Reviewer 1:

The authors have performed a slope stability evaluation of two important towns of the NW Himalaya (India) that have been witnessing subsidence and cracks for many years. They have used different loading conditions to evaluate the response of the hillslopes accommodating these towns. Though it's a brief communication and involves all possible aspects in its scope, certain issues require proper explanation.

1. Why did the authors consider only these two towns in the NW Himalaya when many other towns might be facing similar problems?

   Response: These two towns were selected owing to similar problem of surficial cracks and same geological conditions as both the towns are situated at hanging wall of Main Central Thrust (MCT) Fault. This geological position having MCT Fault allows the occurrence of frequent earthquakes (Supp Fig. 1 of preprint). Further, it also allows relatively higher precipitation in this region owing to orographic barrier topography (Supp. Fig. 2 of preprint). We agree that there might be some other towns too in the Uttarakhand having similar problems, but we wanted to present a brief model of problem and potential response scenario using these two towns. Now, this concept can be replicated to other towns as well.

2. Why did authors use continuum modeling even for the seismic loading, which has been considered mostly using discontinuum modeling?

   Response: We are also of similar understanding that for estimating large strain, particularly during the dynamic analysis, discontinuum modelling could be a better option as also noted by Havenith et al. (2003); Bhasin and Kaynia (2004); Kumar et al. (2021). However, we also can't deny the fact that the loose overburden and complex geometry can be better simulated using a continuum modelling approach. Notably, discontinuum modeling having block concept also consider Finite Difference Method (one of the continuum modeling approaches) mechanism for deformation of blocks. Further, we have used rainfall 'vertical' infiltration and domestic discharge infiltration in our study directly on the slope surface to approximate real scenario, which is limited in discontinuum concept that allows fluid transmission using joints only. Finally, we are of opinion that there is no perfect model as all models have certain relative advantages and limitations and hence, we are considering a detailed 3D slope stability analysis for future prospect for the similar objectives that will involve both continuum and discontinuum concepts for comparison.

3. How did the authors decide the value of extreme rainfall and domestic discharge in these towns?

   Response: The value of extreme rainfall is based on the daily dataset of last 22 years retrieved from GPM IMERG Final Precipitation dataset (Huffman et al., 2020) having spatial resolution of ~ 1 km. Approx. 122 mm/day on 18th Oct. 2021 and ~124 mm/day on 26th July 2010 in Joshimath and Bhatwari region, respectively that are used for rainfall infiltration in the hillslope are based on this dataset.

   The values of domestic discharge (sewage & sullage) is based on the Indian Standard (IS) code: 2470 (Part 1)-1985, pp. 8. According to this code, for a family of minimum 5 members, probable peak domestic discharge may reach up to 9 litres/minute, which equals to 0.00015 m^3/s. Notably, we have provided this value in hillslope as point infiltration and hence m/s unit is considered.

4. The topography (ALOS-PALSAR RTC DEM) that the authors used for the slope stability simulation does not comprise present changes of subsidence. How will the authors justify their displacement findings?

   Response: We understand the reviewer's perspective to have latest topography that of course might be more useful. However, we have following justifications to utilize the ALOS-PALSAR RTC DEM in our analysis;

   - To develop the latest topography, we tried doing UAV-RTK survey, but owing to law and order situation and other restrictions, we were not allowed to do so while performing the analysis.
   - Present study proposes values of displacement based on topography, material property, and various loading conditions and except topography other factors are going to remain relatively same until complete collapse occurs. Further, since the topography is continuously changing owing to continuous deformation (https://discuss.terradue.com/t/results-of-advanced-insar-services-sentinel-1-indicate-that-the-town-of-joshimath-northern-india-is-sliding/1149, retrieved on 3rd Feb. 2023), there will always be some limitations about topographic effect.
   - Further, we are trying our best to incorporate not only updated topography but also subsurface heterogeneity in our ongoing detailed 3D slope stability analysis that will be communicated once we are confident of results and validation.

5. Authors have used 2D slope stability evaluation, which might not cover all aspects of the instability of a slope and 3D modeling could be considered. Please justify the usage of 2D modeling.

   Response: We agree that 2D slope stability analysis might not cover all aspects. We have taken multiple 2D slope sections in this study to minimize the uncertainty caused by single 2D slope sections. Nonetheless, we are trying to develop detailed 3D slope stability model, as also explained in comment no. 2 and 4.

References

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