



Government
of Canada

Gouvernement
du Canada

Canadian General
Standards Board

Office des normes
générales du Canada

Series 171
Série des 171

WITHDRAWAL

December 2016

Standards in series Geomatics

These National Standards of Canada are hereby withdrawn due to limited use and/or support for their revision.

The Standards Council of Canada requires that accredited Standards Development Organizations, such as the CGSB, regularly review a consensus Standard to determine whether to re-approve, revise or withdraw. The review cycle is normally five years from the publication date of the latest edition of the Standard.

The information contained in these Standards was originally developed pursuant to a voluntary standards development initiative of the CGSB. The information contained therein may no longer represent the most current, reliable, and/or available information on these subjects. CGSB hereby disclaims any and all claims, representation or warranty of scientific validity, or technical accuracy implied or expressed respecting the information therein contained. The CGSB shall not take responsibility nor be held liable for any errors, omissions, inaccuracies or any other liabilities that may arise from the provision or subsequent use of such information.

RETRAIT

Décembre 2016

Normes de la série Géomatique

Ces Normes nationales du Canada sont retirées par le présent avis en raison de leur utilisation limitée et/ou du manque de support pour leur révision.

Le Conseil canadien des normes exige que les organismes accrédités d'élaboration de normes, tel que l'ONGC, effectue régulièrement un examen des normes consensuelles afin de déterminer s'il y a lieu d'en renouveler l'approbation, de les réviser ou de les retirer. Le cycle d'examen d'une norme est généralement de cinq ans à partir de la date de publication de la dernière édition de celle-ci.

L'information contenue dans ces normes a été élaborée initialement en vertu d'une initiative volontaire d'élaboration de normes de l'ONGC. Elle peut ne plus représenter l'information disponible et/ou l'information la plus actuelle ou la plus fiable à ce sujet. L'ONGC décline par la présente toute responsabilité à l'égard de toute affirmation, déclaration ou garantie de validité scientifique ou d'exactitude technique implicite ou explicite relative à l'information contenue dans ces normes. L'ONGC n'assumera aucune responsabilité et ne sera pas tenu responsable quant à toute erreur, omission, inexactitude ou autre conséquence pouvant découler de la fourniture ou de l'utilisation subséquente de cette information.

Copies of withdrawn standards are available from the CGSB Sales Centre by telephone at 819-956-0425 or 1-800-665-2472, by fax at 819-956-5740, by Internet at www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-eng.html, by e-mail at ncr.CGSB-ONGC@tpsgc-pwgsc.gc.ca or by mail at Sales Centre, Canadian General Standards Board, 11 Laurier Street, Gatineau, Canada K1A 1G6.

CAN/CGSB-171.100-2009

North American Profile of ISO 19115:2003 – Geographic Information – Metadata (NAP – Metadata) (ICS 35.240.70)

CAN/CGSB-171.101-2010

Canadian Geographic Information Standard – Canadian Geographical Names, Level 1 (CGIS - CGN1) (ICS 35.240.70)

CAN/CGSB-171.102-2010

Canadian Geographic Information Standard – National Road Network 2.0 (CGIS – NRN2) (ICS 35.240.70)

CAN/CGSB-171.103-2010

Canadian Geographic Information Standard – Canadian Digital Elevation Data, Level 1 (CGIS – CDED1) (ICS 35.240.70)

CAN/CGSB-171.104-2010

Canadian Geographic Information Standard – Landsat 7 Orthorectified Imagery over Canada (CGIS – ORI) (ICS 35.240.70)

Des copies des normes retirées peuvent être obtenues auprès du Centre des ventes de l'ONGC. Il suffit d'en faire la demande par téléphone au 819-956-0425 ou 1-800-665-2472, par télécopieur au 819-956-5740, par Internet à : www.tpsgc-pwgsc.gc.ca/ongc-cgsb/index-fra.html, par courriel à ncr.CGSB-ONGC@tpsgc-pwgsc.gc.ca, ou par courrier adressé au Centre des ventes, Office des normes générales du Canada, 11, rue Laurier, Gatineau, Canada K1A 1G6.

