We thank Anonymous Referee #2 for his/her constructive comments. Our reply is in blue and quotes from the revised manuscript are in purple. Line numbers correspond to the original submission.

Anonymous Referee #2

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Review of the manuscript NHESS-2020-310
The heavy precipitation event of 14–15 October 2018 in the Aude catchment: A meteorological study based on operational numerical weather prediction systems and standard and personal observations
submitted for publication to Natural Hazards and Earth System Sciences

The paper presents the analysis of a case of heavy precipitation which led to several damages in south-western France. This case study is analyzed by means of observations and different operational numerical weather prediction models. The manuscript is interesting and the analyses presented are rather extensive. However, in the current form, the presentation of the event and of the results is confusing. Moreover, there are too many figures. I therefore suggest reorganizing the manuscript in order to improve its readability.

> The number of figures has been reduced from 25 initially, down to 18. The objective of the paper has been reduced to the use of operational weather forecasts and standard and crowdsourced observations to highlight the meteorological processes that characterise this extreme hydrometeorological event. Numerous details, which were not essential to the body of the manuscript, and passages that are now off-topic have been either left out or sent to an appendix, with the intent of improving the manuscript's readability.

Major remarks

1) I would completely remove the hydrological description of the event, since it is not important and essential for the other parts of the paper. Therefore, I would remove lines 197-216, Figs. 8 and 9 and Tables 1 and 2.

> The hydrological description of the event has been significantly shortened. However, we kept the brief comment regarding the soil wetness because it could have been one of the meteorological factors explaining the intensity of the floods and the main goal of the article is now to highlight the meteorological processes that characterise this extreme hydrometeorological event.

2) In my opinion Section 5 is not easy to follow. There is a mix between the mesoscale description of the event and the evaluation and interpretation of numerical weather prediction models. I would move all the parts where the event is simply described to Section 3, where the case study can be described both at the synoptic scale and at the mesoscale. So, for example, I would move the description contained in Section 5.1 to Section 3.

> Section 3 is intended to provide an overview of the event without going into detail. The ARPEGE model analyses are used for this purpose, as one could have used those of IFS for example. Section 5 aims to use both deterministic and ensemble-based fine-scale models based on Arome to explain the meteorological processes involved in the event at mesoscale in more detail.

3) Figure 17: Authors say: "Figure 17 indicates that higher precipitation is associated with lower pressure over the Mediterranean Sea, which can be interpreted as a deepening of the mesoscale trough". The lower pressure highlighted in Fig. 17a may be caused by a different timing of the low pressure moving eastward. In my opinion, it would be clearer showing the pressure field of the three members with higher precipitation (all the members or the average) and of the ensemble mean. In this way, the position and the values of the low pressure can be directly appreciated and compared. I think that this comparison would be useful also in the following section where the intensity of the low-level wind is analyzed. The same considerations apply also for panel b). In panel c) I would plot the specific humidity and not the relative humidity, to have an idea of the absolute amount of water vapor. Finally, it is not clear what time is "the middle of the period".

> We are sorry that limits to the length of the paper do not allow us to present the ensemble members maps for all the interesting parameters. The ensemble mean is not a very informative plot because it tends to smooth out important features of the flow, and to confuse the graphical interpretation with many small-scale details. However, we have investigated the interesting point raised by the reviewer and for this we have looked at individual members. The cited sentence has been replaced with the following one:

Figure 10 indicates that higher precipitation is associated with lower pressure over the Mediterranean Sea, which is both due to a larger and earlier deepening of the mesoscale trough as indicated by a visual examination of the pressure fields of all members (not shown).

The 'middle of the period' referred to the 'middle of the period of interest'. It has been clarified in the caption:

The forecast time is 02:00 UTC on 15 October 2018, i.e., in the middle of the period of interest.

Specific humidity was examined too, but its correlation with precipitation is much less clear, which is understandable because the condensation processes that drive convection and precipitation tend to be driven by the occurrence of saturation, rather than the absolute water content. Saturation being sensitive to both specific humidity and temperature it is more effectively diagnosed by relative humidity than specific humidity.

4) In Section 5.3 the Authors discuss the relation between the virtual potential temperature gradients and the localization of heavy precipitations. In my opinion, this temperature gradient is a consequence of the precipitations, so it is not so important for the analysis of the different performance of the members of the ensemble. The Author say: "In this case, near the ground, observations show an existing cold air mass before the event begins, which is cooled during the event, increasing the west-east gradient of temperature along the front". However, this is not shown in the paper, so it is not clear how this cold air mass may have influenced the localization of the precipitations.

In fact, further investigations, which are the subject of another article following this one, show that the contribution of precipitation to the formation of the temperature gradient is small. It is precisely the work shown in this article that has made it possible to highlight the interest of studying the question of the influence of precipitation on the temperature gradient between the two air masses.

Minor remarks

Abstract: the Authors say: "it is shown that the positive Mediterranean sea surface temperature anomaly may have played an aggravating role in the amount of precipitation...". However, this is just a speculation of the Authors, which is not demonstrated in the paper. Therefore, I suggest removing this sentence from the abstract.

The sentence has been rephrased as follows:

Mediterranean Sea surface temperature and soil moisture anomalies are briefly reviewed, as they are known to play a role in this type of hydrometeorological event.

Page 2, line 55: I do not understand why this event is "atypical".

The event is atypical because of the joint presence of a former hurricane (Leslie) and a near-ground cold air mass. This has been clarified in the text by splitting the sentence in two:

This case was chosen because it has had particularly dramatic consequences, but also because of the atypical joint presence of a former hurricane (Leslie) and a near-ground cold air mass. The 2018 floods took place nineteen years after one of the major precipitating episodes recorded in the same region, the episode of 12–13 November 1999 (Nuissier et al.,2008; Ducrocq et al. 2008).

Figure 3: I suggest keeping only one of the four panels of Fig. 3, as the information contained in the four panels is very similar.

Only the daily SST anomaly of 14 October has been kept.