

11.7 NOAA 15, 16, 17 (KLM) Quality Control and Trending Data Available to the User Community on NOAA WEB Site

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1. INTRODUCTION

The National Oceanic and Atmospheric Administration (NOAA) needed the ability to perform Trending and Quality Control (QC) checks of the spacecraft data from the NOAA polar satellite series; NOAA -15,16, and 17. To effectively monitor the science data, instrument status and pre-processing of the instrument data into the level 1B/1B* (1B) data format, a system with the ability to easily view the results of multiple value large data array sets was required.

From this requirement the current QC, Trending, and diagnostic system was developed. It presents the data in a graphical format using searchable data bases providing the results in multiple resolutions; plots of 61 Day averages, 61 Orbit values, and two minute values within one orbit for each instrument and associated reports. Usage of this system has proven invaluable in identifying and investigating anomalies. So much so, that a scaled down version of the system is now available via a NOAA website for the general user community.

2. USER BENEFITS

The QC Trending System allows users to readily determine normal trending data and to easily pick out anomalies that show up in such parameters as Space, Warm Targets and sampled Nadir Earth Views. The users can see if there were any instrument changes which might correspond to their product changes. All the housekeeping and instrument parameters sampled are listed on the Web page in the Master List.

One example of anomaly detection was demonstrated when the NOAA-15 High resolution InfraRed Sounder (HIRS) instrument filter wheel began to have problems. Plots clearly showed as the motor current increased, the noise in the various channels increased until channels became unusable. Since this is a sporadic problem, there is no way to predict when the problem will occur. Using the QC trending system gives the user the ability to verify for themselves that this problem has resurfaced. They will be able to switch their operations before critical data is contaminated.

Another example of an anomaly readily seen in the QC trending plots is that of lunar intrusion. Lunar

intrusion occurs when the angle of the moon is such that the light from the moon actually enters the space view of instruments contaminating the data. This is a problem that NOAA is implementing algorithms to correct in processing the various instrument data. So far corrections have been implemented for the HIRS and Advanced Microwave Sounding Unit-B (AMSU_B) instruments. Lunar intrusion is also a problem in the AMSU-A and Advanced Very High Resolution Radiometer (AVHRR) data.

Although the system provided on the NOAA website indicated at the end of this paper is not the complete QC trending system, it can provide enough information for the user to benefit from its use.

3. ORBITAL DATA COLLECTION PROCESS

In this section, we will describe the entire QC Trending System although the complete complement of data mentioned here is not available to the general user community.

The Polar QC software is kicked off as soon as the 1B instrument data is available. Its job is to capture the orbital instrument data and produce statistics on such parameters as population, gross filtering counts, mean values, standard deviation, Min and Max values, 2-sigma rejection, calibration coefficients, engineering units(EU), quality flags, and Ramp statistics. Currently, there are more than 3400 active parameters in each of the Four Trending Resolutions (Res) of plot data and associated reports. The four trending resolution files are built in the following order: High, Medium, Low, and Day.

3.1 High Trending Resolution

The High Res data is defined based on the calibration period for each instrument and displayed/plotted from a selected Med Res plot period for that instrument. The high Res files are saved by orbit on Central Environmental Satellite Computer System(CEMSCS) for 30 days for the following instruments:

- GHRR (AVHRR Global Area Coverage), Defined as result of 5 scans, to produce detector Calibration Coefficients. (2.5 sec. duration)
- HIRS, Defined as data (>1 sample) in 256 sec, to produce detector Calibration Coefficients.

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- AMSU A&B, Defined as result of one scan, to produce detector Calibration Coefficients.

Plot: X axis - sequential occurrences from within a **selected** medium Res plot time period.
Report: X- Position, Y- Parameter Value, Start Scan line #, Start Scan Time.

3.2 Medium Trending Resolution - Figure 3

The medium res files are saved by orbit on CEMSCS for 60 days. Defined as:

- GHRR, plot of all (2) minute data periods within the orbit.
- HIRS(+), plot of all (256) second calibration periods within the orbit.
- AMSU A&B, plot of all (2) minute data periods within the orbit.

Plot: X axis - sequential occurrences within a **selected** Low Res plot.
Report: X- Position, Y- Parameter Value, Start Scan line #, Start Scan Time.

3.3 Low Trending Resolution - Figure 2

Stored by orbit value in a 14 month rotating file on CEMSCS. **Archived Yearly(Feb.)**

- GHRR, HIRS, AMSU A&B, result of all the medium resolution data values within each orbit.