CAN/CGSB-171.100-2009

Profil nord-américain de la norme ISO 19115:2003 – Information géographique – Métadonnées (PNA – Métadonnées) (ICS 35.240.70)

CAN/CGSB-171.101-2010

Norme canadienne de l'information géographique – Toponymes canadiens, niveau 1 (NCIG – TC1) (ICS 35.240.70)

CAN/CGSB-171.102-2010

Norme canadienne de l'information géographique – Réseau routier national 2.0 (NCIG - RRN2) (ICS 35.240.70)

CAN/CGSB-171.103-2010

Norme canadienne de l'information géographique – Données numériques d'élévation du Canada, niveau 1 (NCIG - DNEC1) (ICS 35.240.70)

CAN/CGSB-171.104-2010

Norme canadienne de l'information géographique – Imagerie Landsat 7 orthorectifiée du Canada (NCIG – IOR) (ICS 35.240.70)



Government
of Canada

Gouvernement
du Canada

CAN/CGSB-171.104-2010

Canadian General
Standards Board

Office des normes
générales du Canada

Canadian Geographic Information Standard – Landsat 7 Orthorectified Imagery over Canada (CGIS – ORI)

ICS 35.240.70



Standards Council of Canada
Conseil canadien des normes

National Standard of Canada

The CANADIAN GENERAL STANDARDS BOARD (CGSB), under whose auspices this National Standard of Canada has been developed is a government agency within Public Works and Government Services Canada. CGSB is engaged in the production of voluntary standards in a wide range of subject areas through the media of standards committees and the consensus process. The standards committees are composed of representatives of relevant interests including producers, consumers and other users, retailers, governments, educational institutions, technical, professional and trade societies, and research and testing organizations. Any given standard is developed on the consensus of views expressed by such representatives.

CGSB has been accredited by the Standards Council of Canada as a national standards-development organization. The standards that it develops and offers as National Standards of Canada conform to the criteria and procedures established for this purpose by the Standards Council of Canada. In addition to standards it publishes as National Standards of Canada, CGSB produces standards to meet particular needs, in response to requests from a variety of sources in both the public and private sectors. Both CGSB Standards and CGSB National Standards of Canada are developed in conformance with the policies described in the CGSB Policy Manual for the Development and Review of Standards.

CGSB standards are subject to review and revision to ensure that they keep abreast of technological progress. Suggestions for their improvement, which are always welcome, should be brought to the notice of the standards committees concerned. Changes to standards are issued either as separate amendment sheets or in new editions of standards.

An up-to-date listing of CGSB standards, including details on latest issues and amendments, and ordering instructions, is found in the CGSB Catalogue, which is published annually and is available without charge upon request. An electronic version, ECAT, is also available. More information about CGSB products and services is available at our Web site — www.ongc-cgsb.gc.ca.

Although the intended primary application of this standard is stated in its scope, it is important to note that it remains the responsibility of the users of the standard to judge its suitability for their particular purpose.

The testing and evaluation of a product against this standard may require the use of materials and/or equipment that could be hazardous. This document does not purport to address all the safety aspects associated with its use. Anyone using this standard has the responsibility to consult the appropriate authorities and to establish appropriate health and safety practices in conjunction with any applicable regulatory requirements prior to its use. CGSB neither assumes nor accepts any responsibility for any injury or damage that may occur during or as the result of tests, wherever performed.

Attention is drawn to the possibility that some of the elements of this Canadian standard may be the subject of patent rights. CGSB shall not be held responsible for identifying any or all such patent rights. Users of this standard are expressly advised that determination of the validity of any such patent rights are entirely their own responsibility.

Further information on CGSB and its services and standards may be obtained from:

The Manager
Standards Division
Canadian General Standards Board
Gatineau, Canada
K1A 1G6

The STANDARDS COUNCIL OF CANADA is the coordinating body of the National Standards System, a coalition of independent, autonomous organizations working towards the further development and improvement of voluntary standardization in the national interest.

The principal objects of the SCC are to foster and promote voluntary standardization as a means of advancing the national economy, benefiting the health, safety and welfare of the public, assisting and protecting the consumer, facilitating domestic and international trade, and furthering international cooperation in the field of standards.

A National Standard of Canada (NSC) is a standard prepared or reviewed by an accredited Standards Development Organization (SDO) and approved by the SCC according to the requirements of CAN-P-2. Approval does not refer to the technical content of the standard; this remains the continuing responsibility of the SDO. A NSC reflects a consensus of a number of capable individuals whose collective interests provide, to the greatest practicable extent, a balance of representation of general interests, producers, regulators, users (including consumers), and others with relevant interests, as may be appropriate to the subject in hand. It normally is a standard, which is capable of making a significant and timely contribution to the national interest.

Those who have a need to apply standards are encouraged to use NSCs. These standards are subject to periodic review. Users of NSCs are cautioned to obtain the latest edition from the SDO, which publishes the standard.

