Understanding the dependence of the earthquake impact on magnitude: testing the Greek seismicity

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Strong earthquakes affect both the built and natural environment. Therefore, the organization of impact databases of past earthquakes is of fundamental importance for the seismic risk assessment. Of interest is to understand how the Earthquake Impact (EI) depends on magnitude (M). To test such a dependence, we examined the Greek seismicity which is the highest in the Mediterranean region with long earthquake record. In Greece no EI database has been organized so far, although various descriptive and parametric earthquake catalogues as well as inventories of intensity observation points are available. For a first time we organized a Greek Earthquake Impact Database (GEID) which for each event includes earthquake parameters and three main quantitative impact elements: building damage, fatalities and injuries covering the time interval from 1800 to 2019. Many sources have been utilized, some of them remaining unknown so far. To select the most appropriate magnitude for each earthquake event occurring in the instrumental period of seismology we performed magnitude closeness analysis between the ISC-GEM catalogue and catalogues of various academic institutions. Formulas for magnitude conversion from one catalogue to another were produced. For the 19th century we improved existing catalogues with new data from documentary sources and compiled a new catalogue by re-calculating macroseismic magnitudes equivalent to M_w from intensity/M relations for Greek earthquakes of the instrumental period after completeness testing and examination for magnitude homogeneity. We found that for single earthquake events the level of impact generally depends on magnitude but this is not valid for offshore events. However, the time distribution of the impact elements examined over the testing period of 220 years showed a relative decrease of the totally collapsed buildings which implied drastic decrease of the fatality rate but not of the injuries rate. This is attributed to the gradual improvement of the building construction particularly after the enforcement of antiseismic building codes in the country.

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