

How is the Data Quality Office Doing?

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Introduction

The Atmospheric Radiation Measurement (ARM) Program has collected data from its Southern Great Plains (SGP) climate research facility since late 1992, from its Tropical Western Pacific (TWP) site since 1996, and from its North Slope of Alaska (NSA) site since 1997. There are numerous instrument platforms at each site, including radiometer suites that measure solar and terrestrial radiation; tower-mounted instruments that measure wind, temperature, and humidity; subterranean sensors that measure soil moisture and thermal properties; a host of cloud-observing instruments that measure cloud extent and microphysical properties; and instruments for observing atmospheric aerosols.

The main goal of ARM is to improve the treatment of cloud and radiation properties in climate models. To this end, the quality of the data collected by the program is crucial to the scientific success or the current research effort and for future data users. The ARM Data Quality Office (DQO) was established in July 2000 to coordinate the inspection, assessment, and reporting of ARM data quality.

Since its inception, the DQO has established tools and procedures for performing automated and manual inspections of data on a daily to weekly basis. These tools are contained within the Data Quality Health and Status (DQ HandS) system (<http://dq.arm.gov/>). This system allows for the quick identification of data problems and the initiation of the problem-resolution process. Checking includes cross-instrument comparisons when possible and longer-term views to track calibration drift or performance degradation. A recent look at instrument problems at SGP has revealed a noticeable improvement in the time it takes to identify and fix a problem. Previous to the existence of the DQ HandS tool, the time from problem identification to resolution was 37 days. This has been reduced to 21 days. Also, the number of data “surprises” has drastically decreased. This can be attributed to more frequent and better data inspection, and better communication between the DQO, site operators, site scientists, and instrument mentors.

Inspection, Assessment, and Reporting Process

The process of data inspection, assessment, and reporting using DQ HandS is described in the rest of this paper.

1. Enter DQ HandS (Figure 1).



Figure 1. DQ HandS entry portal.

