

White Paper for Visible Calibration Coefficients Update

Ref: CCR05-0001: “Update Imager Visible Calibration Coefficients in GVAR”

Section 1:

1.1 Introduction:

Currently, GVAR transmits only factory-measured calibration coefficients for the Imager's visible channel, which quickly become out of date after launch. In the past few years, an adjustment factor for these coefficients has been provided by the STAR and used in many applications. We want to modify the SPS calibration database to include the adjustment factor, which will be updated monthly in collaboration with the STAR, and to modify the GVAR to include the adjustment factor in a location that is currently empty.

1.2 Implementation:

To properly calibrate the visible channel measurements, users should multiply the value of radiance or albedo they obtain from the factory coefficients by the adjustment factor. (The factory coefficients are also transmitted in GVAR.) Alternatively, users can multiply the factory visible-channel first-order gain coefficients and bias coefficients by the adjustment factor. This will produce an updated set of visible-channel calibration coefficients that can be applied to the raw counts. Each month, STAR will supply to WCDA an updated adjustment factor and the date it became effective. The GVAR would include:

- (1) the current adjustment factor and date
- (2) the previous adjustment factor and date
- (3) the initial adjustment factor (it will be 1 always) and initial adjustment date, which is the ITT measurement date

The adjustment factor would be of type 4-byte real and the dates would be of the same format as currently transmitted through GVAR year, day, hr, min, sec. msec, e.g., YYYYDDDDHHMMSSmmm, though the units MMSSmmm is not important for this and may be filled with zeros. The updates will be implemented at the midnight on the date specified.

The GVAR “Imager Calibration and Limits block11” will be updated to include the new calibration information. We choose this particular block 11 since the new parameters are also calibration parameters. The implementation detail is explained in **section 2**.

We will use the currently unused spaces in the block 11 word#7699 onwards. A tentative plan for the updated GVAR block is shown. For side by side comparison, Table 1.1 below shows the currently transmitted GVAR block 11 and Table 1.2, the proposed updated GVAR block for Imager Calibration and limits.

Please note that we have also added the related Factory coefficients into this GVAR block 11 at the formerly “spare” spaces.

1.3 GVAR Block11:

Table 1.1. Imager Calibration and Limits Block 11 Format (Original)

Words	Name	Description
1–30	**	**SAD ID (see Section 3.3.7.1)
31–38	TIRCOC	CDA time IR coefficients calculated
39–46	TCLSCI	CDA time of current limits set
....	
....	
....	
7697-7698	IMBCG1ML_P8	MBCC IR calibration for 8th detector (first-order gain) Mode {1:14}. GOES I-N IR dets 1-7 wd#517
7699-8040		Unused-zeros

Table 1.2. Imager Calibration and Limits Block 11 Format (Updated with Visible Calibration information)

Words	Name	Description
1–30	**	**SAD ID (see Section 3.3.7.1)
31–38	TIRCOC	CDA time IR coefficients calculated
39–46	TCLSCI	CDA time of current limits set
....	
....	
....	
7697-7698	IMBCG1ML_P8	MBCC IR calibration for 8th detector (first-order gain) Mode {1:14}. GOES I-N IR dets 1-7 wd#517
Imager Visible Calibration Adjustment Factors		
7699 – 7706	VISCALINITDATE	Visible calibration initial adjustment date
7707 - 7710	VISCALINITFACTOR	Visible calibration initial adjustment factor
7711 – 7718	VISCALPREVDATE	Visible calibration previous adjustment date
7719 - 7722	VISCALPREVFACTOR	Visible calibration previous adjustment factor
7723 – 7730	VISCALCURRDATE	Visible calibration current adjustment date
7731 - 7734	VISCALCURRFACTOR	Visible calibration current adjustment factor
7735–7766	C_IVCRB*	Visible detectors characteristic response bias coefficients array. C_IVCRB_P0 - P7 Same as block 0 wd#6399-6430 for GOES I-N and Imager Factory Coefficients block 11 wd#135-166 GOES M-P
7767–7798	C_IVCR1*	Visible detectors characteristic response first-order gain coefficients array. C_IVCR1_P0 - P7 Same as block 0 wd#6431-6462 for GOES I-N Imager Factory Coefficients block 11 wd#167-198 GOES M-P
7799–7830	C_IVCR2*	Visible detector characteristic response second-order gain coefficients array. C_IVCR2_P0 - P7 Same as block 0 wd#6463-6494 for GOES I-N and Imager Factory Coefficients block 11 wd#199-230 GOES M-P
7831–7834	C_IVRAL	Visible detectors radiance-to-albedo conversion factor, one value for all eight detectors. Same as block 0 wd#6495-6498 for GOES I-N and Imager Factory Coefficients block 11 wd#231-234 GOES M-P
7835 - 8040		Spares – not used

Section 2:

Visible calibration implementation flow

This section of the document explains how the visible calibration is being implemented with respect to logic and data flow.

