

Department of the Interior  
U.S. Geological Survey

# LANDSAT 7 DATA QUALITY VALIDATION PLAN

**Version 3**

**March 2003**





## Executive Summary

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This Data Quality Validation Plan was written to provide the International Cooperators (ICs) and the U.S. Geological Survey (USGS) with a clear and concise reference document when preparing to send Raw Computer Compatible (RCC) and/or Level Zero Reformatted Distribution product (L0Rp) data to the USGS for data validation.

Under the provisions of the Memorandum of Understanding (MOU) and Annexes, a framework for bilateral data exchange was established between the IC and the USGS.

The reasons for data validation are:

- To certify the quality of RCC data and/or L0Rp products generated by the USGS and the ICs are able to acquire data for key government programs
- To establish a framework for data transfer between the USGS and an IC
- To provide for data exchange in the event of a loss of Landsat 7 Solid-State Recorder (SSR) capabilities

This document is under the control of the Landsat Configuration Control Board (LCCB). Landsat Configuration Change Requests (LCCR) to this document, as well as supportive material justifying the proposed changes, should be submitted to the Landsat Mission Management Office (MMO).

*Keywords: Raw Computer Compatible (RCC), International Ground Station (IGS), Level Zero Reformatted Distribution Product (L0R), Data Quality Validation Plan.*

## Document Change Summary

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## **Section 1 Introduction**

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### **1.1 Purpose**

This Data Quality Validation Plan defines the conditions and procedures used to validate the interchangeability, comparability and quality of Landsat 7 data from the USGS and the International Ground Stations (IGS) in support of the Landsat Project.

### **1.2 Overview and Background**

A bilateral data quality validation is established under the provisions of the MOU between the USGS and the IGS. Data quality validation is essential to the success of the Data Exchange Implementation Plan. This will provide the USGS and the IGS with the ability to extract, ingest and process Landsat 7 image data bilaterally while assuring the data are of equivalent quality.

### **1.3 Goals and Objectives**

The goals and objectives of this data validation plan are to:

- Validate that the approved data exchange formats outlined in the appropriate Data Format Control Books and product specifications are used
- Validate data are interchangeable between the USGS and the IGS
- Validate Landsat 7 image data are of equivalent quality

## **Section 2 Definitions and Requirements**

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### **2.1 Definition**

Data validation consists of extracting, ingesting and processing the RCC and/or LORp data in Hierarchical Data Format (HDF) from one of the approved choices of media. Data quality validation covers both transfers to the USGS from an IGS and to an IGS from the USGS. The data validation exercise includes evaluating the conformity to the relevant DFCB and ensures the IGS data quality is equivalent to the USGS data. The USGS shall be the primary monitor of data quality validation for the Landsat Project.

### **2.2 Data Format**

Data validation formats shall either be RCC data or LORp products in HDF. RCC data shall be specified by subinterval start/stop times and/or path/rows, date and time acquired. All dates will utilize the Julian calendar format. All times will use Greenwich Mean Time (GMT). The LORp data shall be specified by path/row and acquisition date/time and delivered in a single Worldwide Reference System (WRS) scene-oriented manner. The IGS are required to use versions of HDF4 for data-quality validation purposes.

### **2.3 Data Requirements**

The IGS will supply validation data, received at their ground station, to the USGS until that ground station's data are successfully extracted, ingested and processed on the Landsat 7 Processing System (LPS) and/or the Image Assessment System (IAS). The USGS will provide data to the IGS station unique to that station's coverage circle to determine the ability of an IGS to successfully extract, ingest and process the data furnished by the USGS.

### **2.4 Media Requirements**

The RCC data validation media options include:

- Digital Linear Tape (DLT) 7000
- DLT 8000
- Super DLT
- File Transfer Protocol (FTP)

Media options available for the LORp product validation include:

- CD
- DLT 7000
- DLT 8000
- Super DLT
- FTP



## **2.5 Corresponding Data Comparison**

The IGS will capture a subinterval of Landsat 7 image data directly downlinked to their ground station located in their station coverage circle. That same subinterval will also be downlinked from the SSR to the USGS ground station. The USGS will be responsible for managing the corresponding data through the Mission Management Officer (MMO), the Mission Operations Center (MOC) and/or will obtain the corresponding data located in the USGS archive. The revalidation process will occur for an IGS on a biannual basis once the USGS has the ability to extract, ingest and process RCC and/or LORp data from that IGS.

Ground stations using RCC data for validation purposes will copy the Landsat 7 image data to one of the required media and ship them to the USGS with all supplementary information. Upon arrival at the USGS, that image data will be extracted, ingested, processed and compared to the image data that was received and processed from the SSR to the USGS.