2. Indicate a scenario to inspect—site, datastream, facility, and date range (Figure 2).

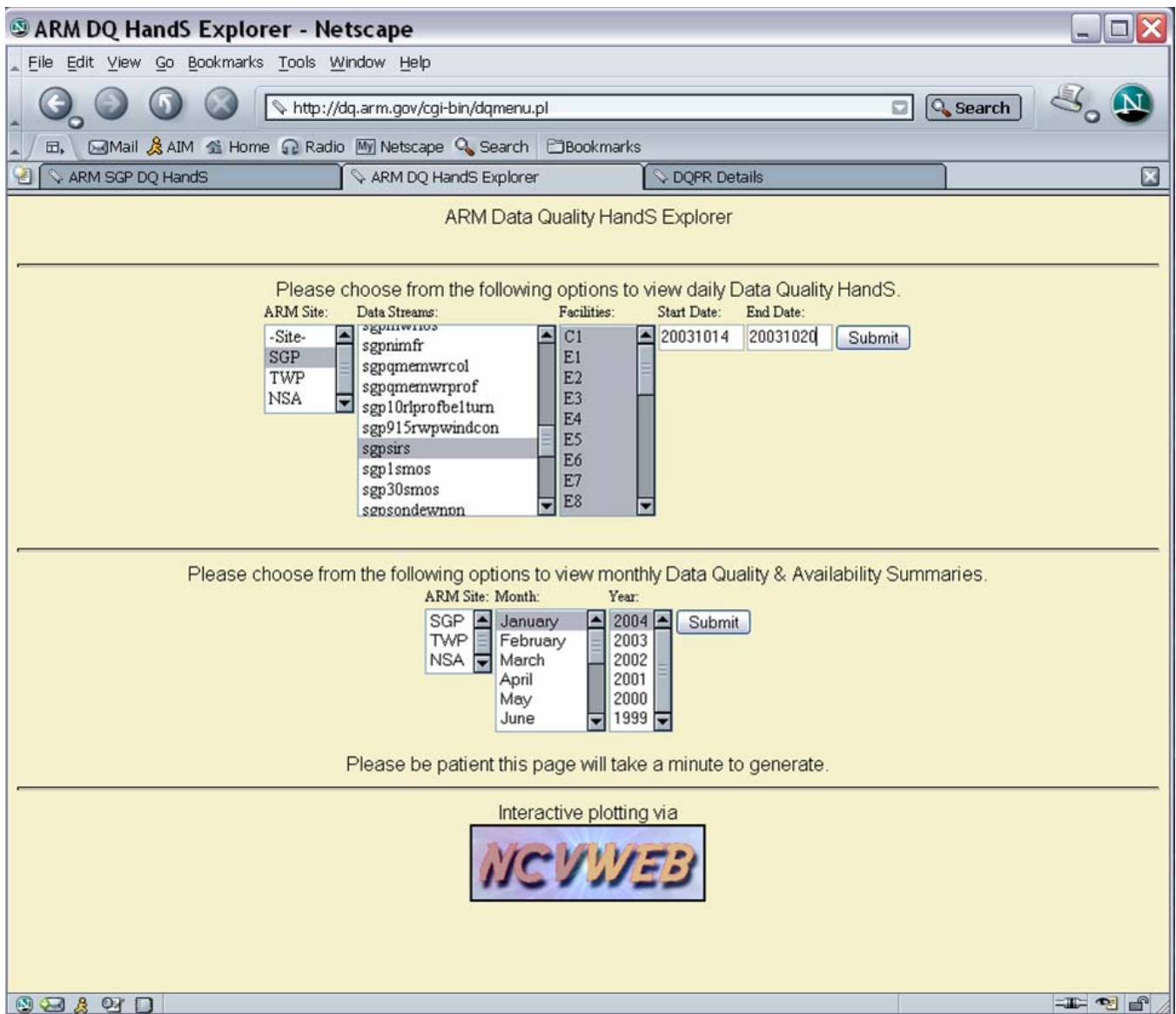


Figure 2. Scenario for SGP Solar and Infrared Radiation System (SIRS), facility E9, for October 14-20, 2003.

- Based on the scenario selected, a display of the daily automated quality control (QC) then results (Figure 3).

