Dear Editor,
We are thankful to the referee 1 for reviewing and helping us to improve this paper. The manuscript has been improved according to the referee's suggestions. In the revised manuscript, the modifications are in the bold letters.
Best regards,

Nadia Imtiaz.

Response to the Major issues:
P.5 L.1 Change “The GEC is the total number of electrons present in the ionosphere at the fixed altitude of about 450 km” to “The GEC is the total number of electrons present in the near-Earth space environment”

Response: In revised manuscript we changed "The GEC is the total number of electrons present in the ionosphere at the fixed altitude of about 450 km” to “The GEC is the total number of electrons present in the near-Earth space environment”.

P.8 L.4 Change “quiet daily variations in blue which are calculated by subtracting the quiet time variations from the value itself. The quiet time variations are computed” To “quiet time daily variations in blue. The quiet time variations are computed...” The quite time daily variations are computed by averaging the quite time data, but not subtracting.

Response: The revised manuscript has been modified as: "The quiet time daily variations are computed by averaging the quiet time data of the five days before the storm having the Kp index below 4 "

P.8 L.23 The figure 4 does not contain “contour plots”, these are vTEC values color coded. I believe, Matlab surf function was used. Please correct the description.

Response: We didn’t use Matlab surf function. The vTEC plots are "contour plots". However, we followed the referee suggestion and removed it.

P.10 L.14 Please clarify where exactly on the plot a reader can see the first (1:08 UT, September 8) of H component at MBO to be strongly negative. Also please make sure ‘however’ must be used, as both the first and the second statement say: “is strongly negative”. From the plot provided, it can not be read the described details. A solution might be to indicate the peaks (“dips”) with the arrows on the plot.

Response: In the revised manuscript the correction has been made. The first dip (at 1:08 UT on September 8) of the H component is strongly

negative for GUA as compared to MBO and KOU. However, the second dip (at 13:56 UT on September 8) of the H component is strongly negative for MBO as compared to GUA and KOU.

P.11 L.4 From the Figure 5, it can be clearly seen that H component at GUA drops below -150 nt (around 170-180), that is inconsistent with what is written. Please clarify.

Response: In the revised manuscript the following correction has been made: Overall, the largest disturbance of the H component of the magnetic field with amplitude −180 nT is observed at **GUA** as compared to −150 nT at **MBO** and −140 nT at **KOU.**

Typos/Corrections:

In the revised manuscript the following Typos/Corrections have been made:

Figure 4: It would be logical to have Pacific sector coming first, as the increase (a peak) in TEC is moving rightward, according to the local time of the sector.

Response: The plots in Figure 4 has been arranged in the logical order according to the local time of each sector.

Figure 5: The y label has Sh, while the legend shows Sq. Please harmonize them.

Response: The discrepancy in the label and legend in Figure 5 has been removed.

Figure 5 Title: Change “the ionosphere disturbance current” to “the variations due to disturbed ionospheric currents”

Response: In the Caption of Figure 5, “the ionosphere disturbance current” has been changed to “the variations due to disturbed ionospheric currents”.

Everywhere: remove space between Δ and parameter name, e.g. “Δ REC” – “ΔREC”

Response: In the revised manuscript, a space between Δ and parameter name GEC/REC has been removed.

P.2 L.18 Change “International Ground Station (IGS)” to “International GNSS Service (IGS)”

Response: In the revised manuscript, “International Ground Station (IGS)” has been replaced with “International GNSS Service (IGS)”.

P.4 L.1 Change “three different longitudinal sectors” to “four different longitudinal sectors”

Response: In the revised manuscript, “three different longitudinal sectors” has been changed to “four different longitudinal sectors”.

P.4 L.24 Change “among them the AE index, the Ap index, the Kp index and SYM-H” to “among them are AE, Ap, Kp and SYM-H indices”

Response: In the revised manuscript, “the AE index, the Ap index, the Kp index and SYM-H” has been changed to “among them are AE, Ap, Kp and SYM-H indices”.

P.4 L.27 Add space into “Data: The” – “Data: The”

Response: In the revised manuscript, a space has been added “Data: The”.

P.4 L.27 Change “International GNSS Service Global Ionosphere Map” to “IGS Global Ionosphere Map (GIM)”.

Response: In the revised manuscript, “International GNSS Service Global Ionosphere Map” has been changed to “IGS Global Ionosphere Map (GIM)”.

P.4 L.27 Change “data that are available in the standard IONEX format” to “data available in IONEX format”

Response: In the revised manuscript, “data that are available in the standard IONEX format” has been changed to “data available in IONEX format”.

P.4 L.28 Remove “; i.e., Crustal Dynamics Data information system”

Response: In the revised manuscript, “; i.e., Crustal Dynamics Data information system” has been removed.

P.4 L.29 Remove “These IONEX files contain the vTEC data for the entire globe. For any time, the vTEC data can be obtained from IONEX files at the time resolution of 2-h.” As GIM maps with 15-min time interval are used in the study.

Response: In the revised manuscript, “These IONEX files contain the vTEC data for the entire globe. For any time, the vTEC data can be obtained from IONEX files at the time resolution of 2-h.” has been removed.

