

Estimation of the Tonga plume-top height using parallax from geostationary meteorological satellites

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The plume top height of the major eruption at Hunga Tonga–Hunga Ha ‘apai on January 15, 2022 was estimated using two geostationary meteorological satellites: Himawari-8 operated by Japan and GOES-17 by the U.S. These satellites observe the Tonga region from highly different angles, creating significant parallax in the observed image for objects in high altitudes. By measuring the parallax in these images both manually and automatically, spatial distribution of the plume top height was estimated every 10 minutes. Results indicate that the umbrella cloud reached nearly 40 km above sea level, descending to 30 km in 3 hours. The altitude of the overshooting top briefly reached around 56 km, entering the lower mesosphere. A web-based tool to conduct the manual estimation is published at <https://weather-models.info/news/20220115HungaTonga/parallax/>. Those results, combined with dynamic plume simulations, would significantly constrain physical parameters of the mass ejection, helping understand the dynamics of the eruption.

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