2.1 Input Format:

1. Each month, STAR provides a visible coefficient update file containing a **time** and **coefficient**:

Time – the format will be of the form YYYYDDDHHMMSSmmm

Where YYYY = year, DDD = day of the year, HH = hour, MM = minute, SS = seconds, mmm = msec.

e.g. for the year 2008, day 102, and hour 14 minute 20, the format would look like

2008102142000000

Coefficient – a 32-bit floating-point number (having a precision of approximately six digits)

e.g. **1.23456** or **0.123456**

2. This information will be sent as a text file email attachment to the WCDA SPS manager and SPS team lead. The file would have two lines – 1st line for the previous and the 2nd line for the latest/current information. For example the file would contain:

```
2008111223344000    1.23456
2008140223344000    1.34556
```

3. The email body will separately specify the **day** on which the new calibration coefficient can be ingested into the SPS (this day is not to be confused with the day/time described above, which is the time the factor was calculated/measured.)
4. The email recipient or SPS manager need to:
 - a) Check for the correctness of the attachment according to the pre-defined format
Error: notify the sender of the email
No error: follow as below
 - b) Extract the email attachment and save it under the following name: **“/rt/viscal/YYYYDDD.txt”**, where YYYY is the current year and DDD is the current day of the year (today), and the directory /rt/viscal is on the SPSGIU.
e.g. for year 2008 and day 111, the name of the file is **2008111.txt**

5. Any time on the day of ingestion (but before the required time of update), the SPS operator issues the following command to the SPS console to ingest the file

```
set viscalupdate 1:1 1
```

6. After ingest the SPS will perform the following actions in the background:
 - a) Check for the validity of the calibration factor in the file. This is calculated as:

```
if last update was on day D1 with value U1 and
the current update is day D2 with value U2, SPS
will accept the update without question if:
0% < [(U2-U1)/U1]/[(D2-D1)/365] < VISCALLIMIT
```

- b) A new event message MST202 is issued on either FAILURE or SUCCESS
FAILURE: SPS will not proceed any more. Operator need to check for the correctness of the filename, contents, etc. If needed, issue the same command as in bullet#5
SUCCESS: SPS would keep on checking if it is time to update the parameters – this update time is pre-determined from the database and is also settable by the operator.
 - c) When it is time to update, it would set the global variables
SPS updates the calibration parameters for the GVAR Imager Calibration and limits block 11

```
copy the current viscal date and factor into
previous viscal date and factor
set the current viscal date and factor to the
newly-received viscal date and factor.
```

The next GVAR calibration block will transmit these new parameters.

- d) The **dbif** I/F, on receiving the update information, would update the satellite database with these new parameters. Consequently, SPS issues an event msg on completion,

```
Success: event message DBI102 is issued indicating success
Failure: event message DBI111 is issued indicating failure
```

7. The new database parameters introduced for this task are shown in Table 2.1 below:

Table 2.1. Imager Visible Calibration database parameters

Parameter	Comments
VISCALFDATE	Visible calibration initial adjustment date (the factory measurement date)
VISCALFCATOR	Visible calibration initial adjustment factor. This is always =1
VISCALPDATE	Visible calibration previous adjustment date
VISCALPFACTOR	Visible calibration previous adjustment factor
VISCALCDATE	Visible calibration current adjustment date
VISCALCFACOR	Visible calibration current adjustment factor
VISCALHR	Time (hour in GMT) of first implementation of current visible calibration adjustment factor – settable. Initially set to the night-time space-look side change hour.
VISCALMIN	Time (minute in GMT) of first implementation of current visible calibration adjustment factor – settable. Initially set to the night-time space-look side change minute rounded up to the next minute.
VISCALLIMIT	The threshold limit for the input updated Visible Calibration parameter – settable. This settable parameter is set to a value = 8 initially (in unit of yearly percentage.)

8. The Following Table 2.2 shows the values to be set in the database initially:

Table 2.2. Imager Visible Calibration database parameter values

PARAMETER	GOES-10 SN05	GOES-11 SN06	GOES-12 SN07	GOES-13 SN08	GOES-14 SN09	GOES-15 SN10
VISCALFDATE	1994324000000000 (Nov 20, 1994)	1996004000000000 (Jan 04, 1996)	1998062000000000 (Mar 03, 1998)	2000229000000000 (Aug 16, 2000)	2001114000000000 (Apr 24, 2001)	2001311000000000 (Nov 07, 2001)
VISCALFCATOR	1	1	1	1	1	1
VISCALPDATE	1994324000000000 (Nov 20, 1994)	1996004000000000 (Jan 04, 1996)	1998062000000000 (Mar 03, 1998)	2000229000000000 (Aug 16, 2000)	2001114000000000 (Apr 24, 2001)	2001311000000000 (Nov 07, 2001)
VISCALPFACTOR	1	1	1	1	1	1
VISCALCDATE	1994324000000000 (Nov 20, 1994)	1996004000000000 (Jan 04, 1996)	1998062000000000 (Mar 03, 1998)	2000229000000000 (Aug 16, 2000)	2001114000000000 (Apr 24, 2001)	2001311000000000 (Nov 07, 2001)
VISCALCFACOR	1	1	1	1	1	1
VISCALHR	3	9	5	5	5	5
VISCALMIN	44	29	14	14	14	14
VISCALLIMIT	8	8	8	8	8	8

Section 3:

Acronyms:

GVAR	– GOES VARIable format
RPM	– Replacement Product Monitor
SPS	– Sensor Processing System
STAR	– Center for Satellite Applications and Research
VISCAL	– Visible calibration