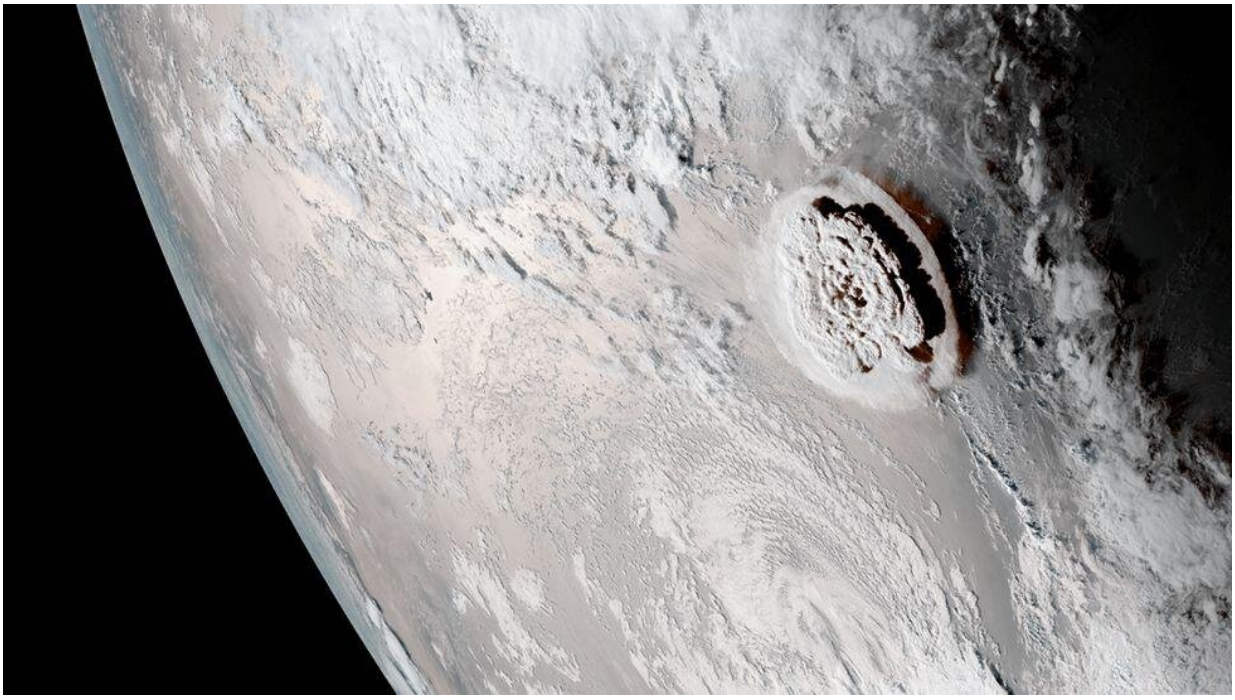
Hawai‘i phones capture data in Tonga volcano blast

February 11 2022



Tonga eruption visible from satellite. Credit: NOAA

The explosion of the underwater volcano Hunga Tonga-Hunga-Ha‘apai on January 15, released a blast "sound" wave that reverberated through Earth's atmosphere and was recorded around the world by monitoring stations—and smartphones. The devastating eruption produced the most powerful air blast since the 1883 eruption of Krakatoa in Indonesia.

