Possible Detection of Infrasound Signal from Tonga Volcanic Event, Detected in the UK

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Abstract

Using a low cost mems infrasound detector we believe that we have detected infrasound signals from the Tonga eruption arriving in the north-east of England.

Intro

On the 15th of January 2022 , the Hunga Tonga-hunga Ha'apai undersea volcano erupted at approximately 04:10 UTC. Given the apparent magnitude of explosion and area of water displacement, it could be expected that a significant infrasound signal could be generated.
Two infrasound detectors were used, both employing mems pressure sensors. The data analysed here was pulled from a sensor with a porous hose wind filter.
We appear to have detected a clear signal commencing at 19:40 UTC. The station located in the North of England is at a distance of some 16500km from the eruption with an expected travel time greater than 13.25 hrs.

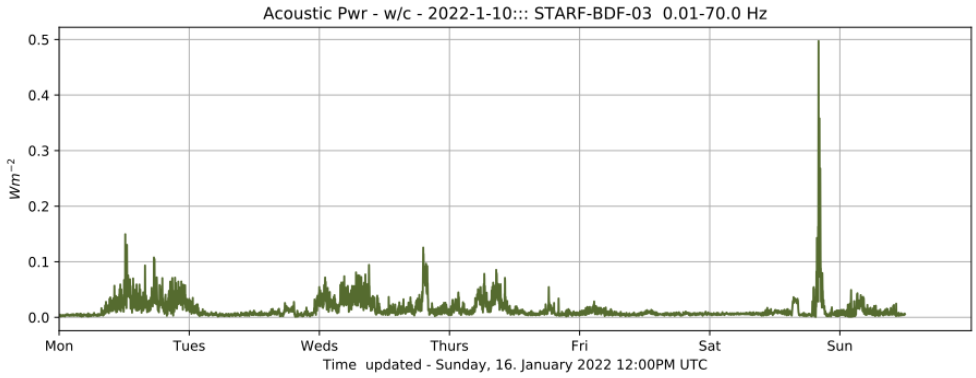

Figure 1: Suspected Signal arriving late Saturday

Event and Data

Both devices detected the same pulse simultaneously late Saturday [fig: 1]. After the wavelet

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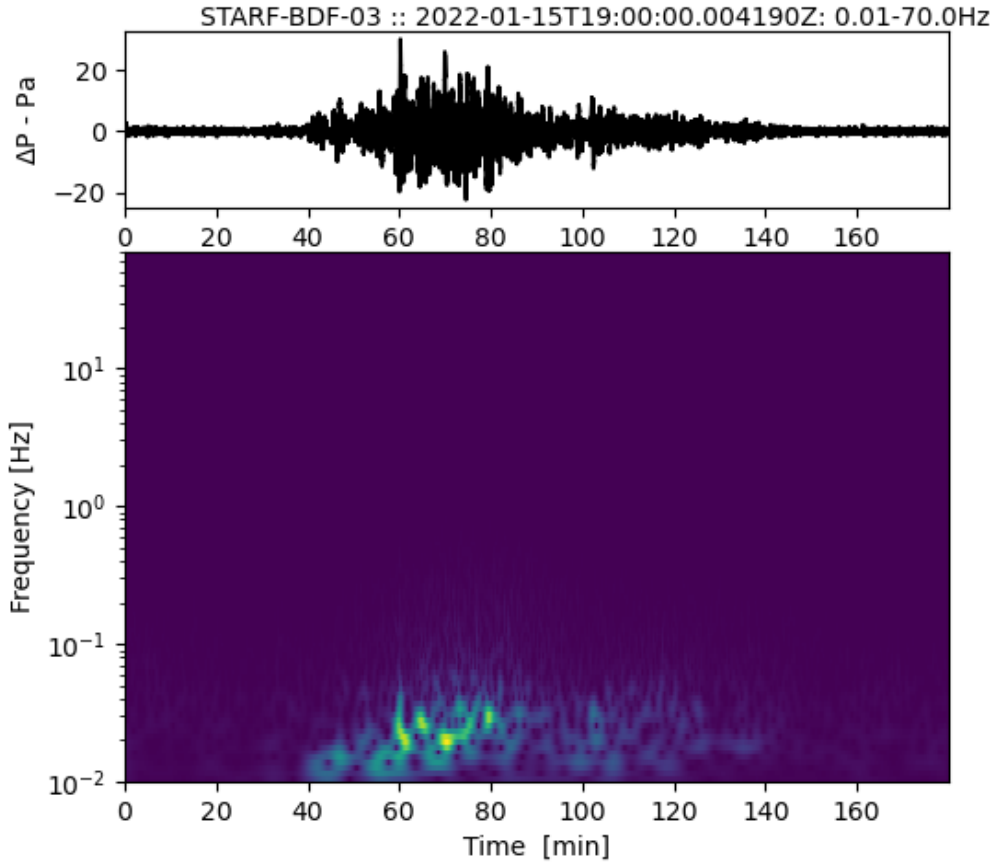

Figure 2: Raw data and wavelet transform of data from 19:00-22:00 UTC

analysis showed most of the signal was below 0.1Hz, we broke the data into signal bands of both acoustic power and raw pressure signals [figs: 3-4].

