Analyzing gravity anomalies over the Caribbean and northern Venezuela tectonic plate boundary

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The tectonic border between northern South-American and Caribbean plates consists of compressive, extensional and strike-slip tectonic regimes and its location is under current debate (Fig. 1). Caribbean plate moves eastwards at a rate of about 2 cm/yr (Mann, *et al.*, 1990, Pérez *et al.*, 2001) with respect to South-American plate. Different theories show the Caribbean Plate as a large basaltic province migrating from west to east since Late Cretaceous-Early Cenozoic times (Pindell, 1994; Meschede and Frisch, 1998). The present eastern border of the Caribbean Plate is the Lesser Antilles subduction zone, where Atlantic oceanic lithosphere subducts at about 4 cm/yr (DeMets *et al.*, 1994). The interaction between Caribbean and South-American plates has generated foredeeps and thrust folds on the continental deformation front observed along the coastline in Venezuela with the oldest located in the west and the recent ones in the east, close to the Orinoco Delta. Allocthonous material has been added and placed onto the Guyana Shield. During this time two important foreland basins has been formed: Barinas-Apure and Oriental Basins. Barinas-Apure is mainly a foreland basin generated by flexural response to the Mérida-Andes Mountain load (Chacín *et al.*, 2005). While the Oriental Basin can be considered as the result of many equally important processes (Jácome *et al.*, 2003): (a) flexural loading of the Cordillera de la Costa Range; (b) large and continuous deposition of continental material from the Guyana Shield; and (c) the subduction dynamics in the east. The deformation zone due to interaction between these two plates goes parallel to Venezuelan coastline and is more than 300 km wide (Audemard, et al., 1997). In the last years different projects have been set up in order to collect geophysical, geological and geodesic data that may help to constraint the understanding of this boundary. At Simon Bolivar University (USB), an investigation about the nature of gravity anomalies over this zone and its implications in terms of sedimentary, crustal and lithopheric mantle bodies is undergoing. A new database has been produced at the USB that consists of more than 90000 gravity stations, comprising about 80000 observations onland and more than 10000 stations offshore (Fig. 2). Gravity anomalies ranges from –250 to 200 mGal, with a prominent low observed in eastern Venezuela associated to the large amount of sediments deposited in the Eastern Basin (Fig. 3). Offshore the trench-type gravity anomaly is observed along the interpreted subduction zone. Different gravity patterns are observed from west to east on the continent, which suggests diverse sources along the same deformation zone in the Caribbean-South-American plate boundary. A final goal is to produce 3D gravity inversion models of the deformation zone constrained by deep wide-angle seismic refraction sections, which has been recently collected and interpreted along four north-south regional transects located close to meridians 70W, 67W, 64W, and 62W (Schmitz *et al.*, 2005). Gravity inversion may be useful in examining different density models and its correlations with available surface geology and geodynamic information.

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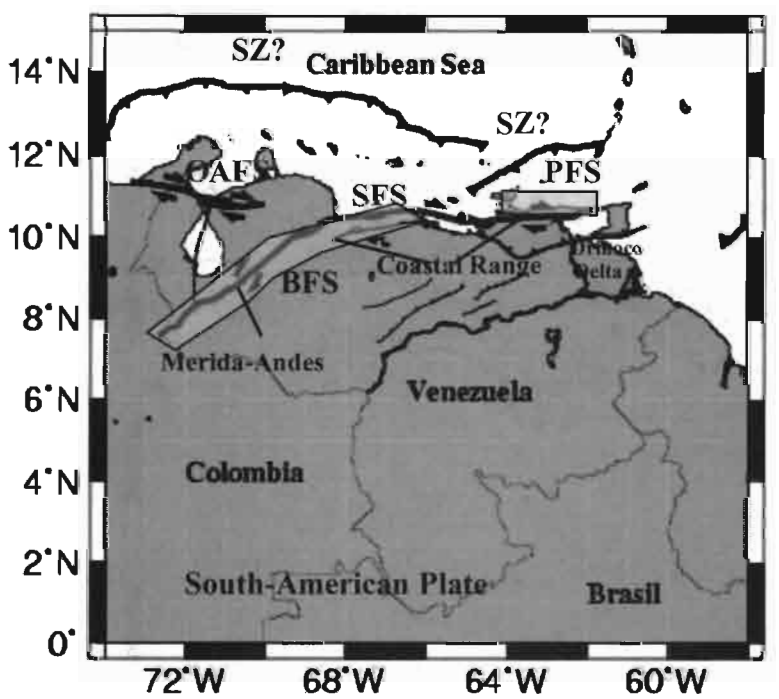

Fig. 1. Location map. Northern South-American plate is tectonically active and mainly 4 right-lateral strike-slip faults systems describe it: Boconó (BFS); San Sebastian (SFS); El Pilar (PFS); Oca-Ancon (OAFS). A possible incipient subduction zone (SZ?) controls Southern Caribbean plate boundary. An important result of the interaction between these two plates is the formation of two main Mountains ranges: Merida-Andes and Coastal Ranges. On the southern flanks they have associated foredeeps basins with active thrusting overlapping.

