Geophysical Research Abstracts
Vol. 20, EGU2018-6534, 2018
EGU General Assembly 2018

Mantle dynamics and wander of the rotational axis in a reference frame described by hotspots since 200Ma

Marianne Greff-Lefftz (1), Jean Besse (1), Sophie Vicente de Gouveia (1), Boris Robert (1,2)

(1) Institut de Physique du Globe de Paris, Geomagnetism department, Paris cedex 5, France (greff@ipgp.fr), (2) CEED, The Faculty of Mathematics and Natural Sciences, University of Oslo, Norway

We start with a simple model for mantle dynamics combining contributions of subducted lithosphere, domes at the bottom of the mantle and upwelling plumes in a new model of hot spot reference frame until 300Ma, based on the comparison of various surface indicators (geological, thermal data from boreholes and a compilation of global surface volcanism), a reassessment of hot spots classification and paleomagnetic data. A dominant feature of our temporal evolution of mantle mass anomalies is a large degree 2 order 2 component which may be explained by the quasi permanence of a girdle of subductions around the Pacific ocean (or its ancestor) and by the presence of two quasi antipodal domes found to remain close to the paleomagnetic equator.
We then deduce from our model the time-dependent Principal Inertia Axis (PIA) and the associated True Polar Wander (TPW, the shifting of the Earth's rotation axis with respect to the mantle) and compare our results with observations. We conclude that the rotation axis remains in a plane almost perpendicular to the degree 2 order 2 component of mantle masses, i.e. in a plane perpendicular to the minimum PIA, and that a major trend of both observed and computed TPW are successive oscillatory tracks separated by abrupt cusps. These cusps are not correlated with synchronous surface events but result from a combination of factors which affects the inertia of Earth when the associated masses are in the deep mantle: for example, the Indo-Sinian collision (270-230 Ma) and the subsequent end of the Neo-Tethys ocean subduction induces a major change in polar motion at $\sim$150 Ma observed both in our experiments and in paleomagnetic observations.