Review of the 4th version of the paper : Reconstructing the Salgar 2015 Flash Flood Using Radar Retrievals and a Conceptual Modeling Framework: A Basis for a Better Flood Generating Mechanisms Discrimination. Nicolás Velásquez et al.

General comments about the revision:

I already did the revision of the three first versions of manuscript. I really appreciated the clarification of the method as well as the new points supplied into the discussion. As the limitations of the results (related to the applied method and the data availability) are now clarified, the present manuscript gained in reliability. It is now easier to see what has been achieved, what has been limited, and what would be the next step. Also as the method has been now well exposed – and even though I'm not totally convinced by several avenues pursued by the authors – any reader has the possibility to understand the scientific guidelines and to make it own review. For those reasons, I contend that this manuscript could be accepted when answering only one question about the floodplain methodology and looking at some writing revisions (here below).

Comments on the floodplain methodology:

Concerning the 1D floodplain methodology, I really don't understand why you are going to such complex method, looking for the loaded sediment while you do not have any data to apply it. Why don't you look directly at the floodplain according to the flood peak discharge without sediment? Moreover, it introduced a big inconsistency within the overall methodology: on the one hand you assessed the flood peak according to mud and flood prints on one river section; on the other hand you use this value to validate your hydrological model while this value must actually content both water + sediment discharge. I agree this is mainly done in hydrological modelling assuming a negligible amount of sediment. But here, as you introduced the sediment discharge in a third step, and above all as you found a non negligible 30 % of loaded sediments, it means that the hydrological model validation on (water) flood peak is not correct anymore. Could you justify that?

Comments on the writing:

I thanks the authors for the effort done to describe the methodology (section 3) of the paper. This time, I have not detected any undefined variable or parameter. Being picky, I just noticed that the slope is called $M_{i,0}$ when being described in the THETIS model, while $\beta_{i,0}$ is used in the landslide submodel. That could be attuned.

A general comment: the authors often use the word "approximately" even for quantities that shouldn't be approximative (e.g the distance between the radar and the basin is approximatively 90 km, line 222, page 10). I suggest to simply remove that word in those case that doesn't make sense.

In the following, I suggested some modifications to improve the writing and make easier the reading. The main idea was to simplify some sentence where too many details were given and where – from my point of view – the main message was then lost.

Abstract.

Page 1, line 17 : "Simulation results indicate that the flash flood and regional landslide features were strongly influenced by the antecedent rainfall, which was associated with a northeasterly stratiform event. The latter ~~that~~ recharged the gravitational and capillary storages within the model, moistening the entire basin before the occurrence of the flash flood event and ~~modulating~~ impacting the subsurface-runoff partitioning during the flash flood event."

1. Introduction

Page 2, line 31-47: "Several authors have assessed the role of the geological and geomorphological features of the catchment, soil type, soil moisture conditions, and the spatiotemporal structure of rainfall on flash flood occurrence, ~~trying to identify~~ identifying the leading causative mechanisms of this hazard (Merz and Blöschl, 2003). Adamovic et al. (2016) and Vannier et al. (2016) ~~tried to understand~~ related the flash floods governing processes to~~from~~ the geological properties~~formation~~ of the basins with mixed results. Wu and Sidle (1995) emphasized the role of the topography, ground cover, and groundwater in the occurrence of shallow landslides and associated debris flows. ~~Due to their rapid nature, flash floods are more likely to occur in small and steep basins (Younis et al., 2008).~~ Many authors have assessed the influence of hills and stream slopes, suggesting the slopes of the hills are significantly more important for flash flood occurrence and magnitude than the slope of the stream (Šálek et al., 2006; Roux et al., 2011; Yatheendradas et al., 2008, Younis et al., 2008). Rodriguez-Blanco et al. (2012) analyzed flash flood episodes in Spain and determined that antecedent soil moisture conditions play a ~~vital~~significant role in runoff production. Castillo et al. (2003)~~, using a modeling approach,~~ also suggested an ~~important~~ significant correlation between flash flood magnitude ~~dependence on~~ and the antecedent moisture conditions. Aronica et al. (2012) used spatial and statistical analysis to reconstruct landslides and deposits, finding a connection between flash flood occurrence and soil moisture antecedent conditions."

