Geophysical Research Abstracts
Vol. 18, EGU2016-16770, 2016
EGU General Assembly 2016

Seismic imaging beneath southwest Africa based on finite-frequency body wave tomography

Mohammad Youssof (1,4), Xiaohui Yuan (1), Frederik Tilmann (1), Benjamin Heit (1), Michael Weber (1), Wilfried Jokat (2), Wolfram Geissler (2), and Gabi Laske (3)

(1) GeoForschungsZentrum Potsdam, Telegrafenberg, 14473 Potsdam, Germany, (2) Alfred Wegener Institute, Am Handelshafen 12, 27570 Bremerhaven, Germany, (3) Institute of Geophysics and Planetary Physics, Scripps Institution of Oceanography, University of California, San Diego, CA 92093-0225, USA., (4) University of Copenhagen, Geology Section, Department of Geosciences and Natural Resource Management (IGN), Copenhagen, Denmark (ms@ign.ku.dk)

We present a seismic model of southwest Africa from teleseismic tomographic inversion of the P- and S- wave data recorded by an amphibious temporary seismic network. The area of study is located at the intersection of the Walvis Ridge with the continental margin of northern Namibia, and extends into the Congo craton. Utilizing 3D finite-frequency sensitivity kernels, we invert traveltime residuals of the teleseismic body waves to image seismic structures in the upper mantle.

To test the robustness of our tomographic imaging, we employed various resolution assessments that allow us to inspect the extent of smearing effects and to evaluate the optimum regularization weights (i.e. damping and smoothness). These tests include applying different (ir)regular parameterizations, classical checkerboard and anomaly tests and squeezing modeling. Furthermore, we performed different kinds of weighing schemes for the traveltime dataset. These schemes account for balancing between the picks data amount with their corresponding events directions. Our assessment procedure involves also a detailed investigation of the effect of the crustal correction on the final velocity image, which strongly influenced the image resolution for the mantle structures. Our model can resolve horizontal structures of 1° x 1° below the array down to 300-350 km depth.

The resulting model is mainly dominated by the difference in the oceanic and continental mantle lithosphere beneath the study area, with second-order features related to their respective internal structures. The fast lithospheric keel of the Congo Craton reaches a depth of ∼250 km. The orogenic Damara Belt and continental flood basalt areas are characterized by low velocity perturbations down to a depth of ∼150 km, indicating a normal fertile mantle. High velocities in the oceanic lithosphere beneath the Walvis Ridge appear to show signatures of chemical depletion. A pronounced anomaly of fast velocity is imaged underneath continental NW Namibia and is separated from the high velocity anomaly of the Congo Craton. We interpret this positive perturbation as depleted mantle materials. The depletion event is most probably related to the emplacement of the Parana-Etendeka flood basalts at about 132 Ma triggered by a mantle plume, which has left traces on the Walvis Ridge as well.