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# Estimation of the 1900-2100 Greenland ice sheet surface mass balance

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Results from a 37-year simulation (1970-2006) over the Greenland ice sheet (GrIS) with the regional climate model MAR reveals that more than 97% of the interannual variability of the modelled Surface Mass Balance (SMB) is explained by the GrIS summer temperature anomaly and the GrIS annual precipitation anomaly. This dependence is also fully confirmed by another model using the ECMWF (re)analysis. This multiple regression is then used to empirically estimate the GrIS SMB since 1900 from climatological time series and reanalysises. The projected SMB changes in the 21st century is investigated with the set of simulations performed with AOGCM's for the IPCC 4th Assessment Report. These estimations show that the high surface mass loss rates of these last year (1998, 2003, 2006) are not unprecedented in the GrIS history of the last hundred years. The minimum SMB rate seems to be occurred in the 1930's due to a combination of dryer and warmer years than now although the effect of the man-induced global warming was not perceptible at that time. The AOGCM's project that the SMB rate of the 1930s would be common at the end of this century. The temperature would be higher than in the 1930s but the increase of accumulation would partly offset the acceleration of surface melt due to the temperature increase. If no change will occur in the iceberg discharge rate, such negative SMB rates would be not large enough to significantly increase in the future the fresh meltwater flux from the GrIS into the ocean. However, these assumptions are based on an empirical multiple regression only currently validated and the accuracy and time homogeneity of the

data sets and AOGCM results used in these estimations constitute a large uncertainty.