Crustal motion in Antarctica simulated by GIA modeling: implications for Holocene ice melting history and viscosity structure of the Earth's mantle

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Geodetic and geomorphological observations in Antarctica's coastal area indicate the uplift trend associated with the removal mass of the Antarctic Ice Sheet (AIS) since the Last Glacial Maximum (LGM). The melting models of AIS derived from the comparisons between the sea-level records and glacial isostatic adjustment (GIA) modeling show the AIS's monotonous retreat through the Holocene era (e.g., Whitehouse et al., 2012). However, in some Antarctica regions, GNSS observations cannot be explained as the uplift amplitude by only glacial rebound due to the AIS's deglaciation. Although the AIS retreat has assumed to be currently at its maximum inland location, recent evidence suggests that the West Antarctic Ice Sheet has re-advanced in the Ross and the Weddell Sea sectors following a post-LGM maximum retreat (e.g., Kingslake et al., 2018). Therefore, this re-advance in mid-to-late Holocene is a possible cause for the mismatch between GNSS observations and numerical predictions.
On the other hand, GNSS observations include the GIA components due to the last deglaciation and the elastic deformation due to present-day surface mass balance (e.g., Hattori et al., 2019). Consequently, to simulate the crustal motion based on the GIA modeling, we must carefully investigate the numerical dependencies of various parameters on Antarctica's crustal movement. In this presentation, we will show the crustal deformation rates calculated by the GIA modeling using the previously published deglaciation histories and the comparisons with the observation of the crustal motion along Antarctica's coast. We intend to discuss the estimated influences of AIS mass changes and the adoption of mantle viscosity profile on the GIA-calculated crustal movement.

References

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