Reviewer comments #2

Thank you so much for the comments.

Specific comments:

Section 3. 1

Could you give more details on the input for the radiative transfer model calculations and on how you conducted the calculations (note: libRadtran is not a radiative transfer model but a library for radiative transfer, i.e. a collection of different solvers and band parametrization models (correct that in line 129)). Specifically:

Ans: We performed the simulations with libradtran, which is a library for radiative transfer which provides several independent solvers such as DISORT (Discrete Ordinate Solver), MYSTIC (Monte Carlo Solver) etc. and band parameterizations such as REPTRAN, LOWTRAN etc. We used DISORT as solver and the program "uvspec". The DISORT solver were being used with number of streams 16 for better accuracy. The specific parameters used for the model calculations are described in the manuscript at lines 156-165 (section 3.1).

- what kind of wavelength grid/band parametrization model did you use to be consistent with the spectra from the BTS? What about beyond 2150 nm? what solver did you use?

Ans: To ensure full consistency with the Bi-Tec Sensor (BTS) spectroradiometer, the model spectra were convolved with the BTS spectral slit functions, which are available every 5 nm in the range from 280 nm to 1000 nm, and every 25 nm in the range between 1000 nm and 2150 nm. The typical spectral resolution (defined at full width at half maximum), is 2 nm in the range 280 nm to 1050nm and 8 nm for the rest up to 5000 nm.

- line 173: "synthetic atmosphere". You may describe this a bit more detailed. You used the (US-) Standard atmosphere, normalized to the indicated observed atmospheric parameters, I guess?

Ans: (Addressed in the manuscript at lines 174-176) Yes, you are right. The term synthetic atmosphere indicates the US standard atmosphere (AFGLUS) which is then normalised using the observed atmospheric parameters such as Pressure, altitude, aerosol angstrom parameters, water vapour, ozone column, carbon dioxide at the site of PMOD/WRC Davos, Switzerland.

Section 3.2

- Have you also studied the impact of microphysical aerosol properties (e.g. single scattering albedo (SSA)) on the fractional contribution R as the aerosol type may also change the solar spectra substantially?

Ans: Direct normal solar irradiance is only affected by the atmospheric extinction (absorption and scattering), and not by the single scatter albedo SSA. However, a minor contribution from forward scattered radiation, entering the field of view, could have a SSA dependence. We evaluated the sensitivity of single scattering albedo (SSA) and found its influence on the direct normal irradiance (DNI) to be negligible, with ratio between the DNI at different SSA is 0.9998.

Because forward scattered radiation by aerosols and other atmospheric constituents, will contribute circumsolar radiation into the instrument field of view, we quantified a possible field of view (FOV) bias due to the different field of views of the BTS and the cavity radiometer PMO2. The BTS spectroradiometer (FOV of 2.4°) and the PMO2 cavity radiometer (FOV 5°) were assessed using the radiative transfer model SMARTS over the aerosol conditions found at Davos (α, β). The resulting DNI bias from the FOV mismatch is approximately 0.03 % – 0.11 % in those conditions. This uncertainty contribution to the combined uncertainty of the PMO2 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

(see also comment of reviewer 1).

In general: Define abbreviations once at their first occurrence and then use them throughout the manuscript (e.g.: Lines 55, 73: World Radiometric Reference is defined in line 9; line 73 World Standard Group is defined in line 56; line 77: the Bic-Tec Sensor (BTS) is defined in line 51 (or should be defined in line 7). Addressed in the manuscript

Line 31: Kopp et al. Addressed in the manuscript in the line 31

Line 144: May define sza, wv, α, β here (instead in section 3.2). Instead of water content, I would use precipitable water, pw, or integrated water vapor, iwv, as you used a column measure in the sensitivity analysis. α and β is to my knowledge termed as Angstrom (or Ångström) α and Angstrom (Ångström) β, respectively. Addressed in the manuscript

Line 189: May add a reference for the OAT method. Addressed in the manuscript in the line 189

Line 216: delete "However" Addressed in the manuscript in the line 216