A numerical calculation of the 3-dimensional distribution of electric potentials in the polar ionosphere

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The ionospheric electric potential is an important parameter for the investigation of the convection and the current system in the magnetosphere-ionosphere system. In order to calculate the ionospheric electric potentials from the observational data such as the ground magnetic perturbations, KRM and AMIE methods have been developed.In the previous study, however, the ionosphere is treated as the thin layer, although the real ionosphere has a 3-dimensional structure. The purposes of the present study are to calculate the 3-dimensional distribution of the ionospheric electric potentials and to investigate the relationship between the ionospheric electric potentials and ionospheric conductivities. Using the Cartesian coordinate, the ionospheric electric potentials are determined by the ionospheric conductivities and field-aligned currents incident on the upper boundary of the calculation region.

It is found that when the Hall conductivity decrease with altitude, the distribution of the electric potential rotates more clockwise as the altitude becomes lower. When the Hall conductivity increases with altitude in the upper half of the calculation region and decreases with altitude in the lower one, the distribution of the electric potential rotates clockwise above the peak of the Hall conductivity. However, the distribution does not vary and rotate below the peak of the Hall conductivity. This result implies that the increase of the Hall conductivity is needed for the rotation of the distribution of the ionospheric electric potentials. In the presentation, we will show the details of the calculation and the results.