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Interactive comment on "Oceanic origins for wintertime Euro-Atlantic blocking" *by* Ayako Yamamoto et al.

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We would like to thank three anonymous reviewers for providing us with positive feedbacks and numerous constructive comments to help us further improve the current version of the manuscript. Below we describe how we currently plan on addressing some of the major and minor comments raised by the reviewers. We are going to provide a thorough point-by-point response to all the comments provided upon resubmission of the revised manuscript.

Major points:

1. Blocking identification (a point raised by Reviewer 1)

Thank you for this comment. We agree with the reviewer that it might be more appropri-

ate to use a blocking definition based on PV in the current study rather than that based on the geopotential height field, given the significance of PV in our main conclusion. Nevertheless, we have decided to use what we believe to be one of the most robust blocking definitions currently available under the constraint that the CFSR dataset provides no PV on pressure levels, which makes it difficult to implement the PV definition based on this dataset. Alternatively, as a proof of concept, we have started a simulation where we have released particles from a few PV-defined blocks based on ERA-Interim (Sprenger et al. 2017, BAMS). We are going to compare the properties along these particles against those along our original particles to test if the same conclusions hold.

2. Particle release points (a point raised by Reviewer 1)

Thank you for this comment. We will add another release level of ∼10,000 m a.s.l. to increase the robustness of our study. Also, we agree that it is a good idea to remove those particles that initially have PV > 2pvu at the time of release. We will implement the criterion for the revised manuscript.

3. Classification of the particles (a point raised by Reviewer 1)

As Reviewer 1 points out, the current criterion essentially separates the particles that once resided in the PBL from those that did not, which is exactly the goal of the current study. PBL is where the oceanic influence can be directly felt by the particles via turbulent heat fluxes, and positive (upward) latent heat flux at the time and location when and where a particle is situated is a very good indicator for the moisture pick-up by the particle. Indeed, Yamamoto et al. (2015) applied the same technique and found that this definition describes the supply of turbulent heat fluxes from the ocean reasonably well. We could instead classify particles into ascending and non-ascending categories as the reviewer suggests. Still, we do not have any prior knowledge that those particles that undergo substantial ascent to become a part of blocks have to get fueled by the ocean. Additionally, ascending particles may also include dry particles that undergo orographic lifting without any role for moisture content. For these reasons,

we believe that our current definition addresses the question of interest in a more direct manner. We will better clarify and justify this classification method in the revised text.

4. Climatological perspective (a point raised by Reviewer 1)

Thank you for this comment. We are currently computing trajectories for particles released from the same regions of interest but when there is no block found within +/- 10 days. We will report how the percentages of the particles of the oceanic origins differ from those released from blocks in our revised manuscript.

5. Further analyses on moisture uptake (a point raised by Reviewer 1&2&3)

Thank you very much for informing us about these studies. We agree that implementing the approach described in Sodemann et al. (2008) and Pfahl et al. (2014) will help us further identify the moisture source regions for blocking events. We will therefore follow this method to investigate more detailed processes on particles' moisture uptake in the revised manuscript.

6. Quantification of PV anomaly along trajectories (a point raised by Reviewer 3)

Thank you for raising this point. We agree that computing PV anomalies along trajectories will further clarify how our results compare with the previous studies. We will include the analysis in the modified manuscript.

7. Relationship between strongly intensifying cyclones and WCBs (a point raised by Reviewer 3)

Thank you for this comment and for letting us know about this study. We will try obtaining the relationship between SLP tendency and ascent in the revised manuscript.

8. Omission of Section 4.4 (a point raised by Reviewer 3)

We appreciate your feedback on this. However, we still think that there is some value in including this section. In particular, while Figure 8 exhibits the mean properties along the particles, it does not answer the question of what kind of meteorological conditions

are responsible for giving rise to the different pathways, which is the aim of Section 4.4. We will try further clarifying these points while making the section more concise in the revised manuscript.

Minor points:

- Methodological explanations:

Thank you for pointing out some methodological explanations that should be better clarified. We will add more detailed explanations in the revised manuscript.

- Title:

Thank you for suggesting the alternative title for our manuscript. We agree with Reviewer 1 that the suggested title better portrays the content of the manuscript and we will modify the title in the revised manuscript accordingly.

- Figures:

Thank you so much for multiple suggestions on improvement of the figures. We will try to follow them.

- Typos and grammatical errors:

Thank you very much for pointing them out. We will carefully go over those points in order to improve readability.

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