CHAMP 衛星データを用いた中規模移動性電離圏擾乱の研究

鈴木臣 [1]、Jaeheung Park [2]、Hermann Lühr [2]、大塚雄一 [1]、塩川和夫 [1]
[1] *名古屋大学太陽地球環境研究所*
[2] *Helmholtz Center Potsdam, German Research Center for Geosciences*

Medium-scale traveling ionospheric disturbances observed with CHAMP

Shin Suzuki [1], Jaeheung Park [2], Hermann Lühr [2], Yuichi Otsuka[1], Kazuo Shiokwa[1]
[1] *Solar-Terrestrial Environment Laboratory, Nagoya University*
[2] *Helmholtz Center Potsdam, German Research Center for Geosciences*

Traveling ionospheric disturbances (TIDs) have long been a subject of interest for more than five decades since the pioneering work by Hines (1960). To date, quite a few studies have been carried out to understand generation and propagation mechanisms of TIDs, especially medium-scale TIDs (MSTIDs), which have horizontal wavelengths of 100-500 km and are often observed in 630-nm airglow in the ionosphere. TIDs had been thought to be ionospheric counterparts of atmospheric gravity waves propagating in the thermosphere. However, many works have reported that MSTIDs in nighttime is caused by a plasma instability, but its growth rate is too small to explain the observations. It is also recognized that MSTIDs show strong preference in their horizontal propagation directions, which cannot be explained by the classical theory of atmospheric gravity waves alone. Recent studies with highly sensitive cooled-CCD cameras have revealed that nighttime MSTIDs are accompanied by electric field perturbations and their structures are connected along geomagnetic field line in both hemisphere. These observational results strongly suggest that ionospheric electrodynamics play important roles for the generation and propagation of nighttime MSTIDs

We have start investigation the difference of MSTIDs in nighttime and daytime using the Challenging Minisatellite Payload (CHAMP) satellite data. CHAMP was launched on 15 July 2000 into a circular orbit whose inclination angle is 87° and swept all local times in 131 days. The altitude was 460 km in 2000 (and slowly decayed to 330 km in 2008). CHAMP has an electrostatic accelerometer to measure the non-gravitational acceleration precisely and neutral mass density is calculated from the data with a time resolution of 10s. CHAMP also measures the plasma density with15-s sampling by a Planar Langmuir Probe (PLP). These dataset are very useful to investigate MSTID signatures in both thermospheric neutral and plasma densities at ~400 km altitude. If the abovementioned mechanisms actually work for the generation of MSTIDs, it would be expected that, for daytime MSTIDs, plasma and neutral density variations correlate with each other because both of them are induced by same atmospheric gravity wave. In nighttime, on the other hand, MSTIDs would have no or out-of-phase neutral density variations.

In the presentation, we will report the initial results of the statistics of MSTIDs in the topside ionosphere observed by CHAMP in 2008.

References

Hines, C. O., Internal atmospheric gravity waves at ionospheric heights, Can. J. Phys., 38, 1441–1481, 1960.