

Revised local- and regional-scale velocity and attenuation models for Canada for improved earthquake/explosion location, magnitude and yield estimates

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The Canadian National Seismic Network (CNSN), covering one of the largest single-network areas worldwide, plays an important role in global nuclear explosion monitoring. As such, and in light of the recent CNSN refurbishment program, we present two national-scale models of local and regional velocity and regional frequency-dependent attenuation relations for 3-D crustal and upper mantle structure. We make significant advancements in Regional Seismic Travel Time (RSTT) tomography (Myers et al., 2010) for Canada using natural and mining-related seismic event data from the Canadian National Earthquake Data Base (NEDB) in addition to a newly-assembled ground truth database of locally and regionally recorded mining events and refraction explosions of known location, depth and timing. For the attenuation model, we use regional Lg amplitude-distance relations in narrow frequency bands in the range 0.5-16 Hz across various regions of Canada and systematically invert for frequency-dependent Q. Improved velocity and attenuation models are of multi-faceted interest to the nuclear explosion monitoring community as they have the potential of 1) reducing earthquake/explosion location errors through improved travel time predictions of regional and local phases, 2) improving explosive yield estimates and 3) reducing regional magnitude bias across adjacent geologic provinces.

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