Response to review comments #RC3

Comment 1: You mention that from figure 1(b) you can deduce the annual and semi-annual variations. I do not see how you can deduce this. In the figures it can hardly be seen the annual variation.

Response: A Section of the Figure has been magnified and inserted in the top left panel of Figure 1 (b) to make the semi-annual variation clear. The caption of Figure 1 was therefore changed to:
The first six basis functions (a) representing the diurnal variation and their coefficients (b) which show the long-term variation of TEC over MAL2. The red curves in the top left panels in (a) and (b) compare the diurnal mean TEC with the first basis vector U1 and the solar radio flux index measured at 10.7 cm wavelength (F10.7) with coefficients C1 of the first EOF mode respectively. Inserted in the top left panel of (b) is a magnified section of the coefficients C1 for 2002-2003 to show the semiannual and annual variations.

Comment 2: Before section 3.2 you say "...from which the ionosphere owes its existence". I would delete this phrase since it is too strong. And, even if the Sun is the main player here, the ionosphere has many other forcings.

Response: Thank you for the observation. The words "from which the ionosphere owes its existence" were deleted. The sentence was therefore rephrased to:
These coefficients are well correlated with the solar radio flux measured at 10.7 cm wavelength (F10.7), confirming that the main driver of ionospheric variability over Malindi is the changes in the extreme ultraviolet (EUV) radiation. This appears in page 5 lines 4-6

Comment 3: Correlation coefficients run from −1 to 1, so I guess that you have multiplied them by 100 in Table 1. You should mention this in the Table, or divide your numbers by 100.

Response: It is true that the correlation coefficients have been multiplied by 100. A percentage sign was used in Table 1 to point out that the correlation coefficients are in percentages.

Comment 4: Regarding the intercept of 3.2 in Figure 2, may be it is not significantly different from zero. So please, provide its error so we can check this.

Response: Thank you for the suggestion. The error in the slope and the intercept have been included in the regression equation. The root mean square error has also been included in Figure 2(d).

Comment 5: Regarding the long-term trend value in Malindi, you should take into account that the magnetic Equator has a secular displacement, with its consequences in the trough and crests of the EIA. So surely, this may be another trend forcing at this location. You could mention this. It deserves another study which can be easily done for another work. I mean, to check how is the magnetic Equator shifting at the longitude of Malindi during the period here analyzed. See for example Gnabahou, D. A., A. G. Elias, and F. Ouattara (2013), Long-term trend of foF2 at a West African equatorial station linked to greenhouse gas increase and dip equator secular displacement, J. Geophys. Res. Space Physics, 118, 3909–3913, doi:10.1002/jgra.50381.

Response: Thank you for the suggestion. Since the relative contributions of the different trend driving mechanisms at Malindi have not been investigated in this work, we preferred to mention secular variation of the dip angle as a possible driver in the general discussion together with the suggestion in comment 7. This mention appears in page 14 lines 2-4 as
While the geomagnetic control of the trends is either due to the long-term changes in geomagnetic activity (Danilov and Mikhailov, 1999; Mikhailov and Marin, 2000) or through Earth's magnetic field secular variations (Foppiano *et al.*, 1999; Gnabahou *et al.*, 2013). This latter view may explain the latitudinal dependence in the trends over African low latitude region

Comment 6: It is not clear for me what does Figures 6(a) mean. 6(a)i is clear. I think that 6(a) ii, iii, and iv, show amplitude of variation for a certain periodicity. And figure 6(b) shows how this amplitude varies in time. If this is so, you should explain more the spatial variability seen in 6(a) ii, iii and iv, which is not trivial. What does is mean the "counter phase" (blues in come regions and red in others) of the smaller scale of these figures? Another possibility is deleting this part from the paper.

Response: Thank you for the suggestions. Figure 6(a) represent the first four basis modes that explain most of the variation in the data. Figure 6(b) indeed show how the amplitudes (coefficients) of these basis modes change with time. We compared Figure 6(a)(i) with the average TEC (not shown) and we concluded that the first mode is related to the average diurnal TEC. We used the periodicity (alternate blue and red regions) in Figure 6(b)(ii) that possibly represent the equinoxes and the solstice to arrive at a conclusion that the second basis mode in Figure 6(a)(ii) is related to the different seasons. This conclusion is similar to what Ercha *et al.* (2012) observed. The spatial variation seen in 6(a)(iii), clearly suggests that the third EOF basis mode is associated with a phenomena related to the equatorial ionization anomaly. The fourth mode in Figure 6(a)(iv) is quite difficult to identify due to the geometric nature of the EOF modes (Hannachi *et al.*, 2007). We included it in Figure 6 just for completeness. However, since all the above analysis are not much connected to the modeling procedure, we have deleted Figure 6 and all related explanations.

Comment 7: Regarding section 5 dealing with long-term trends I see here the typical pattern of positive and negative trends in the map which could possibly due to the displacement of the magnetic equator there. Again, take a look at the paper by Gnabahou et al. (2013), to see if you can add a short discussion on this possibility.

Response: Thank you for the suggestion. We have added a short discussion in relation to the geomagnetic factor as driver of trends as
"While the geomagnetic control of the trends is either due to the long-term changes in geomagnetic activity (Danilov and Mikhailov, 1999; Mikhailov and Marin, 2000) or through Earth's magnetic field secular variations (Foppiano *et al.*, 1999; Gnabahou *et al.*, 2013). This latter view may explain the latitudinal dependence in the trends over African low latitude region". This appears in page 14 lines 2-4

References

Danilov A. D. and Mikhailov A. V, 1999. Spatial and seasonal variations of the foF2 long-term trends. Ann. Geophys., 17, pp 1239-1243

Ercha A., Zhang D., Ridley A. J., Xiao Z., and Hao Y., 2012. A global model: Empirical orthogonal function analysis of total electron content 1999–2009 data. J. Geophys. Res., 117, p A03328

Foppiano A.J., Cid L and Jara V, 1999. Ionospheric long-term trends for South American mid-latitudes. J. Atmos. Sol.-Terr., 61, pp 717–723

Gnabahou A. D, Elias G. A and Ouattara F, 2013. Long-term trend of f o F 2 at a West African equatorial station linked to greenhouse gas increase and dip equator secular displacement. J. Geophys. Res.: space physics,118, pp 3909–3913

Hannachi A, Jolliffe I. T and Stephenson D. B, 2007. Empirical orthogonal functions and related techniques in atmospheric science: A review. Int. J. Climatol., 27, pp 1119–1152

Mikhailov A. V. and Marin D., 2000. Geomagnetic control of the foF2 long-term trends. Ann. Geophys., 18, pp 653–665