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A study of volcanic eruption characteristics using infrasound data recorded on the global IMS network

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Explosive volcanic eruptions have the capability to generate sound waves with infrasonic frequencies (<20Hz). As such waves can propagate over distances of thousands of kilometres within the atmosphere, they present an opportunity to remotely monitor volcanic eruptions and potentially constrain eruptive characteristics. Though most volcanoes in sensitive areas of the world are monitored individually, many volcanoes in remote locations are not monitored directly but can still pose a threat, especially to aviation. The growing International Monitoring System (IMS) network of infrasound stations provides an opportunity to monitor these remote volcanoes. Currently comprising of 43 arrays, the network is designed to achieve global coverage for surface explosions equivalent to a few hundred tonnes of chemical explosive.

In recent years work has been published on the detection of specific volcanic eruptions at IMS stations, primarily at regional ranges (< 1000 km from volcano to receiver). In contrast, work presented here looks to create a catalogue of volcanic eruptions that have been detected at IMS stations, with the aim of assessing the capability of the IMS network for use in global volcano monitoring. At this time 40 eruptive events at 19 volcanoes have been investigated from the period 2004 - 2009; however the work is on-going and it is planned to extend this catalogue.

In total we document 61 individual detections that have been made on the IMS network. These range from Strombolian activity at Mount Erebus (Antarctica) recorded at a range of 25 km distance, to the Plinian eruption of Manam Volcano (Papua New Guinea) recorded at ranges of over 10,000 km distance. The observed signal frequencies for different eruptions range from less than 0.01 Hz to greater than 5 Hz, and in general, lower frequencies are generated by the larger eruptions. We provide examples of analyses for eruptions recorded at multiple stations (e.g., Manam, October 2004; Kasatochi, August 2008) showing how careful interpretation of the recorded signals, incorporating knowledge of the propagation path, is required before eruption characteristics can be inferred. This study adds weight to the idea that a global network of infrasound stations may be used to remotely monitor volcanoes, and that it may be possible to infer eruption size or style based on the characteristics of the observed infrasonic waveforms.