R005-13
B 会場 ：11/4　PM2 （15:45-18:15）
17:15～17:30

GNSS-TEC と SuperDARN 北海道レーダー観測データを用いた 2022 年 1 月 15 日のトンガ火山噴火後に見られた電離圏擾乱の特徴について

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Characteristics of ionospheric disturbances after the Tonga volcanic eruption using GNSS-TEC and SuperDARN radar data

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To elucidate the characteristics of electromagnetic conjugacy of traveling ionospheric disturbances just after the 15 January 2022 Hunga Tonga-Hunga Ha'apai volcanic eruption and their generation mechanism, we analyze global navigation satellite system (GNSS)-total electron content (TEC) data and ionospheric plasma velocity data obtained from the Super Dual Auroral Radar Network (SuperDARN) Hokkaido pair of radars. Further, we use thermal infrared grid data with high spatial resolution observed by the Himawari 8 satellite to identify surface air pressure waves propagating in the troposphere as a Lamb mode. After 07:30 UT on 15 January 2022, two distinct traveling ionospheric disturbances propagating in the westward direction appeared over Japan with the same structure as those at magnetically conjugate points in the Southern Hemisphere. These ionospheric disturbances were observed approximately 3 hours before the initial arrival of the surface air pressure waves. Corresponding to these traveling ionospheric disturbances with their large amplitude of 0.5-1.1x10^16 el/m^2 observed in the Southern Hemisphere, the plasma flow direction in the F region of the ionosphere changed from southward to northward. At this time, the magnetically conjugate points in the Southern Hemisphere were located in the sunlit region at a height of 105 km. The amplitude and period of the plasma flow perturbation are ~100-110 m/s and ~36-38 min, respectively. From the plasma flow signature, we estimated the magnitude of a zonal electric field as ~2.8-3.1 mV/m. Further, there is a significant phase difference of ~10-12 min between the total electron content and plasma flow perturbations. This result implies that an external electric field variation generates the traveling ionospheric disturbances observed in both Southern and Northern Hemispheres. Considering that the magnetically conjugate points in the Southern Hemisphere correspond to a sunlit region, we can interpret that the origin of the external electric field is an E region dynamo driven by the neutral wind oscillation associated with atmospheric acoustic waves and gravity waves. Finally, the electric field propagates to the F region and magnetically conjugate ionosphere along magnetic field lines with the local Alfven speed, which is much faster than that of Lamb mode waves. From these observational facts, it can be concluded that the E region dynamo electric field produced in the sunlit Southern Hemisphere is a main cause of the two distinct traveling ionospheric disturbances appearing over Japan before the arrival of the air pressure disturbances. Therefore, we can obtain important information of surface air pressure waves and relate tsunami from such ionospheric disturbances as seen in GNSS-TEC observation data.