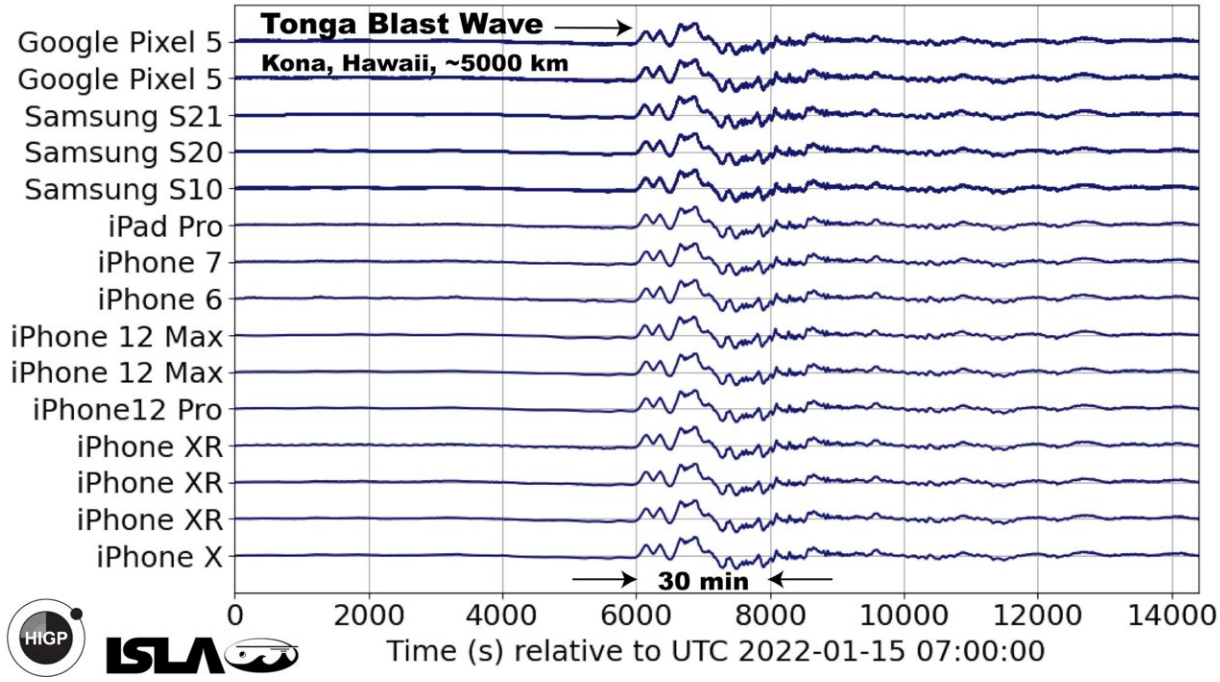
Monitoring systems at the University of Hawai‘i at Mānoa that continuously listen for infrasound—deep, inaudible atmospheric sound produced by extreme natural events, such as volcanoes, asteroid impacts and intense explosions—recorded the Tonga eruption on traditional infrasound and pressure sensors, as well as with a network of smartphone sensors, showing that smartphones can record large blasts from thousands of miles away.

Monitoring technology advancement

The Infrasound Laboratory, based in the UH Mānoa School of Ocean and Earth Science and Technology (SOEST), is led by Hawai‘i Institute of Geophysics and Planetology researcher Milton Garces who has spent more than 25 years developing technology to monitor these deep sounds.

Until the event in Tonga, the 2013 Chelyabinsk meteor over Russia was the largest atmospheric blast recorded in the digital era. The blast intensity of meteor impacts and volcanic eruptions is commonly reported relative to the energy from an equivalent trinitrotoluene (TNT) explosion. At an estimated yield of 500 kilotons of TNT, the Russian meteor blast wave was recorded by conventional geophysical monitoring systems all over Earth. After reviewing the emerging smartphone technology of the time, Garces postulated that on-board microphones and barometer sensors could also record such signals.

