China's offshore gravity and magnetic measurement and interpretation

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With a summary of the Project of China's Offshore Synthetical Survey and Appraisal in 2010, gravity and magnetic data have basically covered the whole of China Seas. In order to improve interpretation and application of the traditional gravity and magnetic data, we have conducted a series of approach optimization.

(1) Data acquisition and correction. Adoption of PPP approach for double-frequency GPS has provided cm-level positioning accuracy to enhance reliability of course, speed and tide calculations, and the Eötvös correction is filtered by the filter of gravity data acquisition to improve quality of gravity data. With the survey line network at the geomagnetic northwest and the northeast directions, ship inducing magnetism is suppressed. An optimum model of ship magnetism is proposed to take care of variation of the base value and fluctuation range of the ship magnetic effect at different latitude.

(2) Data fusion and conversion. From a practical point of view, after all track data are arranged at the order of magnitude of azimuth and distance, each line can be adjusted for minimum of its crossovers to all intersected lines with the linear regression, and it can also be iterated to make the RMS of overall crossovers to be below an expected value. Coastal air-borne geo-potential data and other regional grid data can be effectively performed with iterative downward-continuation by the upward-continuation method, and their continuation factors can also be solved in the frequency domain. By this way, those data would be effectively merged with offshore track data. Based on integrated and reliable merger of overall data, gravity anomalies are corrected for global topography, isostatic compensation, variable density sedimentation in the spherical coordinates, and magnetic anomalies are iteratively performed for reduction to the pole by the balance method of power spectral to suppress noise at the direction of magnetic declination, and the variable inclination reduction-to-the pole is made with different weight distribution at different latitude on the vast region.

(3) Integrated interpretation. By correlation analyses with the seismic-detected sedimentary basement and Moho discontinuities, gravity anomalies can be more reliably separated into two parts originated from the sedimentary basement and Moho discontinuities, respectively, and then by linear regression with the seismic-detected data again, the two parts of gravity anomalies will get their initial models for inverting their source interfaces with faster convergences and more reliable results. Similarly referred to the seismic-detected sedimentary basement or gravity basement, RTP magnetic anomalies can be more reliably separated into two parts originated from the magnetic basement and Curie interface, and then the two parts of RTP magnetic anomalies would inverse the magnetic basement and Curie interface, respectively, improved with restraint from pseudo-gravity anomalies as well.

The above works allow us to track evidences of the same structure linked between land and sea, especially to get in-depth understanding of the offshore uplifts with low level of exploration and research previously. For examples, both the Haiyangdao uplift offshore of the Liaodong Peninsula and the Qianliyan uplift offshore of the Shandong Peninsula are characterized by uplifts of the Moho with high values of free-air, Bouguer and isostatic gravity anomalies. At the middle of the Zhejiang and Fujian uplift there is a sub-depression with －30 mGal of free-air gravity anomalies even lower than those in the shelf basins. Due to NW-trending strike-slip faults, the northern South China Sea continental terrace would be mainly divided into three sections, to show the tendency of tension toward compression from west to east, which reminds us that the Guangdong coast would be more affected by sea-level rise and the southern Fujian coast affected by seismic activities.