Numerical simulation on the rotation modulation of the Jupiter's magnetosphere-ionosphere coupling current

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We investigate the dependence of the magnetosphere-ionosphere coupling current system on the subsolar longitude of Jupiter using a developed numerical model which can calculate ionospheric conductivity, field-aligned current (FAC), and the azimuthal velocity of the magnetospheric plasma by assuming the configuration of Jovian magnetic field. Three types of asymmetries are included: (1) asymmetric magnitude of the intrinsic magnetic field, (2) asymmetric background ionospheric conductivity caused by solar illumination, and (3) asymmetric magnetospheric magnetic field configuration. The current density of FAC varies with the planetary rotation with the maximum value at the subsolar longitude of system III around 240 degree. This FAC asymmetry for the subsolar longitude of system III is found to be result from the planetary intrinsic magnetic field asymmetries largely modulated by configuration of the magnetospheric field lines which depends on local time. It is found that the asymmetric magnetospheric magnetic field configuration modulate the FAC density by a few hundreds of percent, whereas the asymmetric background ionospheric conductivity induce several tens of percent of FAC density variations. The asymmetric intrinsic magnetic field has little effect, just a few percent, on FAC density variations.