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Assesment of SIRGAS Ionospheric Maps errors based on a numerical simulation

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SIRGAS (Sistema de Referencia Geocéntrico para las Américas) is responsible of the International Terrestrial Reference Frame densification in Latin America and the Caribbean, which is realized and maintained by means of a continuously operational GNSS network with more than 200 receivers. Besides, SIRGAS uses this network for computing regional maps of the vertical Total Electron Content (TEC), which are released to the community through the SIRGAS web page (www.sirgas.org). As other similar products (e.g.: Global Ionospheric Maps (GIM) computed by the International GNSS Service), SIRGAS Ionospheric Maps (SIM) are based on a thin layer ionospheric model, in which the whole ionosphere is represented by one spherical layer of infinitesimal thickness and equivalent vertical TEC, located at a fixed height above the Earth's surface (tipycally between 350 and 450 km).

This contribution aims to characterize the errors introduced in the thin layer ionospheric model by the use of a fixed and, sometimes, inappropiated ionospheric layer height. Particular attention is payed to the propagation of these errors to the estimation of the vertical TEC and to the estimation of the GNSS satellites and receivers Inter-Frequency Biases (IFB). The work relies upon a numerical simulation performed with an empirical model of the Earth's ionosphere, which allows creating a realistic but controlled ionospheric scenario, and then evaluates the errors that are produced when the thin layer model is used to reproduce those ionospheric scenarios. The error assessment is performed for the Central and the northern part of the South American continents, where largest errors are expected because the combined actions of the Appleton Anomaly of the ionosphere and the South-Atlantic anomaly of the geomagnetic field.