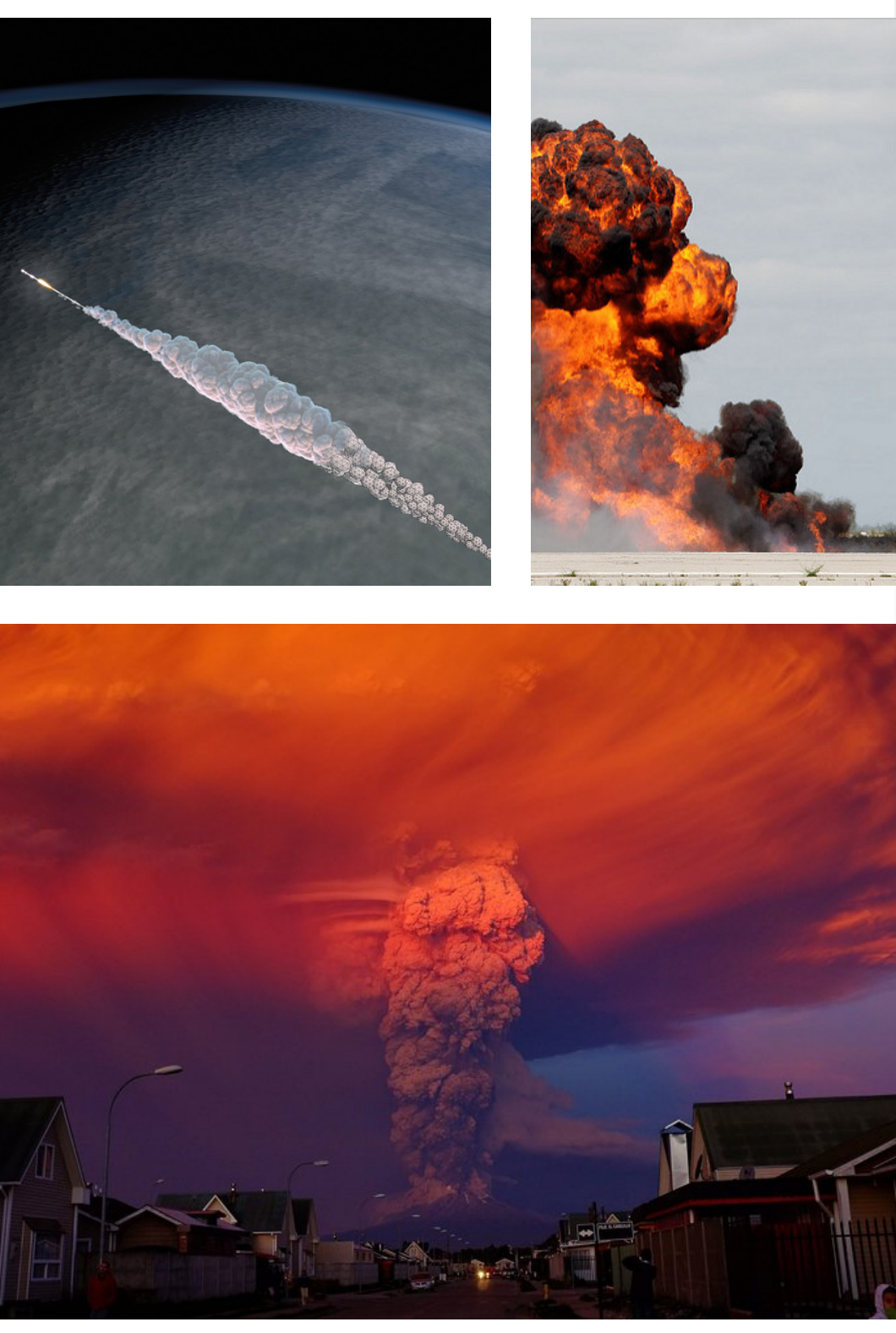


Unlocking Real Time Infrasound Event Classification Abilities

Sarah Albert, Daniel Bowman, Tim Draelos, Leiph Preston



*Exceptional
service
in the
national
interest*

It is nearly impossible for an analyst to classify regional and global infrasound events by eye. Currently, classifying these events requires removing false detections and using seismic or other forms of data as ground truth. There is no real-time event classification code package available for use on local, regional, or global infrasound events. Also, there has recently been a shift towards focusing on ground-based methods to characterize events as anthropogenic or natural. Thus, it would be beneficial to have an algorithm that can provide a classification based solely on the infrasound data. We believe this is possible with support vector machine (SVM), a supervised machine learning algorithm, which can classify infrasound events in real time with small error. Using SVM on a global event catalog, such as the one used in this study, will allow us to classify a variety of events as natural or anthropogenic, and possibly as earthquakes, bolides, explosions, volcanic eruptions, and mining blasts.

