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Aleatory and epistemic uncertainties in interpolated ground motions – Example from the Kashiwazaki-Kariwa Nuclear Power Plant recordings of the July 16, 2007, Niigata-ken Chuetsu-oki, Japan, earthquake

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We quantify the scatter of absolute spectral acceleration, SA, predicted at Kashiwazaki-Kariwa Nuclear Power Plant (KKNPP) based on rupture models derived from waveform inversion of a set of Niigata-area accelerograms from the July 16, 2007, Chuetsu, Japan, earthquake. In an initial inversion we obtain a set of thousands of 'good' rupture models, which we use to predict SA at the KKNPP. The scatter in the predicted horizontal response spectra at KKNPP from the inversion is about 22% bigger than the scatter of response spectra predicted at the Niigata stations. We relate the scatter in the predicted motion to the spatial isolation of the prediction site. We compare our scatter with aleatory variation of ground motions from kinematic and dynamic rupture models. Almost all of the aleatory scatter values of the ground motions from kinematic rupture models exceed the empirically observed scatter in response spectra from a standard ground motion prediction equation. The aleatory variation of dynamic rupture ground motions is much smaller than that of the kinematic rupture models, indicating that the correlations of dynamic models' source properties cause lower ground motion variability. The aleatory variability of dynamic rupture ground motion is comparable to the empirically observed variability. Our scatter at KKNPP approaches the empirically observed inter-event scatter. This means that the variability of predicted motion at KKNPP from the non-uniqueness of the rupture inversion is almost as great as the variability of motion incurred by using a different earthquake having the same magnitude and hypocenter to predict the motion.