

Supporting Information for

**Tropospheric and Thermospheric Lamb Waves of the 15 January 2022 Tonga
Volcanic Eruption Uplift the Ionosphere**

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Additional Supporting Information (Files uploaded separately)

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Introduction

This supporting information provides the locations of ionosondes, barometers, and tide gauges used in this study, as listed in Table S1. The manually scaled f-Plots of NICT from 14 to 16 January 2022 are shown in Figure S1. Figure S2 presents the compressed ionograms from 12 to 15 January 2022 observed in Taiwan. Text S1 compares the observation on the event day and the reference day shown in Figures S1 and S2. The movies S1 – S5 include rapid-run ionograms in Japan and Taiwan on 15 January 2022.

Table S1. Location of Ionosonde, Barometer and Tide Gauges

Ionosonde	Location (°N, °E)
Wakkanai (WK)	(45.2, 141.8)
Kokubunji (TO)	(35.7, 139.5)
Yamagawa (YG)	(31.2, 130.6)
Okinawa (OK)	(26.7, 128.2)
Singwu (TW)	(25.0, 121.0)
Air Pressure	
WAKKANAI	(45.4, 141.7)
TOKYO	(35.7, 139.8)
MAKURAZAKI	(31.3, 130.3)
NAGO	(26.6, 128.0)
NCU	(25.0, 121.0)
Tide Gauge	
Aburatsu	(31.6, 131.4)
Kushiro	(43.0, 144.4)
Mera	(34.9, 139.8)
Naha	(26.1, 127.7)
Wushi	(24.9, 121.8)

Text S1:

Figure S1 presents the f-plots from ionosondes in Japan during 12–16 January 2022, while Figure S2 shows the compressed ionograms obtained in Taiwan from 12 to 15 January 2022. Taking 12 January as a quiet reference day, the f-plot on 15 January in Figure S1 reveals pronounced spread-F signatures across all four stations (WK, YG, OK, and TO). Additionally, Figure S2 highlights a notable difference in h'F variations between the event day and the reference day. On the quiet day, h'F begins to rise from 200 km at approximately 10:50 UT (18:50 LT), reaching a peak of 250 km at 11:25 UT (19:25 LT). In contrast, on 15 January, the uplift associated with the thermospheric Lamb wavefront commences at 08:48 UT (16:48 LT) and peaks at 10:06 UT (18:06 LT). Furthermore, significant spread-F signatures are also observed in Taiwan on 15 January, consistent with the observation in Japan.

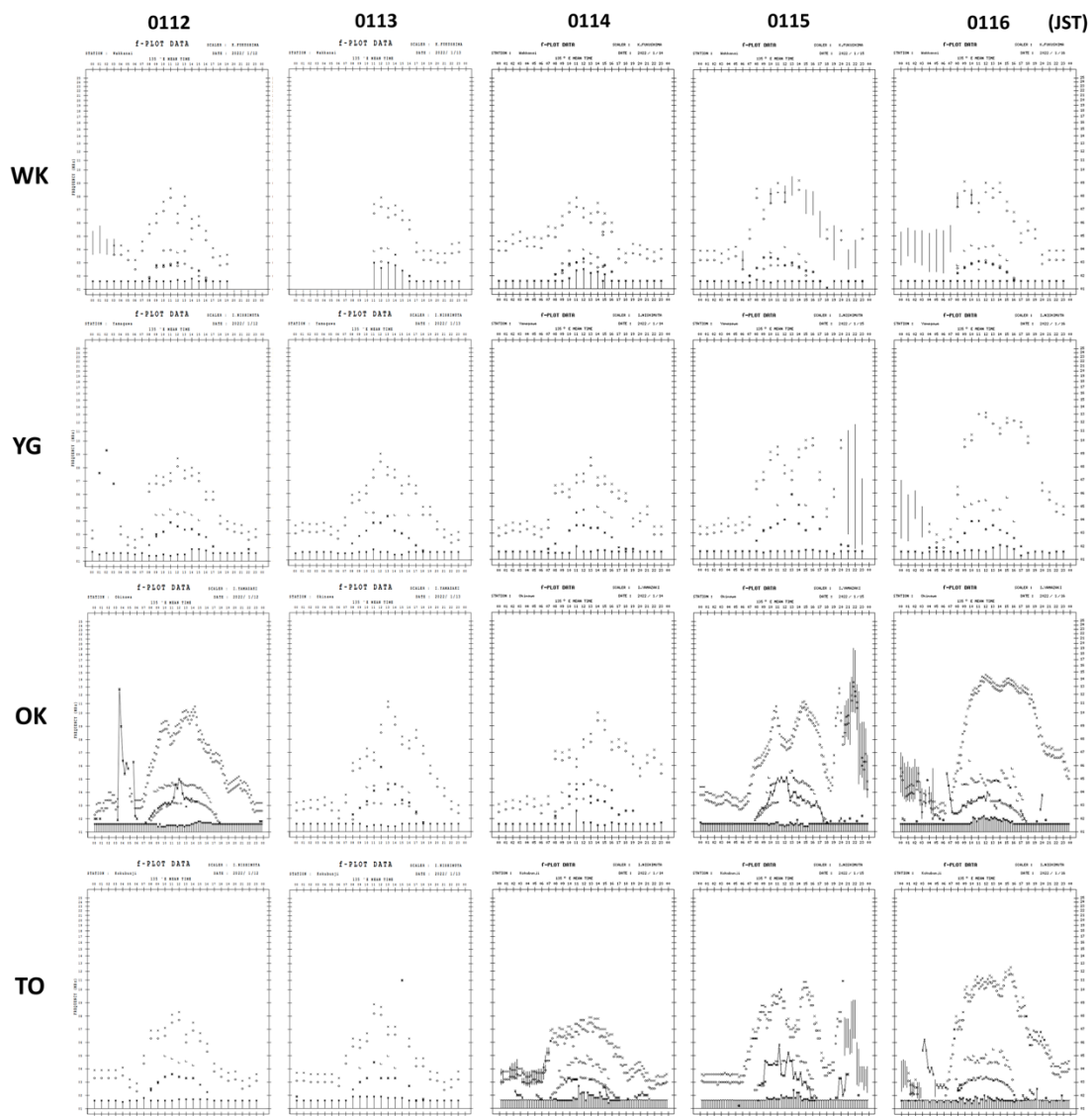


Figure S1. f-Plots of WK, YG, OK and TO from 12 to 16 January 2022 obtained from the National Institute of Information and Communications Technology (NICT, <https://wdc.nict.go.jp/Ionosphere/en/archive/>, last access: 2025/06/13)

