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

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Mass inhomogeneities affect the Earth gravity field. The satellite missions CHAMP, GRACE and now GOCE have introduced an extraordinary improvement in the global mapping of the gravity field, either through the orbit monitoring, or through acceleration and gradient measurements at satellte height. Global models based on observations of satellite data plus terrestrial data are available in spherical harmonic expansion with maximum degree and order of 2159 (Pavlis et al., 2008); global models based on the observations of satellite GOCE are available up to degree and order N=250. This allows us to study the crust and lithosphere at regional scale. Gradients of the gravity field highlights main geological features such as volcanic deposits, sutures, lineaments (Braitenberg et al. 2011). The gravity gradient tensor (Marussi tensor) is composed by five independent 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 vertical derivative of the gravity anomaly (Tzz component) is ideal, as it highlights the center of the anomalous mass (Braitenberg et al., 2011).

The vertical gravity gradient and the gravity field for south Central Andes are calculated (Janak and Sprlak, 2006) using the global model EGM-2008. 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. We control the quality of the terrestrial data entering the EGM08 by a comparison analysis with the observations from GOCE. 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. Comparison 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 satellite data. Therefore this is an advanced and powerful tool that can be used to obtain new information for understanding the tectonics of the region.

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