Satelital gravity anomaly and vertical gradient fields corrected by topographic effect aplicated to South Central Andes region.

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Abstract

Mass inhomogeneities inside earth affects external earth gravity field. Satelital gravimetry is highly sensible to this field, so satelital orbit observations are useful for determining different gravity field characteristics. Geodetic satellite missions maps the terrestrial gravity field with growing precision and spatial resolution. Global models based on observations of satellite data plus terrestrial data are available in spherical harmonic expansion with maximum degree and order of 2159 for example (Pavlis et al., 2008). This allows us to study cortical and lithospheric characteristics at regional scale. Gradients of the gravity field highlights main geological features such as volcanic and deposits, sutures, lineaments (Braitemberg et al. in Press). Gravity Gradient tensor (Marussi tensor) is composed by nine elements and is obtained as the second derivatives of the disturbing potential (e.g. Hoffmann-Wellenhof and Moritz, 2005), while gravity anomaly is obtained as the first spatial derivative. For geological mapping the Tzz component is ideal, as it highlights the center of the anomalous mass (Braitemberg et al. in Press).

Vertical gravity gradient and gravity field for south Central Andes are mapped using the global model EGM-2008 (Jank and Sprlak, 2006). The calculation height is 7000m to ensure that all values are above the topography and is made in a spherical coordinate system. The values are calculated on a regular grid of 0.05° grid cell size, with a maximum degree and order equal to 2160 of the harmonic expansion. The topographic effect is removed from the fields to eliminate the correlation with the topography, which is modeled with Smith and Sandwell (2003). Topographic mass elements are approximated with prismatic mass elements in spherical coordinates (Forsberg, 1983). Thus the topography corrected vertical gravity gradient and the topography corrected gravity anomaly are obtained. By comparing with geologic maps and known tectonic structures, clearly highlights the contact between Pacific oceanic crust and Andean Mountains, thrust and fold belt, and Pampean Ranges. The Bermejo-Desaguadero lineament, the Tucuman lineament, and a new lineament that may be the continuation of the ridge between latitudes 26°S and 28°S, can be also clearly depicted.

The gravity gradient correlates well with the geologic map and to known lineaments, adding the advantage of regional area coverage obtained from satelital data, makes this an advanced and powerfull tool that can be used to get new information for understanding the tectonics of the region.

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