

Analyzing the Reduced Displacement Potentials of DPRK Nuclear Explosions Using Waveform Equalization Technique

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We equalize regional P, surface, and the P+surface waves simultaneously to estimate reduced displacement potential (RDP) and depth of burial (DOB) of DPRK nuclear explosions, using waveforms from the stations at IRIS DMC. RDPs are predicted using the formula in Saikia (2017). The algorithm starts with the initial RDP and DOBs for two explosions. RDP of one explosion S1 is convolved with the other explosion recorded data O2, and vice-versa (i.e., S2 with O1), which generates two convolution seismograms: S1O2 and S2O1. The objective is to minimize the differential error between the two convolution seismograms, and achieve an optimization by cycling through the parameter space. Next we fix the RDP and DOBs of these two explosions using the derived optimized values and continue the process to include the next explosion. Thus, we have two additional source convolved seismograms: S3O1 and S3O2 to minimize the global error between these constructed differential seismograms. We continue the process until the last explosion is included. The investigation resulted RDP and DOB parameters consistent with those established by other investigators except for the September 3, 2017 explosion, which is caused by the influence of non-isotropic seismic sources, and which is a topic of current investigation.

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