Inspections of the wavefields of Rayleigh wave scattering

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The wavefields of Rayleigh wave scattering caused by the mountain root structures (M.R.S) under the Tien Shan, located at the western part of China, are investigated by the use of the finite difference method (Yoshida, 2001). The wavefields are visually plotted with GMT (Wessel and Smith, 1998) and scattering characteristics are extracted. Incident fundamental mode Rayleigh waves have a predominant period of about 23 sec and consist of vertical and radial components of a period range of 15-90 sec. Model T approximates the Tien Shan. Model LB has a double low velocity zone (LVZ) near the lower crust and in the upper mantle. Model S is a stratified medium consisting of upper and lower crusts with a crustal thickness of 37.5 km. Fig. 1 shows the computed wavefields of the vertical component during the time (T) from 25 to 250 sec, in which the waves travel from left to right. The location of the M.R.S is denoted by a horizontal black bar beneath the bottom of the figure. Sites 5 and 15 are located at the left and right ends of the M.R.S, site 10 being located at the midpoint. In each figure amplitudes of the waves are multiplied by one hundred thousand and are plotted in a logarithmic scale color representation. The positive and negative components of the displacement are distinguished in terms of different colors. Max denotes a maximum value of the displacement in a unit of cm.

Distinct scattering characteristics for Models T and LB, not shown in Model S, are summarized as follows: (A1) When incident waves propagate across the M.R.S, scattered waves are generated continuously and concentrically with their centers located at the M.R.S at T=150-250 sec. (A2) Amplitudes of the scattered waves are stronger in Model LB than in Model T because new scattered waves are generated at the LVZ in the upper mantle. (A3) The shift of sources of scattered waves, near the M.R.S beneath from site 5 (T=150sec), next site 10 (T=175sec), and to site 15 (T=200-225sec), can be clearly observed. (A4) In Model T five or six wave fronts constituting a pair of positive and negative phases are contained in the wavefield of a 500 km length between the left edge and site 5. This corresponds to a wavelength of 90-100 km of scattered waves. Several features extracted above are major features pertinent to scattering of Rayleigh waves which propagate across the Tien Shan mountains.

References: Wessel, P. and W. H. F. Smith, EOS Trans. Amer. Geophys. U., 79(47), 579, 1998; Yoshida, M., Earth Planets Space, 53,1099-1109, 2001.

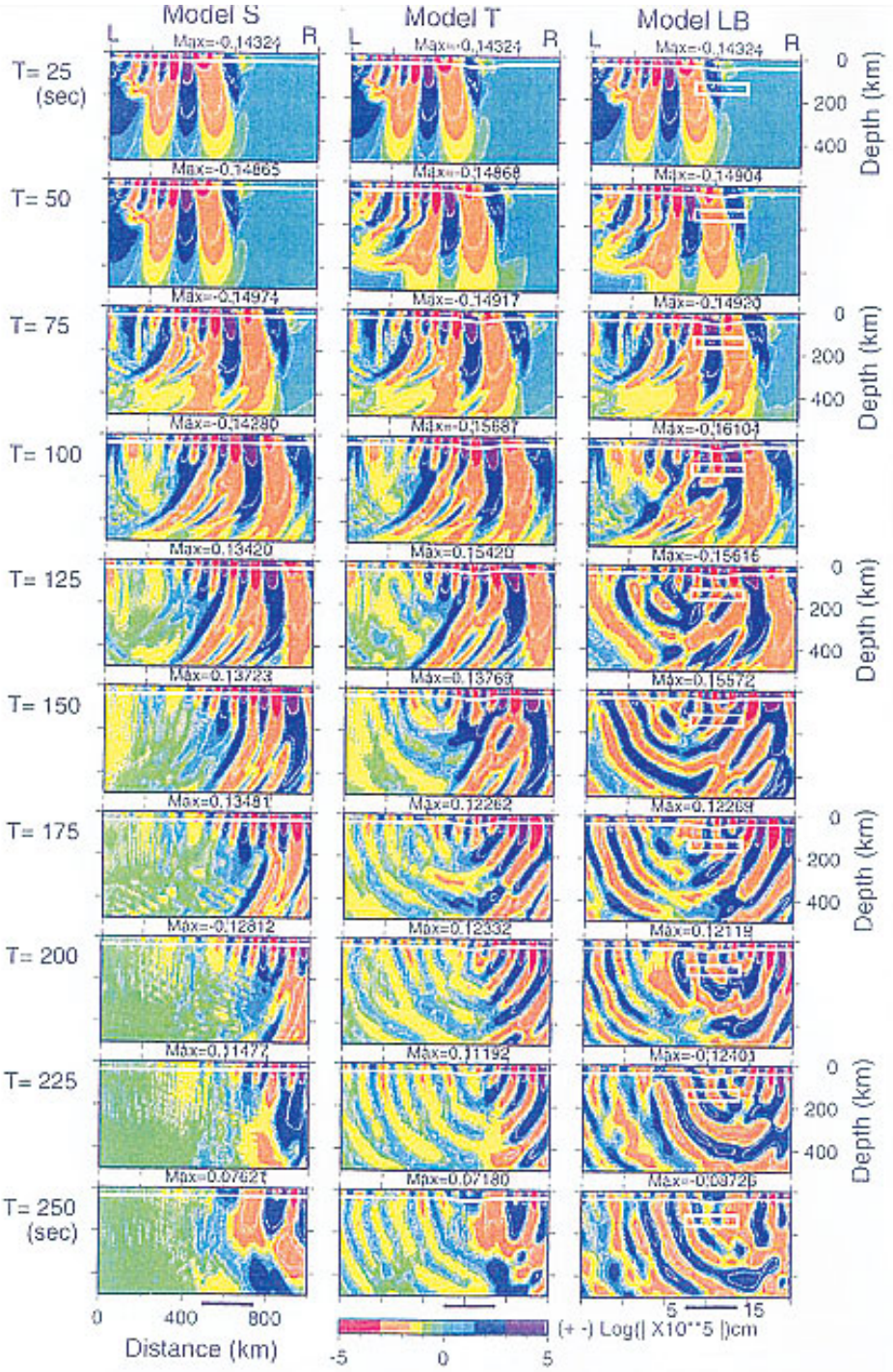

Fig. 1. Wavefields of Rayleigh wave propagation. The Moho is denoted by a horizontal white line in each wavefield. For Model LB the low velocity zone (LVZ) beneath the mountain root structure (M.R.S) is denoted by a white rectangle while the LVZ beneath the M.R.S at a depth of 37.5-52.5 km/s is not shown.