Review of EGUSPHERE-2026-1045

"Persistent episodes of the Euro-Atlantic upper-level jets in summer: precursors, maintainers and impacts"
by
Hugo Banderier, Tim Woollings, and Olivia Martius

Recommendation: major revisions

General Comments:

The authors introduce an analysis of persistent jet periods for both the eddy driven and subtropical jet over the European region. They illustrate the environmental conditions leading to as well as during these episodes. The authors make inferences about potential dynamical reasons for these persistent events. While the results are interesting, the presentation is not easily accessible for the reader, as the text is somewhat repetitive due to the chosen structure and because the authors sometimes speculate without further substantiating their claims. The manuscript might be publishable after major revisions are taken into account.

The authors should provide a more detailed motivation for the presented analysis. What is the relevance of these persistent jet periods? What is the purpose of identifying these jet periods? What motivates to look at these periods from a jet perspective? Where does this question emerge with respect to the jet and not with respect to surface weather or other previously used features in the context of persistent or extreme weather conditions. It also needs to be clarified if the jet is just a feature that is part of a larger scale persistent weather pattern or if the jet is regarded as a driver. In the context of the latter, the authors often argue about mechanisms, though their analysis does not go beyond a synoptic composite of these persistent jet periods. Hence, it is difficult to see how the analysis provides any conclusive findings with respect to the proposed mechanisms. The authors should more clearly distinguish between hypotheses, speculation, synoptic composites, and a dynamic analysis of actual mechanisms.

The structure of the entire manuscript would benefit from weaving the discussion more directly into the results section, because there are many facts, hypotheses, and speculations put forward in the results section, though the reader must memorize all of them until the discussion section. Given the number of facts, hypotheses, and speculations put forward, this is a rather impossible task, which makes the manuscript a difficult read and often leaves the reader confused. Just to give one example: RWB is introduced at some stage, then a hypothesis is put forward in one section, in the next section a negative result is presented with respect to this hypothesis (not much of a signal and not significant), but it is not discussed further or put in context with the original hypothesis. Then, RWB is discussed in the discussion section again, here in an affirmative way with respect to the hypothesis, followed by a concluding remark in the summary. This split of presentation and discussion makes it a bit cumbersome to parse the manuscript and to ensure that one takes the essential messages from it.

The very form of separating results and discussion also leads to quite some repetition, which also reduces the reading efficiency and pleasure of the manuscript. Furthermore,

the discussion reads more like a summary, not like a discussion. In addition, the discussion contains several speculations that are not further substantiated, such as local convection potentially feeding the momentum of the regional STJ, even though no link to the MJO has been found. There have been recent publications addressing the asymmetry of the Hadley cell, which could be put in context here (e.g., publications by Schwendike and Reeder). The third mechanism and its link to the first mechanism also seems rather speculative.

If the authors decide to split the manuscript into these specific sections (results, discussion, summary), the content should adhere to the titles of the respective section. Alternatively, which would also aid the readability of the manuscript, the discussion could be moved directly to where the respective results are discussed. Furthermore, the discussion is repetitive, as the three mechanisms are iterated each at least twice. This also unnecessarily confuses the reader. Please try to structure your discussion more linearly or integrate it entirely into the results while keeping the summary on point.

Sections 3.5.1 and 3.5.2 read like enumerations with many disjoint facts. It would be helpful for the reader if the authors put the different findings into better context with each other, otherwise these sections leave the reader rather confused. The suggested inclusion of discussions with the results could be a way to alleviate these shortcomings.

Several of the variables used for the analysis are inter-dependent, such as theta and PV, but also temperature anomaly and position deviation, where a south/north shift translates into a temperature anomaly. Hence, it is not clear how the choice of these variables and the choice of the method at hand help to disentangle the role of the jet versus everything being part of the same weather pattern. The authors need to more carefully discuss these inter-dependencies and their implications for their analysis. After taking into account these potential inter-dependencies, what would be a net signal and what could be said about its potential origins and causes?

Specific Comments:

Line numbers refer to the ones on the manuscript.

L14: Grammar off in sentence beginning “We…”

L17-21: First sentence difficult to parse. Consider splitting, as it contains two main clauses.

L27: Check style of citation.

L36-54: The paragraph is difficult to parse and includes several topics. Please rephrase and split into at least two paragraphs with logical units to follow the arguments more easily. Also, please further clarify the different strands or arguments related to the momentum fluxes. Momentum flux convergence, baroclinic lifecycles, and Rossby wave breaking are all mentioned, though it remains difficult to understand the implied linkages by the authors.

L55-64: Persistence of different phenomena seems to be addressed in this paragraph, which leaves the reader a bit confused. The connection to the overarching research topic of persistent jets needs to be more clearly developed.

L65-74: The research questions are all interesting, but they need to be more clearly motivated by the previous paragraphs. In a way, there should be a paragraph motivating each of these research questions. This link needs to be developed more clearly for the reader to be able to follow the origin of these research questions and their relevance.

L84-85: What is the motivation for the chosen time of year, i.e., 15 June until 31 September. This has not been motivated anywhere in the introduction, nor is this choice further clarified in the data section.

L97: Clarify how the momentum flux is used to assign the type of RWB. If this is based on previous work, it should be cited.

L105-108: The method of detecting the jet core as a line appears rather similar to Spensberger et al. (2017). In general, the authors should put their detection in context of previously introduced jet detections and clarify why their specific choice is superior to already existing and more commonly used jet detection schemes. In other words, why does the world need yet another jet detection scheme?

L119-122: The explanation of the methodology for connecting jets over time is insufficient. The authors need to provide more details about the method and provide a justification for your choices. Just being “technically simpler” is not a valid justification and it needs to be clarified what the authors mean by “more stable”.

L126: Is this really a persistence metric or rather just a time-weighted distance metric? Persistence would imply a coherence for several time steps, not the distance of two objects for one weighted time step.

127: What were these “several alternative distance definitions” that were tested? Please provide more details and reasoning for your choice of metric as well as a discussion of its advantageous and caveats.

L131-133: Please justify your choices in more detail and discuss the sensitivities of the results to your choices.

L135-136: What are the implications of this statement about STJ and EDJ?

L136-138: This seems to be a discussion of results, though no figure reference or reference to other literature is provided to back up the quantitative statements made.

L150: The authors need to discuss the sensitivity of their choice to project all jet lengths onto a [0,1] length. One wonders about the sensitivity of their findings to jet length, i.e., what is the variability in their analysis and how does it project on different jet lengths.

L168: “the height of the”

Figure 3: The figure caption does not explain the difference between the purple and pink lines and shading. It is thus not clear what is shown in this figure. One can assume that the darker color corresponds to the EDJ and the lighter to the STJ, but this needs to be clarified.

L207: What is the definition of “sensible weather”? A literature search could also not clarify the origin of this term. Please consider rephrasing.

L208: Statement needs backing by references.

L221: “precipitation”

L397-399: These statements read rather speculative, see also general comment.

L404-409: These sentences are rather speculative, and it is difficult for the reader to understand what to take away from this discussion. Please stay closer to your own results and discuss those for the benefit to help the reader to interpret your findings. The amount of speculations makes it difficult to disentangle what was actually discovered in this manuscript and what the key messages are.

L446: The statement that the authors “investigate the mechanisms” is not quite correct. The authors provide a synoptic presentation of various variables around persistent jet conditions. “Mechanisms” implies that the authors provided a causal analysis of what lead and maintained these persistent jet regimes, though such an analysis has not be provided.

L462: What are “event odds”?

L468: “when it is persistent”

L482-483: The statement in this sentence needs to be backed up by literature.