

Interactive comment on “Passive soil heating using an inexpensive infrared mirror design – a proof of concept” by C. Rasmussen et al.

Anonymous Referee #1

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Dear authors, I think your article presents useful methodological information which can be applied by others and the purpose of the experimental mirrors is clearly interesting. The article is well written, the objective, results and conclusion are all clear. Your article is a test of method and your conclusion is a proof of concept, so far so good. Out of interest, I am only missing the perspectives for future studies – are you going to use the mirrors and for what type of studies? I also think it is a pity that you tested the mirrors without vegetation as I assume the response of the soil system to climate change especially is interesting when vegetation is in the game. And for that reason the usability of the mirrors are interesting in combination with vegetation.

Besides, I think the discussion and conclusion are lacking the following two reflections:

C279

1. I think that the proof of concept presented in the article is restricted to the present latitude and climatic regime. As for now the discussion is not reflecting considerations about latitude and climate regime. In tundra environments it is typically much cloudier and rainy and the sun inclination is much different. This will affect the usability of the mirrors and your statements in the discussion and conclusion should reflect this.

2. I do understand that your target is to simply increase the surface and subsurface temperature reflecting the IPCC global average temperature increase. However, on a local scale the climate changes might be a bit more nuanced and therefore it would be interesting with some thoughts about how realistic the pattern of warming from the mirrors is? Would a global climate change induced warming create same type of heat pattern as the mirrors do, i.e. an amplification of the daily temperature oscillation? What about precipitation patterns, which clearly also affect the mirrors?

The rest is a mix of critical comments concerning presentation of data and minor things that will increase the readability of the article, presented here in chronological order.

P.430 line 5-6: it is a detail but be consistent with numbers. Most of the dimensions given for the mirrors are without decimal digits, which makes it seemingly unnecessary to write that: The glass panels were mounted in the frame at a height of 15.25cm above ground. Stay with the same number of digits. Dropping the decimal digits would be better.

P. 430 line 7: a typo: not and, but an

P.430 line 14. In my opinion pictures and drawing are extremely useful to enhance the readability of technical descriptions, such as the mirror frame setup. Since the setup of the mirrors is central to your study I would suggest adding a schematic drawing of the various setups you tried.

P.430 line 15. A reference would be appropriate.

P. 431 line 15, p. 432 line 15 and 19. As I read the Copernicus citing guidelines

C280

websites should be referenced just as other sources with a name and year, and I find it disturbing to read long internet links as references in the text.

P.432 line 9-11. Soil amendments? It is not clear if the “mirror and soil treatments” you later mention (p. 434 line 8) refers to these soil amendments or to the fact that two different soil types are used. Is it crucial to know about this larger project for conveying the information about your study? If a reference exists it could be relevant here as well.

P. 432 line 23-25: (somehow related to the comment above I think) It is not clear what a mesocosm is (and is it important to know it for understanding your study?). Is the mesocosm a micro-climate amendment construction or is it simply a soil pit covered with a geo-textile? How is the geotextile fabric influencing the plot? A brief explanation next to the term would be useful.

P. 432 line 25-27. How many mesocosms did you use, and how many for each treatment type?

P.433 line 1. Why adding two mirrors, when you in the initial trials used one? And how was the influence of the shading using two mirrors relative to the shading observed with one mirror from the initial trials?

P. 433 line 4. Introduce the abbreviation first time it is mentioned.

P. 433 line 11 and 14. According to the manuscript guidelines equations should be numbered, be on a separate line, with Arabic numerals in parenthesis on the right hand side.

P. 433 line 22-24. Why did you use two different methods for measuring soil temperatures – please argue for your decision. Considering the conclusions from the initial trials with both negative and positive temperature changes, it would have been interesting to have a higher measurement frequency I think, and it would give a higher certainty of the temperature trends. Of those six dates of temperature measurements how many measurements per date?

C281

P. 435 line 8-16. Why are you reporting some numbers (ΔT) with standard deviation, while others not. Seems inconsistent.

P. 435 line 14. A typo: not measure but measured.

P.434 line 6. Write IR mirror plot, instead of only IR plot, so the naming of the experiment is consistent.

P. 434 line 10-12. Summarizing by date is not later presented in the results. And the calculated significant differences are also not presented.

P. 436 line 26. A significant negative trend, calls for a statistical quantification.

P. 437 line 16-21. A sentence of four lines! Please reformulate as this is quite interesting.

P. 438 line 1-3. As mentioned in the beginning: I would like a modification to this statement, since your setup depends on the sun inclination and a majority of cloud free days. In for instance tundra environment or basically agricultural systems on other latitudes the cloud cover and sun inclination might be less favorable for your experimental setup. I think this should be reflected in the conclusion.

Table 1. Under comment b: why are you using three different letters to indicate significant differences. Please explain what A, B and C stands for.

Figure 2. Would be helpful with a colour scheme that works in black and white too.

Figure 3. The secondary y-axis to show the amount of rain is missing. Would be helpful with a colour scheme that works in black and white too.

Figure 5. For the significant negative trend please add a statistical quantification, R²-value or the p-value.

If you address the mentioned comments I think your article will be a useful and interesting contribution to the literature.

C282

