

# Modeling Ionospheric Total Electron Content over the African Region

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## Abstract

We used ground-based derived Total Electron Content (TEC) from stations of International GNSS Service (IGS) over Africa and equivalent ground-based TEC estimated using CHAMP- and Swarm-based GPS observations to develop a regional TEC model over Africa. The method of estimating equivalent ground-base TEC from CHAMP GPS observations was recently described in Mungufeni et al, 2019 (<https://doi.org/10.1016/j.asr.2019.03.039>). Data of geo-magnetically quiet days ( $K_p < 3$ ) that were archived during the years 2001 – 2016 were used to develop the regional model. However, the data during the years 2002, 2007, and 2013 were reserved for validation of the model. The two data sets (IGS TEC and equivalent ground-based TEC, excluding the validation years) were leveled and then binned according to suitable spatial grids, local time, day of year, and solar flux level. The regional African TEC model was expressed as a product of four functions. The first function represents the variation with time, the second function represents seasonal variation, the third function represented the geomagnetic latitude dependency, and the fourth expressed the solar flux dependency. After formulating the 4 model dependencies, the binned data were then used to determine the model coefficients by non linear regression techniques. In the presentation, we shall discuss the comparisons between TEC generated by our model and the observed TEC that were not used in developing the African TEC model.