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Application of geomorphic tools to estimate vertical deformation rates for the Yatağan Fault, Muğla, SW Turkey: Implications for the deformation style in extensional tectonic provinces

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The western Anatolia is seismically one of the most active places on the earth. Here, the active deformation is mainly characterized by E-W trending grabens and horsts, which occupies a space of about 300 km-width. To the SW of this extensional system, the total strain is distributed between E-W striking the Gökova Fault, and the accompanying NW-striking faults. The Yatağan Fault is one these NW- striking structures, which prolongs of about 25 km to the west-northwest of the Muğla City Centre.

Geomorphic indices were used for quantifying the deformation along the Yatağan Fault in addition to our field observations. Kinematic measurements and Digital Elevation Model (DEM) analysis suggest a dominant normal sense of motion with minor strike-slip component. In terms of geomorphic analyses, we first classified the Yatağan Fault into three geometric segments, fs1, fs2 and fs3. Then, we applied the most basic indices, such as mountain front sinuosity (SMF) and valley width-height ratio (VF). SMF yields 1.2, 1.46, 1.18, whereas the VF gives average values of 2.3, 1.6, 0.92 for fs1, fs2, and fs3, respectively. These results simply suggest that the fs3 is the most active structure that accompanies the highest vertical deformation. Furthermore, we calculated morphology-based slip rates of 0.18 $\pm$ 0.05 mm/yr (fs1), 0.15 $\pm$ 0.05 mm/yr (fs2) and 0.3 $\pm$ 0.05 mm/yr (fs3) from the relationship of triangular facet slopes and heights by using the Tsimi and Ganas method. We calculate similar rates, 0.23 (fs1), 0.24 (fs2) and 0.36 (fs3) mm/yr according to the relationship between the vertical slip rate and the basal facet height. These estimates are also supported by the mountain front-based tectonic activity classes, which provide high activity (>0.5 mm/yr) for the fs3 and moderate activity (0.05-0.5 mm/yr) for the fs1 and fs2. As a result, estimated results utilizing different empirical methods are consistent with the local deformation pattern. The combined results from our studies illustrate that the Yatağan Fault is active. Combination of these parameters with paleoseismic evaluation will provide valuable information about the earthquake potential of the studied area.

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