ID: **P3.1-860** Type: **E-poster**

Dependence of Frequency Response of Short Period Seismometers

Tuesday, 20 June 2023 10:21 (1 minute)

Short period seismometers were the workhorse of the World-Wide Standardized Seismograph Network built in the 1960s. Because they have very low noise in the band of interest for array seismology, they continue to be used in arrays throughout the International Monitoring System (IMS) of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO). In an earlier study, we used single frequency calibrations to validate a model that predicted the temperature sensitivity of the sensors used at the Yellowknife seismic array (YKA) to be -0.16%/℃. Given that seasonal temperature swings can exceed 50℃ in a place like Yellowknife, the effect on sensor gain can be significant. Here we perform broadband calibrations to validate a model of the temperature dependence of the transfer function of the short period sensor. The model predicts the temperature dependence of the damping to be -0.14%/℃. We show how the temperature sensitivity of the damping results in a predictable seasonal dependence of the instrument gain and phase near 1 Hz. We recommend changes to the nominal response of the sensors in the YKA array, as well as routine broadband calibration of seismometers to detect similarly subtle effects which might impede the performance of the IMS.

Promotional text

Short period sensors are used in many IMS seismic arrays. How does their behaviour change with temperature? We present results from broadband calibrations and use them validate a model of the temperature dependence of the response of these sensors.

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Oral preference format

in-person

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Session Classification: Lightning talks: P1.2-1, P3.1, P3.4, P4.5

Track Classification: Theme 3. Monitoring and On-Site Inspection Technologies and Techniques: T3.1 Seismic, Hydroacoustic and Infrasound Technologies and Applications