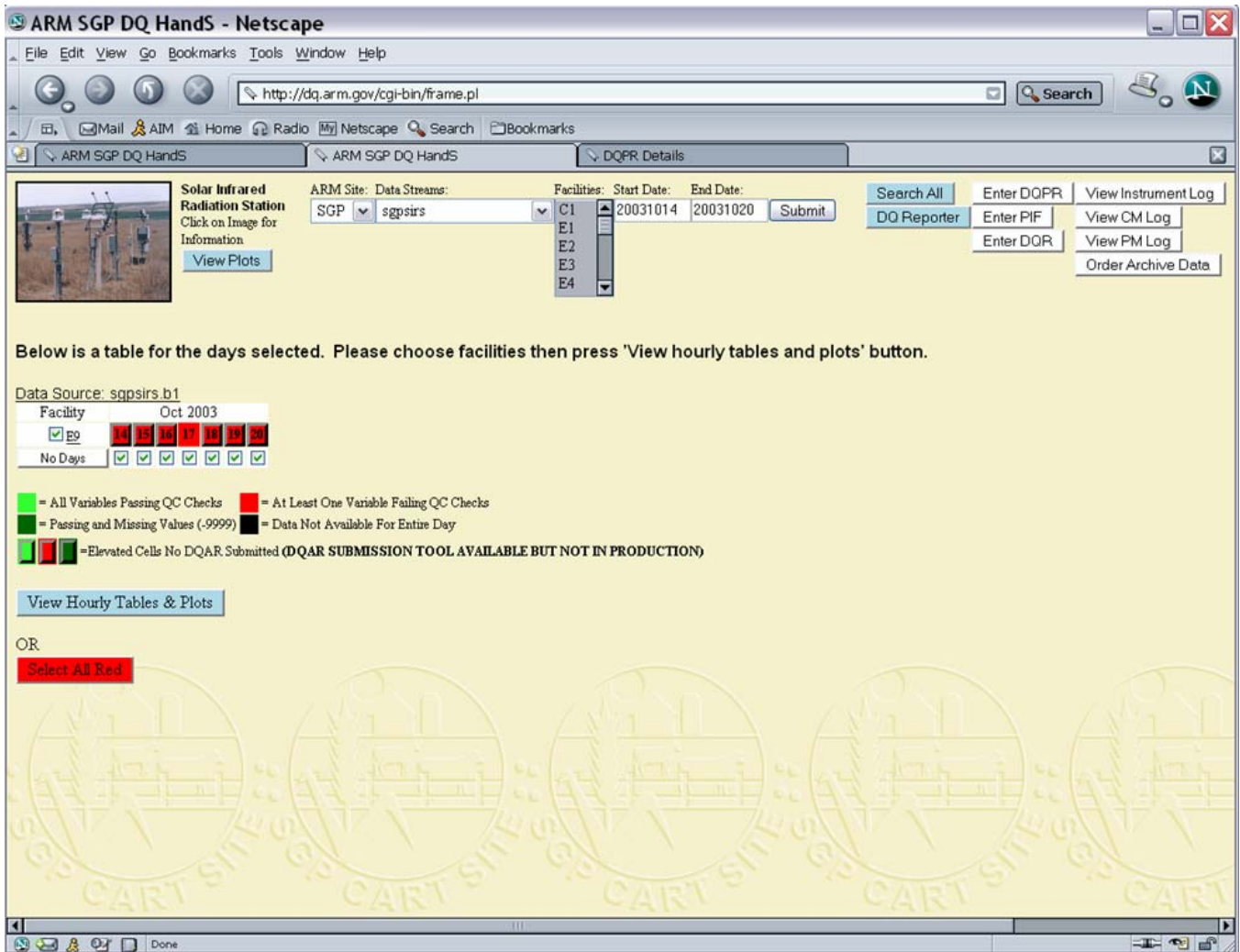


Figure 3. Daily QC results for E9.

- All 7 days above are shown as “red,” which means that at least one observation during each day failed some automated test – let’s look at the hourly table of results for one of these days (October 14) to see what is going on (Figure 4).

