Anonymous Referee #1

Major Comments Line 161-204, Examples. The spacecraft and the ground station are vastly separated. Unless there are other observations at different locations in the magnetosphere and on the ground, it is difficult to evaluate if there is any causality between the oscillations in space and on the ground.

Firstly, we agree, that we cannot discriminate between different mechanisms and physical agents, which provide wave transport from the magnetosphere to the ionosphere. At the present stage, using the data of magnetic field and plasma pulsation phase parameters, we can only suggest that it can be some combination of coupled Alfven and one of kinetic modes, such as drift-compressional one. Secondly, in spite of the difference in MLT, the coherence between the pulsation in the magnetosphere and ionosphere in some cases is surprisingly high, which implies causality. This may be a good subject for subsequent study.
We are going to include these issues into Discussion section such as:
"Counter-phase variations of magnetic field and plasma pressure during event 4 are typical for compressional mode. However, the occurrence of the event 4 at recovery phase of a geomagnetic storm, satellite position in the outer magnetosphere, and high azimuthal wave number allows to attribute this pulsation in the magnetosphere to one of kinetic modes, such as drift-mirror (Pokhotelov et al., 1985) or drift-compressional (Mager et al., 2013). Its propagation at long distances in azimuthal direction can be a result of drift population of fast particles, modulated by a wave".
"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."

During event 4 (13501450 UT, 22 September (DoY = 265) 2015, THEMISD and THEMISE were in the postmidnight sector at radial distances of 12 Re, whereas the SOD station was in the postnoon sector. According to my calculation, the magnetic local time separation of the two spacecraft was 0.25 degrees. Therefore, the pi/4 phase difference of the b// oscillations at the two spacecraft (line 222) translates to an azimuthal wave number of 180. With such a high azimuthal wave number, it is impossible to have any coherence over the vast distance between SOD and THEMIS. I find the discussion on the spaceground coherence given in this section to be highly questionable.

We have a little different result for the azimuthal wave number, probably due to a different technique, used for calculations. According to https://sscweb.gsfc.nasa.gov/ results, summarized in Table 2, the difference in CGM longitude is 0.5 degrees. If we do not take into account possible influence of azimuthal difference due to L-shell difference, which occur near resonant L-shell, $\pi/4$ phase difference corresponds to azimuthal wave number m=90. Nevertheless, it is really very high. However, it is not obligatory mean that the wave exists only in a very narrow sector. Le et al. (2017) report on observation of globally observed high-m waves. The discussion of this problem will be added to the Discussion section such as:
"Below, we present a more detailed analysis of wave properties for the event 4. Figure 22 presents magnetograms for field-aligned component at THEMIS-D and E satellites. Although the distance between the two satellites is only 0.5 Re, and the distance between their footprints does not exceed 0.5◦ both in latitude and in longitude, the phase difference is about $\pi/4$. If we do not take into

account possible influence of azimuthal difference due to L-shell difference, which occur near resonant L-shell, π/4 phase difference corresponds to azimuthal wave number m = 90. 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."

Minor Comments

Multiple lines. Please use the standard date format "24 October 2014", or "24 October (day 297) 2014." This makes it easy for the interested readers to look at other data for comparison.

The date format is changed everyhere in the text and figure captions

Line 38-39. Consider revising the punctuation. "This makes routine techniques based on the estimates at a given frequency altitude nonstable, even in cases when visual detection is possible."

The sentence is rewritten in the following way:

"Because of these reasons, routine techniques of automatic foF2 detection can become unstable, even when visual detection is possible".

Line 51. What is 4D cross? – the phrase is reformulated, such as

"As four fitting factors are used, a 9-point iteration procedure is organized and a parameter ... is maximized over the "cross" in space of parameters $Kt(x0,x0-\Delta xi,x0+\Delta xi)$, where x is a point in the space of parameters, and i is a parameter number".

The notation P_t is changed with K_t in the description of criterion in the iteration procedure.
Line 59. Where is the APPENDIX? This sentence is deleted. Now all the days are available as supplementary files.

Line 70. "righthanded triplet?" changed

Line 75. Use a different symbol for dynamic pressure. "P" is already used for "signal power."

The problem with P is solved. Now PSD is written directly in power spectra, P is used for plasma and solar wind dynamic pressure (the latter with sw index), and D is used for empirical probability density function, because both f and P are already used for other variables.

Line 88-89. "The spectrum of foF2 variations has a maximum at a frequency f = 3.2 mHz, i.e. at a f2 frequency." This is incorrect. The maximum occurs at 3.8 mHz, well above f2.

