

Reviewer 1 Comments:

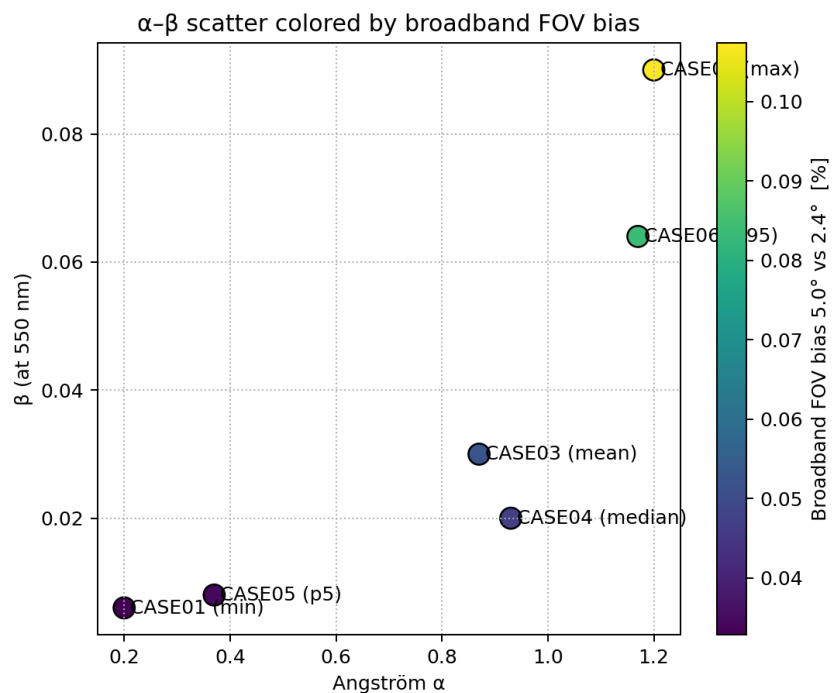
Thank you so much for the comments.

In Section 2.1:

What is the FOV of the BTS spectroradiometer? Does it match the 5 deg FOV of the PM02?

Ans: Thank you for the comment, which we did not consider in our manuscript. The BTS spectroradiometer has a field of view (FOV) of 2.4° and the PM02 cavity radiometer have 5°. We quantified the FOV mismatch bias with the radiative transfer model SMARTS using the conditions of PMOD/WRC (including extreme cases) and found the DNI bias due to FOV differences to lie between approximately 0.03% to 0.11% of the total DNI in the extreme case aerosol conditions. This uncertainty contribution to the combined uncertainty of the PM02 and BTS is well below our other uncertainties, so we regard the FOV effect as minimal for our conclusions. We have added a section on this topic in our manuscript at section 3.4 “Uncertainty of TSI” in page number 10, describing this effect.

The figure depicting the various aerosol conditions found at the measurement site during our study (PMOD/WRC)



How often is the BTS calibrated? If only initially, how do you guarantee that it is stable?

Ans: The BTS responsivity is monitored every 2 months using a 250 W tungsten halogen lamp (KS32). Once per year the BTS is also calibrated in the optical laboratory of PMOD/WRC using a transfer standard FEL 1000 W lamp traceable to the SI (calibration certificate obtained from the German Metrology Institute PTB). At the same time, KS32 is recalibrated as well.

In Section 3:

The caption for Fig. 2 is incorrect in that the grey area does not represent 90 % of the TSI. Addressed in the caption of the manuscript in section3.

Perhaps an insert that blows up the 4000 - 5000 nm region in Fig. 2 would clarify the points made in lines 133 and 134.

Addressed in the manuscript

I did not understand the necessity of a machine learning approach since one needs the model inputs (eqn. 4) to estimate the 2150 – 5000 nm contribution for machine learning or the model runs; why not just run the model to calculate the contribution?

Ans: Because repeated radiative transfer model simulations in libRadtran are computationally expensive. The spectral contribution in the 2150nm to 5000 nm region depends on several atmospheric inputs such as solar zenith angle, precipitable water vapour, and aerosol angstrom exponents (see Eq. 4), and a full DISORT-based forward model must be executed for each unique combination of these parameters. For long time series or real-time applications, this would require a very large number of model runs, resulting in increased computational cost and time.

Instead, a machine learning (ML) approach serves as an efficient replacement to the radiative transfer model for the calculation of TSI. Once trained on a representative set of libRadtran simulations, the model can reproduce the 2150 nm to 5000 nm contribution with negligible computational effort. Thus, the ML framework enables fast predictions while still retaining the physical relationships embedded in the original forward simulations, making applications feasible.

In Section 4:

Fig. 6 is difficult to examine. Perhaps a blow up of just one vertical grouping would more clearly show the degree of agreement. I think you could eliminate the left part (a) of this figure. Addressed in the manuscript

Other:

Line 44 “gases constituents” “gases” Addressed in the manuscript

Look for “could” that should be changed to “cloud” in at least two places. Lines 156 and 178. Addressed in the manuscript in the line 156 and 178

In Fig. 2 caption “grey vertical” “vertical” Addressed in the manuscript