Reviewer 1: Missy Eppes

General comments:

A big thank you to Missy Eppes for her very positive and encouraging comments! In the revised version we included the mentioned additional literature and we emphasised the significance of our work a little more. We pointed out the representativeness of our results by highlighting that our findings are likely generalizable because the studied species represent widely distributed life forms common to rocky outcrop habitats, suggesting broader applicability to carbonate cliff systems beyond the study area.

Implications for erosion rates: Yes, from a geomorphologist's point of view (OS), I'd like to get to the bottom of that in a planned project proposal. Our initial findings do not yet allow us to draw sound conclusions. The question of increased loose debris under plants is a chicken-and-egg problem, as sites with more loose debris are home to entirely different plants.

Apologies for the incorrect description of subcritical cracking – I realised the inaccuracies after reading the manuscript again. We clarified these points (chemo-physical process, influenced by moisture, water chemistry, temperature) in the revised version. After all, highlighting the overarching importance of moisture for sub.cr. provides us with even clearer arguments for the importance of our research and the relevance of the findings.

Changes to the paper:

Rev1: Overall, I think the authors undersell the significance of their work and their results (…) Water held by rock is a bit of a hot topic at the moment and has been addressed by a few groups, e.g.: https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2025JF008424) .

> OS/TD: The paper has now been cited and one of the key questions is briefly discussed at the end of the Discussion section.

Rev1: As a non-biologist, I find it difficult to distinguish between the different latin names of the plants .... Perhaps a visual key to them in a supplemental doc would be helpful – along with providing their common names. Or can you even have a simple sketch of their morphology in the table where you name them?

> OS/TD: We decided to 'embellish' the mentioned table by including the simple morphology sketches as used in Figs. 7+8. We feel that a visual key in a supplemental doc would be the second best option as the reader would have to open a supplementary file which is less comfortable.

Rev1: By including these, can't you sort of increase your impact by talking about how representative they might be of other plants in other settings? I would love to see in the discussion how you expect the results to translate to other climates and plants and rock types a bit. I think these temperatures are very common across the globe for bare rock.

> OS/TD: We thank the reviewer for this insightful suggestion. We have expanded the Discussion to better contextualize the broader relevance of our findings. Specifically, we now highlight that the selected species encompass a range of distribution patterns, life forms, and growth strategies that are representative of rocky outcrop vegetation beyond the study area. We also emphasize that the diversity in plant forms and root architectures

captures plant–substrate interaction strategies likely to occur across different climates and rock types. These additions clarify the potential generality of our results and their applicability to other systems.

Rev1: What are the implications for erosion rates, for example?

OS/TD: We feel that from our pilot study it would be too early to make meaningful guesses on erosion rates. We would like to leave this for a planned full proposal.

Rev1: How could you leverage your methods in a different site to get at the question of acceleration by moisture vs. deceleration by temperature range?

OS/TD: This is not yet possible from our preliminary study – a sentence was added (line 447f)

Rev1: Or even in your own study area. For example: Is there evidence that different parts of the rock are eroding more rapidly than others (ex: areas wth plants have more loose debris on the rock surface?)

OS/TD: We added sentences discussing this point for the steep slopes of our study site (line 451ff): "Our investigated species root in cracks of the rock where they are able to influence weathering, while sites with more loose debris are home to a set of entirely different plant species with different root architecture. On mobile slope regolith plant roots are specifically adapted to stabilise scree, not to penetrate crevices. If rock plants generate significant amounts of regolith, they pave the way for other species, not for their own needs."

Rev1: Although this is not central to the paper, the concept of subcritical cracking is incorrectly or insufficiently presented in much of the paper. Some reorganization and re-emphasis will help [several examples]

OS/TD: We checked all mentions of subcritical cracking and we corrected wrong or misleading explanations in several places. This answers most of Rev1's following comments that also deal with the concept of subritical cracking.

Rev1: In the paper, this concept is not at all clear and subcritical cracking is inferred to occur with thermal cycling alone in one spot (intro) but then in response to chemical factors in another (the table).

OS/TD: Corrected / clarified (see comment above)

Rev1: There are also very confusing references – like the Question 1: "Is the daily temperature amplitude in the rock reduced by vegetation and soil cover, potentially reducing direct and subcritical thermal cracking".

OS/TD: Corrected / clarified (see comment above)

Rev1: It is not clear as written what this might mean. I think it means that a lower temperature amplitude would both reduce the thermal stress (which it would), but also a lower temperature would decelerate thermal cracking even more due to the chemophysical nature of subcritical cracking (yes, that would be the idea as well).

OS/TD: Here, the reviewer tries to find a very clever idea in our very inadequate description. After our corrections at most references to subcritical cracking this should be settled.

Rev1: But I don't think a reader will understand this without basically including the paragraph that I wrote above in their introduction (Feel free to use any part of it).

