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Ionosphere-Thermosphere Coupling in Middle and Low Latitudes

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Though the ionization rate is less than 1% in the region of low latitude thermosphere, the dynamics of neutral atmosphere is strongly controlled by the plasma. The coupling process between the neutral atmosphere and the plasma has been investigated by satellites such as DE-1, AE, CHAMP, etc. The observations showed similar local time variation of plasma drift velocity and neutral wind (Rishbeth, 1971; Heelis et al., 1974), super rotations of thermosphere and ionosphere (Coley and Heelis, 1989), and equatorial temperature and wind anomaly (ETWA; Raghavarao et al.1991). From ground observations of 630nm airglow by Otsuka et al. (2005), meso-scale structure generated by gravity wave was found at the same time in conjugate points of northern and southern hemispheres. The result suggests that the electro-magnetic coupling along magnetic field lines is important in the thermosphere and ionosphere. NCAR TIE-GCM indicated the coupling between ionospheric plasma and strong eastward wind in the evening at magnetic equator (Richmond et al.1992). Fuller-Rowell et al. (1997) suggested the importance of chemical heating in the ETWA. Maruyama et al. (2003) showed the effect of ion drag on the ETWA. Coupling between neutral atmosphere and plasma is a key process to understand the dynamics and structure, but the direct observation is not yet performed. In 2007 summer, we carry out a rocket experiment, and observe plasma drift velocity, density, temperature, electric and magnetic fields, and neutral wind by Lithium release to understand the interaction process due to momentum transfer between atmosphere and plasma, and the generation and development of meso-scale phenomena of atmosphere and plasma.