Dear Editor,

Comments from both reviewers are well taken. I have incorporated reviewer's critics in to the revised manuscript. In particular, I added Figure 17 and last paragraph to discuss the impact of IBSL error in the retrieved SBUV ozone profile. I also revised the abstract and the conclusion to reflect the effects on the ozone. The characterization of night side IBSL error in Section 3.2 has been revised for clarity, which includes 4 more equations to describe the characterization of the time dependence and the goniometric dependence. Changes that follow reviewer's comments line by line are list below. Thank you.

Liang-Kang Huang

List of Changes:

Changes in response to Reviewer #1

P7912/L7: The authors should include a sentence or two describing why it is important to understand inband stray light. What are the effects of inband stray light error on the data produced by SBUV?

Added one sentence in abstract for significance in ozone retrieval.

The IBSL contamination at 273 nm can reach 40% of earth radiance near sunset, which results in as much as 50% error in the retrieved ozone in the upper stratosphere.

P7912/L7: you reference Frederick in 1986 but list to the present day???

Added Reference McPeters 2013 to cover the full data record from SBUV(/2)s.

(Frederick et al., 1986, McPeters et al., 2013)

Also in References:

McPeters, R.D., Bhartia, P.K., Haffner, D., Labow, G.J., and Flynn, L., The version 8.6 SBUV ozone data record: An overview, J. Geophys. Res., 118, doi:10.1002/jgrd.50597, 8032–8039, 2013

P7913/L11: what is a 2% change in "profile"? Does this mean a shift in the entire profile in mixing ratio? Or an area? Or a part of the profile shifts? It is not clear what this means

It was

Detecting a 2% change of ozone profile in the stratosphere requires SBUV/2 albedo measurements at the short wavelengths to be accurate to better than 1%.

Changed to

Detecting a 2% ozone density change in Umkehr layers in the stratosphere requires the calibration of SBUV/2 albedo measurements at the short wavelengths to be accurate to 1%.

P7913/L14: the authors should mention where the calibration of the SBUV instrument comes from and that an absolute calibration is not needed due to the ratio. Is the solar irradiance measured each orbit, or once a day, or what?

More details of SBUV/2 instruments are given in Section 2.

P7913/L18: you might want to comment on the relative importance of OBSL and IBSL and why you are focusing on IBSL

It was

We will not discuss characterization of OBSL in this paper.

Changed to

In the SBUV ozone measurements, a typical OBSL error for bright surface scenes can add a few percent error in radiance at the shortest wavelength (DeLand et al., 2012). A simplified description of the OBSL characterization is presented in that paper, but a detailed discussion would require substantially more space. We will not discuss the characterization of OBSL in this paper.

P7913/L21: analysis of stray light is indeed important in sensor characterization, but point out that it is important in scientific interpretation of the data – it adds a term to the numerator and denominator of the spectral ratio that obviously affects the value of the ratio

It was

Analysis of stray light in the remote sensing instruments is often important part of sensor characterization. It can also serve as lessons in designs of future instruments.

Changed to

Analysis of stray light in a remote sensing instrument is often an important part of sensor characterization. When an IBSL error is present, the sensor's measurements are contaminated with light that does not come from the intended target. This signal is an additive error that will not be cancelled in the albedo ratio. As will be described later in this paper, the IBSL error can also be wavelength dependent, as well as time dependent. Typical retrieval algorithms for atmosphere trace gasses cannot reduce or eliminate such additive errors in their data products. Therefore, detection, characterization, and correction of IBSL, if significant, is necessary. We hope that our study of SBUV IBSL can also provide lessons for the design of future instruments.

P7913/L24: what is the physical size of the ground footprint in km x km?

It was

SBUV/2 instruments have an 11^o (FWHM) field of view, which projects approximately a square on the ground in the nadir direction.

Changed to

SBUV/2 instruments have an 11^o (FWHM) field of view, which projects to approximately a 168 km x 168 km square on the ground in the nadir direction.

P7914/L4: same day AND same location on earth surface?

Added more description in Figure 1 caption.

It was

The radiance spectrum (top panel) is an average of 60 scans between latitude 15^{o}S and 15^{o}N.

