

Review of the manuscript "A Lagrangian analysis of upper-tropospheric anticyclones associated with heat waves in Europe" by Philipp Zschenderlein, Stephan Pfahl, Heini Wernli, and Andreas H. Fink

In order to simplify the revision task, I organized my remarks taking into consideration the list of aspects suggested in the WDC review criteria, as follows:

1. Does the paper address relevant scientific questions within the scope of WCD?

The manuscript addresses interesting questions, concerning synoptic conditions and processes leading to the occurrence of heat waves in Europe, which, regarding the global warming and increasing frequency of positive temperature extremes, is scientifically relevant and perfectly comprises the scope of the journal Weather and Climate Dynamics.

2. Does the paper present novel concepts, ideas, tools, or data?

The concept of analyzing the role of diabatic heating for the formation and maintenance of upper-tropospheric anticyclones associated with heat waves, which was undertaken in the paper is novel and it was pursued with adequate modern methods of a Lagrangian analysis. Authors defined the backward trajectories of air parcels in the days prior to heat waves and quantified diabatic processes along the trajectories, which influenced formation of anticyclones.

3. Are substantial conclusions reached?

Relevant, although surprising conclusions concerning the two source regions of air masses were obtained for heat waves in Central and Southern Europe. Described spatiotemporal variability of the diabatic processes influencing formation and conditions of anticyclones related to heat waves, seems to be one of the most important results.

4. Are the scientific methods and assumptions valid and clearly outlined?

Data and Methods section is well organized and clearly written. Description of all calculations and research procedures are complete and precise; all methods are adequate to the anticipated results.

5. Are the results sufficient to support the interpretations and conclusions?

Interpretations and conclusions in general well correspond to the obtained results, however, some conclusions concerning other European regions than the three analyzed in the study in details (Central Europe, western Russia and Greece/ Italy) seem to be weakly documented. Other regions are addressed only in single paragraphs and figures (Fig. 1b and 5b). I would suggest to consider removing regions IB, BI and SC from the analysis.

6. Is the description of experiments and calculations sufficiently complete and precise to allow their reproduction by fellow scientists (traceability of results)?

Please, see point 4.

7. Do the authors give proper credit to related work and clearly indicate their own new/original contribution?

Yes

8. Does the title clearly reflect the contents of the paper?

The title is adequate to the content.

9. Does the abstract provide a concise and complete summary?

Yes.

10. Is the overall presentation well structured and clear?

Yes.

11. Is the language fluent and precise?

Yes.

12. Are mathematical formulae, symbols, abbreviations, and units correctly defined and used?

Yes.

13. Should any parts of the paper (text, formulae, figures, tables) be clarified, reduced, combined, or eliminated?

Some clarifying of figures seems to be needed, namely:

Fig. 1a – please adjust caption concerning PVU lines to the content of the map; it would be useful to put values on PVU isolines.

Fig. 1b – I would suggest to consider to delete Fig. 1b and eliminate from the analysis regions IB, BI and SC (please, see remarks in point 5).

Fig. 5a – in my copy the difference between 3d and 7d line is not distinct enough.

Fig. 5b – please, see comment in point 5.

Fig. 7 and 8 – I would rather suggest to join the figures; please, note that captions are not complete (what does the black checked field mean?)

Fig. 10 – Please, adjust the caption (I can't see the black dashed line in the picture).

14. Are the number and quality of references appropriate?

The paper contains a reach list of references pertaining to both methods and comparable results.

15. Is the amount and quality of supplementary material appropriate?

There is no supplementary material.