R005-35
B 会場 ：9/25　PM2 （15:45-18:15）
16:30〜16:45

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Variations in the D-region ionosphere after the 2022 Tonga volcanic eruption using AVON VLF/LF transmitter signals

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The Hunga Tonga-Hunga Haʻapai volcano in Tonga (in southern Pacific, 20.54S, 175.38W) explosively erupted around 04:10 UT on 15 January, 2022, and large pressure variations occurred from the volcano. Large and medium scale traveling ionospheric disturbances (LSTID and MSTID) due the eruptions were observed (Themens, 2022), which were caused by Lamb wave excited by the eruptions. In addition to the Lamb wave, Pekeris waves were generated by the eruption (Watanabe et al., 2022). The Lamb waves are a kind of acoustic one, and propagate horizontally with phase velocity of ˜310 m/s. On the other hand, Pekeris waves are internal resonance mode that propagate horizontally with phase velocity of ˜240 m/s. The Pekeris waves have anti-phase between upper and lower stratopause, while the Lamb waves are in-phase vertically. The energy of the Pekeris waves is closed between stratopause and mesopause, so amplitude of Pekeris waves becomes large in the height range of 45-85 km. However, variations in the D-region ionosphere due to the Lamb and Pekeris waves associated with the eruptions has not been revealed at all. In this study, we investigate variations in VLF/LF transmitter signals and atmospheric electric field (or potential gradient) to understand coupling between the D-region ionosphere and atmosphere associated with Tonga volcanic eruptions of 15 January, 2022. The VLF/LF transmitters used in this study were JJY(60 kHz, Japan), JJI(22.2 kHz, Japan), and BPC(68.5 kHz, China). The receivers were Tainan (TNN, 23.07N, 120.12E) in Taiwan, where is one of Asia VLF observation network (AVON). We used 0.1-s sampling amplitude data. Unfortunately, there were no phase data for all paths on that day. The minimum distances of the JJI-TNN, JJY60kHz-TNN, and BPC-TNN propagation paths from the Tonga volcano were 8167.7 km, 8311.6 km, and 8499.9 km, respectively. The atmospheric electric field has been observed in Chiba University (CHB), (35.63N, 140.10E), Japan, and Studenec (STU), Czech Republic (50.26N, 12.52E). The distances of CHB and STU from the Tonga volcano were 7789.5 km and 16634.7 km, respectively. At arrival times of Lamb (˜307 m/s) and Pekeris waves (˜235 m/s), both variations in VLF/LF amplitudes were observed. The period of the variations was 3.3-16.7 min. (1-5 mHz). Amplitude of the variations in VLF/LF amplitudes due to Pekeris wave was larger than that due to Lamb wave, which is consistent with simulation of neutral winds. At arrival time of Pekeris wave, variations in atmospheric electric field were seen at CHB and STU in spite of ground-based observations. Period of the variations in atmospheric electric field due to Pekeris wave was 1.7-16.7 min. (1-10 mHz). Ground-based geomagnetic data at Kakioka also showed similar variation with the VLF/LF amplitudes. Electron density in the D-region varied by Lamb and Pekeris waves. The atmospheric electric field on the ground may vary via global electric circuit, because amplitude of Pekeris wave is very small on the ground. In this presentation, we will discuss the mechanism of the phenomena in detail.