P.5 L.2 Change “the vTEC values” to “vTEC values”, change “UPC-GIM” to “UPC GIM”

Response: In the revised manuscript, “the vTEC values” has been changed to “vTEC values”, changed “UPC-GIM” to “UPC GIM”.

P.5 L.5 Change “of a certain GIM cells.” to “of a certain GIM cell.”

Response: In the revised manuscript, “of a certain GIM cells.” has been changed to “of a certain GIM cell.”

P.5 L.6 Change “is about” to “is”

Response: In the revised manuscript, “is about” has been changed to “is”.

P.5 L.6 Change “UPC-GIM” to “UPC GIM”

Response: In the revised manuscript, “UPC-GIM” has been changed to “UPC GIM”.

P.5 L.17 Add space into “observatories.In” - “observatories. In”

Response: In the revised manuscript, a space has been added into “observatories.In” as “observatories. In”.

P.5 L.23 Change “current Cole (1966)” to “current (Cole, 1966)”, change “It can be calculated” to “It can be estimated”

Response: In the revised manuscript, “current Cole (1966)” has been changed to “current (Cole, 1966)”, and “It can be calculated” has been changed to “It can be estimated”.

P.5 L.23 Change “.” in the formula to the multiplication sign “·”

Response: In the revised manuscript, the correct mathematical symbol has been used for multiplication.

P.6 L.2 Change “.” in the formula to the multiplication sign “·”

Response: In the revised manuscript, the correct mathematical symbol has been used for multiplication.

P.6 L.2 Define ΔH

Response: In the revised manuscript, we have defined the variation in the H component of the magnetic field which is given as $\Delta H=H-H_o$.

P.6 L.7 Remove ”mainly”

Response: In the revised manuscript, “mainly” has been removed.

P.6 L.10 Remove “3 h”

Response: In the revised manuscript, “3 h” has been removed.

P.6 L.11 Change “lead to a minor geomagnetic storm” to “lead to minor geomagnetic storms”

Response: In the revised manuscript, “lead to a minor geomagnetic storm” has been changed to “lead to minor geomagnetic storms”.

P.6 L.23 Change “in northward” to “is northward”

Response: In the revised manuscript, “in northward” has been changed to “is northward”.

P.7 L.2 Change “The IEF is the Ey component” to “The Ey component of the IEF”

Response: In the revised manuscript “The IEF is the Ey component” has been changed to “The Ey component of the IEF”.

P.7 L.6 Change “CME1,” to “the first CME”

Response: In the revised manuscript “CME1,” has been changed to “the first CME”.

P.7 L.9 Change “CME2,” to “the second CME”

Response: In the revised manuscript “CME2,” has been changed to “the second CME”.

P.7 L.10 Remove “for 3 h”

Response: In the revised manuscript, “for 3 h” has been removed.

P.8 L.23 Change “IGS-GIM” to “UPC GIM” (if these were UPC GIMs).

Response: These are IGS GIM.

P.9 L.5 Change “magnetically equatorial region” to “magnetic equator region”

Response: In the revised manuscript “magnetically equatorial region” has been changed to “magnetic equator region”.

P.9 L.19 Change “An enhancement in the vTEC particularly, in the crests regions of the EIA are” to “An enhancement in the vTEC, in particular in the crests regions of the EIA, is”

Response: In the revised manuscript “An enhancement in the vTEC particularly, in the crests regions of the EIA are” has been changed to “An enhancement in the vTEC, in particular in the crests regions of the EIA, is”.

Dear Editor,
We are thankful to the referee 2 for reviewing and helping us to improve this paper. The manuscript has been improved according to the referee's suggestions. In the revised manuscript, the modifications are in the bold letters.
Best regards,

Nadia Imtiaz.

Main comments:

1) **Readability of the manuscript has increased but need to be improved. Several typos and inaccuracies are present also in the revised version. I encourage the author not to make only the corrections suggested by the reviewers but also to critically re-read the manuscript, possibly asking some colleague.**

   Response: With due apology, it is stated that English is not our native language. We have tried our level best to improve the manuscript and consulted some of our colleagues to help us in improving the manuscript.

2) **The Introduction is very heavy to read and does not provide the reader a clear picture of the problem that is addressed by the manuscript, this part needs a thorough review. A lot of previous studies are listed without logical links and a logical sequence; it appears like a mere list of papers. Moreover not all of them are pertinent with the topic of the manuscript. Maybe some part could be removed and some other moved in the "Results/Discussion" section. Some suggestions are present in the annotated manuscript, but do not limit to them.**

   Response: In the revised manuscript, the introduction has been shortened (less than 3 pages) and studies are linked logically.

3) **Section 2 should be renamed for instance "Data sets" into "Data and Analysis", "Results/Discussion" into "Results and Discussion".**

   Response: In the revised manuscript Section 2 and 4 have been renamed as "Data and Analysis" and "Results and Discussion".

4) **"Data sets" section should be structured in a "narrative" form rather than in a "list" form. Moreover, this section does not give important information as the time sampling of the data used, the presence of gaps and the quality of data in general, the list of solar wind parameters used.**

   Response: In the revised manuscript the Data and Analysis"

section has been structured in a narrative form instead of listing.

