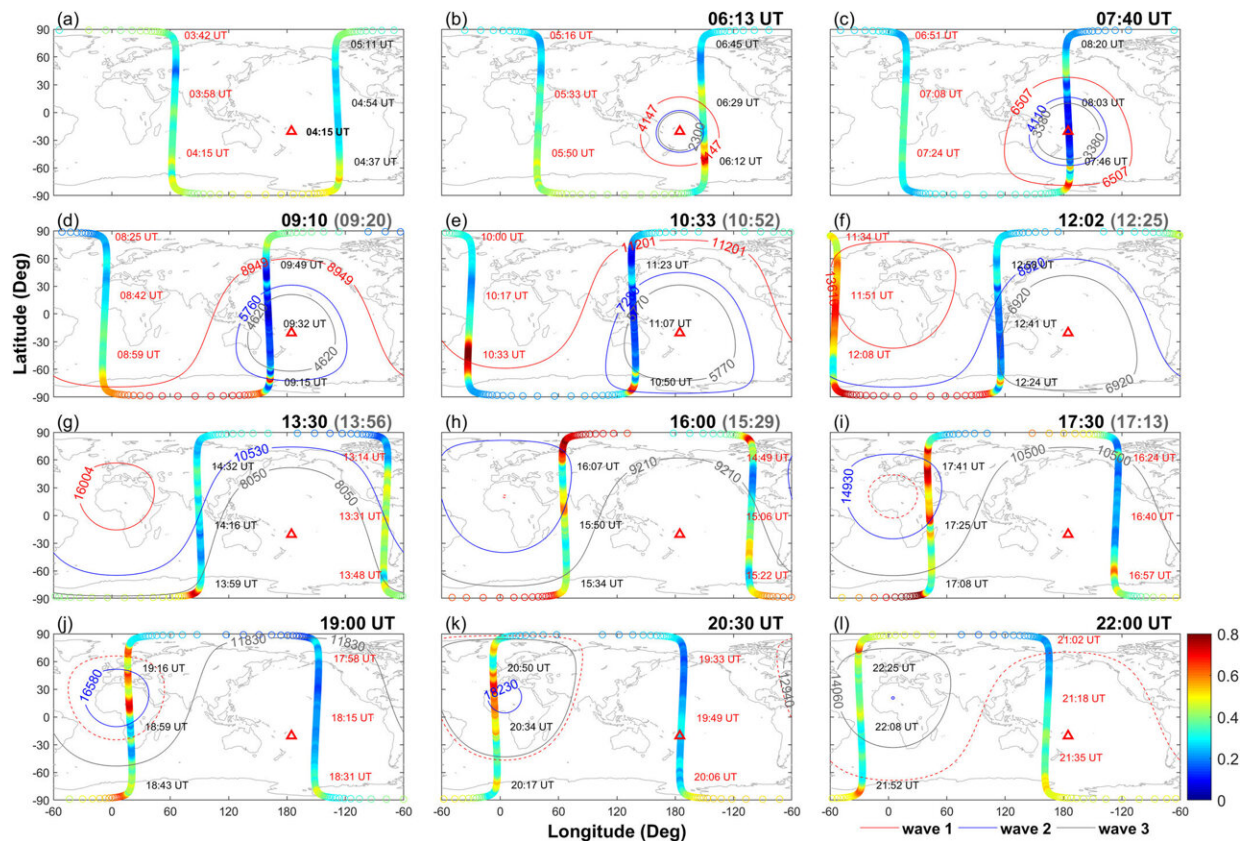


Researchers reveal disturbances of Tonga volcanic eruption

March 3 2023, by Liu Jia



Thermospheric densities at 510 km (in units of 10^{-12} kg/m³) along GRACE-FO trajectories during the eruption of the Tonga volcano. GRACE-FO time epochs are given along the tracks. The descending orbits are marked in red and the ascending orbits are marked in black. The location of the Tonga volcano is marked by the red triangle. The red, blue, and gray solid circles (lines) represent the estimated propagation of the eruption-induced thermospheric waves. The dotted circles (lines) represent the propagation of those waves after they converged to the antipode. Panels (a–l) show 12 successive trajectories from pre-

eruption to about 18 hr after the eruption. The snapshot times for the first and the second waves are labeled in black on the upper right corners of each panel, and in gray for the third wave. Credit: *Geophysical Research Letters* (2023). DOI: 10.1029/2022GL102265

Recently, a team led by Prof. Lei Jiuhou from University of Science and Technology of China (USTC) of the Chinese Academy of Sciences and the collaborators revealed the notable evidence of the dramatic thermospheric disturbances and global upper thermospheric perturbations of the Tonga eruption (January 15, 2022), and confirmed that the impact of volcanic eruption has outreached the ionosphere and creeps into the thermospheric density up to 500 km satellite orbiting altitudes. This study was published in *Geophysical Research Letters*.

The Tonga volcanic eruption significantly redistributed the global neutral density 500 km above the ground, with higher density in the antipode hemisphere and lower density in the volcanic eruption hemisphere.

Researchers discovered that this [eruption](#) stimulated thermosphere atmospheric fluctuations with multiple wave modes in the speed range of 200–450 m/s. Thermosphere atmospheric fluctuations propagate globally in concentric circles centered on the Tonga volcano, and some wave models can propagate and converge to the antipode of the volcano, and further diverge from the antipode to continue propagation.

Researchers believed that in accordance with the characteristics of propagation, thermosphere atmospheric fluctuations may be related to the upward transmission of energy from [gravitational waves](#), Lamb waves and tsunami waves in the lower atmosphere.

This study initiates to provide the direct effect of the [volcanic eruption](#)

on thermospheric density, which may expand the understanding of the interactions between the Earth's spheres from the lithosphere upward to the thermosphere.

More information: Ruoxi Li et al, Large-Scale Disturbances in the Upper Thermosphere Induced by the 2022 Tonga Volcanic Eruption, *Geophysical Research Letters* (2023). [DOI: 10.1029/2022GL102265](https://doi.org/10.1029/2022GL102265)

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