Neutral-ion coupling in the Jovian magnetosphere-ionosphere-thermosphere model

Chihiro Tao[1]; Hitoshi Fujiwara[1]; Yasumasa Kasaba[2]

[1] Dept. of Geophysics, Tohoku Univ.; [2] Tohoku Univ.

Jovian deep atmosphere almost corotates with the planet, while the magnetospheric plasma has lag from this motion. We investigate the region where the slippage happens in order to identify the driving source of the energy and momentum transportation. There are three candidates: (i) between deep and upper layers of the atmosphere, (ii) between the neutral and ion winds, and (iii) between the ionosphere and the magnetosphere. Using a magnetosphere-ionosphere-thermosphere coupling current model, we estimate a decreasing ratio of the zonal angular velocity as a 'slipping ratio'. In the sub-auroral and auroral regions at the latitudes less than 73 deg., the peak of the slippage ratio, 16%, is located between the deep and upper layers of the atmosphere. In the polar region at the latitudes higher than 74 deg., the slippage of each region is (i) 22 (at 74 deg. latitude)-28% (at 80 deg.), (ii) 0-55%, and (iii) 0-25%, depending both on altitude and latitude.

In addition, we investigated the energy transfer in the magnetosphere-ionosphere-thermosphere system. We derived the total power extracted from the planetary rotation into the magnetosphere-ionosphere coupling system as 8.4×10^{13} W. In the region below 74 deg. latitude, the power is used mainly for the magnetospheric plasma acceleration. In the region above 74 deg. latitude, the energy is consumed in the upper atmosphere mainly through Joule heating, larger than ion-drag acceleration by a factor of ˜10.