D108-012 **Room: Function Room B** **Time: May 19 12:00-12:15**

Uplift and gravity change in the Tibetan Plateau from GPS and GRACE

Koji Matsuo[1]; Kosuke Heki[2]

[1] Natural history Sciences, Hokkaido Univ.; [2] Dept. Natural History Sci., Hokkaido Univ.

Tectonic uplift associated with the collision and convergence between the Indian and the Eurasian Plates formed the Tibetan Plateau since the middle Eocene (~50 Ma). It is the world's largest plateau as large as ~250 Million square km and with the average elevation of ~5 km. In its surroundings, high mountain ranges, such as Himalaya, Karakoram, and Kunlun, tower to encircle Tibetan Plateau and continue to Pamir and Tien Shan to the north. These high mountains confront a serious problem, rapid shrinking of the mountain glaciers due to recent global warming (Qiu, 2008). According to the results of field observations 1961-2003 compiled by Dyurgerov and Meier (2005), the largest glacial loss goes on in southeastern Alaska (53.8 Gt/year), and the second in the Asian high mountains around Tibetan Plateau (30.7 Gt/year) and the third in Patagonia (16.9 Gt/yr). Satellite gravimetry with GRACE (Gravity Recovery and Climate Experiment), launched in 2002, enabled us to estimate the mass loss of these glaciers by observing the gravity decrease. Such observations revealed glacial loss of 115 Gt/yr in Alaska (Tamisiea et al., 2005) and 27.9 Gt/yr in Patagonia (Chen et al., 2007), which indicates the duplation of ice loss rate from 1961-2003 due to accelerating warming. On the other hand, there have been no reports on the contraction of Asian high mountains glaciers by GRACE. One of the reasons would be that the gravity decrease detected by GRACE is unexpectedly small in this region. As a possibility, we speculate that crustal uplift in the Tibetan Plateau is obscuring the gravity decrease.

GRACE signal includes both glacial melting and crustal deformation signals, and the true gravity decrease due to glacier melting might be reduced by gravity increase due to crustal uplift. In the Tibetan Plateau, three kinds of uplift would occur; (1) elastic uplift due to surficial load removal such as glacier, (2) tectonic uplift due to orogeny, and (3) viscous uplift due to past melting of ice sheets (Glacial Isostatic Adjustment, GIA). If we extract the portion showing clear seasonal movement from the Lhasa GPS station time series in the International Terrestrial Reference Frame (ITRF) 2005, we get definite uplift as fast as 3.18 +/- 0.13 mm/year. Seasonal movement seen in GPS would be caused by elastic deformation due to surface load made by summer precipitation, because the seasonal signal in GPS is very consistent with GRACE. On the other hand, secular uplift would be tectonic and/or GIA. However, elevation of the Tibetan Plateau around Lhasa has been nearly constant since 35Ma (Rowley and Currie, 2007), tectonic uplift would be relatively small. In this study, we assumed that the observed uplift is half coming from GIA and half tectonic. Uplift due to GIA causes gravity increase, which makes us underestimate gravity decrease due to glacial melting. We assumed that a half of the gravity change due to the TIBET-4 GIA model (Kaufmann, 2005) is occurring, and removed its contribution from the GRACE gravity change. We finally obtained the glacial loss in high mountains Asia as 56 Gt/yr.

- Reference-

D.B. Rowley, B.S. Currie, Nature 439, 677 (2006).

G. Kaufmann, J. Geodyn. 39, 111 (2005).

J. L. Chen, C.R. Wilson, B.D. Tapley, D.D. Blankenship, E.R. Ivins, Geophys. Res. Lett. 34, L22501, doi:10.1029/2007GL031871 (2007).

J. Qiu, Nature 454, 393 (2008).

M. Dyurgerov, M.F. Meier, Occasional Paper 58, Institute of Arctic and Alpine Research, University of Colorado, Boulder, 118pp (2005).

M. E. Tamisiea, E. W. Leuliette, J. L. Davis, J. X. Mitrovica, Geophys. Res. Lett. 32, L20501, doi:10.1029/2005GL023961 (2005).