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Interactive comment on "A strategy for GIS-based 3-D slope stability modelling over large areas" *by* M. Mergili et al.

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General Comments

The paper presents a strategy to improve the computational efficiency of a slope stability assessment model, r.rotstab, through multi-core processing and strategies for geometrical and geomechanical parameters sampling. This model allows the assessment of the susceptibility of slopes to shallow landslides through the computation of factor of safety on potential truncated ellipsoid surfaces of rupture (3D). The paper discussed parallel processing and several strategies for geotechnical parameters samplings. For large areas, a sequential approach would request huge computational times; therefore, the proposed approach is very valuable. The issues raised in the paper are valid for every physically-based model, and in particular for landslide susceptibility assessment.

Therefore, the problematic is valuable for the GMD community.

However, the description of the background and the model (part 1 and 2.1) are very similar to the paper from Mergili et al. (2014). Hence, the described background and the state-of-the-art are more oriented towards the problematic addressed in the former paper (needs for finite slope, physically-based models), while the state of practice in computational efficiency and sampling strategies is not really discussed. There is no information on why these sampling strategies have been selected and there is an offset between the abstract, background and state-of-the-art and the results and discussions. The methods used (models, parallel processing and sampling) are already existing ones. Therefore, in my opinion, both the subject (computational efficiency) and the model are of interest to be published in GMD, but the paper should be totally restructured to reflect the reflections in sampling strategy and parallel computing before publication. Bibliography should also correspond to computational efficiency.

Specific comments:

It is not clear enough what are the differences between r.rotstab and r.slope.stability, except the fact that r.slope.stability can be used with multi-cores computers.

No information on computational times is provided. We cannot judge how necessary are parallel processing and parameters sampling. What are the capacities of the computers used?

Global confusion between "surface" and "plane" of rupture. Not every failure occurs following a plane.

In order to be clearer in the description of the model, it would be good to mention that no inter-column forces are considered in the r.slope.stability model.

The randomization process for W and L is not discussed. Do the authors also use a strategy to increase computational efficiency, or is a Monte-Carlo strategy used? What is the methodology used to ensure a proper repartition of ellipsoids over the whole area? Regular or random sampling?

The hypothesis of soil saturation is not discussed, even if it is a quite conservative hypothesis. It seems reasonable to make this hypothesis for the purpose of the paper, but the results should be analyzed accordingly. The final Pf maps correspond to “probability” of failure in the worst case scenario, and they do not correspond to current probability of failure.

Technical comments

P2 l22: Is this zone the same one as in Mergili et al. 2014? In this case, why the area is different?

P3 l4: “consisting” instead of “consiststing”

P3 l6: not all the physically-based models assume the surface of rupture to be a plane. (i.e. circular assumptions with Jambu or Morgenstern-Price approaches).

P3 l14: “forces” instead of “forcess”

P3 l23: references to Baum et al. (2002) and (2010) are missing in the references section.

P4 l29: is the notion of large areas really commonly related to number of pixels, and not to sizes, or the existence of several objects (i.e. slopes)? A single slope can have ∼10ˆ8 pixels, according to the resolution

P6 l10-11: does the offset correspond to the offset mentioned l 15. In this case, it is better to mention zb l10.

P6 l.19 What could be considered as “relatively small pixels”? Could the ratio W/pixel size∼3 be considered big enough?

P8 l5-6: also variability of the geometry parameters (i.e. d) P8 l16: Does the number “n” of samples of samples to be collected correspond to the samples from the ground,

(in this case, not consistant with the “n” used in the rest of the paper, e.g. p9 l3)?

P9 l4: “largest” instead of “lagest”,

P9 l5: is it correct to consider the probability of failure for a pixel to be the largeest Pf computed for the different parameters combinations? The value could be representative of the propability, but not the propability of failure per see.

P9 l20-25: It is not clear how the sampling is performed: for a) and b), you select a different combinations (c’, ÏŢ’) for each ellipsoid, while for c), you pick one combination, and you consider the parameters homogenous over the whole area? Why don’t you use the last option also for a) and b)?

P9 l25: Please mention that in the paper, it is this solution (application to three parameters) which is applied. It makes confusion after in sect. 4

P10 l14: According to Eq 4, the density is not in ellipsoids per pixel, but ellipsoid per unit of surface (here, meter).

P10 l 16: “A” is not described here, and appears different from the parameter in Eq2

P12 l15: does the inventory correspond only to scarps, to reflect areas of departure?

P13 l24: Please also add the standard deviation of c’

P16 l20: It is good to notice, but isn’t it normal? If you don’t have a new job to give to an available processor, this processor is somehow useless for the computation.

P19 l22 (and Figure 8): which parameter sampling strategy has been selected?

In the discussion part: the recommendation for n∼9ˆ3 is valid for area assuming a unique parameterization over the whole area. Would it be the same with soil-type specific areas? In this case, where ranges of variations of parameters could be probably be reduced, would n smaller than 9ˆ3 suitable?

Would it be possible to consider different soil water content conditions?

In references, Iverson and Major (1986) is not referenced in the text.

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