

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

### Referee #2

The manuscript describes work performed to quantitatively estimate gully geomorphologic dynamics under Mediterranean conditions. A series of historical aerial photographs were used to estimate gully channel length measurements throughout the catchment and gully channel width measurements at selected locations. Gully depths and widths were also measured during field surveys. Statistical procedures were developed to simulate volumes and erosion rates based on measured lengths, widths, and depths values. The measured and simulated gully network geomorphological dynamics were contrasted to rainfall patterns and land use/land cover temporal changes. This is an important topic that deserves attention from the scientific community. I am very appreciative to the authors' efforts to devote time and resources to study gully dynamics. The main contribution of this work is the development of a procedure to combine two-dimensional measurements from historical aerial photographs with three dimensional measurements from field surveys. This is especially important due to the expected increase in field surveys as result of recent technological advances in UAVs and photogrammetric software and hardware. The work also points to the relationship between irregular climate patterns and the respective channel network geomorphological response, an ever-growing concern given projected climatic changes.

Additionally, findings of this study shed light on the need for improved gully theoretical framework specifically developed to simulate gully formation, evolution, persistence, and, more importantly, contribution to soil degradation. This sought new theoretical framework should be able to capture local conditions represented by varying dominant energy regimes (incision, head-cut migration, and channel side-walls lateral expansion) at different environments.

I found that the manuscript reads well, the figures are adequate, and the use of the English language to be appropriate. I also found the topic to be relevant and inline with the scope of the Hydrology and Earth Systems Sciences journal.

My only suggestions are:

Figure 1. Add the locations of the cross-sections.

Maybe add an additional figure with photographs depicting selected locations. This would enhance the visualization from the reader of what Mediterranean conditions look like.

We appreciate the positive evaluation. We have incorporated two new figures, and have modified Fig. 1 to include cross-sections locations.