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ポスター3：11/6　AM1/AM2 （9:00-12:30）

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Effects of the 2022 Tonga volcanic eruption on the D-region ionosphere based on observation of AVON VLF/LF transmitter signals

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The Hunga Tonga-Hunga Ha‘apai volcano in Tonga (in southern Pacific, 20.54S, 175.38W) explosively erupted during 04:10-04:30 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. Due to magnetic conjugate effect, the northern hemisphere TIDs appear three hours prior to the arrival of the Lamb wave (Lin et al., 2022). Both direct and conjugate TIDs match with the theoretical dispersion relation of the atmospheric Lamb and gravity modes. However, D-region behavior for the Tonga eruptions has not been revealed yet. In this study, we investigate variations in VLF/LF transmitter signals and atmospheric electric field (or potential gradient) associated with Tonga volcanic eruptions of 15 January, 2022 to understand D-region ionosphere and atmosphere coupling. 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), Seikei High School (SHS, Tokyo, 35.72N, 139.57E), Japan, and Studenec (STU), Czech Republic (50.26N, 12.52E). The distances of CHB, SHS, and STU from the Tonga volcano were 7789.5 km, 7830.4 km, and16634.7 km, respectively. The first variations in pressure data were seen around 10:57 UT and 19:03 UT on 15 January in CHB and STU, respectively. The propagation velocity was 310-320 m/s, which is typically propagation velocity of atmospheric Lamb waves. The VLF/LF amplitudes for all three paths showed the similar period around the first arrival time of the Lamb waves. The common periods for multi-paths were 4-6, 8-10, 20, and 50 minutes. There were significant coherences (0.45-0.72) of more than 95-% confidence levels between atmospheric pressure at CHB and two LF amplitudes with a period of 14.4 minutes. On the other hand, after arrival time of the Lamb wave, the atmospheric electric field at CHB showed similar variations with the pressure data at CHB. The periods of the variations were 40-50 and 80-100 minutes. The amplitude of the variation in the atmospheric electric field at CHB and STU was similar after arrival time of the Lamb wave at each site. There were variations in atmospheric electric field with a period of 10-100 minutes at CHB at the first (direct) and second (rounding the Earth) arrival times of the Lamb waves. The conductivity in the atmosphere might change due to Lamb wave excited from the Tonga volcanic eruptions. In this presentation, we will report and discuss the phenomena in detail.