NOAA Earth System Research Laboratory (ESRL) Global Monitoring Annual Conference 2018, May 22-23, 2018, Boulder, Colorado

Stratospheric temperature corrections and improvement of total column ozone records in the NOAA Dobson Ozone Spectrophotometer network

G. McConville[1,2], K. Miyagawa[3], I. Petropavlovskikh[1,2], A. McClure-Begley[1,2]

[1] Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309

[2] NOAA Earth System Research Laboratory (ESRL), Global Monitoring Division (GMD), Boulder, CO 80305

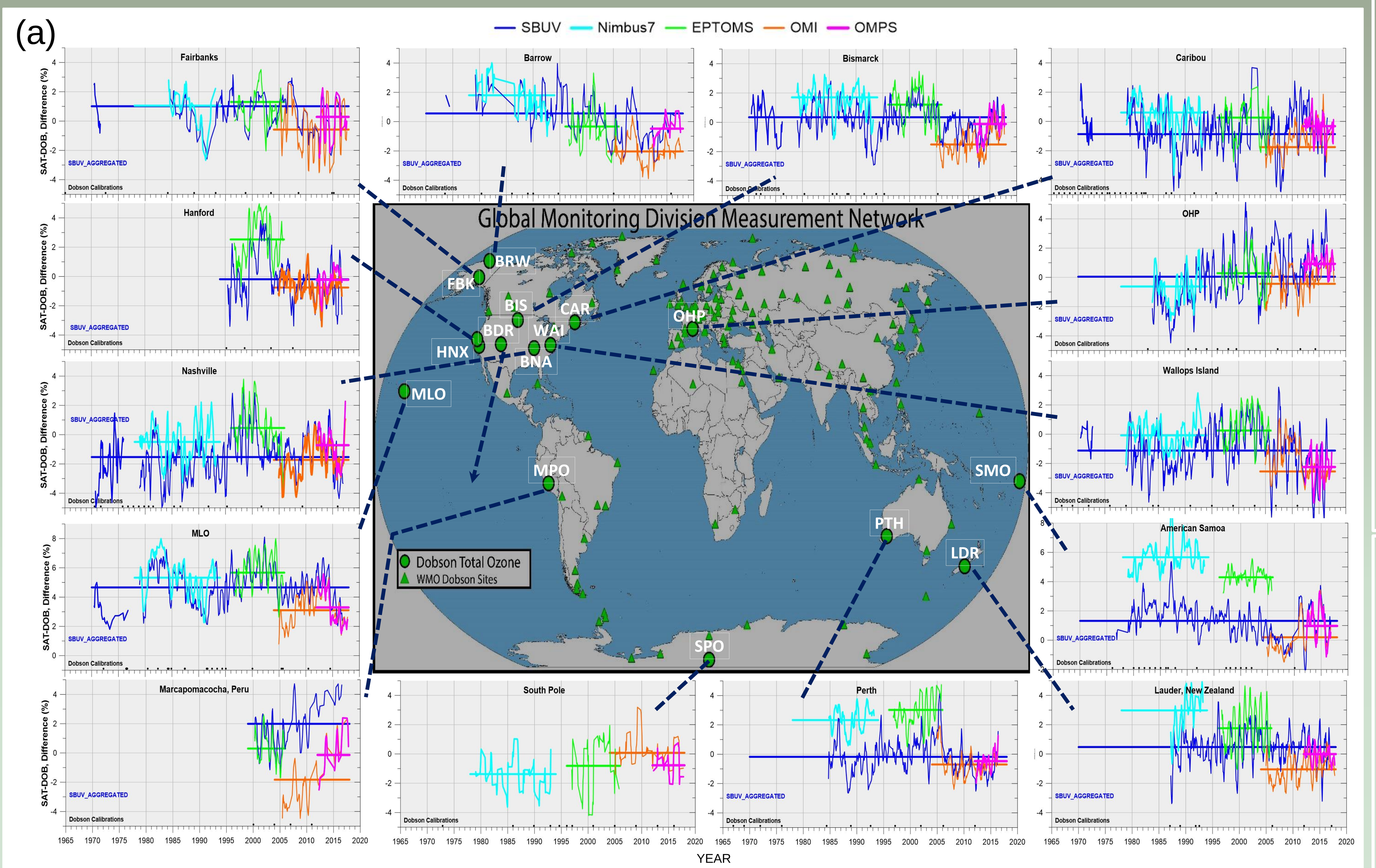
[3] Guest Scientist at NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305

