Aeromagnetic Survey around the Japanese Antarctic Stations

Kazuo SHIBUYA and Katsutada KAMINUMA

Earth Sciences Division, National Institute of Polar Research, Tokyo, Japan

(Received July 21, 1984)

The Japanese MAGSAT Investigations includes the study of the Antarctic continent structure around Lützow-Holm Bay and Prince Olav Coast, through the comparison of ground magnetic observations, aeromagnetic surveys, MAGSAT records, and other relevant geophysical data. The area of magnetic survey covers Syowa Station (69°00′S, 39°35′E), Mizuho Station (70°42′S, 44°20′E), and the Shirase Glacier. This memorandum describes an outline of recent aeromagnetic surveys by the 21st Japanese Antarctic Research Expedition (abbreviated hereafter to JARE-21) and the availability of these data, as well as the information on the past aeromagnetic surveys.

During JARE-8 (1967–68) to JARE-11 (1970–71) and JARE-15 (1974–75), a proton magnetometer was operated on a helicopter or aircraft for a total of 12 flights (2400 miles) around Lützow-Holm Bay. The results of these magnetic surveys have been published by TAZIMA et al. (1972) and KANEKO (1976). It was regrettable that the airborne magnetic survey had to be interrupted during 1971–73 and 1976–79 because of a difficulty in the availability of an aeroplane for survey purpose.

The aeromagnetic survey started again by JARE-21 in 1980–81. Twenty flights of 57 hours were devoted to the aeromagnetic survey; each flight lasted 1.5–4 hours. The total intensity of geomagnetic field was measured every 1.2 seconds by a proton magnetometer on a PC-6 airplane flying at a speed of 90–100 knots.

Figure 1 shows the magnetic anomaly profile over the Shirase Glacier and the total geomagnetic field intensity calculated from IGRF (IAGA WORKING GROUP I-1, 1981) for November 1980 (SHIBUYA and TANAKA, 1983). The anomalies are thought to be caused mainly by the local topographic and geological structures of the Shirase Glacier, although the detailed analysis is still going on with relevant geophysical data in this region, such as seismic data, radio-echo sounding over the glacier (WADA and MAE, 1981), the sea bottom topography (MORIWAKI and YOSHIDA, 1983), and geological data (YOSHIDA, 1978; YOSHIDA and ANDO, 1971). Figure 2 shows the profile between Syowa and Mizuho Stations of the geomagnetic anomaly, free air gravity anomaly, surface topography and the seismic P-wave velocity structures (SHIBUYA et al., 1984). This profile is nearly parallel to the Shirase Glacier, but approximately 100 km northeast of it. A large-amplitude geomagnetic anomaly of 10–30 km horizontal
Fig. 1. Magnetic anomaly profiles over the Shirase Glacier which are superposed onto the isomagnetic contours of IGRF for November 1980.
Fig. 2. Magnetic anomaly profile between Syowa Mizuho Stations, compared with free air gravity anomaly, surface topology and the seismic P-wave velocity structures.
wavelength near 70°S, 43°E must be originated from some peculiar geological structure of the earth's crust below the ice bed.

It is worthwhile to note that the East Antarctica is a region with a noticeable secular geomagnetic variation (NAGATA, 1982). The absolute magnitude of the geomagnetic total force at Syowa Station has been decreasing at a rate of 130 nT/year in recent years, as shown in Fig. 3. The secular variation at Syowa Station for the declination is −3′/year, and 4′/year for the inclination (SHIBUYA and TANAKA, 1983). The MGST(4/81) model agrees very well with the IGRF model, despite the difference in the number of terms for the spherical harmonic expansion of the observed geomagnetic field.

The National Institute of Polar Research, Tokyo, issues JARE DATA REPORTS series, for public use of the observational data. A recent issue No. 89 (Earth Science 1) by KAMINUMA et al. (1984) contains the aeromagnetic and gravity survey data in the Lützow-Holm Bay Region and the Mizuho Plateau. The geomagnetic data of 5 flights out of 20 made during JARE-21 are included in this publication along with the flight logs, and the remaining data will appear in upcoming issues. These data will be hopefully analyzed extensively and compared with MAGSAT data in the near future, in order to contribute to the study of the crustal structure of the Antarctic continent.

REFERENCES


Fig. 3. Secular geomagnetic variation of the total intensity at Syowa Station.
Aeromagnetic Survey around the Japanese Antarctic Stations