Most estimates put the shortest distance from the Volcano to monitor at about 16220km. Assuming a straight path and not accounting for obstacles and with acoustic wave speed at ground level for 20° celsius being 340m/s. This works out to 1224km/h or roughly 13.25 hours at quickest.
With actual travel time seeming to be 15.30 hours it would be interesting to have a look at data from other sites to follow the progression of the pulse and effects on its progression.

Bandsets [3,4] show most all of the signal is below 5Hz with a significant component below 0.1Hz.
After confirming that the majority of the raw pressure was below 0.1Hz I broke things further down specifically in that range of 0.01 - 0.08Hz [figs:5-6]

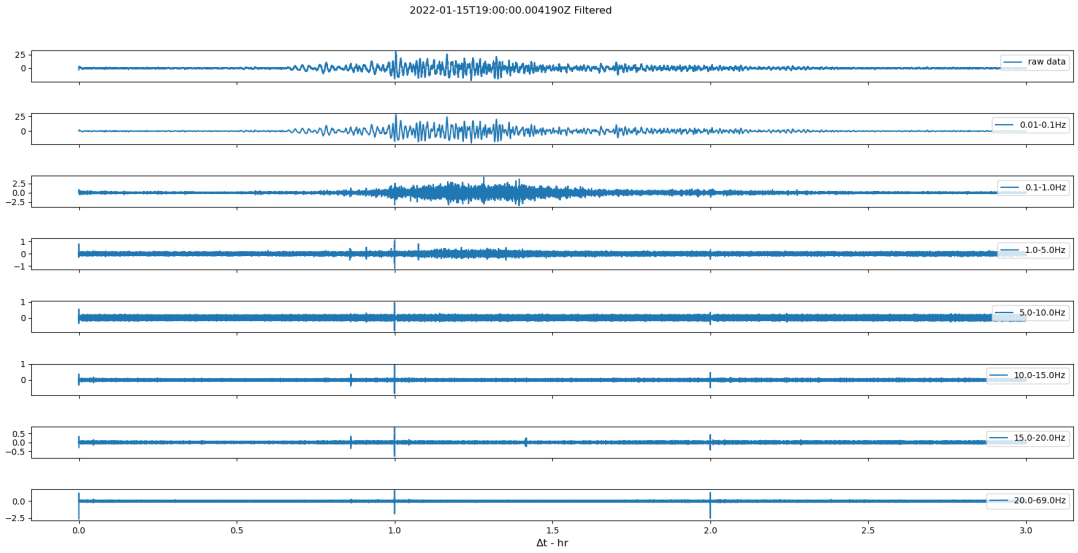

Figure 3: Raw pressure Bands 19:00-22:00 UTC

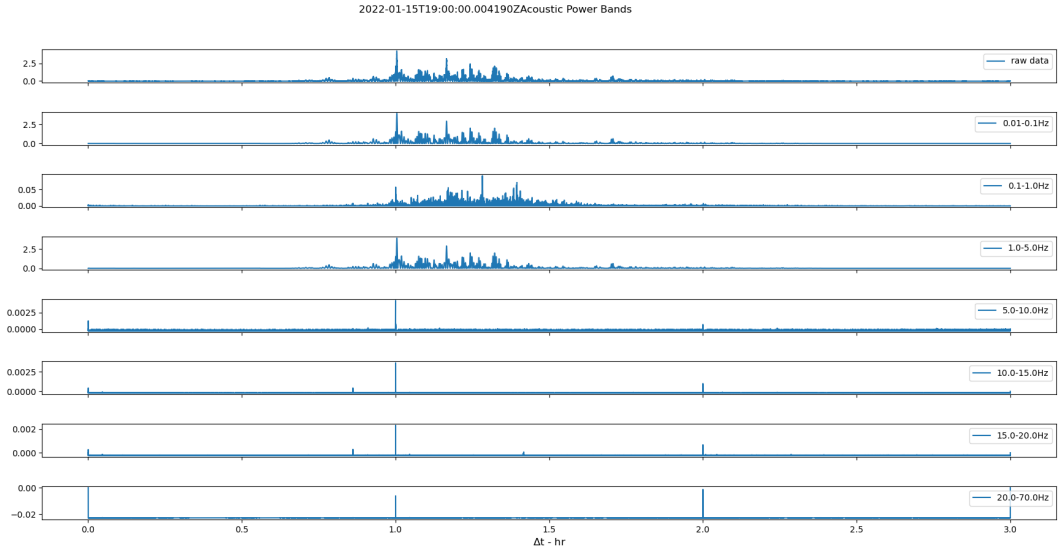

Figure 4: Acoustic Power Bands 19:00-22:00 UTC

Detectors

The system's sensor is the Amphenol DLVR-F50D, a mems piezo-resistive differential pressure sensor with inbuilt temperature compensation. The device has a sensitivity of a 0.05Pa with a sample rate of approximately 150Hz. Sensor, fitted with an pneumatic filter to remove signals below $\frac{1}{200}$ Hz, is connected to a 10m porous hose wind-filter laid across a flat roof about 2 metres above the ground at 54.53N and 1.056E [1].

