

Interactive comment on “Reconstructing long-term gully dynamics in Mediterranean agricultural areas” by Antonio Hayas *et al.*

Referee #3

This is a valuable contribution, but one that could be improved by teasing out some of the relationships as far as possible. There seem to be at least three development processes for the gullies: 1) Once started gullies tend to grow by positive feedback (as they gather collecting area) until they consume the source area. These gullies seem to be approaching this state in the south, but less so in the north. 2) Gullies grow in major events, and fill between them. Can the rainfall element be modelled, roughly, by summing a function of rainfall events for each interval [e.g. (rain-threshold) or a power of it] to try and tease out the effect of the land use element. 3) Residual element may be due to land use (is it uniform over the area?), which might change the threshold beyond which gullies expand. It is perhaps too much to hope that this can be rigorously carried through, but discussing the problem in these terms would greatly enhance the value and wider applicability of the research.

We appreciate the interest of the Reviewer for the manuscript. The observations are very attractive. We have tried to discuss the main traits of the gully network evolution in the comments to Fig. 9, in section 3.3. We have included the interesting observation about the difference between gully evolution in the south and north. Nevertheless we keep the idea to search for a more complete relation between gully evolution, rainfall, and land use by means of an explicit model for further research. For the time being we believe the idea too complex to include in this study and it would be better suited for a new, separate study.

We have included a sentence in this section:

There seems to be a greater increase in the south compared to the north, which suggests a more stable condition in the latter.

Also an additional discussion on land use and rainfall effects in section 4:

Gioia et al. (2008) stressed the importance of different runoff thresholds to explain flood occurrence in the Mediterranean areas. Ordinary flows are produced when rainfall rate exceeds the infiltration rate of the soil in a small area, a typical case of Hortonian runoff generation, or Hortonian threshold, while what Gioia et al. (2008) denominated outlier events, occurred when the water of almost continuous rain spells surpassed the storage capacity of the soil in a large area of the catchments, or Dunnean threshold. This behavior is similar to the complex response to the geomorphic thresholds discussed by Patton and Schumm (1975).