Response to the Reviewer Comments
(the reviewer's text is in italic)

General comments:
" I feel that the manuscript is now almost ready for publication. However, there are still a few issues (discussed below) that should be taken into consideration. Most importantly, the uncertainty estimates should be changed from the 1-sigma level to the 2-sigma level to be more in line with similar estimates of trends reported for other locations (I apologize that I didn't catch this in my 1st review). Furthermore, some parts of the manuscript could still be improved to better readability."
In the revised manuscript, the standard errors in Tables (6, 7 and 8) have been changed to the estimates corresponding with the 95% confidence level. Namely the previous standard errors are multiplied by 2.05 and 2.10 for the 1976-2004 (29 yr.) and 2005-2023 (19 yr.), respectively,

"Bold font indicates a statistically significant trend value at the 95% confidence level, based on the standard error of the trend multiplied by the corresponding critical T-value (T_c) for a two-sided probability. For the periods 1976–2004 and 2005–2023, T_c is 2.05 and 2.10, respectively, with 28 and 18 degrees of freedom "L. 494-496

The parts of manuscript required correction, which are mentioned below, have been taken into account, as stated further in this text.

Specific major comments:
" .... To be more in line with many publications that have estimate trends in UV radiation and their uncertainty at other locations, I suggest that the authors use the same approach and report the uncertainties of their trend estimates for a confidence level of 95%. For a large number of samples (which is the case here), the Student's t statistic is approximately two. Hence the uncertainty values provided in Tables 6 and 7 could be multiplied with 2 to refer to a confidence level of 95% (although technically, it would be a confidence level of 95.45% as 95.45% of values of a normal distribution are within +/- 2 sigma). When using this approach, the number printed in bold in Tables 6 and 7 (indicating significant trends at the 2-sigma level) would also align with the actual numbers of the uncertainty estimate."
According to the reviewer's suggestion, the uncertainties of the trend estimates are shown in Tables 6-8 with the 95 % confidence interval, i.e. the standard error of the slope has been multiplied by factor 2.05 (degree of freedom =28, 1976-2004) or 2.05 (degree of freedom=29, 2005-2023) to obtain the trend error at this confidence level.

L3811ff: I think the assumption that CC2 values are equal to 1 over the period 1976−1992 cannot be supported with the comparison of simultaneous measurements for the periods 1992−1994. Results from that comparison cannot rule out that the sensitivity of the instrument has changed between 1976 and 1992. Fortunately, this does not seem to be the case because the ratios of the modelled and observed DRE values shown in Figure 6a (blue dataset) is rather flat. Hence, the wording in the paragraph starting on line 381 should be toned down, stating that a constant value of 1 is just an assumption that is not supported by data and that the conclusion that the instrument has not drifted significantly over this period can only be established from the CC1 values. This also means that the "oscillation with 0.015 amplitude" mentioned on line 388 is not supported with real data and should be removed.
We agree with this and explain it in the revised manuscript:
'…..However, CC2 values were assumed to be equal to 1 because the RB meter was previously adjusted to the SL501A #927 output using simultaneous measurements taken during the 1992–1994 period (Puchalski et al., 1995). Prior to 1992, CC2 =1 could be inferred from a flat CC1 pattern based on the daily erythemal RE." L. 384-386.

In addition, we remove the text 'oscillation with 0.015 amplitude' and consequently we delete also Fig.6b.

L433–436: I don't understand the sentence starting with "The performance". Please rephrase and better explain the rationale.
This part has been changed. We explain in the revised text:
'In most cases, Mod2 and Mod3 outperform Mod1 (see Table 5), with smaller values of descriptive statistics. This is because these models are based on relative monthly differences from the respective long-term means for the periods 1976–1992, 1993–2013 and 2014–2023. These means were obtained by averaging the re-evaluated RB meter and SL501A, and the original KZ616 data. The Mod1 model did not apply a constraint on the average UVR in these sub-periods." L.428-432.

