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Direct evidence and generation conditions of triggered slow slip event

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In recent years, quite regular recurrences of episodic slow slip events (SSE) were revealed in the deep portion of many subduction plate interfaces in the association with long lasting tremor burst. As breaking such regularity, there exists many evidence of triggered tremor with only transient excitation by incoming seismic waves for various tectonic setting, however SSEs, which are much larger in sizes and continue longer after the transient excitation, have been yet to be identified. Here we found robust and direct geodetic evidence of a SSE with tremor activity in southwest Japan triggered by an earthquake in strain records from a highly sensitive strainmeter network. Based also on spatio-temporal recurrence patterns of the tremor/SSEs, we examine the physical conditions induced this event, including the stress changes by a transient seismic wave, by the tectonic load and by a nearby SSE. As the result, we found that the previous SSE in this fault segment occurred three months earlier almost equal to the regular recurrence period there. On the contrary, the other segments, where the elapse time was up to about 90% of the regular periods, did not show a significant activity at that time. Therefore, it is suggested that the overall segment of the triggered SSE had been necessarily very close to the critical stress level due to tectonic loading, and the seismic wave gave only the last push. Our results provide physical constraints to elucidate how earthquakes start and growth not only for the slow earthquakes but also for regular earthquakes.

Keywords: slow slip event, tremor, slow earthquake, triggering, strain