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Numerical simulation of long-term earthquake activity on an active-fault cluster in the Japanese island

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We have conducted numerical simulations of earthquake activity on an active fault cluster in the Japanese island for 50,000 years. Sixty major active faults were embedded into a 3D realistic inhomogeneous rheological structure model of crust and mantle of the central part of Japanese island for FEM simulations. The rheological model has been constructed, considering geophysical and geological data (Cho & Kuwahara, 2013a, b). The model consists of two layers: an upper part is of the elastic layer which has non-uniform thickness and a lower part is of a Maxwell viscoelastic layer whose viscosity is spatially uniform with a value of 10E21Pas. Parameters of active fault geometries, such as strikes and dips, were given with reference to results of fault evaluations by the Headquarters for Earthquake Research Promotion of Japanese government. We incoorporate a 5-km width shear zone and viscous edge zones into the model as deep extension and both lateral edges of each active fault, respectively, with the same Maxwell viscoelastic properties as the lower layer of the structure model. Tectonic stresses assumed in the simulations are a superposition of an E-W compressional stress to an entire body of the model and stresses that are generated by a collision of the Izu Peninsula to the main land of Japan.

Earthquake ruptures on the active faults are triggered on the occasion that a shear stress reaches an assumed level on some monitoring points on the fault plane. Stresses on the monitoring points are a superposition of the tectonic stress above-mentioned and Green's functions beforehand calculated for the rheology structure model from the ruptured fault to the other faults. Thus, we can show the calculation results involving the effects of constant loading of the tectonic stress and the stress perturbations due to inland large earthquakes on an earthquake cycle of each active fault with the present simulation.

References

Cho, I. and Y. Kuwahara, 2013, Modeling of a three-dimensional thermal structure in the lower crust for numerical simulations of crustal deformation of the Japanese Islands, EPS, 65, 855-861.

Cho, I. and Y. Kuwahara, 2013, Numerical simulation of crustal deformation using a three-dimensional viscoelastic crustal structure model for the Japanese Islands under east-west compression , EPS, 65, 1041-1046.

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