Author response to the comments from referee #1

General comments response:

S/N	Page number	Line number	Referee comment	Correction made / Sentence added to the paper	Response
1	6	8	A) What is the format of skewed normal distribution? Please express the distribution. B) Why do you choose distribution? Is that common for PET? If yes, include the references. Otherwise, statistical test must be performed to ensure the distribution. C) Is it possible that noise ratio can be negative? If not, other distribution must do better job such as gamma.		A) We used a Python function to estimate the skewed normal distribution equation. Where the PDF is given by : Skewnorm.pdf(x,a) = 2.*norm_pdf(x)*norm_cdf(a*x) Where, a= skewness and x is the random variable. B) We chose the skewed normal distribution because the PET values from which the noise ratio is generated resemble a normal distribution with peak values a little later (skewed) after noon local time (see Fig. 1). Given that the mean values are skewed (see Fig.1 gray shade and red line), we use the skew normal distribution at each grid point

					and for each month of the year. C) The noise ratio is always above zero (positive), as it is calculated based only on the daytime PET values from hPET. Ultimately, we found that the skewed normal distribution fit the data the best (Fig 4b).
2	3	15	There is no full equation that explains the stochastic simulation model of PET including sine +noise+annual variability. Each element is explained in separate sections. Combined model description must be provided.	The overall stochastic PET generation model can be expressed as follows: Stochastic PET = (Average diurnal cycle of PET using a sine function * a random Noise ratio) + user-defined annual PET variability Each of the three components are described in detail in the subsequent sections.	A sentence has been added to the paper expressing the overall equation/method for simulating PET
3	7	15	The overall comparison between hPET and stoPET is not acceptable since the hPET was employed to build the stoPET model. naïve or other stochastic model must be used for comparison.		The comparison with hPET is necessary in order to show that the patterns and distributions of the stoPET model-derived PET replicate the underlying data that they are supposed to represent. This is a

					crucial point for checking that the model works as it should. . There are no other global stochastic PET models that would be considered 'naïve' in this case and that we could compare against. More importantly, we have already done a detailed comparison between hPET and various other PET products in Singer et al., 2021.
4	9	6-10	Double cycle of seasonal variability shown in Africa of A4 (Figure9) does not seem perform good. Please describe the potential reasons.	The pBias values range between 0.54 % to 7.76 % indicating that stoPET is not systematically overestimating or underestimating PET values relative to hPET (Table 1). The NRMSE values range from 0.02 to 0.08 for humid and 0.02 to 0.04 for arid sites. The NRMSE shows small values (<0.1) for all locations indicating a good representation of the hPET dataset by stoPET.	Thank you for pointing out this discrepancy. We did some further checks and indeed we found a bug in our code for preparing the data for plotting Figure 8 and Figure 9. The nighttime PET values from hPET were not removed properly, leading to incorrect plots, showing notable discrepancies between hPET and stoPET simulations. We have replaced these two figures using the updated code and provide a sentence summarizing the match between these datasets.

					Figure 8 and Figure 9 are now corrected, and all the statistical analysis (Table 1) are corrected.
5	17	1	Explanation of the program and data must be provided. Provide specific steps to download the data.		The step-by-step guide for downloading and generating stochastic PET is provided in the User Guide Manual submitted with our manuscript. See supplemental documents.
6	11	5	Fig12: stoPET is the stochastic simulation model. One might have wrong implication that the model was not performed good. Separate panels can be used instead of overlapping.	**Figure 12. Time series of hPET and stoPET data for the last 15 days of 2020 (for A1 in Fig. 7). The figure indicates that stoPET captures the diurnal cycle of PET. The differences between the diurnal curves illustrates the stochasticity of the model, which is a strength of the modeling approach.**	We feel the reviewer may have misunderstood what we are presenting here. We put the timeseries plot on the same panel to indicate that stoPET captures the daily diurnal cycle of PET, which is similar to values from hPET. However, stoPET is a stochastic model, where the noise ratio is chosen randomly, so it may simulate both higher and lower values than the underlying data. This is a strength rather than a weakness of the model. A sentence has been added to the figure caption to avoid ambiguity about model performance.

7			For example, Method 1 and 2, isn't it better with different user-defined-changes at each year. This reviewer suggest that the authors reasonably set up the scenario to change the annual variation.		Thank you for this very useful suggestion. We will implement this as a new method of accounting climate change in a subsequent version of the model. However, we do feel that the current options for simulating climate change give the user suitable flexibility for characterizing different scenarios of future climate.

Author response to the comments from referee #2

General comments response:

S/N	Page number	Line number	Referee comment	Correction made / Sentence added to the paper	Response
1	2	33-35	Provide overview of the potential application of the model in the introduction.		A sentence is already written in the introduction naming some potential applications of the model (page 2, line 33-35). We also provide further details of potential applications in the discussion.
2	8		Wouldn't be more interesting a comparison with a different stochastic source? E.g. Hargreaves computed PET with input from a stochastic weather generator (at higher computational cost)?		What we wanted to show in Fig. 5 is that the stochastic PET generates PET values that are consistent with separately calculated PET. Comparing it with other stochastic PET formulations is not possible because we are aware of no other global stochastic PET generator. Furthermore, other methods for PET estimation (e.g., Hargreaves) are not directly comparable to values generated by the Penman-Monteith method.
3	14	1	About method 3, adoption of linear trends for timeseries of complex variables can hardly be considered robust.		Thank you for pointing out this. The model provides three options to modify PET, of which the use of linear trend is one. The idea is to provide users more flexibility to generate stochastic PET which accounts for potential future changes. In our analysis of hPET we recognized that many locations

			4.1.3 when do you consider the beginning for the historical PET start and how long is it?		exhibited linear trends (associated with increases in atmospheric temperature), so providing the option for a linear trend seemed sensible. We are considering adding additional methods in subsequent versions as suggested by another referee. One such method would account for year-to-year variable temperature changes rather than using a single value of step change in temperature for all years. The historical hPET data used is the paper is a 40-year long record (1981 to 2020). However, hPET is updated till 2021 now.