

Interactive comment on “Hydrological modelling of a slope covered with shallow pyroclastic deposits from field monitoring data” by R. Greco et al.

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Received and published: 8 July 2013

General

One of the merits of this paper is that it shows the results of a very detailed monitoring campaign over a longer time period, which forms a perfect basis for any kind of modelling of hydrological processes in ash covered slopes. Figure 3 gives a nice overview of the monitored moisture and pressure conditions of the soil profile. But I miss here some detailed frames (for different seasons) where I can see more in detail the temporal development of the moisture and pressure profile curves to see whether

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there is an effect of the contrast between the different layers especially the ash and the pumice layers. That brings me to the first discussion point : a fast increase in moisture content even until nearly saturation can happen in a finer ash layer above a coarse pumice layer, before infiltration in the coarse layer can take place. This may have a great influence on the triggering time of the landslide and the depth of the slip plane. This well known effect cannot be modelled in the single layer model presented in this paper This brings me to the second discussion point: I like the idea of the simplification to a one layer model, But I would like to have seen more in the discussion about the disadvantages of this simplification: The calibrated effective parameters are based on one single profile with an alternation of ashes and pumice layers and even not a complete profile (see my detailed discussion points) . The large spatial variability in profile building was one of the arguments to construct a one layer model to get a general picture of the temporal water balance. But how representative is the calibrated model for a whole slope or even catchment? I can imagine that due to this variation the calibrated effective parameters will also vary quite intense? from place to place. For me the role of vegetation in triggering these landslides on these steep slopes is still not clear. In the simulation of 1999 it was the amount of rain in spring and early summer which resulted in a relative moist profile after the summer and probably had a positive effect on the wetting of the profile after the dramatic rainfall of December 14 and 15 . But how large was this effect given the huge amount of rain which felt during these two days. And what could have been the role of evapotranspiration (vegetation) during the summer. I tend to minimize the role of the initial moisture content of the triggering of these type of shallow landslides (turning into debris flows) on very steep slopes and to maximise the role of the amount and intensity of the triggering rain event. The 1999 scenario did not change my vision. The role of vegetation especially for these shallow landslides triggered by intensive rainstorms on steep slopes remains to be debated . How important is this initial moisture content . The coupling of the hydrological conditions with the conditions of failure and the development of shallow slides which might develop into flows is vague. It would have been nice to explore with a simple equilibrium model at

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which slope gradient or slope configuration and until which possible depth instability can occur given the outcome of the hydrological model and to compare these results with the topographical characteristics of the slopes which failed nearby the measuring plot.

Detailed discussion points 5803/07 Must we not know the root density for the model? 5804/1-5 A bit more information about this calibration. How good was the correlation? 5804/19-23 According to me the higher losses of water in the top soil points to the influence of evapotranspiration on the water balance in the topsoil? 5805/5-12 I see : during the july month : -gradient upper soil going up and then down (effect of dropping groundwater and then effect of evapotranspiration) -gradient middle soil strongly going up >1 (effect of dropping groundwater) -gradient lower soil going up and down but not above 1 so not so clear effect of a dropping groundwater ?? 5805/14. I would say already during May 5805/20 What is understory? Did the rainfall gauge measure the effect of canopy interception . The rainfall graph did not show high daily rainfall in May and the months after. 5806/1 Indicate behind the soil depths in Figure 5 the soil types . Also in Figure 7 5807/0-23. See general discussion about one layer assumption 5813/16 What are the soil types in Figure 6 ? Are there no large differences between ashes and pumice even under unsaturated conditions? 5814/9 Flow slide? What do you mean a shallow slide which developed into a flow with a long run-out distance 5814/27 More elegant to use the same units in figure 9 and in the text. It is also nice to give an idea of the water content here. According to Figure 5, θ must be around 0.4 which is far from saturated ? I wonder if this conditions can create mudflows with long run-out distances? 5815/1 Would have been nice to explore with a simple equilibrium model which slope gradient or slope configuration would have led to instability and to compare these results with the topography of the slopes which failed nearby the measuring plot. Figure 1 and 2 : I do not see a relation between Figure 1 and 2 I see that layer C and D are not instrumented. They are quite different from layer A and B ? Measurements in these layer could have influenced the calibration process? I miss also a table which describe some characteristics of the layers depicted in Figure 1

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Technical 5804/13-16 Complex sentence Rewrite in pieces Some graphs are in colour, (Fig 3, 7,8,9,) which must be adapted for a black and white printing process using different signatures in stead of colours. I hope you can find a way to keep the figures readable given the huge amount of point signatures.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 10, 5799, 2013.

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