Response to reviewer #1

Dear Anonymous Reviewer,

Before I start, first, also on behalf of Dirk Mittelstrass, I may thank the reviewer for investing the time and going through our manuscript. I very much appreciate the positive feedback and the comments (of minor nature, but doubtlessly important). To get a discussion started, I list my answers below after the reviewer's comments.

> Page 6, Figure 2: how was the exposure time determined at 4.2s? Why does the channel time (5s) higher than the exposure time?

Thank you for flagging this. After reading your comment, I realised that our terminology should be more transparent and better align with the software settings the user can find in *LexStudio2*. The exposure time is the actual time the camera is recording the image, and the channel time is the time between pictures because the camera has a specific dead time and needs to process the images. The screenshot shows the actual setting chosen for the measurement and is deliberately set smaller than the channel time. The channel time itself is set in the *LexStudio2* software sequence editor, which is a little bit confusing for the user. I will discuss how to avoid this confusion with Dirk, and we will come up with a revised version of the manuscript.

> Page 7: The solar simulator settings here are not the same as Frouin et al. 2015. Please check the numbers

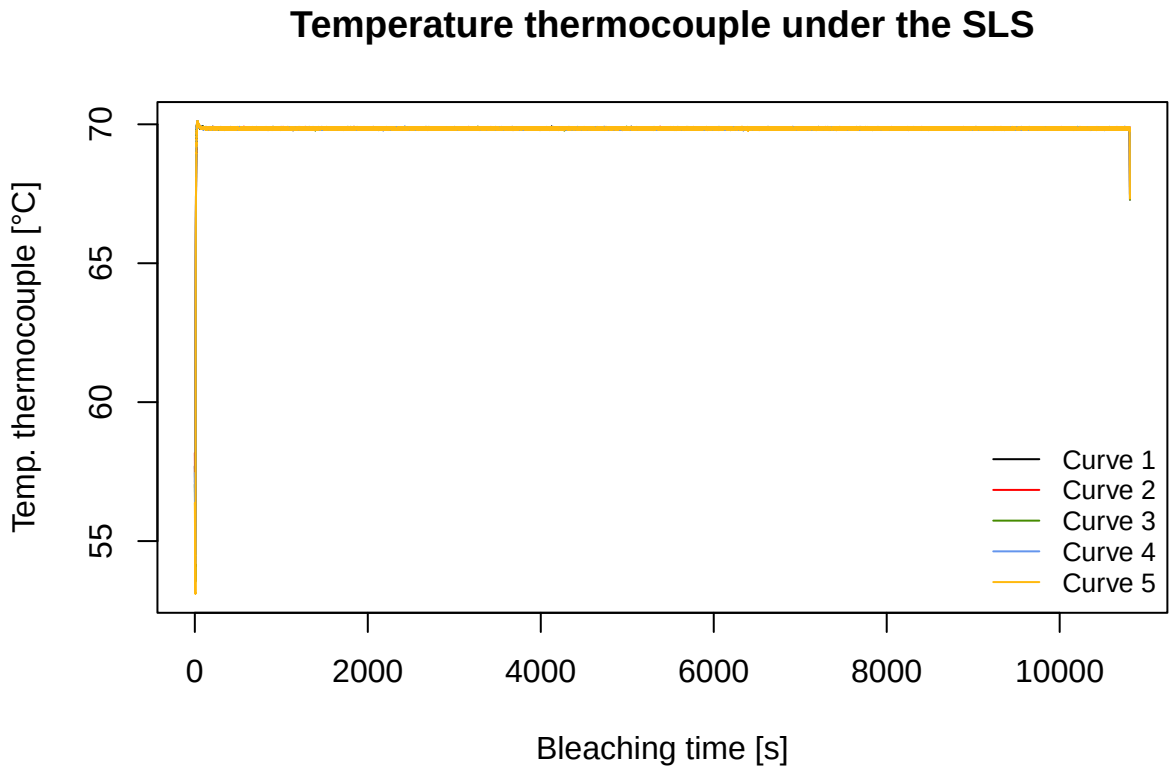
You are right. Thank you for spotting this. The here reported solar-simulator settings are correct. Unfortunately, the reference is not well suited. It should be Frouin et al. (2017). However, while double-checking, I realised that we accidentally reported the wrong settings in the manuscript in Frouin et al. (2017). Though I believe it should not matter much, the settings reported in our manuscript were also used by Frouin et al. (2017) (I verified the original sequence files). More importantly, in our case, these settings are the same used by Kreutzer et al. (2018), and we re-measured one of those samples. Our dataset available on Zenodo (Kreutzer & Mittelstrass, 2021) contains all applied sequence files. There it is visible that we applied the settings we reported. Either way, I rephrased the manuscript text to clarify that the settings are correct.

> Moreover, the UV intensity has been doubled. An increase in UV induces a higher temperature during bleaching, which can activate a shallow TL peak (at ~120C at 10C/s, Huot et al., 2015). I am therefore not convinced that:
>
> 1. 1hour pause is sufficient for the thermocouple to completely cool down (see Huot et al., 2015 fig. 3) and for the phosphorescence signal to completely disappear,
> 2. and that the RFreg signal truly compares with the RFnat signal (if the shallow TL peak has been indeed activated during bleaching).

