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Signals from the 2017 North Korean Underground Nuclear Explosion and the Subsequent Collapse Event

This study focuses on the assessment of infrasound signals from North Korean underground nuclear explosion at 03:30:01 UTC and the subsequent collapse event at 03:38:31 UTC on September 3, 2017. We use infrasound observations from ten infrasound arrays in and nearby to the Korean peninsula. The explosion generated local, diffracted, and epicentral infrasound, while only epicentral infrasound accompanied the collapse. Infrasound phases were identified and used to constrain the locations of the two events. Detection results for the closest stations to the sources are used to constrain differences in source phenomena between the explosion and collapse. Arrival times for the explosion and collapse are compatible with stratospheric propagation times, while a variety of current atmospheric models do not predict such arrivals during the period leading up to the equinox. In order to reconstruct an atmospheric model that predicts the infrasound observations, we search the best-fit atmospheric profile from historical G2S model using empirical orthogonal function analysis. We also constrain the possible source location from all arrays based on a backward ray tracing technique using an ECMWF model. The data and analysis highlights the need to understand the transitionary nature of the atmosphere at the time of the September 2017 explosion.

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