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Crustal structure and seismicity of the Northern Apennines, Italy

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The region of northern Apennines shows intriguing features, that have not been explained yet. It is affected by frequent extensional earthquake sequences in the upper 8 km of the crust below the belt, by a background seismicity between 8 and 15-20 km depth and deepening to the east, and by infrequent compressive swarms in the outer Adriatic region. It also shows a peculiar “subcrustal” seismicity dipping from east to west below the belt down to about 80 km depth.

Today, the availability of many high quality seismological data from both the National Seismic Network, the regional networks, and temporary experiments, allows us to better constrain the crust-upper mantle structure and the seismicity. We use broadband seismic data to retrieve the Moho depth below the region and compare it to the seismicity distribution and to tomographic models obtained from the integrated data set. The Moho depth is well resolved throughout the region and shows strong heterogeneities, with a very thin crust (20 km) in the Tyrrhenian side and an Adriatic Moho dipping from east to west, reaching a depth of more than 50 km below the belt. The deeper seismicity, well located with the new data set, follows the trend of the Adriatic crust-mantle boundary and seems to be located above the Moho in its shallower portion, suggesting the underthrusting of sediments beneath the belt. In its deeper part, seismicity appears to shift under the Adriatic Moho, pointing out that earthquakes occur within the slab mantle. Local earthquake tomography clearly reveals a composite structural style, featuring both thin- and thick-skinned tectonics related elements. We also find lateral variations in the seismological features (for instance, a discontinuous

subcrustal seismicity distribution) that can shed light on the Plio-Pleistocene evolution of the region and on the present-day tectonic setting. We integrate all the information in a comprehensive model trying to better define the deep structure and to understand the occurrence of crustal and deeper earthquakes.