

Inter-hemispheric comparison of the ionosphere-plasmasphere system.

N. Bergeot* ^(1,2), J. B. Habarulema ^(3,4), J.-M. Chevalier⁽¹⁾, E. Pinat⁽¹⁾ and, P. J. Cilliers ⁽³⁾

(1) The Royal Observatory of Belgium – Solar Terrestrial Center of Excellence, Brussels, Belgium, e-mail: nicolas.bergeot@oma.be ; jmchev@oma.be, elisa.pinat@oma.be

(2) Université catholique de Louvain, Louvain-la-Neuve, Belgium; e-mail: nicolas.bergeot@uclouvain.be

(3) South African National Space Agency, Hermanus, South Africa; e-mail: jhabarulema@sansa.org.za, pjcilliers@sansa.org.za

(4) Department of Physics and Electronics, Rhodes University, Grahamstown, South Africa

An increasing demand for a better modelling and understanding of the Ionosphere-Plasmasphere system (I/Ps) is required for both scientific and public practical applications using electromagnetic wave signals reflecting on or passing through this layer. This is the case for the Global Navigation Satellite Systems (GNSS, i.e. GPS, GLONASS, Galileo) and for spacecraft designers and operators who need to have a precise knowledge of the electron density distribution.

Additionally, despite the long-term ionospheric studies that have been on-going for many decades, a number of aspects are still complicated to understand and forecast accurately even in mid-latitude regions during quiet conditions. Performing inter-hemispherical climatological studies in European and South African regions should highlight differences/similarities in I/Ps response during different phases of solar activity and geophysical conditions.

In that frame, the Royal Observatory of Belgium (ROB) and the South African National Space Agency (SANSa) started a collaboration named “Interhemispheric Comparison of the Ionosphere-Plasmasphere System” (BEZA-COM). The goal is to provide inter-hemispheric comparison of the I/Ps implying: (1) a characterization of the climatological behavior of the Total Electron Content (TEC) in the I/Ps, over European, South African, Arctic and Antarctica regions; (2) an identification of the mechanisms that regulate inter-hemispheric differences, asymmetries and commonalities in the I/Ps from low to high-latitudes, (3) study of the different responses of the I/Ps during extreme solar events and induced geomagnetic storms in the two hemispheres.

In this paper, the ROB-IONO software [1] is used to reprocess the GNSS data (GPS+GLONASS) of the dense EUREF Permanent GNSS Network (EPN) and South African TRIGNET networks as well as IGS stations for the period 1998-2018. The output consists in vertical Total Electron Content (vTEC), estimated every 15 min., and covering the central European and South African regions. The vTEC is then extracted at different locations (high-, mid- and low-latitudes) and used to constrain empirical models [2] to highlight the climatological behavior of the ionospheric vTEC over Europe and South Africa.

1. Bergeot N., Chevalier J.-M., Bruyninx C., Pottiaux E., Aerts W., Baire Q., Legrand J., P. Defraigne and W. Huang, Near real-time ionospheric monitoring over Europe at the Royal Observatory of Belgium using GNSS data, *J. Space Weather Space Clim.*, 4 A31 DOI: <http://dx.doi.org/10.1051/swsc/2014028>, 2014

2. Bergeot N., Chevalier J.-M., Bruyninx C., Climatological behavior of the ionospheric total electron content over Europe for the period 1998-2014, *EGU General Assembly 2015*, 2015EGUGA..17.6363B, 2015