

Interactive comment on “User-oriented hydrological indices for early warning system. Validation using post-event surveys: flood case studies on the Central Apennines District” by Annalina Lombardi et al.

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The paper presents an interesting method that could be used in the practice to mitigate flood risk. Despite the interesting topic, the paper needs to address some issues before being ready for publication. I'll mention those not already covered by the other reviewer.

1. “In the abstract the effect of dams is mentioned, however, there is not either a further discussion about it or presentation of results regarding dams.”

Response: thank you for your careful observation. We have deleted the sentence

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relating dams because it was redundant.

2. “The paper would benefit from a reorganization. For instance, the study area description cannot be part of results but should be a separated sect. or subsection. “

Response: As suggested, the study area description is a new section, now.

3. “Sect. 4 comprehends a part that could be considered belonging more to an Introduction than to a Method section.”

Response: we agree with this consideration, however, we found that providing such information here makes this section self-consistent. Considering the complexity of the paper, in our opinion it can facilitate the understanding of the work done.

4. “I would also kindly suggest to add a discussion section to provide a brief discussion on the results that otherwise are just presented in the Results section and then summarized in the Conclusions section. “

Response: this is a right observation. Actually, during the drafting of the paper, we had conceived to insert a single section treating both the results and their discussions with the aim of not further lengthening the paper.

5. “I kindly suggest to move the stress indices description under the section Materials and Methods. Please, recall the figures in consecutive order. In case, move some figures before the others.”

Response: as suggested by the Reviewer, we moved the indices description.

6. “The English grammar should be revised.”

Response: The manuscript has been revised and some corrections have been made. Any further corrections from the reviewer are welcome.

7. “Even though the topic is relevant and of interest also considering as end-user the Civil Protection, I wonder if the topic would be more suitable on NHESS for instance

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or on a more technical Journal. In the following, there are some more issues to be addressed.”

Response: the reviewer is right when he/she stresses out that the developed indices are a tool definitely intended for civil protection end users. This is one aspect of our research; the other relevant aspect is the validation methodology we had proposed, that deals with lack of discharge data and homogeneous and well organized flood databases. Moreover, some validation techniques and are typical of other scientific fields and have been adapted and applied to hydrometeorology. For this reason we believe that this work is suitable for both journals.

8. “line 85: since the indices "are calibrated taking into account a correspondence between the issued civil protection alarm level and index threshold." I ask to clarify how the lead time is taken into account. The lead time available for triggering civil protection measures is typically short, especially in case of flash floods. The longer this time is, the better. “

Response: The calibration of the indices thresholds related was carried out by a comparison with hydrometric threshold and water level profile behavior. This work is aimed at validating indices information in “perfect conditions” i.e. with forcing the hydrological model with observed meteorological model variables. In our operational activity, as stressed out in Ferretti et al. (2020) and Colaiuda et al. (2020), the CHyM model uses meteorological observed data for the spin-up process and meteorological model output to predict hydrological stress for the next 24/48 hours. Therefore, operationally, when we release the hydrological forecast, we give this information from 6 to 48 hours in advance.

9. “line 149 p. 5: please notice that it is km and not Km. “ Response: Done

10. “Table 2: after "each", the singular form is needed.” Response: Done

11. “line 463: replace "figura" with "figure". “ Response: Done

12. “line 491 "thought" instead of "though". “ Response: Done

13. “line 285: it is not statistically relevant that often floods and flash floods occur in ungauged basins. This sentence may refer to the need of improving the sensors networks deployment or to the fact that ungauged basins would largely benefit from the method proposed. “

Response:

Unfortunately, especially in Italy, it is statistically significant that floods and flash floods occur in unmeasured basins because the monitoring network is poor. The considered sentence may refer to the fact that non-instrumented basins would greatly benefit from the proposed method. Other authors also suggest that the index approach may be a possible solution (e.g. Alfieri et al, 2012 highlighted as precipitation-based indices are preferable over uninstrumented rivers). In detail we have referred to the following assessment reported by Alfieri et al., 2017: “Flash floods usually occur in ungauged catchments, where the only source of information is post-event descriptive reports. Besides, even when gauging stations are available, they are sometimes damaged and made inoperative by the rage of the flood flow.” The reference is also insert in the paper. There is a mistake concerning the year of publication which is 2017 instead of 2019.

14. “line 345 the time to peak should be considered proportional to the concentration time as 3 h may be a long time for small basins. “

Response:

correct observation. this information is provided in the calculation of the RLTP (Relative Leg Time Peak) score. We agree that three hours could not be suitable for the smallest catchment. In our collaboration with the Civil Protection Dept., “3 hours” of guard band are anyway the minimum time needed to activate protection measurements in case of emergency.

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15. “p.10: for the sake of understanding, I kindly suggest to remove Table 3 and add the explanation of acronyms before introducing the indices.”

Response:

we agree with the comment, however, during our experience in conferences we noticed as, although it seems intuitive to understand how the contingency table is structured, this is missing in some cases. Since it takes up little space in the paper, we preferred to report this information as a table, which seems to be easier to consult.

16. “line 469: Casanuova River? Maybe Chiascio River and Casanuova dam.” Response: Done

17. “line 620: "two signals" instead of "to signals". “ Response: Done

18. “Figures 1 and 7 are in low quality Captions should be self-standing, please explain all acronyms present both in the figure and in the legend. “

Response: Done

Caption Figure 1: the Central Apennines Hydrological District (blue solid lines) and its main hydrography (blue thin lines). The north-eastern boundary is delimited by the Potenza river basin, while the south-eastern limit is represented by the Sangro basin in Abruzzo. The western side is delimited by the Tiber basin. Yellow lines indicates administrative boundaries of Italian regions. The three considered regions were highlighted: Umbria, Marche, Abruzzo (courtesy of Tiber Basin Authority, <http://www.autoritadistrettoac.it/>).

Caption Figure 7: total accumulated rainfall (spatialization from rain gauges official network) during the event, from 11st November 2012 00 UTC to 13rd November 2013, 23 UTC (picture generated from the Dewetra Platform, Italian Civil Protection Department and CIMA Research Foundation, 2014). The localization of the six raingauges were indicated on the map: 1) Castel del Monte station (Abruzzo Region), 2) Castelluccio di Norcia station (Umbria Region), 3) Conca 1 station (Marche Region), 4) Gualdo Tadino

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station (Umbria Region), 5) Pintura di Bolognano station (Marche Region); 6) Pretara station (Abruzzo Region). The raingauges recorded significant accumulated rain (up to 400 mm per 72 hours, purple area).

19. "Figs. 9, 11 and 13 are not clear as the legends are not explained in the caption."

Response: Done

Caption Figure 9, 11 and 13: time series comparison for six hydrometric stations: BDD hourly profile (red line), BDD Moderate Threshold (red flat line); CAI hourly profile (green line), CAI Moderate Threshold (green flat line); Hydrometric Level hourly profile (blue line), Hydrometric Level Moderate Threshold (blue flat line). Quantities profiles and related thresholds are normalized.

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