The responsibility for approving standards as National Standards of Canada rests with the:

Standards Council of Canada
200-270 Albert Street
Ottawa, Ontario
K1P 6N7 –

How to order Publications:

telephone – 819-956-0425 or
– 1-800-665-2472

fax – 819-956-5740

mail – CGSB Sales Centre
Gatineau, Canada
K1A 1G6

in person – Place du Portage
Phase III, 6B1
11 Laurier Street
Gatineau, Quebec K1A 1G6

by e-mail – ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca

on the web – www.ongc-cgsb.gc.ca

Canadian Geographic Information Standard – Landsat 7 Orthorectified Imagery over Canada (CGIS – ORI)

CETTE NORME NATIONALE DU CANADA EST DISPONIBLE EN VERSIONS FRANÇAISE ET ANGLAISE.

Prepared by the

**Natural Resources Canada,
Canadian Council on Geomatics**



Canadian Council
on Geomatics



Conseil canadien
de géomatique

Reviewed by the

Canadian General Standards Board



Approved by the

Standards Council of Canada



Published November 2010 by the
Canadian General Standards Board
Gatineau, Canada K1A 1G6

© HER MAJESTY THE QUEEN IN RIGHT OF CANADA,
as represented by the Minister of Public Works and Government Services,
the Minister responsible for the Canadian General Standards Board 2010.

No part of this publication may be reproduced in any form without the prior permission of the publisher.

Permission notice

© Her Majesty the Queen in Right of Canada, Department of Natural Resources, on behalf of the Canadian Council on Geomatics. All rights reserved. Permission is granted to the Department of Public Works and Government Services, Canadian General Standards Board to produce a National Standard as a derived work based on this document

Withdrawn/Retirée

CANADIAN GENERAL STANDARDS BOARD

Committee on Geomatics

*(Voting membership at date of approval)***Chair**

O'Brien, D.

IDON Technologies Inc. (General Interest)

General Interest Category

Brodeur, J.

Natural Resources Canada, Centre for Topographic Information

Fay, B.

Brad Fay and Associates

Hum-Miller, J.

Department of National Defence

Kena-Cohen, S.

DMR Land Management and Geomatics

Kralidis, T.

Environment Canada, Geospatial Data Section

Levinsohn, A.

A.G. Levinsohn Consulting Inc.

Tychon, G.

Spatial Data Systems Consulting

Varma, H.

Varma Consulting

Producer Category

Cree, J.

Environment Canada, Canadian Wildlife Service

Dumontier, L.

Montréal Port Authority

John, K.

DMTI Spatial Inc.

Keighan, E.

Cubewerx Inc.

Lake, R.

Galdos Systems Inc.

Schut, P.

Agriculture and Agri-Food Canada

Steeves, R.

Service New Brunswick

User Category

Bishop, B.

BB Consulting Services

Garrard, G.

Natural Resources Canada, GeoConnections

Gaulton, D.

Fisheries and Oceans Canada

Goadsby, M.

Ontario Ministry of Natural Resources

Hamilton, S.

Department of National Defence

Kyle, H. M.

Sierra Systems

Loukes, D.

OPUS International Consultants (Canada) Ltd.

Plunkett, G.

ESRI Canada Ltd.

Secretary (non-member)

Schuessler, M.

Canadian General Standards Board

Acknowledgment is made for the translation of this National Standard of Canada by Natural Resources Canada.

Contents	Page
1 Scope	1
2 Conformance	1
3 Normative references	1
3.1 Canadian General Standards Board	1
3.2 International Organization for Standardization	1
4 Terms and definitions	2
5 Acronyms and abbreviations	2
6 Overview	3
6.1 Title.....	3
6.2 Reference date	3
6.3 Responsible party.....	3
6.4 Language	4
6.5 Informal description of the data product	4
7 Product specification scope.....	4
7.1 Scope general	4
7.2 Scope identification.....	4
7.3 Level.....	5
7.4 Level name	5
7.5 Extent.....	5
8 Data production identification.....	6
8.1 Title.....	6
8.2 Abstract	6
8.3 Purpose.....	6
8.4 Topic category	6
8.5 Spatial representation type.....	6
8.6 Spatial resolution.....	6
8.7 Geographic description	7
8.8 Reference to specification scope.....	7
9 Data content and structure	7
9.1 Description	7
9.2 Coverage information.....	8
9.3 Reference to product specification scope	8
10 Reference systems	8
10.1 Spatial reference system	8
10.2 Horizontal reference system.....	9
10.3 Reference to product specification scope	9
11 Data quality.....	10
11.1 Completeness	10
11.2 Logical consistency	10
11.3 Positional accuracy	10
11.4 Temporal accuracy	11
11.5 Thematic accuracy.....	11
11.6 Reference to specification scope.....	11
12 Data capture	12
12.1 Description	12
12.2 Reference to the specification scope	12
13 Data maintenance	12

13.1	Description	12
13.2	Reference to specification scope	12
14	Data product delivery	13
14.1	Delivery format information GML 2.1.2	13
14.2	Delivery medium information	13
14.3	Reference to product specification scope	13
15	Metadata	14
15.1	Metadata general	14
15.2	Reference to product specification scope	14
Appendix A (normative) Abstract test suite		15
Appendix B (normative) Application schema		17
Appendix C (normative) Feature Catalogue		18
Appendix D (informative) Bibliography		21

Introduction

Canadian Geographic Information Standards

This document is part of a series of Canadian Geographic Information Standards (CGIS). These standards are localized national standards for particular types of geographic data, such as the product specifications for the GeoBase suite of publicly available data products, or specializations or profile of international standards in the Canadian or North American context.

