Geostructural complexity and passive seismic surveys: a geostatistical analysis in the Kathmandu basin

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In this study a set of 39 single station passive seismic surveys conducted in the Kathmandu basin (Nepal), based on the horizontal to vertical spectral ratio methodology (HVSR), is analyzed by means of a geostatistical approach. The Kathmandu basin is characterized by a heterogeneous sedimentary cover and by a complex geostructural setting, inducing high spatial variability of the bedrock depth. In relation to the complex geological setting, the interpretation and analysis of HVSR data are challenging, both from the perspective of bedrock depth analysis as well as of seismic site effects detection. In order to maximize the broad range of information available, the HVSR data are analyzed according to a geostatistical approach. First, the spatial continuity structure of HVSR data is analyzed and interpreted taking into consideration the geological setting and available stratigraphic and seismic information. In addition, we test the possibility to integrate the analysis with potential auxiliary variables, derived from geomorphometric variables and considering the distance from outcropping bedrock. The explorative geostatistical analysis confirms the complexity of the geo-structural setting of the area. Finally, a mapping of HVSR resonance periods, with the evaluation of interpolation uncertainty, is obtained by means of ordinary kriging interpolation. The resulting map, even if characterized by a large interpolation support, is congruent with the geo-structural setting and the main lineaments of the area. The adopted approach is particularly useful in the context of micro-zonation studies based on HVSR methodology conducted in historical urban areas. Moreover, this work contributes to the geo-structural knowledge of the deep structure of the Kathmandu basin.

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