

VII LOCAL SOIL AND GEOLOGIC SITE CONDITIONS

At present, most empirical equations which describe the effects of local soil and geologic site condition use factors (e.g., like the coefficient functions $b_2(T)$, $b_4(T)$, $b_7^{(1)}(T)$, $b_7^{(2)}(T)$ in Eqn (II.1)), to describe the amplification of spectral amplitudes on “soft” sites ($s = 0$ or $h > 0$ and $s_L = 1$ or 2) relative to “hard”, often referred to as “rock” sites ($s = 2$ or $h = 0$ and $s_L = 0$). In Eqn (II.1), $b_2(T)$, for example, suggests a progressively larger factor to describe the local geologic site effects, on deeper sediments, since $b_2(T)$ is multiplied by h . However, other analyses suggest that it is not only the thickness of the layer that should be considered, but also the layer properties Trifunac (1990b). Furthermore, the frequency band within which such amplification occurs should depend on the characteristic dimensions of the inhomogeneities involved. To reconcile these requirements with the simplified average and overall effects as modeled by equations similar to Eqn (II.1), we will use here all site amplification factors as described in Eqn (II.1), but will modify the frequency range of their applicability, as follows. We will suppose that the average local amplification occurs only for periods $T < T_1 = 4H_L/\beta_L$, where H_L and β_L are the thickness and the shear wave velocity in the equivalent layer describing the geological site conditions. We will further assume that this amplification gradually dies out in the interval $T_1 < T < 5T_1$. Figures VII.1 and VII.2 illustrate this by showing how spectral shapes change (Trifunac, 1990b) for $T_1 = 16, 8, 4$ and 2 . sec. In these figures, the three top dashed lines corresponds to motions at sites with layer thickness $H_L = 4, 2$ and 1 km. The bottom solid line is for a site with $H_L = .5$ km. For all cases it was assumed that $\beta_L = 1$ km/sec and that $s_L = 1$ (stiff soil site).

