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Seismotectonic regions for Germany - Concept and results

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Seismotectonic regions are a basic input in seismic hazard assessment. Several seismotectonic regionalizations for Germany were proposed in the past. We are presently developing a new regionalization based on the definition in the Safety Standard of the Nuclear Safety Standards Commission KTA 2201.1 (2011-11): “A seismotectonic unit is a region for which uniformity is assumed regarding seismic activity, geological structure and development and, in particular, regarding neotectonic conditions. A seismotectonic unit may also be an earthquake source region.” Our new concept focusses on a transparent implementation of the required geological criteria. Our approach is to initially analyze those separately from present-day seismicity. Compared to existing source area models we strive for a better documentation and justification of the geological elements used to delimit seismotectonic regions. This includes an analysis of the geological history of structures in six time slices from the Permian to the Present that will be considered in the regionalization. The time slices are (1) Permian, (2) Triassic, (3) Jurassic to Early Cretaceous, (4) Late Cretaceous, (5) Cenozoic > 20 Ma and (6) Recent (< 20 Ma). They were chosen because they are separated by marked changes of stress and kinematic regimes and were associated with the evolution of new fault systems or reactivation of existing ones. The tectonic characteristics of the time slices are briefly described.

The present-day observable fault network comprises faults from all time slices. For each time slice, a subset of active faults will be extracted based on geological evidence for fault activity at that time, e.g. syntectonic deposits. The uncertainties of these age assignments will be documented. The fault subset will be used to estimate overall kinematics, a paleo-stress field and to delimit little deformed or stable areas. Faults, kinematics, stress and stable areas can then be compared to present-day seismicity/active faults, slip directions, stress and undeformed areas as well as other parameters such as crustal and lithospheric thickness. These steps are repeated for each time slice. The superposition of active faults and stable regions across all time slices will identify faults prone to reactivation and regions that remained undeformed over geological time, potentially indicating areas of increased or reduced present-day seismic hazard.

A comparison with seismicity of the last 1000 years shows partial agreement between regions of strong (or repeated) deformation and regions of higher seismicity. On the other hand, stronger earthquakes occasionally cluster in regions appearing stable since Permian time, the Anglo-

Brabant Massif being a prominent example of this type.