

PRESS RELEASE

**Volcanic Eruption in Africa Affects the Atmosphere over Japan**  
— Geostationary Satellites Capture an “Atmospheric Wave” Traveling ~10,000 km —

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Hiroshima Institute of Technology

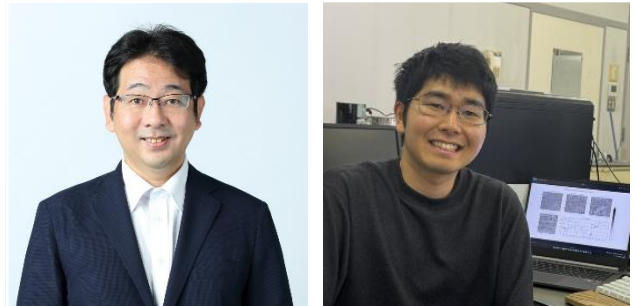
A research group led by Mr. Taichi Murakami, a PhD candidate (first author) in the Graduate School of Engineering at Hiroshima Institute of Technology, together with Professor Kenji Tanaka (Department of Global Environment Studies; Director, Center for Disaster Mitigation Education and Research), has revealed that internal gravity waves generated by the eruption of Hayli Gubbi volcano in Ethiopia in November 2025 propagated eastward along the upper-level westerlies and reached the atmosphere over Japan, approximately 10,000 km from the eruption site.

The results of this study have been published in the international scientific journal *Scientific Reports* (Nature Portfolio).

#### ■Background

Volcanic eruptions are known not only to emit ash and gases, but also to generate various types of atmospheric waves. In particular, the submarine eruption of Hunga Tonga–Hunga Ha‘apai in January 2022 produced globally propagating pressure waves and volcanic meteotsunamis, highlighting the potential for volcanic activity to affect the atmosphere and oceans on a planetary scale.

However, it has remained unclear under what conditions atmospheric waves generated by eruptions of more moderate scale can propagate over long distances.



Prof. Tanaka (left) and Mr. Murakami (right)

#### ■Research Findings

In this study, the research team focused on the eruption of Hayli Gubbi volcano on November 23, 2025. They analyzed high-frequency observations by combining data from Japan’s geostationary meteorological satellite **Himawari-8** (operated temporarily at that time following an anomaly of Himawari-9) and Europe’s **Meteosat-9**.

By applying analytical techniques that enhance temporal variations in infrared bands sensitive to atmospheric water vapor, the team successfully detected internal gravity waves propagating through the atmosphere.

The analysis revealed that the eruption-generated internal gravity waves traveled eastward along the **subtropical jet stream in the mid- to upper troposphere**, maintaining coherence for nearly **three days** and reaching the vicinity of Japan with little attenuation. The study also showed that the waves were transported together with extremely **dry air masses containing volcanic sulfur dioxide (SO<sub>2</sub>)**. These exceptionally dry conditions within the jet stream are considered a key factor that suppressed wave damping and enabled the long-range propagation.

#### ■Difference from the 2022 Tonga Eruption

The January 2022 Tonga eruption generated strong pressure waves affecting the entire atmosphere, which led to observable global sea-level disturbances known as volcanic meteotsunamis.

In contrast, the Hayli Gubbi eruption primarily produced **internal gravity waves confined to the mid- and upper troposphere**. Surface pressure changes associated with this event were extremely small, and **no significant sea-level or tsunami signals were observed**. This contrast demonstrates how differences in eruption magnitude and atmospheric conditions can result in fundamentally different atmospheric responses.

### ■Figure Explanation (for Press Use)

Figure 1 illustrates the long-distance propagation of internal gravity waves generated by the Hayli Gubbi eruption in November 2025, as observed by geostationary meteorological satellites. The left panels highlight weak temperature perturbations associated with atmospheric waves, while the right panels show pseudo-color composites visualizing dry air masses containing volcanic sulfur dioxide. The map at the bottom indicates the region traversed by the wave packet (shaded in gray), and the green line represents its approximate central propagation path. The waves traveled along the subtropical jet stream for approximately 10,000 km, eventually reaching the atmosphere over Japan.

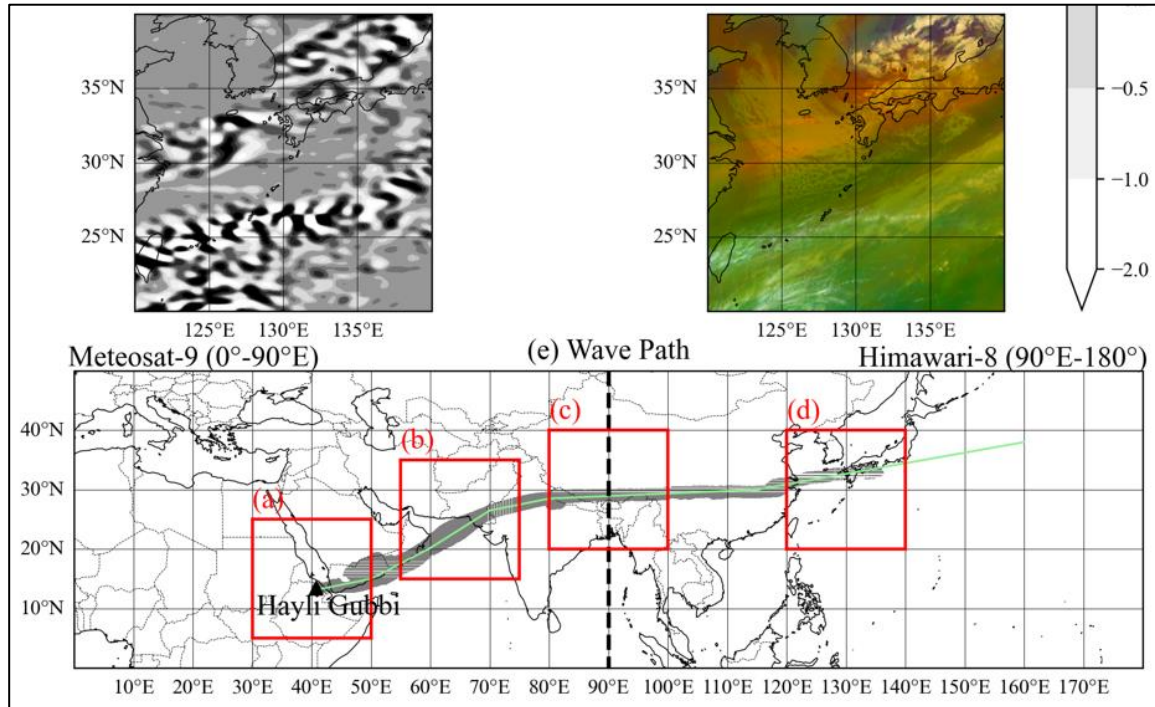


Figure 1. Long-range propagation of internal gravity waves generated by the volcanic eruption

Image credit: Hiroshima Institute of Technology

### ■Significance and Future Outlook

This study demonstrates that geostationary meteorological satellites can continuously monitor atmospheric waves generated by volcanic eruptions on a global scale. The findings advance understanding of the interaction between volcanic activity and atmospheric circulation, and provide important insights for identifying eruption-induced atmospheric waves and assessing their potential to generate surface pressure disturbances and volcanic meteotsunamis. Further research will continue to explore these processes and their implications for disaster mitigation.

### ■Publication Information

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