Plot: X axis - sequential Orbit occurrences, 0 = Most recent.
Report: X- Position, Y- Parameter Value, 44 Character Data Set Name(DSN), *Length - Orbit time in Minutes, *14 orbit month data position in file. * = not shown in report

3.4 Day Trending resolution - Figure1

Defined as the data point parameter average of 14 orbits/24 hours over 61 days of data.

Plot: X axis - sequential Orbit occurrences, 0 = Most recent.
Report: X- Position, Y- Parameter Value, First 44 Character Data Set Name(DSN), *Length - Orbit in Minutes, *14 orbit month data position in file.

3.5 DAILY QC TRENDING ANALYSIS

Each morning the Daily QC processing is submitted by the CEMSCS auto scheduler. Its job is to highlight any orbital parameter anomalies (exceeding 6 times standard deviation of yesterdays 14 orbit values or exceeding specification limits) that have occurred in the last 24 hours and flag them. These Plot Data and Reports are sent via File Transfer Protocol(FTP) to the PC, for graphical display (of most recent 61 orbits) and analysis.

Orbit & Day TRENDING

Each morning the CEMSCS will transmit (from the rotating 14 orbit month file) the most recent orbit/days via FTP to the PC for viewing in two(2) forms: Most recent 61 **ORBIT** values and the most recent 61 **DAY** (average of 14 orbits/24 hours) values. These data sets (most recent 61 orbits, days and reports) are sent to the Internet server Web Page for distribution.

Medium & High Resolution Trending

From those previously downloaded data sets, Medium and High Res plots allow the user to search/analyze the Plots on the PC. They also can compare any parameter/s, from **multiple orbits** within each resolution. The most recent Medium Resolution orbit, data and reports are sent via FTP to the Internet server Web page each morning for distribution.

3.6 YEARLY TRENDING

Plots of 14 Orbit Months of selected parameters Vs. Orbit number and Julian day, from the current or Yearly Archival data file can be provided on demand.

4. WEB SITE PROVIDED DATA

Although the above section gives you information on the entire QC trending process used for NOAA -15,16, and 17, NOAA provides only the following data via the website to interested Instrument scientists and data users.

Day Trending resolution

- 61 Day trending values (day point, average of 14 orbits/ 24hours).

Low Trending Resolution

- 61 Orbital values (resultant of each orbit).

Medium Trending Resolution

- One Medium Resolution orbit per instrument, once per day.

A set of data and Report are provided for each of the following instruments (labels as indicated)

- GAC GHRR
- AMSU_A AMSA
- AMSU_B AMSB
- HIRS HIRS

The parameters represented in these plots varies, from instrument telemetry parameters to level 1B parameters, Quality flag checks and statistics. Over 3400 parameters can be observed. Check out the website for PC software, loading instructions and more information.

<http://www.osdpd.noaa.gov/PSB/PPP/CALIB/klm/index.html>

GHRR, WBB PRT1 TARGET TEMP,EU

| X | Y | Orbit DSN |
|----|---------|--|
| 0 | 288.287 | NSS.GHRR.NL.D02284.S0635.E0820.B1057778.WI |
| 1 | 288.286 | NSS.GHRR.NL.D02283.S0646.E0832.B1056364.WI |
| 2 | 288.275 | NSS.GHRR.NL.D02282.S0656.E0843.B1054950.WI |
| 3 | 288.271 | NSS.GHRR.NL.D02281.S0707.E0854.B1053536.WI |
| 4 | 288.271 | NSS.GHRR.NL.D02280.S0718.E0913.B1052122.GC |
| 5 | 288.273 | NSS.GHRR.NL.D02279.S0730.E0924.B1050708.GC |
| 6 | 288.268 | NSS.GHRR.NL.D02278.S0741.E0935.B1049394.GC |
| 7 | 288.253 | NSS.GHRR.NL.D02277.S0611.E0757.B1047879.WI |
| 8 | 288.244 | NSS.GHRR.NL.D02276.S0622.E0808.B1046465.WI |
| 9 | 288.248 | NSS.GHRR.NL.D02275.S0635.E0819.B1045051.WI |
| 10 | 288.241 | NSS.GHRR.NL.D02274.S0645.E0831.B1043637.WI |
| 11 | 288.241 | NSS.GHRR.NL.D02273.S0656.E0842.B1042223.WI |
| 12 | 288.23 | NSS.GHRR.NL.D02272.S0706.E0853.B1040809.WI |
| 13 | 288.231 | NSS.GHRR.NL.D02271.S0718.E0912.B1039495.GC |
| 14 | 288.229 | NSS.GHRR.NL.D02270.S0918.E1051.B1038182.GC |
| 15 | 288.232 | NSS.GHRR.NL.D02269.S0929.E1102.B1036768.GC |
| 16 | 288.232 | NSS.GHRR.NL.D02268.S0940.E1114.B1035354.GC |
| 17 | 288.227 | NSS.GHRR.NL.D02267.S0953.E1125.B1033940.GC |
| 18 | 288.225 | NSS.GHRR.NL.D02266.S1003.E1136.B1032526.GC |
| 19 | 288.216 | NSS.GHRR.NL.D02265.S1001.E1147.B1031112.GC |
| 20 | 288.217 | NSS.GHRR.NL.D02264.S1025.E1158.B1029798.GC |