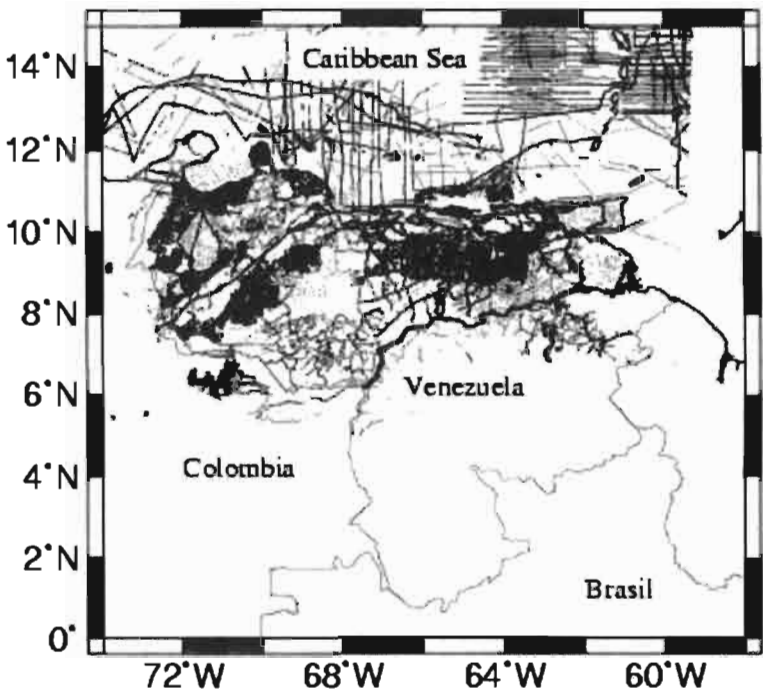

Fig. 2. Map showing gravity stations in the Northern Venezuela and Southern Caribbean Sea. A total of 96844 gravity observations are in the USB database, from which more than 80000 are onshore.

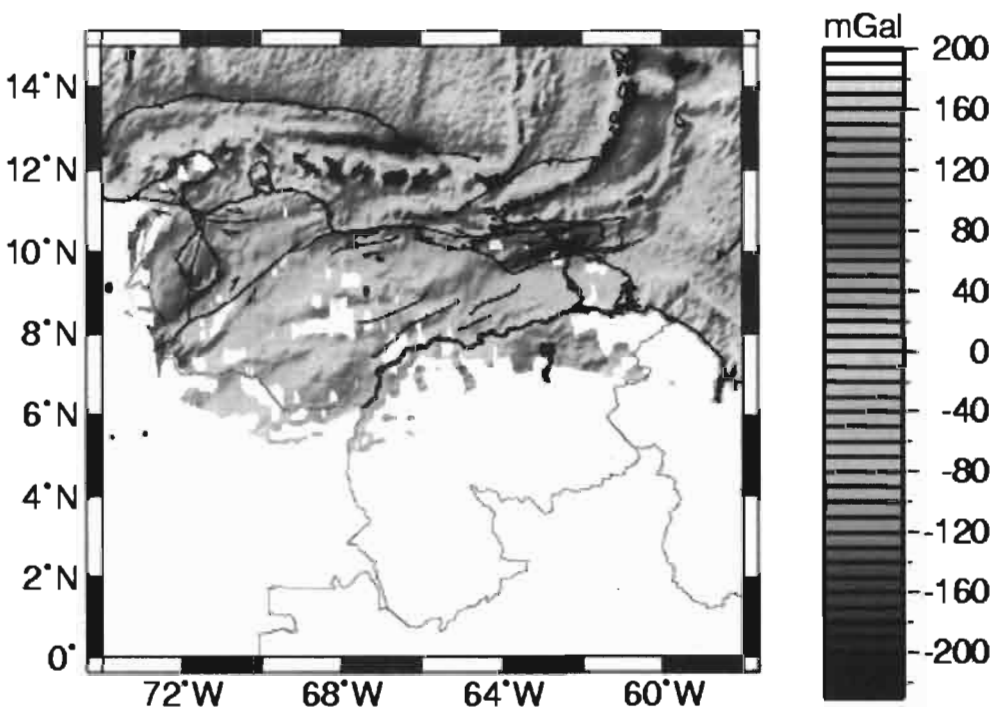

Fig. 3. Gravity anomaly map in Northern Venezuela and Southern Caribbean Sea. Grid spacing is 3mx3m.