Introduction

The NOAA Dobson Spectrophotometer network for monitoring of long-term stratospheric ozone was established in the early 1960s, and currently includes 15 stations. The network record has been reprocessed with updated quality control software (Evans et al., 2017). The official algorithm for ozone retrieval from Dobson measurements includes static absorption coefficients derived using Bass and Paur (1985) ozone cross-sections. We use DBM and IUP absorption coefficients and derived temperature corrections based on climatology from McPeters and Labow (2011) to investigate the impact of temperature corrections on the reduction of seasonal biases found between Dobson (ADDS) and satellite (Aura MLS, Aura OMI, NPP Suomi OMPS, and SBUV MOD) observations. We achieved 2% reduction in seasonal biases and overall improvement in long-term agreement between the NOAA Dobson network and satellite total ozone records.

Differences between Dobson and satellites

Dobson applies the temperature effective dependence correction using climatology.



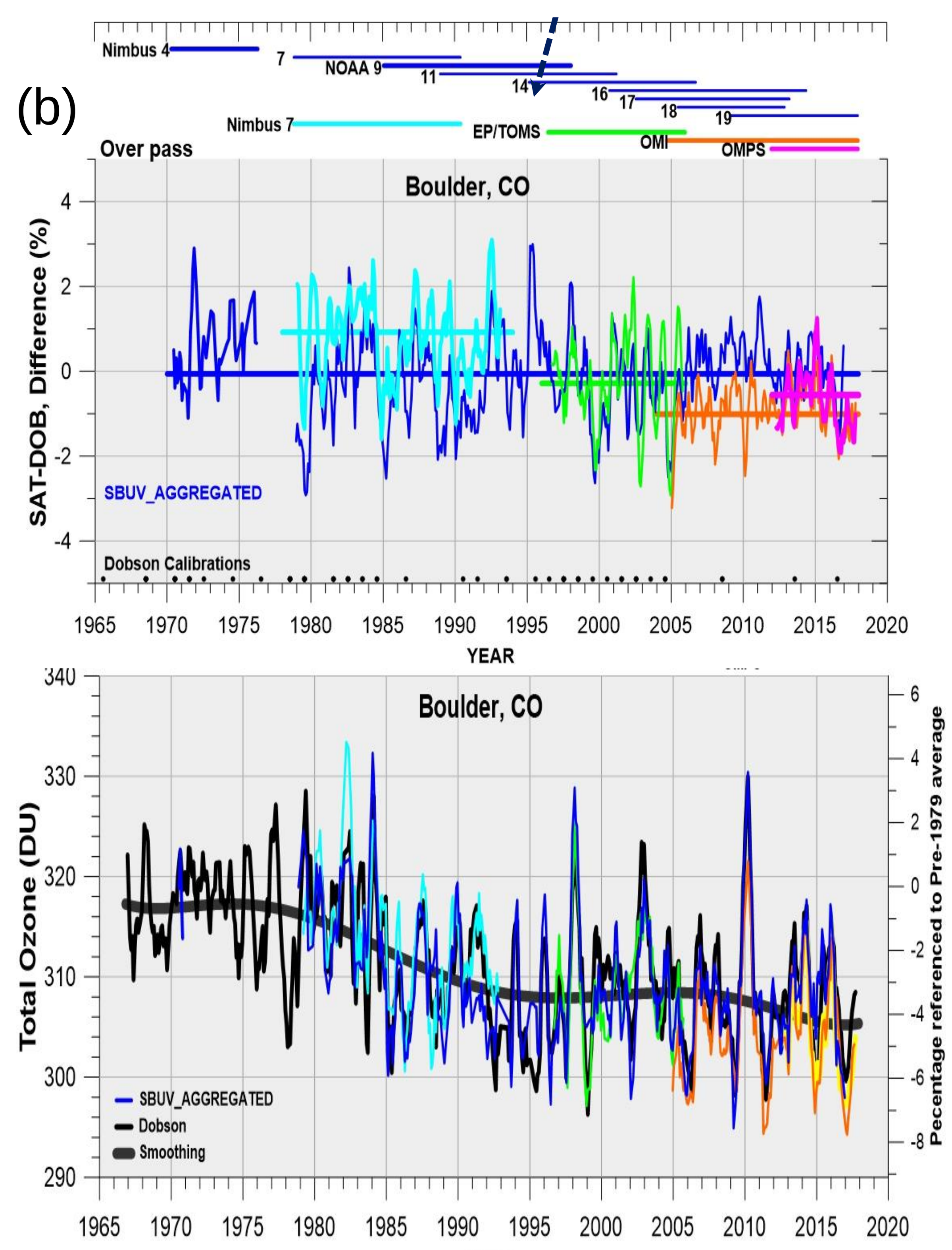


Figure 1. Time series of difference between Dobson total column ozone and satellites. Dobson ozone uses all the daily observation matched with satellites. (a) Fourteen NOAA Dobson sites (b) Time change of total ozone and difference in Boulder.