In essence, this research aims to leverage state of the art, pre-existing, Python code to **develop a useable infrasound event classification code package** that can be implemented alongside real time detection algorithms. Our final product will create the ability for national security agencies to **deduce the nature of an event immediately after its detection**, aiding in important decision making.

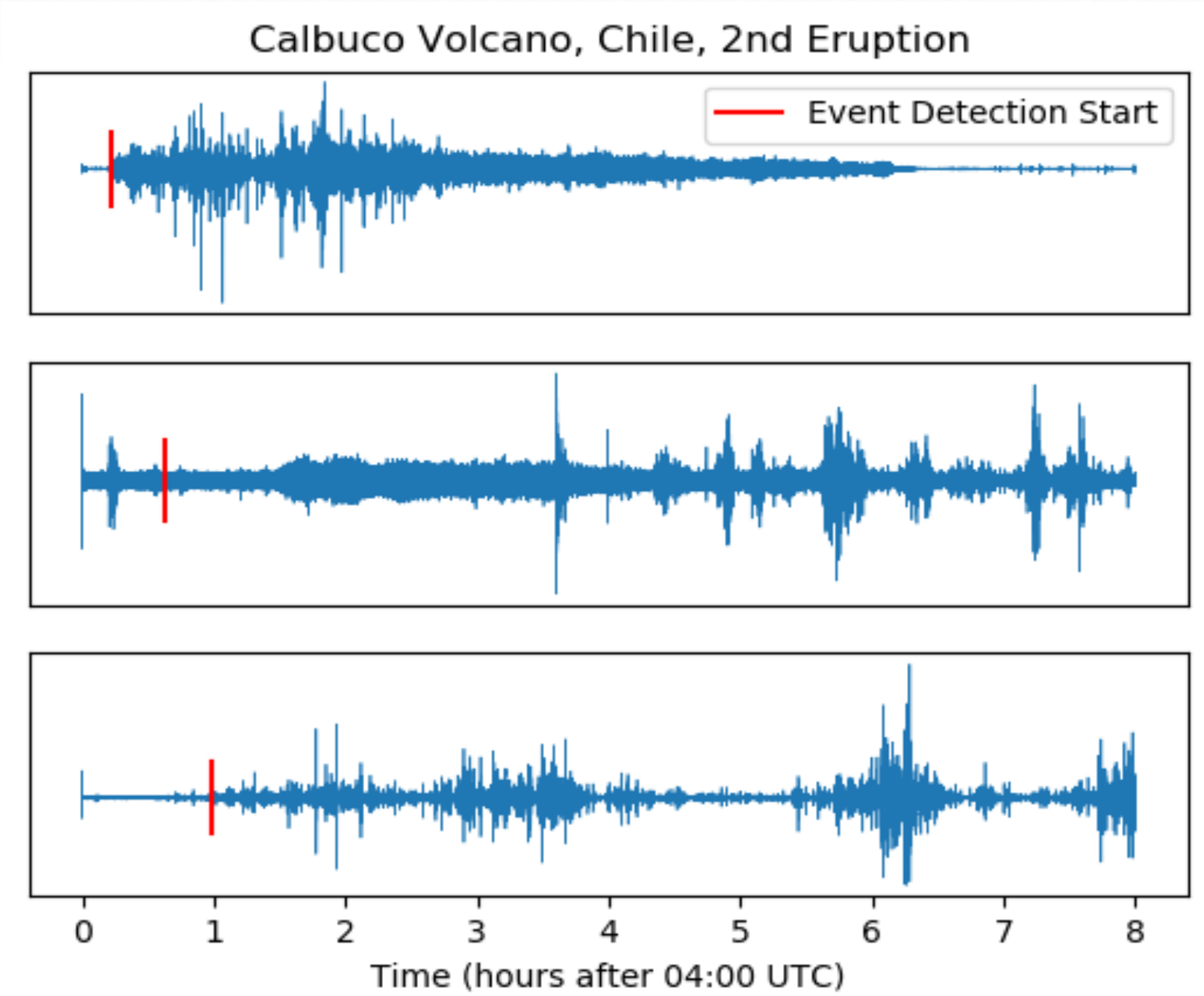


Figure 1. Three infrasound sensors in Chile detected the second eruption of Calbuco Volcano on April 23rd, 2015. Without seismic information it would be practically impossible to determine the source of the signals just by looking at them. Machine learning may be the key to unlocking this ability.

