Bonn, Nussallee 8, 53115 Bonn, Germany

We present the results of a two-dimensional variational analysis (Simonis et al, 2012, *Quaternary International*) extending the method by Gebhardt et al. (2008, *Climate Dynamics*) to reconstruct paleo-temperature fields on the typical scale of climate model output, providing the necessary basis for quantitative comparison of reconstructions and model results. The extension of the previously available method takes into account the full statistics of the analysis error of the variational analysis to study the inherent uncertainties of the proxy data representing the imperfect paleo-climate information and their impact on the field reconstruction. The method is applied to reconstruct realizations of monthly mean temperature anomaly fields in Europe for January and July in Europe as averages for several time slices in the Late Glacial and Holocene. We use well dated palynological observations and extract presence/absence of specific climate sensitive taxa at about 50 - 80 sites. We show single realizations of reconstructions which include the uncertainties of the used paleo-proxy data with respect to the reconstructed physical variables. The individual realizations can differ substantially from the field of expectation values in terms of spatial patterns due to the inherent correlation of the spatial uncertainties of the paleo-proxy data. Additionally the fields of expectation values generally are much smoother than the realizations. This indicates that it is misleading to only regard expectation values in case of uncertain input proxy data. In addition, we use the ensembles of realization to calculate robust error measures for area mean values which is valuable for the quantitative comparison of the results of different time slices. The presence/absence information is not able to resolve statistically significant the difference in climate between the Alleröd and the Younger Dryas. The connection of mid-European variability and that in the Levant region will be discussed.