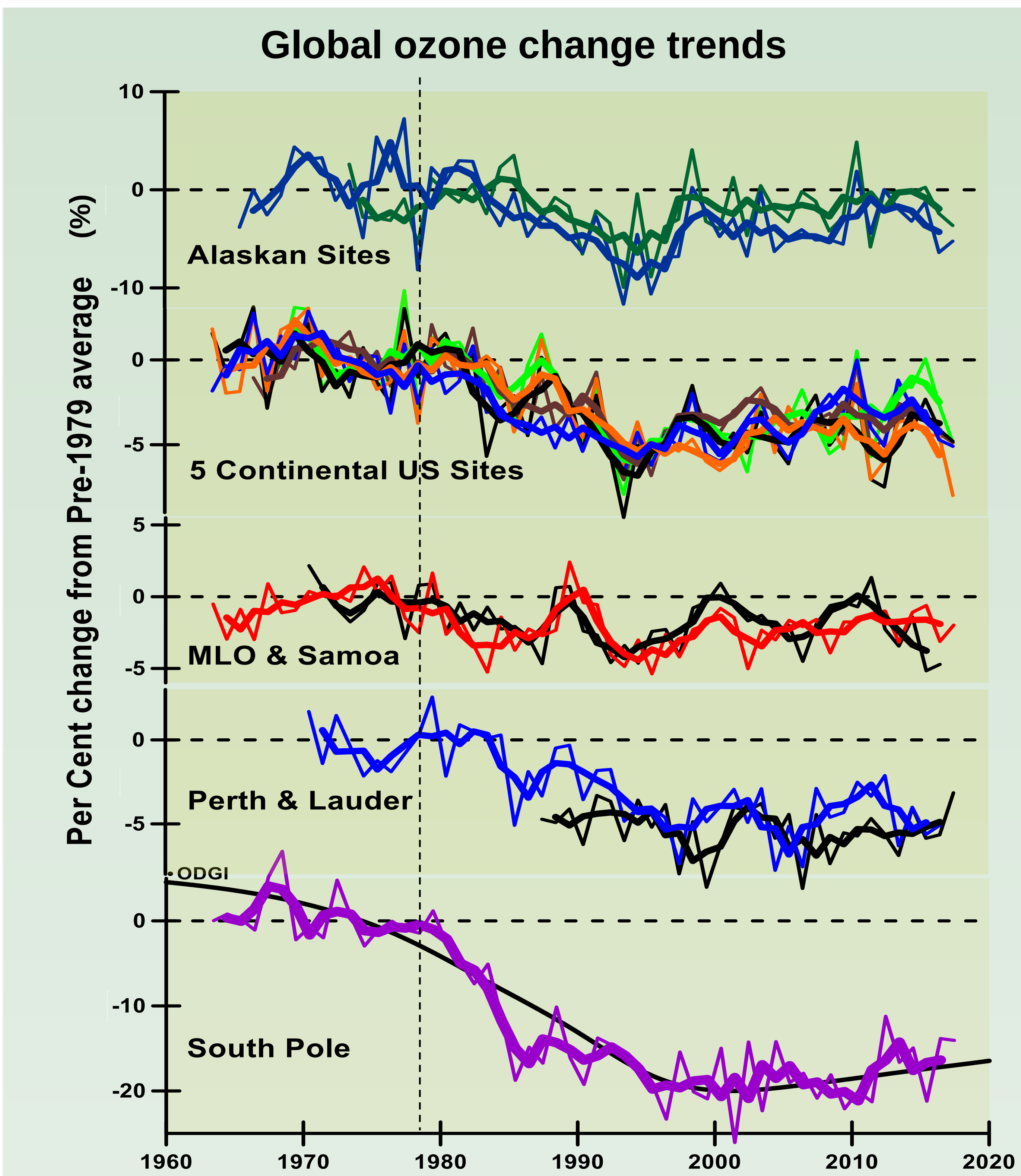


Figure 2. Total ozone change in the region from Pre-1979 average. The SBUV data is used for stations where Pre-1979 average of Dobson record is not avialiable. Alaskan sites are **FBK** and **BRW**. US sites are **BIS**, **BNA**, **CAR**, **BDR** and **WAI**.