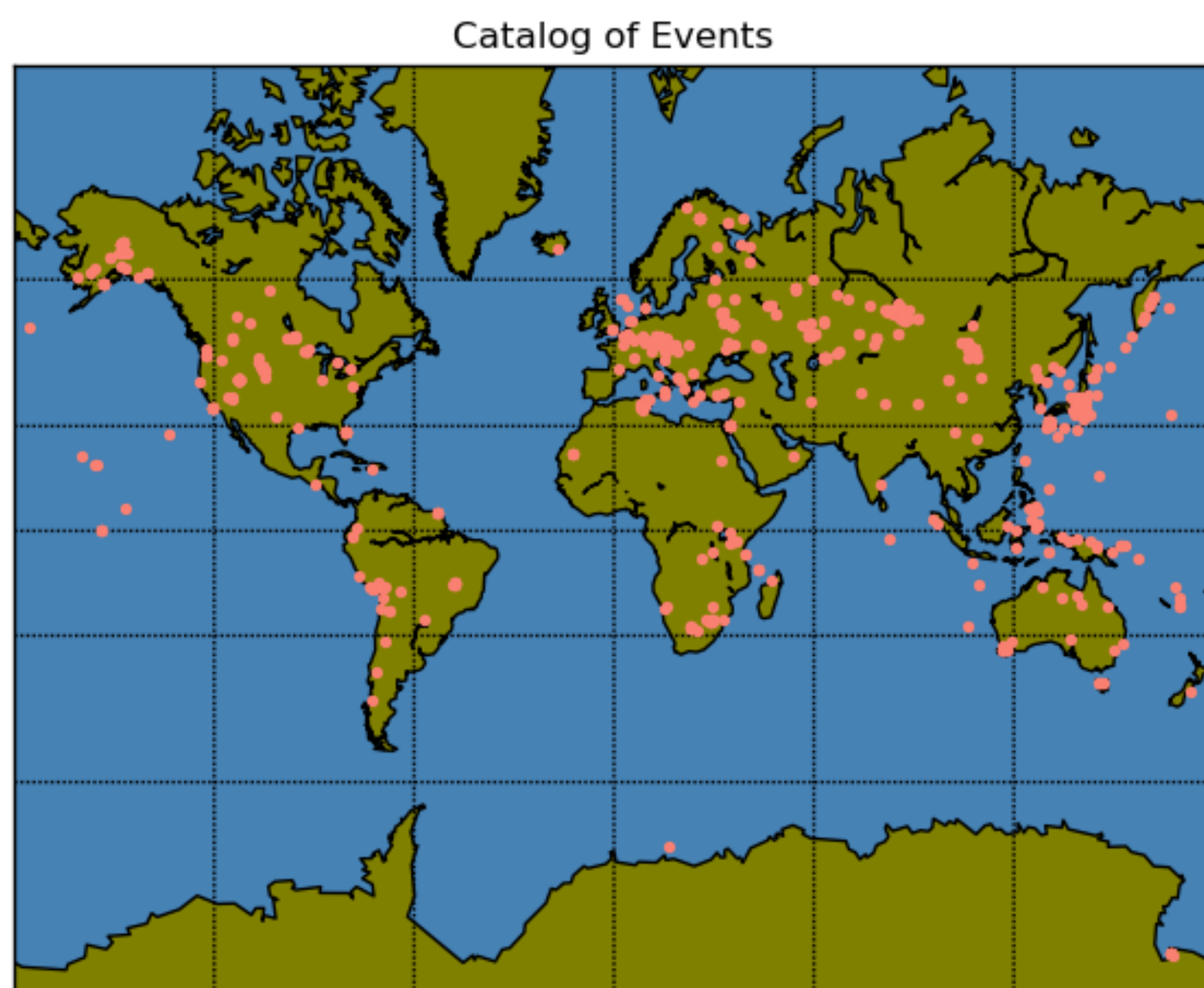


Figure 2. Our event catalog consists of a 750 events detected at the International Monitoring System (IMS) infrasound stations, a global set of infrasound arrays put in place to verify that countries are remaining in compliance with the Comprehensive Nuclear Test Ban Treaty. Events are from various sources including