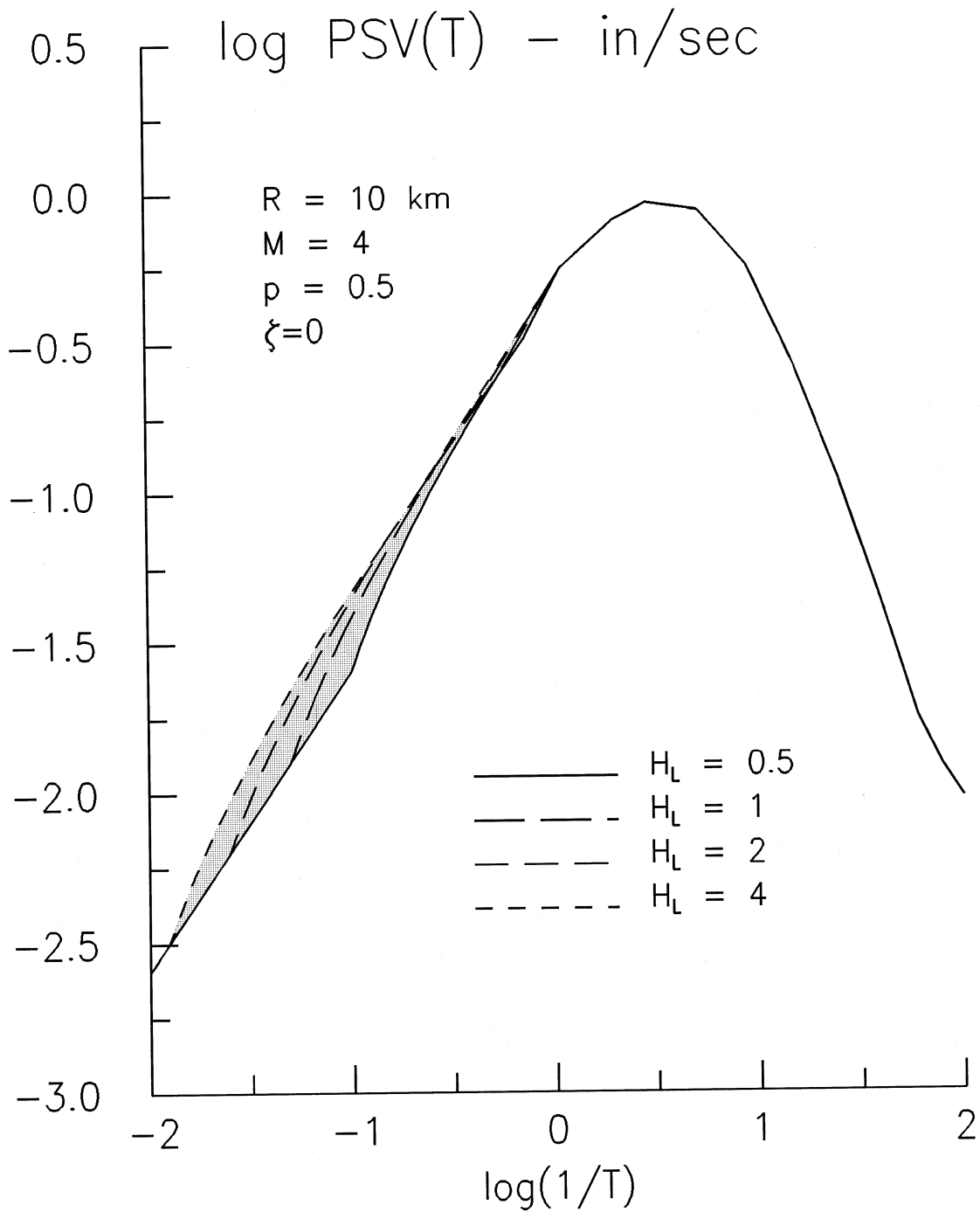


Fig. VII.1 An example of how the local geologic site conditions can modify the shape and amplitude of $PSV(T)$ spectra. The dashed lines (top to bottom) correspond to thickness of the sedimentary layer over basement rock $H_L = 4, 2$ and 1 km and average shear wave velocity $\beta = 1$ km/sec. The spectra are for epicentral distance $R = 10$ km, magnitude $M = 4$, probability of exceedance $p = 0.5$ and damping ratio $\zeta = 0$.

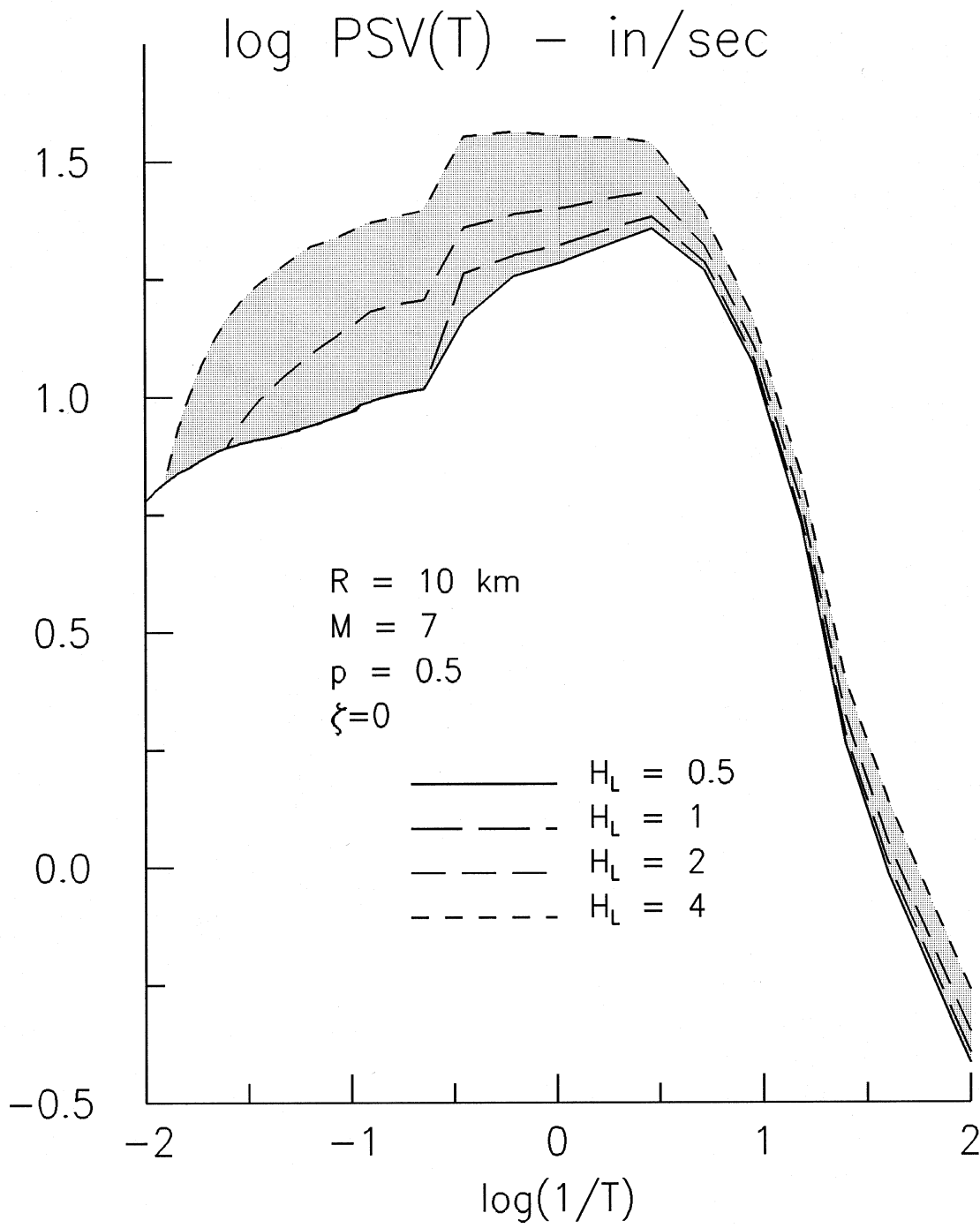


Fig. VII.2 Same as Fig. VII.1 but for magnitude $M = 7$.