

## The impact of the 2022 Hunga-Tonga-Hunga-Ha'apai eruption on the stratosphere observed by radio occultation measurements

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The violent eruption of the Hunga Tonga-Hunga Ha'apai (HTHH) volcano in 2022 not only sent huge shock waves around the globe, but also set a new record for the height of the plume, which reached a mesospheric altitude of more than 50 km. However, compared to its high explosiveness, the eruption released only a small amount of aerosols, equivalent to that of a rather moderate volcanic eruption. Yet, compared to other volcanic eruptions, the HTHH eruption also released an enormous amount of water vapour, resulting in a previously unobserved hydration of the stratosphere.

Although the radiative properties of aerosols and trace gases such as water vapour released during extreme events such as volcanoes or forest wildfires are very different, they can have significant impacts, especially in the stratosphere where they persist for months to years. Nevertheless, we still know little about their impact on stratospheric climate. This raises the question of how the HTHH outbreak has affected important atmospheric parameters such as temperature.

We will discuss the effects of the water vapour and aerosol plume from the HTHH eruption on temperatures in the middle and lower stratosphere. In the radio occultation data we find a significant, long-lasting cooling of the middle stratosphere, which seems to be related to both aerosols and water vapour. We also find a comparatively small and short-lived warming of the tropical lower stratosphere that can be attributed to aerosol heating. Furthermore, we will discuss the results in comparison to other volcanic eruptions and wildfires.

Our research on extreme events aims to improve the separation between natural variability and anthropogenic influences in the detection of climate trends, especially in the stratosphere.