Changed to

The radiance spectrum (top panel) is an average of 60 scans between latitude 15^{o}S and 15^{o}N, which were taken during four consecutive orbits once per week in November 2001.

P7914/L24: you will use 19 as an example. Why not use 19 in Fig 2 for consistency?

The comparison of the earth radiance spectrum between a good measurement and an IBSL contaminated measurement requires not only both measurements at the same geo-location, but also at the same local time to avoid differences due to diurnal ozone variations. N19 was selected in the paper for easy illustration because its IBSL error is the largest among the SBUV/2 instruments. N16, which is still active, is the only one with negligible IBSL error whose lifetime is overlapping with the other four recent SBUV/2s with significant IBSL error. When N19 was launched into a 2 pm orbit, the N16 orbit was drifting into terminator Equator-crossing time, then later into a morning orbit. N18 was the only instrument in an orbit close to N16 at one time. In response to the reviewer's question, two changes are made in the same page, and one in Figure 2 caption.

L5 was

Both N16 and N18 were emerging from darkness into daylight in the Southern Hemisphere and moving into darkness in the Northern Hemisphere in the same week around fall equinox 2006.

Changed to

Both N16 and N18 were emerging from darkness into daylight in the Southern Hemisphere and moving into darkness in the Northern Hemisphere in the same week around fall equinox 2005, which were in orbits with equator crossing local time 2:59 pm and 2:01 pm, respectively. We selected two instruments with similar orbits to minimize radiance differences due to diurnal ozone variations.

L24 was

This paper reports our analysis and characterization of the SBUV/2 IBSL error in orbit, using the NOAA-19 SBUV/2 instrument as an example.

Changed to

This paper reports our analysis and characterization of the SBUV/2 IBSL error in orbit, using the NOAA-19 SBUV/2 instrument as an example, which has the largest IBSL error among SBUV/2 instruments for an easy illustration.

Added in Fig2 caption

NOAA-16 and NOAA-18 orbits were in proximity at equator crossing time, 2:59 pm and 2:01 pm, respectively, to minimize diurnal difference in the earth radiance.

P7915/L1: is the extinction ate 10(-6)? Was it measured? You say "ideally"

SBUV/2 slit functions were derived from their prelaunch tests and their orbital data. They do have extinction rates of 1.0E-6 or better. Therefore, the phrase "ideally" is deleted in the revised text.

It was

SBUV/2 instruments are equipped with double Ebert monochromators, which can ideally block OBSL at extinction rate of 10^{-6}.

Changed to

SBUV/2 instruments are equipped with double Ebert-Fastie monochromators, which can block OBSL at extinction rate of 10^{-6}.

P7915/L2: does the FWHM vary with wavelength – it should – so what is the variation from one end to the other

The FWHM value reported here is a nominal value. The actual spectral resolution measured ~~s~~ in SBUV/2 prelaunch tests varies by a couple hundredths of a nm from instrument to instrument. It *is also a function of wavelength. The FWHM increases ~0.05 nm when the wavelength decreases from 340 nm to 250 nm. Since this paper will discuss IBSL only, which is not related to the slit function, we will not discuss details of the FWHM issues.*

It was

The monochromator covers a wavelength range from 160 nm to 405 nm, with a spectral band pass of 1.13 nm FWHM.

Changed to

The monochromator covers a wavelength range from 160 nm to 405 nm, with a nominal spectral bandpass of 1.13 nm FWHM.

P7912/L22 was

… a spectral bandpass of 1.13 nm FWHM (full width at half maximum) for ozone monitoring.

Changed to

… a nominal spectral bandpass of 1.13 nm FWHM (full width at half maximum) for ozone monitoring.

P7915/L6: Fig 1 says a scan takes 168 sec and here says 32sec

Changes are made in Figure 1 caption.

It was

The monochromator completes a spectral scan in 168 seconds. … Square symbols represent SBUV/2 discrete wavelengths used for ozone. …

Changed to

The monochromator completes a continuous spectral scan from 405 nm to 160 nm in 168 seconds. … Square symbols represent SBUV/2 discrete wavelengths used for ozone measurements in a 32-second scan cycle.

P7915/L11: concerning….. of a grating spectrometer which acts as an analyzer.

