

# Lightning associated with submarine volcanic eruptions

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The large-scale eruptions occurred at Fukutoku-Oka-no-Ba in 2021 and at Hunga Tonga-Hunga Ha'apai in 2022. Since these were both submarine volcanoes in the vicinity of isolated islands, there is little information available from field observations. Therefore, we examined what was happening at the sites from the lightning observation data.

We used the data from the World Wide Lightning Location Network (WWLLN), which is a lightning observation network operated by universities and research institutes around the world. Since WWLLN uses a frequency band called VLF (3-30 GHz) that propagates over long distances, it covers all areas of the earth, but only targets lightning with relatively large peak currents.

The Fukutoku-Oka-no-Ba eruption cloud had a shape like a so-called tapering cloud as seen in satellite images, and lightning also occurred along this shape. As for the Tonga eruption, lightning occurred in concentric circles as the umbrella cloud developed at first. After that, there were new strokes inside the lightning circle that had occurred in the first stage. From the WWLLN lightning data, the scale of the Tonga eruption is estimated to be larger than that of the Fukutoku-Oka-no-Ba eruption.

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