Great thrust earthquakes and slow slip events along the Sagami trough, central Japan: Quantitative modelling using mechanically coupled areas on the plate interface

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We develop a method to detect mechanically coupled areas (Saito and Noda 2022 JGR), or high stress rate patches, on the plate interface and apply it to the plate interface along the Sagami trough, central Japan. The locations of the estimated stress patches agree with the locations of the Boso slow slip events and the focal areas of the 1703 Genroku and the 1923 Taisho Kanto earthquakes. We create a model of the Boso slow slip event as an aseismic stress release with a recurrence interval of 5 years of a stress patch estimated on the east coast of the Boso peninsula. The modeled slip distribution and the moment magnitude of M_W 6.5 are consistent with those of the observed Boso slow slip events. We also introduce the strain-energy magnitude M_{W0} determined from the minimum strain energy release based on the notion to quantify the earthquake magnitude in Kanamori (1977). The strain-energy magnitude is useful to compare slow slip events with ordinary earthquakes in terms of the energetics whereas the moment magnitude does not appropriately represent the energy release amount of slow slip events. The strain-energy magnitude of the model of the slow slip event was M_{W0} 4.8 (J) which is significantly smaller than the moment magnitude of it. This is because the moment magnitude is defined assuming a constant stress drop of ordinary earthquakes but the stress drop of the slow slip event is considerably smaller than that of ordinary earthquakes. Furthermore, assuming that the stress has accumulated in other stress patches with a constant rate since the last great earthquakes and that the stress is released suddenly at the stress patches that ruptured in the 1703 Genroku earthquake, we create a rupture scenario of a great earthquake in the Sagami trough. The magnitude of the earthquake is M_W 7.8 and the minimum strain energy release is J corresponding to the strain-energy magnitude of M_{W0} 7.5. This amount of the energy release satisfies a necessary condition for earthquake generation introduce by Noda et al. (2021 JGR).

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