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Determination of stress fields from focal mechanisms of earthquakes in the Marmara Sea

Gonca Orgulu

Istanbul Technical University – Mining Faculty – Department of Geophysical Engineering, Istanbul, Turkey (orgulu@itu.edu.tr)

The Marmara Sea is a highly complex area where different tectonic models are proposed. These are pull-apart model, responsible for the tectonic evolution of depression areas in the Marmara Sea and single strike-slip fault model, linked with a two-stage evolutionary model; first extension to generate present morphology of ridges and depressions beneath the Marmara Sea and then strike-slip deformation. When these models are examined in detail, it is clearly seen that major discrepancy between these models is closely related to structural development of the depressions beneath the Marmara Sea. Therefore, this study is mainly focussed on analysis of active faults in the depression areas. To reveal seismic behavior at these areas, all focal mechanisms of available earthquakes ($2.4 \leq M_d \leq 5.0$) occurring beneath the Marmara Sea between 1999 and 2006 are investigated within the scope of this study. Then, P-and T-axes of these focal mechanisms are inverted to determine stress fields in the Marmara Sea. This analysis uses zmap program including two distinct algorithms of stress tensor inversion. The inversion programs yield orientation of three principal stress axes (σ_1, σ_2, σ_3) and their relative magnitudes. This analysis has been done for all focal mechanisms in the Marmara Sea, also repeated for each major basin along the northern Marmara Sea whether to see any systematic variation in the distribution of stress tensors. Even if slight variations are observed in orientation of stress axes in each basin, the orientations of principal stress axes in the Marmara Sea are nearly vertical for σ_2 and nearly horizontal for $\sigma_1$and σ_3, indicating that dominant deformation in the Marmara Sea and its major depressions is mainly governed by strike-slip faulting.