KASTELIC VANJA[1], TIBERTI MARA MONICA[1], ROVIDA ANDREA[2], ALBINI PAOLA[2], BASILI ROBERTO[1]

[1]- INGV - Roma1; [2] - INGV - Milano-Pavia

e-mail: vanja.kastelic@ingv.it

Geoitalia 2009

Outline

Geology-based seismogenic source models are becoming the fundamental input for seismic hazard assessment at the scale of an entire country. In this work, we illustrate in simple steps the complex process that leads from basic data to a fully-fledged seismogenic source model of the Dinaride thrust belt, running along coastal Croatia, Montenegro and part of Albania.

We started from a layer of basic geological and structural data and explored a wide range of indicators of recent tectonic activity, such as drainage anomalies/diversions and displaced or warped geological markers. We then analyzed the interplay of these indicators with known or prospective tectonic structures. To the picture thus obtained, we added a layer with a revised historical seismic catalog and selected a few earthquakes for which we re-estimate epicenter and magnitude. At the end of our analyses we combined all these data in a structured GIS database. With these data at hand, we also compared the longer-term indicators with present-day stress/strain data such as GPS velocities and earthquake focal solutions.

Following the approach already developed for the construction of the Database of Individual Seismogenic Sources for Italy, we developed a seismogenic source model for the Dinarides in which the better constrained seismogenic faults have been mapped and parameterized and made ready for use in seismic hazard practice.

1. Regional structural and tectonic setting

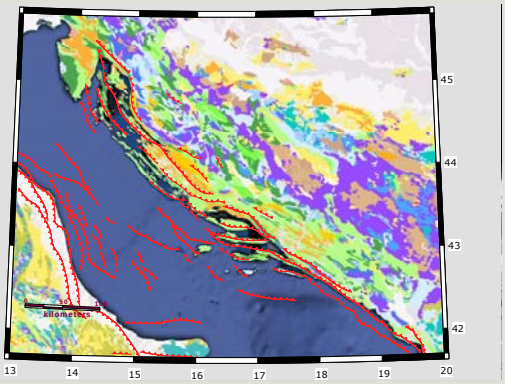


Figure 1: Regional geologic setting and traces of active faults for the costal and off-shore parts of the Dinaride structure (data on geological formations taken from onegeology internet portal).

2. Drainage anomalies and local geological characteristics

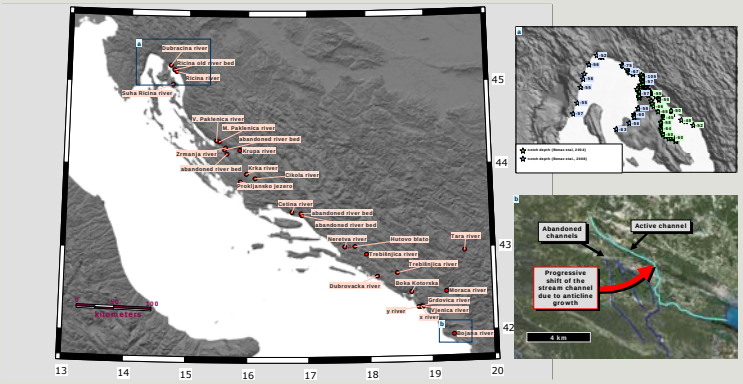


Figure 2: Map of courses of rivers in the costal parts of the Dinarides with spotted drainage anomalies. Upper right figure shows depth position of submerged marine notch in the Kvarner area (data taken from Benac etal., 2004; Benac etal., 2008). The lower right figure demonstrates hydrographic conditions of Bojana river with a set of abandoned and active river channel.

3. Historical seismicity

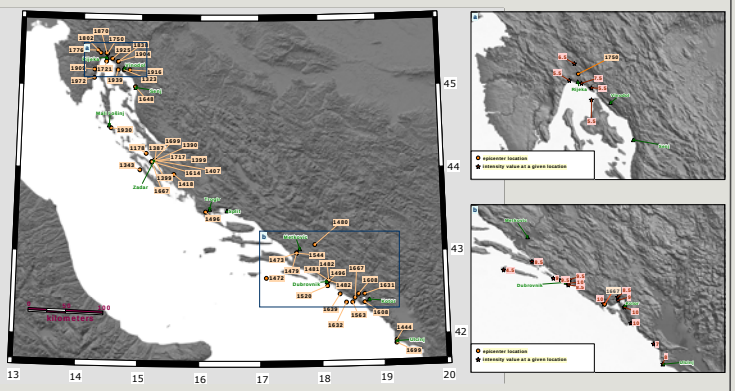


Figure 3: Historical earthquakes along the costal and off-shore parts of the Dinarides. The figures on the right show two selected historical earthquakes with reported intensity values; the 1750 Rijeka in the upper figure and 1667 Dubrovnik earthquake in the lower figure.

4. Focal mechanism solutions and orientation of mean S_H stress axis

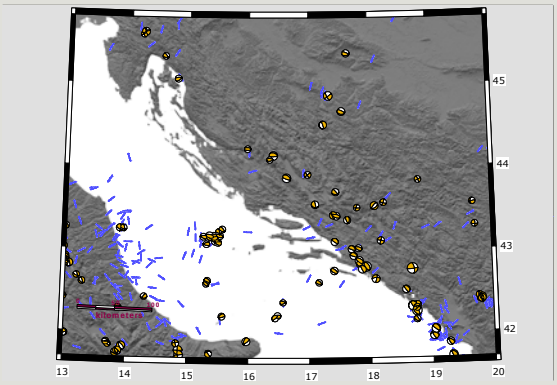


Figure 4: Map of focal mechanism solutions for earthquakes in the Dinaride region (from Pondrelli etal., 2006 together with orientation of mean S_H stress axis obtained from various data sets (taken from Heidbach etal., 2008).

