Geophysical Research Abstracts, Vol. 9, 00279, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-00279

Tectonics of the Friuli area (NE Italy): results from continuous GPS and kinematic modeling

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We use deformation velocities from continuous GPS observations and kinematic modeling to investigate the active tectonics of the Friuli area. We processed 1600 days of GPS observations from June 2002 to November 2006 using GAMIT/GLOBK for 40 stations around the Adriatic region. All eight stations of the Friuli Regional Deformation Network (FReDNet), that form the focus of our study, present at least 2.5 years of data, the minimum time span for a reliable determination of the deformation velocity. The resulting velocity field suggests shortening of the crust in the region, with southern Friuli moving NNW towards northern Friuli at the relative speed of 1.7 mm/yr.

We developed a 3D kinematic model of the northern boundary of the Adria microplate using the software "3DMove". This software allows the inclusion of realistic values of topography and fault geometry in the model. The main controlling factor of the model is the three-dimensional geometry of the active faults. Based on information from structural maps, cross sections, seismicity distribution, the GPS velocity field and the current DEM, we built one, indenter-shaped fault plane of 200 km length and to 20 km depth. This fault plane approximates the plate boundary. Using the "fault-parallel flow" algorithm, we moved the hanging wall along the fault plane with the direction indicated by the GPS velocities. The resulting strain field shows strain maxima and discontinuities in the orientation of the principle strain axes, which may indicate zones of secondary faulting. Evaluation of the seismicity shows that there is a good correlation between groups of hypocenters of the major earthquakes (including their aftershocks) and the pattern of the strain field, revealing structures that are both fault-parallel, as well as perpendicular to the strike of the fault. This approach can contribute to characterize areas of higher or potential seismicity.