On modelling the kinematics and evolutionary properties of pressure pulse driven impulsive solar jets, MS No.: angeo-2019-67

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Dear Editor;
Thanks for your email and constructive comments. Here we reply to all the mentioned comments. We have made the suggestes corrections in the revised manuscript.

1st Comment:
Please correct the MHD system (page 3, line 1). There is the whole term missing; also please make a clear difference between vectors and scalars throughout the manuscript. Please also check the text around the MHD system - there are problems, for example I (unit matrix) and p_t are not used, while identified in the text. This is due to aforementioned mistake. Note that it should be p_t instead of pt.

Reply:

$$\frac{\partial}{\partial t}\begin{pmatrix}\rho\\ \rho\mathbf{v}\\ E\\ \mathbf{B}\end{pmatrix}+\nabla\cdot\begin{pmatrix}\rho\mathbf{v}\\ \rho\mathbf{v}\mathbf{v}-\frac{\mathbf{B}\mathbf{B}}{\mu}+\mathbf{I}p_t\\ (E+p_t)\mathbf{v}-\frac{\mathbf{B}}{\mu}(\mathbf{v}.\mathbf{B})\\ \mathbf{v}\mathbf{B}\text{-}\mathbf{B}\mathbf{v}\end{pmatrix}=\begin{pmatrix}0\\ \rho\mathbf{g}\\ \rho\mathbf{v}.\mathbf{g}\\ 0\end{pmatrix}$$

and

$$E=\frac{p}{\gamma-1}+\frac{\rho\mathbf{v}^2}{2}+\frac{\mathbf{B}^2}{2\mu}$$

Yes, by the mistake, term Ipt is missed. So now, we have added this term in the set of MHD equations and in the revised manuscript. We have shown difference between vectors (bold) and scalars (normal) throughout the manuscript and we have replaced standard natation p_t in place of pt in the revised manuscript.

2nd Comment:
Page 3, line 10: "we do not consider the microscopic interactions"... The ideal equation of state is due to elastic collisions between particles, so assuming an ideal gas law you already assume interaction between particles.

Reply:

we have removed the statement "we do not consider the microscopic interactions of the particles at considered length scale" in the revised manuscript.

3rd Comment:

Page 3 line 21 - "attributed by the measurement of Avrett..." - this temperature profile was not measured, but inferred from the observed line profiles.

Reply:

we have correct and replace this statement by "inferred from the observed line profiles by Avrett and Loeser (2008) and also depicted in Konkol et al. (2012).

We have also added this correction in the revised manuscript.

4th Comment:

Page 5 line 6 - there is "s-2", while it should be s^{-2}.

Reply:

we have correct the suggest notation " s^{-2}" in the revised manuscript.

5th Comment:

Page 6 Line 2 - the code cannot be "finite volume and finite difference". It can be "finite volume or finite difference", if it is possible to switch that.

Reply:

Yes, a place of finite volume and finite difference, it should be finite volume / finite-difference.

We have corrected this statement in the revised manuscript.

6th Comment:

Page 7 lines 25-30: I still suggest making it properly. I cannot see where in the plot G=255 or 245, because there is no colour bar in this figure. I understand what you are doing there, but ultimately the values, which are shown in the figure, are the values of density. It is the jump of density in the photosphere you see as change in the colour. You do not have to refer to the values of colour to establish the boundary of the simulated jet, you just need to find a threshold value for the density.

Reply:

We have analyzed the same by image processing using Matlab which can also be done using the threshold values for density as suggested by you. Also we have attached the RGB values in color bar alongside the density values for reference in fig. 7.