The International Organization for Standardization Technical Committee TC/211 Geographic information - Geomatics has developed a suite of international standards for geographic information. These are primarily high level abstract standards that describe the fundamental information components for feature oriented vector based, or coverage (imagery and gridded) data, or geospatial services. The ISO standards tend to be too high a level to be directly implementable. It is necessary to be able to develop profiles to address specific national needs or implementations of the ISO standards such as the development of feature catalogues and product specifications in accordance with the ISO standards.

GeoBase

GeoBase is an initiative of the federal, provincial and territorial governments in Canada operating through the Canadian Council on Geomatics (CCOG) to ensure the provision of, and access to a common, up-to-date and maintained base of quality geospatial data for all of Canada. This allows Canadians to have access to the wealth of knowledge about the geography of Canada. This data is provided on line and free of charge under common terms and conditions by the participating members of the CCOG through Natural Resources Canada. The data is structured based on international standards to ensure maximum compatibility with users' systems.

The GeoBase suite of Product Specifications has been made into National Standards of Canada to stabilize the specifications and to make them permanently available. As national standards these specifications may also be referenced by other specifications and standards within and external to Canada thereby increasing the level of interoperability. Geospatial information is presented in GeoBase in separate layers, each one addressing a specific topic. There are initially four layers of geospatial information available through GeoBase which have been produced as National Standards.

These standards describe the information content of the GeoBase data layers. They do not mandate the encoding or representation of the data. GML is described as a neutral encoding. This permits multiple encodings that may be used in different media and services. A common metadata schema is used that is compatible with the CAN/CGSB-171.100-2009 (NAP-Metadata). The actual metadata elements were developed using the earlier US Federal Geospatial Data Committee (FGDC) metadata standard; however, this is directly convertible to the new North American standard. For those data layers that are geographically feature oriented a geospatial feature catalogue is included as an appendix to the standard.

Canadian Geographic Information Standard – Landsat 7 Orthorectified Imagery over Canada (CGIS – ORI)

1 Scope

This National Standard of Canada describes a product specification in compliance to ISO19131:2007 – Geographic information – Data product specification for the provision of fundamental geographic information to the public through the GeoBase initiative of the CCOG. This product specification describes orthorectified satellite imagery. This is the first part of a multi-part standard describing multiple types of satellite imagery. This is Part 1 Landsat 7 Orthorectified Imagery over Canada. The Landsat Orthoimages consist of raster data in 9 spectral bands. Associated with the raster images are a separate data set of control points to be used with the orthoimagery.

2 Conformance

Any data set claiming conformance with this National Standard shall pass all the requirements described in the abstract test suites in Appendix A.

3 Normative references

The following documents contain provisions that, through reference in this text, constitute provisions of this National Standard of Canada. The referenced documents may be obtained from the sources noted below. The following referenced documents are indispensable for the application of this document.

A dated reference in this standard is to the issue specified. An undated reference in this standard is to the latest issue, unless otherwise specified by the authority applying this standard.

3.1 Canadian General Standards Board

CAN/CGSB 171.100:2009 – *North American Profile of ISO19115:2003 – Geographic information – Metadata (NAP – Metadata)*¹

3.1.1 Source

The above may be obtained from the Canadian General Standards Board, Sales Centre, Gatineau, Canada K1A 1G6. Telephone 819-956-0425 or 1-800-665-2472. Fax 819-956-5644. E-mail ncr.cgsb-ongc@tpsgc-pwgsc.gc.ca. Web site www.ongc-cgsb.gc.ca

3.2 International Organization for Standardization

ISO 19115: 2003² *Geographic Information - Metadata*

¹This standard contains a cross reference from the US FGDC Metadata fields used in the data to the definitions in the NAP – Metadata standard. All the definitions, codes and tables from CAN/CGSB-171.100-2009 are available at <http://www.geoconnections.org/nap/metadata/>

3.2.1 Source

The above may be obtained from IHS Canada, 1 Antares Drive, Suite 200, Ottawa, Ontario K2E 8C4, telephone 613-237-4250 or 1-800- 387-4408, fax 613-237-4251, e-mail gic@ihscanada.ca, Web site canada.ihs.com.

