Review of the manuscript HESS-2019-223
"Regional ensemble forecast for early warning system over small Apennine catchments on Central Italy"
by Ferretti R, Lombardi A, Tomassetti B, Sangelantoni T, Colaiuda V, Mazzarella V, Maiello I, Verdecchia M, Redaelli G

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1 General comments

The manuscript aims at assessing the relevance of applying ensemble simulations to meteo- and hydro-logical modelling to improve the forecast of flood events. The work is quite interesting, even if the statistical analysis of the ensemble and of the results is rather weak and some conclusions are not fully supported by the research outcomes.

I think that the paper can be improved with an accurate major revision, in order to fix the scientific flaws listed in the specific comments below.

2 Specific comments

1. The description of the ensemble is quite confusing to me. Throughout the paper, ensembles of 20 members and of 21 members are often mentioned (at page 2, lines 14 to 32; page 3, lines 30 to 32; page 6, lines 11 to 13; page 17, lines 9 & 10; etc.), but at the end I was not sure to have understood the difference between the two ensembles.

2. The statistical description of the ensemble and of the results is very weak. Only few, very basic statistics are considered and they are defined in a rather cumbersome way (see technical comments # 31 & 32).

3. Section 3.2 "Ensemble precipitation time series" should be discussed in a more accurate way.

   - I am sorry, but I think that the agreement between forecast and observations is not so exciting. In fact, I do not agree with the sentence "The meteorological ensemble well reproduces the event in terms of heavy precipitation area identification, as well as its onset and length" in the conclusions (Page 19, lines 21 & 22). A qualitative assessment would be more objective and the reader could decide whether the agreement is satisfactory or not.

   - The variability among ensemble members appears much smaller than the difference between ensemble mean and observations (Figure 6). This fact is not sufficiently considered, quantified and discussed in the text.

4. Page 20, lines 7 to 15. These conclusions should be reinforced. After a first, possibly fast, reading, I asked myself: "what is the relevance of the proposed method, if it merely confirms the results of the methods already in use by the civil protection agency?". Instead, the added value of the proposed method should be better discussed.

5. A few grammar and language errors should be fixed. They are listed in the technical comments.

3 Technical comments

1. Page 1, line 2. Correct "resolution". Rephrase "newly developed" in order to be more explicit.

2. Page 1, line 5. Modify "ensemble system" in order to clarify it.

3. Page 1, line 8. Substitute or specify "period".

4. Page 1, lines 11 & 12. Rephrase and improve "and of the uncertainty of this flood".

5. Page 1, line 15. Substitute "one of" with "among". Correct "estimated".

6. Page 1, line 20. Rephrase "large gradients", possibly by adding "of meteorological quantities". Rephrase "the cooler atmosphere and the warmer sea": which is the comparison term? cooler and warmer than what?

7. Page 1, line 23. Rephrase "Recent decades".

8. Page 2, line 2; page 25, line 24. Check the publication date of Van den Besselaar et al. (2011).

9. page 2, lines 3 & 4. Rephrase "a warmer atmosphere and a greater amount of water vapor": which is the comparison term?

10. Page 2, line 4. Check spelling of "Willet".

11. Page 2, line 6. Substitute "to" with "on".

12. Page 2, line 9. Is "occur" the proper word? May be, "are expected"?

13. Page 2, line 10. EU Flood Directive (2007) is referenced wth a different "author name" in the reference list. Add "," after "2007)". Provide references for "Recent studies".

14. Page 2, line 12. Is "lead time" the right expression?

15. Page 2, line 15. "Assuming an appropriate hydrological model formulation": this is not a weak assumption, this should be discussed more accurately.

16. Page 2, line 16. Correct "scales".

17. Page 2, line 23. Substitute "on" with "in".

18. Page 2, line 25; page 8, lines 13 & 17; page 19, line 9. Add "with" before "respect".

19. Page 2, line 26. "their added values belong" or "their added value belongs".

20. Page 3, line 10. Erase "ing" from "fostering".

21. Page 3, line 11. Substitute "placed in", possibly with "associated to".

22. Page 3, line 17. The GFS acronym has been introduced without explanation.

23. Page 3, lines 23 to 25. Rephrase the sentence "The results... extreme events".

24. Page 3, line 26. Substitute "as it has been discussed by", possibly with "on the basis of the results of". This topic should be discussed in more detail.

25. Page 4, line 4. Add "," after "trough".

26. Page 4, lines 9 & 10. Rephrase "The thermal advection... at the upper ones": thermal advection is a physical process and I am afraid that is not correct to associate this expression to adjectives like "warm" and "cold".

27. Page 4, line 11. Please replace "13 November 2017" with a more precise definition of the timing of the two phases.

28. Page 4, line 12. Please rephrase "not shown". Do you mean, not represented in the figures or in some of them? Or not discussed in the paper?

29. Page 4, line 18. Substitute "because of", possibly with "as evidenced by".

30. Page 4, line 27. Substitute "Similarly to", possibly with "Following" or "In accordance with". Erase "," after "study".

31. Page 8, lines 13 to 15. In the statistical literature, this is simply called the "ensemble standard deviation".

32. Page 8, lines 19 & 18. In the statistical literature, this is simply known as the "coefficient of variation".

33. Page 8, line 21. Add "it" before "has been".

34. Page 8, line 28. Substitute "this latter"; it is not clear.

35. Page 10, line 25. Check spelling of "Lighthill".

36. Page 10, line 32. The word "based" is repeated twice at short distance.

37. Page 13, line 3. Erase "," after "comparison". Erase "even".

38. Page 13, line 4. Rephrase "hourly data in m".

39. Page 20, line 11. Correct "initialized".

40. Page 20, lines 19 & 20. Rephrase "as a complementary tools by using both".

41. Page 23, line 20. Check "Coauthors".

42. Page 24, lines 11 to 14. These references are cited with a different, abbreviated author's name in the text.

43. Figure 1. Add contour spacing for the two represented quantities in the figure captions. Expand the acronym "mslp". Black lines are hardly visible; I think that they would be more visible if drawn in yellow.

44. Figure 2. I am afraid that it will be very difficult to read the legend in the printed version of the paper. In the caption, add a space in "24 hours".

45. Figure 6. I think that a better choice of the colours could help to examine the plots. In particular, inverting the colours for the Ensemble members and the Ensemble mean could help to visualize the mean more easily.

46. Table 1. The first column can be erased because it is not informative: it has the same value for all the simulation types. I think that it could be useful to add a column to assign a code to each simulation type.