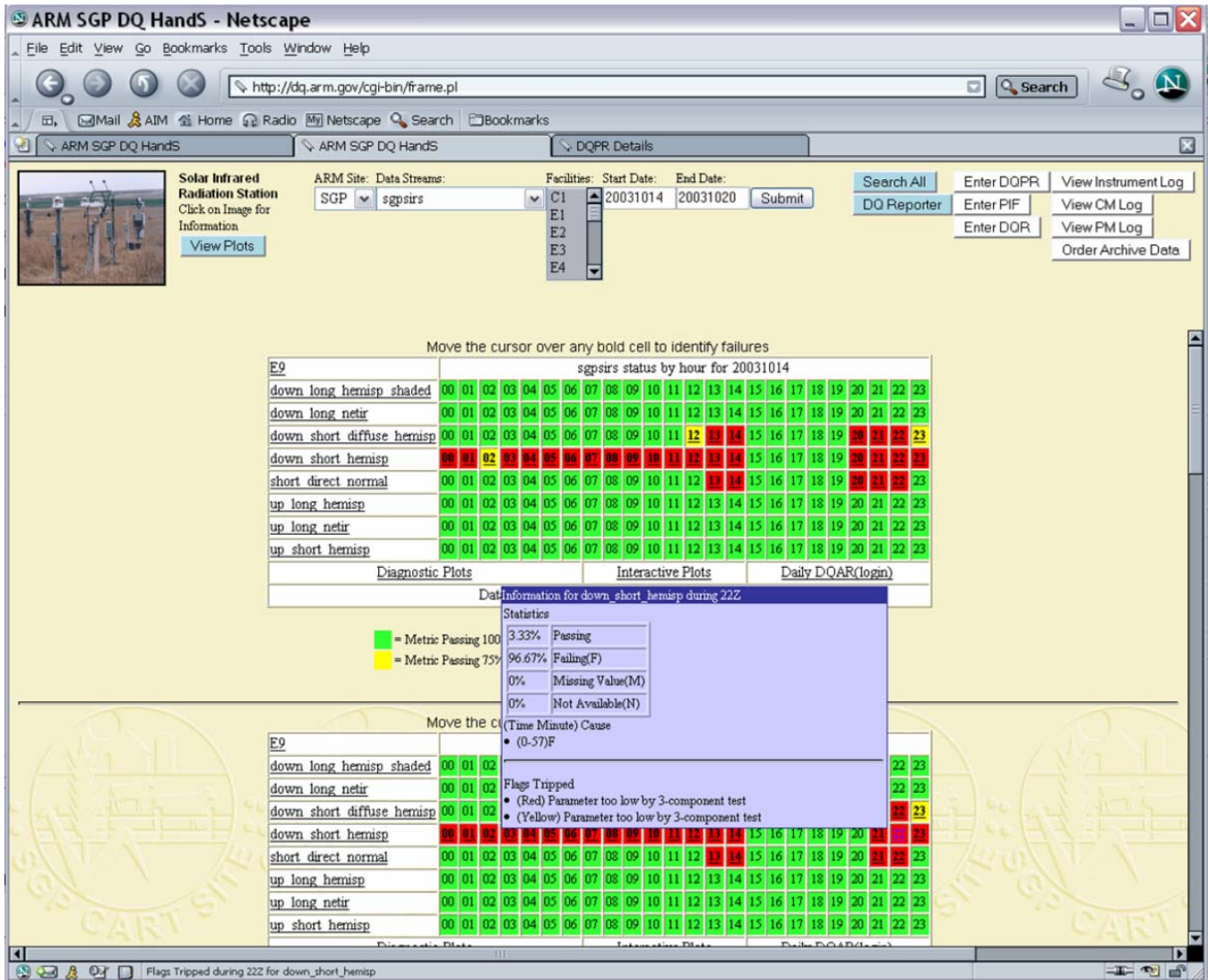


Figure 4. Hourly QC results for October 14, 2003, at E9.

- Figure 4 shows that the downwelling shortwave hemispheric irradiance measurement is consistently failing the 3-component test during the day, comparing this measurement to a derived value based on the corresponding direct normal and diffuse irradiance measurements. At night, the measurement is failing a minimum test. The diagnostic plot (Figure 5), used to further assess the situation, indicates that the hemispheric measurements are consistently 30-50 W/m^2 lower than the derived values, and sometimes fall below zero at night.

