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Proposed, Standardized Multimode Representation of 3-D Varying Structures Having Variable Surface Curvatures

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Our problem is the computational treatment, with multimode seismic procedures, of the true 3-D heterogeneous structure having variable surface curvature. Since these multimode seismic procedures are based on a laterally-homogeneous structure with fixed surface curvature, our problem becomes that of devising, implementing, and testing a satisfactory means for assigning *locally*, a laterally-homogeneous structure with fixed surface curvature, to the true structure. The availability of modern computational hardware, and Internet communications for network computations, have led us to develop multimode procedures for application to large-scale 3-D mapping of the upper mantle by an international group. There are four main parts of this multimode mapping: (1) an initial 3-D structural specification (the most difficult part of the mapping), (2) static computations (whose algorithms, computations, and network are treated here), (3) wavefront-propagation computations (whose input is the output of (2), and whose output is theoretical seismograms to compare with those recorded experimentally), and (4) inversion computations (to obtain an improved structure from the above comparison). To apply these mapping procedures, a standardized multimode seismic representation of a geographical region, with surface dimensions of a few thousand km, is critical. This requirement enters in the static computations which assign a full, propagating-mode (spheroidal and torsional) specification to each latitude-longitude location of the geographical region. Explicit, fundamental assumption involved in treating a 3-D varying structure, having variable surface curvature, with modal pro-

cedures: it requires that for a given latitude-longitude location, each multimode triplet (frequency, mode number, surface azimuthal direction of propagation) be assigned its own specific laterally-homogeneous structure and its own specific radius of surface curvature. This assumption reduces to the specification of the extent of the true structure that is used to determine the triplet-specific, laterally-homogeneous structure and constant surface cuvature. The vertical extent is obvious: the triplet's depth of penetration; for the triplet's lateral extent, we use a surface diameter equal to the depth of penetration (key detail in the fundamental assumption). Within the assumptions, large-scale network computations in the extended Himalaya have been used to test the feasibility of the procedures: graphics are employed to illustrate and quantify the effects of (1) lateral heterogeneity of the structure, and of (2) variable surface curvature. The second feasibility tests concern computation time and storage requirements. Seeking 10 km lateral resolution in our mapping, static computations are carried out on a 10 km x 10 km grid of surface locations. This and the surface dimensions of the region being mapped (say, 3000 km x 4000 km) govern computation-time and storage requirements. For 2000 technology having network nodes with 64-bit-arithmetic chips and 0.6 GHz speed, the static computations that treat the 120,000 locations in our target time of 2 months require 211 nodes; for 2007 technology (nodes with 2.4 GHz speed), 53 nodes are needed. Storage requirements: the 80 or 120 GB of external disk storage per node, is not a problem. Our standardized representations: these proposed standards are illustrated as (1) multimode graphical representations at a set of fixed azimuths, and as (2) multi-azimuth graphical representations.