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Evaluation of secular variation models of IGRF11 and its application to an epoch reduction of magnetic anomalies

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Magnetic anomaly of total intensity is defined as the residual from the IGRF model. The IGRF11 is recommended for the IGRF model by IAGA. The secular variations in the vicinity of Japanese Islands observed at the magnetic stations were compared with those of IGRF11. The secular variation model of IGRF11 fairly approximate the real secular variation, however, more than several tens of differences were recognized. In the case of Kakioka magnetic observatory, the differences ranges from -10nT to +140nT between 1955.0 and 2010.0. This result implies that the magnetic anomaly value also varies depending on the observed year. In the case of compiling regional magnetic anomaly map, the data sources usually spans several decades, so the epoch reduction of magnetic anomalies is needed. In corresponding to this demand, author proposes an epoch reduction method. The method is composed of thee steps; in the first step the magnetic anomaly variations between 1960.0 and 2010.0 at the magnetic stations are approximated by the Fourier expansions, in the second step the differences between the epoch date (ex., 2000.0) and the arbitrary date (field observation date) are calculated using the Fourier expansions of the magnetic stations, In the third step a distribution of these differences are approximated by the 2nd order polynomials of latitudes and longitudes, then the correction value at the arbitrary point(field observation point) is estimated from this polynomials. This reduction method was applied for compiling the regional magnetic anomaly maps at the epoch 2000.0.

Keywords: magnetic amomaly, IGRF11, secular variation, Regional magnetic anomaly map, Epoch reduction