



Doctoral Thesis

## **Present-day crustal dynamics in the Adriatic-Aegean plate boundary zone inferred from continuous GPS-measurements**

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**Present-day crustal dynamics in the  
Adriatic-Aegean plate boundary zone inferred from  
continuous GPS-measurements**

A dissertation submitted to the  
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presented by  
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# Abstract

The earthquake activity around the Aegean Sea is the most conspicuous geodynamic phenomenon in the Eastern Mediterranean region. The clearest seismicity feature is associated with the Hellenic arc forming a semi-circle from the Ionian Islands to Western Anatolia. The right-lateral Kefalonia Fault Zone (KFZ) dominates the seismic activity in the Ionian Sea.

Previous GPS measurements have revealed distinct crustal motion of the Central Ionian Islands and SW Greece in a SW direction relative to SE Italy. The trajectories constructed from repeated observations lead us to interpret the KFZ as part of the boundary zone separating the stable Apulian/Adriatic block from the Aegean/Anatolian region, which is rapidly moving towards the Southwest.

In 1995 the progress made in GPS and computer technology made it realistic to consider a relative dense continuous GPS (CGPS) network which would bridge the main tectonic units and provide a high temporal resolution of crustal motion. In order to monitor the deformation and evaluate the strain field in the area, we established a network of continuous GPS stations across the KFZ. The first sites were monumented during Spring 1995, and the network was gradually augmented with new stations. It was considered as fully operational by the beginning of 1996. In addition to our own network, data of four surrounding IGS sites (Graz, Matera, Noto and Ankara) were introduced in the processing.

The main results are daily solutions, which can be used to derive time series and rates of crustal motion. A detailed behavior of the different sites during the period 1995 to 1998 is presented in terms of N-S, E-W and Up components. Clearly non-tectonic discontinuities due to hardware changes were estimated and corrected, increasing the consistency of the solution. The use of a common-mode filtering technique reduced the scatter of the time series by a factor of about 2. Following the calculation of the time series, we have determined the rates and trajectories of crustal motion. These data provide a better overview of the kinematic processes across the KFZ. The sites to the north of the KFZ show almost no motion relative to Eurasia, while an increase of rates up to  $30 \pm 2$  mm/a is clearly seen when moving to the southern Ionian Islands.

The inter-seismic motion of the Aegean block was interrupted by the Strofades earthquake (Ms 6.4, Nov. 18, 1997), which was associated with a distinct south-oriented co-seismic slip of 12 cm and an uplift of about 10 cm. The time series analysis clearly reveals that also the island of Zakynthos was affected by this event (co-seismic slip of 1.5 cm to the south).

The deformation rates are evaluated by means of strain analysis, using the collocation method. The resulting strain rates depend strongly on the correlation length