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# Damage-consistent hazard assessment – the revival of intensities

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Proposed key-note speech (Introduction of session).

Current civil engineering standards for residential buildings in many countries are based on (frequently probabilistic) seismic hazard assessments using ground motion parameters like peak ground accelerations or pseudo displacements as hazard parameters. This approach has its roots in the still wide spread force-based design of structures using simplified methods like linear response spectra in combination with equivalent static forces procedures for the design of structures. In the engineering practice this has led to practical problems because it's not economic to design structures against the maximum forces of earthquakes. Furthermore, a completely linear-elastic response of structures is seldom required. Different types of reduction factors (performance-dependent response factors) considering for example overstrength, structural redundancy and structural ductility have been developed in different countries for compensating the use of simplified and conservative design methods. This has the practical consequence that the methods used in engineering as well as the output results of hazard assessment studies are poorly related to the physics of damaging. Reliable predictions for the response of structures under earthquake loading using such simplified design methods are not feasible. In dependence of the type of structures damage may be controlled by hazard parameters that are different from ground motion accelerations. Furthermore, a realistic risk assessment has to be based on reliable predictions of damage. This is crucial for effective decision-making.
This opens the space for a return to the use of intensities as the key output parameter of seismic hazard assessment. Site intensities (e.g. EMS-98) are very well correlated to the damage of structures. They can easily be converted into the required set of engineering parameters or even directly into earthquake time-histories suitable for structural analysis.
The paper discusses in detail the possible use of intensities in seismic hazard assessment as well as the conversion of intensities into any required set of engineering parameters. This opens the space for a damage-consistent design of structures and therefore, for a truly performance-based approach to earthquake engineering design.