EGU23-7445, updated on 01 Aug 2023
https://doi.org/10.5194/egusphere-egu23-7445
EGU General Assembly 2023

A New Vs30 Prediction Strategy Taking Topography, Geology, Terrain and Water Saturation into Account: Application to Türkiye and California

Hakan Bora Okay and Atilla Arda Özacar
Geological Engineering Department, Middle East Technical University, Ankara, Türkiye (hbokay@metu.edu.tr, ozacar@metu.edu.tr)

The time averaged shear wave velocity of the top 30 meters (Vs30) is the most widely used parameter for the geotechnical characterization of site conditions. However, the spatial availability of Vs30 observations are rather limited except specific areas where conducted micro-zonation studies include closely spaced measurements suitable for assessment of earthquake site effects. In order to infer Vs30, global models use slope or morphological terrain classes as proxies. In a regional scale, these proxies are commonly combined with geologic and geotechnical data to improve the accuracy of Vs30 predictions. So far, a region specific Vs30 model that would aid seismic hazard assessments is not yet constructed for Türkiye and its near vicinity. In this study, a new Vs30 prediction strategy is developed using data from Türkiye and California, and its performance is compared with others.

At first, Vs30 measurements are classified into 4 sedimentary rock classes according to their ages (Quaternary-Pliocene, Miocene, Paleogene, Pre-Paleogene) and 3 non-sedimentary rock classes (Intrusive, Extrusive, Metamorphic). Observations from Quaternary-Pliocene rocks are most abundant and characterized by large data scatter, thus further divided into 2 major terrain classes. Since the reduction in Vs30 due to fluid saturation is pronounced, especially in unconsolidated young units, Quaternary-Pliocene rocks are also differentiated as saturated if the water table depth is less than 30 meters and unsaturated otherwise. In California, saturation is determined by using available groundwater measurements. Throughout Türkiye, flat areas with elevation differences less than 30 meters from water bodies (sea, lake, and major rivers) are mapped out as saturated zones. After the elimination of outliers, slope and elevation based Vs30 prediction equations are developed separately for sub-classes of Quaternary-Pliocene, Miocene, and Paleocene aged sedimentary rocks using multi-variable linear regression while Vs30 is fixed to class average in others. Resultant model misfits and comparisons with results of micro-zonation study conducted across İstanbul, clearly indicate that our proposed Vs30 prediction strategy is performing better, especially in younger sedimentary units and thus provide a new, more accurate Vs30 model of Türkiye.