L586: The Conclusions are rather disconnected from the rest of the paper and some conclusions are not supported by the paper's results. For example, overlapping datasets were not discussed sufficiently in this paper. So this statement is not supported by the results and should therefore be removed. Please consider improving the Conclusions.
Conclusions have been reworded and the term 'overlapping data sets' has been precisely defined to strengthen the link to the results obtained in the manuscript. As this paper falls into the 'data paper' category, in order to support the suitability of the data for future analysis, a deeper analysis of the data will be published in other journals, and these activities are ongoing.
"It is generally accepted that the use of a sample of time series containing different possible realisations of a time series increases the reliability of the results compared to the analysis of a single time series. Therefore, this study includes 7 time series (refer to number of analysed time series shown in Table 7) to discuss the reliability of year-to-year variability and trends in annual and summer biologically effective radiant exposures. This is beneficial for evaluating the quality of the data and establishing confidence in the results. Data archived in PANGEA (Krzyścin et al., 2024) and in the IG PAN Data Portal (Krzyścin, 2024), together with the results of three regression models, form the reliable basis for analysing UVR time series at Belsk for the period 1976–2023. The long-term variability of erythemal radiation calculated for Belsk corresponds to that previously recorded at distant stations in central/eastern Europe, making results of these future analyses applicable to wider areas. For example, the daily characteristics of BE radiation at Belsk seem to allow the development of scenarios for outdoor human activities, enabling people to obtain the maximum health benefits from sunbathing while minimising the risk of erythemal overexposure. L.585-596

Specific minor comments:

L120-121: It is described here that sunburn units are converted to MED. However, in the remainder of the manuscript either the UV dose or the UV index are discussed. Hence, it would be good to mention explicitly that MEDs were converted to the erythemal dose by multiplication with 210 J m-2.
We agree with this and explain it in the revised manuscript:
"…MEDs were converted to the erythemal doses by multiplication with 210 J_{eryt} $m^{-2...}$"L. 122-123.

L136: *"roughly calibrated" sounds awkward. I would be better to say that these instruments were calibrated by the manufacturer but that these calibrations are subject to large uncertainties. Then emphasize again that one objective of the work presented in this manuscript is to adjust the manufacturer's calibration in order to reduce these uncertainties.*
We agree with this and explain it in the revised manuscript:
"Subsequent UVR measurements included SL501A # 927 (1993−1994) and #2011 (1995−2013), which were calibrated by the instrument manufacturer prior to shipment, but these calibrations proved to be very inaccurate Therefore, this paper is another attempt to recalculate past UVR data" L. 135-137.

L148: "daily average TCO3 measurements throughout the day" is awkward. A daily average is one number per day. Just delete "throughout the day".
We agree and "throughout the day" has been deleted. L. 149.

L180: Please state the "typical values" that were used, in particular the values of the single scattering albedo and the asymmetry parameter.
We agree with this and explain it in the revised manuscript:
" Taking into account climatology of the Belsk's aerosol characteristics (AERONET, 2025) values of 0.95 and 0.69 are taken for single scattering albedo and asymmetry factor, respectively." L.181-183.

L186: In addition to TUV (2025), please also consider to cite the paper introducing the TUV model: "Madronich, S.: UV radiation in the natural and perturbed atmosphere, in: UV-B Radiation and Ozone depletion. Effects on Humans, Animals, Plants, Microorganisms, and Materials, edited by: Tevini, M., 2, Lewis Publishers, Boca Raton, 17-69, 1993."
Reference to Madronich (1993) has been included in the revised manuscript.
"The UV model, which was introduced by Madronich (1993), has since been widely used in UVR simulations."
L. 189-190.

L212: Regarding "(equal to the value of erythemal irradiance at noon during a cloudless day)." If there were scattered clouds, which can increase the UVR beyond the noon clear sky value, was the noon value archived or the maximum UVI under those clouds?
Daily maxima were archived from the measurements. Model simulations (TUV) of UVI under cloudless conditions give UVI maxima at local solar noon, so for cloudless conditions the two maxima are equal.

L221: Adding to my previous comment: If UVI_max and not the noon values was archived, there would be a bias because the model only calculates the clear sky value at noon. Was this taken into consideration?
YES. In the manuscript, the measured UVI maxima were compared with the modelled values at local solar noon only for clear sky conditions, which are inferred from the cloud proxy.

