We would like to thank the referees for their suggestions and comments. We have listed the referees' comments and written a response below each comment.

Reviewers' comments are in black text; our responses are in blue text.

Anonymous Referee #2

Summary:

This paper explores the effects of changes to the environmental moisture field on a developing tropical cyclone. In particular, rather than changing the moisture field everywhere, changes ahead of and behind the cyclone are considered separately. Each particular case is represented by a mini-ensemble of 5 simulations with small variations to the initial condition; this is a considerable improvement over many previous studies.
Thanks for the referee's positive comments.

It is found that an increase in moisture ahead of the storm can lead to overall weakening, while an increase in moisture behind the storm leads to strengthening. However, the mechanisms for the changes are, in hindsight, due to the unrealistic formation of secondary, satellite vortices around the storm caused by the strong and deep moisture perturbations.
We have tested moisture perturbations of different magnitudes and concluded "modification of environmental moisture has insignificant impacts on the storm in this case unless it leads to convective activity that deforms the quasi-Lagrangian boundary of the storm and changes the moisture transport into the storm".

Recommendation: May be acceptable after major revisions

Major comments:

1. The general modeling framework and initialization are fairly reasonable, except for one problem: The simulations are initialized with global model data, but then run for only 48 hours. When a high-resolution model like WRF is initialized from global models, there is generally a "spin-up" or adjustment period of about 12 hours. This means that 1/4 of the whole simulation includes this adjustment period.
Considering reviewer's comments, we have conducted three simulations (CTRL+12hr, MF+12hr and MR+12hr) initiated 12 hours earlier and run for 60 hours. The results are shown in the following Figure 4. The CTRL+12hr simulation produces a slighter higher intensity at Hour 60 than the original CTRL at Hour 48. However, the differences in storm intensity at the end of simulations between the CTRL and MF/MR are consistent with those shown in the manuscript. Thus, the extra spin-up does not change the conclusions. We mentioned these extra simulations in the first paragraph of section 4.1 as following:

"Similar experiments with initialization at 12 hours earlier show consistent results to the CTRL, MF and MR experiments, except a more intense storm developed in the experiment with a moist perturbation in the rear (figure not shown)."

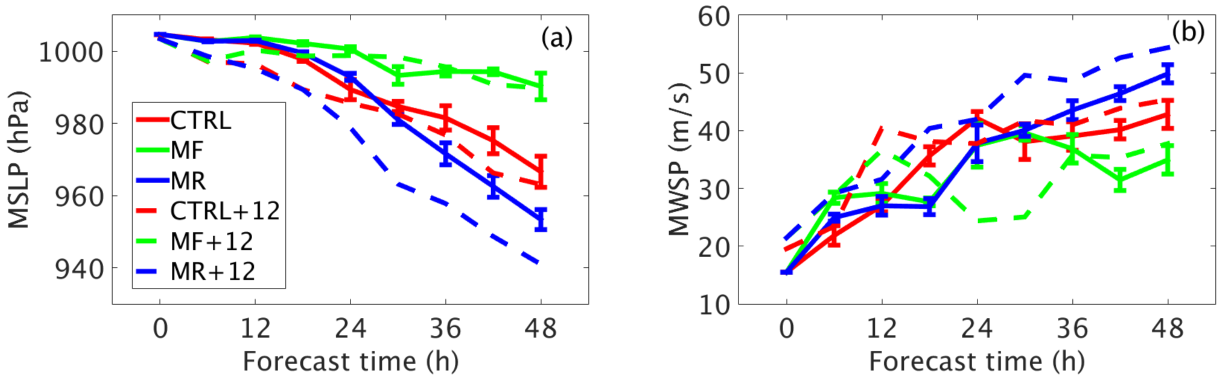

Figure 4. The simulated (a) MSLP (hPa) and (b) MWSP (m/s) for CTRL (solid red), MF (solid green), MR (solid blue), CTRL+12hr (dashed red), MF+12hr (dashed green) and MR+12hr (dashed blue).

2. The strategy for the moisture perturbations seem reasonable at first, but turns out to have unrealistic effects: they initiate convection so strong that they generate new circulations outside of but fairly close to the storm. For the MF case, the vortex is very strong, with a mean tangential wind of about 8-10 m/s (as best as I can tell from the plots) averaged over 0-5 km height. This is practically a tropical cyclone in its own right. For the MR case, the vortex is weaker but the net result is the same.

The height-varying experiments further prove the point: large changes only occur if the moisture perturbations extend into the boundary layer. So, if the instantly imposed moisture perturbations are strong and extend into the boundary layer, then in the first 12 hours (the adjustment period), they generate convection which is strong enough to significantly change the circulation around the primary TC, in one case causing it to be affected by dry air, and in the other case to be affected by moist air, leading to intensity changes in each case.

But this not how moisture interacts with real storms. For example, in this case, if the air to the north of the storm (Earl) had not been dry and there was no dry slot in front of it, that does not mean a burst of convection would occur creating a small vortex which then would have caused changes (weakening, in fact) to Earl. Or, to put it another way, similar effects could have been created by adding vortices to the flow instead of moisture changes. The question of how Earl or similar hurricanes might have evolved if there had been no dry slot in front, or an extra moist slot behind, is unfortunately not answered by the paper in its present form.
We agree with the reviewer that whether the enhanced environmental moisture could affect the primary cyclone depends on the intensity of the moisture perturbation and the background moisture values. Although our experiments are based on the specific atmospheric conditions for Earl, the general conclusions drawn from the series of experiments is that the particular MF and MR simulations have different impacts. The MFI case shows a rather insignificant impact with intermediate strength of moisture perturbations. Thus, our general conclusions about “modification of environmental moisture has insignificant impacts on the storm in this case unless it leads to convective activity that deforms the quasi-Lagrangian boundary of the storm and changes the

moisture transport into the storm" would hold regardless the special distributions associated with Earl. In the case of Earl, in some quadrants, it may take very vigorous convective activity to "open up" the TC circulation. But in other quadrants and/or cases, less provocation would be needed.

While I am always reluctant to ask for new simulations when reviewing a paper, I see little choice in this case. I recommend repeating the simulations with the following changes: 1) Use a 72 hour simulation, with the first 24 hours for an adjustment period; then add the moisture changes at t = 24 h. This separates the adjustment and moisture responses.
We have run a 72 hour simulation as suggested. However, the 72 hour simulation cannot reproduce the intensification of the storm. Alternatively, we run a 60 hour simulation with the first 12 hours for model adjustment. Results are shown in Figure 4.

2) Use less radical moisture changes, which are more representative of the variations that occur in the Tropical Atlantic.
The MFI experiment in the manuscript is an intermediate perturbation. The CTRL, MFI and MF cases represent the dry, intermediate moist and extreme moist environments at the front of the storm, respectively. The dry, intermediate moist and extreme moist environments at the rear of the storm are represented by the DR, CTRL and MR experiments, respectively.