We thank the reviewer for their careful reading of the paper, their comments and for their time. Our responses are provided below each comment.

1 Reviewer 2

In this study, IBTrACS and ERA-Interim data on NATL tropical cyclones from 1966-2019 are used to investigate the synoptic-scale patterns that are associated with different characteristics of TC acceleration. Three major synoptic-scale patterns are identified: Rapid tangential acceleration of TCs occurs in cases with a developing extratropical wave packet, resembling a development typically observed during ET. Rapid curvature acceleration of a TC is linked to a dominant anticyclone east of the TC, initiating its recurvature. For rapid tangential deceleration and small (near-zero) curvature acceleration, the synoptic pattern resembles a cyclone-anticyclone dipole. Further, a statistical assessment on the characteristics of TC acceleration and speed is conducted, using quantile regression approach. The statistical analysis reveals that the extremes in tangential acceleration (both rapid acceleration and deceleration), the maximum of curvature acceleration, as well as the translation speed of TCs have decreased somewhat (negative trend) over the past five decades. The most robust negative trend has been found for a 20-50°N band during August and September.

This manuscript focuses on the characteristics on TC motion/acceleration during the interaction of a TC with the midlatitude flow in the NATL. It thus could help to complement the findings from previous work, which put a focus on the characteristics of the midlatitude flow and its wave packets during the interaction. In this context, the manuscript compares the results of this study with the findings of Riboldi et al., who focused their investigation on the translation speed of the upstream trough. Overall, the manuscript is well organized and written in a clear manner, and fits well into the scope of WCD, as it investigates both the dynamics perspective of the interaction as well as climatological aspects. However, the comparison to the results in the context of the work by Riboldi et al. is, in its current version, not fully convincing to me (see major comment 1). Furthermore, some parts could benefit from some more clarity in the description/discussion, and in other parts, information on the approach that has been used is lacking. Once these comments has been addressed during the revision of the paper, it will make a very suitable contribution to WCD.

Response We appreciate the reviewer's effort and numerous constructive suggestions.

1.1 Major comments:

The discussion of the results in the context of the study by Riboldi et al (2019) needs revision. First, from the discussion in paragraph 258-267, it is not clear whether the reference is made to the ACCEL or DECEL scenario of Riboldi et al., this information (reference to DECEL) is only made in the Discussion (l.421). On the one hand, it sounds reasonable that the deceleration of a trough, during phase-locking, also manifests in a deceleration of the TC. However, I am not fully convinced yet by the reasoning and figures that are presented in this manuscript. The DECEL scenario of Riboldi et al. is conducive to baroclinic interaction and leads to a (strong) amplification of the downstream wave pattern (TC acts as a "wave maker", Keller et al. 2019). For such a synoptic configuration, I´d expect to see a stronger upstream trough in Fig. 7f-j directly upstream of the TC, as e.g. in Fig. 10 a, c, e of Riboldi et al. Further, when comparing Figs. 4 f-j and 7 f-j with the DECEL scenario in Fig. 10 of Riboldi et al., the position of the TC with respect to the ridge appears to be different. While in the DECEL scenario, the TC becomes positioned in the western part of the ridge during the development, ahead of the upstream trough, where it supports ridge amplification. In Figs. 4 and 7, the TC rather appears to be placed south to the center of the ridge. From the figures provided, its contribution to ridge building is not directly obvious. Please expand on the discussion of these findings in the context of the work by Riboldi et al. This could e.g. include a tracking of the upstream trough to demonstrate the phase locked configuration, additional analysis of the PV (or eddy kinetic energy budget) to analyse the contribution of the TC to the amplification of the ridge, or another suitable means.

Response You make excellent points. We have made several changes to our reference to Riboldi et al. (2019). To be clear, our main intent was to acknowledge that, to our best knowledge, no prior study has examined tangential and curvature accelerations of tropical cyclones and the attendant synoptic patterns. The Riboldi et al. (2019) study is the closest to ours in a narrow sense. The focus of our paper is quite different and we have made changes to the way we refer to Riboldi et al. (2019) in the revised text to clarify this. Your suggestions for additional work are quite appropriate, but given the scope and the current length of this paper, we respectfully defer it to a follow-up study in order to establish firmer connections between this paper and Riboldi et al. (2019).

I am a bit confused by the explanation of the rapid curvature acceleration marking the point of the recurvature of a TC. The explanation in ll. 234-241, on the one hand, sounds reasonable to me. On the other hand, it appears that the (composite) TC in the case of rapid tangential acceleration also undergoes recurvature, as it is e.g. obvious from Fig. 5, but also from Figs. 4 compared to Fig. 7. Please further expand on the differences between the cases of rapid tangential acceleration and strong curvature acceleration to make this point on recurvature clearer. In this context, it could also be of help to see the individual tracks of the TCs included in the composite (e.g. plotting the tracks of all cyclones in the composite after the shift of the grids has been performed).

