Response to review by Martin Volwerk (Referee #2)

We wish to thank Martin Volwerk for his valuable input and evaluation of our manuscript. Below, we have included the referee comments in italics and our own response in regular text.

I would completely take out the word "event" it is too confusing, with all the mixed versions of describing the steepened waves. Maybe it would be good to use an abbreviation, stw, for steepened waves? It gets very confusing with "steepened wave", "wave event", "wave", etc.
We have removed all the occurrences of "wave event" and refer to the structures as steepened waves or waves consistently throughout the manuscript.

What I am missing is what the steepened waves look like in all three components of the magnetic field. This is also not present in the first paper, where the events were sought. Here is an example (from AMDA) of the waves shown in Fig. 5 (top left). It gives the reader at least an impression of what these steepened waves look like in the components.
Figure 1 of the updated manuscript contains magnetic field components for two different intervals (16 July 2015 and 21 November 2015) with multiple occurrences of steepened waves.

Line 219: The authors give here as one explanation for the tableau in Fig. 3a that "the observed stagnation may be caused by underestimating the local mass-loading". I do not quite see how this can be a solution. Do the authors mean that adding the mass loading of the other masses will completely rearrange all bars in the histogram, and thereby removing the plateau?
While the period considered in the study is heavily water dominated other neutral gas components are still present. CO_2 for example has a higher

molecular mass than H_2O. Hence, when the contribution of other neutral gas components is not taken into account, the local mass-loading may be underestimated. Since the outgassing is anisotropic the contributions of the other masses will change with time an space. This may cause a reordering of the bars in the histogram.

Line 232: "sharp increases coincide" -¿ "sharp increases in the inter-wave time coincide"
Changed as suggested.

Line 236: "Shortly before" here I think the authors are using a euphemism because "shortly" here is 40(!) and 16 hours.
We have adjusted the sentence as following: "A day before, on 13 September 2015, the interaction region is completely different."'

Line 244: "a time span of multiple hours" this should then be "a time span of dozens of hours" regarding the previous point.
Changed as suggested.

Line 256: "However, adjacent to HCSs are very high plasma densities" I do not understand why the high plasma density is "adjacent" of the HCS, while the latter should have the highest density, or am I missing something?
HCS are essentially just a reversal in the magnetic field direction. The high plasma densities, which are also known as heliospheric plasma sheets, typically surround the HCS and are, hence, adjacent to the HCS. More information about this can be found e. g. in [Tsurutani et al. 2016, Heliospheric plasma sheet (HPS) impingement onto the magnetosphere as a cause of relativistic electron dropouts (REDs) via coherent EMIC wave scattering with possible consequences for climate change mechanisms, J. Geophys. Res. Space Physics, 121, 10,130– 10,156, doi:10.1002/2016JA022499] (Figure 1) or in [Lavraud et al. 2020, The Heliospheric Current Sheet and Plasma Sheet during Parker Solar Probe's First Orbit, American Astronomical Society, 894, L19, 10.3847/2041-8213/ab8d2d].

Line 302: "unfiltered data" – is "unfiltered" just hi-res data? filtering the data has not been mentioned before.
Depending on which data product from the PSA is used the magnetic field data has been filtered to e.g. remove influences of reaction wheels or as a

consequence of resampling. The unfiltered refers to data which explicitly has not been filtered since a filter can affect the shape of the steepened wave depending on the chosen filter parameters.

Line 309: "For the following analysis . . . " Start a new paragraph here. And add a short sentence that here "the individual steepened waves are fitted" and then that you only use fits with an R greater then 0.7
As suggested we have added the following lines to the manuscript: "For the following analysis the individual steepened waves are fitted and only fits with an adjusted R-squared value above 0.7 are further analyzed."

Line 321: "the footpoint in the magnetic field data" How do the authors determine the "footpoint" for example in the cases with "whistler waves" present such as in Fig. 7b?
The whistler waves superimpose the magnetic field in front of the steep edge. Hence, we assume that the whistler waves approximately oscillate around the "footpoint" of the steepened wave and determine it accordingly. In the rare cases where the whistler waves are significantly more developed than in Fig. 6b, the adjusted R-squared value of the fit will fall below the threshold of 0.7 an the waves are discarded for the following analysis.

Line 330: "the waves are highly non-linear" I would say "can be", because 0.4 is not really "highly non-linear".
We have changed "the waves are highly non-linear" to "the waves can be highly non-linear".

Line 348: Why is there an upper limit for the eigenvalue ratio of 40?
We imposed an upper limit on the eigenvalue ratio because disturbances caused by the components on the spacecraft, like heaters, typically have a high eigenvalue ratio (> 40) and we wanted to exclude those. To make sure the upper limit does not skew the results we computed the minimum variance direction again without the upper constraint. Figure 1 was computed analogously to Fig. 10 in the manuscript, just without the upper constraint on the eigenvalue ratio. The distribution of the angles only changes marginally.

Line 409: The compressional nature of these waves – and the mainly strongly oblique propagation direction
We have changed the sentence as following: "The compressional nature of

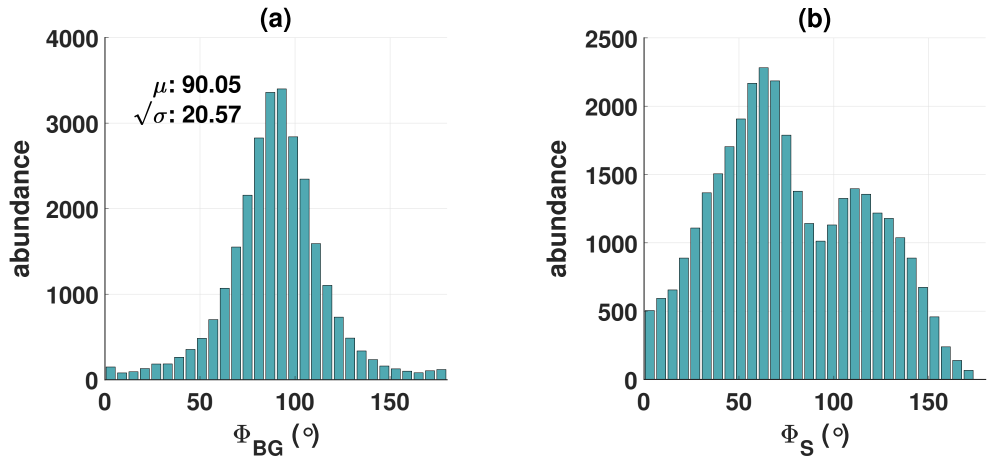

Figure 1: Histograms of the angle between the minimum variance direction and the background magnetic field (a) and the spacecraft-Sun connection line (b) without the upper limit for the eigenvalue ratio.

these waves (Engelhardt et al., 2018; Hajra et al., 2018b) and the mainly strongly oblique propagation direction are clear indicators that they behave like fast magnetosonic waves.“