EGUsphere, author comment AC1
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Reply on RC1

Enrique L. Rojas et al.

Author comment on "Fluid models capturing Farley–Buneman instabilities" by Enrique L. Rojas et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-1264-AC1, 2023

Thank you for your questions and comments. Here you will find our replies.

Lines 66-67: Why did the authors artificially increase the electron mass? This should only apply to models that need to resolve the plasma frequency, which is what places the constraint on the simulation time step. If the authors simply wanted to mimic the parameter values used in previous works, they may say so. Otherwise, they should justify this choice.
Reply: We chose the same simulation parameters as Oppenheim(2008) to compare our results to theirs.

Lines 78-79: Can the authors elaborate on "we see dominant wave modes growing distinctly faster"? What makes the fastest-growing wave modes dominant other than the fact that they're growing fastest?
Reply: We just wanted to point out that there is a clear dominant mode in the linear regime, but we can see now that this was redundant because the dominant mode, by definition, grows faster.

Line 79: What is the geometry of E and B? It would help the reader to not have to refer to previous work in order to determine the ExB direction.
Reply: The electric and magnetic fields are parallel to y and z, respectively. We have added this clarification to the text.

Lines 79-83: Have the authors made any attempt to quantify the angle of deflection from ExB? Comparing that angle between regularized and unregularized models, as well as to previous results from PIC simulations, would support the authors' main argument. The presentation would benefit from a figure that shows the 2D wavenumber spectrum corresponding to each stage.
Reply: The main goal of this paper is to show that the five-moment fluid system can remain stable and capture several qualitative features of the Farley-Buneman instabilities. We think showing the small but visible tilt in the density structures from Figure 1 is enough for a qualitative argument. A systematic quantitative analysis of this and other metrics is a topic we are currently working on, but it will be published in the future.

Line 82: The note about "a slight turning of the waves in the direction consistent with linear theory" shouldn't apply to the turbulent regime. Did the authors mean to associate this with the linear (or possibly mixing) regime?
Reply: Even though the analytical estimations of the wave-turning effect have been

derived for the linear regime, we are assuming that the preferential direction criteria should still hold approximately as the system goes through saturation. Nevertheless, we agree that the text is ambiguous, so we have modified it to restrict the comment for the linear regime.

Have the authors considered changing the resolution while maintaining the simulation domain size, to see if the dominant wavelength changes?
Reply: As mentioned before, a more systematic evaluation of diagnostics and numerics is part of a current project. And although we have done this analysis and haven't seen a significant change, we decided not to elaborate on this because we were focusing on the qualitative aspects of the results. One of the main contributions of this work is to challenge the standard assumption that simulating Farley-Buneman instabilities in the fluid domain would quickly produce small-scale structures growing faster than the larger ones. In our simulations, we see a dominant mode, so the dependence between growth rate and wavenumber is not monotonically increasing as the standard linear theory predicts. Even though the exact growth rate could change with the resolution of the system, we are assuming that it will maintain the same general behavior.