Response to Reviewers

Reviewer 1 - Kristian Strommen

1. Should the anomalous duration of a round-trip equal ... the sum of westward and eastward anomalies? ... If this is not the case, then can you explain why?

As flagged in the online discussion, this arises due to the mathematics of how wind and flight directions interact, and we have added explanatory text on this topic. This is discussed further in the response to Reviewer 3 (Mark Baldwin).

2. L301: "In all cases, the adjusted R^2 estimator suggests that our indices describe nearly a third of total variance" ... Your sentence here therefore seems to oversell the actual results quite strongly, especially the way you say "in all cases"! You could rather say that the values range from 3 to 27% explained variance, with an average of 10%.

The 'in all cases' is very clearly incorrect here - this is most likely an error introduced during text-editing, and has been removed. Thank you for spotting and flagging it! The paragraph has also been modified to say "as much as a quarter", as this is indeed a much fairer description than a third, and to also mention the cases where the value is low.

3. On page 4 where you introduce the NAO index, you should say that a positive NAO is also associated with higher jet speeds, not just latitudinal shifts.

This is a useful addition, and has been added to the text as suggested.

4. I was left wondering if all the indices you consider affect flight times primarily by modulating the speed of the jet. One could imagine testing this by computing Woollings' jet speed index and seeing how much of all the effects can be explained by variations in jet speed. I think this might be beyond scope, so could be left as a question for follow-up work. Some brief discussion on this point in the Discussion at the end would, in any case, be nice.

This is an interesting suggestion. To test this, we have reproduced jet latitude and jet speed indices consistent with those of Woollings et al. 2010 but modified slightly to take advantage of locally available data - specifically, we use ERA5 rather than ERA-Interim, on model levels rather than pressure levels, at a resolution of $1.5°$ and 3 hours. As with Woollings et al. 2010, we use a ten-day Lanczos filter working in 61-day chunks - the window length is less important with modern computing capabilities as we could operate at the whole dataset level, but reduces the chance of differences being introduced between our version and the originals.

Interestingly, the relationships (shown in the table below) between these new indices and the original four are maybe not as close as might intuitively be expected. This is perhaps consistent with Woollings and Blackburn 2012, who required a combination of both the NAO and the East Atlantic pattern to still explain only 62% of the spread between jets in CMIP3 models.

Test	Without jet indices	With jet indices	Typical safe range
VIF	1.0073 - 1.0418	1.0183 - 4.2110	<5
Durbin-Watson	1.7067 - 2.0017	1.7115 - 2.0020	1.5-2.5
Belsley	0.0012 - 0.6412	6×10^{-7} - 0.9242	<5

Considering the relationships quantitatively, the Durbin-Watson and Belsley tests both return quite small values which are only marginally changed from those in the original manuscript.

However the VIF has increased by a large amount and is now edging close to where concern is usually warranted when using this test - the typical cutoff at 5 is a rule-of-thumb rather than a binary flag and affects how much trust can be put in the results, so some additional caution is warranted here given the large fractional increase.

On this basis, it is probably a little risky to include these new results in the primary narrative, but well worth including them in the study overall. The two new indices have therefore been included in a new Appendix summarising the above information and showing a modified form of Figure 5 but including the jet indices, so the reader can draw their own conclusions about whether they are sufficiently independent for inclusion.

For clarity, including this information as an Appendix rather than in the main narrative is very much a choice and we are happy to reconsider this if the Reviewers and Editor feel strongly. We did give serious consideration to including them in the primary study in this revision, but given almost every number in the study would change by a small amount, we judged that the risk of introducing subtle-but-cumulative inconsistencies and errors was greater than the benefit added by the additional explanatory power these indices provide.

References

Woollings, Tim and Mike Blackburn (Feb. 2012). "The North Atlantic Jet Stream under Climate Change and Its Relation to the NAO and EA Patterns". In: *Journal of Climate* 25.3, 886–902. DOI: 10.1175/jcli-d-11-00087.1.

Woollings, Tim et al. (Apr. 2010). "Variability of the North Atlantic eddy-driven jet stream: Variability of the North Atlantic Jet Stream". In: *Quarterly Journal of the Royal Meteorological Society* 136.649, 856–868. DOI: 10.1002/qj.625.