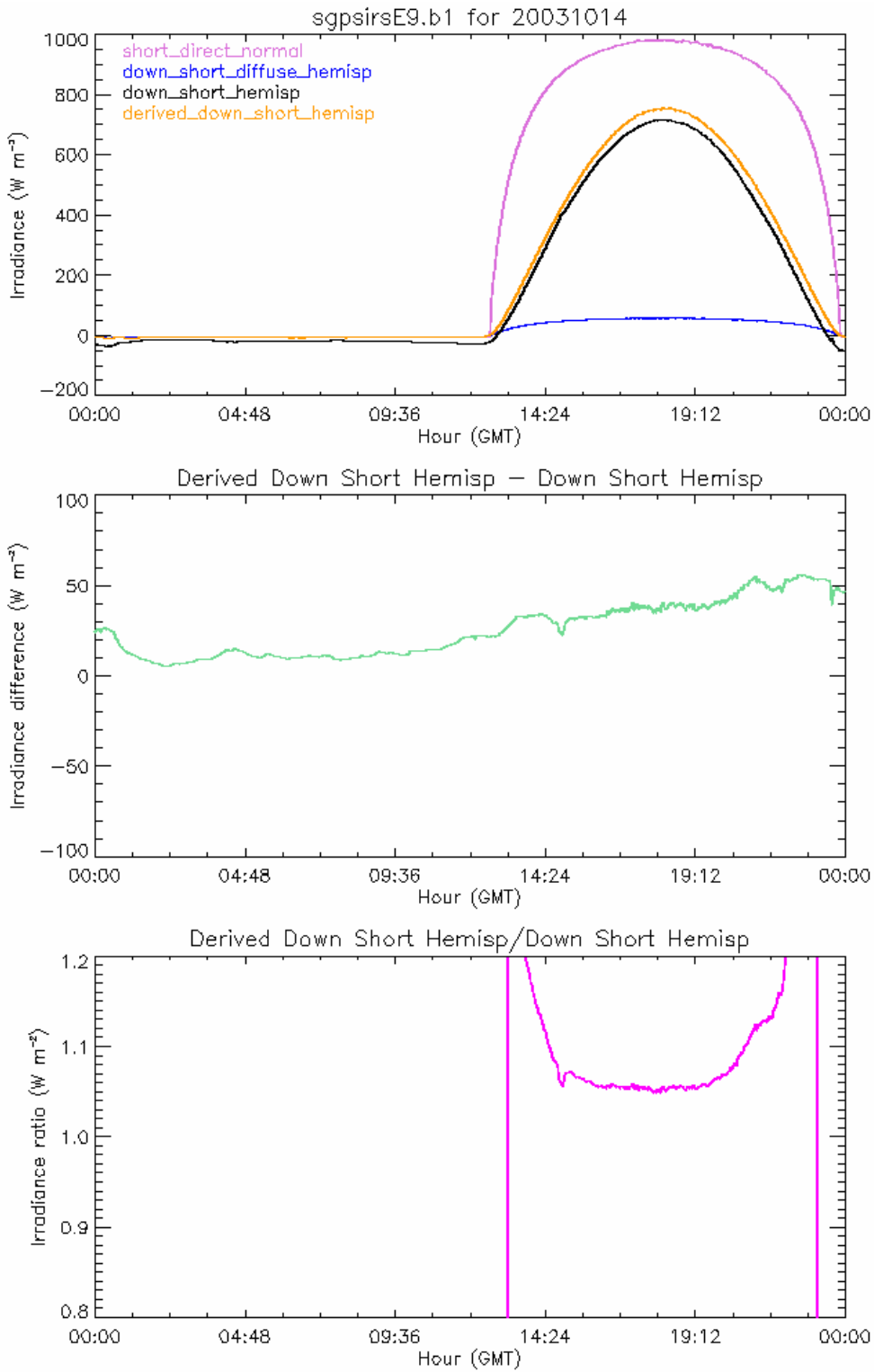


Figure 5. Diagnostic plots for SGP SIRS at E9 on October 14, 2003.

- Let's look at any available supporting information, such as the instrument log and previous reports that may have been filed. The instrument log (Figure 6) shows previous to the reporting period that logger voltage was being monitored, and subsequent to the period the radiometers were changed out. The problem report window (Figure 7) shows that a Data Quality Problem Report (DQPR) was filed on this problem and a subsequent Data Quality Report (DQR) to data users was written.

Date	Initials	Description
10/21/03	ZW	PM. The SIRS radiometer change out for calibration was due. R/R the SIRS *DD radiometer @ 1500 GMT. R/R the SIRS **US radiometer. R/R the SIRS ***NIP radiometer. R/R the SIRS ****DS radiometer. Uploaded the new program @ 1539 GMT. Status OK. RTS 1600 GMT. *Old - 33235 *New - 33787 **Old - 30951F3 **New - 31098F3 ***Old - 30718E6 ***New - 29738E6 ****Old - 31626F3 ****New - 30894F3
10/7/03	SS	PM and monitor instrument. The request was made to check the internal battery voltage in the CR10X data loggers. The voltage was checked and was reading 3.1 at 1600 GMT. RTS 1615 GMT. Status was OK at this time.
9/23/03	SS	PM and monitor instrument. RTS 1555 GMT. Status was OK at this time.
9/9/03	SS	PM and monitor instrument. Performed screen cleaning and cable check. RTS 1535 GMT. Status was OK at this time.

Figure 6. Instrument log for E9.

