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Infrasound Broadband Bulletin Products of the IMS for Atmospheric Studies and Civilian Applications

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The International Monitoring System (IMS), which has been established for the Comprehensive Nuclear-Test-Ban Treaty (CTBT) verification since the late 1990s, is supposed to detect every explosion of at least 1 kt TNT equivalent worldwide. Pressure waves in the infrasound range (between ~0.01 and 20 Hz) can efficiently propagate over long distances, depending on the winds near the stratopause. Therefore, the IMS verification technology monitoring the atmosphere comprises a global infrasound network consisting of up to 60 stations, 53 of which have already been certified. Moreover, research studies and projects have suggested infrasound observations of repeating or persistent sources for probing the winds in the middle atmosphere, where numerical weather prediction models suffer from the lack of continuous observation technologies for data assimilation. One type of repetitive source is active volcanoes. In turn, this natural hazard for civil security can be monitored using infrasound, and prototypes of applications for the release of early volcanic eruption warnings have been established. However, access to raw infrasound data or products of the IMS is limited to specific user groups, which might hinder the utilization of infrasound observations.

In this study, we present IMS infrasound open-access data products for atmospheric studies and civilian applications. For this purpose, 18 years of raw infrasound data (2003-2020) were reprocessed using the Progressive Multi-Channel Correlation method with a one-third octave frequency band configuration between 0.01 and 4 Hz. From the comprehensive detection lists of 53 stations, four products were derived that differ in frequency range and temporal resolution. These are (i) low-frequency infrasound events (0.02-0.07 Hz, 30 min), detections in the microbarom frequency range – in both (ii) a lower (0.15-0.35 Hz) and (iii) a higher (0.45-0.65 Hz) frequency spectrum (both 15 min) – and (iv) observations with relatively high centre frequencies of between 1 and 3 Hz (5 min). Along with several detection parameters, calculated quantities for assessing the relative quality of the products are provided. All four products are provided per station and include detections of volcanic eruptions, while the microbarom products best reflect the middle atmosphere dynamics. The data products are demonstrated by historical and recent examples of natural events that produced infrasound detected at IMS stations. Global compilations of the products highlight the stratospheric circulation effect in the microbarom detections.

