This paper presents a new setup for an OSSE assimilation system. The main novelties are the nature run (front convection) and the ensemble generation. I like very much the choice of the nature run but I have some questions regarding the initial ensemble. The ensemble is too far from the nature run (see below). I also think that adding results of the free ensemble (without assimilation) would make the results more interesting. For that reasons I recommend major revision.

1) The initial ensemble seems quite far from the nature run as it is shown in Figure 7, where the nature run profiles are often far from the ensemble spread. I think this is a result of the generation ensemble, which has run for over 24 h (with full physics) in comparison with the nature run. These are difficult conditions for an assimilation system, and I do not think that these are quite realistic (the errors in the cold front are ~4K). I wonder how the nature run would be if the same procedure would have been applied (run each part of the front independently for 24 hours).

I guess that to have a bad ensemble is the author’s choice, but this should be clear in the abstract or introduction: not only that the errors are non-gaussian, but also that the nature run profile is often out of the ensemble spread with the consequence of a much weaker convection in all ensemble members.

2) In figures 11, 12, 13, 14 and 15 would it be very useful to plot the skill of the initial ensemble without data assimilation. We could then see the skill of the assimilation system. In figure 13 you could also plot the nature run.
3) It would be interesting to see how realistic the prediction of reflectivity is. I suggest plotting the reflectivity of one member (without assimilation, CTRL and ENVI) at assimilation time and after 3h forecast.

4) The generation of turbulence in the nature run is not clear. I do not understand why radiation and surface friction are switched off, when these are the main driver for boundary-layer turbulence. I also do not understand why you want to run the simulation for 12 hours, which is much longer than any boundary layer process.

Minor:

1) Equation 1. Set the appropriate limits. The equation is only true if the argument is larger than 0.

2) Equations 1,2,3: the letter f is used for two different functions. This is confusing.

3) Please specify if the simulations to generate the ensemble are done with the nature-run physics or with the forecast physics.

4) Please specify which cloud cover scheme (if any) is used in the nature run and forecast physics. Also specify if the turbulent schemes are 1D or 3D.

5) Line 265: I guess there is a not missing.

6) I cannot see the soundings in Figure 10.

7) Do you see much updraft helicity in the forecast?

8) OSSE assimilation systems can also be used for improving the assimilation system independently of the errors in the model physics (see for example Zeng et al. 249, 105282, 2021,https://doi.org/10.1016/j.atmosres.2020.105282)
9) Figure 11. Innovation is probably not the right label for the y-axis.