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Block modeling of GPS velocities in Italy and surrounding regions and kinematics of the Adriatic microplate

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We use GPS measurements and block modeling to investigate the present-day deformation and kinematics of the Italian peninsula and surrounding regions. The central Mediterranean displays an assemblage of lithospheric blocks with different structural and kinematics features and a variety of geodynamic processes, including subduction, back-arc spreading, rifting, thrusting, normal and strike-slip faulting, trapped between the relatively rigid African and Eurasian plates. The block model incorporates secular GPS velocity and fault geometry estimates, as well as elastic strain accumulation along block bounding faults. We study the kinematics of several crustal blocks, which are playing a major role in governing the complexity of the actual stress and strain fields, with particular emphasis on the kinematics of the Adriatic domain. With this model we can assess whether different hypotheses are compatible with geodetic data, estimates of fault slip rates and locking depths, areas of rigid block rotation, and regions of anomalous strain accumulation. We present a new geodetic velocity solution for the Euro-Mediterranean region that combines GPS surveys performed in the 1991-2002 time interval with continuous GPS observations collected in the 1998-2005 time span on several networks operating in the study region. The block model provides quantitative indications about the relative kinematics of major and minor plates. Results are presented in terms of horizontal velocity field, block-bounding fault slip rates and Euler rotation poles for major and minor plates. The model developed shows that the Adriatic is a microplate moving independently from the Nubian plate. The model

shows that most of the observed tectonic features (extension in the Apennines, shortening in the central and eastern Alps, Dinarides and Epiro, and right-lateral slip along the Kefallinia fault zone), are governed by the counter-clockwise rotation of the Adriatic block with respect to the Eurasian plate. The predicted fault slip rates are in fairly good agreement with other geodetic and geologic observations. The model developed allows us to put further quantitative constraints on the rates of deformation along major seismic belt surrounding the Adriatic sea and provide relatively simple explanation about the tectonic processes which are governing the regional and local kinematics in the study area.