L217: The term "synthetic" can be misleading. I would prefer using the word "modelled" throughout the document when referring to the results obtained with the radiative transfer model.
We follow this recommendation and replace the word 'synthetic' with 'modelled' throughout the document.

L234: it was not discussed previously what the difference between CC1 and CC2 results is. So mentioning "even greater differences" is odd if there is no reference.
We agree: the line containing "even greater differences" has been deleted.

L248 and similar: I find it odd to use symbols with two letters for year, month and day of the month. Why not just use Y, M, and D?
We agree and Y, M, and D have been used in the revised manuscript.

L252: Do you really mean "Julian Day" here? The Julian Day is the day since 1 January 4713 BC (e.g., https://en.wikipedia.org/wiki/Julian_day). Is that what you mean or do you mean the "day of the year" (a value between 1 and 366)?
We agree and use "day of the year" in Eq. (4) and in the text (L.254).

L336: regarding "monthly ratios": Do you mean: "monthly averages of the ratios of BS064 and KZ616 measurements during clear skies"? If so, please say so!
We agree and explain:
"In addition, Figure 3b shows the monthly mean ratios between BS64 and KZ616 erythemal irradiance obtained during cloud-free periods from 2014 to 2023." L.338-339.

Paragraph starting on line 348: It is confusing that the discussion jumps between the Brewer/KZ comparison in Figures 2 and 3 to the model comparison in Figure 4 and then

back to the Brewer–KZ comparison in Figure 5. I suggest to move Figure 5 before Figure 4, and discuss the annual cycle of the correction coefficient CC1 at the end.
It has been done according the reviewer suggestion. Fig.5 has been moved before Fig.4 and the discussion on the CC1 pattern has appeared at the end.

L454: Mod1 does not use "re-evaluated ERE values". It uses radiative transfer calculations and CMFs.
We agree with this and explain it in the revised manuscript:
"In the case of Mod1, the erythemal annual and summer RE are constructed using the results of the TUV model and the CMFs estimated from the DCI values" L. 450-452.

L472: Since TCO3 and cloud transparency data are available, it should be analyzed whether these large fluctuations are caused by either or both of the two factors.
We agree with this and explain it in the revised manuscript:
"As TCO_3 and cloud transparency data are available, it is important to analyse whether these large fluctuations are due to one or both of these two factors." L. 469-470.

L545: "standard error of ~1 % per decade" should be changed to "standard error of ~2 % per decade at a 95% confidence levels" per my "major" comment above.

The mentioned standard error of ~1 % per decade was derived averaging the trend values shown in Table 7 for various models (in total 7 models participated in the calculations), which are shown in the column for the period 1976-2004. This is not the standard error of the slope of the regression. In Table 7, for each model we calculate the 95% confidence range (slightly larger than 2xstandard slope error). Further in the text we explain:
"The uncertainty (at the 95% confidence level) of the individual trend estimates for the period 1976-2005 (Table 7) are of about 2-3% per decade, i.e. quite close to double the standard error of the mean trend derived from the sample." L. 546-548.

Technical comments

L17: "the erythema" > erythema
Done (L. 17)
L20: Robertson-Berger > Robertson-Berger meter, Kipp-Zonen > Kipp & Zonen (please use consistent spelling with "&" throughout!
Made using the WORD option to replace one word with another.

L25: Brewer spectrometer > Brewer spectrophotometer (at least that's the official name of the instrument, although it is not really a photometer
Done (L. 25)

L28: "on common UVR indices" Don't use "indices" since this can be confused with the UV Index. Use either "proxy data" or rephrase, e.g.: "depending on the most important factors affecting UVR (total column ozone ...)"
We use reviewer recommended "proxy data" (L. 28).

L44: "in the catalytic" > "in a catalytic" or " in ... cycles
Done (L.44)

L59: effective > "important factors".
Done (L.59).

L69: "the radiative" > "a radiative"
Done (L.69).

L71: "were their results in" > "were that their results were reported in".
Done (L.71-72).