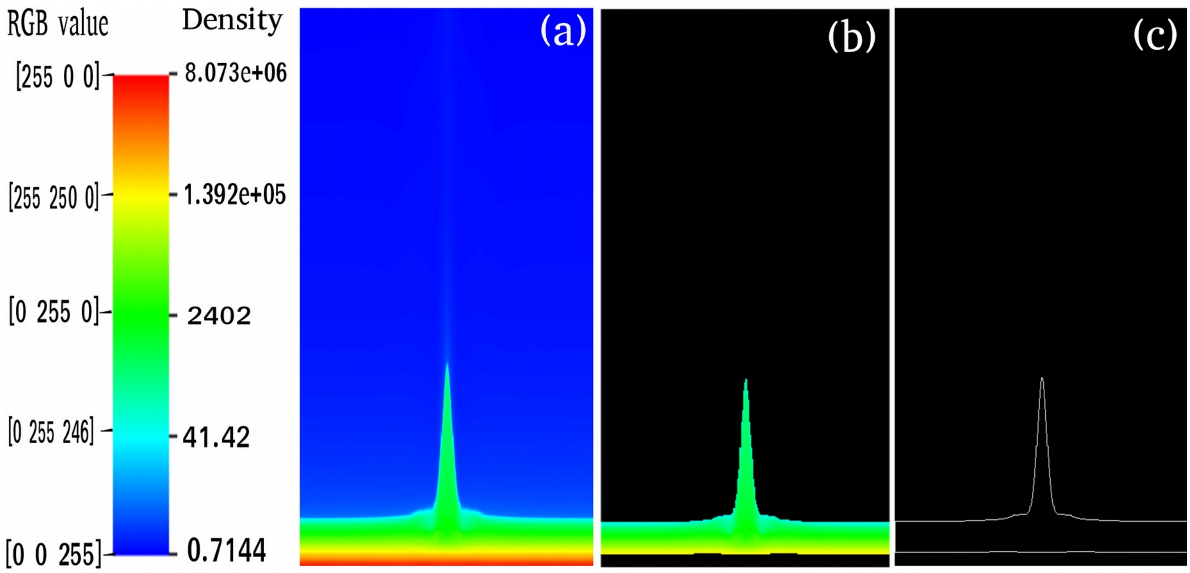

Figure 7. Automated detection of the plasma jet in the numerical simulation data to establish its time-distance profile and termination point.

7th Comment:

Page 11 fig. 6 - I do not understand this figure. How do you measure the width of jet at their maximum height, and what is this exactly? Is this width measured when the jet is highest? Then, at which height the width is measured? Or this width is measured at the tip of the jet? Then it is not a reliable measure. If the former, I suggest adding description on where exactly the width is measured. If the latter, then I would suggest to measure the width at half-maximum instead.

Reply:

The width of the jets is measured by using Gaussian fit to the spatial profile of the jets when they attain maximum height. The example spatial profiles of various jets when they reach at their respective maximum heights are shown in Fig. 10 (top-panel). Since the base of these jets exhibits complex shape and motions, therefore, the triple or single Gaussian profiles are fitted on their spatial profiles and the respective FWHMs are estimated after determining the fitted Gaussian width. Width of the jets vs. pressure pulse strength (A_p) in

the solar atmosphere for the magnetic field B= 56 Gauss (blue-diamonds) and B=112 Gauss (red circles) are shown in the bottom panel of Fig. 10.
The FWHM of various jets lie between 0.42 to 0.48 Mm. Although, they exhibit on average mild increasing trend for both the magnetic fields.