OS/TD: We are grateful for this offer and we wanted to do that, but to avoid making the paper too long, we decided against it as subcritical cracking is not the main focus of the paper.

Rev1: It would strengthen the paper to emphasize that moisture plays a role in the stress magnitudes and efficacy of weathering processes like temperature cycling and freezing, but ALSO plays a role in the bond-breaking itself – accelerating physical breakdown rates even when the stress magnitudes are identical. This 'double role' of water makes measurements like the ones presented herein even more important…

OS/TD: We added this thought in the Introduction (we feel that it belongs there because we provide no new data on the subcritical cracking process itself).

Reviewer 2: Anonymous

We thank reviewer2 for his thoughtful comments that helped to improve the paper.

Rev.2: In the conclusion section, the authors claim that plant covered rock surfaces will have a reduced frost cracking based on their results. As measurements of temperature and moisture were done during spring and summer and without any reported < 0 day, how can they support this claim with their presented results? While it is very likely the same attenuation of temperature will occur during winter months, how can the author be certain while not accounting for effects such as the thermal effect of snow?

OS/TD: Due to the exposed character of the slopes investigated, snow cover in winter is relatively short. As reviewer2 states, it is highly likely that similar attenuation of temperature will occur in the winter months as long as there is no snow cover. In times of snow cover, surface temperatures at this altitude are usually attenuated to a relatively constant BTS (bottom temperature of snow cover) just below 0°C which means "equal conditions" between plants and no plants. Thus, freeze-thaw events almost exclusively occur in snow free periods; and thus we feel that we can confidently conclude that plant cover will reduce the probability of freeze-thaw events during the winter months.

Changes to the paper: We added some of these thoughts in the Discussion at line 395-400.

Rev.2: The paper claims that the observed temperature attenuation of 3–5 K under vegetation reduces thermal weathering intensity, but this link is not sufficiently established. Thermal weathering is driven not only by the magnitude of diurnal temperature amplitude, but also by the rate of temperature change, yet the paper provides no data on the latter. The observed temperature attenuation is an interesting finding, but the causal chain between it and reduced

thermal weathering intensity remains undemonstrated, especially at >0 degrees conditions throughout the study period.

OS/TD: We performed new data analysis on the rates of temperature changes. We can clearly see that the mean maximum heating rate is around 10 K/hr for the rock sites and only 2-3 K/hr for the plant covered sites. The same is valid for the maximum cooling rate which is between -5 and -10 K/hr for the rock sites and mostly between -1 and -3 K/hr for vegetation sites. We have produced two new figures showing this.

Changes to the paper: Rates of temperature change are shown in two new heating/cooling rate figures in the Appendix. The abovementioned numbers are provided in the text (lines 259-264) and two short senteces were added in Discussion and in Conclusions.

Rev.2: The paper shows well how moisture responds temporally to rainfall events (Figures 5 and 6), a similar presentation of the temporal view of temperature would be interesting to assess the rate of temperature change and its relationship to claims made about cracking ("there is no doubt that the thermal effect of vegetation in our study area reduces the intensity of ciritical and subcritical cracking") that are only based amplitude of daily temperature.

Changes to the paper: The rate of temperature change is shown in the new heating/cooling rate figures. A temporal view of temperatures was added in the Appendix.

Rev2: Page 22 Line 460 - "Higher and deeper-seated moisture has the potential to promote subcritical cracking." … Page 20 Line 394 "there is no doubt that the thermal effect of vegetation in our study area reduces the intensity of critical and subcritical cracking." The link between the presented results and these claims is not sufficiently clear.

OS/TD: Generally, the two quotations selected by Rev2 on Line 394 (thermal attenuation reduces sub.cr.) and Page 22 Line 460 (higher moisture promotes sub.cr.) do not contradict each other. Both effects are likely to occur and the question is which of them is more important on the long term. Due to the pivotal role of moisture for sub.cr. we believe that the moisture effect is dominant (see our reply to Reviewer1).

Changes to the paper: In response to Rev1 we made the concept of subritical cracking clearer throughout the paper. We omitted the sentence on line 394 as it was somewhat confused.

The handheld MW sensor used in this study requires full contact with the measurement surface to produce reliable result. In the methodology section, how this inherent limitation of the sensor was mitigated while measuring on plant covered surfaces is not addressed. Could the variation in plant type and architecture influence results? This would be a useful clarification to add.

OS/TD: It is difficult indeed to find spots that are smooth enough to place the microwave sensors but it is possible (it took quite a while to find). The procedure for plant cover is addressed at the end of section 3.3.: "For measurements below plant leaves and soil, the cover had to be (temporarily) removed. The measurements were taken below the plant leaves for all species except *Primula auricula L.*, where the plant leaves did not cover

much space of the rock. There, measurements took place directly below the plant individual.”