Response You make a very good point. Indeed, many of the cases in the composites of rapid tangential acceleration also undergo recurvature. So, the two are not independent. In a composite (or statistical) sense, however, a distinction can be noted in the timing of the peak accelerations. This is evident most clearly in fig. 9b. We note that the mean curvature acceleration peaks right around the objectively determined recurvature point. On the other hand, the composite TC experiences increasing tangential acceleration for at least 24 hours after recurvature. The net effect is that the forward speed of the TC continues to rise after recurvature while undergoing ET.

ll. 218-224: Please add information on how the ridge of the extratropical wave packet has been tracked. It would also be good to add information on why the track of the ridge has been used here, instead of the upstream trough, which wraps around the TC, pointing also to a merging of the TC with the extratropical wave packet.

Response The ridge was tracked by objectively determining the peak geopotential value (local maximum). We have added this information in the revised version of the paper. Tracking the upstream trough would still lead to the same interpretation albeit from a slightly different visual perspective. We chose the ridge because of the emphasis placed in the past literature on the downstream ridge building related to ET.

1.2 Minor comments:

l. 94-96: The statement on improved reliability of TC data during the satellite era is partly a repetition of paragraph ll.64-70. Consider revising.

Response We have removed this line.

l.140-141: Could you add a statement on what this implies?

Response This is just an observation of the statistical distribution of the two types of accelerations.

l.160: Centroid position of *all* storms?

Response No, just of the storms that went into the composites. That is, the subset based on the latitude ranges and thresholds used.

l.168: Given the distribution of curvature acceleration in Fig. 2, the 32 km/h per day as the “near-zero” curvature acceleration seems a bit high. Should this be 3 or 2, instead of 32?

Response Thanks for catching this typo. Indeed, the threshold for near-zero curvature acceleration was 3.3 km/hr instead of 32 km/hr. Also, note that the rapid curvature acceleration cut-off was 46 km/hr and not 48 km/hr. These have been corrected in the revised paper.

l.170: For completeness, please also state how many unique storms fall into the category of rapid and slow curvature acceleration.

Response We have now added the text to answer this: “These correspond to 196 and 168 unique storms for rapid tangential acceleration and deceleration respectively, and 170 and 149 unique storms for rapid and near-zero curvature acceleration respectively.”

ll.177-181: This information is already contained in the figure caption (same applies to l 200-202). Consider revising.

Response Done. We have deleted the redundant sentences.

l.199 and later: The use of the word „system“ to refer to the synoptic structure was a bit confusing to me, as system is typically also used to refer to e.g. a tropical cyclone. Consider revising throughout the manuscript

Response Done. We have replaced “system” with storm whenever it was used in the context of a TC. We use this term now only when describing the entire synoptic field (including the TC and the extratropical wavepacket).

l.210: Consider adding also information on day +2, as it is included in Fig. 4.

Response Day+2 is a mere continuation of what happens on Day+1 and we were hoping that the figure is self-evident.

l.211: The downstream trough has not been discussed before. Consider mentioning to already during the discussion of the wave packet in the paragraph above.

Response We have corrected this statement to read: “..downstream ridge-upstream trough couplet..” We are referring to the upstream trough here, not downstream trough. We agree that our original sentence was open to misinterpretation and we hope this corrects that.

l.213: From the figures presented, the strengthening of the geopotential gradient north of the storm is rather hard to detect (a tightening of the geopotential height isobars can somehow be identified in both the left and the right panels).

Response The panels are a tad cluttered owing to the space constraint but when viewed on screen (esp. with a little bit of zooming in), the increase in gradient can be seen, particularly poleward and eastward of the composite storm. We have added the word “eastward” to narrow down the region.

ll.215-216: Downstream dispersion of energy may occur in both cases (if the TC interacts with an existing wave packet, as well as if it excites a new one)

Response Agreed. That is the intent of this statement.

l.239: Consider adding a bit more information on the study/findings of Aiyyer (2015) here.

Response That paper was concerned with predictability of the downstream response related to recurving typhoons. We cite that paper here to provide a reference for the objective method of determining the recurvature point.

l.307: The “all storms” in Fig. 10 are shown in pink/magenta, but text and figure caption state grey.