4 Terms and definitions

For the purposes of this National Standard of Canada, the following terms and definitions apply.

4.1

Orthorectified image / Orthoimage

An image derived from a conventional perspective image by simple or differential rectification to remove image displacements caused by sensor tilt and relief of terrain.

5 Acronyms and abbreviations

CRS	Coordinate Reference System
CRSID	Coordinate Reference System Identifier
CCOG	Canadian Council on Geomatics
CCRS	Canada Centre for Remote Sensing
CDED	Canadian Digital Elevation Data
CGSB-CoG	Canadian General Standards Board – Committee on Geomatics
CMAS	Circular Map Accuracy Standard
CSDGM	Content Standard for Digital Geospatial Metadata
CTI-S	Centre for Topographic Information – Sherbrooke
DEM	Digital Elevation Model
ETM+	Enhanced Thematic Mapper
EPSG	European Petroleum Survey Group
FGDC	United States Federal Geographic Data Committee
FTP	File Transfer Protocol
GCMD	(NASA) Global Change Master Directory
GeoTIFF	Georeference Tagged Image File Format
GRS80	Geodetic Reference System of 1980
GPS	Global Positioning System

² The normative reference is to the base ISO 19115 metadata standard. Although ISO 19115-2 exists for Imagery, this part is not applicable here.

ISO	International Organization for Standardization
LCC	Lambert Conformal Conic
NAP	North American Profile
NAD83	North American Datum of 1983
NAD83CSRS	North American Datum 1983 (Canadian Spatial Reference System)
NRCan	Natural Resources Canada
NRN	National Road Network
NTDB	National Topographic Data Base
OGP	International Organisation of Oil and Gas Producers
ORI	Ortho Rectified Imagery
TC	Technical Committee
UTM	Universal Transverse Mercator

6 Overview

6.1 Title

Canadian Geographic Information Standard – Landsat 7 Orthorectified Imagery over Canada (CGIS – ORI)

6.2 Reference date

Data product specifications creation date: 2010-11-10

6.3 Responsible party

GeoBase
 Natural Resources Canada
 Earth Sciences Sector
 Centre for Topographic Information
 2144 King Street West, Suite 010
 Sherbrooke, Quebec, Canada
 J1J 2E8

Telephone: 819-564-4857 / 1-800-661-2638 (Canada and USA)

Fax: 819-564-5698

E-mail: supportgeobase@NRCan.gc.ca

URL: <http://www.geobase.ca/>

6.4 Language

This data product is available in:

eng - English

fra - French

6.5 Informal description of the data product

Landsat 7 orthoimages are stored as raster data and comprise 9 spectral bands: a panchromatic band with a pixel size of 15 meters, 6 multispectral bands with a pixel size of 30 meters and 2 thermal infrared bands with a ground resolution of 60 meters. They were produced in alignment with NAD83 using the UTM projection.

The orthoimage data sets were created with the most accurate control data available at the time. A variety of sources were used for image correction; the most accurate were given priority. The usual priority ranking was: GPS source for the NRN, provincial vector data, accurate NTDB data, federal aerotriangulation data, and other sources. The accuracy was evaluated for each orthoimage data set. The control data, which was extracted from sources as mentioned above, could consist of road intersection vector data or lake/island centroids. In some cases the intersection of the centre line of a surficial river might be used. The control points were distributed homogeneously within the image in specific sectors. Sectors were located in the image surround, in the area of the image with the lowest and highest elevations, and in all other areas in which overlapping image base sectors were located.

Different DEMs also served in generating these orthoimages: provincial DEMs and CDED [1] at the 1: 50,000 and the 1: 250,000 scales.

The National Orthoimage Project produced a complete set of cloud-free (less than 10%) orthoimages covering the Canadian landmass using ETM+ data from the Landsat 7 satellite. This Landsat 7 data which is available from GeoBase was provided by the National Orthoimage Project.

Landsat 7 images used to produce this data set were captured between 1999 and 2003. The purpose is to promote the use of geomatics and educate by providing a Web site and file transfer protocol (ftp) site that distribute Canada's geospatial data.

Data (choice of spectral bands) are available for download in GeoTIFF format using either LCC or UTM projection.

7 Product specification scope

7.1 Scope general

This product specification describes the ORI data product which consists of raster data containing multispectral orthoimagery from the Landsat 7 satellite together with accurate control data.

7.2 Scope identification

Global

Note: "Global" means that this scope refers to all parts of this data product specifications

7.3 Level

This scope refers to the following level according to the ISO 19115 standard:

006 - series

7.4 Level name

Landsat 7 Orthorectified Imagery over Canada

7.5 Extent

This section describes the spatial and temporal extent of the scope.