5. GPS vectors

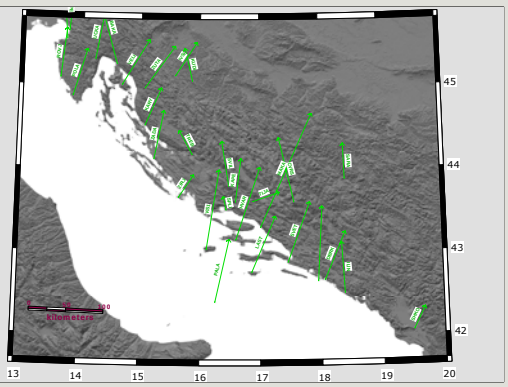
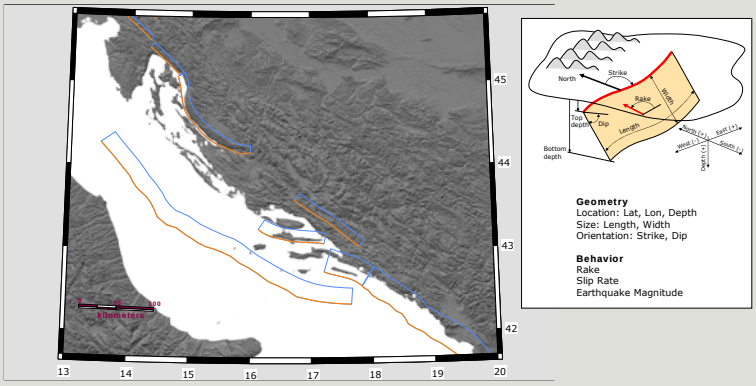


Figure 5: GPS vectors obtained for the area of the Dinarides (data taken from Caporali etal., 2009).

6. Source model



IDSource	SourceName	MinDepth	MaxDepth	StrikeMin	StrikeMax	DipMin	DipMax	RakeMin	RakeMax	SlipRateMin	SlipRateMax	MaxMag
HRCS001	Mljet	2	15	280	330	30	45	70	110	0.12	0.5	6
HRCS002	Hvar	3	15	260	310	40	65	20	70	0.1	0.45	6.1
HRCS003	Imotski	2	20	290	320	50	70	95	130	0.1	0.4	6
HRCS004	Eastern Mid-Adriatic offshore	2	12	270	310	35	60	70	100	0.15	0.45	5.5
HRCS005	Velebit	2	18	270	340	45	70	80	140	0.1	0.4	6
HRCS006	Vinodol - Rijeka	1	15	310	325	45	60	100	140	0.2	0.4	6
MECS001	Montenegro offshore	1	15	290	330	25	45	60	100	0.15	0.8	7.2

Figure 6: Composite seismogenic sources (see sketch to the right for definition) for the coastal and off-shore parts of the Dinarides. Table shows the values of the parameters depicting each source (data taken from DISS 3.1, 2009).

References

Basili R., G. Valensise, P. Vannoli, P. Burrato, U. Fracassi, S. Mariano, M.M. Tiberti, E. Boschi (2008), The Database of Individual Seismogenic Sources (DISS), version 3: summarizing 20 years of research on Italy's earthquake geology, *Tectonophysics*, doi:10.1016/j.tecto.2007.04.14

Benac, Č., M. Juračić and T. Bakran-Petricioli, Submerged tidal notches in the Rijeka Bay NE Adriatic Sea: indicators of relative sea-level change and of recent tectonic movements, *Marine Geology* **212** (2004), pp. 21–33.

Benac, Č., M. Juračić and I. Blašković, Tidal notches in Vinodol Channel and Bakar Bay, NE Adriatic Sea: indicators of recent tectonics, *Marine Geology* **248** (2008), pp. 151–160.

Caporali, A., et al., Surface kinematics in the Alpine–Carpathian-Dinaric and Balkan region inferred from a new multi-network GPS combination solution, Tectonophysics (2009), doi:10.1016/j.tecto.2009.04.035

DISS Working Group, 2009, Database of Individual Seismogenic Sources (DISS), Version 3.1: A Compilation of Potential Sources for Earthquakes Larger than M 5.5 in Italy and Surrounding Areas: http://diss.rm.ingv.it/diss/.

OneGeology - Making Geological Map Data for the Earth Accessible: http://www.onegeology.org/.

Heidbach, O., Tingay, M., Barth, A., Reinecker, J., Kurfeß, D. and Müller, B., The World Stress Map database release 2008 doi:10.1594/GFZ.WSM.Rel2008, 2008.

Pondrelli, S., Salimbeni, S., Ekstrom, G., Morelli, A., Gasperini, P., and Vannucci, G., 2006, The Italian CMT dataset from 1977 to the present: Physics of the Earth and Planetary Interiors, v. 159, p. 286–303, doi:10.1016/j.pepi.2006.07.008.