Geophysical Research Abstracts
Vol. 16, EGU2014-13383, 2014
EGU General Assembly 2014

Equivalent magnetization over the World's Ocean and the World Digital Magnetic Anomaly Map

Jerome Dyment (1), Yujin Choi (1), Mohamed Hamoudi (2), Erwan Thébault (1), Yoann Quesnel (3), Walter Roest (4), and Vincent Lesur (5)

(1) Institut de Physique du Globe and CNRS, Paris, France (jdy@ipgp.fr), (2) Université des Sciences et de la Technologie Houari Boumédiène, Alger, Algérie, (3) CEREGE, Aix-Marseille Université, Aix en Provence, France, (4) Ifremer, Centre de Brest, Plouzané, France, (5) GeoForschungsZentrum, Helmholtz-Zentrum, Potsdam, Germany

As a by-product of our recent work to build a candidate model over the oceans for the second version of the World Digital Magnetic Anomaly Map (WDMAM), we derived global distributions of the equivalent magnetization in oceanic domains.

In a first step, we use classic point source forward modeling on a spherical Earth to build a forward model of the marine magnetic anomalies at sea-surface. We estimate magnetization vectors using the age map of the ocean floor, the relative plate motions, the apparent polar wander path for Africa, and a geomagnetic reversal time scale. We assume two possible magnetized source geometry, involving both a 1 km-thick layer bearing a 10 A/m magnetization either on a regular spherical shell with a constant, 5 km-deep, bathymetry (simple geometry) or following the topography of the oceanic basement as defined by the bathymetry and sedimentary thickness (realistic geometry). Adding a present-day geomagnetic field model allows the computation of our initial magnetic anomaly model.

In a second step, we adjust this model to the existing marine magnetic anomaly data, in order to make it consistent with these data. To do so, we extract synthetic magnetic along the ship tracks for which real data are available and we compare quantitatively the measured and computed anomalies on 100, 200 or 400 km-long sliding windows (depending the spreading rate). Among the possible comparison criteria, we discard the maximal range - too dependent on local values - and the correlation and coherency - the geographical adjustment between model and data being not accurate enough - to favor the standard deviation around the mean value. The ratio between the standard deviations of data and model on each sliding window represent an estimate of the magnetization ratio causing the anomalies, which we interpolate to adjust the initial magnetic anomaly model to the data and therefore compute a final model to be included in our WDMAM candidate over the oceanic regions lacking data. The above ratio, after division by the magnetization of 10 A/m used in the model, represents an estimate of the equivalent magnetization under the considered magnetized source geometry.

The resulting distributions of equivalent magnetization are further discussed in terms of mid-ocean ridges, presence of hotspots and oceanic plateaus, and the age of the oceanic lithosphere. Global marine magnetic data sets and models represent a useful tool to assess first order magnetic properties of the oceanic lithosphere.