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Discussions
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Interactive comment on "Towards an increase of flash-flood geomorphic effects due to gravel mining and ground subsidence in Nogalte stream (SE Spain, Murcia)" *by* J. A. Ortega-Becerril et al.

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Response to Anonymous Referee #1

Our responses to review comments (R) are following each comment (AC)

R: The manuscript by Ortega-Becerril et al. investigates the effects of human-induced changes on the streams in semi-arid regions arguing that the changes to longitudinal profile and the lowered base level due to in-channel gravel mining and aquifer overexploitation lead to the intensification of geomorphic effects of flash floods. In this study, the authors compared two events occurred in the study catchment in 1973 and 2012 that were characterized by similar discharge but featured different flood dynamics. The

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manuscript is well written and easy to follow by the reader. In general, the analysis is sound and quite well documented but several points need to be better clarified. My main concern is related to the comparability between the two flash floods events and specifically on the flash floods characterization in terms of spatial and temporal rainfall evolution. A spatially-detailed representation of the rainstorms that caused flash floods, based on radar data, is not reported. This could not be a problem given the aims of the manuscript but this aspect should be at least mentioned along the text. Accordingly, there is a lot of literature on flash floods and their geomorphic effects that could be cited (e.g., Borga et al., 2011; Gaume and Borga, 2008; Rinaldi et al., 2016; Surian et al., 2016) even if not focused on semi-arid regions.

AC: As the referee comments in this manuscript the aim of the study is not a deep characterization of the rainfall. Of course rainfall is a very important factor in a flash-flood generation, and we try to give a wide view about both flood events, anyway, we provide hydrographs and data about discharge that was similar. Radar information was not able to record from the first event in 1973, so we couldn′t compare with the 2012 one.

As the referee suggest, we include a comment about this in section 4:

"...Therefore the rainfall in the 1973 event was lower than estimated for this period, but the 2012 event may be assigned to a 500-year return period. Information about radar data which provides a spatially-detailed representation of the rainstorms was not possible, due to the lack of information about radar during the 1973 event..."

AC: Related to literature of flash-flood and their geomorphic effects: The references provided by referee #1 are very interesting, but they deal either with continental Europe or Northern Mediterranean areas, not so much with more arid southeastern Mediterranean Region. The studied ephemeral channels are substantially different in behavior, development, sediment entrainment and mobilization in comparison to mountain rivers in the references suggested. Anyway some of them arise interesting questions that we

have included in the introduction in order to highlight differences and in the discussion in relation to the significance of antecedent soil humidty.

-Rinaldi, M., Amponsah, W., Benvenuti, M., Borga, M., Comiti, F., Lucía, A., Marchi, L., Nardi, L., Righini, M., Surian, N., 2016. An integrated approach for investigating geomorphic response to extreme events: methodological framework and application to the October 2011 flood in the Magra River catchment, Italy. Earth Surf. Process. Landf. n/a-n/a. doi:10.1002/esp.3902 -Surian, N., Righini, M., Lucía, A., Nardi, L., Amponsah, W., Benvenuti, M., Borga, M., Cavalli, M., Comiti, F., Marchi, L., Rinaldi, M., Viero, A.,2016. Channel response to extreme floods: Insights on controlling factors from six mountain rivers in northern Apennines, Italy. Geomorphology. doi:10.1016/j.geomorph.2016.02.002

AC: We answer to this comments one by one below this lines in the supplementary annotated copy

R:L26. More international literature could be cited in the introduction maybe highlighting differences between flash floods in semi arids regions and other environments and the issue related to the spatial and temporal characterization of causing rainstorms. AC: We answer to this question above. We have added further references and include a sentence in the introduction section.

R: L48. Please consider to reformulate. "A new event, with lower precipitation than the 1973 event but characterized by similar discharge, occurred on October 28, 2012. AC: This has been done

R:L64. Add : AC: Done

R:L70. do you mean topographic cross section survey? Please add more details here (which kind of measurements? Which instruments were used?) AC: We have modified the sentence: "...a detailed field analysis including channel measurements (as topographic cross section survey using a laser distance meter, GPS for positioning and

a measuring tape to obtain bank entrenchment), flood stage indicators, sedimentary sections. . .”

