Pn Velocity Structure from South Western Europe to Western Asia

D. E. McNamara, C. Schultz and R. A. Hansen

The vast region of convergent margins, extending from the western reaches of Europe and the Mediterranean, eastward in to western Asia, is likely the most structurally and technically complex area in the world. Tectonic structures include: 1) large sedimentary basins such as the Persian Gulf, the Mediterranean Sea and the Caspian Sea; 2) high elevations such as the Zagros mountains, the Iranian Plateau, the Alps, Caucuses and Himalaya; 3) Stable continental shields of Northern Africa and the Arabian Peninsula; and 4) areas of active extension such as the Red Sea rift. The region is also characterized by abundant seismicity and active volcanism. Given the tectonic complexity of the region we can expect the lateral seismic velocity structure of the crust and upper mantle to be equally complex. For this reason, predicting the characteristics of regional waves, that dominantly travel within the crust and upper mantle, can be a formidable task. Since seismic waves that propagate at regional distances (<1800km) are becoming increasing important to verifying the CTBT it is, none the less, important to understand their propagation characteristics.

In order to place some constraints on regional wave propagation in the region we attempt to model the lateral variation of upper mantle P-wave velocity. To do this, we have inverted the travel times of over 50,000 first arrivals (from NEIC 1598 earthquakes at 749 stations, raypath distance=200-1600 km), in a backprojection tomography scheme. We assume that the first arrival in this distance range, Pn, is a head wave with a travel time that can be divided into three parts: a mantle leg that travels directly beneath the Moho, one crustal leg beneath the recording station and a second crustal beneath the source. For estimating lateral velocity perturbations, the region is divided into cells and a velocity is computed as a function of all rays traversing that cell. Preliminary results suggest significant lateral heterogeneity of upper mantle Pn velocity that correlate well with major tectonic features and previous geophysical results. Results from this study will be used to better define seismic parameters required to verify the CTBT.

Work performed under the auspices of the U.S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48.

Daniel E. McNamara
Geophysical Institute
University of Alaska, Fairbanks
903 Koyukuk Dr.
P.O. Box 757320
Fairbanks, AK 99775-7320
mcnamara@giseis.alaska.edu

Daniel E. McNamara SSA member#13206
Craig Schultz SSA member#
Roger A. Hansen SSA member#11669