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CHARACTERISTICS OF GEOSAT ALTIMETRIC GEOID IN THE CIRCUM ANTARCTIC RIDGES AND ITS IMPLICATION TO THE TECTONICS OF THE ANTARCTIC PLATE (ABSTRACT)

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The Antarctic plate is surrounded mostly by active mid oceanic ridges and has no clear convergence boundary around it. However, as the spreading rate of a certain ridge is different from that of another ridge, the shape of the Antarctic plate may deform due to strain from the surrounding plates. The regional geoid obtained by satellite altimetry data can be used to detect the relationship between the deformation of the plate and the sub-bottom structure. Several GEOSAT tracks across the circum-Antarctic ridges were examined to investigate the characteristics of geoid anomaly and to detect the sub-bottom structure.

Correlation between residual geoid (GEOSAT altimetric geoid subtracted by the reference geoid based on the GEM10B model with the harmonics to degree and order up to 36) and sea bottom topography was examined. The Pacific-Antarctic ridge area is characterized by a positive correlation coefficient, whereas the Southeast Indian ridge area shows a negative correlation coefficient. The wavelength of the topographic high (and also local high of geoid) of the ridge is about 2000 km in these two cases. In the Southwest Indian ridge, the correlation coefficient is positive, and the wavelength of the topography of the ridge is about 1000 km, which is less than that of the former two.

The isostatic equilibrium along the circum-Antarctic ridges was examined for the Airy model and elastic plate model in wave number domain of geoid and topography. Airy model can be applied to the eastern part of the Pacific-Antarctic ridge and Southwest Indian ridge, and the average crustal thickness is obtained as about 10 km in both cases. An elastic plate model can be applied to the western part of the Pacific-Antarctic Ridge, and the thickness of the assumed elastic plate is estimated as 5-10 km. The Southeast Indian ridge cannot be explained by these isostatic models, and another assumption such as a large-scale melting layer beneath the ridge should be taken into account. These results correspond well with the velocity anomaly structure in the mantle.

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