R:L71. Define the acronym (Digital Elevation Model) since it is cited for the first time AC: Done

R:L81. Add – AC:Done

R:L86. Why not using the LiDAR DEM if it was available for the whole study area? AC: Since we used ENVISAT data ($\sim$20 m resolution cell) and the small baseline approach, the srtm90 DEM is adequate to remove the topographic contribution. The use of the LiDAR DEM would have required downsampling to be used in the processing, and would have increased considerably the processing time.

R:L139. Add , AC:Done

R:L145. Delete T, only 500 AC:Done

R:L157. Both hydrographs (Fig. 3) indeed.. AC:Done

R:L159. another factor that should be considered is the spatial distribution of rainfall that could have been markedly different in the two floods... AC: We addressed this question with a change of the sentence, unfortunately we don′t have similar information about both events, anyway, rainfall records suggest a wide distribution of high rainfall values all basin around.

“. . .Another factor that might be considered is a different spatial distribution of rainfall, but from the scarce available data, apparently all stream headwaters where homogeneously affected during both floods. . .”

R:L167. I guess that the high resolution DEm is the one derived form LiDAR data. If it’s true please reformulate. If it’s not the case please explain how did you exploit LiDAR point clouds AC: We change the sentence for clarification

“. . .According to our measurements using a DEM derived from LIDAR data from

Cartomur-Iderm, with a 4-m horizontal resolution and a vertical accuracy < 50 cm, the gravel pits exploited. . .”

R:L168. in fig 4b you show 1956-2009 boundaries and not the 1981 one. AC: We change the sentence for clarification:

“. . .According to our measurements obtained using LIDAR and a high–resolution DEM the gravel pits exploited in the streambed affected around 30% of the channel during the period 1956-2009(Fig. 4 B and C), starting gravel pit mining in 1981. . .”

R:L173. I cannot see a clear correspondence between the percentages indicated in Fig 4d and the bondaries reported in Figure 4b. See specific comment on Figure 4. AC: See specific response in comment of Fig 4

R:L225. sediment in the upper catchment AC: Done “. . .large sediment amount from the upper catchment. . .”

R:L229. it would be interesting to see also the time series of most representative pixels to understand the temporal pattern of ground deformation rates AC: We have included the time series of the region with maximum deformation rates in figure 10 (see new fig 10)

R:L330. Add (AC:Done

R:L335. this paragraph fits better into the discussion chapter than in the conclusions. AC:This section of the text has been removed to discussion section and we extended conclusions to explain better this part:

“. . .Ephemeral streams and alluvial fans in semi-arid areas are fragile systems that store potential energy during the long inactive periods capable of triggering catastrophic changes during extreme catastrophic events. Management interventions driven by social pressure after a catastrophe (construction of flood-defenses) usually serve to maintain sediment budget deficits, which induces a delay of the benefits of natural morphological adjustments...”

R: Fig. 2. Maybe you could use relative elevation in the y axis to allow a better comparison AC: Both forms of representation could .be useful. We choose absolute elevation to reinforce the idea of the existence of two different profiles, those that flows along Guadalentin valley (Guadalentin River and Viznaga rambla), and, lateral ephemeral channels with higher gradient.

R:Fig. 4. There are two different boundaries highlighted by black lines in reach 6. Which is the correct one? I cannot see a clear correspondence between this percentages and the image above (e.g., Reach 2 changes seem lower or almost similar to those of reach 4). Please check carefully these data and please explain how did you calculate the changes (areal?). Did you consider also gravel quarries in the computation? AC: Flood area in reach 2 in 1956 is 0,25 Km2 and 0,14m2 in 2009, the difference is 43,2%. Flood area in reach 4 in 1956 is 0,30m2 and 0,28m2 in 2009, the difference is 7,4%. We think, the error comes from a change in right margin of the river that adds a portion of floodplain instead of decreasing all the section around. We modify the figure (see new figure 4) in order to clarify this aspect.

Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2016-136/nhess-2016-136-AC1-supplement.pdf

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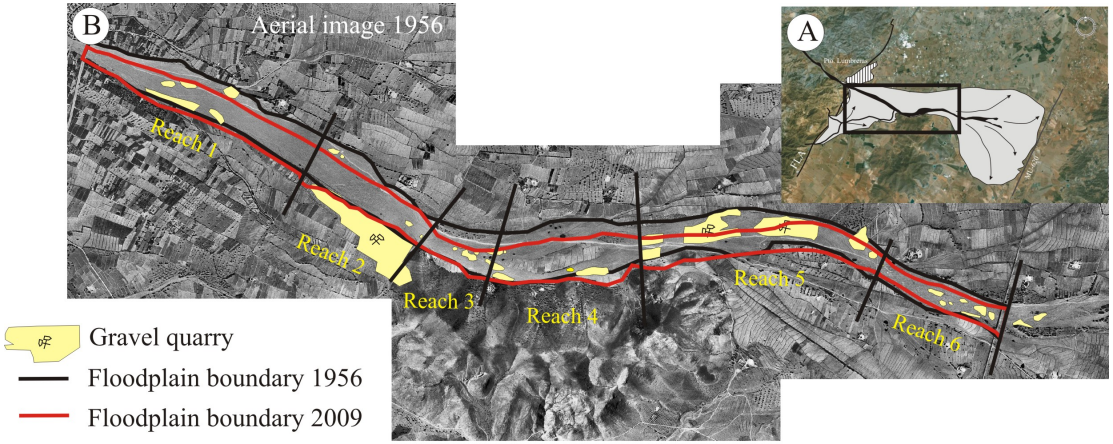

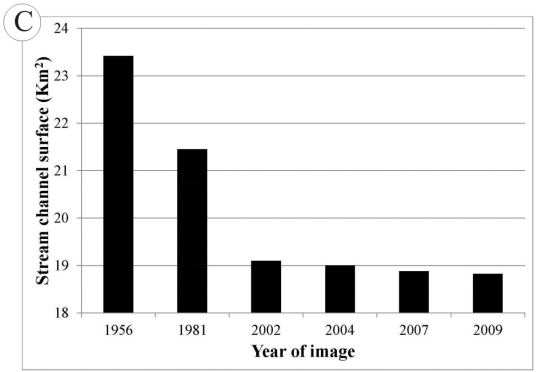

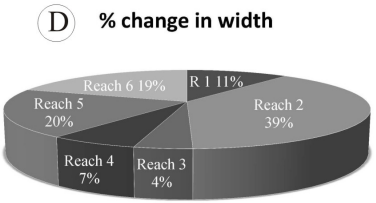

Fig. 1.

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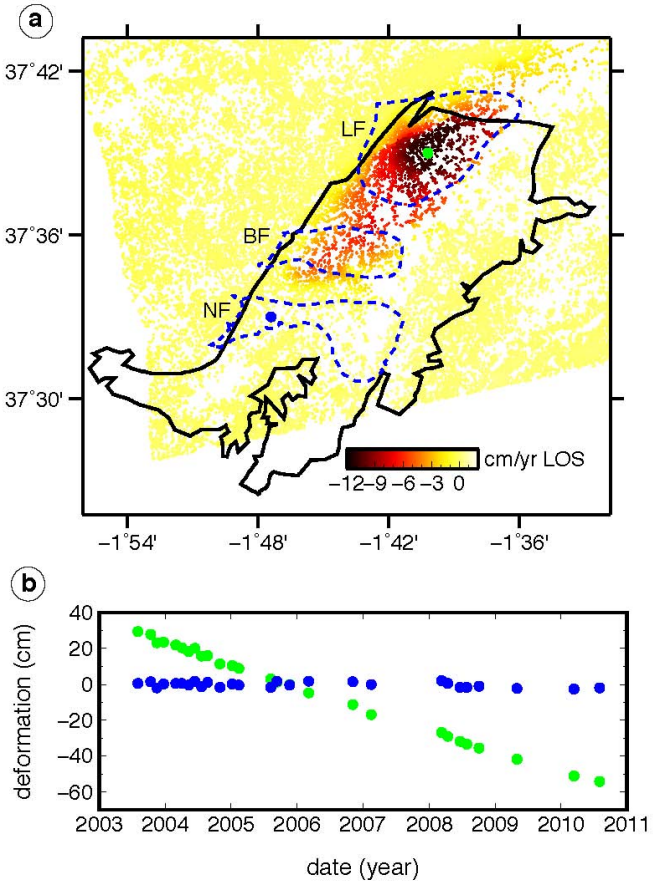

Fig. 2.

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