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Source time functions of North Korean nuclear tests

I compute the source time functions of North Korean nuclear tests directly from seismograms. Because the events are located close to each other, the spectral ratio of the seismograms of two events measured at the same seismic station is the spectral ratio of the reduced velocity potential (RVP) source time functions: the path effect between the test site and the seismic station cancels. A scaling law relates the RVP of two events via two independent parameters: the yield ratio and the source depth ratio. The tests of 2009 and 2013, the two tests of 2016 and the test of 2017 have source time functions that are scaled versions of each other, suggesting they were detonated in the same rock formation. The 2006 event does not share the same source characteristsics. The form of the RVPs is similar to a damped sine wave, in agreement with theory. The natural frequency and damping factor is proportional to the cube-root of the radial stress at the elastic radius and inversely proportional to the cube-root of the yield; the amplitude is proportional to the square of the cube root of the yield. Calbration for yield is via published data from Nevada Test Site.

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