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Estimation of regression laws for ground motion parameters using as case of study the Amatrice earthquake

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The possibility to directly associate the damages to the ground motion parameters is always a great challenge, in particular for civil protections. Indeed a ground motion parameter, estimated in near real time that can express the damages occurred after an earthquake, is fundamental to arrange the first assistance after an event. The aim of this work is to contribute to the estimation of the ground motion parameter that better describes the observed intensity, immediately after an event. This can be done calculating for each ground motion parameter estimated in a near real time mode a regression law which correlates the above-mentioned parameter to the observed macro-seismic intensity. This estimation is done collecting high quality accelerometric data in near field, filtering them at different frequency steps. The regression laws are calculated using two different techniques: the non linear least-squares (NLLS) Marquardt-Levenberg algorithm and the orthogonal distance methodology (ODR). The limits of the first methodology are the needed of initial values for the parameters a and b (set 1.0 in this study), and the constraint that the independent variable must be known with greater accuracy than the dependent variable. While the second algorithm is based on the estimation of the errors perpendicular to the line, rather than just vertically. The vertical errors are just the errors in the ‘y’ direction, so only for the dependent variable whereas the perpendicular errors take into account errors for both the variables, the dependent and the independent. This makes possible also to directly invert the relation, so the a and b values can be used also to express the gmps as function of I. For each law the standard deviation and R2 value are estimated in order to test the quality and the reliability of the found relation. The Amatrice earthquake of 24th August of 2016 is used as case of study to test the goodness of the calculated regression laws.