

## ***Interactive comment on “Multi-scale hydrometeorological observation and modelling for flash-flood understanding” by I. Braud et al.***

### **Anonymous Referee #2**

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This work describes a coupled observation and modelling strategy aiming at improving the understanding of processes triggering flash floods. The observation-modelling strategy is coupled in that the observations provide an input to the modelling framework, and the outcomes from the modeled events are used to improve the monitoring methods. Aspects of this strategy are illustrated for two Mediterranean French catchments (Gard and Ardèche), both larger than 2000 km<sup>2</sup>. The work is structured into three parts: 1) the experimental set up and the instrumentation; 2) the associated modelling strategy; 3) results obtained from the first year of observation and modelling work.

The topic is very interesting in that it provides a clear example of a coupled observational and modelling methodology: this coupling is central for the advancement of

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hydrology. The objectives are of great interest for the readers of HESS, and the writing is good (even though it should be improved at specific points – see below). Nevertheless, the paper suffers from elements of structure and lack necessary details on some specific issues. The main element of structure concerns the requirement of linking the specificities of flash floods with the observational and modelling strategy. Often, these specificities are recognized and even addressed in the description of the monitoring methods; however, a section is missing where the characteristics of flash floods are described and where the logic of the observational/modelling strategy is illustrated as a consequence of these characteristics. I think that improving these elements of structure and reducing the length of the paper will make the already good work much more readable and impactful.

Considering the general interesting topic I think that the work might be publishable after moderate revisions. In the following I will try to outline, where and how the manuscript can be improved.

1. Linking the flash floods physical characteristics with the structure of the coupled monitoring/modelling approach.

This topic plays a role in the Introduction, but it is presented in a rather limited and scattered way, as if flash flood monitoring was only a question of contracted space/time scales and (consequently) of ungauged basins. These two elements are necessary elements, but not sufficient. There is a third element, in that flash floods are locally rare events. This is very important from a monitoring viewpoint, and has important consequences in terms of monitoring organization and observation risk within the given funding period. These two separate issues should be appropriately considered. Typically, events which are locally rare but not too rare within a monitored region, can be approached by means of opportunistic observations. This is clear to the authors, which have introduced an ‘on alert’ monitoring branch (Section 2.5) (perhaps using the term ‘opportunistic measurement’ instead of ‘on alert’ can make text more understandable). However, Section 2.5 arrives as a surprise within the story line. There is therefore a

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need to improve the layout of the Introduction, with a better linkage of process physics and monitoring organization. The authors should also provide some considerations about the likelihood of observing above threshold events within the given funding period (4 years), given a certain design threshold (Troutman and Karlinger, 2003).

There is also a need to clean the text by removing long and somewhat boring description. This is the case for two lengthy sections. The first is between P1873 L21 and P1874L15, where both the space-time scales of socio-economic impacts and of the flash flood processes are introduced. I think this is confounding, and the authors may rely only on the typical physical scales of the processes. The second one is between P1875 L23 and P1876 L6, where the funding projects are presented. I think that this text can be strongly reduced.

## 2. The role of radar observations

I was surprised to find radar observations relegated to the 'large catchment' section (both in Section 2.4 and in Fig. 2). I think this is not appropriate and not consistent with the large body of research work done with weather radar in this region. This work permits use of radar rainfall estimates as a cross scale information source. I think this type of information is also needed to assist the opportunistic measurements, which are not necessarily carried out at large scales and which needs rainfall estimates to be mechanistically evaluated and understood.

## 3. More precision required at some instances.

Dominant processes: the monitoring methodology is carried out in different ways accordingly with the presumed local runoff generation dominant process. Two dominant processes are considered: infiltration excess and saturation excess (see for example P1879 L9). I think that at least a reference to the methodology used to map the dominant runoff generation should be provided here. Moreover, by virtue of the intensities associated to flash floods, runoff generation dominant processes may change. The authors should address this specificity.

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Part of the hillslope monitoring net is periodically dismantled and moved to another place (P1879, L18). The motivations for this procedure should be reported.

Role of karst aquifer. Karst specific processes are well known to influence flash flood dynamics (Delrieu et al., 2005; Zanon et al., 2010), and are well represented in the Gard region (Delrieu et al., 2005). However, karst processes are not specifically considered in the monitoring and modelling strategy. The authors should provide a comment on this decision.

Specific comments.

P1874 L8: ‘flash flood studies’: studies is perhaps inappropriate here, and a more correct term is predictions.

P1883 L29: connection instead of connexion.

P1884 L20: I wouldn’t say that current meter is limited to small streams and small discharges.

P1888 L16-20: The text about the fractal approaches is completely disconnected from the rest of the section and is meaningless. Please remove it.

Data mining: One of the building blocks of the paper is that flash floods are poorly observed flood events. Therefore I think that the emphasis given to the ‘data mining techniques’, made at P1888 L12 and at P1889 L3, should be nuanced.

P1889 L11: ‘exposition’ here and in other places, should be ‘aspect’.

Fig. 2: This figure is interesting, but rather generic. Which is the place of flash floods within this figure?

P1910: Martin Caliano should be Martin Calianno.

References

Delrieu, G., Ducrocq, V., Gaume, E., Nicol, J., Payrastre, O., Yates, E., Kistetter, P.,

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Troutman, B. M., and M. R. Karlinger, 2003: Regional flood probabilities, *Water Resour. Res.*, 39 (4), 1095, doi:10.1029/2001WR001140.

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