Active Tectonics of the Alps-Dinarides junction – what have we learned?

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The collision of the Adriatic Plate with Europe leads to crustal deformation in the Southern Alps-Dinarides transition. Many aspects of this deformation are still unknown. This concerns for example sources of historical earthquakes in the hinterland of the Southern Alpine orogenic front and the overall distribution and the partitioning of strain. Also, the response of the upper crust to deep-seated processes and the influence of the lithospheric architecture on active tectonics has not been fully understood. In many cases, the reason is the very low overall deformation rate in this region. Several projects in the framework of SPP2017 have shed light on these problems, and many new studies unrelated to the SPP have recently published exciting new results. In this presentation I summarize new findings from the fields of geodesy, seismology, structural geology, geomorphology, and earthquake geology. These studies have used GNSS and InSAR data, seismological data from the AlpArray and SWATH-D experiments, new high-resolution digital elevation models, satellite imagery, field mapping, near-surface geophysics, paleoseismology, and Quaternary dating techniques to understand the pattern of Late Quaternary tectonics. In Italy, most of the deformation is accommodated by thrusting on the Southern Alps mountain front, or thrusting has already stepped southward into the Friulian plain, partly on blind faults. This behavior is known from several contractional regimes around the world. Although strong historical earthquakes (M>6) occurred in the interior of the mountain chain, present-day seismicity is rather low. In this region, geological evidence of fault activity is poor because sedimentation/erosion and anthropogenic overprint outpace most tectonic signals on a Quaternary time scale. This is similar to southern Austria, where there is very poor geological evidence of active faulting, despite a record of strong historical earthquakes. New dating results from both deformed and undisturbed geomorphic markers allow us to place constraints on the maximum amount of deformation that is accommodated here. In Slovenia, a system of NW-SE striking right-lateral strike slip faults in a more than 60 km-wide zone takes up most of the deformation. Additionally, many smaller, <15 km long faults show postglacial activity. In general, the deformation is widely distributed. A similar behavior can be observed in may strike-slip fault systems worldwide. In the study area there is a first order correlation between the distribution of seismicity during the Quaternary and gradients of crustal thickness and crustal density. However, other processes like a still ongoing, though very slow eastward extrusion of Eastern Alps crustal material or vertical motions due to glacial isostatic rebound or erosion are likely to contribute to the overall pattern of active tectonics.