Determination of Sedimentary Basin Basement Depth: A Space Domain Based Gravity Inversion using Exponential Density Function

Vishnubhotla CHAKRAVARTHI and Batta RAMAMMA

Centre for Earth and Space Sciences,
University of Hyderabad, Hyderabad, India;
e-mails: vcvarthi@rediffmail.com (corresponding author),
ramageophd@gmail.com

A b s t r a c t

An automatic inversion using ridge regression algorithm is developed in the space domain to analyze the gravity anomalies of sedimentary basins, among which the density contrast decreases with depth following a prescribed exponential function. A stack of vertical prisms having equal widths, whose depths become the unknown parameters to be estimated, describes the geometry of a sedimentary basin above the basement complex. Because no closed form analytical equation can be derivable in the space domain using the exponential density-depth function, a combination of analytical and numerical approaches is used to realize forward gravity modeling. The depth estimates of sediment-basement interface are initiated and subsequently improved iteratively by minimizing the objective function between the observed and modeled gravity anomalies within the specified convergence criteria. Two gravity anomaly profiles, one synthetic and a real, are interpreted using the proposed technique to demonstrate its applicability.

Key words: gravity anomaly, exponential density contrast, automatic inversion, space domain, sedimentary basin.