

CHAMP 衛星で観測された MSTID に伴う電離圏 F 層上部の電子密度変動

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CHAMP measurements of plasma density fluctuations in the top-side ionospheric F-region associated with MSTIDs

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Medium-scale traveling ionospheric disturbances (MSTIDs) are a well-known wavy phenomenon in the F-region ionosphere. They typically have a horizontal wavelength of several hundred kilometers and a periodicity of about one hour. Although, the MSTIDs had been considered to be caused by atmospheric gravity waves propagating upward from the lower atmosphere, recent studies have suggested that the generation of the MSTID in nighttime is highly associated with coupling processes between the E- and F-region electrodynamics. To confirm the different processes in the MSTID generation in daytime and nighttime, CHAMP satellite measurements would be greatly helpful; CHAMP plasma and neutral density data obtained in the day- and night-side sector can monitor the phase relations between the neutral (i.e., atmospheric gravity wave) and ionospheric plasma perturbations associated with the MSTIDs simultaneously at the top-side F-region (approximately 400 km).

As the first step in the above-mentioned study, we compared the MSTID signatures between the CHAMP and ground-based 630-nm airglow measurements to validate the MSTID detection by CHAMP. Airglow imaging is a quite useful technique to investigate two-dimensional structure of the nighttime MSTIDs at the bottom-side F-region (approximately 250 km). We found clear 14 conjugate events of MSTIDs in which CHAMP passes down to the airglow height along the magnetic field were in the field-of-views of the airglow measurements. In most case, plasma density in the top-side ionosphere showed systematic polarity changes which were consistent with airglow intensity variations: plasma density enhancements (depletions) coincided with the airglow depletion (enhancement) regions, suggesting that plasma density fluctuation of MSTIDs induced by the polarization electric field is extended up to the top-side.

In this presentation, we will also discuss the primary results showing the day- and night-time differences of MSTID in the top-side ionosphere obtained from the CHAMP plasma and neutral densities.