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# OBSERVATIONS OF EARTH TIDES AND EARTH'S FREE OSCILLATIONS BY A SUPERCONDUCTING GRAVIMETER AT SYOWA STATION ANTARCTICA (ABSTRACT)

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As part of the five-year earth science program (1993-1998) in the Japanese Antarctic Research Expedition, observations of earth tides and earth's free oscillations are being carried out at Syowa Station by a superconducting gravimeter, SCG, (T. SATO *et al.*; Proc. NIPR Symp. Antarct. Geosci., **6**, 17, 1993). The continuous observations by the SCG started on March 22, 1993. We examined the performances of this observation in the frequency bands of the earth tide or longer. The data obtained for eleven months from March 1993 to January 1994 have been used in the present analysis.

(1) Data processing: Original 2-s data of the tide channel were sampled every 1 min through a digital filter to reduce high frequency noises, then these data were resampled every 1 hour for the tidal analysis. Sensitivity (scale factor) of the gravimeter was tentatively given by comparing the amplitude of M2 constituent of the SCG record with that previously obtained from the observation by a LaCoste & Romberg gravimeter (M. KANAO and T. SATO; Proc. 12th Int. Symp. on the Earth Tides held at Begin, in press).

(2) Short period tide: The short period tides whose periods are shorter than one week were analyzed by means of a FORTRAN program called as BAYTAP-G (Y. TAMURA *et al.*; Geophys. J. Int., **104**, 507, 1991). The response of the gravity data to the atmospheric pressure changes was simultaneously calculated with that to the tide generating forces. The analysis shows that the tidal parameters, *i.e.* amplitude factors and phase lags, obtained by the SCG are consistent with the previous values given by M. KANAO and T. SATO (Proc. 12th Symp. on the Earth Tides, 1993, in press). Thus we recognize that the amplitude factors, especially of the semidiurnal tides at Syowa Station are large enough to exceeding the observation errors. The reasons for this should be explained first.

(3) Long period tide: The long period tides were analyzed using the drift component obtained from the analysis of short period tides. This analysis shows that the SCG data at Syowa Station have a potential from which we can determine the amplitude and phase of the Mf constituent within the errors of 0.05 $\mu$gal and 0.2 degrees. If the data length available is longer, the errors should be more reduced.

(4) Long term stability of the gravimeter: After the three terms mentioned above are subtracted, *i.e.* the short period tides, the long period tides having the period of less than 1 year and the effect of atmospheric changes, the drift remains which consists of mainly two effects, *i.e.*, exponential drift and polar motion. Although the data length used here is too short to separate

the Chandler motion and annual component in the polar motion, the residual after subtracting the exponential drift clearly shows the gravity changes which are consistent with those predicted from the polar motion data given by the International Earth Rotation Service in both the amplitude and the phase. The exponential drift is well approximated by two exponential terms clearly distinguished by their time constants. The amplitude and time constant are respectively $-4.59\ \mu$gal and 3.7 days for the short period term. While those of the long period term are $-12.26\ \mu$gal and 78.1 days. It is worth noting that the sign of the drift trends to decrease gravity or to have up the ground. A detailed analysis for the long term behavior of the SCG will be given in the paper by T. SATO *et al.* (Proc. Workshop on 'Non Tidal Gravity Changes' held at Luxembourg, 1994, in press).

In order to assure the relation between the secular changes of gravity observed by the SCG and those of the crustal movement at the Syowa region, it is desired to realize the cooperative observation by the SCG and the absolute gravimeter. This kind of observation is also needed to calibrate the scale factor of the SCG.

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