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# Detection of mantle plumes under hotspots

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Hotspots are centers of massive volcanism not linked to plate boundaries, such as Hawaii or Iceland, and they are commonly explained by mantle plumes. There are a variety of models on the origin of hotspots, and several hotspot lists have been published. The number of volcanic centers included on these lists ranges from about 20 to more than 100. Many studies have been made on the surface hotspots by using geochemical and geophysical observations such as isotopic ratios, bathymetry, gravity and heat flow. However, seismic images are available for only a few hotspots. In this study, referring to the lists of hotspots published so far, we have compiled a list of 56 hotspots to examine the seismic velocity images under them. The distribution of the 56 hotspots is not random. Hotspots are concentrated in South Pacific and Africa to Atlantic regions. A few of them are located on continental regions such as North America. A recent whole mantle tomographic model (Zhao, 2001) was used to examine the seismic structure under the 56 hotspots. We show at least one cross-sectional image for each hotspot. We also computed root-mean-square (RMS) amplitudes of velocity anomalies using the tomographic model of Zhao (2001). Prominent plume-like slow anomalies are detected under major hotspots from the crust down to the core-mantle boundary (CMB). Hotspots in Hawaii, South Pacific, Iceland, Kerguelen (Indian Ocean), Canary (North Atlantic Ocean), Discovery (South Atlantic Ocean), Afar (East Africa), and Eifel (Europe) are located above slow anomalies in the lower mantle down to CMB, suggesting that the mantle plumes under those hotspots may originate from the CMB. The slow anomalies under those hotspots usually do not show a vertical pillar shape, which suggests that plumes are not fixed in the mantle but can be deflected by the mantle flow. Hotspots in Western North America, Southeast Australia and Antarctica are located above notable slow anomalies; but those slow anomalies are not continuous down to the lower mantle, which suggests that these hotspots may originate from the upper mantle or the mantle transition zone. Slow anomalies are superior to fast anomalies in areas with hotspots. Slow anomalies exist beneath almost all hotspots, but a plume-like, continuous low-velocity column in the entire mantle is visible under only several hotspots. In many cases, the low-velocity zone is not continuous but visible at only some depth ranges under a hotspot. This could be caused by a variety of reasons. (1) The thinner portion of the plume may not be detected due to the limit of the resolution. (2) In some cases, it is possible that the surface location of a hotspot is not correct. (3) Under certain hotspots, seismic rays in the data set do not crisscross well enough and so have no resolution. (4) Some plume may have no seismic anomaly, possibly because it is a chemical plume or a 'wetspot' rather than a 'hotspot'.