

## Review amt-2020-391

### A fully Automated Dobson Sun Spectrophotometer for total column ozone and Umkehr measurements

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**Initial Comments:** This submitted manuscript would fit in the category of a commentary, as it describes the modernization of an existing measurement program. I recommend publication after the issues below are addressed.

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#### Specific Comments/Questions:

I am not commenting on the details of the automation and electronics, as I am not currently experienced in this field.

#### Introduction:

A reference to the history of the discovery of ozone depletion by chlorofluorocarbons (CFCs) is expected. [The discovery of the Antarctic ozone hole](#) by Dr. Solomon is a good source for the history. Suggest a lead-in sentence similar to: *The history of the detection of the ozone layer depletion is one of the most important scientific stories of the 20th century (Solomon, 2019).*

Line 20: The term "calibrate" is not correct. This paragraph should be re-written. The various ground-based and space-based networks have independent calibration methods. Data results from the various instruments and networks are inspected and intercompared to detect problems within networks. I believe that authors are also saying that the algorithms used to convert data to total ozone values are evolving with increased understanding of the instrument characteristics, and the assumptions used in the measurement and data reduction algorithms.

Line 25: There should be some mention of the development of the instrument for the early 1900s' studies in Stratospheric Circulation.

#### Dobson measurement principle and instrument design:

Table 1: Why is there no A-pair wavelength values for  $D_{062}$  or FWHM values for  $D_{062}$  or  $D_{051}$ ?

#### 3.4 Automation of instrument tests

There are other processes in the operation of a Dobson observing program. One of which is determining the attenuation curve of the optical attenuator. Has there been an attempt to automate this process?

Page 14, line 10: *Larger changes are normally a sign of either an aging lamp or a change in the instrument response and are corrected by an update of the attenuator calibration curve.* A better explanation is required. The data reduction algorithm incorporates the changes in the standard lamp test values from the lamp values determined at the time of the instrument's calibration by comparison to a reference instrument. The attenuator calibration curve is determined by a different procedure. The standard lamps are actually reference lamps, with measured values for a certain Dobson instrument on a specific date. The change in the measured values with time indicates aging of the instrument. Use of multiple lamps on varying time schedules allows for detection of aging lamps.

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### **Technical Corrections/Comments/Suggestions**

#### **Abstract:**

Line 3: Suggest: *However, the Dobson sun spectrophotometer requires manual operation which has led to the discontinuation of its use at many stations, thus disrupting long term records of observation.*

Line 8, Suggest: *Compared to manual operation, the automation results in a higher number of daily measurements with lower random error and additional housekeeping information to understand the measuring conditions.*

#### **Introduction:**

Line 9: Suggest: *Moreover, the uncertainties associated with climate change feedback on the ozone recovery process require dedicated ground-based measurement networks for sustained monitoring.*

Line 14: Suggest: *The principle of the instrument developed by G. M. B. Dobson in the early 1920s is based on measurements of the intensity of ozone-attenuated radiation in a number of narrow spectral bands. This was first done by analyzing spectra recorded on photographic plates, later directly on spectra within the instrument with photoelectric detectors and nowadays with photo-multipliers (PM) detectors.*

Page 2, Line 32: Suggest: *After the discovery of ozone layer depletion by CFCs, the measurement program continued as part of the global effort to verify that the Montreal Protocol was working. The more recent automation of the Dobson operation allows for continuation and improvement of this observation program, with reduced operational cost.*

### **3 Automation of the LKO Dobson instruments**

Suggest starting with a sentence similar to: *The instrument and observation facilities have had numerous improvements over the years.*

### **3.1 Instrument Control**

Page 7, Line 7: the *local* horizon

Page 7, Line 11: Suggest: *The sun's image must fall on the entrance window of the instrument, thus the sun's azimuth and elevation must be tracked.*

### **3.3 Measurements results**

Page 12, line 12: suggest: *has not yet been automated.*

### **3.4 Automation of instrument tests**

Page 14, Line 2, Suggest: *Once the measurement procedure had been developed, the data acquisition (DAQ) system could then be programmed to perform other specific tasks.*

Page 14, Line 12: Suggest: *A Hg lamp is used to verify the wavelength settings and to check the optical alignment of the Dobson instrument.*

## **Discussion**

Page 18. Line 6 : Komhyr not Koomhyr

Page 18, Line 10: Suggest: *The Swiss automation system is unique in that the instruments...*

## **References:**

Page 20, Line 20 Komhyr, not Komyhr -- references in text (Page2, line 19; Page 4, Line 2) have to be corrected