Revision — authors' response

Reviewer's comments:

The paper is very interesting and it is a contribution to IRI-2016 performance, which is always welcome. It uses a statistical technique (EOF) which sometimes is a bit confusing to understand. At least it is my opinion. But overall the paper presents the main differences which are well explained. I have only some additional comments to those made by Reviewer 1.

Main comments:

In page 5 you mention "Figure 2 demonstrates that the daily predicted RMS of IRI-2016 is in good agreement with the daily solar F10.7 index." If the bias is the deviation from GIM, it is not trivial that it should depend on solar activity level. Why is this?

Answer: Fig.2 demonstrates the RMS of bias value of the IRI-TEC and GIM-TEC. Relate research showed that the accuracies of GIM are about 4.0-4.5TECu. Therefore, GIM-TEC data were used as reference values in our study. The ionosphere is ionized by solar radiation, and the correlation coefficient between the global average TEC parameter calculated by GIM and the F10.7 index can reach approximately 0.9. From Fig.2, the ionospheric TEC prediction error of the IRI-2016 model presents a strong correlation with solar activity. We think there are two reasons. On the one hand, when the solar activity is strong, the TEC changes will be more intense. On the other hand, the IRI model does not fully describe the changing characteristics of the ionosphere with solar activity, and this can be verified in the comparison of the later part of the article. In Fig.9, we compared the time variation of IRI-TEC and GIM-TEC based on the same spatial variation component. The solar activity F10.7 index is also given on the figure. The diurnal and semi-diurnal changes of GIM-TEC vary with the F10.7 index, but IRI-TEC values do not reflect this variation characteristics (Figs 9(d), (f), (j), and (l)). The variation of the IRI-TEC is closer to the smoothing effect of the GIM-TEC time variation.

Which is the data used for Figure 3 ? IRI or GIMS ? I do not understand what this Figure shows.

Answer:

The spatial patterns and temporal variations of the global TEC data are separated by EOF decomposition and can be properly represented by the base functions E_k and associated coefficients A_k, respectively. We combined the data to form a whole data set for EOF decomposition and compared the two data sets according eq.(6).

$$\begin{bmatrix} X_{GIM} \\ X_{IRI} \end{bmatrix} = \sum_{k=1}^{N} \begin{bmatrix} E_{k,GIM} \\ E_{k,IRI} \end{bmatrix} \cdot A_k \qquad (6)$$

Then, the GIM-TEC and IRI-TEC can be written and reconstruct as follows.

$$X_{GIM} = \sum_{k=1}^{N} E_{k,GIM} \cdot A_k$$

$$X_{IRI} = \sum_{k=1}^{N} E_{k,IRI} \cdot A_k$$

Therefore, the same coefficients of the EOF base function A_k can be obtained, and were shown in Fig. 3. The spatial patterns of GIM-TEC and IRI-TEC $E_{k,GIM}$ and $E_{k,IRI}$ are shown in Fig.4.

This analysis method allows us to clearly see the difference in the spatial variation patterns of the two sets of data.

Minor correction: At the end of page 3: “University Time (UT)” should be “Universal Time (UT)”

Answer: Yes, it is a mistake. We changed " University Time (UT)" to " Universal Time (UT)" in revised version. Thank you.

Special thanks to you for your good comments and suggestions.