It was

A depolarizer in front of the monochromator is used to eliminate the polarization effects of atmospheric Rayleigh scattering, concerning strong polarity of a grating spectrometer.

Changed to

A depolarizer in front of the monochromator is used to eliminate the polarization effects of atmospheric Rayleigh scattering, concerning strong polarity of a grating spectrometer which acts as an analyzer.

P7915/L15: assuming the diffuser does not degrade between measurements – which brings up the freq of measurement using the diffuser – please specify

Added statements at L14 and L22

L14 was

A diffuser plate can be deployed to reflect the solar light into the sensor's aperture after terminator crossing to measure the solar irradiance.

Changed to

A diffuser plate can be deployed to reflect the solar light into the sensor's aperture after terminator crossing to measure the solar irradiance. This measurement is performed every day during normal operations.

L22 was

The SBUV/2 diffuser reflectivity changes, from laboratory to spacecraft and from launch to many years in orbit, are monitored using an on-board mercury spectral lamp. Details of SBUV/2 calibrations can be found elsewhere …

Changed to

The SBUV/2 diffuser reflectivity changes, from prelaunch tests to on-orbit conditions and over years of operation, are monitored using emission lines from an on-board mercury lamp. Typically, the diffuser reflectivity at 250 nm degraded at a relative annual rate no more than 3% per year, with significantly smaller changes observed at longer wavelengths. The diffuser calibration measurements in orbit were scheduled on a weekly basis to ensure the accuracy of the albedo calibration. Details of SBUV/2 calibrations can be found elsewhere …

P7915/L24: FLIGHT baffle plates

It was

Figure 4 shows a picture of an SBUV/2 instrument in the laboratory, with baffle plates installed surrounding the aperture and diffuser deployment mechanism.

Changed to

Figure 4 shows a picture of an SBUV/2 instrument in the laboratory, with flight baffle plates installed surrounding the aperture and diffuser deployment mechanism.

P7917/L2: does the use of “includes” mean that correction has been made for the the properties listed, or not? Please clarify. I assume not.

It was

We have identified IBSL with direct comparison of N16 and N18 albedo measurements at 273 nm in Figure 2. This comparison includes differences in their field of views, scene reflectivity, terrain height and other atmospheric and geophysical properties.

Changed to

We have identified IBSL error in Figure 2 using direct comparison of N16 and N18 albedo measurements at 273 nm. These instruments were in similar orbits in 2005, which reduces possible differences in measured radiances due to diurnal ozone variations. Otherwise, the measured radiances as a function of SZA by two instruments at different orbits can be very different due to difference in their field of views, scene reflectivity, terrain height and other atmospheric and geophysical properties.

P7917/L14: TEMPERATURE dependent ozone absorption …

It was

The difference between the measurement and the computed albedo value, called the Initial Profile Albedo Residue (IPAR) in this paper, contains the difference between the actual ozone profile and the initial estimate, the ozone absorption cross section error, the calibration offset, as well as any IBSL error.

Changed to

The difference between the measurement and the computed albedo value, called the Initial Profile Albedo Residue (IPAR) in this paper, contains the difference between the actual ozone profile and the initial estimate, the temperature dependent ozone absorption cross section error, the calibration offset, as well as any IBSL error. Weekly 0.5^o latitude band zonal means of IPAR are computed and compared between two SBUV/2 instruments at the same latitude to minimize both geophysical and atmospheric differences.

P7917/L17: remind the reader why 17 does not contain the error – you use flight model numbers on the previous page. In fact looking at flight model numbers, pg 7914 says FM5=14, FM6=17, FM7=18 and FM8=19. Pg 7916 says FM5 – FM8 have the large air gaps and hence will have the large IBSL. Thus, 17 has IBSL as stated in line 23. So now you say N17 is not contaminated with IBSL and N19 is. I am confused?????? N17 is clean because of the selection of SZA? Please explain this, it is not at all clear. I will assume in reading the rest that N17 does not contain IBSL, but not clear it does not.

Two changes are made for clarity.

P7916/L12 was

This geometry is consistent with the finding of IBSL error onset and rapid rising around SZA = 77^o shown in Figure 2.

