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Simultaneous observation of tidal gravity in Juneau, Southeast Alaska with gPhone #032 and L & R G578 gravimeters

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Southeast Alaska (SE-AK) is a region with very rapid uplift rates, exceeding 30 mm/yr in maximum, which are mainly caused by glacial isostatic adjustment (GIA) effects due to the past- and present-day glacier changes (Larsen et al., 2004 and Larsen et al., 2005). A joint Japanese-American observation project called ISEA was initiated in 2005 to follow up the work of the University of Alaska Fairbanks (UAF) by adding new geodetic data sets (Miura et al., 2007). The observations under this frame work started in 2006.

Due to the complex topography and bathymetry, SE-AK shows large ocean tide amplitude exceeding 8 m and both the amplitudes and phases show complex spatial distribution. Consequently, at a place, the oceanic tidal loading (OTL) effects exceed 10 cm and 100 microGal in the vertical displacement and gravity, respectively. The tides including the OTL effects are the major signal in the geodetic observations over periods less than seasonal in this area. On the other hand, it is known that the accuracy of tidal modeling in SE-AK is very poor (e.g. Schenewerk et al., 2001). Therefore, precise tidal modeling is indispensable to increase the accuracy of discussion GIA process based on the geodetic observations, especially when they are carried out with a campaign style of over a short period of 1-3 days. In order to improve this situation, we intensively carried out the improvement of the accuracy of ocean tide modeling of the regional scale in SE-AK. By using the newly developed ocean tide models, we have succeeded to reduce the error of tidal corrections at the order of 1 microGal or better than it for the case of gravity, for instance (Sato et al., 2008, Inazu et al., 2009).

Conventionally, the viscoelastic structure of the earth has been studies in that for a long-term phenomena exceeding a few hundred years in the time-scale. On the other hand, it is known that the viscoelastic property is frequency dependent. We may have a chance to determine it at the tidal frequency band from the comparison between the observations and the model tides at the accuracy better than 1 microGal, because the OTL effects in SE-AK exceed the order of 100 microGal in total magnitude. In order to obtain a data set to discuss this problem, in 2009, we have carried out a simultaneous observation of gravity tide in Juneau, SE-AK with the gPhone #032 manufactured by micro-g solution and a LaCoste-Romberg gravimeter G578 improved into a feedback type with the Harrison & Sato method (Harrison and Sato, 1984).

The scale factor of each gravimeter was calibrated using an absolute gravimeter FG5 in December 2009, and the calibration was done with the accuracy at +/-0.2 % for both gravimeters of the gPhone and G578. The observation with the G578 gravimeter started in 2007 and its scale factor was calibrated with the reading dial of the gravimeter at a frequency of one or twice a year, and we have confirmed that it was stable within the variation of less than 1 % through the observation period. On the other hand, for the phase, the timing signal of data acquisition was supplied from the system clock and the clock was synchronized to the clock of NTP server at every 10 minutes. Therefore, we consider that the sampling interval (1 s) and its timing are

synchronized to UTC within the accuracy better than 10 ms.

We will report the detail of the observation and the preliminary results for the tidal analysis.

Keywords: gPhone#032, G578, gravity tide, Southeast Alaska, ocean tide loading, viscoelastic structure