Geophysical Research Abstracts, Vol. 8, 01424, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01424
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Uncertainty analysis of statistical downscaling model outputs from two global climate models in northern Canada

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Fine resolution climate change information for use in impact studies can be obtained using statistical downscaling (SD) methods to relate the large or coarse scale climate variables from Global Climate Models (GCMs) with local or station scale observations. However, to have some level of confidence on these climate change information and their plausibility, one has to be at least convinced that the downscaled outputs reproduce the current observed characteristics of temperature and precipitation regimes, i.e. one has to check if the increased resolution achieved by the downscaling corresponds to increased confidence in the projections of local climate information compared to raw GCM outputs. To evaluate the SD models limitations with some objective criteria, some uncertainty analyses are required and in this study, an uncertainty analysis is done on regression-based SD results using predictors from two driving GCMs (namely the Canadian CGCM2 and the British HadCM3 models), with respect to their skill to reproduce the probabilities of extreme observed temperature and precipitation in some specific locations of northern Canada over the 1961-1990 time period. Two complementary methods, namely Wilcoxon Signed Rank hypothesis testing and the Bootstrap confidence-interval estimation technique are used to make the uncertainty analysis of the output of the SD model on the mean and standard deviation of different climate indices on a seasonal and monthly basis. When compared to the observed temperature data, the SD results corresponding to CGCM2 predictors have been found to be less certain than the HadCM3 ones for some particular months or locations, i.e. the majority of SD results are rejected or are outside the 90% confidence interval for the differences between the monthly mean values of the observed and downscaled temperature. For the case of precipitation downscaling, there is no systematic difference

in the performance of the SD model. Despite these problems, the study has generally shown the feasibility of regression-based downscaling of large scale climate variables to local temperature and precipitation provided that unbiased climate predictors could be derived from different GCMs over the area of interest.