Dear Dalia Burešová,

The Authors are grateful for the valuable recommendations, which have allowed the Authors to greatly improve the quality of the manuscript.

All changes in the manuscript are marked in yellow.

As time goes by, new interesting results are being published. Thus, the Authors have enlarged the review part of the paper and have added the reference to the paper [Habarulema, J. B., Katamzi-Joseph, Z. T., Burešová, D., Nndanganeni, R., Matamba, T., Tshisaphungo, M., Buchert, S., Kosch, M., Lotz, S., Cilliers, P., and Mahrous, A. (2020). Ionospheric response at conjugate locations during the 7–8 September 2017 geomagnetic storm over the Europe-African longitude sector. *J. Geophys. Res.: Space Physics*, 125 (10), e2020JA028307, https://doi.org/10.1029/2020JA028307, 2020]

A list of changes and a rebuttal against each point, which has been raised by Topical Editor in Comments to the Authors.

Topical Editor Decision: Publish subject to revisions (further review by editor and referees) (18 Mar 2021) by Dalia Buresova

Comments to the Author:
Dear author, dear co-authors,

(1) Comment to the Authors:

The manuscript contains the results of interesting measurements and provides information about the effects of an ionospheric storm on the propagation of radio waves over a certain locality, which is useful information for the scientific community. Unfortunately, in its current form, the article still gives the impression of inconsistency: a large amount of diverse information without proper interpretation and discussion.

Authors' reply:

According to D. Burešová "… the article still gives the impression of inconsistency…". This is a seeming contradiction. In fact, the authors have performed sufficiently detailed analysis of the solar wind parameters, the state of space weather, the parameters of the geospace storm and its components, i.e. magnetic and ionospheric storms. Further, the effect of the ionospheric storm on the Doppler spectra and signal amplitudes for 11 radio wave propagation paths is described in detail. Such an analysis is fully consistent with the goal we have address in this study, and which, as it seems to us, has been fully achieved.

(2) Comment to the Authors:

Please, clarify for yourself what was the main goal of your research, the results of which you wish to publish. In your responses you stated that "The subject of this study is the influence of the ionospheric storm on the characteristics of HF radio waves propagating over the area of the People's Republic of China". If this is indeed the case, please focus particularly on this goal. Then it is not necessary to analyze in detail the individual solar and geomagnetic parameters of the storm, because in the article you do not analyze how this or that specific parameter affected the observed changes in the propagation of radio waves. On the other hand, in the manuscript we are reading "This study provides general analysis of the 30 August–2 September 2019 geospace storm, the analysis of disturbances in the geomagnetic field and in the ionosphere, as well as the influence of the ionospheric storm on

the characteristics of HF radio waves over the People's Republic of China." If you are analysing both the storm occurrence, its course and the effects on HF radio wave propagation, then you should give information on storm characteristics, discuss the physical mechanism of storm behaviour and also how individual features/parameters of the storm affect the propagation of radio waves.

Authors' reply:

Our goal is twofold: the analysis of the storms and disturbances in the characteristics of radio waves. These are two sides of the same coin. Using the perturbations in the characteristics of the radio waves observed, we judge about dynamic processes in the ionosphere.

It is well-known fact that negative ionospheric storms are accompanied by a significant decrease in the electron density, when the level of reflection shifts upward in altitude by tens or even hundreds kilometers. Furthermore, storms generated AGWs that modulate the electron density and the Doppler shift of frequency. Both of these are manifested in the signal amplitude (see Table 2 added to the manuscript).

In reality, we could not have analyzed such questions as "how this or that specific parameter affected the observed changes in the propagation of radio waves" and "how individual features/parameters of the storm affect the propagation of radio waves".

The main reason for this is the paucity of authors' observations, only the Doppler data collected in the bottom-side F region over just a spot on the globe, and only during nighttime.

To give answers to such questions as "how individual features/parameters of the storm affect the propagation of radio waves", one must have the data on the specific processes that have really acted in the vast expanse between the solar wind and just a spot on the globe over China.

Of course, the authors could have re-written a general scheme for the processes acting during ionospheric storms. This scheme is well-known and is taught to students (e.g., Section 11.16 in the textbook by Robert W. Schunk and Andrew F. Nagy, Ionospheres Physics, Plasma Physics, and Chemistry, Second Edition, CUP, 2009).

However, the presentation of common knowledge from a textbook in a scientific paper is not adding anything valuable except for just academic speculation.

Now regarding the title of the paper.