Summary

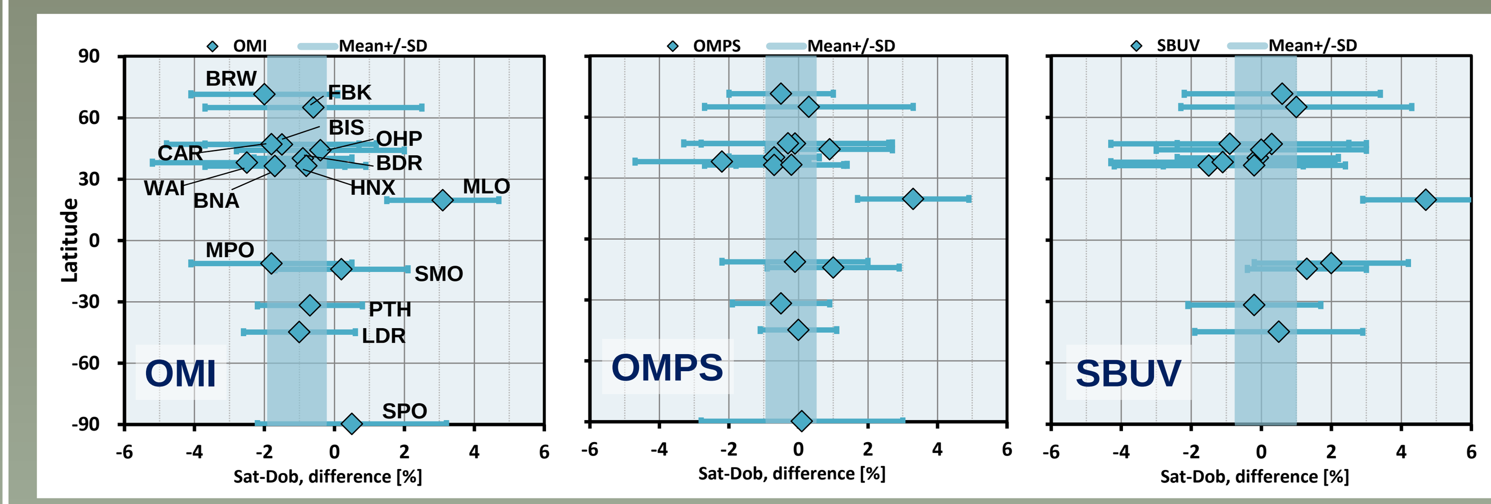


Figure 3. Averaged differences between Dobson and satellites overpass measurements. MLO and MPO are the stations of high altitude. The error bar shows ± 1 standard deviation.

