Review of 'The upstream-downstream mechanism of North Atlantic and Mediterranean cyclones in semi-idealized simulations'

I found this manuscript to be very well written and easy to follow. The experiments were carefully designed and the analysis was thorough and insightful. I have a few substantive comments on the analysis and discussion and several recommendations for clarification, all of which should be fairly straightforward to address. Therefore, my recommendation is for the authors to make minor revisions prior to publication.

General Comments:

1. The only additional analysis I would to see is a comparison of pairs of cases (selected based on Fig. 8) for which the Med cyclone intensity is similar, but the Atlantic cyclone intensity is different. Specifically, I would like to know how the max jet speed compares between the two cases, and where in the process chain linking Atlantic cyclones to Med cyclones there is a breakdown that leads to the limited sensitivity of downstream cyclone intensity to the upstream cyclone. For example, do the PV streamers or RWB events differ substantially between the two cases, and if so, does this imply that these nonlinear links in the upstream-downstream process chain are key sources of downstream variability/uncertainty? Or are the differences between the two cases strictly local in the sense that difference growth primarily occurs within the Mediterranean region? There is a bit too much speculation around Line 315 on this matter, and I feel that this comparative analysis could help make this part of the manuscript less speculative.

2. The abstract states that the sequence of events leading to Mediterranean cyclogenesis "rarely occur in a spatially consistent, fully repetitive pattern", but the results from the idealized simulations actually suggest that this sequence of events leads to Mediterranean cyclogenesis rather consistently. Details of the intensity and position of the Mediterranean cyclone may vary by time of year or with the intensity of the upstream perturbation, but the overall sequence of events leading the cyclogenesis in the Mediterranean seems quite robust in the simulations. It may help to clarify in the abstract this apparent lack of consistency in the proposed mechanism is for real cyclone cases. Additional statements in the discussion about possible reasons why this pattern more reliably leads to cyclogenesis downstream in the simulations than in the real atmosphere would also be useful. For example, could the consistency of the mechanism in simulations be a result of using smoothed, climatological initial conditions?

3. I am curious if the fact that this mechanism is absent during JJA implies that it is contingent upon there being a zonally extensive and continuous jet stream waveguide across the Atlantic, or if the lack of downstream Mediterranean cyclogenesis during JJA is simply a result of weaker upstream baroclinicity over the North Atlantic preventing the formation of North Atlantic cyclone seeds. If the existence of the waveguide is a necessary condition for the upstream-downstream mechanism, then I would also imagine that climate change impacts on the jet stream/waveguide will influence this mechanism. For example, a weaker jet in future climates could make everything more JJA-like, in which case Med cyclones triggered through this mechanism might become less common. I understand that this is well beyond

the scope of the study, but it may be worth mentioning at the very end of the manuscript that climate change impacts on the jet stream could conceivably influence the prevalence of this mechanism in future climates.

Clarification Comments

Figure 3 caption: The caption should state what the difference between the left and right columns is.

Figure 3: I found the purple stars and cyclone tracks to be very difficult to see on these plots. Perhaps they could be outlined in white to enhance their visibility.

Line 186: It's somewhat ambiguous what "the second one" refers to here; consider replacing "one" with "PV streamer" for added clarity

Line 195: To what cyclone climatology are the authors referring here?

Figure 6 caption: Here the terminology is "perturbation amplitude", but in the Fig. 5 caption, it is referred to as a "wind anomaly" and in earlier captions it is "perturbation intensity." I recommend being consistent in the text and captions regarding the terminology for the strength of the perturbation to the jet.

Line 305: Please state in the text the significance test and confidence level for assessing the statistical significance of this correlation.

Line 322: Here the authors state that the connection between Med cyclone intensity and the max upper-level jet velocity is "substantially weaker" than the connection between the Atlantic cyclone intensity and the max upper-level jet velocity. This seems an overly-simplistic statement that overlooks the fact (acknowledged in the previous paragraph) that the connection between Med cyclone strength and max jet velocity is comparable to that for Atlantic cyclones for jet velocities < 50 m/s. I think it is worth including this important nuance in this sentence.

Figure 12 caption: Please state in the caption what the dots mean on these panels.

Line 403: I recommend added the word "three" before "seasons" for added clarity, since I assume the authors are only referring MAM, SON and DJF.

Line 404: I think this should say 4 hPa higher*, unless I am misunderstanding the sentence.

Grammar and Style Remarks:

Line 15: This sentence gets overly complex. I recommend starting a new sentence after "polar jet", with "We refer to this as the upstream-downstream…"
Line 31: Change "results" to "result" for subject-verb agreement
Line 50: Remove "e.g."

Line 51: Change “the North Atlantic cyclone” to “a North Atlantic cyclone”
Line 52: Add a semicolon after “Mediterranean, and replace “as by removing” with “when they removed”
Line 103: Change “reproduced” to “parameterized”
Line 193: Change “of the” to “off the”
Line 197: Remove “naturally”
Line 216: Change “intruded the” to “intruded into the”
Line 257: Change “shits” to “shifts”
Line 268: Change “cause” to “causes”
Fig. 7 caption: I recommend changing “asterisks” to “stars” in this caption, as what is plotted appear to be stars rather than an asterisks.
Line 350: Remove comma
Line 376: Add the phrase “initial perturbations” before the parentheses on this line.
Line 384: The sentence starting “In MAM,” gets overly complex. I recommend simplifying by splitting it into two sentences.
Line 408: Add “the” before “ocean surface”
Line 429: Change “cycle” to “cyclone”
Line 429: Add “into” before “the Mediterranean”