Response to Referee #2:

We thank referee #2 for their helpful comments. Our responses are given below in black with the referee's comments in blue. The new/revised text in the modified manuscript is given in red (italicized).

The time series of the observations as the source of the analysis must be on the main paper rather than on the supplement.

Done.

The assessment of the Brewer reference instruments was performed using Models 1, 2, and 3 defined in Section 3. The time series of Brewer reference triads' total column ozone (TCO) observations in Toronto is shown in Fig. 1. To ensure the assessment is based on good quality data, the data were strictly filtered (i.e., data from single and double spectrometer instruments with reported standard deviation > 3 DU or μ > 3.5 are removed).

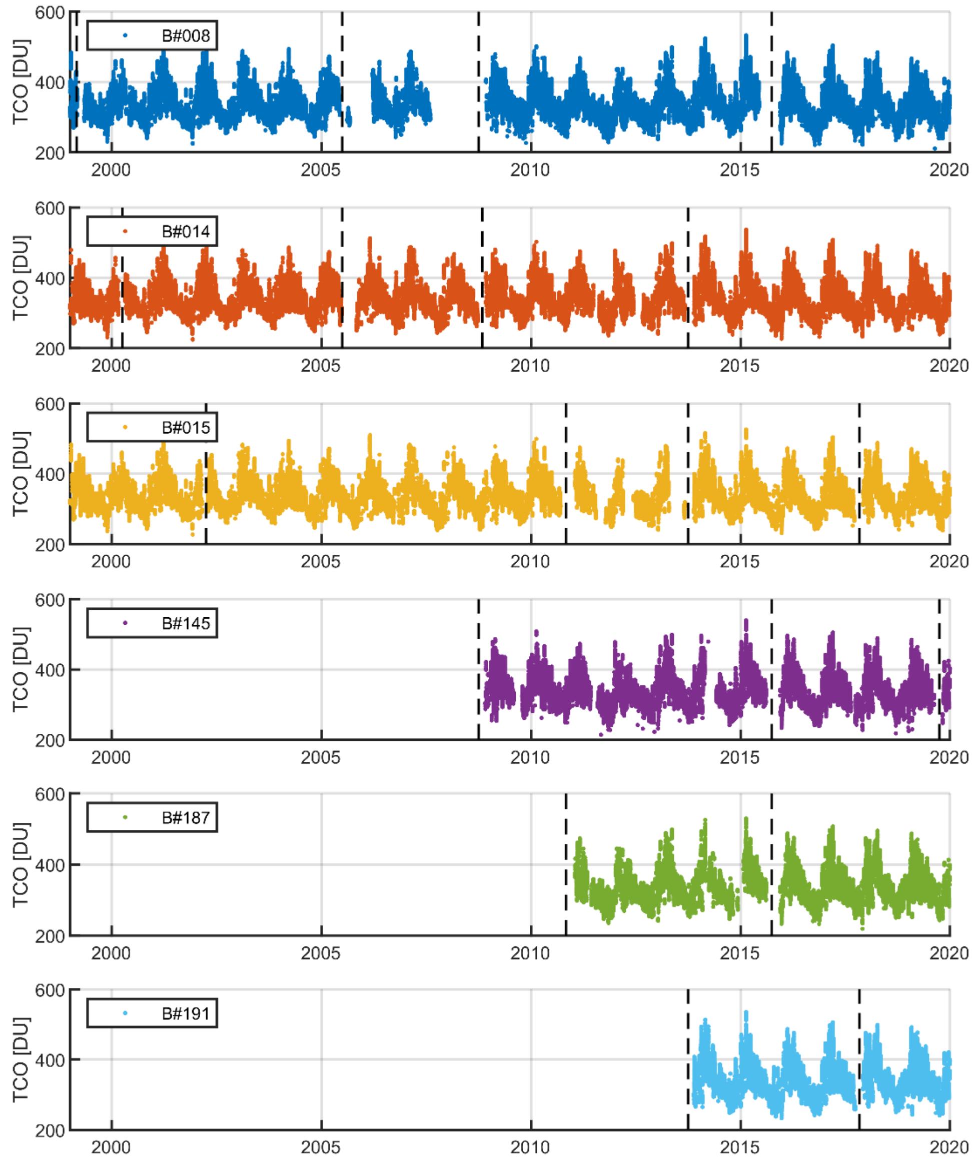

Figure 1. Time series of Brewer reference triads' total column observations observations in Toronto. Vertical black dash lines indicate the time of primary calibrations as shown in Table 2.

