Passive seismic interferometry of the ultraslow-spreading Southwest Indian Ridge

Mohamadhasan Mohamadian Sarvandani¹, Emanuel Kästle², Lapo Boschi³, Sylvie Leroy⁴, and Mathilde Cannat⁵

¹Sorbonne University, France (mohamadhasan.mohamadian_sarvandani@sorbonne-universite.fr)
²Free University of Berlin, Germany (emanuel.kaestle@fu-berlin.de)
³University of Padova, Italy (larryboschi@gmail.com)
⁴Sorbonne University, France (sylvie.leroy@sorbonne-universite.fr)
⁵Institut de Physique du Globe de Paris (IPGP), France (cannat@ipgp.fr)

Passive seismic interferometry (ambient-noise seismology) is an increasingly popular, eco-friendly, relatively inexpensive exploration geophysics tool, to map S-wave velocity in the Earth's crust. This method has not yet been applied widely to marine exploration. The purpose of this study is to investigate the crustal structure of a quasi-amagmatic portion of the Southwest Indian Ridge by interferometry, and to examine the performance and reliability of interferometry in marine exploration. To achieve this goal, continuous vertical-component recordings from 43 ocean bottom seismometers (OBS) deployed during the SISMO-SMOOTH cruise (2014) were utilized. Recorded signals span frequencies between 0.1Hz and 3Hz. We show that reliable estimates of the Green's function are obtained for many station pairs, by cross-correlation in the frequency domain. The comparison of the cross-correlations with the theoretical Green's (Bessel) function provides one Rayleigh-wave dispersion curve per station pair; dispersion curves are then averaged, and inverted through a conditional neighborhood algorithm to determine a 1D S-wave velocity model, that we estimate to be well constrained within the crust. Our S-wave velocity model is analyzed and interpreted with geological information, and independent geophysical studies in the region of interest, as well as other areas characterized by similar tectonically-dominated, quasi amagmatic spreadings.