At first, the title of the paper was "*Dynamic processes in the magnetic field and in the ionosphere during the 30 August–2 September, 2019 geospace storm*" Then the Topical Editor suggested to incorporate into the title something regarding radio waves, which resulted in the second title "*Influence of 31 August – 1 September, 2019 ionospheric storm on HF radio wave propagation*". After this change, we must "clarify for yourself what was the main goal of your research, the results of which you wish to publish". Now, we propose to combine both these titles as follows:

" *Dynamic processes in the magnetic field and in the ionosphere during the 30 August–2 September, 2019 geospace storm: Influence on HF radio wave characteristics*"

(3) Comment to the Authors:

Recently, your Conclusions are focused mostly on the storm classification, parameters and changes in the ionospheric parameters. There is no convincing summary/findings on the effects on the radio wave propagation. The only finding on HF wave propagation you gave here is that "In the course of the ionospheric storm, the altitude of reflection of radio waves could exhibit sharp increases from ~150 km to ~300–310 km". However, in your response you mentioned that this could be due to ionospheric transition from the day to the night time. Yes, it seems to be a most possible reason.

To see the effects of the storm on the reflexion height, you should compare measured values with the mean values of the reflexion heights (or the values for quiet days) for the same time period.

Authors' reply:

We have described the main characteristics of storms: their duration, moments of beginning and end, their strength (energy), individual features.

We have added section 7.3.4 and a Table 2 to the Discussion section, where the variations in the characteristics of radio waves are described in detail.

We have emphasized that at night the influences of the ionospheric storm on the characteristics of HF radio waves are exhibited more strongly, since the radio waves are reflected in the more disturbed F-region of the ionosphere.

To identify storm effects, we compared measurements for disturbed days (August 31 and September 1, 2019) with measurements for a quiet day (August 30, September 2 and 3, 2019).

(4) Comment to the Authors:

In the Conclusions you also stated that "The geospace storm acted to notably disturb the ionospheric E region, as well as sporadic Es layer." The Es layer is sporadic layer. It could appear during the storm, but this is not a rule. It could be formatted under quiet conditions during different seasons or time of the day and could have different duration. What you have observed, are changes in the critical frequency foEs (again, comparison with mean values or quiet time values would be useful).

Authors' reply:

Regarding the Es layer. We can only assert that during the period of the ionospheric storm, the foEs frequency increased from 3 MHz to 6–7 MHz. In the abstract and conclusions, we added that this is **possibly** related to the storm.

(5) Comment to the Authors:

Abstract and Introduction: You have newly introduced a statement "The concept that geospace storms are comprised of synergistically coupled magnetic storms, ionospheric storms, atmospheric storms, and storms in the electric field originating in the magnetosphere, the ionosphere and the atmosphere (i.e., electrical storms) was validated a few decades ago." This is correct. Nevertheless the another sentence in the abstract says that "The geospace storm was accompanied by a moderate to strong negative ionospheric storm", what evocates that ionospheric disturbances are out of the "synergistically coupled" system. Please, make a correction, for example "…during this geospace storm significant negative ionospheric effects were observed above China…" or so (the same for Conclusions)

Authors' reply

Quite an embarrassing error in our English. Indeed, the word "accompanied" does not belong in this phrase. Thank you very much.

We have removed the phrase "'The geospace storm was accompanied by…"everywhere in the manuscript.

Some remarks with regards to previous comments:

(6) Remark (1) to the Authors:

Remark with regards to previous comment **(8)**:

(8) Comment to the Authors:

"The main feature of this geospace storm is its duration, of up to four days."(between lines 70-75). The duration of storms could be quite different depending on driver (from several hours up to 8-10 days).
Authors' reply:
We have made a more accurate as "One of the interesting features of this geospace storm is its duration, of up to four days."
Dear authors, I could not agree with the change you made in the sentence above ("interesting" instead of "important"). The duration of the storm in this case is not exceptional or interesting, so there is enough to state that the storm lasted four days.
The same is true for the comment (9)

Authors' reply

We have omitted all phrases containing the duration of the storm as their feature.

(7) Remark (2) to the Authors:

Remark with regards to previous comment **(9)**:
(9) Comment to the Authors:
"Thus, this magnetic storm had the longest duration observed over the last few years,…" (part 135-140).
This statements is also doubtful.
Authors' reply:
We have made a more accurate assertion: "Thus, this magnetic storm was seen to be of quite a long duration over the last few years, ".

Authors' reply

We have omitted all phrases containing the duration of the storm as their feature.

(8) Remark (3) to the Authors:

Again, as for its duration the storm you have analysed is not exceptional when you consider that it is a storm of CIR-origin. Usually these storms have longer (more than four days) duration when comparing with those CME-related storms and the total energy input into Earth's upper atmosphere could also be larger. Going back into last few years we had several storms with similar or longer duration both CME- or CIR-related (e.g. June and March 2015; March, May, July, September, November 2017; April, August 2018)

Authors' reply

We have omitted all phrases containing the duration of the storm as their feature.

(9) Remark (4) to the Authors:

Remark with regards to previous comment:

Please, try to modify the article once again in the light of the reviewers' recommendations. The work contains interesting experimental results. It would be good to organize the results logically, put them into context and discuss them appropriately. Then the article will be understandable and beneficial for the reader.

Authors' reply:

The authors have tried to give answers to all Topical Editor's comments.

Kindest regards

Yours cordially
Dalia Buresova

Best regards,
Authors.