

South Pacific mantle plume imaged by P-wave tomography

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The French Polynesian region is characterized by positive topographic anomalies of 700 m, a concentration of hotspot chains. Many seismic tomography results show a broad low-velocity anomaly in the lower mantle continued from the core-mantle boundary (CMB). These observations suggest that a large-scale mantle flow rises from the CMB. Joint Japanese-French broadband seismological observations were performed from 2001 to 2005 with 10 island stations and 10 broadband ocean bottom seismometers (BBOBSs). 9 BBOBSs were additionally deployed around Society Islands during 2009 - 2010. A P-wave tomography model was obtained by adding these data to the ISC first arrival data and by taking the finite frequency effect into account for the frequency-dependent differential travel times. The frequency depended differential travel times were measured by multi-band cross correlating P waveforms. The P-wave tomography (Figure 1.) shows strong slow anomalies beneath the Society Islands and Pitcairn in the upper mantle although they do not extend to the 660-km discontinuity. This model also shows that large-scale (~1000 km in diameter) slow anomalies from the CMB become small and weak in the depth range about 550 - 900 km. The small-scale slow anomalies seem to shape a circle connecting the Society, Marquesas, Pitcairn and MacDonal hotspots.

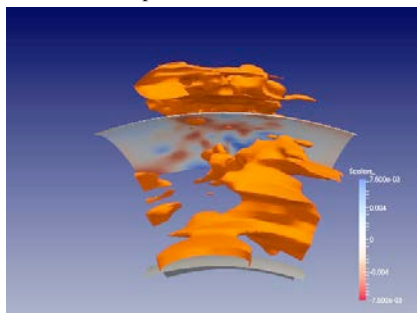


Figure 1. 3D image of slow anomalies below French Polynesia viewed from the east. Isosurface is rendered in red where P-wave velocity is 0.5% slower than the spherical global average.