

**Referee comment to:**

Journal: HESS

Title: Reducing the hydrological connectivity of gully systems through vegetation restoration: Combined field experiment and numerical modelling approach.

Author(s): A. Molina et al.

MS No.: hess-2009-77

**General comments:**

The paper is discussing an interesting issue of hydrological connectivity of gully systems in the Ecuadorian Andes. The modeled runoff and sediment dynamics based on field investigations represent a novel approach in the area investigated, but not innovative in general. However, the obtained results are relevant to understand runoff and infiltration dynamics as well as the role of vegetation roughness for sediment transport and deposition. Consequently, the topics addressed in the paper are adequate to be published in HESS. The paper is well structured and written. Nevertheless some general and specific remarks should be considered before publishing.

- 1) It is not clear what the criteria have been to select the gully systems. Therefore it is also not clear if the derived model covers only local conditions or could be applied in a larger context. Please explain in what geologic and geomorphic settings the gully systems are located. Where in the landscape the gullies occur and why?
- 2) Please specify the gully genesis (e.g. retrogressive or backward erosion, head erosion, structural reasons?)
- 3) In the introduction a short review of similar studies conducted elsewhere in the world would be interesting especially to judge the obtained results. (e.g. Kosov et al. 1978).
- 4) Since the gully development stage is important for the general behavior of the system especially for sediment dynamics (erosion transport and deposition) a rough classification of the studied systems in different development stages (active, passive transient) would be very helpful. Thus, you might be able to explain dynamics as reported for gully San Miguel 2.
- 5) The role of vegetation is only considered through the roughness parameters but not directly for the infiltration dynamics. Moreover soil structural issues like cracking or sealing are also not taken into account but often they play an important role for infiltration dynamics. Especially in soils with high clay contents this might be essential. Furthermore also soil depth should be considered. The above mentioned issues should be discussed in the paper.
- 6) Model calibration should be validated with measured K values (e.g. Hood infiltrometer).
- 7) You should discuss in the final section whether the model can be applied elsewhere in the world or not.
- 8) It would be good to have an outlook in the discussion or conclusion chapter where you should explain how the existing model could be improved. What are the most important parameters and how they could be measured more accurately?

## Specific comments:

Page 2538, line 27: ...parameters o predict the transfer of runoff ...

Page 2539, line 22: ...activities are considered to induce ....

Page 2539, line 22-24: The statement that overland flow is rarely observed in natural mountain forests is not correct especially in areas where shallow landslides occur overland flow processes are observed on the landslide scars unprotected by vegetation (see e.g. Beck et al. 2008:Gradients in a Tropical Mountain Ecosystem of Ecuador , Springer, Berlin.)

Page 2541, line 15-25: It would be very helpful to get a rough sketch of the area showing the location of the gully systems within the catchment.

Page 2542, line 4: ...altitudes.

Page 2542, line 5: ...the term degradation seems more appropriate.

Page 2542, line 20: Please explain the criteria for choosing the gully systems. Moreover especially for sediment transfer and hydrological dynamics it is important to characterize the development stage of the gully systems (see e.g. Sidorchuk et al 2003, Gully erosion modelling and landscape response in the Mbuluzi River catchment of Swaziland. Catena, 50, 507-525). To characterize the development stage you could determine the ratio between upstream area and total gully area. It would be also helpful to have a table with morphologic parameters for the 9 chosen gully systems t

Page 2543, line 5: Figure 1 please give scale reference in figure 1

Page 2543, line 11 eq 1; maybe better ... $S$  = linear hydraulic head loss approximated by slope of gully bed.

Page 2544, line 2: Please specify or define the term ephemeral gully. From the Fig 1.without scale I have the impression that the gully systems are rather permanent then ephemeral.

Page 2544, line 24: ..Philip's equation (Eq. 4) as infiltration component....

Page 2545, line 11: Please discuss if there are any effects that maybe different in small and incised gullies instead of larger grassed water ways.

Page 2546, line 245:  $S$  is already defined

Page 2548,18: is  $K$  or infiltration also measured in situ in order to validate the calibrated values?

Page 2553, line 4: Relationship between optimized model parameters and gully characteristics

Page 2553, line 25..gully systems do not reach steady state conditions....

Page 2553, line 27: ...so part of these effects are covered by variations in hydraulic conductivity....?

Page 2554, line 17: I would rather say a processed based model with calibrated parameters.

Page 2554, line 18: why do you think so? Is it the model or the input parameters that do not allow a proper prediction?

Page 2553, line 4: Relationship between optimized model parameters and gully characteristics

Page 2558, line 3: Le Bissonnaise does not appear in the