Example of Daily Average Plot and associated Report , EU = Degrees Kelvin

GHRR,WBB PRT1 TARGET TEMP,EU

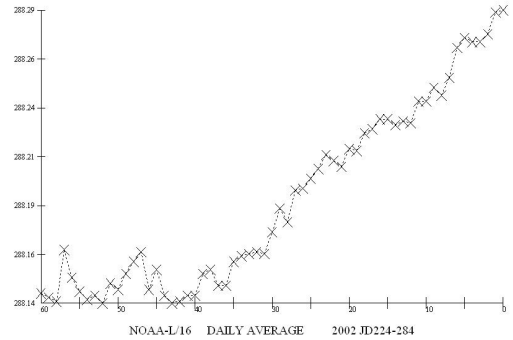


Figure 1

GHRR, WBB PRT1 TARGET TEMP,EU

| X | Y | Orbit DSN |
|----|---------|--|
| 0 | 288.283 | NSS.GHRR.NL.D02284.S0635.E0820.B1057778.WI |
| 1 | 288.31 | NSS.GHRR.NL.D02284.S0446.E0639.B1057677.WI |
| 2 | 288.388 | NSS.GHRR.NL.D02284.S0257.E0451.B1057576.WI |
| 3 | 288.338 | NSS.GHRR.NL.D02284.S0109.E0302.B1057475.WI |
| 4 | 288.264 | NSS.GHRR.NL.D02283.S2326.E0113.B1057374.GC |
| 5 | 288.318 | NSS.GHRR.NL.D02283.S2142.E2329.B1057273.GC |
| 6 | 288.304 | NSS.GHRR.NL.D02283.S1953.E2148.B1057072.GC |
| 7 | 288.27 | NSS.GHRR.NL.D02283.S1810.E1958.B1056971.WI |
| 8 | 288.134 | NSS.GHRR.NL.D02283.S1645.E1815.B1056970.WI |
| 9 | 288.231 | NSS.GHRR.NL.D02283.S1505.E1650.B1056869.GC |
| 10 | 288.281 | NSS.GHRR.NL.D02283.S1325.E1510.B1056768.GC |
| 11 | 288.356 | NSS.GHRR.NL.D02283.S1144.E1330.B1056667.GC |
| 12 | 288.292 | NSS.GHRR.NL.D02283.S1003.E1149.B1056566.GC |
| 13 | 288.246 | NSS.GHRR.NL.D02283.S0828.E1008.B1056465.GC |
| 14 | 288.274 | NSS.GHRR.NL.D02283.S0646.E0832.B1056364.WI |
| 15 | 288.316 | NSS.GHRR.NL.D02283.S0500.E0650.B1056263.WI |
| 16 | 288.371 | NSS.GHRR.NL.D02283.S0310.E0504.B1056162.WI |
| 17 | 288.352 | NSS.GHRR.NL.D02283.S0123.E0314.B1056061.WI |
| 18 | 288.241 | NSS.GHRR.NL.D02282.S2343.E0125.B1055960.GC |
| 19 | 288.386 | NSS.GHRR.NL.D02282.S2155.E2348.B1055859.GC |
| 20 | 288.268 | NSS.GHRR.NL.D02282.S2010.E2159.B1055758.GC |

Example of Low Res Orbital Value Plot and associated Report , EU = Degrees Kelvin

