

Ion-Neutral Coupling in the Thermosphere and Ionosphere

Shigeto Watanabe

Hokkaido University

Though the ionization rate is less than 1% in the region of thermosphere, the dynamics of neutral atmosphere is strongly controlled by the plasma. The zonal neutral wind in the thermosphere flows strongly at the Earth's magnetic dip equator instead of the geographic equator around 20 magnetic local time (MLT). On the other hand, the fast zonal plasma drift occurs in the low latitude F region of evening ionosphere, but the velocity decreases at the magnetic dip equator. Therefore, the fast plasma drift velocity structure forms an arch in the frame of latitude and altitude in the evening. The fast zonal neutral wind occurs inside of the arch. The fast neutral wind occurring in the evening F region over the magnetic dip equator may result in atmospheric super-rotation in the low latitude thermosphere. Why does the neutral atmosphere know the geomagnetic field? To understand the physical process of the interaction between the neutral atmosphere and the plasma in the thermosphere and ionosphere, JAXA/ISAS launched successfully S-520-23 and S-520-26 sounding rockets from Kagoshima Space Center (KSC) on September 2, 2007 and January 12, 2012, respectively. The rocket experiments were carried out for WINDs (Wind measurement for Ionized and Neutral atmospheric Dynamics study) Campaign. The rocket installed Lithium Ejection System (LES) as well as instruments for plasma drift velocity, plasma density and temperature and electric and magnetic fields. The atomic Lithium gases were released at altitudes between 150km and 300km in the evening for S-520-23 and at altitude of ~100km in the morning for S-520-26. The Lithium atoms scattered sunlight by resonance scattering with wavelength of 670nm. The neutral winds and atmospheric gravity waves in the thermosphere were clearly observed.