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Testing and improving the Rock Mass Quality Index (RQI) in North-Western Tuscany (Italy).

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Many geo-mechanical classification system for rock masses have been developed for engineering geology applications. However, most of them are site-specific and they take into account the combination of rock mass data related to different geological and physico-mechanical properties. For these reasons, they may hardly be applied when regional, continuous representation over wide areas (map scale) are necessary (i.e. spatial planning, seismic microzoning).
The aim of this study is to test and improve an existing method for engineering geology mapping of rock masses based on quantitative integration of geological information, fieldwork geo-mechanical measurements, lab determinations and spatial analyses. This method has been applied to a new study area located in North-Western Tuscany (Italy) where due to a complex structural setting, different structural and lithological units of the Northern Apennines chain crop out. Fieldwork measurements were performed for the outcropping geological formations by choosing sets of sites representative of different rock mass characters (lithology, weathering, jointing), both at local and wide scale. For each surface or sub-surface site, a regular grid of measuring points was defined, where each point underwent rebound measurements (R - Schmidt hammer). Frequency of grid points and measurements were chosen in order to obtain reasonable statistical stability of average site rebound values. Following methods from the literature, the Geological Strength Index (GSI) was also estimated for each investigation site. We collected representative rock samples for lab evaluation of unit weight to be used along with R to calculate the Rock Mass Quality Index (RQI) . In fact, according to the literature, unit weight is related to weathering and mechanical properties of rocks. A statistical analysis of correlation between both R – GSI and RQI – GSI was performed and the results are presented and discussed. Moreover, the spatial analysis of the whole dataset confirm that the proposed method allows one to recognize different engineering geology characters among different formations, as well as to identify different geo-mechanical units within the same formation. The spatial analysis of RQI also highlights variability among different structural domains of the study area. In conclusion, this study supports this method as suitable for cartographic engineering geology applications.