Geophysical Research Abstracts,
Vol. 11, EGU2009-4711-1, 2009
EGU General Assembly 2009

On multimode computations for laterally-heterogeneous structures with variable surface curvature: the extended Himalaya

G. GURUNG (1), F. SCHWAB (2), and B. G. JO (1)

(1) Department of Earth and Environmental Science, Chonbuk National University, Jeonju, Republic of Korea 561-756 (moostang@chonbuk.ac.kr), (2) Institute of Geophysics and Planetary Physics, University of California, Los Angeles, California 90095-1567, USA

In 3-D seismic mapping, complete multimode-multistructure computations are now feasible for laterally heterogeneous structures with variable surface curvature; specifically, for a 10 × 10 km grid of surface locations with surface azimuths 0(11.25)348.75° treated at each location, surface dimensions of 2500 × 3100 km, depths from surface to 800 km, and frequencies 0.0005(0.0005)0.1000 Hz. The fundamental assumption for modal treatment of a 3-D varying structure with variable curvature, is that each triplet (frequency, mode number, surface azimuthal direction of propagation) at a location can be assigned its own specific laterally-homogeneous structure and radius of surface curvature. The extent of the true structure used for this is defined by the modal depth of penetration D, and the vertical cylinder with diameter S equal to 1.5 times this depth of penetration. With an initial 3-D structure specified, "static computations" generate a complete (torsional and spheroidal) multimode specification for each location. Standardized representations for this specification are critical to the 3-D mapping procedure: a compact, eight-parameter graphical representation is needed to monitor the network output, location-by-location. For this we use the appropriate 32 modes of frequency-dependent physical phase velocity C_1, attenuation parameter Q_c, physical group velocity U_1, energy-density integral I, radius of surface curvature R, surface sensing-circle diameter S, depth of penetration D, and the ratio S/D. The overall feasibility of the static computations was demonstrated previously. Here, three phases of the these computations remain to be presented: (1) In applying the fundamental assumption during the computational procedures, we must iterate over the ratio of input S and output D to satisfy the fundamental assumption to the level $S/D = 1.500 \pm 0.004$, or to 3.3 sig. fig.. This then ensures the computational accuracies: 5.0 sig. fig. in C_1, 4.4 sig. fig. in Q_c, 3.7 sig. fig. in U_1, 3.8 sig. fig. in I, and 4.2 sig. fig. in R. (2) With $S/D = 1.500 \pm 0.004$, computed R is good to 4.2 sig. fig.; but to obtain the desired 5.0 sig. fig. in C_1 the *sufficient* condition on R is 5.0 sig. fig. Fortunately, the corresponding *necessary* conditions are far less stringent. These depend upon the ratio D/R, and it is only for $D/R \approx 1$ that R needs to be good to 5.0 sig. fig.; but for the upper 800 km beneath the extended Himalaya, $0.04 < D/R < 0.14$ and we need only 3.7 < accuracy of $R <$ 4.0 sig. fig. (3) The group velocity on a laterally heterogeneous structure with variable surface curvature, depends upon $dR/d\omega$ and $dS/d\omega$. If these frequency derivatives are ignored, the accuracy of computed U_1 can fall to 2.4 sig. fig. (torsional modes) and 2.7 sig. fig. (spheroidal modes).