S06cp-S06cp S06c Strong Ground Motion: Ground Motion Prediction Equations

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MARS: A new tool for macroseismic data regression and analysis

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This work is focused on the development of a tool (named MARS - MAcroseismic data Regression and analysiS) for an integrated analysis of macroseismic intensity datasets in order to support the calibration of Intensity Prediction Equations (IPEs). Modules are developed for: i) data plot; ii) statistical analysis of the dataset; iii) IPEs calibration; iv) analysis of residuals. MARS is designed to develop an in-depth study of large datasets composed by earthquakes and intensity points, as well as by a single event.

Statistical analysis and data plot modules allow users to examine: frequencies of data features (e.g. classes of distances and intensities), intensity distribution on map as well as on graph (intensity versus hypocentral distance).

Regarding IPEs calibration, a module has been dedicated to implement a variety of functional forms. Starting from a basic form (e.g. $I=a+b*M+c*R_{hypo}+d*\log_{10}(R_{hypo})$), it is possible to use more complex magnitude scaling terms, commonly employed in GMPEs. For the IPEs calibration a standard regression approach thought best least squares fit analysis has been implemented.

Another important application regards the analysis of the residuals, in order to evaluate the goodness-of-fit between a given dataset and an IPE through: i) total residuals ($I_{Predicted} - I_{Observed}$) decomposition and analysis; ii) IPEs ranking; iii) calculation of the mean error per event (between-event). Such functionalities help the user to check earthquake parameters and macroseismic intensity attribution, in order ensure the quality of the dataset used for the IPE calibration.