[EE] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG53]Science of slow earthquakes: Toward unified understandings of whole earthquake process

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Accumulating observational studies on various types of slow deformation events, such as tectonic tremors, very low frequency events, and slow slip events, portrays some universal characteristics in generally complex behavior, including interaction among events and influence by various outer loadings. Some of these phenomena seem to have causal relation with the occurrence of very large earthquakes. A unified understanding of these slow and fast earthquake processes requires an approach integrating geophysics, seismology, geodesy, geology, and non-equilibrium statistical physics. We welcome presentations based on, but not limited to, geophysical observation, data analysis, analytical theory, numerical simulation, field study, and laboratory experiments.

[SCG53-P06]Triggered tremors and stress perturbations due to surface wave passages

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Surface waves radiated from distant large earthquakes sometimes trigger a series of deep non-volcanic tremors with intervals of 20-30 seconds, which are the same as dominant periods of surface waves [e.g. Miyazawa &Brodsky 2008]. Understanding the triggering mechanism is important because it provides us clues on the slip process occurring along the transition zone of subducting plate interface. Dynamic stress perturbations due to surface waves that triggered tremors were estimated on the order of 1 to 10 kPa [e.g. Chao &Obara 2016]. To study the relationship between triggered tremors and stress perturbations due to surface waves, we computed theoretical dynamic stresses due to surface waves from large earthquakes by using the method of normal mode summation.

We focused on the triggered tremors in the western Shikoku region of the Nankai subduction zone. Most of them occurred in two clusters where tectonic tremors actively occur. We computed theoretical dynamic stress perturbations due to surface waves from 76 earthquakes between 2004 and 2016 with a moment magnitude of 7.5 or greater. The receiver point at which the stress components were computed was located at the middle of the two clusters. The earth model PREM [Dziewonski &Anderson 1981] was used for computing eigenfrequencies and eigenfunctions of the Earth’s normal modes, and centroid moment solutions in the Global CMT catalog [Dziewonski et al. 1981; Ekström et al. 2012] were used for computing initial stress amplitudes of the normal modes. Source time functions were approximated with triangular functions whose half durations are equal to the centroid times.

The stress components in the source coordinates were transformed to the stress normal to the plate interface and the stress along the slip direction of tremor. The normal and slip directions were obtained from the model plate interface [Baba et al. 2002; Nakajima &Hasegawa 2007; Hirose et al. 2008] and plate convergence vectors [Miyazaki &Heki 2001]. We computed waveforms of the Coulomb failure function (DCFF) using a frictional coefficient of 0.2 at periods between 20 and 50 seconds.

The result shows that the maximum DCFF for all the events that triggered tremors are greater than 1 kPa, which is consistent with the previous results. The important point is that most of the events with the stress perturbation greater than 1 kPa did not trigger tremors. This shows that only the stress perturbation due to surface waves cannot trigger tremors: other stress perturbations due to, for example, slow slip event and/or pore fluid pressure are required.