Overprint of Quaternary extension on a young orogenic belt: two examples from Italian Apennines

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The complex 3D setting of the Italian Apennines reflects the multiphase tectonic history of the Adria paleomargin. Inherited Mesozoic normal faults were inverted or transported within the Cenozoic orogenic pile. They were reactivated and still show a strong interaction with the major thrust faults propagated during the compression. This poster illustrates two case studies in Central Italy, specifically in the areas affected by the 2016-2017 and the 1997 seismic sequences. These areas were widely investigated by seismic reflection profiles that allowed a 3D geological reconstruction of the upper crust and the main features of the Apennine chains. The 3D models were validated through kinematic restoration and gravimetric analysis. The comparison with the distribution of the aftershocks of the two sequences suggests that the palaeogeography before the orogenesis has a strong control on the geometry and position of the main thrusts, the segmentation of the reactivated and newly formed Quaternary normal faults, and finally, in the generation of the current seismicity.

Assessing earthquake recurrence from complementary approaches in the Apennines

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The assessment of temporal recurrence of seismic events with magnitude above the damage is relevant for human activities and life, and provides a fundamental contribution to seismic hazard. Different sources of information are generally employed including integration of historical and instrumental records of past earthquakes, geological/paleoseismological studies extending back in time knowledge of spatio/temporal occurrence of seismic events, and geodetic data measuring the rate at which on-going elastic deformation will be possibly released by future earthquakes. Finding the consistency between these data sources (or lack thereof), different for spatial scale and time windows of observations, is the first step towards their integration in a modern approach to seismic hazard assessment. According to the seismotectonic environment, seismic history, cultural development and availability of observational networks, emphasis has been generally preferentially given to only a limited part of the complete spectrum of available information. We posit the Apennines as a study area where scientific efforts and infrastructural development allows the consistency between the three datasets to be explored towards their integration in seismic hazard practices. In particular, recent developments contributed to 1) parameterization of the records of historical earthquakes in term of moment magnitude, 2) a large number of scientific studies assessing long-term fault slip rates at various time scales and with alternative approaches and seismic history of faults through paleoearthquakes and 3) spatial densification and longer observation interval of GNSS time series. These data collectively provide the opportunity for a consistency check between the estimates of earthquake occurrence for M>6 events resulting from the different approaches. In this presentation we will review the information on earthquake recurrence independently provided by the three datasets in the Central/Southern Apennines and evaluate their potential integration in seismic hazard assessments. Particular emphasis will be given towards the integration of geodetic data with historical and paleoseismological data and its implications for defining 1) overall seismic moment release, 2) partitioning and spatio-temporal patterns of deformation across the actively deforming belt and 3) assessments of moment release deficit.