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Automatic processing of macroseismic observations to assess site effects and their applications in earthquake hazard calculation

V. Schenk (1), Z. Schenková (1), I. Kalogeras (2), R. Pichl (1), P. Kottnauer (1), G. Stavrakakis (2)

(1) Centre for the Earth's Dynamic Research, Institute of Rock Structure and Mechanics, Academy of Sciences, Prague, Czech Republic, (2) National Observatory of Athens, Geodynamic Institute, Athens, Greece, (schenk@irsm.cas.cz / Fax: +420-284680105)

Macroseismic intensity, a useful measure of earthquake effects, is still applied in a wide range of seismological applications. Isoseismals represent the spatial distribution of macroseismic intensities and their shapes depend on source properties, lithosphere structures, tectonic line orientations, site geology and topography. An application of the point kriging griding method for an automatic computer drawing of isoseismal maps is delivered. Smoothing rates and numerical parameters used in the kriging algorithm were tested on macroseismic data of Greek earthquakes and the optimum values were defined. The isoseismals of higher intensities are shaped in accordance with local rupture zones and their seismotectonic characteristics, lower intensity isoseismals reflect broad regional structural features of the shaken area. Less consolidated geological formations (soils, sands, etc.) even in large epicentre distances can influence the isoseismals significantly too. The point kriging method allows for every earthquake a local macroseismic effect difference, residue, between individual original and smoothed values to be evaluated. Detected residues were related to physical properties of local rock formations, e.g. seismic wave velocity and bulk density, to find appropriate relations. The positive intensity rate (an intensity increase) correlates to less consolidated young sediments and negative rate (an intensity decrease) to igneous or metamorphic rocks as well as limestone, dolomite, etc. An application of the intensity rates to earthquake hazard calculations with respect to local geologic structures brings more reliable assessment of the hazard values.