This is a justified claim, and it can be tested quickly. The thermocouple in the reader, installed in the sample arm, records the bleaching temperature (here at 70 °C). If your claim is correct, we should see a significant increase in the thermocouple's temperature over the 10,000 s of bleaching. Below I, exemplary, extracted all temperatures recorded during the sample's bleaching with the manuscript's settings for the sample TH0. The R script may ease an additional inspection and show how I extracted the data. The here used dataset is part of the dataset available on Zenodo (Kreutzer & Mittelstrass, 2021).

```
library(Luminescence)
temp <- read_XSYG2R("2019-09-15_20190913_TH0_blanchi_RF70_CAL_L2.xsyg",
    verbose = FALSE,
    fastForward = TRUE
```

```
) %>%
get_RLum(curveType = "measured", drop = FALSE) %>%
get_RLum(recordType = "bleaching (NA)") %>%
set_RLum(class = "RLum.Analysis", records = .) %T>%
plot_RLum(
  combine = TRUE,
  legend.pos = "bottomright",
  ylab = "Temp. thermocouple [\u00b0C]",
  xlab = "Bleaching time [s]",
  main = "Temperature thermocouple under the SLS"
)
```



The figure shows that the thermocouple's temperature remains very stable over 10,800 s (the bleaching time), even with the higher UV power settings. The true sample (grain) temperature is likely slightly higher. However, suppose the higher power settings would have caused a temperature rise, such an increase should be visible in the plot; in particular over such a long time. Luckily, a temperature increase is not visible. Moreover, the temperature stayed at the target temperature of 70°C. Hence, I am convinced that our settings are justified and did not bias our results.

> I wonder if the large scatter on the natural sample can be due to this variation in temperature during the IR-RF measurement procedure (due to high UV contribution) and/or insufficient pause.

See my comments above, I do not think so. The measurements results do not support any interpretation in this direction.

> Page 14, line 281: what signal did you use for the Feldspar paleodose?

The feldspar palaeodose was obtained with IR-RF using the RF_{70} protocol.
I will add this information to the manuscript.

> Page 14, line 289: same question

We will add this information in the revised manuscript.

> Page 17, figure 6. It would have been nice to see a picture of each aliquot in daylight for the readers to have an idea where the signal is coming from and see how close to each other the grains actually are. It looks like the light is coming from a much smaller area than the grain. Could you comment on that?

Unfortunately, we cannot provide such a photo. Admittedly, we discussed this during writing this manuscript, but the aliquots were already discarded because I changed the laboratory and had free cups.

Besides and in general, the answer is, yes, the light seems to originate from a smaller area. The original photos taken with the camera are ready for inspection on Zenodo (Kreutzer & Mittelstrass, 2021). There we also uploaded processed data, which include images created during the analysis. From those images, it should be easier to see where the light origin.

> Page 2, line 28: there are three "and" in one sentence. Please remove one at least.

I removed two 'and's.

> Page 2, line 42: (e.g. Duller and Roberts (2018)) replaced by (e.g. Duller and Roberts, 2018)

Thanks corrected.

> Page 6, Figure 2, caption: change the quote marks

Thanks for spotting, this was introduced by a recent change of the software that converts our manuscript written in markdown into a PDF via LaTeX.

> Page 6, line 141: "measurements: one. . . ."

Corrected.

> Page 15, figure 5, B, the graph shows a IRreg signal measured for 8000s but line 298, it is written that the measurements were done until 10,000s.

Well spotted. The text is apparently correct, and the sample was irradiated for 10,000 s. Still, it appears that the system threw away the last image dataset of the curve. Likely the reader stopped unexpectedly. We added additional information to the figure caption and the text, we had a lot of trouble with the PC during the measurement campaign.

> In caption, please add "grain diameter: 7 px"

I added the unit.

> Page 15, line 295: did you use silicon to mount the grains?

Yes, I added this information to the text.

> Page 18, line 357: "IR-RF age of ca 31 ....Gy" and "quartz age of 26.1... Gy", you mean "ka" I guess?

Of course, our mistake, corrected.

Sebastian Kreutzer, Aberystwyth, March 3, 2021

References

Frouin, M., Huot, S., Kreutzer, S., Lahaye, C., Lamothe, M., Philippe, A., Mercier, N., 2017. An improved radiofluorescence single-aliquot regenerative dose protocol for K-feldspars. Quaternary Geochronology 38, 13–24. doi:10.1016/j.quageo.2016.11.004

Kreutzer, S., Duval, M., Bartz, M., Bertran, P., Bosq, M., Eynaud, F., Verdin, F., Mercier, N., 2018. Deciphering long-term coastal dynamics using IR-RF and ESR dating: A case study from Médoc, south-West France. Quaternary Geochronology 48, 108–120. doi:10.1016/j.quageo.2018.09.005

Kreutzer, Sebastian, & Mittelstrass, Dirk. (2020). Spatially Resolved Infrared Radiofluorescence (SR IR-RF) Image Data (Version 1.0) [Data set]. Zenodo. http://doi.org/10.5281/zenodo.4395968