Primary scope and recent progress for testing earthquake forecasts in Europe

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Most of the currently used seismic hazard assessments are static; they do not change with time. However, based on the increasing understanding of earthquake clustering in space and time, seismologists increasingly realize that seismic hazard maps should be dynamic: a time-dependent approach to hazard assessment is needed. First time-dependent models (STEP, ETAS, etc.) already exist in California and elsewhere. However, these models are not generally accepted and practically used in hazard assessment. We are now implementing the Europe node of the envisioned global Collaboratory for the Study of Earthquake Predictability (CSEP) framework. In the EU, these activities are funded through the EU FP6 NERIES and SAFER projects.

We present the current status of the CSEP framework in the EU, which consists of several elements: (1) Establishing authoritative and quality controlled data streams for testing, (2) A cyberinfrastructure suitable for testing earthquake forecasts, and (3) Model development on multiple temporal and spatial scales. Related to the first task, we are currently developing and implementing a robust tool to estimate the magnitude of completeness (M_c). A reliable M_c is vital for many seismicity and hazard related studies. We adopted a new method for determining a probabilistic magnitude of completeness (PMC), proposed by Schorlemmer and Woessner (2007) and calibrated for California. PMC uses only empirical data (e.g., earthquake data, phase-picks, and station information). In order to check the applicability of PMC to regions of moderate to low seismicity, such as many European regions, we applied it to Switzerland. Using date available for estimating M_c at Oct. 1, 2006, we find that M_c is above 2 in the areas close to the national boundary while M_c is almost 1.0 in the Valais area. We also evaluate the temporal evolution of M_c for the period 1983-2006 and compare the results with a study of the completeness based on detecting the point of deviation from a power law distribution of earthquake magnitudes. Our results suggest the applicability of the PMC to Europe, allowing us to move towards constructing a space and time history of completeness as a baseline for model development and testing.