Page 2, line 48-54: "The fact that small basins are more prone to flash floods ~~increases their intrinsic physical and measurement uncertainty of the latter~~ (Wagener et al., 2007) makes difficult their measurement and, consequently, their understanding and ~~making difficult~~ their prediction (Hardy et al., 2016; Ruiz-Villanueva et al., 2013; Yamanaka and Ma, 2017; Borga et al., 2011; Marra et al., 2017). The local rainfall storm events related to flash floods require that ~~and underlines the need for~~ high spatio-temporal resolution to be characterized~~precipitation data~~ (Norbiato et al., 2008). ~~Given the critical role of precipitation,~~ Some authors follow a climatological approximation to assess the recurrence of flash floods in particular regions, focusing on the atmospheric causative mechanisms."

Page 3, line 57-61: "Schumacher and Johnson (2005) studied extreme rain events associated with flash flooding in the United States over a 3-year period, using the national radar reflectivity composite data. ~~to examine the structure and evolution of each extreme rain event. The use of radar data to study flash flood-generating storms is vital for understanding and forecasting these events (National Research Council 1996).~~ They found that 65% of the total number of flash floods are[...]"

Page 4, line 96: please change "with non-existing" by "without any".

Page 4, line 98: please remove "certainly not available in real time".

Page 5, line 111: please change "the second issue" by "the second one"

Page 5, line 114-115: The modeling framework used in this study is~~methodology followed in this study is based on a modeling framework using~~ the TETIS hydrological model (Vélez, 2001; Francés et al., 2007), that has been modified to include a shallow landslide sub-model, and a floodplain submodel termed HydroFlash.

Page 5, line 116: please replace "termed" by "called".

Page 5, line 121: please put in brackets the reference *Aristizabal et al, 2016*.

Page 5, line 121-123: "HydroFlash is~~corresponds to~~ a low-cost 1D model that ~~assumes infinite sediment supply and~~ estimates the cross-sectional filled area at all time steps on the basis of ~~based on~~ the liquid discharge and the sediment transport."

Page 5, line 131-133: "Section 3 presents a description of the overall methodology and the TETIS model ~~used for the reconstruction of the 2015 La Liboriana flash flood event~~, including flow separation, [...]"

2. Study site and data

Page 6, line 139-141: "By 2015, ~~the population of~~ Salgar counted~~ was estimated at~~ 17 400 inhabitants~~ persons~~, including 8 800 residing in the urban area. La Liboriana basin joins the El Barroso river basin, and both drain to the Cauca River."

Page 6, line 142-143: "The availability of the ALOS-PALSAR DEM (ASF, 2011), with an approximate resolution of ~~approximately~~ 12.7 m, allow~~s~~ to estimat~~ing~~e the main~~fundamental~~ geomorphological features of the basin."

Page 6, line 162-163: ~~While the elevation differences described in Figure 2 are typical of the region,~~ The social challenges lie in the high vulnerability of Salgar, given the location of the main urban settlement (see Figure 2).

Page 7, line 173-174: In Figure 3, the Zoom 4, corresponds~~ing~~ to the first affected urban area from upstream to downstream during the flash flood~~;~~. I~~i~~t is also possible to see a marked presence of crops and some patches of forest.

Page 9, line 213: please replace "are central to" by "are used to".

Page 10, line 216-220: "The assessment of the 2015 Salgar flash flood event following a hydrological modeling strategy uses a radar-based QPE technique described in Sepúlveda (2016) and Sepúlveda and Hoyos (2017), using radar reflectivity fields,~~ using~~ rainfall gauges and disdrometers~~ within the radar domain to obtain spatiotemporal precipitation maps over the basin~~."

Page 10, lines 222-223:
[…]~~, located.~~ The radar is ~~approximately~~ 90 km away from the basin. ~~The radar~~It has an optimal range in a radius of 120 km for rainfall estimation and a maximum operational range of 240 km for weather detection.

Page 10, lines 224: please replace "every 5 minutes" by "at 5 minute time step".

Page 10, line 240: I would suggest to replace "Event 2 corresponds to approximatively 38 mm; however, over the upper watershed, the accumulation exceeded 180 mm according to the estimated rainfall amounts based on the radar measurements" by "Event 2 corresponds to a moderate average of 38 mm, however the accumulation exceeded 180 mm over the upper watershed".

Page 10, line 244: please write "[…] for the region. However, the combination" instead of "[…] for the region; however, but the combination […].

3. Methodology

page 15, line 338-342: The model archives the results of the virtual tracing algorithm at the outlet of the basin and for each reach, enabling ~~allowing~~ to~~he~~ study ~~of~~ the different flow paths and water origins ~~role of flows of different nature during extreme events~~ at different spatial scales~~, thereby providing insight about the soil-dependent flow regulation~~.