

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

Anonymous Referee #1

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This paper is a great topic and a novel approach to understanding dynamics through extrapolation and quantification of uncertainty through Monte Carlo. The detailed network mapping is impressive. However, the field sample sizes are fairly small, and a bit of a concern for understanding true field variability. More emphasis could be put on field interpretation of geomorphic processes and channel evolution, to match better with observations and extrapolation from air photo interpretation and generalized land use metrics.

Moderate revisions are recommended to correct some misunderstandings and also more importantly bring out the underlying geomorphic processes that could be operating in this catchment.

Moderate Comments There is nothing overly special about Mediterranean climates and

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gully erosion. Other areas of the globe with highly variable rainfall also have gullies. Perhaps downplay the Mediterranean climate emphasis or compare to other areas of the globe. Soils and geology and topography are also big factors with gully erosion.

Page 2 Line 17 Focus more on field empirical data and methods of other authors, as models you review here do not really help estimate gully volumes at the catchment scale. Are there more references you can cite that use your methods of estimating gully volume from remote measurements of width and length, and field measurements of depth? And then the use of m Carlo simulation to extrapolate from small sample sizes of 35 and 27?

Page 2 Line 70 See recent paper by Shellberg et al. 2016 in Geomorphology as an example on the rates and dynamics of gully erosion pre- and post European settlement in Australia... and over long time periods. Many other examples around the world too.

Page 3 Line 48 What were the various scales that these air photos were originally collected at? Could differences in scales influence the accuracy of results between years, even with the working scale for measurement was set at 1:5000? Also, the data gap between 1956 and 1980 and 1984 and 1999 are large, compared to the other years. It would be good to highlight the dynamic uncertainty more for these years, as this data limit the ability for “high temporal resolution” analysis. Use the high resolution years for discussion if uncertainty in other years.

Page 3 Line 74 Were these 35 stretches the same as the 27 sections visited below? If not, why were not the 35 stretches visited in the field to confirm measurements from air photos? There seems to be a mismatch here/

Page 3 Line 74 Are there more references you can cite that use your methods of estimating gully volume from remote measurements of width and length, and field measurements of depth? And then the use of Carlo simulation to extrapolate from small sample sizes of 35 and 27? Will also need more convincing of the readers that 27 or 35 sample points are enough to extrapolate to a 20km² catchment.

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Page 5 Line 1 Is this % of total catchment area? or % of all land uses? Or just % of occupied land by humans?

Page 5 Line 64 Was there a correlation between farmer infilling and leveling activity during one period with an increase in erosion during the next period? That is, a lag effect of the influence of actual machine disturbance on gully erosion and perhaps water yield. Generally if you disturb a gully, it will erode faster for a while into the future until it settles back down.

Page 5 Line 73 This is a key hypothesis, and needs to be brought out more here and in discussion, as you say that extreme rainfall is the dominant variable, but you do not have any other data on land use besides just % area covered, and thus do not have a metric that links runoff accelerated by land use to gully erosion.

Page 6 Line 27 Could this be partially due to the higher quality and resolution of air photo data late in the period? Mismatch of data sources here for these different periods.

Page 6 Line 37 ha of total catchment area? Or ha of total gully area? ton or tonnes? which units? Metric or English? This is an issue through the paper.

Page 6 Line 53 again, are these yields based on total catchment area or gully area? That is, are the gully rates averaged across the whole catchment area?

Page 6 Line 8 Many of us in the world would consider Mediterranean Climate a type of Temperate Climate. Under the Koppen climate classification system, a Mediterranean climate is a type of the temperate climate group ("C" climates). Please expand more or change terms and classification. Maybe deemphasize the climate variable and talk more about soils and geology, and the build-up of colluvium/alluvial soils and then their release during major events and gully erosion.

Page 6 Line 91 See recent paper by Shellberg et al. 2016 in Australia on continued near linear increases of gully erosion over time in highly erodible soils.

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Page 6 Line 103 Dams often decrease sediment yields and can create incision in main channels, and thus rejuvenate tributary systems. You cannot discount this without some references or data for overall channel stability in the catchment. Also over long time periods, most catchments are in a degradation state, and thus maybe you are in some part of a bigger cycle? No doubt human land use has also increased erosion. Plenty of references there. But is it from upstream or downstream impacts and controls, or both?

Page 7 Line 37 How would this uncertainty be reduced if you had much more field data. 40 data points is a small sample size to be sure you have calculated uncertainty correctly.

Page 7 Line 54 Please do not recommend more modelling. Field measurement is essential to understand gully dynamics. Or Repeat airborne LiDAR. or small scale terrestrial lidar.

Page 7 Line 67. again, need field measurements not models to understand these dynamics.

Page 9 Figure 1 Figure 1 needs to be improved. The stream map shows not much. Perhaps this would be a great place to show the high resolution air photos so we can see what the landscape and land use looks like?

Some field photos of gullies and land use would be really useful for the geomorphic reader.

Page 10 Table 1 What about scale? 1:50000 etc....

Page 13 Figure 10 Were these from the field measurements at the 40 sites or from extrapolated estimates?

Page 14 Figure 12 This is a major increase in gully volume. If real it shows a major permanent shift and increase in erosion.. Perhaps a threshold was reached due to intrinsic variables like sediment storage in valleys, or land use or rainfall, or combina-

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tion. See threshold complex response by Schumm. Shellberg 2016 also has a decent literature review on the subject, as well as Tucker in USA.

Page 15 Table 2 Should not crops just be used for crops, pasture for grazing, and dense scrub-land for not grazed or cropped areas? Are there only two simplified classes or 3?

Minor Comments There are many grammatical English errors in the document, which is understandable for multiple-language speakers. There are too many errors to list here one-by-one, but a PDF of the original document is included/attached with "sticky-note" locations with grammar issues or suggestions.

Many paragraphs spaces are need to help flow of text.

Please also note the supplement to this comment:

<http://www.hydrol-earth-syst-sci-discuss.net/hess-2016-239/hess-2016-239-RC1-supplement.pdf>

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., doi:10.5194/hess-2016-239, 2016.