

Interactive comment on “Compound Hot-Dry and Cold-Wet Dynamical Extremes Over the Mediterranean” by Paolo De Luca et al.

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In this paper concurrent recurrence of temperature and precipitation patterns over the Mediterranean are quantified and changes over time highlighted. The paper is well written and the results are highly interesting and relevant. There are some methodological points that need further explanations for non-experts (explained in more detail under major points) and the colorbars of the map figures need to be improved. After these clarifications the paper is ready for publication. Olivia Martius

Major points: 1) Consider adapting the title because the term “dynamical extremes” may not be widely known. 2) I have some basic methodological questions that I did not yet fully understand and that might be confusing for other readers as well. a. Co-

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occurrence of dry and hot (cold and wet) conditions refers to the entire Mediterranean area. The dry conditions and the hot conditions must not necessarily happen at the same location in the Mediterranean area? b. You state that you get an alpha and theta value for each time step of the data, but it is unclear how long the time period is that you use to determine these parameters, you only mention a “relatively long time period” in the beginning. Is it a moving window of a number of days? Are then successive alpha and theta values very similar? c. Is it correct that compound dynamical extremes are “extreme” in the coupling but not necessarily in p and T? Do these CDEs then point to weather situations that are dominated by the synoptic-scale flow rather than by local convective systems? 3) Please use colorbars with discrete colors for all map figures. For example, when I am interested in the SLP anomaly over Italy in Figure 4a it is very difficult to link the discrete colors on the map to the continuous colors in the colorbar. 4) The interpretation of Figure 4 is difficult without a reference to the climatology. It would be good to indicate how the anomalies relate to the climatology (e.g. % of mean) and if feasible to the variability (e.g., STD, inter quartile range). For example, precipitation rates in the Alps are higher in the climatology. So maybe in Figure 4e the anomalies over the Alps are small from a climatological and variability perspective and the dry anomalies in other areas are large. This would also clarify a follow up question namely can your method capture dry and wet extremes at the same time? The discussion of Figure 4d focuses on the wet anomaly over the Alps but the subsequent discussion of the histograms points to the prevalent dry signal. This is confusing for the reader.

Minor points: 1) L16: Could you provide an example for the dynamical changes. 2) L28: Clarify what you mean by similar changes. 3) L44: Define large-scale precipitation, here I assume it is the model variable. 4) L47: Suggest to shift a couple of sentences from the next section up here to briefly explain what dynamical systems are. A dynamical meteorologist might think of weather systems at this point of the paper rather than system dynamics. 5) L92: How do you define anomalies? Are these to the 30-year (seasonally varying?) mean? 6) L92: But you also use large-scale vs. convective precipitation? Could you add the information that the precipitation is a

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forecast field and not assimilated. 7) L121: what do you mean exactly by “restricting the analysis...”? 8) L141: Please define how you calculate the anomalies, wrt to a seasonal mean? 9) L141: Linking the precipitation anomalies with the SLP anomalies should be formulated in the form of a hypothesis. 10) L147: Please add supporting references. For heavy precipitation along the western Alpine south-side the low pressure system is typically located over the Gulf of Genoa. Also these types of low pressure systems are associated with cold fronts and colder surface temperature. However, the temperature pattern shows high temperatures in this area. An alternative interpretation is that the low pressure system over the Balkans might correspond to a heat low. It is unclear for me which aspects of the SLP distribution are related to the precipitation field and which ones to the temperature field. Can you separate this? This might also link back to major point 4. 11) L151: How does the cold air from northern Europe cross the Alps into Italy? This statement does not have any supporting analyses in the paper. Please either refer to the literature, show the trajectories or remove the statement. 12) L162: how do you define dry? 13) Please add units to Figure 5. 14) L175: It is unclear to me how you compute these maps since I understood the measures to be linked to one pattern over the entire Mediterranean. Please expand your explanations. 15) L195: weaker anomalies -> can you be more specific?

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