Dear Reviewer #1,

Thank you very much for taking the time to review our manuscript in such a thorough and constructive manner. You have significantly improved the quality and rigor of our work through your insights. Each of your points has been carefully considered, and substantial revisions have been made to address them. In response to each of your comments, we provide a detailed response below:

1. Quantification of turbulence levels:

The importance of a more rigorous analysis of turbulence levels cannot be overstated. A new subsection has been added to the Observations section that quantifies magnetic field variances and correlation scales before, during, and after the GLE event. A power spectral analysis and structure function analysis were conducted on the OMNI magnetic field data. It is evident from this analysis that there was a significant increase in turbulence levels during the GLE event, particularly in the frequency range of 10^-4 to 10^-2 Hz. The correlation length decreased from 1.2×10^6 km pre-event to 8.5×10^5 km during the event, further supporting increased turbulence. In addition to providing concrete evidence for our claims about turbulence levels, these quantitative results also validate our model assumptions.

2. Model introduction:

The initial model description we provided was insufficient. A comprehensive subsection has been added to the Model section, including all relevant terms and boundary conditions for the transport equation we are solving. The focused transport equation is now presented as:

$\partial f/\partial t + \mu v\, \partial f/\partial z + (1-\mu^2)/(2L) v\, \partial f/\partial \mu = \partial/\partial \mu (D_{\mu\mu}\, \partial f/\partial \mu)$

Detailed explanations are provided for each term and our numerical approach, making the paper self-contained while still referencing Paper 1 for additional context.

3. Perpendicular diffusion:

We appreciate your point regarding perpendicular diffusion. A discussion of perpendicular diffusion effects has been added, along with a sensitivity analysis. It is estimated that for $\alpha \leq 0.01$ (where $D_\perp = \alpha D_\parallel$), the impact on our results is negligible (<5% change). However, when $\alpha > 0.05$, the effects become more pronounced. As a result of increased turbulence levels during the GLE event, we have also addressed the potential for enhanced perpendicular transport. Based on this analysis, we have decided to focus on parallel transport, while acknowledging the potential role of perpendicular effects in future, more comprehensive models.

4. Justification of λ_par:

We have expanded our discussion on the radial dependence of λ_par, comparing our chosen parameters ($\lambda_0 = 0.3$ AU at $r_0 = 1$ AU, $\alpha = 0.2$) with recent theoretical predictions and observational studies. Our chosen values fall within the range reported by Lang et al. (2024) (α between 0 and 0.5) and are consistent with the observations of Bieber et al. (1994) and Zhao et al. (2019). We've also compared our results more explicitly to previous modeling efforts, finding broad consistency with the work of Dröge et al. (2010) and He et al. (2011).

5. Non-axisymmetric perpendicular transport:

In addition, we have included a brief discussion on how local SI conditions might result in non-axisymmetric perpendicular transport, based on Strauss et al. (2016). Despite not including this effect in our current model due to computational complexity and a lack of detailed 3D SIR structure, we discuss qualitatively how it might affect our results, particularly in terms of particle spreading and local trapping within the SIR.

6. Figure 7 issues:

Thank you for pointing out the error in Figure 7. We apologize for any inconvenience. The code and calculations have been thoroughly reviewed, and the implementation has been corrected. Now the updated figure shows diffusion coefficients with appropriate units (s^-1) on the y-axis. Moreover, we have expanded our discussion of the pitch-angle diffusion coefficient, including itsμ-dependence and time evolution through the SIR.

Minor points:

All minor points raised by you have been addressed, including correcting references, fixing typos, and adding missing units.

Our paper has been significantly strengthened by these revisions, providing a more comprehensive and rigorous analysis of GLE 72 and its associated interplanetary conditions. While maintaining the core findings of our study, we believe these changes address your concerns.

Thank you again for your valuable feedback, which has undoubtedly enhanced the quality and impact of our work.

Sincerely,

Olakunle Ogunjobi