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Adding geodetic strain rate data to a seismogenic context: the study case of the Adria plate indenter

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In several seismic or potentially seismic areas deformation processes at moderate depth generate deformation at the surface, and the measurement of such surface deformation is an important boundary condition to models of the evolution of interacting blocks before, during and after earthquakes. The network of some 160 permanent GPS stations disseminated in Europe under the European Permanent Network of EUREF and the CERGOP 2 Project of the European Union, with additional local densification stations, provides a valuable contribution to the estimate of the average surface strain rate. The expected strain rate is of the order of 20 – 40 nanostrain per year, corresponding to a velocity change of a few mm/year over distances of some hundreds of km. Consequently, we require accuracies in the velocities of fractions of mm/year, and full control of systematic errors which may mask tectonic signals. Based on our systematic processing of GPS data from permanent European GPS stations covering nearly a decade (1995- 2005) we present the large scale velocity flow across most of continental Europe, and the associated horizontal gradient, or strain rate field. We focus on the Eastern Alps area, where the distribution of GPS stations is relatively dense, there exist a number of seismic and gravimetric profiles, and the Adria microplate is actively indenting northwards, into the stable European foreland. This seismic province is characterized by compressive deformation and affected by seismicity which has been well monitored since the 1976 Friuli Earthquake of M=6.3. Based on historical seismicity, we estimate the seismic budget of the area by comparing the strain rate accumulation determined geodetically with the strain release estimated with the Kostrov formula by averaging the seismic moment released by earthquakes in the area during an hypothetical seismic cycle. We review the frictional 'stick slip' model of Anderson to describe fault interaction and stress release, and discuss requirements on the knowledge of fault

geometries, local rheology, fault plane solutions, role of pore fluid pressure and historical seismicity which, in conjunction with the surface geodetic data, are necessary to attempt a more advanced dynamic modelling of potentially seismogenic processes at depth.