Changed to

This geometry is consistent with the finding of IBSL error onset and rapid rising around SZA = 77^o near the sunset shown in Figure 2. It also explains the clean radiance signal at sunrise when the diffuser deployment mechanism turns its back towards the sun.

P7917/L17 was

Figure 5 shows the weekly average differences in IPAR at the same latitude between N19 and N17 near North Pole as a function of spacecraft centered solar elevation angle (SCSEA) of N19, where the N19 data are contaminated with IBSL error and the N17 data do not contain this error.

Changed to

Figure 5 shows the weekly average differences in IPAR at the same latitude between N19 and N17 near North Pole as a function of spacecraft centered solar elevation angle (SCSEA) of N19, where N19 approaching sunset was contaminated with IBSL error and N17 at sunrise was not impacted by IBSL error. Since this error is observed near spacecraft sunset, N17 measurements have significant IBSL errors near the South Pole, while N19 measurements in that region are not contaminated. Therefore, a similar comparison to Figure 5 near the South Pole would reveal N17 IBSL error.

P7917/L15: Fig 5 would be easier to read if you plotted the difference rather than the real numbers.
heavy going the next few pages getting used to SCSEA and AA and what it means –any wording to help the reader through these few pages would be worthwhile – choice of SCSEA values seems appropriate, but you have to think about them and look at the first graphs to really see why they were chosen (18 deg, 6, -10, etc)

Figure 5 Caption was

The difference is plotted against N19 SCSEA.

Changed to

The difference is plotted against N19 Spacecraft Centered Solar Elevation Angle (SCSEA). Under normal satellite attitude conditions, SCSEA is equal to SZA-90^o. Therefore, these figures cover the day side from SZA = 70^o to SZA = 90^o.

L18 was

The spacecraft centered coordinates, SCSEA and spacecraft centered solar azimuth angle (SCSAA), are preferred in the IBSL analysis over the reference frame on the terrain surface since IBSL is attributed to the direct solar incidence on the spacecraft rather than the earth shine. Note that in normal attitude conditions SCSEA is equal to SZA - 90^o. The IBSL error rises rapidly in the region between SCSEA = -15^o and SCSEA = -10^o (corresponding to SZA = 75°-80°), and flattens between SCSEA = -10^o and SCSEA = -2^o.

Changed to

The spacecraft centered coordinates, SCSEA and spacecraft centered solar azimuth angle (SCSAA), are preferred for the IBSL analysis over the reference frame on the Earth's surface, since the IBSL error is attributed to the direct solar incidence on the spacecraft rather than Earthshine. We will demonstrate the strong correlation between IBSL and SCSAA in the next sections, whereas there is no direct correlation between SAA (measured at the surface clockwise from due north) and IBSL. Note that in normal attitude conditions SCSEA is equal to SZA - 90^o. The IBSL error rises rapidly in the region between SCSEA = -15^o and SCSEA = -10^o (corresponding to SZA = 75°-80°), and flattens between SCSEA = -10^o and SCSEA = -2^o (corresponding to SZA = 80^o-88^o).

P7923/L28: reference please for s/c contamination

It was

This is a typical behavior in metal surface reflectivity in UV in the processes of photo carbonization of prelaunch contamination on the spacecraft (Hilsenrath et.al. 1994).

Changed to

This is a typical behavior in metal surface reflectivity in UV in the processes of photo carbonization of prelaunch contamination on the spacecraft (Hilsenrath et al. 1994).

Added reference

Hilsenrath, E., Bhartia, P. K., and Cebula, R. P.: Calibration of BUV satellite ozone data – An example for detecting environmental trends, The Earth Observer, NASA, Vol 6, No 6, 26-33, 1994

Changes in response to Reviewer #2

Abstract: I suggest to add already in the abstract the 4 for effected instruments, NOAA-14, 17, 18 and 19.

It was

… in 4 SBUV/2 instruments has been characterized.

Changed to

… in 4 SBUV/2 instruments, onboard the NOAA-14, 17, 18 and 19 satellites, has been characterized .

