Stress state of the Earth’s crust in the Korean Peninsula with reference to Japanese islands: Implication of weak faults

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The stress state in the Korean Peninsula is re-evaluated by analyzing earthquake focal mechanisms with a stress inversion method. Several previous studies of the stress state in the Korean Peninsula give consistent results: the stress state in Korea is characterized in average by a strike-slip faulting stress regime with the ENE-WSW maximum and the NNW-SSE minimum compressions. Further, Soh et al. (2018) suggests a nonuniform spatial distribution of stress magnitudes of the order of 100 MPa, which increase from west to east in the peninsula, by assuming a high Coulomb friction value of 0.85 and hydrostatic pore pressures. This suggestion is based on the “strong fault” hypothesis. In contrast to this, several results of stress states in Japanese islands indicate the weak fault, where the differential stress level is a few tens MPa, providing the apparent friction is around 0.1 at depths. Thus, this difference between the results in Korea and in Japan urges us to re-analyze the data, mainly because the assumptions or constraint models for the estimations of the absolute stress values still seem to be debatable. We then evaluate the focal mechanism data in the Korean Peninsula, and suggest possible estimations of the absolute values. We point out that the earthquake faulting types in the Korean peninsula are strongly controlled by azimuths of preexisting fault-strikes, being consistent with a spatially uniform distribution of the strike-slip stress regime with nearly equal tensional and compressional stresses relative to the vertical stress. We could explain that these reverse and normal faulting events in the Korean peninsula are caused by local stress heterogeneity around strike-slip faults under the strike-slip stress state with a low differential stress expected from the weak fault hypothesis.

Keywords: Earthquake, Korean Peninsula, Japanese islands, crustal stress, weak fault

