EGUsphere, referee comment RC1
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Comment on egusphere-2022-658

Anonymous Referee #1

Referee comment on "A new analytical method for stability analysis of rock blocks with cavity in sub-horizontal strata by considering eccentric effect" by Xushan Shi et al., EGUsphere, https://doi.org/10.5194/egusphere-2022-658-RC1, 2022

The manuscript deals with the an analytical method for stability analysis of rock blocks susceptible to differential erosion at the base and the corresponding application to a case study in China.

The manuscript is relatively well-written and well-organized, but several doubts regarding the novelty, the methodology and the conclusions proposed by the work arise. Here is a list of questions and comments that need to be clarified:

- English language presents some mistakes throughout the paper and needs to be improved
- Figure 8: it is unclear why for case b (three free faces) there is the scheme corresponding to the side view along the x direction (lower and right portion of the figure), since the corresponding face should not exist. Moreover, the upper captions (side view along the x and y directions) should be exchanged, according to this reviewer.
- Line 156: the sentence “rainfall is the main predisposing factor of rockfall” is strongly questionable from a theorical point of view. Rainfall is universally known to be not a predisposing factor.
- The coefficients k in all the equations at pages 11-13 are not introduced at all. Please, check that all the parameters mentioned are clearly defined in the text.
- The Authors state that, according to the results of in situ surveys, mudstone is not subjected to deformations (line 171). If so, why the need to introduce Fos corresponding to compressive strength (Fos_{co}) and tensile strength (Fos_{te}). What happens if these strength are reached? What is the effect of stresses exceeding strength in the mudstone? Please, clarify this point, since it represents a central innovative concept proposed in the manuscript, although it is not sufficiently described in detail.
- Related to the previous point, while the text portion corresponding to the 3D sliding and toppling stability analysis is not new and well-known in the literature, what should be the effect of a Fos_{co} lower than 1.0 from a physical point of view? Is actually important for the block stability? And what about the effect of a Fos_{te} lower than 1.0? The

phenomenological and physical interpretation of these concepts seem to be not sufficiently investigated by the Authors.

- It seems that in eq. 31 and 32 the terms should be exchanged: st_{max} should refer to FOSte, while scmax refers to FOSco. Again, terms st_{max} and scmax have not been defined in the text.
- Lines 289-290: if there is uncertainty related to the choice of the mechanical parameters, has been such uncertainty quantified? Why not providing a range of the parameter values to account for such uncertainty, along with the corresponding results in terms of FOS?
- Figure 10: if a large amount of cases provides FOSte lower than 1.0, why have the authors not observed tensile failure in the field?
- Figure 11b does not show rmax, so line 299 is uncorrect. In general, Figure 11b is not adequately explained. Lines 300-301 are uncorrect, since FOSmin is not always lower than 1 for the points lying above the red dashed line (see points with 1.53, 2.95, 1.06).
- The relationship in Figure 11b (red line) cannot be considered to be generalized for block stability analysis, since the block stability is highly affected by the value of mechanical parameters chosen and the driving factors acting on the block (water level height within the joints, seismic actions), which have been assumed as fixed in the analysis presented. If these input data should vary, the corresponding FOS will change.
- Lines 308-315: this part of the text is highly important because it provides a global interpretation of the conceptual model proposed by the Authors, However, it is excessively synthetic, while it should be enlarged and enriched with a clearer description. The Authors should highlight in a clear way that compressive and tensile states within the block foundation do not provide global instability, as sliding and toppling, but could be only considered as preliminary signs of a possible future failure.
- Line 313: English is bad. Please, revise.
- Figure 14: this reviewer again strongly suggest to avoid emphasizing excessively the generalization of the results in terms of threshold value for stability, for the same reason described above.

Based on the aforementioned comments, the manuscript can be accepted for publication, providing that all the comments described above are discussed in detail.