7.5.1 Description

Canadian landmass

7.5.2 Geographic extent

The horizontal extent is given by the following geographic bounding box

7.5.2.1 Westbound longitude

141° West (or -141°)

7.5.2.2 Eastbound longitude

52° West (or -52°)

7.5.2.3 Southbound latitude

41° North (or +41°)

7.5.2.4 Northbound latitude

85° North (or +85°)

7.5.3 Temporal extent

The temporal extent is given by the following period of time.

7.5.3.1 Beginning

1999

7.5.3.2 Ending

2003

8 Data production identification

8.1 Title

Landsat 7 Orthorectified Imagery over Canada

8.2 Abstract

The orthoimages produced in partnership comprise 9 spectral bands: a panchromatic band with a pixel size of 15 meters, 6 multispectral bands with a pixel size of 30 meters, and 2 thermal bands with a pixel size of 60 meters. The orthoimages are based on the NAD83 coordinate reference system and are provided in several projections. The projections include the UTM and the LCC. Images produced with the UTM projection that overlap two 6-degree UTM zones are generated in both zones.

Note: A cooperation agreement between the various departments of the federal and provincial governments was signed in order to produce Canadian Landsat 7 orthoimage coverage that is accurate and reasonable in cost. This agreement provided access to the country's most accurate topographic data that can be used to carry out geometric correction of the images.

8.3 Purpose

The creation of national coverage with Landsat 7 orthoimages makes it possible to implement an infrastructure shared by many partners and users of geospatial data. In addition to being a very valuable source of raster information, this orthoimage coverage also provides for integrating data from different sources, updating existing data, and creating new geospatial data in order to respond to user needs.

8.4 Topic category

Main topics for the product, as defined by the ISO 19115 or CAN/CGSB 171.100:

010— imageryBaseMapsEarthCover

8.5 Spatial representation type

Type of spatial representation for the product, as defined by the ISO 19115 or CAN/CGSB 171.100:

002 - grid

8.6 Spatial resolution

The spatial resolution, or the spatial dimension on the earth covered by the size of a pixel (nominal ground sample distance), varies according to each spectral band in Landsat 7 orthoimages.

Figure 1

Landsat 7 Band	Resolution (pixel size in m)
1 (Blue-green)	30
2 (Green)	30
3 (Red)	30
4 (Infrared (IR))	30
5 (Mid infrared I)	30
6L (Thermal IR (Low gain))	60

6H (Thermal IR (High gain))	60
7 (Mid infrared II)	30
8 (Panchromatic)	15

8.7 Geographic description

8.7.1 Authority

International Organization for Standardization (ISO)

8.7.1.1 Title

Standard of the code of geographical regions:

ISO 3166-1:1997 *Codes for the representation of names of countries and their subdivisions – Part 1: Country codes.*

8.7.1.2 Date

Reference date of the ISO 3166-1 standard:

1997-10-01

8.7.1.3 Date type code

Type of date according to ISO 19115 or CAN/CGSB-171.100:

002 - publication

8.7.2 Code

Code of the geographical region covered by the product according to the ISO 3166-1:

CA – Canada

8.8 Reference to specification scope

Global (see 7.2)

9 Data content and structure

9.1 Description

Landsat 7 orthoimages are stored as raster data and comprise 9 spectral bands: a panchromatic band with a pixel size of 15 meters, 6 multispectral bands with a pixel size of 30 meters and 2 thermal infrared bands with a ground resolution of 60 meters. They were produced in alignment with NAD83 using the UTM projection.

9.2 Coverage information

9.2.1 Application schema

The Landsat-7 orthoimages schema in Appendix B provides the formal description of the data structure and content of the data product. It is a conceptual model described with UML.

9.2.2 Feature catalogue

A feature catalogue in Appendix C contains the description of feature types in the application schema.

9.3 Reference to product specification scope

Global (See 7.2)

10 Reference systems

10.1 Spatial reference system

Spatial data are in two projected coordinate reference systems: LCC and UTM. The horizontal reference datum used is NAD83CSRS and the GRS80 ellipsoid served as a reference.

The data are in meters and stored in 2 dimensions for both projections (LCC and UTM): there are 2-coordinate system axis (north-south and west-east).

The unit of measure for data coordinates in X (north-south) and Y (west-east) axis is meters adjusted to the spatial resolution (pixel dimension) of each spectral band (15, 30 or 60 meters).

In Canada, for the LCC projection, the standard parallels are 49° North and 77° North, the latitude of projection origin is also 49° North and the longitude of central meridian is 95° West. The false easting and the false northing are both equal to 0 (zero) metre.

