Assessment of Seismic Slope Stability Using GIS Modeling

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Abstract

In recent years there has been a growing interest in developing GIS based models for mapping and identification of seismically-induced landslide hazards. A review of assumptions in the relationships and the data typically used in GIS seismic slope stability models, shows that there are three components which are commonly used together: pseudo-static slope stability analysis, attenuation of ground shaking models, and Newmark's displacement method (Newmark 1965). These relationships are typically combined in a raster or vector data model to produce a map of seismically-induced landslide displacements. To produce a map of ground displacement, a digital coverage of the geology and a high resolution DEM are needed at the very least. Additional data layers such as shear strength parameters and soil depth can be estimated from the geology and they can add to the sophistication and accuracy of the model. A case study was developed which combines the components of site and slope response in a vector data model and the results show that qualitatively acceptable results can be readily obtained. However, the model falls short of capturing the overall performance of any particular slope and at best it only provides a mean estimate of the potential seismically induced slope displacement. Thus, more sophisticated methods of slope and site response will have to be implemented in this platform to increase the robustness of the model. In particular, the resolution and quality of input data sets will have to be improved and rigorous probabilistic procedures will have to be implemented, so that the error bounds and the magnitude and the source of errors can be fully quantified.