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# *Interactive comment on* "Geomagnetic pulsations in the Pc5/Pi3 frequency range and fluctuations of foF2 frequency" *by* Nadezda Yagova et al.

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Dear referee, thank you very much for helpful comments. A point-by-point answer is given in the window and a colored version is put as a supplementary file.

The paper presents several puzzling results: The occurrence of speciïňĄc Pc5 oscillations with coherent ionospheric and geomagnetic pulsations, where the relative ionospheric response $\Delta N/N$ is about order of magnitude larger than the relative amplitude of a driver $\Delta B/B$. These speciïňĄc oscillations are supposedly associated with global magnetospheric oscillations driven by the solar wind quasiperiodic ïňĆuctuations. However, in presented events, the satellites were in a different sector of the magnetosphere as compared with ground station. The paper could not ïňĄnd a con-



sistent description of these observations, but it is stimulating that these possibilities have been raised. In particular, antiphase plasma and magnetic pressure variations recorded by satellite, contradicts the assumption on global fast compressional mode responsible. The smallscale mode (highm) hardly can be responsible for global pulsations. To conïňĄrm the global character of oscillations, additional satellite (e.g., GOES) and ground stations should be used in further studies.

Actually, high azimuthal wave number does not contradict to a possibility of global scale of oscillations. A far, as we know now direct observations of global high-m pulsations have been reported only for storm-time pulsations (Le et al., 2017). We plan to study pulsations found in the present study to discriminate between properties of quiet-time pulsations and those developed at storm-time using a more dense "network" of satellite observations, which became available after MMS launch in 2015. Besides, measurements of differential electron flux at GOES can give information about association of observed pulsations to one of kinetic modes, such as drift-compressional. However, these problems require separate studies. In the present MS, we have extended the Discussion section and where these points are now briefly discussed, e.g.

"At first glance, there is a contradiction between small azimuthal scale in the magnetosphere and high coherence between magnetic pulsations at THEMIS and foF2 fluctuations at SOD. However, high m does not obligatory correspond to a narrow sector in MLT, where the wave exists. It only means that the phase changes quickly in azimuthal direction. An example of global observations of high-m pulsations has been reported by Le et al. (2017). Their observations corresponded to pulsations at a recovery phase of the magnetic storm. The event 4 in the present study also developed at the recovery phase. The question about conditions necessary, or at least favorable, for such pulsations and about physical mechanisms, which provide wave transport, should be a subject of a special study." ... "The wave properties found for the event 4, as well as statistical analysis of wave parameters, show features of both pure compressional or kinetic with a pronounced compressional component modes and Alfven modes. This can be a result of coupling between different modes in a non-uniform plasma (see e.g. Klimushkin and Mager (2015) and references therein). Next steps of experimental study can be done with more dense "network" of satellites in the magnetosphere, which has become available after MMS launch in 2015. Besides, measurements of differential particle flux at GOES can give information about association of observed pulsations to one of kinetic modes."

A picture with coherent variations of THEMIS-D magnetic pulsation and electron flux measured at GOES-13 separated by 4.5 hours from THEMIS – D during the event 4 is given below as an illustration.

Minor comments

1) In the equation (1) dimensionless expression for altitude h is desirable. – done

2) In Subsection 3.2.2, a description of THEMIS positions, for which the results are shown in Figure 20, is necessary. At least, L values and separation in MLT from SOD should be provided.

A picture of footprint distribution for THEMIS-D in CGM coordinates is included (Figure 20) and a description of relative position of THEMIS footprints and SOD is added to the text.

3) Line 140 the end of the subsection. The decrease of probability at high geomagnetic activity may be the artifact of the method because it contradicts to the analysis cited in the m/s. This result should be discussed in a more explicit way to avoid misunderstanding.

Now a desctiption is given in the following redaction:

"Actually, the selection procedure, used in the present study to detect intervals with clearly seen foF2 fluctuations, is limited by quiet and moderately disturbed geomagnetic conditions. This leads to low probabilities to detect foF2 fluctuations at Pc5/Pi3 frequencies under highly disturbed conditions. This result naturally follows from the



condition of existence of clear layer structure, necessary for the pulsation detection procedure. During geomagnetic storms detection of the foF2 variations is often impossible because of enhanced ionization in the lower ionospheric layers (E and/or D)".

4) Line 98: MHZ > MHz

done

5) abbreviations like FP in Table 1, and notations for variables should be explained, when they occur in the text for the ïňĄrst time.

done

6) in the introduction, authors reviewed the papers where modulation of the ionosphere by Alfven waves were treated. For completeness, it would be helpful to mention the possibility of the ionosphere modulation by fast compressional mode [Vorontsova, E., et al., Modulation of total electron content by global Pc5 waves at low latitudes, Advances in Space Research, 57, N1, 309319, 2016, doi: 10.1016/j.asr.2015.10.041].

The citation is added to Introduction

"Observations of pulsations in the total electron content (TEC) are rather rare (Pilipenko et al., 2014a, b; Watson et al., 2015; Vorontsova, 2016)" . . . "An effect of TEC modulation by ULF wave at low latitudes reported by Vorontsova (2016) is important because it is observed far away from the resonant L-shells and zones where kinetic modes can occur due to wave-particle interaction. This allows to identify observed pulsations as fast magnetosonic mode".

References

Le, G., et al.: Global observations of magnetospheric high-m poloidal waves during the 22 June 2015 magnetic storm, Geophys. Res. Lett., 44, 3456–3464, doi:10.1002/2017GL073048, 2017.

Please also note the supplement to this comment:
https://www.ann-geophys-discuss.net/angeo-2019-155/angeo-2019-155-AC2-supplement.pdf

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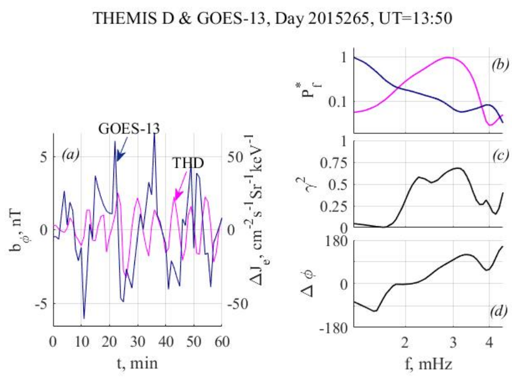


**Fig. 1.**