We thank the referee for reading the revised version of our manuscript and for their constructive comments. In the following we respond to the various comments of each referee and point out any changes we made to the paper based on them. Line numbers and figure references in the reviewer's comments refer to the original manuscript, line and figure references in the responses refer to the revised version. The reviewer's comments are in black; our responses are in blue *blue italics*.

Very minor comments

(1) I think the authors should consider revising the language about wave breaking causing "overall net-poleward jet shifts" (line 229) or that it "dominantly induces poleward jet shifts." (line 279; the final words of the manuscript. Given that there is a stable jet climatology, I don't think it makes sense to say that the eddies are always moving it poleward absent discussion of an opposing process that drives it equator ward.

I appreciate that the authors mean that eddies chiefly transport momentum poleward (out of the subtropics), leading to an observed climate where the jets are poleward of where they would be relative to some radiative equilibrium state absent eddy dynamics. I simply encourage them to emphasize that the eddies are driving the jet poleward against radiative forcing that tends to accelerate them on the equatorward flank; cyclonic wave breaking and a net equatorward momentum transport is a fundamentally transient feature!

We are now specifically referring to "eddy-induced" jet shifts in Sections 5 and 6.

(2) Upon reading the paper again, particularly the introduction and the authors' discussion in lines 37-46, it seems that the most robust feature of eddy lifecycles is that higher wave number instabilities tend to favor more cyclonic breaking (as what occurs initially in the high noise LC1 experiments, or standard LC2 experiments with wave 6), and that larger wave numbers tend to break cyclonically (as wave 6 in the monochromatic LC1 experiment, or waves 4, etc. in the noisy LC2 experiments). Adding shear tends to shift the line between anticyclonic and cyclonic wave breaking to higher wave numbers, but in the presence of noise, the anticyclonic features always win in the end. The authors need not make any changes in response to this, but could consider coming back to the point in the discussion or conclusions. Given the large scale gradient in angular momentum from the tropics to extratropics, perhaps larger waves simply have to move momentum poleward?

We thank the referee for this comment. This is indeed a very important aspect of our findings. We added a paragraph in Section 5 discussing the wave number sensitivity in more detail:

In particular, our experiments suggest that the type of canonical LC1/LC2 evolution is mostly set by the dominant zonal wave number of the perturbation. Small wave numbers produce LC1 behaviour, while large wave numbers produce LC2 behaviour (consistent with the findings of Hartmann and Zuercher, 1998}. While for monochromatic initial perturbations small changes in the initial conditions (e.g., adding a meridional surface shear) can induce transitions between LC1 and LC2 evolutions, non-monochromatic initialisations (like used in this study) will always include LC1 phases due to a robust upscale energy transfer (see Fig 7).

Very minor typographical suggestions

Line 51 “Some main…” seems awkward. Consider “Main findings …”

Fixed.

Line 59 “1000 hPa” (no space)

Fixed.

Line 68 Consider incorporating this footnote into the text to minimize the disruption, say “are visually similar to the ones used by Thorncraft et al. 1993; who did not specify how their initial conditions were constructed) and hence…”

We removed the footnote entirely, since it did not actually add any useful information.