For the UTM projection in Canada, the scale factor at central meridian is 0.9996, the longitude of the central meridian is determined with the formula $((180^\circ - \lambda) / 6^\circ) + 1$, where the latitude of projection origin is 0 (zero), the false easting is 500 000 meters, and the false northing equals 0 metre.

Note: The epoch of the CRS is 1998.

Note: The authority responsible for the CRS NAD83CSRS is the Geodetic Survey Division of Natural Resources Canada. The contact information is given below.

Geodetic Survey Division
Natural Resources Canada
615 Booth Street, Room 440
Ottawa, Ontario
Canada
K1A 0E9

Phone: 1-613-995-4410 (Monday - Friday, 07:00 - 16:00 EST)

Fax: 1-613-995-3215

Email: information@geod.nrcan.gc.ca

<http://www.geod.nrcan.gc.ca/>

The register of geodetic codes and parameters maintained by the OGP makes authoritative reference to the source of the CRS it contains. The following sub-clauses define the authority for the management of the code space, not the CRS itself.

10.2 Horizontal reference system

10.2.1 Authority of code space

10.2.1.1 Title of code space register

Coordinate reference system registry:

EPSG Geodetic Parameter Registry

10.2.1.2 Date of reference to the code space register

Reference date:

2009-11-25

10.2.1.3 Date type code

Date type according to ISO 19115 and CAN/CGSB - 171.100-2009:

002 - publication

10.2.1.4 Responsible party for code space register

OGP – International Organisation of Oil and Gas Producers URL: <<http://www.ogp.org.uk> > or

< <http://www.epsg-registry.org> >

10.2.2 Code

Coordinate reference system identifier (CRSID):

The CGIS - ORI makes use of the OGP/EPSPG code - 4617 which is equivalent to NAD83CSRS from the Geodetic Survey of Canada since this code is recognized by many vector mapping system implementations.

10.2.3 Code space

EPSPG – European Petroleum Survey Group

10.2.4 Version of code space register

7.4.5

10.3 Reference to product specification scope

Global (See 7.2)

11 Data quality

11.1 Completeness

Not applicable

11.2 Logical consistency

11.2.1 Conceptual consistency

Not applicable

11.2.2 Domain consistency

Not applicable

11.2.3 Format consistency

The Landsat 7 Orthorectified Imagery data format conforms to the distribution formats described on the GeoBase portal (www.geobase.ca).

11.2.4 Topological consistency

Not Applicable

11.3 Positional accuracy

11.3.1 Absolute external positional accuracy

Orthoimage planimetric accuracy depends on control data, the digital elevation model (DEM), and the method used to extract the positions of the control points in the image. The best sources of control data available in Canada were used to generate the orthoimages.

The control points were derived from road and river intersections and lake/island centroids. A variety of sources were used for the control points; the most accurate were given priority. The usual priority ranking was: GPS source for the National Road Network, provincial vector data, accurate NTDB data (10 m to 90 %), federal-government aerotriangulation data, and other sources.

Control points were chosen in predefined areas in the image to ensure good and equitable distribution. A minimum of 3 control points by sector was selected. The image area planned for control-point selection was reduced by 4.5 km in the east and west boundaries of the image. This reduction ensured that the same control points were reused in the next image update. Tests were done on 3 images to determine the best location for control points in an image in order to achieve greater accuracy. These images contained various types of terrain and were very representative of the Canadian landmass. Various control-data types and accuracy were used for these images. The tests concluded that control points in 6 base sectors in the image surround and in the minimum and maximum elevation sectors delivered the best accuracy. Overlapping images were considered and corresponding base sectors were added. These additional sectors (between 4 to 10) did not improve the accuracy, but ensured that the same control points were reused in image overlaps. This makes it possible to maintain coherency in correcting adjacent images and improves the quality when creating image mosaics.

The DEM used could be provincial, NTDB data at the 1: 50,000, or NTDB data at the 1: 250,000, depending on availability. The process used a provincial DEM, if available, to complete the gaps with DEMs derived from NTDB 1: 50,000 contours; remaining gaps from DEMs derived from 1: 250,000 contours were then completed. The DEM accuracy had a small impact on orthoimage accuracy ($\tan 7^\circ \times \text{DEM accuracy}$). The worst DEM accuracy (including slope impact) served in assessing orthoimage accuracy.

A number of parameters were analysed in order to obtain orthoimage accuracy with an acceptable level of confidence. These parameters included the mean square error (MSE) along the x-axis and y-axis of the ground control points after the correction model was generated, the accuracy of the image control data and the altimetric and planimetric accuracy of the digital elevation model (DEM) covering the satellites scene. Once all errors were combined, the accuracy was calculated to a level of confidence of 90% (Circular Map Accuracy Standard (CMAS) (CCSM, 1984)).