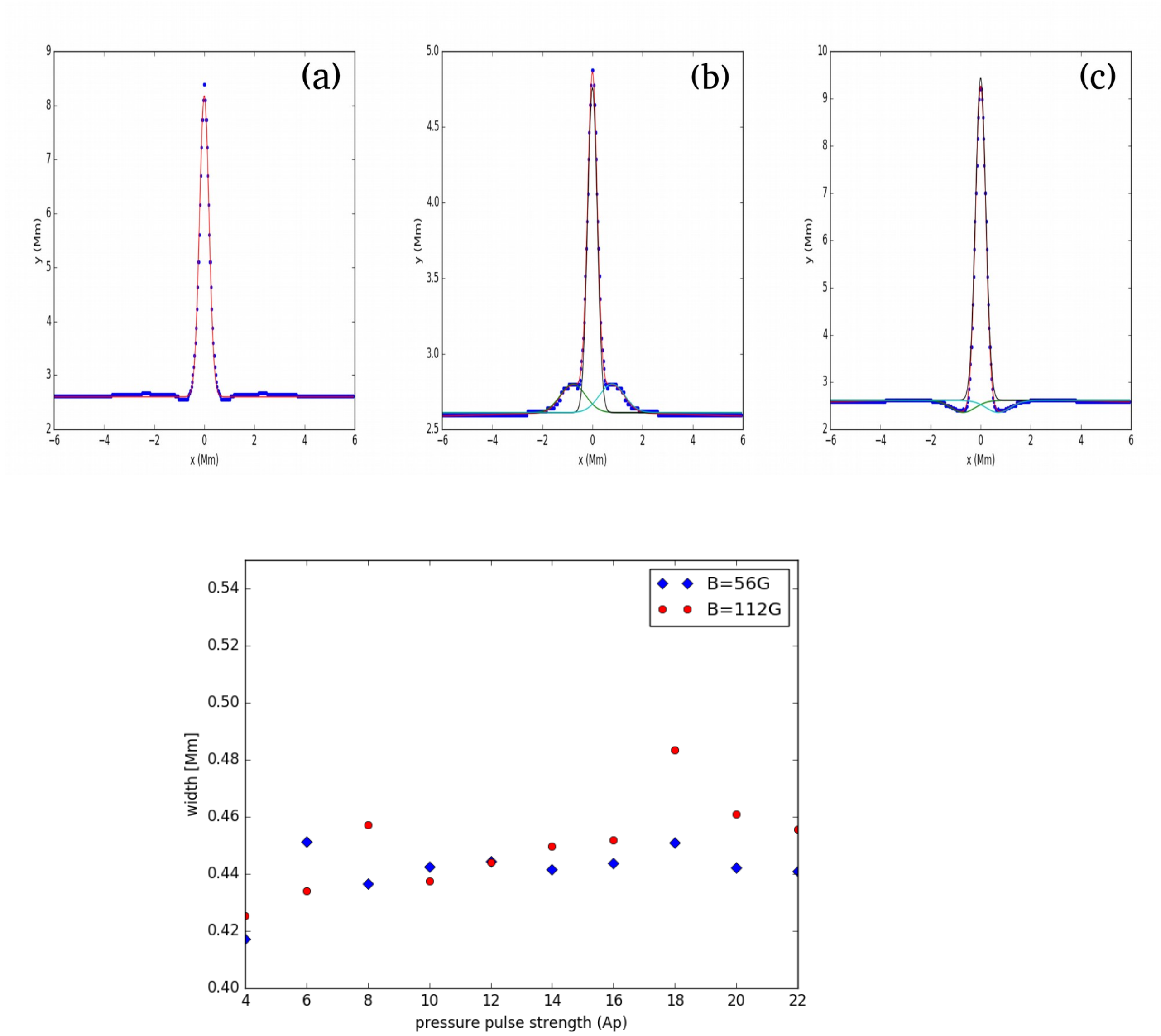

Figure 10. Top-panel: The example spatial profiles of various jets when they reach at their respective maximum height In the top-panel, figures 'a', 'b', 'c' respectively show spatial profiles of the jet at B=56 Gauss, A_p=16; B=56 Gauss, A_p=6, B=112 Gauss, A_p=18. Since the base of these jets exhibits complex shape, therefore, the triple or single Gaussian profiles are fitted and the respective FWHMs are estimated after determining the Gaussian width. Bottom-panel: Width of the jets vs. pressure pulse strength (A_p) in the solar atmosphere for magnetic field B= 56 Gauss (blue-diamonds) and B=112 Gauss (red circles). The FWHM of various jets lie between 0.42 to 0.48 Mm. They show mild increasing trend though for both the magnetic fields.