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Reply on RC1

Etienne Behar et al.

Author comment on "*Menura*: a code for simulating the interaction between a turbulent solar wind and solar system bodies" by Etienne Behar et al., Ann. Geophys. Discuss., https://doi.org/10.5194/angeo-2021-64-AC1, 2022

We thank the referee for the encouraging feedback and for the time spent on the draft. We try to tackle the comments in the following answer.

1 – Readability of the introduction : We have shortened and tried to fix some language issues, though we can iterate once more if needed.

2 – References formatting : that is our mistake, \cite were replaced by \citep everywhere.

3 – Figure reference: fixed.

4 – The polytropic index k is now tackled with the following sentence “In all the results presented below, an index of 1 was used, corresponding to an isothermal process.” when introducing equation 6. The change of index when discussing the magnetosonic mode now reads

“The magnetosonic modes were also tested using a different polytropic index of 5/3 instead of 1, resulting in a shift of the dispersion relation along the ω-axis. Changing the polytropic index in both \emph{Menura} and \emph{WHAMP} resulted in the same agreement.”

Additionally, at the beginning of the physical test, it is now stated “A polytropic index of 1 is used here, with no resistivity.”

5 – The paragraph tackling the hyper-resitivity has been expanded to introduce the corresponding dissipative scale. The value of 0 was mentioned above for the physical tests, and the value and corresponding scale for the turbulent run also given.

“, introducing the Laplacian of the total current and the hyper-resistivity coefficient, $\eta_h \nabla^2 \mathbf{J}$. The dissipative scale L_dis of such a term is characterised by the physical time of the simulation $T = \text{nb. iterations} \times dt$ and the hyper-resistivity, such as $L_\text{dis} = (\eta_h \cdot T)^{1/4}$.”

“The polytropic index is 1 and a normalised hyper-resistivity of $\eta_h=1.5 \cdot 10^{-3}$ is used, corresponding to a dissipative scale at time $t=500\ \omega_{ci0}^{-1}$ of 0.93 d_i, i.e. the scale of the smallest fluctuations simulated with a node spacing of $\Delta x = 0.5 d_i$.”

As stated previously, all parameters including the polytropic index and eta_h are kept unchanged for step 2 of the simulation.

6 – Test done on a 2D domain with one main direction x: it is indeed a cut taken for one precise index y.

“(saving one cut, given by one single index along the y-direction)”

7 – The number of particle per node is added for the ion acoustic Landau damping.

“This low amplitude, allowing for comparison with the linear solver, further increase the need for a high number of particle per node, so the 1\% oscillation in number density can be resolved by the finite number of particles. For this run, 32768 (2^{15}) particles per grid node were used.”

8 - k in units of di0^{-1}, rather than di0: absolutely.

9 – Scalability: a fairly complete study of scalability was motivated by the comment, which is now given in paragraph 5.4.2 and Figure 7 (attached to this answer).

10 & 11 – Table A1 was removed, and was indeed an old copy of Table 1. The caption now reads

“Background values used to normalise all variables in the solver (cf. Eq. \ref{eq:norm})”

All typos were addressed with the exception of one, we kept “to go further in the in situ space data analysis, further in their understanding ...”

Please also note the supplement to this comment:
https://angeo.copernicus.org/preprints/angeo-2021-64/angeo-2021-64-AC1-supplement.pdf