A $V_{S30}$-derived Near-surface Seismic Velocity Model

Geoffrey Ely (gely@usc.edu), Patrick Small, Thomas H. Jordan, ...or the Harvard model (CVM-H v6.3). The elevation-referenced CVM-H model was developed by the University of Southern California, Los Angeles, CA 90089.

Introduction

Deeper spatial structure, such as that required by the ground-motion simulations, can be inferred from the surface measurements of $V_{S30}$ (e.g., Wald et al., 2005). In Figure 2, $V_{S30}$ is shown for an area west of the epicenter, compared to CVM-S 4.0 (red) and CVM-H 6.3 + GTL (blue) simulations. Peak values in cm/s are indicated on each trace.

Depth dependence

Various formulations for S-wave velocity depth dependence, such as linear in $z$ or the Harvard model (CVM-H v6.3). The elevation-referenced CVM-H model was developed by the University of Southern California, Los Angeles, CA 90089.

Implementation

The use of $V_{S30}$ as an engineering near-surface parameter is not new. $V_{S30}$ has been used in earthquake engineering for several decades (e.g., Wald et al., 2005). In this study, $V_{S30}$ is used as a rough indicator of the S-wave velocity at the surface.

References


Ground motion simulations

The new CVM-H model, with and without the GTL model, is used to simulate ground motions for a range of scenarios. The results are compared to the CVM-S 4.0 and CVM-H 6.3 models. The new CVM-H model produces results that are generally consistent with the CVM-S 4.0 and CVM-H 6.3 models, but with some differences in the details.

Figure 10: CVM-H v6.3 S-wave velocity cross-section through the Los Angeles basin sediments, geologically defined site-condition categories for California, and topography-estimated curvature, and ratio of surface velocity to original 30 meter average, $V_{S30}$.

Figure 11: CVM-H v6.3 + GTL S-wave velocity cross-section through the Los Angeles basin sediments, geologically defined site-condition categories for California, and topography-estimated curvature, and ratio of surface velocity to original 30 meter average, $V_{S30}$.

Figure 12: CVM-H v6.3 + GTL S-wave velocity cross-section through the Los Angeles basin sediments, geologically defined site-condition categories for California, and topography-estimated curvature, and ratio of surface velocity to original 30 meter average, $V_{S30}$.