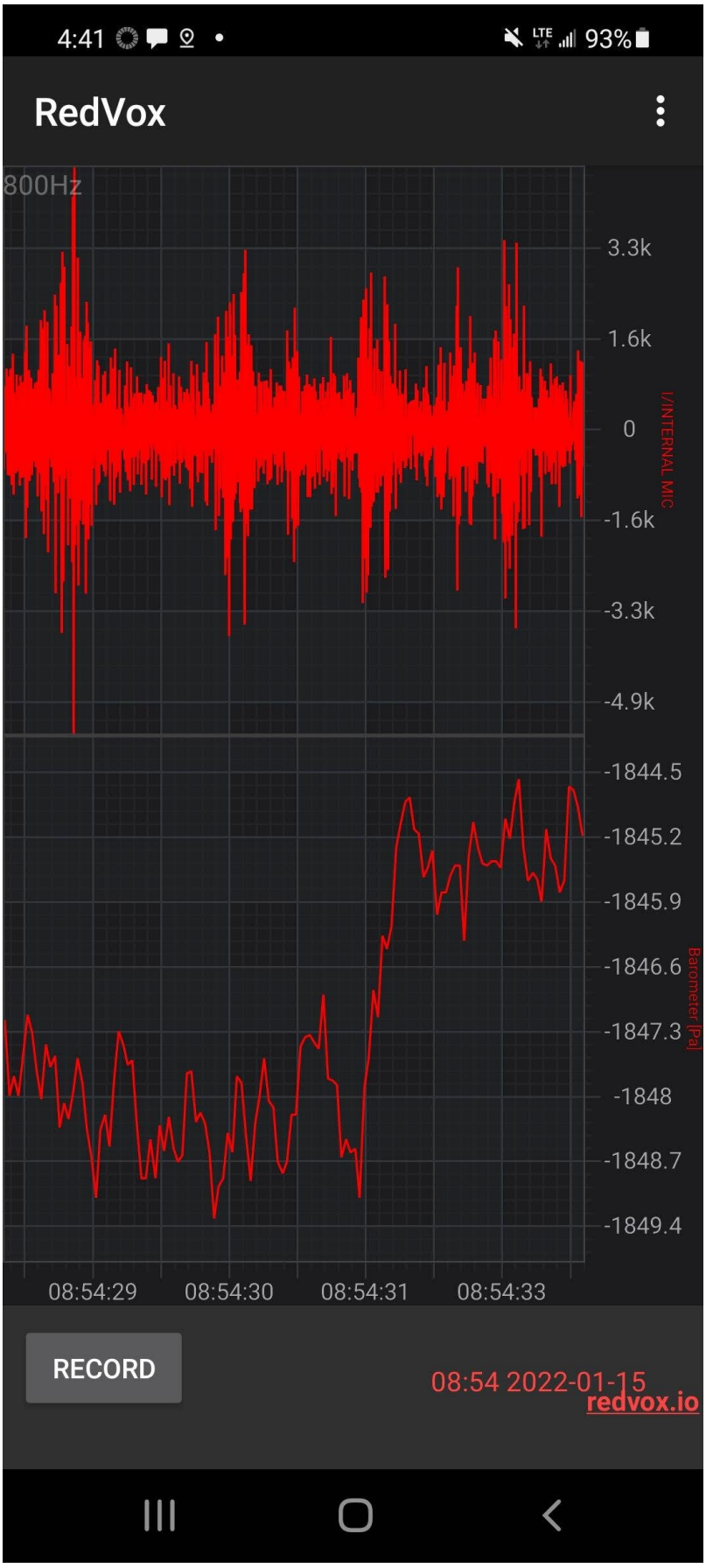
"Both smartphone and traditional networks captured unique and extraordinary infrasound measurements in Hawai‘i from the Tonga eruption," said Garces. "Not only did the smartphones pick up the direct arrival, but also the multiple circumglobal transits of the air wave. Nine years after the Russian meteor, the Tonga blast demonstrated that on-board smartphone sensors can record large blasts thousands of miles away."



Infrasound Laboratory captured signal from Tonga eruption on smartphones via the RedVox App. Credit: University of Hawaii at Manoa

Free RedVox app expands network

In 2014, the U.S. Department of State supported Garces' development of the RedVox Recorder smartphone application to detect infrasound from atmospheric blasts. More recently, in support of the nation's nuclear nonproliferation goals, research funding from the U.S. Department of Energy's National Nuclear Security Administration has enabled Garces to expand his smartphone technology and enhance capabilities to measure diverse sound and vibration signatures near Earth's surface, as well as in the upper atmosphere and the ocean.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redvox.io

Screenshot of RedVox App recording infrasound from Tonga eruption. Credit: UH ISLA

Teams of scientists, engineers, programmers, students and citizens have contributed to mature the technology and make it available to the public. The free RedVox Infrasound Recorder app is available in the Apple App and Android Play stores, and runs on most modern smartphones.

"Ubiquitous sensors, such as smartphones, can take our infrasound monitoring potential to the next level," said Garces. "For example, from calculations based on pressure data collected via the app and traditional sensors, we can estimate the Tonga blast was larger than Tsar Bomba's, which at 50 megatons was the most powerful nuclear weapon ever tested. It is likely to be closer to the 1883 Krakatoa blast, which weighed in at 200 megatons. That something as evanescent and intangible as infrasound can last for days is remarkable; and we have a free smartphone app that can record these primal signals in the deep end of sound. This was not possible 10 years ago."

Provided by University of Hawaii at Manoa

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