earthquakes, volcanic eruptions, bolides, rockets, mining blasts, and other explosions.

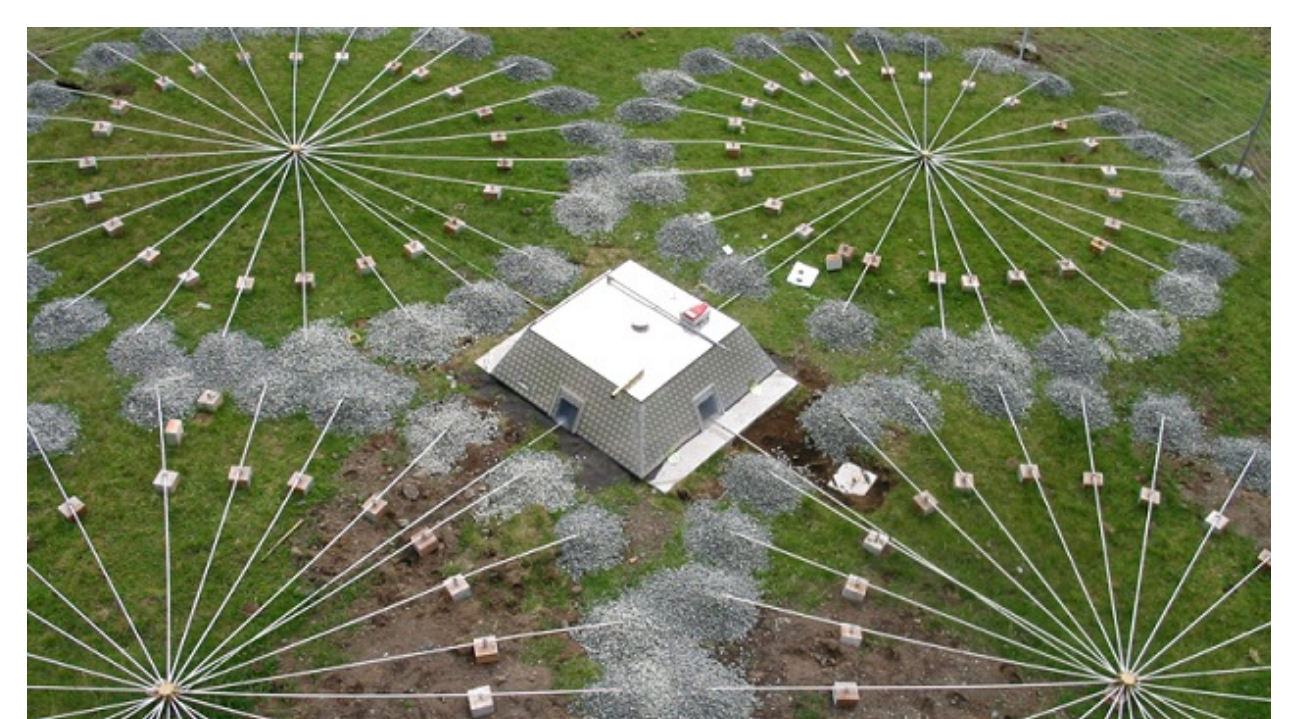


Figure 3. An example of an IMS infrasound sensor and its wind noise reduction system. Each IMS station consists of at least 4 infrasound sensors, which are used in conjunction with detections at other stations to form the events in our catalog.

