GAIAによって計算されたSq磁場変動の評価

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Evaluation of the Sq magnetic field variation obtained by GAIA

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Geomagnetic variations reproduced by the Ground-to-topside model of Atmosphere and Ionosphere for Aeronomy (GAIA) are compared with those observed at global magnetic observatory network in dead calm days in order to evaluate accuracy of the ionospheric current system calculated by GAIA. The results are as follows:

Correlation coefficients of the magnetic variations between the GAIA and observations are as high as 0.8 for the Y component. The X and Z components also show good correlation higher than 0.5 in many observatories.

There are some exceptional observatories with the low correlation. In the latitudes of the Sq current vortex center, the X component exhibits low correlation. The low correlation for the Y component appears in the magnetic equatorial region.

Essentially, the amplitude of the calculated Sq magnetic variation does not correspond to the observed one because GAIA does not consider induction of the conducting Earth. Calculated intensity of the horizontal geomagnetic variations (X and Y components) exhibit larger than the observed ones, whereas that of the vertical variation (Z component) shows depressed to the observed one. This tendency is consistent with the induction effect of the conducting Earth. Thus, we conclude that GAIA reproduces the ionospheric current system.

As a conclusion, we confirm that the ionospheric current distribution of GAIA is considerably realistic except the amplitude. If we do not care the amplitude difference, the global patterns of the ionospheric current and ground magnetic variation are regarded as proxies of the observed currents and ground magnetic variations, respectively. Therefore, we can utilize GAIA to elucidate unresolved issues about the Sq, for example, the atmospheric effect to the day-to-day variability of the Sq current system. In addition, it is proved that the Sq magnetic variations derived by GAIA can be used as the first guess of the 3D EM inversion problem for estimation of electrical resistivity in the mantle transition region. Furthermore, the inversion result will provide the new ionospheric current system compiled by induction of the Earth. This is one of the ultimately important researches that bridge the space science and the solid Earth geomagnetism.