

Post-Glacial Rebound around Syowa station, Antarctica from GPS measurements

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In Antarctica, post-glacial rebound (PGR) is occurring as a crustal uplift caused by load decrease due to the deglaciation since LGM. Around Syowa station (39.07°E and 69.58°N), this effect is estimated as large as 2-3mm/yr [James and Ivins, 1998].

Space geodetic techniques such as GPS and VLBI have been imported to Syowa station to determine its precise position. A continuous GPS measurement started in 1995, and the station (SYOG) was registered as one of the IGS (International GPS Service) stations in Antarctica. In addition, benchmarks for GPS campaign measurement were constructed on open rocks along the coastline near Syowa to detect local crustal movement. Since 1998, campaign measurements have been conducted 2-5 times a year at 5 temporary stations within a distance of 70km from Syowa. One campaign lasts 1-9days and so far 245-day data in total have been collected. In this study, we analyze these campaign data to estimate local crustal movement.

We determine positions of 5 temporary stations relative to SYOG, tightly constraining coordinates of SYOG to the ITRF2000 values. Bernese GPS Software Ver.4.2. is used for data processing. Then deformation rate is calculated from coordinates time series at each site.

Short-term repeatability of coordinates in one campaign is at a level of 1mm in the horizontal component, and about 1cm in the vertical. The results are comparatively good for the polar region where satellite visibility is generally poor. Deformation rates are as small as 3-5mm/yr in the horizontal component and 2-3mm/yr in the vertical (uplift at four sites and subsidence at other two). Unfortunately standard deviations of rate estimation are larger than the expected values at most stations. This is chiefly because of small amount of GPS data under polar climate. Data period is still too short to precisely determine crustal uplift at a small rate, and epoch of the GPS campaigns are irregularly distributed. Moreover large standard deviations are partly due to the scatter of coordinates time series. Despite the small short-term repeatability within one campaign, coordinates values sometimes show an unexpected jump from one campaign to the next. We think that the scatter may be caused by antenna installation error, seasonal variation of deglaciation, and different condition of the ocean.

Crustal uplift at a rate of 2-3mm/yr estimated in this study is preliminary. We think that GPS data from longer time span will make possible to discuss PGR in Antarctica more accurately in the near future.