A new towed marine vector magnetometer: Methods and results from a Central Pacific cruise

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Abstract: This paper focuses on new instrumental and methodological aspects of the acquisition, processing and interpretation of marine magnetic data. Between two Overhauser sensors towed as a longitudinal gradiometer, a new fluxgate vector magnetometer was employed. A second independent vector magnetometer system operated simultaneously. This equipment was used during research cruise SO-180 of R/V SONNE in the Central Pacific at about 120°W just south of the equator. The survey area on the Pacific Plate is the mirror image to the currently subducting Cocos plate off Central America. The oceanic crust was formed around 23 Ma at the East Pacific Rise when the Farallon plate broke up into the Cocos and Nazca plates. The magnetic seafloor anomalies in the survey area strike approximately north-south almost parallel to the main field, resulting in very low anomaly amplitudes which had hindered detailed anomaly identification so far. A new processing scheme was applied to the data which identifies the weak anomalies in the total field and those in the vertical component that, as a consequence of the source body geometry, have about doubled amplitude. The vertical component constrains 2-D modelling much better than the total field alone. Processed fluxgate total field data are practically identical to the Overhauser reference and even provide a reliable gradient when combined with one Overhauser. Although towed vector magnetometers typically provide no independent estimate of yaw, we illustrate that a numerical yaw (bandpass filtered magnetic heading) can provide reasonable estimates of the horizontal field components. These component data open additional analysis tools: the strike direction of magnetic lineations can be estimated from single profiles by either magnetic boundary strike ellipses in the space domain or by coherences between vertical and horizontal components in the wavenumber domain. Auto power spectra of the total field provide an approximate depth to the anomaly source or, if in obvious contradiction to the bathymetric depth, allow the detection of distortions, for example, by external temporal geomagnetic variations. © 2007 The Authors Journal compilation © 2007 RAS.

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