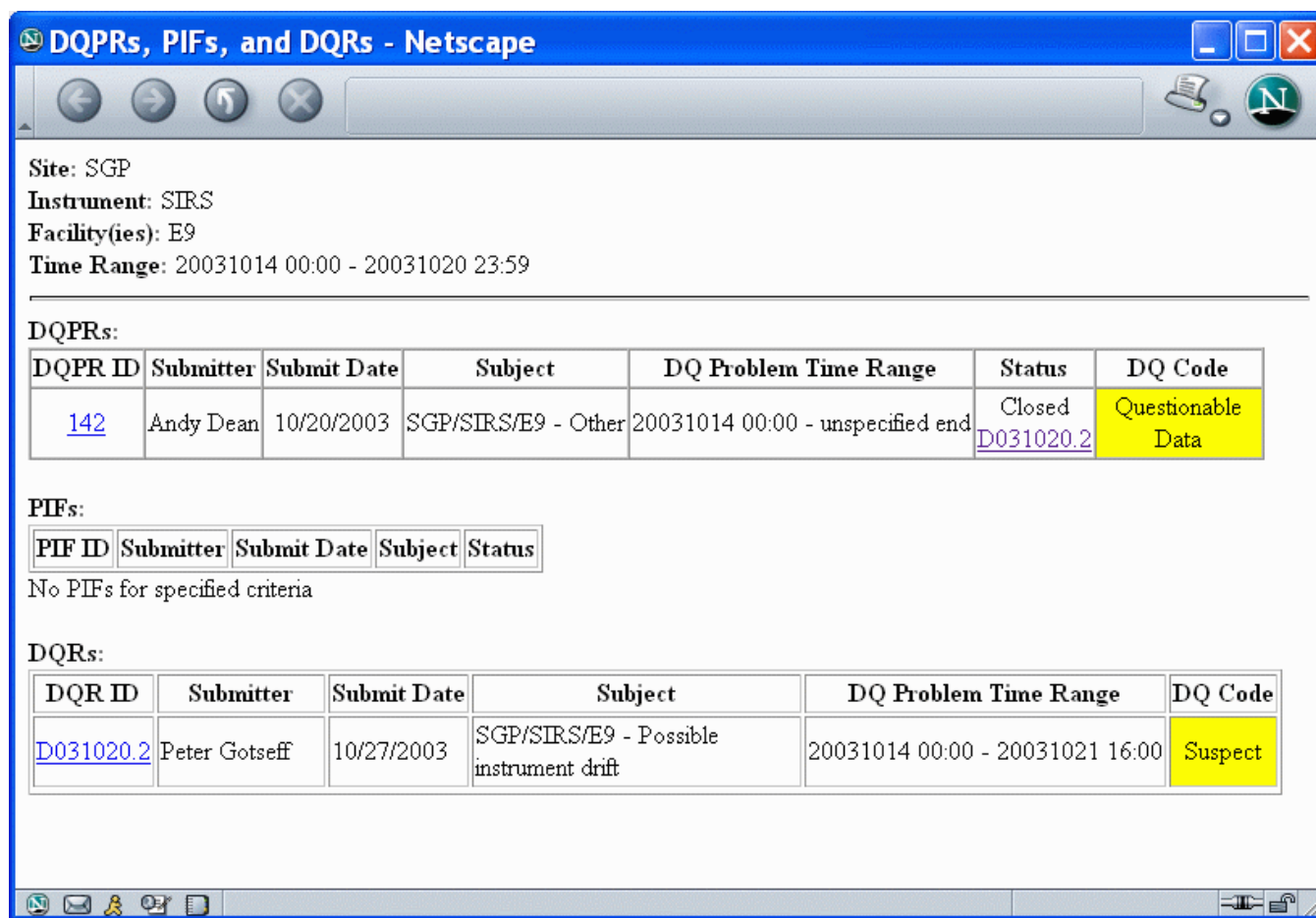


Figure 7. Problem report window for E9.

- It is worth looking at DQPR 142 (Figure 8) for this problem, since this is the procedure through which the DQO alerts the instrument mentor, site scientist, and site operator that a problem has been found, and that it needs to be resolved. The DQPR process captures all discussion and key information about the resolution. This one indicates that a DQO analyst noticed the problem described in step 5 above and filed the report on October 20. The site operator responded that these radiometers were scheduled for a changed out on October 21, and were indeed replaced that day. Data were rechecked on October 27 and found to be acceptable (Figure 9) – the actual hemispheric measurement now closely matches the derived measurement, and does not fall below zero at night – so the problem report was closed that day and a DQR was written by the instrument mentor on November 6. The DQR is shown in Figure 10 – it describes the problem and its resolution. This report is attached with data when ordered from the ARM Data Archive.

DQPR Details - Netscape

File Edit View Go Bookmarks Tools Window Help

http://www.db.arm.gov/cgi-bin/DQPR/search/DQPRDetails.pl?DQPRNo=142&person_id=4948&menuid=0&menudp Search

ARM SGP DQ Hands ARM SGP DQ Hands DQPR Details

You are logged in as user: DQO - Andy Dean

Data Quality Problem Report (DQPR): 142

Issue Date: 10/20/2003 **DQPR Originator:** DQO - Andy Dean
Date Closed: 11/6/2003
Location: SGP - E9: Ashton, KS
Instrument: SIRS

DQProblem Date Range:
 Start: 10/14/2003 00:00
 End: unspecified

QA Code: Questionable Data
QA Reason(s): Other

Problem Description:
 Downwelling shortwave values appear to be too low... dropping below -10 W/m² at night and being 30-50 W/m² lower than DS calculated from direct and diffuse measurements during the day. This is probably a gradually worsening problem, though it became more noticeable beginning on 10/14, when nighttime values began to drop below -10 W/m² consistently.

DQPR HISTORY:

Entry Date/Time (GMT)	Who	Comment
10/20/2003 20:32	OPS - David Breedlove	<u>ASSESSMENT OF SUSPECTED CAUSE</u> The radiometers are scheduled for calibration replacement this week. Assessment of other possible causes for this indication will be made (i.e. cable connections, dirty domes ect.)
10/27/2003 17:35	OPS - David Breedlove	<u>MAINTENANCE PERFORMED</u> The radiometers were replaced at 1600 GMT.
10/27/2003 17:35	OPS - David Breedlove	Please evaluate the data for correction.
10/27/2003 17:52	DQO - Andy Dean	Data quality is much improved since the radiometers were changed out on 10/23. This DQPR can be changed to "pending DQR".
10/27/2003 19:50	IM/SSST - Don Bond	The status of this DQPR has been changed to Pending DQR
11/06/2003 19:47	IM - Peter Gotseff	DQR D031020.2 submitted and Reviewed by PRB

Current DQPR Status: Closed

Enter a comment:

Submit Comment

Figure 8. Data Quality Problem Report 142 for SIRS at E9.