L78: I note that the Solar Light Biometer's model number is referred to as "501A" here, without a space between "501" and "A". In the rest of the manuscript, the model name is referred to as "501 A", i.e., with a space between "501" and "A". I believe the spelling without a space is the correct one and should be used throughout the document. This would also improve readability since an orphaned "A" looks awkward.
Throughout the text, in line with the reviewer's comments, '501A' has been used instead of '501 A'

L94: "Database Network for the Detection of Atmospheric Composition Change (NDACC) include also stations" > The data archive of Network for the Detection of Atmospheric Composition Change (NDACC) also includes data of stations with at least three decades of".
Done (L. 94-97).

L102: "and UV index" > "and the UV index".
Done (L. 102).

L111: "calculations in" > calculations for"
Done (L. 111).

L112: "and versions of the recalculated" > "and three versions of recalculated"
Done (L. 113).

L126: "those with" > "those obtained with"
Done (L. 126).

L142: involved > used
Done (L. 143).

L167: What are "intra-day TCO3 values"? Do you mean "several TCO3 values throughout the day"?
Exactly. Sometimes, it was around 40 measurements a day.

Table 1: The Kipp & Zonen (not Kipp-Zonen) UV-AE-T serial number is given here as "30616". In the rest of the manuscript, the serial number of the instrument is referenced as "616". Please use the correct serial number throughout the document. Regarding the TCO3 row in the table, in addition to the Dobson measurements, also the source of the TCO3 satellite data used in the manuscript should be mentioned here.
The abbreviation 'KZ616' (Kipp & Zonen UV-AE-T #30616) is defined in line 100 and used throughout the main text. The full name is used in Table 1. Satellite sources (from OMI and OMPS instruments) have been added to Table 1.

L185: "the look-up" > look-up
Done (L. 188).

L190-191: Reverse the sequence of the two equations. Since Eq. (1) uses the result of Eq. (2) as input, Eq. (2) should be first.
Done (L. 194-195).

L197: The text uses upper case acronyms for eryt, vitD3 and psor. Please use consistent spelling.
Done (see the new legend Fig.1 and L. 200-201).

L120: "(t=noon)" > "for noon". Also please specify whether you refer to local solar noon or a specific time (e.g., 12:00) that remains constant throughout the year.
It has been explained in the revised manuscript:
"… and the corresponding value of the biologically effective irradiance at local solar noon, $Ir_{EFF,MAX}$, have been archived in the IG PAS Data Portal…" L256-257.

L208: Delete "intraday"
Done (L. 211).

L225: below > "less than"
Done (L. 228).

L259: excluded > "ruled out"
Done (L. 261).

L260: delete "should" or better, repeat "that"
Done (L. 262).

L270: "the current day" > "a given day"
Done (L. 272).

Eq. (7): The subscript in "c_k" should be upper case to be consistent with the spelling elsewhere
Done (L. 296).

L309: "model value" > "the value of the regression model" (to make clear that this is not the RT model)
Done (L. 310).

L331: "KZ616 replaced the raw SL501 A #2011," > "data of KZ616 replaced the raw data of SL510A"
Done (L. 333).

Figures 2 and 5: Replace "Biometer" with "EBR" on the title of the y-axis.
Done (see new Fig.2 and Fig.4).

L344: monthly > monthly average
Done (L. 345).

Figure 4: The title of the y-axis should be "Correction coefficient
Done (see the y-axis of Fig.5).

L398: Why "original"? There is only one KZ data set as these data were not corrected to my understanding.
Yes. KZ616 data were not corrected, so we delete "orginal'(L.347, 355, 409, 432, and 515)

L440: "The lowest correlation" > "The smallest correlation"
Done (L. 436).

L457: The nomenclature using parentheses to indicate summer data is confusing. Please split in two sentences if necessary.

The splitting is:
"Fig.8a and Fig.8b are for the erythemal annual and summer RE with the use of CC1 but correspondingly Fig.A1a and Fig.A1b are based on CC2 values." L.455-456.

L536: "to assess the uncertainty range of the correction method applied to the raw UVR data." > "to correct and homogenise the time series of erythemal data"
Done (L. 534-535).

L555: "of about" > "of only about"
Done (L. 551)