Table 1. Summary of difference between Dobson and satellites from Figure 3. Mean value, and standard deviation of the differences.

Over Pass (%)	Mean	S.D.	S.E.	S.D. mean
N7TOMS	1.6	1.8	0.21	2.2
EPTOMS	1.3	1.4	0.17	2.4
OMI	-1.1	0.9	0.19	2.2
OMPS	**-0.2**	0.9	0.28	2.0
SBUV	**0.1**	1.0	0.14	2.6

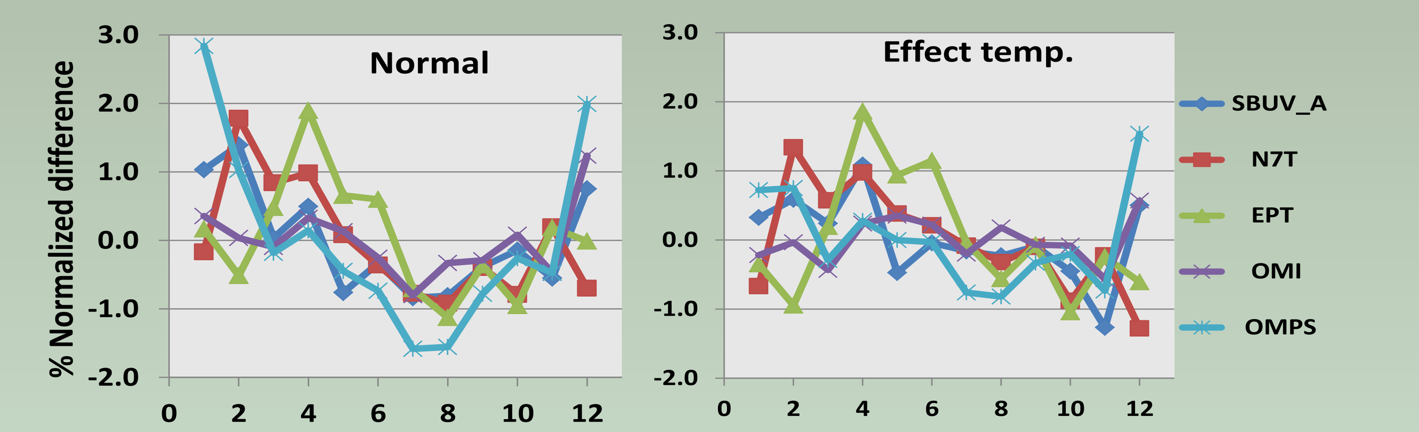


Figure 4. Seasonal change of percent difference. The difference applied climatology as having no temperature corrections for BP cross sections at Boulder

Effective temperature dependency and Discussions

We estimated the impact of the latitude using three different ozone cross-sections (BP, DBM and IUP) and temperature dependence (Redondas et al.).