Thank you, the description is improved.

Line 90. I suggest ". . .weather conditions for event 1" done

Line 9494. What is the spacecraft that measured the solar wind parameters? Where was the spacecraft located?

A description of OMNI data and a link is added to section 2:

"To analyzed space weather conditions, OMNI data including interplanetary magnetic field, solar wind speed and dynamic pressure, re-calculated to the sub-solar point of the magnetosphere (Bargatze et al., 2005), are used, and Dst and AE indexes. The data are available at http://cdaweb.gsfc.nasa.gov".

Lien 112. Is the distribution normalized? The vertical axis of Figure 9 is labeled "P." Use a different symbol to avoid confusion with the "P" that is already used for other quantities.

Now D is used instead of P for empirical probablility density. All the distributions are normalized.

Line 129. What are "background pulsations"? Are they all events excluding the coherent events? Thank, this parapgaph is rewritten, such as

"However, the coherent foF2 and geomagnetic pulsations do exist, and a question arises about the pulsation properties and external parameters, favorable for their occurrence. To answer this question, the geomagnetic pulsations at SOD for which $bX - foF2$ coherence is high ($\gamma 2 > 0.5$) are compared with all the intervals, selected for spectral analysis of foF2 fluctuations at SOD during 21 months from April of 2014 till the end of 2015 (see complimentary files for full information). To avoid the influence of different seasonal and diurnal variations of the selected pulsations and average pulsation properties, the statistics for all the pulsations is calculated with the weight functions calculated from the seasonal and diurnal variations of coherent pulsations. Figure 11 illustrates the difference between coherent and pulsations and averaged properties of all pulsations for three parameters: $PSDbx$ (Figure 11a), PSD ratio $RXY = PSDbx/PSDby$ (Figure 11b), and the bX PSD ratio along a magnetic meridian $R\Phi = PSDbx(\Phi)/PSDbx(\Phi+\Delta\Phi)$ (Figure 11c). The latter is calculated for SOD-MAS station pair (MAS station is located nearly at the same magnetic meridian, but it is shifted in 2° northward). $PSDbx$ for coherent pulsations is enriched with frequencies$f > 2$ mHz in comparison with the background pulsations. In this frequency band, RXY also increases and $R\Phi$ demonstrates a non-monotonous dependence on frequency with minimum at $f = 2.7$ mHz and growth at $f \geq 3$ mHz. These features are only weakly seen in averaged $R\Phi(f)$ dependence for all pulsation intervals. To understand, what space weather conditions are favorable for generation of coherent $bX - foF2$ pulsations, we compare the geomagnetic indexes and SW/IMF conditions for intervals when coherent $bX - foF2$ were registered with all the intervals analyzed. The influence of seasonal and diurnal variation was eliminated in the same manner, as for pulsation parameters. We use for the analysis the 4-day minimum Dst and 6-hour maximal AE, as Pc5 amplitudes are maximal at recovery phase of geomagnetic storms (Posch et al., 2003), and auroral substorms are followed by Pi3 pulsations (Kleimenova et al., 2002) and Pc5 waves with high azimuthal and intermediate wavenumbers (Zolotukhina et al., 2008; Mager et al., 2019). The results for Dst and AE indexes are summarized in Figure 12. Coherent pulsations tend to occur under moderate geomagnetic and auroral activity. The most favorable Dst interval is from -100 to -50 nT (Figure 12a), and for AE index it is from 250 to 500 nT
(Figure 12b)."

Although, because of rare occurrence of coherent pulsations, there is almost no difference between coherent and background, defined as "all – coherent", coherent intervals are compared with all the selected intervals (i.e. those, for which quality of foF2 detection was enough for spectral estimates), and now it is written in the text in a more explicit way.

Line 143. "Under highly disturbed . . .the probability . . . vanishes" This is misleading because the occurrence distributions shown in Figure 12 are not normalized by the occurrence distributions of Dst and

AE.

Thank you, this point is changed. The other problem is the selection procedure which also leads to decrease of weight of disturbed intervals and this is also mentioned in the text in the following way

"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)".

Line 224 and Figures 21 and 22. The THEMISD b// waveform does not match between Figure 21a and 22d.

Thank you, it was really an other interval, by mistake shown in Figure 21. All the intervals are checked and improved.

Figure 5. Place the axis label on the left of the panels (c) and (e). This comment applies to other similar figures. The label for the bottom axis of panel (f) should be "tau (Greek), min".

done