Geophysical Research Abstracts
Vol. 18, EGU2016-6288, 2016
EGU General Assembly 2016

Global Lithospheric Apparent Susceptibility Distribution Converted from Geomagnetic Models by CHAMP and Swarm Satellite Magnetic Measurements

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Recently, because of continually accumulated magnetic measurements by CHAMP satellite and Swarm constellation of three satellites and well developed methodologies and techniques of data processing and geomagnetic field modeling etc., global lithospheric magnetic anomaly field models become more and more reliable. This makes the quantitative interpretation of lithospheric magnetic anomaly field possible for having an insight into large-scale magnetic structures in the crust and uppermost mantle. Many different approaches have been utilized to understand the magnetized sources, such as forward, inversion, statistics, correlation analysis, Euler deconvolution, signal transformations etc. Among all quantitative interpretation methods, the directly converting a magnetic anomaly map into a magnetic susceptibility anomaly map proposed by Arkani-Hamed & Strangway (1985) is, we think, the most fast quantitative interpretation tool for global studies. We just call this method AS85 hereinafter for short. Although Gubbins et al. (2011) provided a formula to directly calculate the apparent magnetic vector distribution, the AS85 method introduced constraints of magnetized direction and thus corresponding results are expected to be more robust especially in world-wide continents.

Therefore, in this study, we first improved the AS85 method further considering non-axial dipolar inducing field using formulae by Nolte & Siebert (1987), initial model or priori information for starting coefficients in the apparent susceptibility conversion, hidden longest-wavelength components of lithospheric magnetic field and field contaminations from global oceanic remanent magnetization. Then, we used the vertically integrated susceptibility model by Hemant & Maus (2005) and vertically integrated remanent magnetization model by Masterton et al. (2013) to test the validity of our improved method. Subsequently, we applied the conversion method to geomagnetic field models by CHAMP and Swarm satellite magnetic measurements and obtained global lithospheric apparent susceptibility distribution models. Finally, we compared these deduced models with previous results in the literature and some other geophysical, geodetic and geologic datum. Both tests and applications suggest, indeed, that the improved AS85 method can be adopted as a fast and effective interpretation tool of global induced large-scale magnetic anomaly field models in form of spherical harmonics.

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This study is supported by State Key Laboratory of Geodesy and Earth’s Dynamics (Institute of Geodesy and Geophysics, Chinese Academy of Sciences) (SKLGED2015-5-5-EZ), Natural Science Fund of Hubei Province (2015CFB361), International Cooperation Project in Science and Technology of China (2010DFA24580), China Postdoctoral Science Foundation (2015M572217 and 2014T70753), Hubei Subsurface Multi-scale Imaging Key Laboratory (Institute of Geophysics and Geomatics, China University of Geosciences, Wuhan) (SMIL-2015-06) and National Natural Science Foundation of China (41574070, 41104048 and 41504065).