Ground stations using LORp data will write their LORp product in HDF to the required media and ship to the USGS with all supplementary information. That same Landsat 7 image data will also be downlinked to USGS via SSR and processed to an LORp product for data-quality validation comparisons. Both the USGS and IGS LORp data will be processed to a Level 1 Geometrically Corrected (L1G) product and will be compared to validate that the data are of equivalent quality.

## **2.6 Supplementary Information**

Information such as path/row(s), ground station data originated from, acquisition date/time, subinterval start/stop times and the method used to write data to the media (e.g., block size, tar) is required in order to gather information for the documentation of the data quality validation exercise. This information shall accompany all validation data shipped to the USGS.

## **2.7 Scheduling and Frequency**

Initially, data exchanged for validation purposes will be scheduled twice per year with the option of becoming an annual event at the discretion of the Landsat Project Manager or the MMO. Stations will be notified and requested to deliver validation data biannually. An IGS may request data from the USGS at any time but not more than twice per year for validation purposes. The IGS are not required to request validation data at any time. However the USGS will provide validation data to the IGS annually. Additional data sets may be provided with the approval of the Landsat Project Manager.

## **Section 3 Data Quality Validation Procedures**

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### **3.1 Validation Diagram**

The validation diagrams contained in Appendix A outline the data flow which the IGS data will follow in validating RCC and LORp data received from an IGS.

### **3.2 Raw Computer Compatible Data Validation**

The objectives of the RCC data quality validation are to extract and process the IGS data on the LPS and compare the processed IGS data to the corresponding USGS metadata information.

- The media containing the IGS RCC data will be inspected for damage and logged into a database with all supplementary information.
- A checklist will be initiated that will follow the Landsat 7 image data until extraction, ingestion and processing of the Landsat 7 image data fails or is successfully validated.
- Landsat 7 image data will be extracted/ingested to the Data Capture System (DCS).
- The IGS RCC data will be ingested into the LPS once it is determined that the RCC file names are correct.
- If IGS RCC file names are found incorrect according the RCC DFCB, the specific IGS will be notified.
- If the RCC data are correctly named, that data will be processed on the LPS.
- The IGS metadata will be compared to the corresponding USGS metadata for verification of equivalent quality when processing is successful.
- IGS data found to be of equivalent quality to the USGS data will be flagged as validation data and transferred to the Landsat Archive Manager (LAM).
- If processing fails, the IGS will be notified of failure and new data will be requested.
- The successfully processed data will be sent to the LAM where that data will reside until it is ordered by the IAS for further processing and quality comparisons. See Section 3.3 for further ingest, processing and validation comparisons.

### **3.3 LORp Data Validation**

- The LORp data quality validation ensures that the IGS LORp data in HDF meet the DFCB conformance to specifications and that the IGS data are of equivalent quality to USGS data.
- The media containing the IGS LORp data will be inspected for damage and logged into a database. LORp data received via FTP will be written to media for future USGS records and reference.
- A checklist will be initiated which will follow the LORp data until the extraction, ingestion and processing of the Landsat 7 image data fails or is successfully validated.

- The LORp data will be extracted to the IAS.
- Software tools will determine if:
  - Files are in HDF
  - Files are consistent with LORp DFCB and are consistent with product specifications
  - Vdata and Vgroup naming conventions are correct
  - MSCD and Payload Correction Data (PCD) start/stop times comply with the DFCB
- The IGS LORp data will be ingested into the IAS.
- If ingest fails, the IGS will be notified by the USGS who will include details why the LORp data failed ingest.
- Data ingested successfully will be processed on the IAS to a Level 1G product.
- The IGS will then be compared to the corresponding USGS L1G scene for verification of equivalent quality.

### **3.4 Routine Publication of Validation Results**

The USGS will report to each ground station directly regarding performance during the validation or revalidation exercise. Initial distribution shall be limited to the Landsat Technical Working Group (LTWG) and the Landsat Ground Station Operations Working Group (LGSOWG) participants. A summary of each station's performance will be made available to the LTWG and the LGSOWG.

