Geophysical Research Abstracts
Vol. 14, EGU2012-6444, 2012
EGU General Assembly 2012

Satellite gravity field derivatives for identifying geological boundaries.

O. Alvarez (1), M. Gimenez (1), C. Braitenberg (2), and A. Folguera (3)

(1) Instituto Geofísico y Sismológico Ing. Volponi, Universidad Nacional de San Juan, Ruta 12-Km17, San Juan, Argentina, (2) Dipartimento di Matematica e Geoscienze, Università di Trieste, Via Weiss 1, 34100 Trieste, Italy, (3) INDEAN - Instituto de Estudios Andinos "Don Pablo Groeber". Departamento de Cs. Geológicas - FCEN - Pab. II. Universidad de Buenos Aires

The Pampean flat slab zone developed in the last 17 Ma between 27º and 33ºS, and has denuded an intricate collage of crustal blocks amalgamated during the Pampean, Famatinian and San Rafael deformational stages, that is far of being completely understood. For potential field studies these amalgamations have the effect of defining important compositional and density heterogeneities.
Geophysical data from different studies show a sharp boundary between the two adjacent and contrasting crusts of Pampia and the Cuyania terrane. Recent aeromagnetic surveys have inferred a mafic and ultramafic belt interpreted as a buried ophiolitic suite hosted in the corresponding suture. This boundary coincides locally with basement exposures of high to medium grade metamorphic rocks developed in close association with the Famatinian orogen of Early to Middle Ordovician age. Lower crustal rocks are exposed along this first order crustal discontinuity.
The Río de la Plata basement crops out from southern Uruguay to eastern-center Argentina with an approximate surface of 20,000 km2. Oldest rocks have been dated in 2,200 and 1,700 Ma, indicating that they constituted a different block to Pampia. The boundary between Pampia and the Rio de la Plata craton is not exposed. However, a strong gravimetric anomaly identified in the central part of the foothills of the Sierras de Córdoba indicates a first order crustal discontinuity that has been related to their collision in Neoproterozoic times.
This work focuses on the determination of mass heterogeneities over the Pampean flat slab zone using gravity anomaly and vertical gravity gradient, with the aim to determine discontinuities in the pattern of terrain amalgamation that conformed the basement. Satellite gravimetry is highly sensitive to these variations. Recent satellite missions, (CHAMP, GRACE, and GOCE) have introduced an extraordinary improvement in the global mapping of the gravity field. We control the quality of the terrestrial data entering the EGM2008 by a comparison analysis with the satellite only gravitational model of GOCE up to degree N=250. Using the global model EGM2008, the vertical gravity gradient and the gravity anomaly for South Central Andes are calculated. We correct the observations for the topographic effect using tesseroids by using a 1-arc minute global relief model of earth's surface. Results are compared to a schematic geological map of the South Central Andes region, which includes main geological features with regional dimensions presumably accompanied by crustal density variations.
We clearly depict the geological structures and delineation of significant terrains such as Pampia, Cuyania, and Chilenia terranes. Of great interest is the contact between the Rio de la Plata craton and the Pampia Terrain, a boundary that has not been clearly defined till now. Our work aims to highlight the potential of this new tool of satellite gravimetry, with the addition of topographic correction, to achieve tectonic interpretation of medium to long wavelength of a determined study region. We demonstrate that the new gravity fields can be used for identifying geological boundaries related to density differences, in a regional dimension and thus are a new useful tool in geophysical exploration.