Reply to referee comments

On heating of solar wind protons by the parametric decay of large amplitude Alfvén waves

Manuscript ID: angeo-2018-14 (AngeoComm)

H. Comişel, Y. Nariyuki, Y. Narita, and U. Motschmann

I thank the authors for their positive responses to my comments. The revised manuscript is definitely improved, but I am sorry to report that I have problems with some of the revised material. Therefore, I feel it is necessary to request another revision of the manuscript.

Abstract: Replace the second and third sentences with Three simulations with the same physics are carried out with spatial variations in one dimension, two dimensions, and three dimensions (3D); comparison shows that the 3D simulation yields the strongest proton heating. The protons are heated parallel...

Page 1, line 3: Replace The comparison made among different spatial dimensions proves with Comparison is made among one-dimensional, two-dimensional, and three-dimensional simulations, showing that.

Page 1, line 3: Replace proves with demonstrates.

Page 1, line 4: Replace more efficient with the strongest proton.

Page 1, line 4: Replace Plasma is with Protons are.

Page 1, line 13 and several other locations: Replace plasma heating with proton heating. Plasma heating implies both ions and electrons are heated, whereas only proton heating is described here.

Page 2, line 2: Replace outwards with away from.

Page 2, line 11: Replace plasma with proton.

Page 2, line 18: Replace prove with show.

Page 2, line 22: Replace plasmas with ions.

Page 2, line 27: Replace plasma with proton.

Page 3, line 2: The properties of the 1D and 2D runs should be clarified: In the one-dimensional box spatial variations are allowed only in directions parallel and antiparallel to the background magnetic field, whereas in the two-dimensional simulation spatial variations are allowed in both the parallel/antiparallel direction and one perpendicular direction.

Page 3, lines 13-15: Delete is not irrelevant from the solar wind studies. In fact..the solar corona and simply say is relevant for the solar corona and inner heliosphere.

Page 3, line 21: Replace waves with wave.

Page 5 lines 12-14: The terms rigid shifted and rigid displacement are unclear. The t=0 distributions in the top row suggest a donut shape; perhaps that term might be used. Also, Figure 1 of Verscharen and Marsch (2011) is very different from the top row of Figure 3. Please explain.

Page 6, line 11: Replace The more efficient heating of plasma with The stronger heating of protons.

Page 6, line 16: Replace plasma with proton.

Page 6, lines 28-29: Delete the sentence beginning A detailed spectral analyzing... Promises of future work are inappropriate in a scientific manuscript.

Page 6, line 33: Replace more efficient with most strongly.

Page 7, line 2: Replace plasma with protons.

==========

Reply:

We thank the reviewer for reading the revised manuscript and raising helpful suggestions. The actual manuscript has a major revision mainly based on the analysis of the 3-D simulation results. In this revised manuscript, the above suggestions have been considered. Here we have a comment regarding the following question raised by the reviewer.

Page 5 lines 12-14: The terms rigid shifted and rigid displacement are unclear. The t=0 distributions in the top row suggest a donut shape; perhaps that term might be used. Also, Figure 1 of Verscharen and Marsch (2011) is very different from the top row of Figure 3. Please explain.
Reply:

This is true. Our velocity distributions at time $t\Omega_p$=0 are similar with the particle-in-cell simulation discussed by Sakai et al., 2005 (Fig. 10). Figure 1 of Verscharen and Marsch (2011) refers to the effect of the wave field of force resulting in the apparent temperature anisotropy at an intermediate time ($t\Omega_p > 0$). However, the different time evolution in our three simulation setups suggests that the apparent temperature anisotropy does not significantly influence the proton heating reported at the latest time of simulation.

Sakai , J.I., Yamamura, W., Saito, S., Washimi, H., Tsiklauri, D., and Vekstein, G.: Particle simulation of plasma heating by a large-amplitude shear Alfvén wave through its transverse modulation in collisionless plasmas, New J. Phys., 7, 233, https://doi.org/10.1088/1367-2630/7/1/233, 2005.

Changes in the manuscript:
Page 9, Row: 17-19:
" We also mention that starting from similar velocity distribution functions distorted by the initial wave fields, their different time evolution in the three simulation setups suggests that the apparent temperature anisotropy does not significantly influence the proton heating reported at the latest time of simulation."