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## Comment on wcd-2021-56

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Referee comment on "Atmospheric blocking and weather extremes over the Euro-Atlantic sector – a review" by Lisa-Ann Kautz et al., Weather Clim. Dynam. Discuss.,  
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Review of Atmospheric blocking and weather extremes over the Euro-Atlantic sector — a review

Recommendation: suggested revision

Comments: This paper surveys current and recent literature describing the weather and climate implications of atmospheric blocking over the Euro-Atlantic sector. Temperature, hydrological, winds and compound anomalies are discussed, together with predictability and future climate projections.

It is widely recognized that blocking patterns drive surface weather anomalies but there are few papers that catalog many specific events that demonstrate their associations and this review paper is unique in that regard. On the other hand, the discussion of hazard types and case studies is sprawled over many disparate events and pertinent publications yet it is hard to grasp key points other than that each event is different (it was a laborious read). Certainly section 8 nicely summarizes the current state of the field and main challenges (I agree with all the points raised in that section), but instead of just laying them out in the conclusion, the authors can proactively structure the text to address some of these challenges. For example:

- I think it is important to stress the importance of case studies at the beginning because (i) the sporadic nature of events hinders statistical analysis of data and (ii) there is a wide variety of weather extremes associated with the types and position of blocks
- How one generally determines whether a surface event is related to blocking is probably worth discussion before diving into the list of case studies, even though this may reveal the main challenge of the field (metric dependence, etc).
- It would be useful to have a table (possibly in the supplementary material) that lists

the notable events mentioned in this paper, with the dates, affected regions, the types of hazards, the association with the block according to the region specified in Figs.1 and 2, the phase of NAO, and the estimated damage/fatalities. (It is not easy to find an authoritative estimate of economic losses even remotely associated with blocking. The list will be an easy reference for scientists who search for past relevant events.)

- If we have a list of events in the table mentioned above, perhaps Sections 3-5 may be shortened, highlighting only quintessential examples.

Other points:

LL17-20 (also Section 3.1): I'm not sure about Europe, but in the US, heat waves on average kill more people annually than any other form of natural hazards: <https://www.nrdc.org/sites/default/files/tracking-silent-killer-heat-health-fs.pdf> (and many are demonstrably related to blocking). Since heat affects the population in otherwise cool climate the most, its potential danger may be stressed more.

LL122-124: This reads like low PV air generated near the surface is advected upward. Is it what it implies? — I suspect latent heating can occur over a column of the troposphere; in that case it is the upward diabatic mass flux that 'dilutes' PV in the upper troposphere that leads to a negative PV anomaly (what gets advected from the boundary is mass, not PV)? (Haynes and McIntyre 1987, JAS p.828 Fig.2)

LL128-133: Meridional displacement of PV is generally related to Rossby wave transience, but it can operate in different ways — feeding of transient Rossby waves from upstream is an important ingredient but the modulation of quasi-stationary Rossby waves by the remote (sub)tropical sources can be also important.

LL235-240: Does orography play any role at all (e.g. adiabatic heating associated with a foehn wind)?

LL254-259: Does the balance between radiative cooling and adiabatic warming (subsidence) play more prominent role in summer (in association with heat waves) when advection is weaker?

LL349-359: I think droughts here largely refer to meteorological droughts, but there are other types of droughts (hydrological, agricultural, socioeconomic, and ecological) that could spawn from persistent blocking events and making that distinction may be useful.

L482: One of the most exceptional drought —> One of the most exceptional *droughts*

LL534-535: Record-breaking snowfall happened the northern part of the Alps → Record-breaking snowfall happened *in* the northern part of the Alps

L584: Costal storm surges → *Coastal* storm surges

L600: the presence of and a blocking system → the the presence of a blocking system

L624: power plants → power *outages* (?)

LL630-637: The discussion in Section 6 focuses on short-term predictability. But climate models tend to underestimate blocking occurrences in the Euro-Atlantic sector. Does that mean that climate models also underpredict the frequency of extreme weather?