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Deep mantle upwelling under Réunion hotspot and the western Indian Ocean from P- and S-wave tomography

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We present two high-resolution body-wave tomography models of the whole mantle column, beneath the western Indian Ocean, centered on the volcanic hotspot of La Reunion, the presumed location of a deep mantle plume.

The P-wave model shows a source in the lowermost mantle for the upwelling beneath La Réunion, rooted in the African LLSVP. The model is consistent with previous studies observing 'fat' plumes in the lower mantle but reveals more detail and considerable complexity in the transition zone and upper mantle beneath the Réunion hotspot. Rather than being near-vertical, the upwelling shows a tilt in the lower mantle (2000-1000 km depth) and splits into branches closer to the surface (upper 600 km).

The new S-model consists of three datasets: teleseismic multifrequency waveform measurements from the ocean-bottom and island-based RHUM-RUM experiment around La Réunion (2011-2015, Barruol & Sigloch, 2013); cross-correlation measurements of teleseismic S-waves from S40RTS (Ritsema et al., 2011); and picked S-phases from the ISC/ISC-EHB catalog (Weston et al., 2018). Like the P-model, the S-model reveals a whole-mantle, low-velocity upwelling rooted in the African LLVP. The two models are highly correlated throughout the mantle but additional low-velocity features are imaged by the S-model in the upper mantle.