

Comment on acp-2021-350

Anonymous Referee #1

Referee comment on "Overview towards improved understanding of the mechanisms leading to heavy precipitation in the western Mediterranean: lessons learned from HyMeX" by Samira Khodayar et al., Atmos. Chem. Phys. Discuss.,
<https://doi.org/10.5194/acp-2021-350-RC1>, 2021

This paper presents an overview of the main mechanisms associated with heavy precipitation over the Mediterranean. In particular, it reviews the main outcomes from the HyMex international project and their field campaigns.

After a general introduction and a description of the observational and modelling infrastructure, the paper encompasses many of the key mechanisms leading to heavy precipitation. In general, all mesoscale and microphysical aspects are very well covered with the correct highlight of the results coming from the HyMex observation campaign.

The only aspect which in my view could have been further expanded, given also the relevance in the genesis of heavy precipitation, is their relation with the large-scale dynamics (section 3.1). Amongst the important literature on this topic, like Massacand et al. 1998 and Martius et al. 2008, it is worth mentioning a few very recent papers like 1) De Vries 2020, 2) Mastrantonas et al. 2021, 3) Grazzini et al. Part II 2021, which are showing robust and quantitative relations and dynamical linkages with large-scale precursors. But I understand that the focus of the current review is more on the mesoscale and local interaction so take my suggestion as not compulsory but as a simple indication. You decide whether it is necessary to expand the section. Other than that I think the manuscript is ready for publication after very minor changes reported below.

Minor changes:

- On page 9, line 291, you mention "comma-shaped" cloud coverage. You did not explain the meaning but hinting some implication of that. The explanation comes later, on pages 10 lines 324-327. It would be preferable to introduce first the relevant concepts.

- For the benefit of readers non used to European geography, it would be helpful to show CI, NEI, CO regions (only defined in the text) delimited on a geographical map

References:

- 1) Vries, A. J. D., 2020: A global climatological perspective on the importance of Rossby wave breaking and intense moisture transport for extreme precipitation events. *Weather and Climate Dynamics*.
- 2) Mastrantonas, N, Herrera-Lormendez, P, Magnusson, L, Pappenberger, F, Matschullat, J. Extreme precipitation events in the Mediterranean: Spatiotemporal characteristics and connection to large-scale atmospheric flow patterns. *Int J Climatol.* 2021; 41: 2710– 2728. <https://doi.org/10.1002/joc.6985>
- 3) Grazzini, F, Fragkouidis, G, Teubler, F, Wirth, V, Craig, GC. Extreme precipitation events over northern Italy. Part II: Dynamical precursors. *Q J R Meteorol Soc.* 2021; 147: 1237– 1257. <https://doi.org/10.1002/qj.3969>