5) **“Data sets” section: Formulas used in the part devoted to geomagnetic data are not rigorous. As they are, they are relations among constants and not among time varying quantities, time t or an index is missing. Moreover these formulas need to be check (see Kashcheyev et al.) being one of them wrong (more details in the annotated pdf).**

Response: In the revised manuscript, the discrepancies in the formulas have been removed by rechecking the published study of Kashcheyev et al.

6) **Page 6, lines 10-15. The sentence “The arrival of this CME caused a significant compression to the day side magnetosphere which provoked a severe geomagnetic storm...” This is not correct, the only compression of the magnetosphere due to the arrival of the CME is not sufficient to generate a geomagnetic storm”.**

Response: In the revised manuscript, the sentence “The arrival of this CME caused a significant compression to the day side magnetosphere which provoked a severe geomagnetic storm...”has been corrected as: “The arrival of this CME caused a significant disturbance in the magnetosphere which leads to a severe geomagnetic storm having maximum value of the geomagnetic index Kpmax = 8.”

7) **The plots of Figure 1 need to be reordered. Solar wind parameters/IMF are mixed with geomagnetic indices. I suggest to group, for instance on the top, the plots of Bz, Vsw and Ey, then F10.7 and all the remaining indices.**

Response: In the revised manuscript, the plots of Figure 1 have been reordered according to the referee’s suggestions.

8) **The section case study describe the behavior of the single quantities plotted in Figure 1 but do not explain the physics, as far as concerns the present knowledge, underlying the observed behavior.**

Response: The case study contains a brief description of the space weather events and the resulting variations in plasma and magnetic field parameters occurred during September 4-14, 2017. We have explained the underlying physics in the Results and Discussion section.

9) **In Results/Discussion section, to calculate DGEC and DREC the**

quiet values of GEC and REC are defined through Ap index. Why do the authors now refer to this index and not to Sym-H or Kp, that have been already used. It is necessary to introduce another index? Where do the value of 22 nT, considered as a threshold, come from?

Response: In the revised manuscript, we have removed the Ap index and considered quiet days on the value of Kp<3.

10) **Figure 2. Since the authors talk of DGEC before of DREC, the order of the two plots should be inverted. Moreover, Figure 2 shows SymH not AE as written in the main text. Which is right? Text or figure? Please correct the one that is wrong.**

Response: In the revised manuscript, the order of ΔGEC and ΔREC plots have been reverted. The bottom plot is SYM-H index, the text of Figure 2 has been corrected.

11) **On the discussion of Figure 2. Features observed in DGEC and DREC are related to features of the AE index. The AE index do give an idea of the energy transfer from the solar wind to the magnetosphere but it is highly representative of phenomena occurring at the high latitudes while this paper deals with mid-to-low latitudes. How phenomena occurring at mid-to-low latitudes can be explained in terms of high-latitude ionosphere dynamics and hence of AE index?**

Response: The AE index indicates the storm time energy inputs from the solar wind to the magnetosphere. The auroral region is the region of the strong coupling between the interplanetary medium, the magnetosphere, the thermosphere and the ionosphere. The storm time enhanced auroral electric currents can drive the equatorward thermospheric winds via joule heating and the momentum transfer. The thermospheric winds extending from the auroral to the mid and low latitudes produce strong daytime ionization and hence, increase the electron content.

12) **Page 8, line 30. What the authors mention here is not accurate. Indeed, the intensification of the EIA is present also before the geomagnetic storm in the Pacific (5 September) and African sectors (6 September), while in the Asian sector the pattern of vTEC is does changes dramatically from 4 September to 11 September.**

Response: In the Asian sector, the vTEC exhibits a regular behavior. Everyday we observe well-defined crests of the EIA except on September 8. On the day of the storm, a strong

intensification of the vTEC with a complex pattern can be observed in the Asian sector. On September 10, the pattern returns to the normal form as it was before the storm. An irregular pattern of the vTEC can be seen in Pacific, African and American sectors during the period September 4-14, 2017.
On September 5 and 11, the amplitude of the vTEC at crests of the EIA is higher than that on the days prior to the storm (September 4). The observed intensification of the vTEC can be attributed to the HSSWS effect.

13) **Figure 5. Since here the authors have plotted all but Hm components of the observed magnetic field (i.e. Diono and Sq), I suggest to add also Hm.**

Response: In Figure 5, we have plotted three components; i.e., H, Diono and Sq. Here our focus is to study the storm time response of the H component.

14) **Page 11, lines 11-17. The part on the observation of O/N2 is not convincing and not essential for the manuscript. First of all, the authors dedicate to this part about 1/3 of the abstract and a very minimal part of the manuscript. In these lines the authors talk of a significant decrease, but how do they objectively measure this significance? It is not possible to discern it only by looking at the maps that, on top of that, do not show very evident changes in the colour.**

Response: By considering the referee's point of view about O/N2 observation, we have removed O/N2 observation part from the revised manuscript.

Note: We have incorporated the minor and major comments made by the referee directly on an annotated pdf.