## **Section 4 IGS Roles and Responsibilities in Data Validation**

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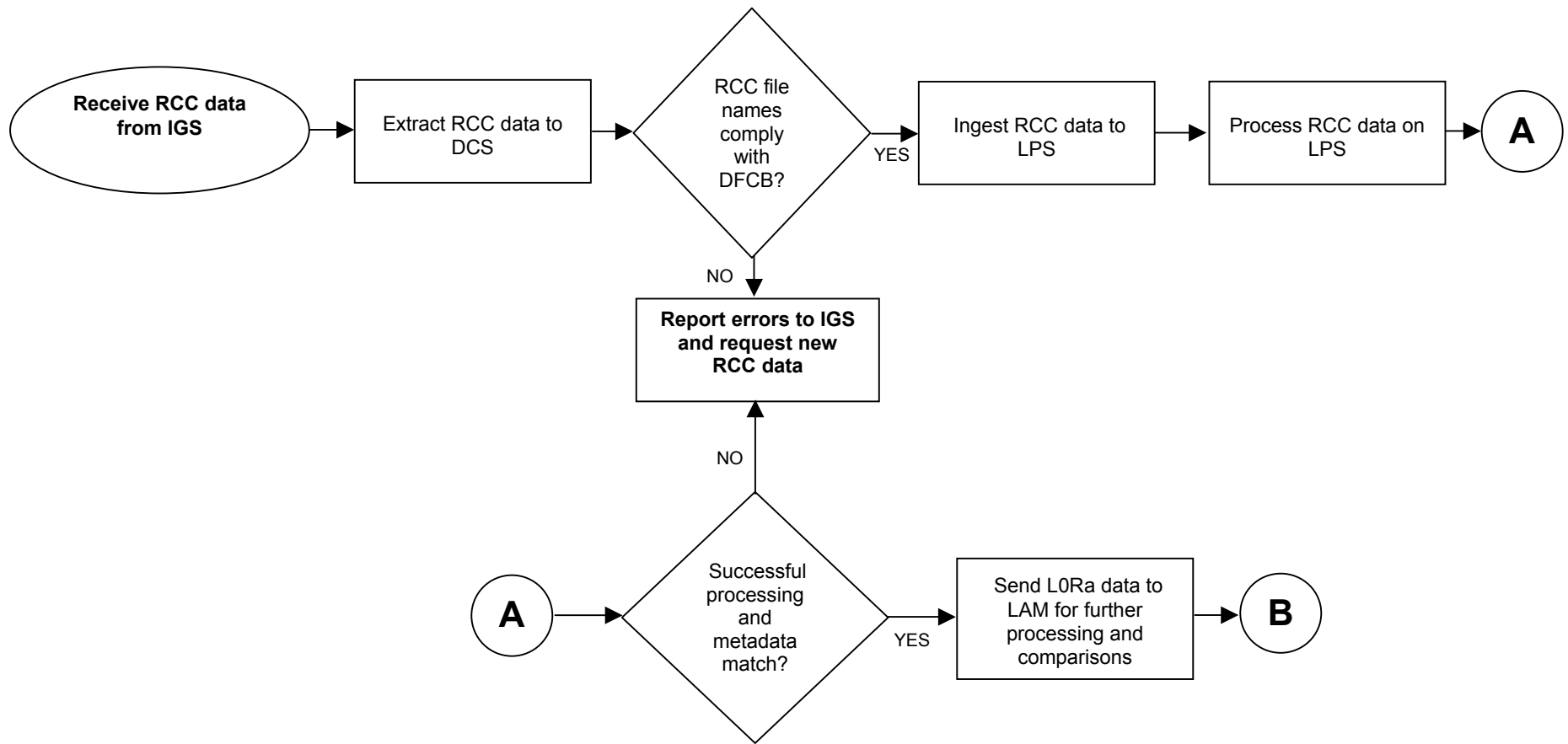
### **4.1 IGS Goals and Objectives**

When USGS data are provided to an IGS for data validation purposes, the IGS will be requested to provide a detailed summary of the data validation analysis performed within 30 days after the station receives the data.

