Probing mantle structures beneath La Réunion hotspot from land and ocean bottom observations: results from the RHUM-RUM experiment

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RHUM-RUM (Réunion Hotspot and Upper Mantle - Réunions Unterer Mantel) is a French-German passive seismic experiment designed to image an oceanic mantle plume –or lack of plume –from crust to core beneath La Réunion Island.
La Réunion is the present-day surface evidence of an intra-plate volcanic hotspot that started 65 Ma ago with the eruption of the Deccan flood basalts of India. It generated a 5,500 km-long hotspot track into the Indian Ocean seafloor and represents one of the most active volcanoes on Earth.
In the frame of the RHUM-RUM program, we deployed 57 German and French ocean-bottom seismometers (OBS) for one year (Oct. 2012 - Dec. 2013), over an area of 2000 km x 2000 km2 centered on La Réunion Island, and at depths ranging from 2500 to 5400 m, using the “Marion Dufresne” and “Meteor” vessels. The stations from the German DEPAS and from the French IPGP-INSU pools were equipped with broadband, three-component seismometers (corner frequencies of 60, 120, or 240 s and sampling rates of 50-100 Hz), and with broadband hydrophones (corner period 100 s, cutoff frequency 8 Hz, and sampling rates of 50-100 Hz). The network was complemented by 30 RHUM-RUM land stations that operated for 2-3 years on La Réunion, Mauritius, Madagascar, the Seychelles, and the Eparses islands in the Mozambique channel.
We present an overview of the whole mantle imaging using body waves finite frequency tomography, of the upper mantle surface wave tomography and of upper mantle flow from SKS and Rayleigh-waves seismic anisotropy. We also present various environmental seismology results derived from microseismic noise analyses, such as cyclone tracking from ocean bottom observation, detection of the seismic hum on the ocean floor, long-range cross-correlation of microseismic noise on OBS, and the detection, identification and tracking of whales, and passing ships.

Keywords: Mantle plume, La Reunion hotspot, Seismic tomography, Mantle anisotropy