

3次元氷床力学モデル *IcIES* より求められた氷床変動史に基づく グリーンランド沿岸域の海水準変動

奥野淳一¹、齋藤冬樹²、阿部彩子^{3,2,1}、高橋邦生²

¹ 国立極地研究所

² 海洋研究開発機構

³ 東京大学大気海洋研究所

GIA-related sea-level changes in Greenland based on the loading histories derived from *IcIES*

Jun'ichi Okuno¹, Fuyuki Saito², Ayako Abe-Ouchi^{3,2,1} and Kunio Takahashi²

¹ *Natinal Institute of Polar Research*

² *Japan Agency for Marine-Earth Science and Technology*

³ *Atmosphere and Ocean Research Institute, The University of Tokyo*

Recent satellite geodetic observations (e.g., GRACE, GPS) are clarified the melting of mountain glaciers and both polar ice sheets, which are Greenland and Antarctic ice sheets, related to the global warming (e.g., Wu et al., 2010). However, these observations include the uncertainties derived from the component of glacial isostatic adjustment (GIA)(e.g., King et al., 2012), which is the response of the solid Earth to ice and ocean loading during the Quaternary period. In particular, the GIA signals in the glaciated regions are strongly dependent on both of the past ice loading history and the viscosity structure of the Earth's interior. Hence, ice loading history and mantle viscosity as the GIA parameters are important for the interpretation of satellite geodetic observations. On the other hand, typical melting histories of ice sheets from Last Glacial Maximum have been inferred on the basis of geographical and geological constraints using the GIA modelling (e.g., Peltier, 2004). These reconstructions include the some problems that ice thicknesses are unconstrained in regions from which the required geophysical and geological data are unavailable and are not the glaciologically self-consistent. In this study, we try to reconstruct the deglacial history of the Greenland ice sheet in comparison with the GIA predictions and observations of relative sea-level (RSL) obtained in the coastal regions of Greenland. As the stating ice loading model, we adopt the recently published ice sheet history in Northern hemisphere and Greenland ice sheet derived from the 3D thermo-mechanical ice sheet model (Ice Sheet for Integrated Earth system Studies: *IcIES* developed by Abe-Ouchi et al. 2013). The *IcIES* produces physically self-consistent ice sheet which further constrains the history and spatial variations of the ice load. To characterize the effects of this glaciologically consistent ice sheet history, we compare the predictions of GIA-related RSL changes using the previously published ice load models (ICE-5G; Peltier, 2004, ANU; Lambeck et al., 2014) and output of *IcIES*. In this presentation, we show the temporal and spatial characteristics of predictions of GIA-related RSLs in Greenland in comparison with these observations. And also, we show the the effect of non-Greenland ice sheets on the RSLs in Greenland. We expect that using the ice sheet histories derived from *IcIES* as input in GIA model may put better constraints on postglacial rebound and current rates of crustal deformation obtained by geodetic satellites.

References

- Abe-Ouchi, A., F. Saito, K. Kawamura, M.E. Raymo, J. Okuno, K. Takahashi and H. Blatter, Insolation-driven 100,000-year glacial cycles and hysteresis of ice-sheet volume, *Nature*, 500, 190-194, 2013.
- King, M. R.J. Bingham, P. Moore, P.L. Whitehouse, M.J. Bentley and G.A. Milne, Lower satellite-gravimetry estimates of Antarctic sea-level contribution, *Nature*, 491, 586-589, 2012.
- Lambeck, K., A. Purcell, J. Zhao, P. Johnston, and M. Nakada, The ANU-2012 ice model from the penultimate glacial maximum to the present, in preparation for *Quaternary Science Reviews*, 2014.
- Peltier, W.R., Global glacial isostasy and the surface of the ice-age earth: the ICE-5G(VM2) model and GRACE, *Annual Review of Earth and Planetary Sciences*, 32, 111-149, 2004.
- Wu, X., M.B. Heflin, H. Schotman, B.L.A. Vermeersen, D. Dong, R.S. Gross, E.R. Ivins, A.W. Moore and S.E. Owen, Simultaneous estimation of global present-day water transport and glacial isostatic adjustment, *Nature Geosciences*, 3,9, 642-646, 2010.