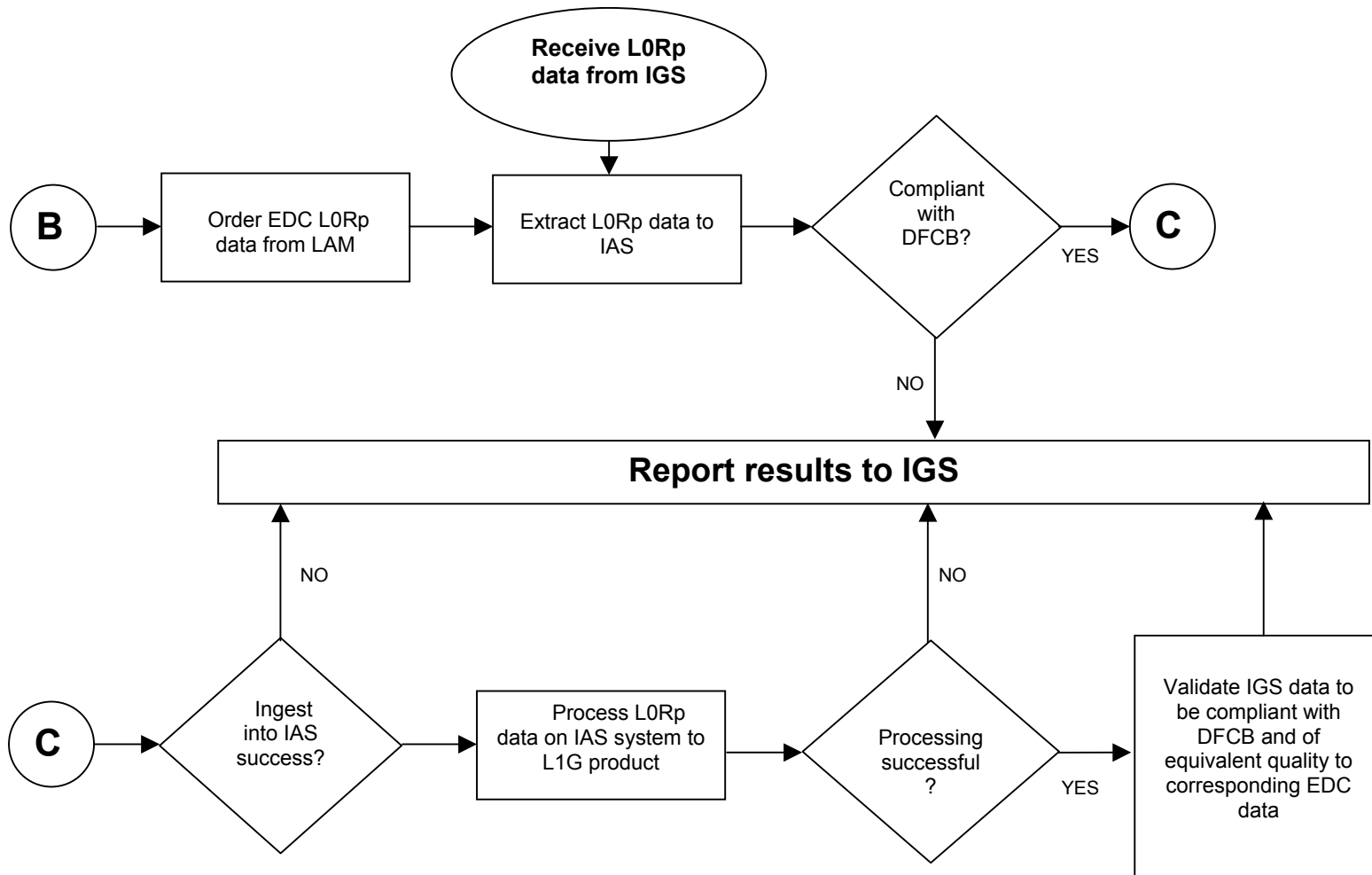
The IGS goals and objectives in the validation plan are to:

- Validate that the approved data exchange formats per the appropriate DFCB and product specifications are used
- Validate data are interchangeable between the IGS and the USGS
- Validate Landsat 7 image data are of equivalent quality

Each IGS will be responsible for creating and maintaining their own methods and procedures throughout their data validation exercise.



**Figure 4-1. Data Quality Validation Process**



**Figure 4-2. Data Quality Validation Process (Continued)**

## **Appendix A                      Acronyms**

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|        |                                                 |
|--------|-------------------------------------------------|
| DCS    | Data Capture System                             |
| DFCB   | Data Format Control Book                        |
| DLT    | Digital Linear Tape                             |
| FTP    | File Transfer Protocol                          |
| GMT    | Greenwich Mean Time                             |
| HDF    | Hierarchical Data Format                        |
| IAS    | Image Assessment System                         |
| IGS    | International Ground Station                    |
| L0Rp   | Level Zero Reformatted Distribution Product     |
| L1G    | Level 1 Geometrically Corrected                 |
| LAM    | Landsat Archive Manager                         |
| LCCB   | Landsat Configuration Control Board             |
| LGSOWG | Landsat Ground Station Operations Working Group |
| LPS    | Landsat 7 Processing System                     |
| LTWG   | Landsat Technical Working Group                 |
| MMO    | Mission Management Office                       |
| MOC    | Mission Operations Center                       |
| MOU    | Memorandum of Understanding                     |
| MSCD   | Mirror Scan Correction Data                     |
| PCD    | Payload Correction Data                         |
| RCC    | Raw Computer Compatible                         |
| SSR    | Solid State Recorder                            |
| SAIC   | Science Applications International Corporation  |
| WRS    | Worldwide Reference System                      |

## References

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Lockheed Martin. Landsat 7 Data Format Control Book (DFCB), Volume 4: Wideband Data/ Revision K. December 1998.

USGS/EDC. L7-DFCB-01. Landsat 7 Raw Computer Compatible Data Format Control Book. Version 2. August 2002.

USGS/EDC. L7-DFCB-03. Landsat 7 Data Format Control Book (DFCB) Level Zero-R Distribution Product. Version 4. June 2002.

USGS/EDC. L7-PD-04. Landsat 7 Data Exchange Implementation Plan. Version 2. May 2001.

Memorandum of Understanding Between the U.S. Geological Survey of the Department of the Interior and the International Cooperator for the Direct Reception and Distribution of Landsat 7 Data, and the draft Annex III for Data Exchange.