Added at P7914/L5 after *Figure 2 shows sample albedo measurements at 273 nm on the same date by NOAA-18 SBUV/2 (N18) in top panel and NOAA-16 SBUV/2 (N16) in bottom panel.*

We will use the abbreviation N9, N11, N14, N16, N17, N18 and N19 for SBUV/2 instruments on board the NOAA-9, 11, 14, 16, 17, 18 and 19 satellites, respectively.

p 7916: line 15-18: Notation FMx instead of Nxx, see remark above.

It was in P7914/L17

We found significant IBSL contamination in the earth radiance measurements at the short wavelengths with the last 4 SBUV/2 flight modules (FM#5, FM#6, FM#7 and FM#8, which respectively flew on N14, N17, N18 and N19) at SZA higher than 78_ approaching terminator.

Changed to

We found significant IBSL contamination in the earth radiance measurements at the short wavelengths with N14, N17, N18 and N19 at SZA greater than 78^o approaching the terminator.

It was in P7916/L18

To avoid further such problems, the last 4 SBUV/2 instruments (FM#5 through FM#8) were modified …

Changed to

To avoid further such problems, the last 4 SBUV/2 instruments manufactured, which flew on the N14, N17, N18 and N19 spacecraft, were modified …

p 7913: please add also the approximate size of the ground pixel in km x km.

Added in P7913/L24

approximately a 168 km x 168 km square

p 7917: line 24/25 and Fig. 5: "The error bars are the statistical error for the mean." Please clarify, which mean you are referring to. Are the crosses in the plot points with error bars? Please add this information than in the figure description. There is also a dashed and full line in the plots, which is not explained in the figure caption. Please add. Probably the use of colored lines would be helpful for the readers, especially the dashed line is hardly to distinguish from the points and its error bars. Anyhow, these lines are not explained anywhere in the text. Probably, p. 7918, line 25-27 refers to these lines. Please clarify.

Added description of latitude zonal mean and error bars in both text and Figure 5 & 6 captions. The cross in the original figure 5 is not error bar. Added error bars and color in Figure 5.

Added at P7917/L15

Weekly 0.5^o latitude band zonal means of IPAR are computed and compared between two SBUV/2 instruments at the same latitude to minimize both geophysical and atmospheric differences. …. The error bars are the standard errors for the latitude band zonal means.

Added in P7918 2nd paragraph at the beginning and the ending:

The IPAR differences, weighted with the reciprocal of the squared standard error values, are fitted with two straight lines separately over the angular ranges SCSEA $\leq$ -15^o and SCSEA $\geq$ -10^o, as shown by the thick solid black lines. The fitting gives IPAR differences at SCSEA = -10^o and SCSEA = -15^o. …… in Figure 6. The standard errors in the weekly 0.5^o latitude band zonal means are propagated through the linear regressions, and produce the uncertainties for the IPAR differences. The estimated uncertainty in the dayside weekly IBSL errors varied from 5% to 10%, as plotted in error bars.

Fig. 6: Something missing here? There are no triangles in the plot.

Sorry, the caption was not updated with the changes in the figure. Revised once again Figure 6 and its caption.

Fig. 9: This is obviously not a vector graphic, but a pixel based plot. Please provide the vector graphic here. … Figure 9a The dots are not visible in the plot!

Revised for better resolution and larger font. The noise level of measured IBSL error at SCSEA = 18^o is very low, and the derived IBSL function fits the data very well. Therefore, the continuous curve overlaps most dots most times in Figure 9a. With the better graphic resolution and blue color dots, the raw data is slightly more visible.

p. 7920: In general, the exact calculations in section 3.2.1 are hard to follow. … Actually, I did not fully understand your calculations from this description. A formula might be helpful here.

I added 4 more equations for the characterization of the time dependence and the goniometric dependence in this section, and more explanation along with the equations.