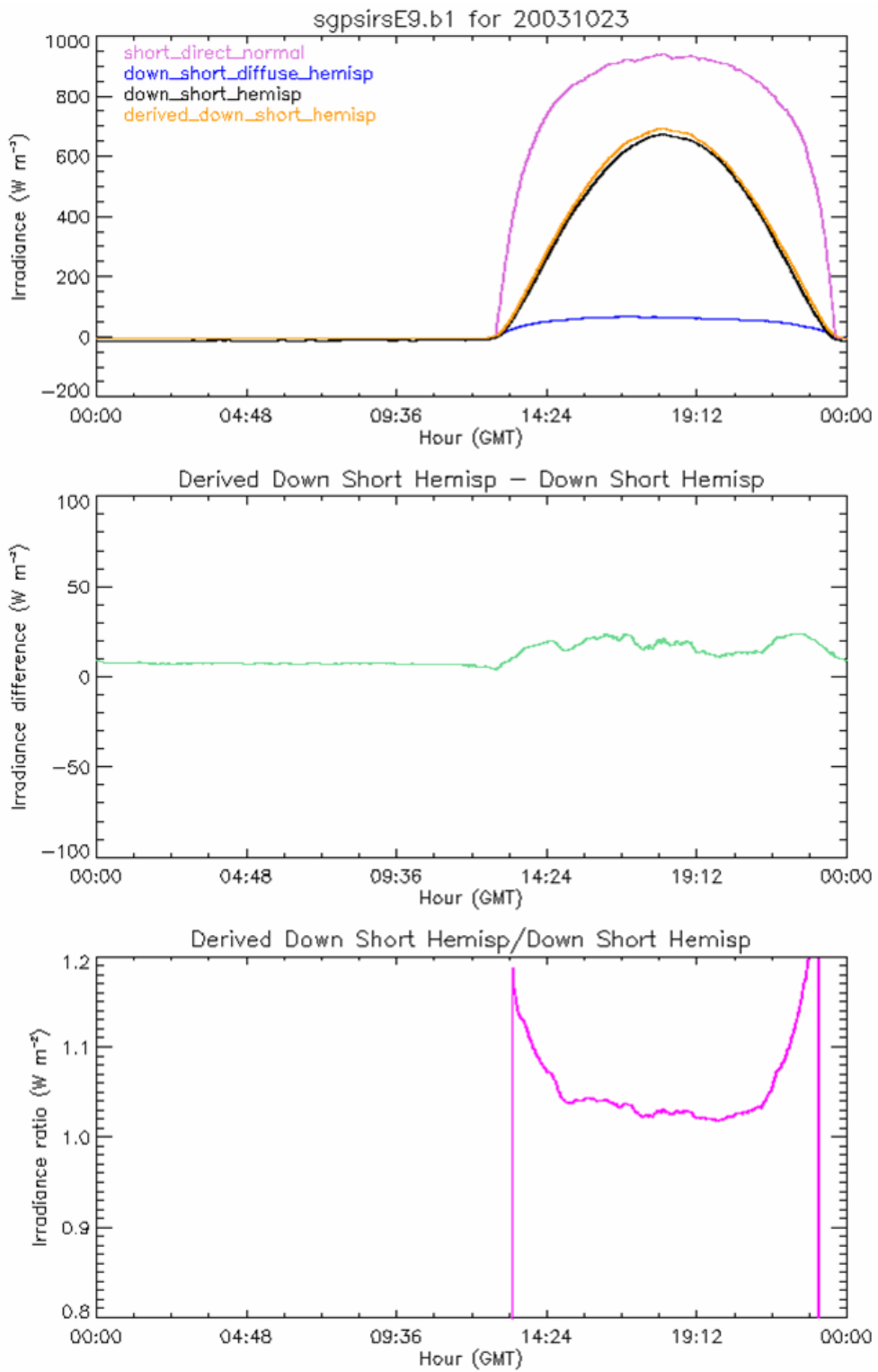


Figure 9. Diagnostic plots for SGP SIRS at E9 on October 23, 2003, after corrective maintenance activity.

