

Estimation of Greenland surface mass balance using positive degree-days method and energy balance model

Ryouta O'ishi¹, Fuyuki Saito², Ayako Abe-Ouchi^{1,2,3} and Takashi Obase¹

¹*Atmosphere and Ocean Research Institute, the University of Tokyo*

²*JAMSTEC*

³*NIPR*

A sea level rise is an important topic in a future climate projection. In the past warm period known as the Last Interglacial (LIG), paleoevidences indicate sea level rise of several meters. Paleoclimate modeling community applies past GCM results on ice sheet models and tries to reproduce past sea level rises. Typically, an empirical method called PDD (Positive Degree Days) is applied for the estimation of surface mass balance on the ice sheet as an upper boundary condition. The PDD only refers the surface atmosphere temperature and snowfall. In the present study, we use a process-based land surface model MATSIRO to estimate the Greenland surface mas balance forced not only by temperature and snowfall but also by other surface variables including shortwave and longwave radiation which are based on a regional climate model NHM-SMAP with 5km resolution. We compare the characteristics of resultant ice melt amount from PDD and MATSIRO to evaluate the inclusion of process-based heat and water balance instead of empirical equation. We also

interpolated anomaly of the LastInterglacial (LIG) GCM experiment result from the presentday experiment and added them to the observed variables which are forcing of MATSIRO to predict the Greenland surface mass balance in the LIG. We use these surface mass balance as input to a 3D ice sheet model IcIES and obtained distribution of Greenland ice sheet in the LIG. We plan to apply this method on the estimation of the Greenand behavior not only in the past but also in the future warming scenario.

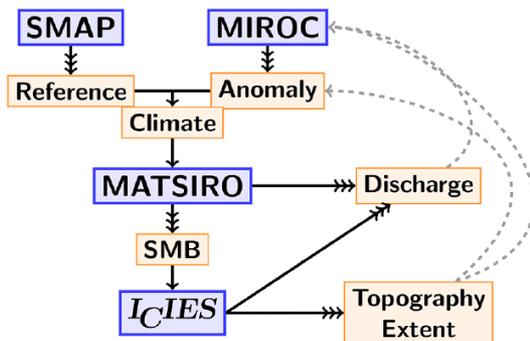


Figure 1: Models and coupling plan.

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MATSIRO PDD

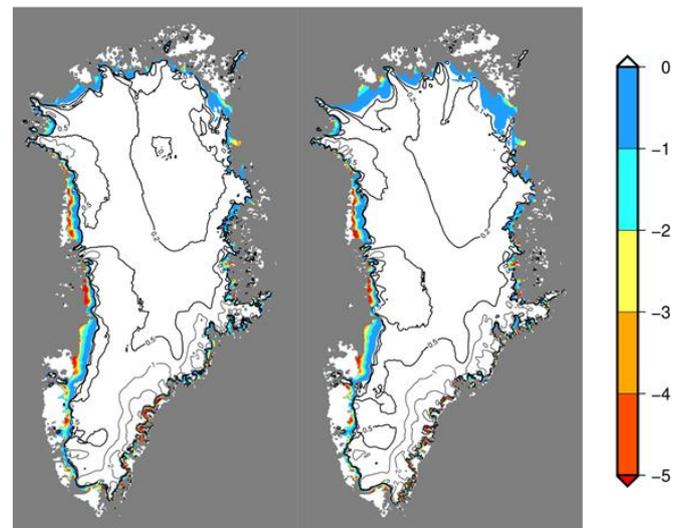


Figure 2: SMB in the LIG by MATSIRO (left) and by PDD (right).