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Analyses of Regional Seismic and Infrasound Data from Five North Korean Nuclear Explosions

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We analyze seismic and infrasound signals generated by five underground nuclear tests in North Korea in 2006, 2009, 2013, and 2016 (January and September). Regional data from six seismo-acoustic arrays, cooperatively operated by Southern Methodist University (SMU) and Korea Institute of Geosciences and Mineral Resources (KIGAM) in the Korean peninsula, were used with two additional infrasound arrays operated by KIGAM and an additional seismic station in China. We explore the relative seismic source scaling of Pn, Pg, Sn, and Lg phases, using the Mueller and Murphy (1971) and Denny and Johnson (1991) source models. This analysis constrains a range of relative source strengths and depths. We analyzed infrasound signals detected from all the explosions using an automatic detector and compared these with the model predictions using time dependent atmospheric specifications. These results suggest that infrasound detections from the five explosions are strongly dependent on atmospheric condition at the time of each explosion (best detectability in January 2016 case) with infrasound event locations improved using this information. Future work is needed to integrate both seismic and infrasound analyses to provide combined constraints on source depth as well as free surface interactions near the source.

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