Revised Section 3.2.1

3.2.1 Separation of time dependence and goniometric dependence

A linear fit of daily IBSL measurements between SCSEA = 14^o and SCSEA = 22^o gives values for both the IBSL error and the rate of change dIBSL/dSCSEA at SCSEA = 18^o. Figure 9(a) shows the derived daily IBSL error at SCSEA = 18^o at 273 nm as a function of time (dots) for N19. The seasonal variations have a strong correlation with variations in SCSAA (dash curve). Since the reflectivity of surfaces near the instrument entrance slit may change with time, and the illumination geometry of the SBUV/2 instrument will vary with season, the overall IBSL error is assumed to be a product of a time dependence function and a goniometric function,

$$IBSL(t, \varphi) = F(t) \times G(\varphi) \quad (1)$$

where t is time, φ is SCSAA, and the wavelength dependence in F and G is implied. Note that φ is also a function of time, and φ, F and G are all considered at SCSEA = 18^o. In order to derive the time-dependent factor $F(t)$, we first compare each daily IBSL measurement with one at the same SCSAA in a reference year, defined as April 2010 to March 2011,

$$R_i(t) = IBSL(t, \varphi) / IBSL(t_r, \varphi) = \mathrm{F}(t) / \mathrm{F}(t_r) \quad (2)$$

where t_r is the time in the reference year, and Equation 1 is used to eliminate the goniometric factor. For a given set of t and φ, two consecutive days in the reference year are selected for having SCSAA adjacent to φ, and their IBSL errors are interpolated as a function of φ to obtain $IBSL(t_r, \varphi)$, where t_r is an interpolated time between these two consecutive days. Depending on the season, as many as three periods in the reference year may occur with adjacent φ values. We select the period with the largest time interval. Then, normalized drift rates are calculated,

$$\Delta R_i(t)/\Delta t = (R_i(t) - 1) / (t - t_r) \quad (3)$$

The results are plotted in Figure 9(b). No drift rates in the reference year are included to avoid large noise associated with the small time interval. There are missing days in the figure because some SCSAA values are outside the range of the reference period. The average drift rate over 4 months before April 2010 and 4 months after March 2011 is calculated to determine the drift rate during the reference period, shown by the solid line. This allows us to make an initial estimate of the IBSL time dependence during the reference period, using a linear approximation. An initial estimate of IBSL time dependence can then be obtained with

$$f(t) = [1 + (t - t_b)\times\langle\Delta R_i(t)/\Delta t\rangle]\times R_i(t) \approx F(t)/F(t_b) \quad (4)$$

where $\langle \Delta R_i(t)/\Delta t \rangle$ is the average drift rate during the reference year, t_b is chosen to be on the beginning of the reference year for convenience, and the '≈' sign could be replaced with '=' sign if the drift in the reference year is strictly linear. Thus far, the time dependence function for IBSL is normalized at t_b. We renormalize it to the first day of N19 earth radiance measurement,

$$F_n(t) \equiv f(t)/f(t_1) \approx F(t)/F(t_1) \quad (5)$$

where t_1 is the time of the first day of N19 radiance measurements. The resulted $F_n(t)$ values are shown by the dots in Figure 9(c). Note that $F_n(t) \approx F(t)$ will be valid when we choose $F(t)$ in Equation 1 to be normalized on day one, These $F_n(t)$ values are smoothed and interpolated with a piece-wise linear fit to get an initial estimate of the time dependence, shown as the solid curve. The IBSL daily values shown in Figure 9(a) can also be plotted as a function of SCSAA, as shown in Figure 9(d). Dividing these daily IBSL values by the $F(t)$ function derived in Figure 9(c) gives us the IBSL SCSAA dependence, which is now a well behaved function, as shown by the dots in Figure 9(e). A 4th order polynomial function fits these data well, as shown by the smooth curve, which will be used as $G(\varphi)$ in Equation 1. The fitted $G(\varphi)$ function is then used to remove the SCSAA dependence from the daily IBSL measurements. This creates a new estimate of the IBSL time dependence using all measurements, as shown by the dots in Figure 9(f). These values are smoothed to determine the time dependence function $F(t)$. This process is iterated once. The final IBSL time dependence is shown with the smooth curve in Figure 9(f). Combining the IBSL time dependence and the IBSL SCSAA dependence from Equation 1, we can calculate the IBSL error at SCSEA = 18^o, shown by the smooth curve in Figure 9(a), where SCSAA is measured at SCSEA = 18^o and is approximately constant in a given day.

