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2-D and 3-D Models of Broadband Wave Propagation in the San Francisco Bay Region and Northern Coast Ranges

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We are proceeding with the development of a 3-D laterally heterogeneous model of crustal and upper mantle structure in the San Francisco Bay area and surrounding regions, based on data gathered from geologic, recent tomographic and seismic relection, gravity and other studies to be used to characterize 3D wave propagation throughout the region and to simulate the effects of large damaging earthquakes occuring on the Hayward and other faults in the region. This paper presents preliminary results from this effort based on modeling of waveforms recorded on broadband instruments in the region from recent earthquakes. A gridded finite difference model will be constructed from the geologic structure covering roughly the entire Bay area and adjacent regions of the Coast Ranges, with sufficient density to model seismograms to frequencies approaching 1 Hz. Effects of 3-D attenuation will hopefully be included. Previous modeling using two dimensional finite differences has been found to be inadequate in explaining wave propagation through the northern Coast Ranges to Berkeley, while 3-D structure has been shown to explain at least some waveform characteristics fairly well (e.g., Lomax, 1992; Frankel and Vidale, 1992). Several moderate sized events with well constrained source parameters have occurred in recent years both in the south bay area and around the Geysers region. After completion of the initial model these events will be used to test its applicability in explaining features of wave propagation throughout the region, including basin edge wave effects, focussing from strong reflectors, and refraction of wave paths from lateral velocity contrasts across the major faults. Comparisons with simpler 2-D models will also be presented to illustrate these features. In this way we hope to construct a realistic model with demonstrated ability to explain the existing broadband data. At the same time, we are using the initial model as a first step in estimating ground motion hazards from possible large earthquakes on the Hayward Fault (see Larsen et al., this volume).

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