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GOCE data to analyze Moho undulations in Brazil

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The GOCE satellite mission is currently providing Earth's gravity data with unprecedented accuracy and resolution. We quantify the GOCE-data quality over the South America platform through a comparative statistical analysis with a terrestrial dataset EGM2008, (Pavlis et al., 2008; de Sá 2004; Pail et al., 2011). Our results show that in some areas, like the Parecis basin, where the terrestrial data are poor, the GOCE data reveal more details than the previous gravity models. The resolution of GOCE models (80 km half-wavelength at equatorial latitudes) is consistent with the size of Moho structures. The South American plate is a good example where gravity gives a significant contribution in the study of the crust-mantle boundary. Conventional deep refraction seismic methods in an area such as the Paraná Magmatic Province have difficulties in penetrating the deeper crust, due to a thick layer of basalt which is an obstacle to detect the weak signals from the deeper masses below it. Using the spherical harmonic expansion of the GOCE potential field, we correct it for the effect of topography and sediments generating density variations. We proceed with the solution of an inverse gravity problem to map the Moho under the Paraná basin and surrounding area. We include seismological constraints on the Moho (Lloyd et al., 2010) as well as an isostatic Moho-model. We see that in the northern part of Paraná basin the seismologic crustal thickness is greater than 40 km, which is deeper than what would be predicted from gravity and isostasy, taking into account the topographic load and the known sedimentary masses. This would announce a densified body that, if it is located at 40 km depth and has a density contrast of -500 kg/m3 will have a maximum thickness of 13 km. Over the quaternary basin to the west of the Paraná basin, the isostatic, gravity and seismic Mohos are more compatible, demonstrating a different crustal evolution and justifying a normal crust. We conclude that the Moho inversion of gravity observation helps to detect unknown crustal bodies in a region of poor or absent seismic data.

References:

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