Daily values of dIBSL/dSCSEA at 273 nm are plotted as a function of time in dots in Figure 10(a). We find that dIBSL/dSCSEA is also correlated with SCSAA. The normalized slope is shown as a function of SCSAA in Figure 10(b), where we have removed the time dependence $F(t)$ shown in Figure 9(f). The normalized slope can be then fitted with a polynomial function, $S(\varphi)$, shown by the smooth curve in Figure 10(b). Thus, we can reproduce the time dependence of the slope with the fitted functions,

$$dIBSL/dSCSEA(t) = S(\varphi(t)) \times F(t) \quad (6)$$

which is shown by the smooth curve in Figure 10(a).

p. 7923, l. 15: "in terms of STDV " What is STDV? Please explain this acronym.
The full phrase, standard deviation, is now used throughout the manuscript.

p. 7924, l. 1: "Fig. 14a" a/b is not marked in the plot and also not in the figure caption. Please add at both place.
Figure 14 is revised as suggested.

p. 7925: I would like to read here a short discussion about the differences between the corrected instruments. Is the correction very similar for all 4 SBUV/2, or are there systematic differences?
Added one last paragraph to describe the magnitude difference among the instruments, and the IBSL error impact to the ozone profile retrieval.
The last paragraph:

Figure 16 shows an example of N19 albedo measurements at 273 nm before and after IBSL correction. The data were taken on the spring equinox 2010 near North Pole. While the IBSL error was approximately constant in absolute terms (~2×10^{-5} between SZA = 80°-88°), the percentage contamination in the albedo measurements increases from ~25% at SZA = 80° to ~40% at SZA = 88°. Figure 17 compares retrieved ozone profiles before and after the IBSL correction. The impact of uncorrected IBSL error to the retrieved ozone profile above 1 hPa (Layer 16) is more than 30%. While the retrieved total column ozone amount, which depends on the long wavelength channels, is not affected by IBSL, the V8.6 ozone retrieval algorithm pushes up the ozone layers below 10 hPa by 1-2% to compensate for the deficits in the upper layers. Even though the IBSL error impacts only a small portion of the SBUV/2 data at very high SZA, this error can result in large errors in the retrieved stratospheric ozone values in polar regions. The methodology developed in this paper reduces the IBSL-related uncertainty in the retrieved upper layer ozone to only a few percent.

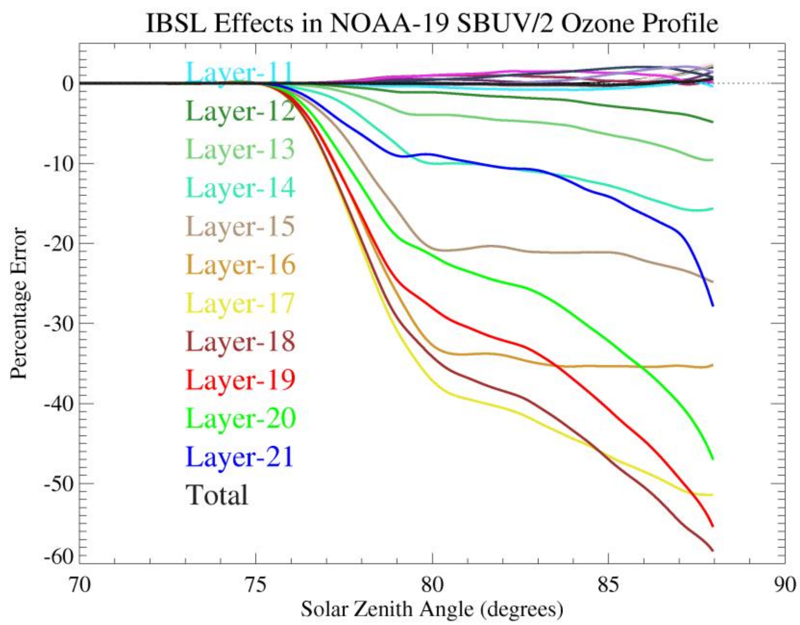

Figure 17. The sample of IBSL effects in the retrieved ozone profiles near North Pole is taken from an average of two weeks around the spring equinox 2010. Twenty one SBUV V8 profile layers are defined by 10^{-2n} atmosphere pressure levels, where n starts from 0 for the bottom boundaries. Only top layers above 10 hPa are labeled. Other lower layers overlap each other within 2%. The black curve for the total column ozone difference is near zero.