The figures are difficult to view, lines connecting points should not be drawn when are missing observations in between like Figure 3. To improve the visibility I suggest extending the x-axes using the page width, increase the size of the symbols and use different symbols for BrT and BrT-D.

Done.

There are several references to Savastiouk's 2006 thesis, it will be helpful for the reader if the chapter and/or pages are specified.

Done.

For example, the effective ozone absorption coefficients ($\Delta\alpha$) are determined for each individual instrument in laboratories via dispersion test, and are regularly checked using the stable solar spectrum as the reference using the so-called Sun Scan test (Savastiouk, 2006, Sect. 4.2).

Table 1. Specific features of single and double Brewer reference triads

	Single Brewer	***Double Brewer***
Model Version	*Mark II*	*Mark III*
Serial No.(s)	*#008, #014 and #015*	*#145, #187 and #191*
Start of triad observations	*September 1984*	*October 2013*
Optical and spectral characteristics	*Single monochromator: a dispersing monochromator with an 1,800 line/mm holographic diffraction grating.*	*Double monochromator: a top dispersing monochromator with a 3,600 line/mm holographic grating, and a bottom recombining monochromator that is a mirror image of the dispersing monochromator*
	Spectra measured by a single monochromator that is affected by the internal instrumental stray light in the UV region (Bais et al., 1996; Fioletov et al., 2000).	*Significantly less instrumental stray light (out-of-band, stray light fraction 10^{-7}) than in the single monochromators (10^{-5}) (Fioletov et al., 2000). Thus, increased accuracy of ozone and UV measurements under certain conditions (Bais et al., 1996; Wardle et al., 1996).*
Output	*Solar radiation at six UV wavelengths is measured with the spectrometer. The wavelengths are 303.2 nm (almost exclusively for wavelength calibration, i.e., spectral reference test) and five operating wavelengths (306.3 nm, 310.1 nm, 313.5 nm, 316.8 nm and 320.1 nm) used to measure total column ozone and sulphur dioxide using the sun, sky or near full moon as a light source.*	
	Provides high-quality ozone measurements with a slant ozone column amount up to 1000 DU, which for the global average total ozone column of 300 DU corresponds to an ozone air mass factor of 3.33 and a solar zenith angle (SZA) of about 73° (Zanjani et al., 2019).	*Provides high-quality ozone measurements with a slant ozone column amount up to 2000 DU, which for the global average total ozone column of 300 DU corresponds to an ozone air mass factor of 6.67 and a SZA of about 81° (Savastiouk, 2006, Sect. 4.4).*

The Brewer retrieval algorithm removes effects that are linear as a function of the wavelength, but this offset may not be enough in some cases and a shift of up to a few DU in the retrieved ozone values can *occur as a result of a ND filter switch (e.g., from ND filter #1 in the early morning to ND filter #4 in the noon; Savastiouk, 2006, Sect. 4.3). Instruments with ND filters from the same manufactured batch will demonstrate almost identical spectral behaviour. Thus, these instruments may have very similar characteristics, and therefore, demonstrate high precision; however, they all may be affected by the same or similar hardware-related systematic errors. There are other hardware-related factors that affect the accuracy and precision of Brewer measurements. For example, a simple replacement of the mercury bulb that is used to ensure the instrument stability could affect total ozone measurements, creating jumps in the data record. The bulb change has the potential to affect the CalStep (calibration step, the optimal micrometer position found in the "Sun Scan" test; Savastiouk, 2006, Sect. 4.4) of the instrument. If the combined focus of the monochromator mirrors of the instrument (see Savastiouk, 2006, Sect. 4.1 for more details of instrument's optical elements) is not optimized and the illuminated filament of the mercury bulb is located in a significantly different location than the illuminated filament from the original bulb, as much as a 5 micrometer step (one micrometer step is 0.7 pm) change may be seen.*

The SL record is a good indicator of the stability of the instrument calibration and a key parameter on the data processing. Showing the time series of the SL record and the SL correction will to address the stability of the instruments.

