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 referee's comments. Here we reply to all the mentioned comments by editor.

1st Comment:
In the introduction, author should include/discuss some more works that are focused on “pressure pulse driven solar jets”, e.g., Martinez-sykora et al. 2011, Judge et al. 2012, Kuzma et al. 2017.

Reply:-

Martinez-sykora et al. (2011) and Judge et al. (2012) have studied the structure and evolution of the spicule-like jets that are triggered by the pulses which are launched in the vertical velocity component from the upper chromosphere. The vertical velocity pulse is converted into a shock that propagates in the upward direction by which chromospheric plasma follows these shocks and comes out into the corona (Martinez-Sykora et al. 2009A, McIntosh et al. 2007 and references cited therein). These shock-driven spicules like jets show a narrow linear structure that reaches a few Mm above the chromosphere. B. Kuźma et al. (2017) also proposed the model for spicules like jets which are triggered by the vertical velocity pulses, while radiative cooling and thermal conduction terms do not exert any significant role in the dynamics of these type of spicules.

We have written these descriptions in the Introduction of the manuscript.

2nd Comment:
Explain why you specifically chosen certain height for pressure pulse?

Reply:-

The pressure pulse driven cool jets depend on the amplitude of the initial pulse (Ap) as well as the height of its triggering. This further converts into the acoustic shocks that trigger plasma into the upward direction. The low-pressure region is created behind the slow magnetoacoustic shock, which

drives the cool plasma from the chromosphere upward. So the amplitude of the pressure pulse as well as its triggering site are the important factors on which the evolution of the jets depends. In this model, we have studied chromospheric cool jets, so we can take a certain amplitude of the pressure pulse at the chromospheric height below the TR to generate these jets.

We have added this description in the revised manuscript by citing relevant references also.

3rd Comment:
Why the particular pulse is chosen?

Reply:-

Observations reveal that these type of chromospheric jets are found to be associated with the impulsive origin in the chromosphere, and their footpoints are usually associated with the brightening. The chosen pressure pulses in this modeling mimic the heating scenario at their footpoints before their evolution. This is not a direct implementation of the heating as we use the ideal set of MHD equations in the numerical simulation. However, the Gaussian pressure pulse implies the disturbance that represents the response in the form of the pressure perturbation once the underlying heating episode is completed. This perturbation locally alters the equilibrium and generates the propagating perturbations. The pressure pulse is chosen with varying amplitude Ap = 4-22 to understand the evolutionary and propagation properties of the cool chromospheric jets.

We have added these justifications in the revised masnucript.

4th Comment:
Please describe a little more about the response of chromosphere pressure disturbance.

Reply:-

These perturbations are converted into magneto-acoustic shocks when they move up in the stratified solar atmosphere. The low pressure region created behind the shock is followed by the motion of cool plasma that form the jets.

These physics related arguments are added in the revised manuscript.

5th Comment:
What is the physical implication of chosen magnetic field?

Reply:-

The quiet-Sun chromospheric cool jets are simulated in our model. We set the source magnetic field of the typical order in the quiet-Sun. Moreover, the chosen magnetic fields smoothly extend to the inner corona and appropriately set the reasonable values of plasma beta and Alfven speed. This helps in the evolution of the perturbations and the launch of the collimated jets. In this model, we have chosen two different configurations of magnetic field strength, i.e., B=56 Gauss and B=112 Gauss.

We have added these justifications in the revised manuscript.

6th Comment: Describe a little more specifically that how pressure driven jets are more likely in the chromsophere than other wave driven jets.

Reply:-

The pressure pulse driven jets are most likely driven by the localized heating at their footpoints lying in the lower solar atmosphere. These perturbations are converted into magneto-acoustic shocks when they move up in the stratified solar atmosphere. The low-pressure region created behind the shock is followed by the motion of cool plasma along the field lines that form the jet.

The wave-driven jets are usually launched by the evolution of the magnetic as well as plasma perturbations both. When the velocity, as well as pressure perturbations, are launched higher in the solar atmosphere, they can generate MHD modes in the structured solar atmosphere. In the case of only the Lorentz magnetic force and related velocity perturbations, the Alfven modes can be generated. These waves under the non-linear effects can be associated with the ponderomotive force that can guide vertical plasma flows in the form of the jets.

We have added relevant discussion as per the suggestion of the referee and cited the references in the revised manuscript.