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New geodetic evidence of quantitative and qualitative tectonic analysis of the Corinth Gulf, Greece

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One of the most tectonically active rifts worldwide is the WNW–ESE trending Corinth Gulf in Greece, exhibiting extension range of 7 – 16 mm/yr. Numerous E–W to NW–SE active fault zones are recorded, while several active fault segments appear onshore. The active fault zones of the southern part of Corinth Gulf are generally dipping to the north, while the corresponding ones of the northern part are dipping to the south, confirming the active rift character of Corinth Gulf. According to the Greek Database of Seismogenic Sources (GreDaSS), 15 different active individual seismogenic sources (fault zones) are determined in the Corinth Gulf region. Most of the seismically active faults within the rift, related to historical seismic events, are located along its southern margin.
The Corinth Gulf rift is monitored by 14 GPS permanent stations, recording the margins movement. The processed raw data of every three stations are combined and a series of parameters is calculated based on the triangle formed by each three stations set. Totally 26 such triangles were examined. The estimated parameters are: maximum horizontal extension, total velocity, maximum shear strain, area strain and rotation. The aforementioned parameters are referred to the triangle centroid.
The estimated maximum horizontal extension rates show N–S direction, more or less perpendicular to the fault's strike, being in good agreement with the fault zones. The highest values (341.47 nano-strains, 312.15 nano-strains, 247.17 nano-strains) are observed into the Corinth Gulf area, while the values decrease with the distance away from Corinth Gulf. Total velocity is the result of the combination of North and East velocity components, showing a NE – SW direction. The fact that the total velocities have been estimated with respect to the Eurasia fixed reference frame (European Terrestrial Reference Frame 2000), confirm the aforementioned direction. The total velocity values range between 15.16 and 30.11 mm/yr, while the lowest are observed at the northeastern part and the highest at the southwestern part of the study area. Maximum shear strain constitutes an indicator of identifying active faults. The greatest values (402.60 nano-strains, 348.66 nano-strains, 326.46 nano-strains) are concentrated into the Corinth Gulf, as in the case of maximum horizontal extension. Area strain represents the surface deformation (dilatation and contraction), indicating normal faulting or thrusting. A great percentage of the centroids (approximately 85%) show positive values, while the negative values are observed in areas, mainly at the southeastern part of Corinth Gulf. Interpretation of their origin is problematic, however it is probable that they are local phenomena, caused by micro-movements and/or measurement errors. The positive area strain values range between 10.65 and 334.29 nano-strains and the negative between -3.02 and -137.73 nano-strains, respectively. Regarding the rotation of the examined area, an overarching clockwise rotation is presented, while a small percentage (approximately 15%) of the examined centroids shows counterclockwise rotation. Rotation values were modeled in order to be examined the rotation rates in -1, -5 and -10 Myr and to be estimated the rotation rates for the next 1, 5 and 10 Myr.