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Clim. Past, 3, 297-313, 2007

www.clim-past.net/3/297/2007/

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Selection of borehole temperature depth profiles for regional climate reconstructions

C. Chouinard and J.-C. Mareschal

GEOTOP-UQAM-McGill, Centre de Recherche en Géochimie et en Géodynamique, Univ. du Québec à Montréal, Canada

Abstract. Borehole temperature depth profiles are commonly used to infer time variations in the ground surface temperature on centennial time scales. We compare different procedures to obtain a regional ground surface temperature history (GSTH) from an ensemble of borehole temperature depth profiles. We address in particular the question of selecting profiles that are not contaminated by non climatic surface perturbations and we compare the joint inversion of all the profiles with the average of individual inversions. Very few profiles of the Canadian data set meet the selection criteria (e.g. only 13 out of 73 profiles in Manitoba and Saskatchewan were retained). We show that the resolution and the stability of the inversion of selected profiles are much improved over those for a complete data set. When profiles have been selected, the average GSTH of individual inversions and the GSTH of the joint inversion are almost identical. This is not observed when the entire data set is inverted: the average of individual inversions is different from the joint inversion. We also show that the joint inversion of very noisy data sets does not improve the resolution but, on the contrary, causes strong instabilities in the inversion. When the profiles that are affected by noise can not be eliminated, averaging of the individual inversions yields the most stable result, but with very poor resolution.

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