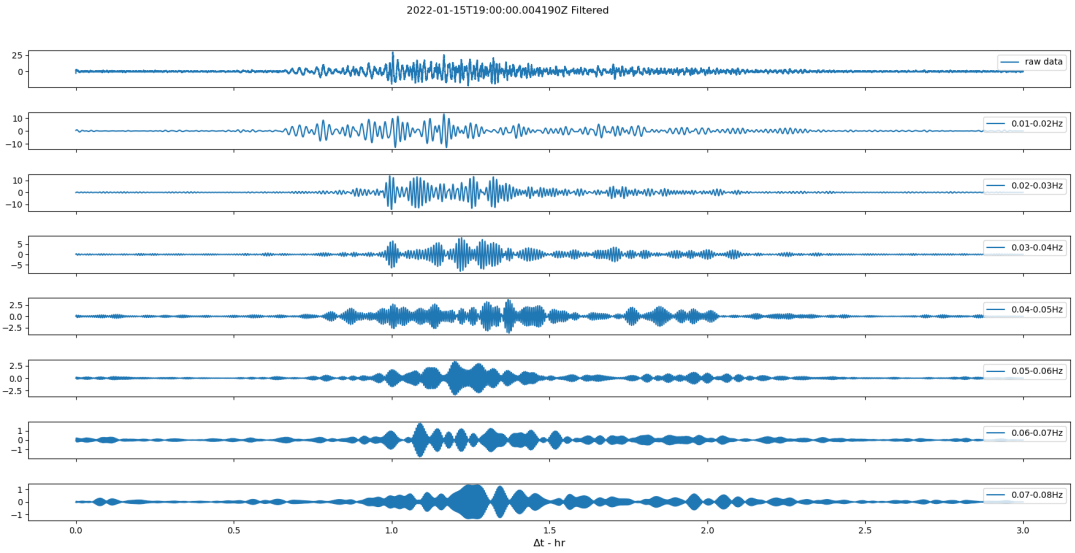

Figure 5: Raw pressure Bands (0.01-0.08Hz) 19:00-22:00 UTC

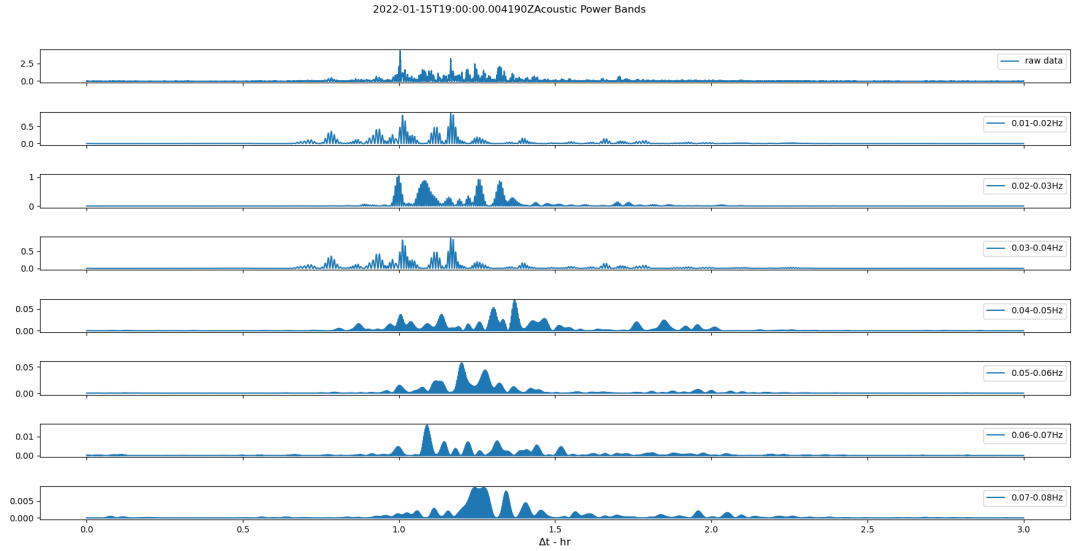

Figure 6: Acoustic Power Bands (0.01-0.08Hz) 19:00-22:00 UTC

Summary

We have detected an unusual, significantly sustained low frequency infrasound pulse across two detectors. This I believe results from the Tonga eruption of 16500 km away.

Datafiles in .mseed format and high resolution versions of these plots may be downloaded from http://starfishprime.co.uk/projects/infrasound/TongaEvent/

For further information refer to project homepagel [2]

Thanks to Dr Ian Robinson for the detector and the infrasound analysis code.

References

[1] Robinson et al. , Novel infrasound monitor project: real geophysics research on a budget https://doi.org/10.1088/1361-6552/ab9e9d

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[2] Project Homepage http://starfishprime.co.uk/projects/infrasound/infrasound.html

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