Geophysical Research Abstracts
Vol. 21, EGU2019-5769, 2019
EGU General Assembly 2019

Characterizing the geometry of necking zones at rifted margins using edge detection of potential field data: applications to the margins of the southern North Atlantic and their inboard basins

Min Yang (1,2), J. Kim Welford (1), and Wanyin Wang (2)
(1) Memorial University of Newfoundland, Earth Sciences, St. John's, Canada (miny@mun.ca), (2) Chang'an University, Institute of Gravity and Magnetic Technology, School of Geology Engineering and Geomatics, Xi'an, Shaanxi, CN

Rifted margins are typically described in terms of the distinct zones that they comprise, namely the proximal domain, the distal domain and the oceanic domain. Of these, the distal domain contains most of the rift-related deformation and includes the thinning of the continental crust from approximately 30 km to often less than 10 km, with a change in Moho geometry from relatively flat in the proximal domain to a dip of up to 35° in the necking zone. This abrupt geometry, and corresponding shallowing of the denser upper mantle, generates a significant gravity anomaly. Identification and further processing of this gravity anomaly allows for the necking zones along rifted margins to be accurately located and their thinning geometries characterized. The resulting information can be used as inputs for generating more realistic deformable plate kinematic reconstructions with tools like GPlates.

We present a new edge detection method, based on the normalized vertical derivative of the total horizontal derivative, to enhance and characterize the necking zone geometries along the rifted margins of the southern North Atlantic Ocean and their inboard basins. First, we calculate the total horizontal derivative (THDR) of the potential field data and then compute the n-order vertical derivative (VDRn) of the THDR, called VDRn_THDR. Last, the Normalized Vertical Derivative of the Total Horizontal Derivative (NVDR-THDR) is obtained by taking the ratio of VDRn_THDR to THDR, normalized by their respective maximum values. The resulting NVDR-THDR maps can be used for identifying the necking zones around the southern North Atlantic Ocean via edge detection, with the lateral variations in the NVDR-THDR maps at different upward continuations providing detailed information about the lateral and depth variations in necking geometries along strike of the rifted margins and on the edges of the inboard basins. Velocity models from seismic refraction experiments are used to support the interpretations from the edge detection method.