Crustal Deformation of Broader Athens (Greece) by GPS Measurements

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A geodetic determination of the crustal deformation in the broader area of Athens is presented, using GPS data from a newly established network, measured on a yearly basis between 2005 and 2008. The Athens Geodetic NETwork (AGNET) covering the central part of Attica consists of 39 observation sites with an average distance at approx. 5 km. The geological framework of the region was taken into consideration during setup and monumentation of the network, in order to facilitate the identification of relative motions of primarily tectonic origin. The network (about 25×25 km^2) was tied to the ITRF2000 through the coordinates and the velocities of the continuous GPS station in Dionysos (DION C), which was also selected as the reference point for the examination of the local displacement field. Displacement velocity vectors were computed at each station from the slope of each coordinates time series by least-squares adjustment. Considering the difficulties involving the accurate estimation of the vertical component of motion over short time intervals, herein only the horizontal solutions are reported. Despite the short observation period, the relatively high density of the network and the spatial consistency of the velocity field, they were proven essential for the recognition of the present day kinematics. The results were generally in agreement with what expected from the regional tectonics. The observed deformation pattern enabled the definition of the high fragmentation of the area with numerous tectonic blocks of small dimension, controlled by fault systems of complex kinematics. Crustal movements are mainly accommodated at Parnitha Mt. and Thriassion Basin to the west of the Athens, with the highest rates of approximate 10 mm/yr observed at the central part of Parnitha. One of the most interesting features of the displacement field is the significantly higher rates at the western than the eastern part, where almost negligible motion occurs. The large scale discontinuity coincides with the location of the NNE-SSW trending detachment fault bounding the metamorphic and non-metamorphic alpine basement of the area. Finally, a unique strain tensor was calculated for the whole area, showing a roughly north-south extension, which implies strain accumulation mainly on normal faults with almost E-W strike.