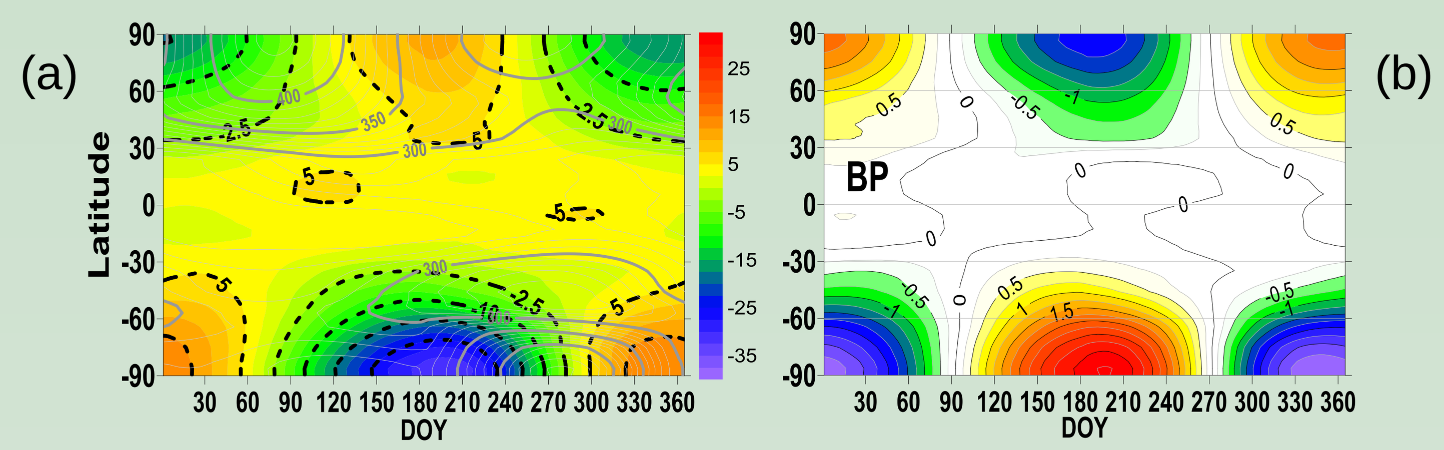
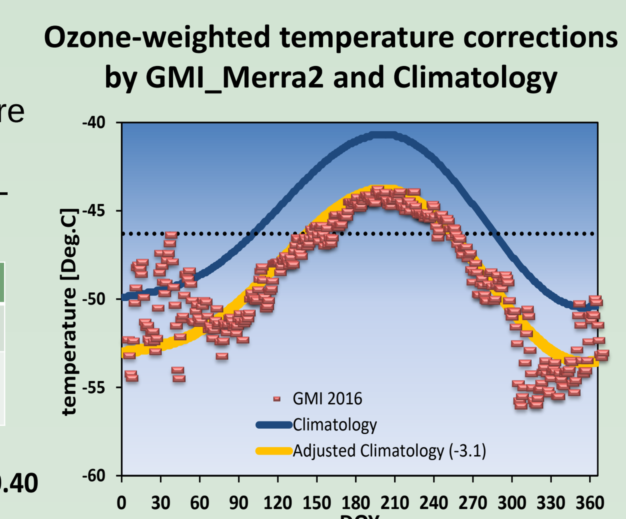


Figure 5. Different O3 cross-sections and temperature dependence from McPeters and Labow 2011 climatology use. (a) Difference of Dobson ozone-weighted temperature (226.7 K) and Total ozone (gray line). (b) Temperature correction applied to Dobson official BP applied O3 cross-sections and temperature correction.

For Dobson	BP	DBM	IUP
Ozone Cross-Sections	1.000	1.008	1.009
Temperature Correction (%k-1)	-0.133	+0.042	-0.104



