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The new Database of Individual Seismogenic Sources (DISS): learning about Italy's active tectonics from a regional seismotectonic view

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The DISS (extensively described elsewhere in this session: also available at http://www.ingv.it/∼wwwpaleo/DISS3/) is a large and fully georeferenced repository of tectonic, fault and paleoseismological information on Italy. The new version 3.0.2 contains over 120 "Individual Seismogenic Sources", over 75 "Seismogenic Areas", over 300 "Macroseismic Seismogenic Sources", all complemented by over 700 images, about 2,000 references and a number of maps and datasets regarding widely diverse geophysical datasets. The data analysis tools supplied by DISS' GIS engine allow the user to select, overlay and process several types of data and to perform spatial and statistical analyses.

For all of these reasons DISS is not simply an archive of outcrop-scale field data, but rather a precious tool that allows the seismogenic process to be represented and investigated in 3D and at various scales, and particularly at regional scale. One of the key points in the design of the structure of the Dabatase was the full exploitation of basic physical constraints concerning the rates of crustal deformation, the continuity of deformation belts, the spatial relationships between adjacent faults, both at the surface and at depth. A few examples will help elucidating these concepts.

a) There is growing evidence that along major extensional belts, such as along the crest of the Apennines, the state of segmentation is a long-lived feature that modulates the length of large seismogenic faults, and hence the expected earthquake size. An ongoing regional-scale appreciation of historical and pre-historical earthquakes has

already helped locating a number of “silent” sections of the belt. It is conceivable that these apparently aseismic sections will experience significant earthquakes before a large event is repeated on the adjacent, historically activated sections.

b) The seismicity of the outer northern Apennines arc between Emilia Romagna and Marche has always appeared rather scattered and apparently random. The area is characterized by reverse faulting at widely different depths. A careful reassessment of the typical depth of instrumental earthquakes and an “educated guess” of the depth of the main historical events allowed us to match the location of the main earthquakes with geologically-documented portions of the same major thrust belt. In particular, deeper earthquakes concentrate along the western portion of the arc, whereas shallower events occur along the outer front.

c) The most up-to-date views on the tectonics of southern Italy imply that the region is subjected to a well-established far-field tectonic stress, but also that it exhibits widely different local stress fields within different structural units at correspondingly different depths. In particular, NW-SE compression dominates below 12-14 km, while NE-SW extension acts above this level. The existence of such a dual tectonic system was first highlighted by the 2002 Molise earthquakes (Mw 5.7), an isolated and relatively minor event. A full 3D regional perspective is needed to capture all different hints for a deeper contractional stress field and for setting the boundaries of the region that is experiencing it.

d) Mediterranean and Italian permanent GPS networks are starting to return meaningful estimates of the strain rate across the peninsula. The information is very interesting as it confirms or modifies on a sound basis expected shortening and extension trends. However, it is still too scattered to be of use for estimating slip rates on individual faults, and hence for understanding where and how crustal strain is adding up to generate earthquakes. Partitioning the GPS-documented strain on discrete and independently identified seismogenic sources (such as those in DISS) should provide a brand-new way of assessing earthquake rates and hence supply new elements for the assessment of seismic hazard at regional scale.