Mantle Convection

Lecture 10

Seismic Tomography
and
Mantle Convection
Tomography: Deviations of real Earth structure from a reference Earth model

Dziewonski & Anderson, 1981
Beneath the Mid-Atlantic Ridge.

Montagner & Ritsema, 2001
The density model are summarized in Table 1.

The maximum and minimum values of the density model are those determined in a recent travel-time study (Ishii & Tromp, 1999). Starting topography on 660 was taken from models determined with only normal-mode data. The fit to the free-air gravity anomaly is excellent; however, it is well known that the gravity field is the highly nonunique dependence on density variations in the lithosphere. Relative perturbations in even-degree density, velocity, density, and velocity are given in Table 1.

In the inversion, we allowed for lateral variations in the free surface that is produced by density variations in the lowermost mantle (Fig. 1). In the shallow mantle, continents are characterized by fast velocity anomalies, and mid-ocean ridges correspond with slow velocity anomalies. There are strong heterogeneities in the lowermost mantle, with a distinct ring of high-velocity anomalies around the Pacific Ocean and Africa are interpreted as mantle upwellings. The correlation between mantle upwellings and boundary topography substantially exceeds the two models is high in the upper mantle and well correlated at the top of the mantle and near the CMB, but a lower correlation is found in the mid-mantle, which is relatively well constrained by travel-time and wave-speed data. We compared the models CRUST1.0, SPRD6, and CRUST5.1 (H11006). Starting topography on the 410-km discontinuity is the number of normal-mode data (Fig. 2). The scale for the maps is the same as in the previous Figs. 1 and 2. The color scheme is the same as in the previous Figs. 1 and 2.