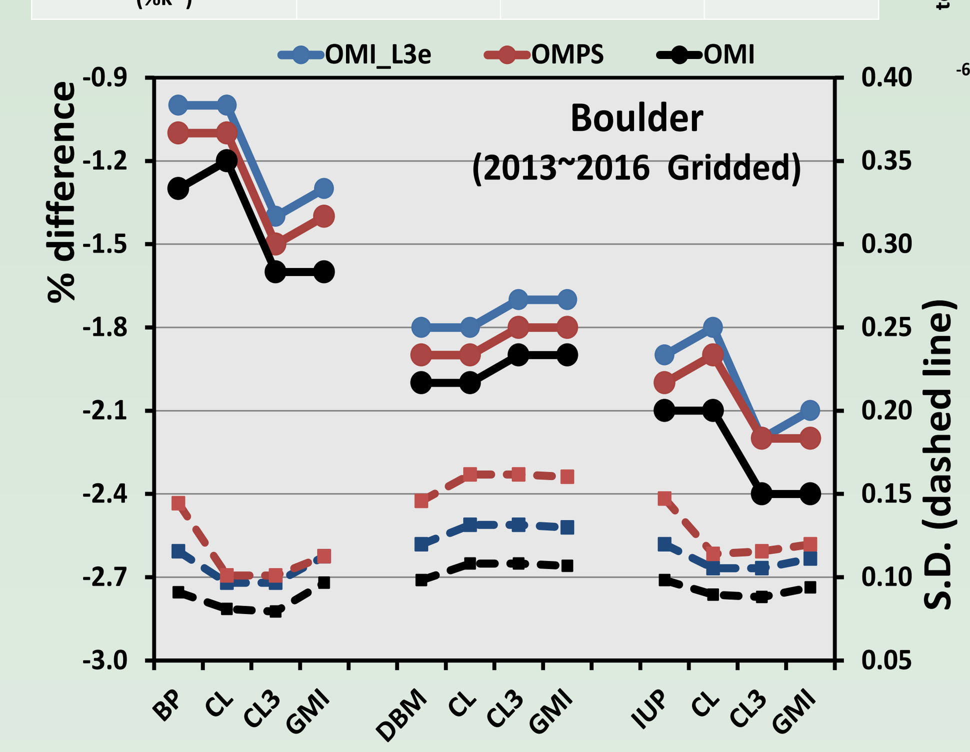


Figure 6. Three O3 cross-sections (BP, DBM and IUP) and different ozone-weighted temperature corrections (CL; Climatology, CL3; adjusted climatology and GMI; GMI_MERRA2) at Boulder. The difference of Dobson (matched ADDS) and satellite are based on the bi-linear interpolation from gridded for a station.

Ozone observation at high altitude in Marcapomacocha Peru (MPO)

Low column ozone is observed in the tropics and along the high altitude Andean region (~4500 m). The relation between Dobson ozone and satellites in Andean region shows a clear seasonal difference (OMPS are low in February to March, and high in July to October ozone).

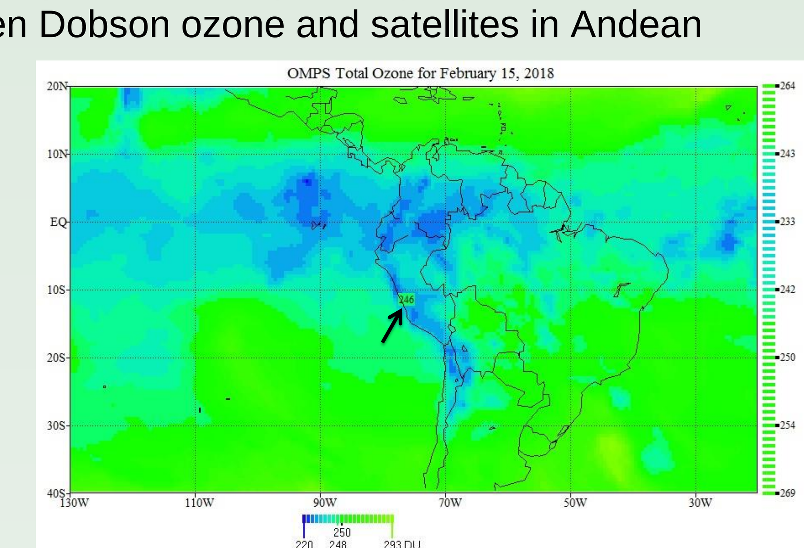


Figure 7. Total ozone map for February 15, 2018 based on data from Ozone Mapping Profiler Suite (OMPS). Total ozone by Dobson observation is shown at MPO. The Dobson (ADDS) observation is 246 DU, and OMPS is 228 DU.