Does high-frequency waveform similarity for small repeating earthquakes depend on the time interval between the events?

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Recent studies have investigated the amount of quasi-static slip on a plate boundary using small repeating earthquakes [Igarashi et al., 2003; Uchida et al., 2003, 2004]. However, they might underestimate the slip when large afterslip occurs. For example, Ariyoshi et al. [2007] shows that large afterslip caused by the rupture of a large asperity affects the rupture of a nearby small asperity and degrades the waveform similarity with the other events, especially in the higher frequency range. They also suggest that some of the events at a small asperity may not be identified as the repeating earthquakes at this asperity when repeating interval becomes far shorter than usual.

In this study, we examined the relation between occurrence time intervals of a pair of small repeating earthquakes and its waveform coherences at various frequencies. We identified repeating earthquakes on the basis of waveform similarity as Igarashi et al. [2003] and Uchida et al. [2003] did. We selected earthquake pairs with epicenter separations of less than 30km and calculated coherences for a 40s window containing both P and S waves. In this study, the criterion for selecting repeating earthquakes was set that the coherence averaged over the frequency range of 1-4 Hz must be larger than 0.80 at two or more stations. A pair of repeaters was linked with another if the two pairs shared the same earthquake. In addition, we rejected groups that have no pairs of events with averaged coherences of greater than 0.95.

As a result, we found the coherences tend to lower as the occurrence time intervals shorten, especially in the interval range of less than one year. We also found that this trend is more significant in the higher frequency range (9-16 Hz). These observational results support the idea of Ariyoshi et al. [2007].