Response to Referee 1

I am recommending minor revisions focused on organization of discussion and acknowledgement of losses between precipitation and recharge.

We are grateful for the review, and respond to the comment below.

The difference between rainfall and the recharge was not properly addressed. Indeed, not the whole volume of precipitations goes as water table recharge. Some is lost through runoff and some through evapotranspiration. The former effect was taken into account by limiting the infiltration rate to the hydraulic conductivity, and the latter was considered negligible at our timescale. This is now explicitly discussed (lines 125-130).

Response to Referee 3

An analysis of landslides triggered by excess pore water pressure is described in the paper, with particular reference to typhoon events in Taiwan. The topic is certainly of interest to NHESS, and the work contains interesting data and considerations. I have listed in the accompanying file a number of small corrections, and a few requests of clarification on some issues that are not clear to me.

We are grateful for the detailed review provided by Referee #3. We answer to the main comments below.

In many parts of the manuscript (starting from the intro) Authors refer to catastrophic landslides. Nevertheless, they never define what a catastrophic landslide is. Is it a landslide of great volume and high velocity? Or is it a slope movement causing severe damage? Or what? In some sections, catastrophic landslides are in some ways counterposed to slow-moving landslides. Is it therefore just a matter of velocity? This should be clarified at the beginning of the article, by defining what a catastrophic landslide is.

Catastrophic landslides are indeed opposed to slow-moving landslides. A catastrophic landslide is characterized by the suddenness of the failure and movement. By definition they are therefore more susceptible to cause damages and losses. A short clarification has been added in the introduction (lines 36-37)

The introduction is well written and clear. However, I found lack of reference to an issue which I consider of extreme relevance to landslides, especially as concerns slope movements induced by rainfall: namely, weathering processes. These very often predispose the material to what is described in the introduction, that is changes in infiltration capacity and pore pressure. Therefore, a couple of sentences and some references should be added to this part in order to make it more complete. This is particularly important also given the study area (Taiwan) where the presence of weathered materials is particularly diffuse.

Thus, as concerns weathering, I suggest in particular to have a look at the chapters in the Engineering Geology Special Publication no. 23 by the Geological Society of London (2010, edited by Calcaterra and Parise) and at the references therein.

This is a very good point, we agree that weathering plays a critical role in slope stability by changing the material mechanical and hydrological properties. However, the effect of weathering is a slow process that comes into play on long time scales. The aim of the study being the effect of typhoons on slope stability, we focus on short time scale phenomena. Rock properties during typhoons are considered constant and no spatial heterogeneity is introduced into the hillslope.

This being said, we agree the weathering process needs to be acknowledged – especially given the study area. It indeed could explain the observed landslides distribution towards the hillslope toe, where the shallower water table leads to stronger weathering. We mentioned the weathering process lines 33-34 & 83-87.

Specific comments:

Line 121: there are quite generic definitions, you should provide some numbers, at least as an order of magnitude, in order to let the readers understand what you mean by gentle and steep. Further, it is not clear to me what you mean by narrow hillslopes. Please clarify this point.

This is related to the Dupuit-Forchheimer hypothesis. Since the flow is considered horizontal only and transmissivity constant, the aquifer needs to be large and thick. This may not properly represent small hillslopes inside small catchments, where there is a lot of flow convergence. We now explain in more details this part of the hypothesis lines 131-137.

Lines 183-185: talking about mechanisms of catastrophic landslides and slow-moving landslides, it is not very clear to what mechanisms are you referring to. This should be clarified, tpp.

The mechanisms we referred to were the failure mechanisms, as the coulomb criterion and the safety factor are the same for slow-moving and catastrophic landslides. It has been clarified (line 196)

Lines 392: typhoon Morakot caused more than 10,000 landslides, but nothing is said about these landslides. What typology do they have, are mostly shallow or not, what materials are involved, etc... Some information are needed about this event.

Additional information about the observed landslides and their distribution has been provided in section 5.7 about the Morakot event (lines 559-561).

In section 4 Taiwan is introduced but without a real description of the main physical characters of the area (basic description of its geology, presence of complex weathered profiles, typology of landslides, triggering factors, etc.). This must be included in the manuscript.

This was indeed necessary, a short paragraph has been added (lines 282-285).

A brief text explaining the importance of establishing relationships between rainfall and geological hazards could be useful (see for instance at this regard the works by Peruccacci et al. 2012, Rossi et al. 2012, and Vessia et al. 2014).

A sentence was added in the introduction to emphasize the importance of a better understanding of the role of weather events in risk assessments (lines 49-50).

Suggested references:

Calcaterra D. & Parise M., 2005, Landslide types and their relationships with weathering in a Calabrian basin, southern Italy. Bulletin of the Engineering Geology and the Environment, vol. 64, no. 2, p. 193-207.

Calcaterra D. & Parise M., 2010, Weathering as a predisposing factor to slope movements: an introduction. In: Calcaterra D. & Parise M. (Eds.), Weathering as a predisposing factor to slope movements. Geological Society of London, Engineering Geology Special Publication no. 23, p. 1-4.

Peruccacci, S., Brunetti, M. T., Luciani, S., Vennari, C., and Guzzetti, F.: Lithological and seasonal control on rainfall thresholds for the possible initiation of landslides in central Italy, Geomorphology, 139–140, 79–90, 2012.

Rossi, M., Peruccacci, S., Brunetti, M. T., Marchesini, I., Luciani, S., Ardizzone, F., Balducci, V., Bianchi, C., Cardinali, M., Fiorucci, F., Mondini, A. C., Reichenbach, P., Salvati, P., Santangelo, M., Bartolini, D., Gariano, S. L., Palladino, M., Vessia, G., Viero, A., Antronico, L., Borselli, L., Deganutti, A. M., Iovine, G., Luino, F., Parise, M., Polemio, M., and Guzzetti, F.: SANF: a national warning system for rainfall-induced landslides in Italy, in: Proceedings of the 11th International Conference and 2nd North American symposium on landslides, Banff, Alberta, Canada, 3–8 June, 2012.

Vessia G., Parise M., Brunetti M.T., Peruccacci S., Rossi M., Vennari C. & Guzzetti F., 2014, Automated reconstruction of rainfall events responsible for shallow landslides. Natural Hazards and Earth System Sciences, vol. 14, p. 2399-2408.