

Nat. Hazards Earth Syst. Sci. Discuss., referee comment RC3  
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## Comment on nhess-2021-396

Anonymous Referee #3

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Referee comment on "The unusually long cold spell and the snowstorm Filomena in Spain in January 2021" by Philipp Zschenderlein and Heini Wernli, Nat. Hazards Earth Syst. Sci. Discuss., <https://doi.org/10.5194/nhess-2021-396-RC3>, 2022

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In this paper an attempt is made to investigate the large scale dynamics of a cold spell in Spain along with a following snowstorm and to examine their characteristics on a climatological basis. The paper deals with an interesting topic and the authors have investigated it to some extent. However, I have the following queries:

- The study provided an analysis of basic large mechanisms that are well known for the occurrence of snowfall in the Mediterranean region. From this point, the study does not contribute any new knowledge. The only interesting feature I found is the analysis of the role of WCB. I think that the study should include mesoscale processes that facilitated the snowfall. Alternatively, the authors should perform a full analysis of other similar studies and comparison among them to exhibit similarities and/or differences. For instance, the authors refer briefly two cases in section 6 in comparison to Filomena, with obvious orographic forcing without further discussion. Furthermore, a comparison of the snowfall with forecast and investigation of possible forecast failure would be an interesting topic.
- The authors employed short term ECMWF forecasts for precipitation and snowfall during the examined period. Furthermore, they employed ERA5 reanalysis data with resolution  $0.5^{\circ}5^{\circ}$  for the climatological part of their study during the period 1979-2021. I suspect that they employed the ERA 5 reanalysis data for plotting  $\theta_e$  and PV (Figures 6, 7 and 8). However, they performed comparison of the specific snowfall event and the cold spell with other events employing different datasets, probably providing biases in their results (e.g section 2.3 or 4). I am wondering why they did not use ERA5 reanalysis data throughout the whole study.
- The analysis of trajectories was useful only for the part of WCBs. The source of the cold air mass can be easily seen from the synoptic analysis. More details should be provided about the use of the LAGRANTO model on a climatological basis
- There are some points where there is no justification. For instance: the anticyclonic wave breaking (Fig 6e), the content of the clouds (Figure 8)
- Observational data (station data, radionsonde data or radar data) should be incorporated to justify findings from the reanalysis plots.

## More specific comments

- Figures 6-7: These figures contain many details (coloured parameters, contours, labels) and it is difficult for the reader to follow
- Figure 6: the letters L1, L2, F should be annotated what they stand for