**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 18$^{th}$ Oct. 2021 and ~124 mm/day on 26$^{th}$ 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.

**Reviewer 2:**

The brief communication on the NW Himalayan towns; slipping towards potential disaster addresses two towns of the Uttarakhand in the NW Himalaya (India), with similar litho-tectonic conditions and precipitation regimes, where past and recent evidence of slope instability can be found. The topic fits the scope of the journal and the study area is of high interest since it is frequently affected by disastrous landslides. The manuscript is clear and well written, and the results obtained highlight the importance of further in-depth study. Therefore, I highly recommend the acceptance of this brief communication. Nevertheless, I recommend some minor corrections according to the following:

1. Despite the manuscript is clear and well written it would benefit if the various sections were identified according to the typical structure (e.g. Introduction, study area, etc…).

   **Response:** We agree with the suggestion that the typical structure might be simpler for readers to differentiate between different sections of study. The purpose to make the structure of this study as continuous was decided for comparative representation of both the hilly towns having similar problems. Keeping the entire study 'brief in nature' was another objective that was targeted while writing the MS. We are hopeful that the reviewer will get convinced with our justification and support our way of presentation in this study.

2. Page 1, line 13 and page 3, lines 7-8 : "In the last 1-2 weeks…": please, be more specific for future reading (e.g. provide the month/year);

**Response:** As suggested, the MS has been revised accordingly.

3. Page 3, line 24: please replace 1.025 % with 1 %;
   **Response:** As suggested, the MS has been revised accordingly.

4. Page 4, line 4: the authors mentioned Fig. 2i-j, but I think the “j” is missing;
   **Response:** As suggested, the MS has been revised accordingly.

5. Page 4, line 4: please delete “of these”;
   **Response:** As suggested, the MS has been revised accordingly.

6. Page 5, line 20: please replace “in shown” with “is shown”;
   **Response:** As suggested, the MS has been revised accordingly.

7. Page 6, line 1: please replace Meunier et al. (2008) with (Meunier et al. 2008)
   **Response:** As suggested, the MS has been revised accordingly.

## References


Bhasin, R. and Kaynia, A.M.:Static and dynamic simulation of a 700-m high rock slope in western Norway. Engineering Geology, 71(3-4), pp.213-226, 2004

Havenith, H.B., Strom, A., Calvetti, F. and Jongmans, D.: Seismic triggering of landslides. Part B: Simulation of dynamic failure processes. Natural Hazards and Earth System Sciences, 3(6), 663-682, 2003.

Huffman, G.J., Stocker, E.F., Bolvin, D.T., Nelkin, E.J. and Jackson T.: GPM IMERG Final Precipitation L3 1 day 0.1 degree x 0.1 degree V06, Edited by Andrey Savtchenko, Greenbelt, MD, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: Sep. 5, 2020, 10.5067/GPM/IMERGDF/DAY/06, 2020.

Kumar, V., Cauchie, L., Mreyen, A. S., Micu, M., & Havenith, H. B.: Evaluating landslide response in a seismic and rainfall regime: a case study from the SE Carpathians, Romania. Natural Hazards and Earth System Sciences, 21(12), 3767-3788, 2021.

**Editor:** Thank you for fully addressing the reviewer comments in your revision and response.

There is just one point that remains - the precipitation amounts given for each site (pg. 3 line 15 and pg. 4 line 1) are not reasonable. It looks like you are reporting a monthly precipitation that is equal to a full month at the highest daily recorded precipitation for each site? This vastly overestimates the actual monthly precipitation. Here you should choose an appropriate metric to calculate from the dataset and be specific about what it is (i.e. mean monthly precipitation, mean annual precipitation, maximum recorded monthly precipitation, mean monthly precipitation during the monsoon (June, July, August).

**Response**: We are thankful to Editor (Prof. Kristen Cook) for pointing out these rainfall values that could have created a confusion among readers. Editor is right in concluding it as monthly precipitation, which was equal to a full month at the highest daily recorded precipitation for each site.

We apologise for using this value, which is not the best way to represent the rainfall scenario at this location. In view of Editor's suggestions, we have replaced these values. The updated values in the revised MS refer to <u>average annual rainfall</u> (Oct. 2000-Dec. 2021).