Source fault model of the 1703 Genroku earthquake with the constraints of average stress drop

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Crustal deformations, such as uplifts or subsidence, accompanied with fault dislocations are often observed after large earthquakes. From these distributions of crustal deformations, rupture areas and slip amounts of source faults can be derived by inversion analysis. While we can evaluate the source faults precisely if detailed data of crustal deformations or waveform are abundant, it is quite difficult to estimate the parameters of faults of paleoearthquakes because only sparse data is available for remaining geomorphological evidences. In this study, with focus on the 1703, Genroku Kanto earthquake, I attempted to add a new constraint to the method for estimating the source faults of paleoearthquakes based on the physical properties of the fault, which is the stress drop. The geomorphological evidence obscurely determines the source model size of the Genroku earthquake, while a large fault area extending to southeast off the Boso peninsula is estimated only from historical records of tsunami (Matsuda et al., 1978; Namegaya et al., 2011). This limitation raises problems in the reconstruction of the history of paleoearthquake and the long-term earthquake forecasting in this region.
Kanamori and Anderson (1975) revealed that nearly all of huge earthquakes exhibited an almost constant stress drop between 1 to 10 MPa. Although there exists an important characteristics of fault parameters called the scaling law, which determines the relationship between fault sizes and slip amount through the stress drop, previous paleoseismological studies barely take them into account.
The coseismic crustal deformation accompanied with the Genroku earthquake was estimated from uplifted shoreline (Shishikura, 2003) together with GEONET data to determine the steady deformation rates. We assumed several rectangular subfaults, and grid-searched the optimal source size, location and slip to describe the data. .
As a result of this study, it was revealed that the fault extending to the offshore is necessary to explain the distribution of crustal movement of Genroku earthquake when the constraint of stress drop is introduced to the model. This is understandable if we consider the large uplift in the Boso peninsula cannot be accommodated by the fault slip on the fault areas beneath the Boso peninsula and Tokyo bay, needed the extension of the source area to the southwest off shore. This result may provide a new insight to the studies of paleoseismology through the physical properties concerned to the parameters of earthquakes.
We also mention how this physically based source modeling is used to interpret the newly revealed gap in the emergence date of the marine terraces in Chikura low land, southern Boso peninsula (see presentation by Komori et al., 2016, this meeting).

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