Geophysical Research Abstracts, Vol. 8, 05524, 2006
SRef-ID: 1607-7962/gra/EGU06-A-05524

Pre-observational surface temperature changes as constrained by borehole temperature measurements in Romania

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Long-term meteorological records since 1860 are used to infer the temperature signal in the subsurface corresponding to a conductive heat transfer mode. Filtering out the short-period (2-7 years) and the 11-year signals in data reveals a pronounced ˜30-year variation, with amplitudes of 0.3-0.4 °C, which dominates the temperature time series. The ˜30-year variation is superimposed on a longer variation, with a maximum around 1940 and a minimum around 1980 (about 0.5 °C peak to trough). The signature of the decadal and centennial components of the surface temperature variation and models of surface temperature variations prior to the instrumental record are discussed. The latter are constrained by temperature measurements in several boreholes in the depth range 0-500 m, located in the Eastern Carpathians and the Transylvanian Basin. Pre-observational temperature steps of 2-3 °C are necessary to explain the borehole measurements. Corrections for the lateral variability of the temperature over the study territory are being considered. The effect of older (and larger) temperature steps in the past, such as the one at the end of the Weichselian glaciation, is discussed as well.