Review of the manuscript: Modeling of GPS total electron content over the African low latitude region using empirical orthogonal functions

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The paper presents empirical orthogonal function (EOF) based models of total electron content based on GPS TEC and GIM data, as well as a study of trends in TEC over low latitude region of the African sector. The contribution of the paper towards research progress is not clear and I am inviting the author to revise it taking into consideration the following points: 1) Specific objective of the paper, 2) Contribution of the paper to research progress, 3) specification of the new finding in this work. As it is difficulty for the reviewer to evaluate the contribution of this work to already existing works, I recommend a major revision.

Major comments

Comment 1: EOF analysis has been applied to TEC/foF_2 modelling in low and middle latitudes, during geomagnetically quiet and storm conditions, and at regional/global scale (References below).

[1]. A, E., D. Zhang, A. J. Ridley, Z. Xiao, and Y. Hao (2012), A global model: Empirical orthogonal function analysis of total electron content 1999 - 2009 data, J. Geophys. Res., 117, A03328, doi:10.1029/2011JA017238.

[2]. Dabbakuti, J. R. K., & Ratnam, D. V. (2017). Modeling and analysis of GPS-TEC low latitude climatology during the 24th solar cycle using empirical orthogonal functions. Advances in Space Research, 60(8), 1751 - 1764.

[3]. Dabbakuti, J. R. K., & Ratnam, D. V. (2016). Characterization of ionospheric variability in TEC using EOF and wavelets over low-latitude GNSS stations. Advances in Space Research, 57(12), 2427 - 2443.

[4].Mao, T., W. Wan, X. Yue, L. Sun, B. Zhao, and J. Guo (2008), An empirical orthogonal function model of total electron content over China, Radio Sci., 43, RS2009, doi:10.1029/2007RS003629.

[5]. Uwamahoro, J. C., and J. B. Habarulema (2015), Modelling total electron content during geomagnetic storm conditions using empirical orthogonal functions and neural networks, J. Geophys. Res. Space Physics, 120, 11,000 - 11,012, doi:10.1002/2015JA021961.

[6]. Ercha, A., D.-H. Zhang, Z. Xiao, Y.-Q. Hao, A. J. Ridley, and M. Moldwin (2011), Modeling ionospheric f o F 2 by using empirical orthogonal function analysis, Ann. Geophys., 29(8), 1501 - 1515.

[7]. Chen, Z., S.-R. Zhang, A. J. Coster, and G. Fang (2015), EOF analysis and modeling of GPS TEC climatology over North America, J. Geophys. Res. Space Physics, 120, 3118 - 3129, doi:10.1002/2014JA020837.

[8]. Le, H., N. Yang, L. Liu, Y. Chen, and H. Zhang (2017), The latitudinal structure of nighttime ionospheric TEC and its empirical orthogonal functions model over North American sector, J. Geophys. Res. Space Physics, 122, 963977, doi:10.1002/2016JA023361.

In my point of view, the presented work seems to be a repetition of what has been done previously and its contribution towards research progress referring to existing works is not clear. I am suggesting the authors to revise the introduction and include the references provided above and then highlight briefly and concisely their contribution to research progress.

Comment 2: (Page 2, lines: 18 - 19). The authors mention that 2-hour GIM data was interpolated to 1-hour data and it is evident that during interpolation some errors are introduced. I am suggesting the authors to clarify how the interpolation method used in this study has been validated before being applied, and how errors due to interpolation will affect TEC modelling results.

Comment 3: Discussion of the results and conclusions should be revised. The authors should highlight the main findings of the current work referring to previous works.

Minor comments

Comment 1: (Page 3, line 33) The six EOF modes are not elements of the matrix U as stated by the authors. Please remember that EOF modes ($U_j \times C_j$), EOF basis functions U_j and EOF coefficients C_j are different.

Comment 2: (Page 4, lines 4 - 7) "The fluctuations ... dynamics". I disagree with this statement. Please refer to the above suggested works and explain correctly what the basis functions U_j, $j = 2, ..., 6$ are describing.

Comment 3: (Page 4, Figure 1 (a) and (b)) Please clarify in the text that the top left panels of Figure 1 (a) and Figure 1 (b) compare diurnal mean TEC with U_1 and solar flux index with C_1, respectively.

Comment 4: (Page 4, line 16) A period of 0 means a harmonic function of infinite angular frequency. The statement is incorrect.

Comment 5: (Page 4, Table 1) Please specify that the explained variances and cumulative variances are expressed in percentage.

Comment 6: (Page 5, lines 3 - 5) The sentence is wrong. The least square method is used to estimate EOF coefficients from the exact coefficients C_j (and not GPS-derived TEC as mentioned) and model inputs. (Please see Equation 5).

Comment 7: Specify the inputs of the models in section 2.

Comment 8: (Page 7) Comment about the failure/inaccuracy of IRI in predicting TEC during storms. IRI and GPS satellites provide TEC up to 2000 km and 20,200 km altitude, respectively. Comment discuss about this and the plasmaspheric contributions.

Comment 10: (Page 6, Figure 3): Add Kp index as the authors have used it to select quiet days.

Comment 11: (Page 7, Figure 4): Specify in the text that top panels represents Dst index.