Amplification of seismic waves in Nenana basin, central Alaska

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We are interested in better understanding the interactions between the seismic wavefield and large-scale sedimentary basins. Our region of focus is Nenana basin in central Alaska. Nenana basin is a northeast-trending, several-km-thick, narrow sedimentary basin overlying the Minto Flats fault zone. Seismic stations, including the temporary FLATS network and EarthScope's Transportable Array, record regional earthquakes as well as continuous ambient noise. Seismic waves from earthquakes and from ambient noise are strongly amplified within the basin. We identified specific frequencies where amplification occurs by applying various filters to earthquake waveforms. Our approach considers amplification with the waveform metrics: duration, radiated energy, peak displacement, peak velocity, and peak acceleration. With two published maps of the depth-to-basement, we test the linearity between depth and our calculated metrics and explore differences between the two maps. We find good correlations between depth and the values of several metrics for periods near 1 second. We use amplitude spectra of recorded earthquakes from stations inside and outside the basin to quantify the influence of the basin, which is prominent at periods of about 1 second. We also use frequency-dependent variations in ambient noise to investigate the basin response. Amplitudes of ambient noise correlate with basin depth at periods greater than 1 second. Our results from earthquake metrics, spectral ratios, and ambient noise show that basin excitation occurs at periods of 0.5–2 seconds, consistent with observations from other large basins.

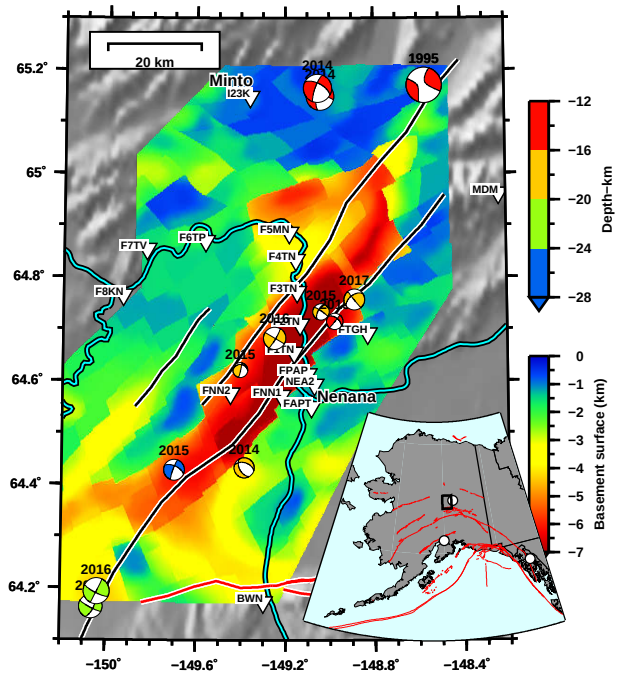

Figure 1: Basement surface (Doyon, Ltd.) for Nenana basin, central Alaska. White triangles show the FLATS seismic stations, which cross the Minto Flats fault zone. Beach balls show earthquakes used in this study with the exception of the 1995 M6 event.