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3D Forward Gravity Modeling of Vargeão Impact Structure: Preliminary Results

Henrique Santos (1), Elder Yokoyama (2), Edgar Santos (3), Emilson Leite (4), and Julio Cesar Ferreira (4)

(1) Departamento de Engenharia de Petróleo, Universidade Estadual de Campinas, Campinas, Brazil (hbuenos@gmail.com), (2) Departamento de Geofísica, Universidade de São Paulo, São Paulo, Brazil (elder@iag.usp.br), (3) Instituto de Física, Universidade de São Paulo, São Paulo, Brazil (edgarbueno.santos@gmail.com), (4) Instituto de Geociência, Universidade de Campinas, Campinas, Brazil (emilson@ige.unicamp.br, julio.cferr@gmail.com)

Impact cratering processes are of primary importance to understand the planetary evolution of the Solar System. These processes produce significant changes on the geophysical signatures of the planetary surfaces. In this context, the study of gravity anomalies associated to terrestrial impact structures can provide important clues about the origin of similar anomalies that are observed in other planets and satellites. However, craters on basaltic rocks, which are the best analog for the surface of other planets/satellites, are rare on Earth. The 12-km-wide Vargeão is a well-preserved complex impact structure formed on basaltic and subordinately rhyodacites flows of the Serra Geral Formation (133-131 Ma) of the Paraná Basin. We have estimated a 3D density distribution model of the Vargeão impact structure. For this purpose, we assumed that gravity anomalies are caused by density anomalies that are confined within a three-dimensional region of the subsurface. This region was represented by a set of juxtaposed right rectangular prisms that have different density values. The gravitational attraction at each point on the surface is the sum of the contribution of each prism. Prior information about density and approximate depths of the body are required. To build this model, we started by extracting information that is available from a stratigraphic chart and also from field observations. We removed a Bouguer regional anomaly in order to isolate anomalies that are originated by near-surface structures. Gravity profiles across the impact structure show a good fit of the calculated values with the residual Bouguer anomaly. Furthermore, in comparison with the normal stratigraphic pattern in this part of the basin, our model shows that sandstone is vertically displaced by hundred of meters and it reaches the crater floor. Our interpretative model can contribute to a better understanding of the impact crater formation and might be used for analogue studies on planetary surfaces.