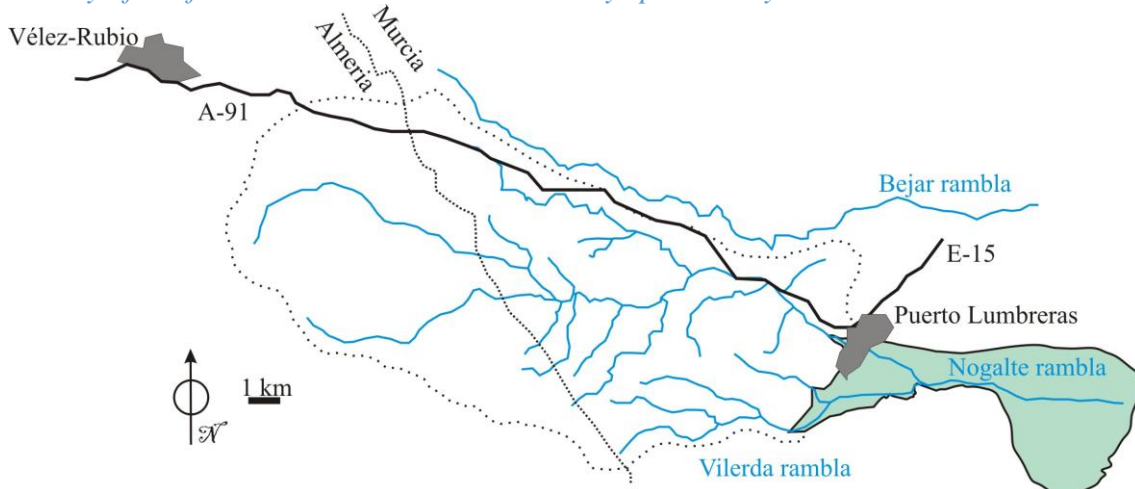
Response to Referee #2

The presented manuscript aims towards the understanding of the human effects on the fan dynamics in semi-arid region on the south of Spain, during two main food events occurred in 1973 and 2012. In my opinion, the manuscript is well written, clear and concise, but it can be improved or enhanced in some sections. My main concerns are in the Hydrology section:

140 Page 5 In this line presented the precipitation over Puerto Lumbreras to determine the return period of precipitation which affect the runoff. I consider this methodology has to be improved, since measure of precipitation over the apex fan might not be representative of the precipitation that caused the discharge. This aspect is especially critical in semi-arid areas with marked slopes as is the case of Guadalentín River. Particularly the 1973 event discharge in Puerto Lumbreras was a consequence of the intense precipitations upstream, in its upper watershed (Capel-Molina, 1974). For this reason, I consider that to determine the return period of the floods based on precipitation, all the precipitation over the watershed draining to the study area has to be considered for both floods (1973 and 2012).

We disagree with the reviewer in this point. Capel-Molina, (1974) in his work indicates the scheme suggested by the reviewer only for the Guadalentin River during the 1973 event (181mm/24h in Velez Blanco, 105mm/24h in Lorca and 19mm/24h in Murcia) with a clear decrease in rainfall from the upper (Velez Blanco) to the lower (Murcia) basin. This is not the case for Nogalte stream. Data from locations near the upper basin, see attached figure (Velez Rubio, 151mm/24h, 215mm/48h) and the lower basin (Puerto Lumbreras, 96mm/24h, 160mm/48h) refer to a high amount of precipitation over 100mm the day of the flood and over 150mm in two days practically in the entire basin.

144-147 page 5 The wide range of runoff found in the bibliography may indicate moderate high (1500 m3 s-1;Benito et al., 2012) or beyond the T500 return period (2489 m3 s-1; CHS, 2013). In Methodology section is presented that an analysis of the field area affected by the 2012 flood, gathering information on water levels and the effects of flooding whas made for this study. Which are the results of this analysis? Are closer to 1500 or2489 m3 s-1?

In the short paper of Benito et al. (2012), the referred data are not supported by additional information about the hydrological calculation method and/or other sources of information. In addition, he is talking in a context of Guadalentin river flood, whilst the data from CHS are based on hydrological analysis in Puerto Lumbreras channelized section. For this reason we believe the last one are the most accurate data within the available information. Our water level measurements have been done at the distal fan

with the aim of obtaining an approach of the local depth of water flow in this point (related to sedimentary forms, grain size…), obviously this is not enough to perform an accurate flood modeling otherwise very complex in this fan area with a compound infiltration-underground water characteristics.
We addressed this point in the discussion section and methodology

Additionally, I have a comment regarding the discussion section, lines 341- 348 As presented in the discussion, there are two main factors considered to affect the fan morphology. 1) The gravel mining which reduce the sediment availability and 2) the over-exploitation of aquifers. In my opinion, there is a third possible factor, which is the movements of the Alhama-Lorca fault, which crosses the fan apex, and generated the 2011 earthquake in Lorca. Has the influence of the fault movements been considered in this study? If not, it might be interesting to add some discussion of how fault movements can affect the slope of the fan and the aquifer connectivity.

The Lorca 2011 earthquake was generated by the movement of a small (3 km long) segment located 2 km northeast of Lorca (Martinez-Diaz et al. 2012), in any case the surface deformation from this event was limited to a few millimeters uplift in epicentral region. The Puerto Lumbreras - Lorca section of the Alhambra de Murcia Fault (FAM) has not suffered tectonic movement in historical epoch that could affect the slope of the fan. Previous studies analyzing the current activity of the FAM from geological data, paleoseismic data (Ortuño et al. (2012), and also GPS data (Echevarria et al 2014.) support that there is no slow movement on the fault that could affect the morphology of the fan in the time period covered by this work. This fault has a typical behavior of an active fault locked during the interseismic periods that can span thousands of years. Last historical large earthquake that could be related to the movement of this fault occurred in 1674. This is the reason why that aspect has not been included in the discussion.

-Martínez-Díaz, J.J., Bejar-Pizarro, M., Álvarez-Gómez, J. A., Mancilla, F.D.L., Stich, D., Herrera, G., Morales, J., 2012b. Tectonic and seismic implications of an intersegment rupture The damaging May 11th 2011 Mw 5.2 Lorca, Spain, earthquake. Tectonophysics 546–547, 28–37. http://dx.doi.org/10.1016/j.tecto.2012.04.010.
Ortuño, M., Masana, E., Garcia-Melendez, E., Martinez-Diaz, J.J., Stepancikova, P., Cunha, P.P., Sohbati, R., Canora, C., Buylaert,J.-P., Murray, A.S., 2012. An exceptionally long paleoseismic record of a slow-moving fault: the Alhama de Murcia fault (Eastern Betic shear zone, Spain). Geol. Soc. Am. Bull. 124(9–10), 1474–1494. http://dx.doi.org/10.1130/B30558.1.
-Echeverria, A., Khazaradze, G., Asensio, E., Gárate, J., Martín Dávila, J., Suriñach, E., 2013. Crustal deformation in eastern Betics from CuaTeNeo GPS network. Tectonophysics 608,600–612.

Also, In my opinion conclusions are too long and include cites, some of this content is more appropriate on discussion section.
Other minor comments Line 189 page 7 errata, 2002 in state of 2012 There are citations without reference, I located Benito el al 2012, CHS 2013 and Capel-Molina, 1974 but it might be others, please revise

We agree with the reviewer, conclusions are too long, we have been cut part of this section. We revised and corrected all references and the errata.