

## ***Interactive comment on “The AROME-WMED re-analyses of the first Special Observation Period of the Hydrological cycle in the Mediterranean experiment” by Nadia Fourrie et al.***

### **Anonymous Referee #1**

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Review of the manuscript The AROME-WMED re-analyses of the first Special Observation Period of the Hydrological cycle in the Mediterranean experiment, by N. Fourrier et al.

This manuscript presents the results of the second Reanalysis performed with AROME-WMED model for the two-month period of the first Hymex field campaign SOP1. The results are contrasted with those available during the real time activity and those obtained with the first reanalysis. In particular, with respect to the latter, the new reanalysis employs a new B matrix for the 3DVar and assimilates a larger number of observations. Although the results show that the improvement of the second reanalysis is limited (I

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would say less than expected, this is my feeling reading the paper), the methodology and the statistical results are suitably presented. I would suggest to highlight better what is really the valuable result of Reana2, since the effort was considerable. Moreover, some clarifications are required, as detailed in the following, together with minor corrections.

Abstract Line 15: remove upper-level

Introduction page 2 line 6: to study heavy precipitation line 24: provide acronyms of projects line 31: undertaken to exploit observations

Section 2 page 3 line 20: occur over the north western Mediterranean, from Catalonia... Otherwise it seems you are interested only on the event over the coast and I don't think it is true. page 4 Is the difference between the two orography computed on the raw (original) data, or on those interpolated on AROME grid? line 13: are temperature, specific humidity, the two horizontal component of the wind and surface pressure page 7 lines 8-11: I would remove the word resp. Brackets are clear enough.

Section 3 page 8 line 2: In addition, new line 3: between the two re-analyses line 13: radiosondes (available in France ...) were line 18: were also used in the second line 18: profilers data were carefully checked line 20: lidars were processed page 9 line 1: These data were smoothed. Moreover what does it mean? You mean they were interpolated at that resolution or did you used filter? lines 9-10: The higher amount of observations mainly comes .... profilers, satellite radiances, scatterometer wind estimates, Caption of Tab 2: between the first (REANA1) and the second (REANA2) reanalysis. The same for Fig. 5 caption.

Section 4 page 11 line 3: the performance of the data assimilation systems line 6: on figure 7 for observations related to humidity and on figures 8 and 9 for wind line 15: by the different number of assimilated observations, For REANA2, the use of a different lines 26-28: Does it mean that the difference between REANA2 and the others, with the same number of observations, indicate the impact of background statistics?

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Please, make this point more clear. However, I can not see relevant differences in figs. 7 and 8, so maybe it would be better to stress where exactly you consider these differences relevant. line 30: the increase in wind profiler observations numbers is hardly visible in Fig. 8. Maybe it would be better to indicate explicitly the approximate number of observations. page 12: Caption of fig.7: explanation of the yellow lines in the middle panels is missing Fig. 7: the first impression looking at this picture is that the only relevant differences in the reanalyses are obtained when lidars are assimilated. I understand this is not the correct explanation of Fig. 7, but you should stress better the lidar impact in the text. page 14: lines 1-4: I can not understand if the impact of dropsondes is retained and considered positive or not. lines 7: the reference to fig.8 third row is correct for radar? page 15 line 3: more than a diurnal bias, I would say that the model underestimates the diurnal cycle line 5: how can you ascribe the impact to the different orography. Is there any clue? line 6: slightly reduced. This is hardly visible in the plot. Is this significant? lines 10-11: not true for wind page 17 line 3: re-analyses forecast: I believe forecasts starting from re-analyses is better. lines 7-9: please revise this part. I can not find correspondence with the figures. For example for temperature I would say above 800 hPa instead of below 600 hPa as you wrote last line: (Bock et al., 2016) page 18 line 1: These data being assimilated ... Are you assimilating GPS in REANA2 and then comparing results against the same data? Is this fair? page 20 line 13: eastern part page 21 line 1: some moisture bias: do you see this bias from Fig.15? In case, I believe it very difficult to make a fair comparison between the three reanalyses and observations, given missing data over the sea and over large portion of the land area. A statistical quantitative comparison would be needed to draw conclusions. line 2: Central Italy

Section 5 page 22 line 5: IOP was line 9: Lion, associated with line 10: cut-off drove line 11: how can be the SEly flow reinforced by the orography of Cevennes? line 13: 100 mm/24h were recorded page 23 line 3: that compare well line 11: remove lead lines 10-11: results are worse for low precipitation values in the 6-30h range. I was wondering how different is the number of raingauges in 0-24 and 6-30 periods. Does

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it have an impact on the statistics? lines 12-16: The explanation of positive impact on QPF should be better supported. Here it is just an hypothesis and no one can say if it's true or not. Please provide more details and more evidence.

Conclusions page 25 line 8: Larger values: are these values too large or not? It is not clear.

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