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Infrasound from the 2017 DPRK underground nuclear test

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Following the 2017 underground nuclear test of the Democratic People's Republic of Korea, clear infrasound signals were recorded at the Russian IMS infrasound station I45RU at a distance of 400 km. Two distinct pressure peaks were observed with travel times of about 25 minutes after the explosion, showing acoustic celerities and back-azimuths pointing towards the test site, thus indicating infrasound generation near the epicenter.

Infrasound propagation between the test site and the infrasound array was modeled using two-dimensional ray-tracing and parabolic equation methods. The results thereof argue that the observed signals can be explained by waves ducted along stratospheric and thermospheric propagation paths. The frequency-time and directional content of coherent signal energy as well as the attenuation along the paths are used to characterize the recorded infrasound signals. In addition, the 2017 observations are compared to the ones from the previous North Korean nuclear tests.

Other miscellaneous infrasonic signals were observed at I45RU preceding and succeeding the main arrivals by several minutes. The early arrivals are most-likely related to seismo-acoustic coupling, when seismic waves from the underground explosion cause ground shaking in mountain areas between the test site and the infrasound array. This may generate secondary infrasound closer to station I45RU, thus preceding the main pressure peaks. The later signal may be related to epicentral infrasound from an aftershock that occurred eight minutes after the main event.