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Structure of the lithosphere around La Réunion hotspot from teleseismic receiver functions

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La Réunion Island, located in the Indian Ocean, east of Madagascar, hosts one of the most world's active volcano, the current surface expression of La Réunion hotspot. Together with Mauritius, these volcanic edifices are built on a Late Cretaceous-Early Palaeocene oceanic lithosphere formed during the opening of the Mascarene basin, east of the active Central Indian ridge.

Although La Réunion hotspot is considered as the archetype of a primary plume impinged below an oceanic lithosphere, several observations raise pivotal questions. First, the lack of lithospheric flexure below La Réunion island suggests complex effects of lithosphere elastic thickness, thermo-mechanical erosion and magmatic underplating. Second, the atypical bathymetric bulge bounded by two transform faults could sign for a localised anomaly in the asthenosphere. Third, large differences in crustal thicknesses between La Réunion and Mauritius may indicate plume-induced magmatic underplating and/or different crustal nature.

To answer these questions, we use the P-receiver functions method to investigate the structure of the lithosphere below 20 three-component broad-band seismometers deployed on islands and 57 ocean bottom seismometers (OBS) installed on the seafloor during the RHUM-RUM (Réunion Hotspot and Upper Mantle – Réunions Unterer Mantel, www.rhum-rum.net) experiment in the southwestern Indian Ocean. This allows to determine the depth of seismic discontinuities (the base of the volcanic edifice, the Moho, and the base of the lithosphere) and nature of the crust to mantle transition over this area affected by a mantle plume and two mid-oceanic ridges. We combine two different inversion techniques to constrain the shear-wave velocity model underneath each seismic station: the Neighbourhood Algorithm and the Transdimensional Bayesian approach.

Preliminary results obtained at OBS show a Moho depth at about 11 km relative to the sea level surface (i.e about 7 km below the seafloor) west of La Réunion Island and at around 10 km between Mauritius and La Réunion. These values are lower than a Moho depth at 12 km obtained at STPI station located south of La Réunion Island, consistent with previous seismic studies. This suggests lateral crustal thickness variations possibly induced by the plume activity.