To address the suggestion, the SL correction values are provided below. The measured SL-test records are included in the data processing. Thus, the ETC values have been corrected based on the SL tests. However, the SL test is not a measure of data quality, but a measure of the instrument's spectral sensitivity changes that are applied to the data processing. The SL test results do not always reflect the instrument's stability. Changes and repairs of the Brewer hardware also affect SL readings and therefore can be misleading. For this reason, the SL test results shown in Figure R1 are not included in the revised manuscript.

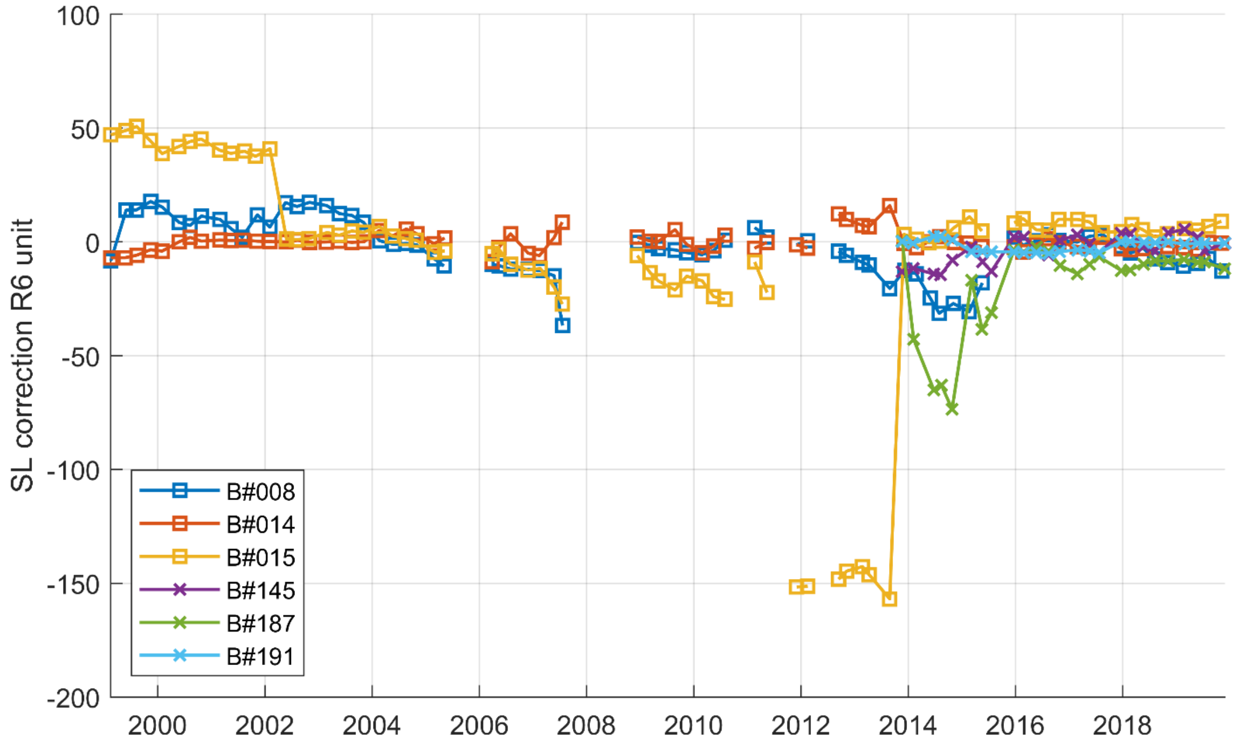

Figure R1. Time series of Brewer SL corrections in R6 unit in Toronto. Each point on the graph represents a 3-month average.