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Horizontal ion drag effect on the thermospheric mass density anomaly in the cusp

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CHAMP satellite observations have revealed that the thermospheric mass density in the cusp region is statistically larger by a factor of about 1.3 than that in its adjacent region. Many studies have pointed out that the upward mass transport due to heating is important for the generation of the mass density anomaly, but what confines the heating rate to the cusp is controversial. We have paid attention to the effect of the horizontal mass transport. Our reasoning on this point is as follows. Ionospheric convection gives momentum to the neutral air through ion drag, and the ion drag can modify the distribution of the neutral mass density. Our recent results from numerical simulations have indicated that the ion drag enhances the neutral mass density in the cusp that the terminator overlaps. In this paper, we report on the result about more general situations including cases when the terminator is located away from the cusp. Our results show that the mass density anomaly is confined to the cusp by ion drag, irrespective of the location of the terminator. We show detailed relations between the ion drag distribution and the mass density enhancement or depletion.

Keywords: thermosphere, mass density, cusp, CHAMP satellite