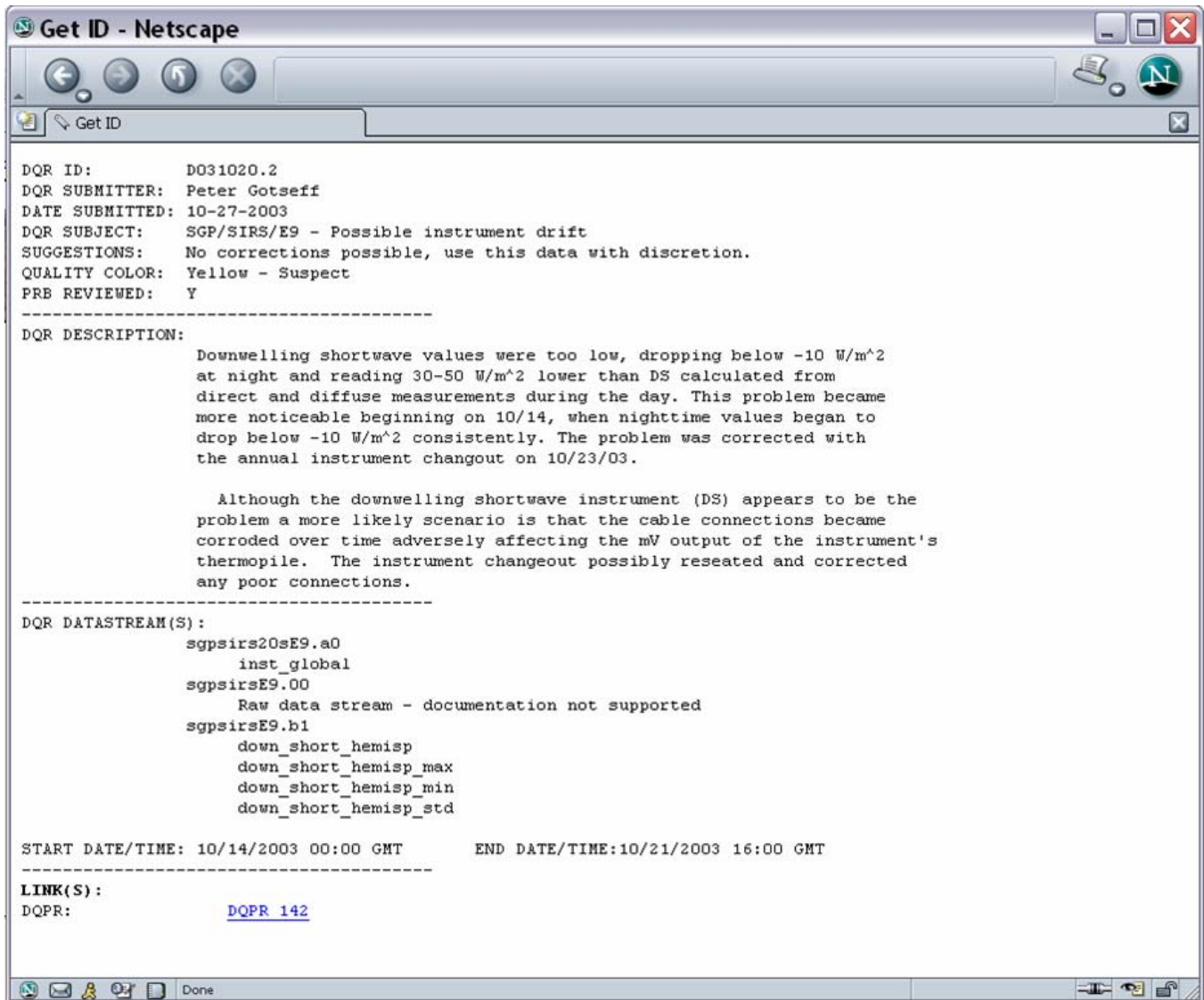


Figure 10. Data Quality Report (DQR) for SGP SIRS at E9.

Summary

Overall, the DQ HandS system continues to improve data quality inspection, assessment, and reporting success and speed, through (1) more frequent inspection and assessment, (2) quicker and more meaningful communication and interaction with site operators, site scientists, and instrument mentors, (3) comprehensive reporting of problems and their formal documentation, and (4) faster resolution of problems, minimizing the amount of unacceptable data collected.

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