GHRR,WBB PRT1 TARGET TEMP,EU

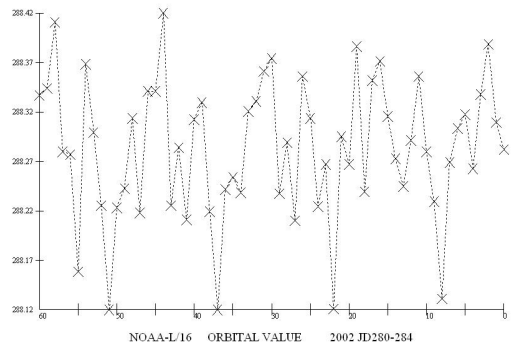


Figure 2

GHRR, WBB PRT1 TARGET TEMP,EU - MED RES ,ORB# 1057778

| X | Y | Scan# | Time |
|----|---------|-------|----------|
| 1 | 289.052 | 1 | 06:35:02 |
| 2 | 288.924 | 236 | 06:36:59 |
| 3 | 288.791 | 471 | 06:38:57 |
| 4 | 288.672 | 706 | 06:40:54 |
| 5 | 288.548 | 941 | 06:42:52 |
| 6 | 288.432 | 1176 | 06:44:49 |
| 7 | 288.324 | 1411 | 06:46:47 |
| 8 | 288.227 | 1646 | 06:48:44 |
| 9 | 288.135 | 1881 | 06:50:42 |
| 10 | 288.051 | 2116 | 06:52:39 |
| 11 | 287.966 | 2351 | 06:54:37 |
| 12 | 287.869 | 2586 | 06:56:34 |
| 13 | 287.774 | 2821 | 06:58:32 |
| 14 | 287.687 | 3056 | 07:00:29 |
| 15 | 287.614 | 3291 | 07:02:27 |
| 16 | 287.545 | 3526 | 07:04:24 |
| 17 | 287.467 | 3761 | 07:06:22 |
| 18 | 287.377 | 3996 | 07:08:19 |
| 19 | 287.286 | 4231 | 07:10:17 |
| 20 | 287.204 | 4466 | 07:12:14 |
| 21 | 287.214 | 4701 | 07:14:12 |
| 22 | 287.229 | 4936 | 07:16:09 |
| 23 | 287.222 | 5171 | 07:18:07 |
| 24 | 287.193 | 5406 | 07:20:04 |
| 25 | 287.188 | 5641 | 07:22:02 |
| 26 | 287.224 | 5876 | 07:23:59 |
| 27 | 287.266 | 6111 | 07:25:57 |
| 28 | 287.361 | 6346 | 07:27:54 |
| 29 | 287.487 | 6581 | 07:29:52 |
| 30 | 287.628 | 6816 | 07:31:49 |
| 31 | 287.768 | 7051 | 07:33:47 |
| 32 | 287.914 | 7286 | 07:35:44 |
| 33 | 288.065 | 7521 | 07:37:42 |
| 34 | 288.194 | 7756 | 07:39:39 |
| 35 | 288.309 | 7991 | 07:41:37 |
| 36 | 288.423 | 8226 | 07:43:34 |
| 37 | 288.535 | 8461 | 07:45:32 |
| 38 | 288.647 | 8696 | 07:47:29 |
| 39 | 288.781 | 8931 | 07:49:27 |
| 40 | 288.891 | 9166 | 07:51:24 |
| 41 | 288.98 | 9401 | 07:53:22 |
| 42 | 289.087 | 9636 | 07:55:19 |
| 43 | 289.189 | 9871 | 07:57:17 |
| 44 | 289.283 | 10106 | 07:59:14 |
| 45 | 289.365 | 10341 | 08:01:12 |
| 46 | 289.416 | 10576 | 08:03:09 |
| 47 | 289.459 | 10811 | 08:05:07 |
| 48 | 289.503 | 11046 | 08:07:04 |
| 49 | 289.473 | 11281 | 08:09:02 |
| 50 | 289.425 | 11516 | 08:10:59 |
| 51 | 289.333 | 11751 | 08:12:57 |
| 52 | 289.227 | 11986 | 08:14:54 |
| 53 | 289.094 | 12221 | 08:16:52 |
| 54 | 288.959 | 12456 | 08:18:49 |

Example of Medium Res(2 minute) Plot and associated Report, EU = Degree Kelvin

GHRR,WBB PRT1 TARGET TEMP,EU

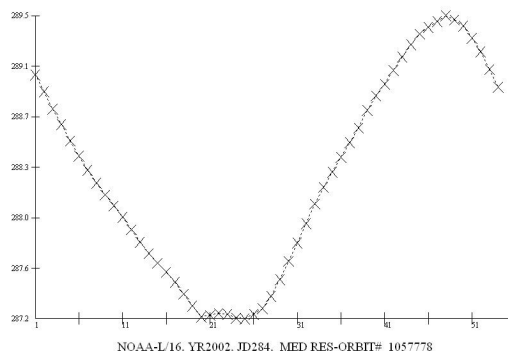


Figure 3