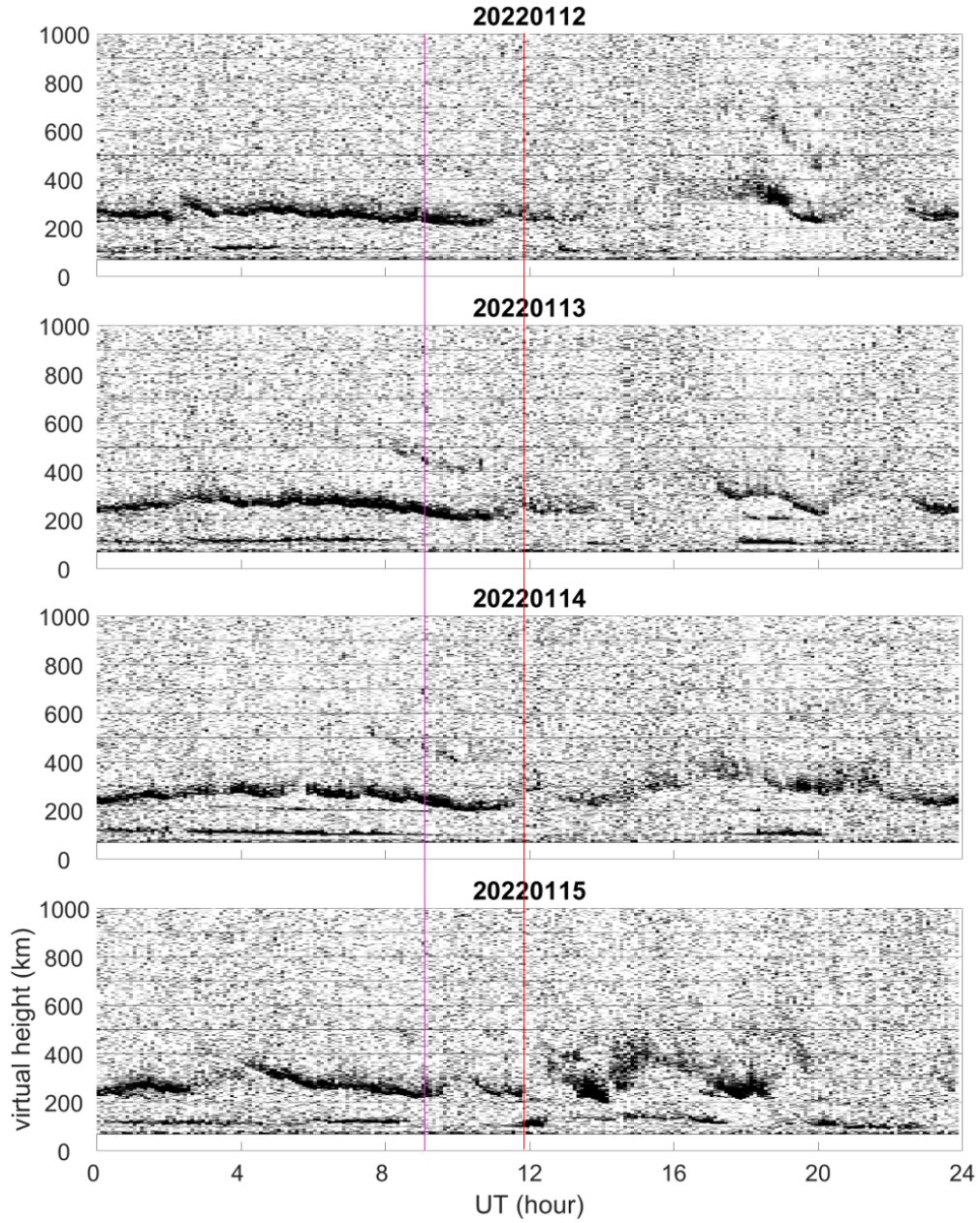


Figure S2. Compressed ionograms observed at TW from 12 – 15 January 2022. The magenta line indicates the expected arrival time of the thermospheric Lamb wavefront (487 m/s) while the solid red line marks the arrival time of the tropospheric Lamb wavefront (315 m/s) on 15 January 2022.

Movie S1. The condensed rapid-run ionograms observed in Taiwan with 6 minutes resolution on 15 January 2022 (LT = UT + 8hr).

Movie S2. The rapid-run ionograms observed in Wakkanai (WK) with 5 minutes resolution on 15 January 2022 (LT = UT + 9hr).

Movie S3. The rapid-run ionograms observed in Yamagawa (YG) with 5 minutes resolution on 15 January 2022 (LT = UT + 9hr).

Movie S4. The rapid-run ionograms observed in Okinawa (OK) with 5 minutes resolution on 15 January 2022 (LT = UT + 9hr).

Movie S5. The rapid-run ionograms observed in Kokubunji (TO) with 5 minutes resolution on 15 January 2022 (LT = UT + 9hr).