Geophysical Research Abstracts, Vol. 8, 06773, 2006
SRef-ID: 1607-7962/gra/EGU06-A-06773
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Palaeoclimate and palaeovegetation reconstructions from European fossil pollen records by the inversion of a vegetation model

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Fossil pollen sequences are amongst the most widespread source of terrestrial fossil data, and provide information on past vegetation structure and composition. This data is now well established as a tool for climate reconstructions, using the relationship between climate and taxa distributions. These relationships are also contained in vegetation models, which simulate vegetation characteristic, composition and functioning in response to climate, CO2 and soil texture changes. These models may therefore be used to estimate past changes in these variables from palaeodata, by running the model in inverse mode. For this, a large number of different climate scenarios are used, and the resulting simulated vegetation is compared to the observed fossil vegetation. This work is facilitated by the use of computation algorithms (MCMC) that accelerate the search for appropriate climate scenarios. We present results obtained using pollen data for the Last Glacial Maximum (LGM: 21 ka BP) and an equilibrium vegetation model (BIOME4), that are coherent with previous results obtained with statistical approaches: the land surface maps show a strong reduction of forests during the LGM, and a colder and dryer climate in Europe. We present also some first results in an adaptation of this method with dynamic vegetation model (LPJ-DGVM), which allows not only the reconstruction of the average past climatology, but also the changes in the variability of the palaeoclimate.

This model-based approach does not replace statistical approaches as model itself does not represent perfectly the reality, but it is necessary to understand the interactions

between past vegetation and climate and to check if other factors can induce biases in the reconstruction. In addition, as such vegetation models simulate also water budget, dC13, it can be used to integrate different proxies measured on for the same core (e.g. diatoms, isotopes). This presentation is a contribution to the ESF-EuroCLIMATE project DECVEG (FP04).