Response Thanks for catching this typo. Fixed it.

l.309 and others: Thiel-Sen should read Theil-Sen **Response** Thanks for catching this typo. Fixed it.

l.309: According to figure caption, it should read 20-50°N band.
Response Thanks for catching this typo. Fixed it.

l.320: This section could benefit with a brief introductory sentence on its aim (even if it is just a sub-section), as e.g. the start into sections 6, 7 and 8, or like the sentences in L. 329-331. Consider adding.

Response Done. We now start this section with the following sentence: “We now examine trends in the accelerations. We begin with a overview of the shift in acceleration distribution over the past 5 decades.”

l.325: bottom row -> There is just one row in Figure 12

Response Thanks for catching this typo. Fixed it.

l.325-327: The shifts in the CDFs for curvature acceleration are there, but not as clear as for the tangential acceleration, e.g. for 0-20N the 1988-1997 period appears to be characterized by more rapid acceleration that the prior and later period.

Response Agreed. We show the CDFs for a big picture view but rely on the Quantile regressions for a clearer quantitative estimate of the trends.

l.326: Consider adding “not shown” already after the sentence on the CDF over the entire year.
Response Done.

l.327: Could you comment on what might cause this increase in shifts seen in the CDFs, when October and November are omitted. October typically shows the highest percentage of TCs undergoing ET in NATL, e.g. Hart and Evans 2001.

Response It is unclear from our analysis. This will entail looking at the shifts in the storm tracks month by month, something that we are hoping to follow up in a later study

l.360: Could you comment on why the restriction has been made to August-September here, instead of e.g. September-October (same reason as above).

Response We chose Aug-Sep because these two are the busiest months of the Atlantic Hurricane season. These subsets are provided to illustrate some sensitivity to the choice of months.

l.362: I do not understand the reference to Table 1 (tau=.5) here. Do you refer to the 0.68 median tangential acceleration in Table 1 for “Full basin”? Please clarify. **Response** yes, that is what we mean here.

l.382: I am a bit confused by the statement that the OLS estimate of the trend is nearly the same value as it was for the annual-mean speeds. From Table 5, the OLS trend for the entire Atlantic and all months is -0.01, but from Table 2, for full basin and all storms, we get a trend of 0.029 (LR) and 0.028 (MK-TS), but maybe I am comparing the wrong information.

Consider adding a more specific comparison (e.g. number) for clarity.

Response Thanks for asking this. The comparison is being made with the numbers for the full basin (and excluding ET/NR). Those trends for speed are -0.007 (LR) and -0.008 (MK-TS). They are close to -0.01 value shown in Table 5. We have edited the sentence to read:
"For completeness, we also show the corresponding QR results for translation speed (Fig. 15 and Table 5). The OLS estimate of the trend for the entire basin (-0.01 km hr^{-1} year^{-1}) is close to the trend calculated from the annual-mean speeds shown in Table 2 ($-0.007, -0.008$ km hr^{-1} year^{-1})"

ll.405-408: Please be more specific here on how the impact of phasing is evident in the rapid curvature acceleration (as you did above for the rapid tangential acceleration). The aspect of phasing is not discussed in the section 5.2.2.

Response Perhaps not with the same words, but we did discuss the arrangement of the tropical cyclone and the extratropical wavepacket earlier.

l.409: "for rapid tangential deceleration and near-zero curvature acceleration", as there is no curvature deceleration. Same applies to l.421 (rapidly decelerating TCs) and other instances. Consider revising throughout the manuscript.

Response Done. All instances have been replaced.

ll.476-477: For the negative trend in in translation speed and in curvature acceleration this statement sounds convincing, as well as for the negative trend in rapid tangential acceleration. However, could it also serve as an explanation for the observed decrease in rapid tangential deceleration?

Response Yes, the magnitude of rapid tangential deceleration has also decreased.

l.481: three (?) broad sets of synoptic-scale patterns

Response Yes, Corrected.

1.3 Figures & Tables:

Fig. 11 and 12: Labels are hard to read, consider enhancing their size.

Response Agreed.

Tab. 4: The OLS 95% confidence bounds are put in brackets here, but not so in Tab. 3 and 5. Consider harmonizing.

Response Agreed. Done

1.4 Typos:

11 T->t

Response Corrected.

48 shown->show

Response Corrected.

169: There is a bracket missing.

Response Corrected.

250: There is a superfluous space in the bracket for Fig. 7.

Response Corrected.

Corrected
258: 8a->8b

Response Corrected.

259: . . . poleward, the(?) tropical

Response Corrected to read: “The key point here is that the tropical cyclone-ridge system acts like a vortex dipole and is nearly stationary in the zonal direction.”

Several instances: To my knowledge, it is more common to use “storm track” instead of “stormtrack”

Response Corrected.