The planimetric accuracy for the orthoimages in Southern Canada is about 20 meters, compared to about 30 meters in the northern part of the country. It should be noted that only control data within Canada was used. The planimetric accuracy of the part of the image located outside of Canada may therefore be lower. Each orthoimage has a different planimetric accuracy.

11.3.2 Relative internal positional accuracy

Not Applicable

11.3.3 Gridded data positional accuracy

The mathematical model used to orthorectify Landsat 7 images was the "Toutin's model"³ (PCI Geomatics 2006). The decision to use this mathematical model was based on the fact that it provides a rigorous geometric correction method that takes into account all distortions. This model is based on principles related to orbitography, photogrammetry, geodesy, and cartography. It reflects the physical reality of the complete viewing geometry and corrects distortions that occur due to platform, sensor, Earth, and cartography projection.

11.4 Temporal accuracy

Not Applicable

11.5 Thematic accuracy

11.5.1 Thematic classification correctness

Unknown

11.5.2 Non quantitative attribute accuracy

Not Applicable

11.5.3 Quantitative attribute accuracy

Not Applicable

11.6 Reference to specification scope

Global (See 7.2)

³ Developed by Dr. Thierry Toutin with the Canada Centre for Remote Sensing

12 Data capture

12.1 Description

Landsat 7 data are collected from a nominal altitude of 705 kilometres in a near-polar, near-circular, sun-synchronous orbit at an inclination of 98.2°, imaging the same 183-km swath of the Earth's surface every 16 days. Each frame is denoted by a sequential Path and Row determined by the 16-day (233 orbits) repeat cycle. The Rows, indexed east/west, are generated by partitioning each Path into 23.92 seconds of spacecraft time in both directions at the equator, resulting in 248 Rows per complete orbit. The Landsat sensors continuously collect data which are segmented post-collection on the ground, using telemetry ephemeris data, into individual framed scenes. The orbital tracks can drift over time due to a variety of factors and are adjusted when necessary. The framing is unique for each orbit. Accordingly, the frame locations are not exact, but are within a tolerance of movement off the original satellite orbit. The satellite orbit results in a coverage side overlap of a minimum of 7.3% at the equator increasing to approximately 85% at 80° of latitude.

Orthoimages were derived from Landsat 7 raw image level L1G and were produced from control points and DEMs.

A number of control sources were used to correct the Landsat 7 images, namely provincial vector data, roads resulting from GPS, data from the NTDB, and geometrically corrected aerial photography (orthophotos). The control points extracted from the sources generally represent road intersections and centres of mass of lakes or islands.

Different DEMs also served in generating these orthoimages: provincial DEMs and CDED at the 1: 50,000 and the 1: 250,000 scales.

The originators and the source data used to produce Landsat 7 orthoimages were:

- U.S. Geological Survey (raw image);
- Centre for Topographic Information (NTDB, GPS road network, CDED, aerotriangulation data);
- British Columbia: provincial vector data and provincial DEMs;
- Alberta: provincial vector data and provincial DEMs;
- Ontario: provincial vector data ;
- Quebec: provincial vector data ;
- New Brunswick: provincial vector data.

Note: Where provincial data were not available, federal data was used.

12.2 Reference to the specification scope

Global (See 7.2)

13 Data maintenance

13.1 Description

There will be no maintenance on the product.

13.2 Reference to specification scope

Global (See 7.2)

14 Data product delivery

The National Standard only addresses the information content of the product specification and multiple encodings and product delivery mechanisms for the data are permitted.

14.1 Delivery format information GML 2.1.2

14.1.1 Format name

GeoTIFF

14.1.2 Version

GeoTIFF Revision 1.0

14.1.3 Specification

The GeoTIFF is a Tagged Image File Format. The georeferencing tag permits the addition of geographic information such as projection, datum, and coordinate parameters to imagery or other raster-based data. Adobe Systems (<http://www.adobe.com/>) holds the copyright for TIFF specifications. GeoTIFF is a highly flexible and platform-independent format supported by numerous software packages.

Note: Information about the GeoTIFF standard can be found at:
<http://www.remotesensing.org/geotiff/geotiff.html>.

14.1.4 File structure

The format specifications for GeoBase Landsat 7 orthorectified imagery in GeoTIFF are uncompressed, 8-bit, band-separated.

14.1.5 Language

eng – English

14.2 Delivery medium information

14.2.1 Units of delivery

Landsat 7 satellite scene

14.2.2 Transfer size

A complete Landsat 7 orthoimage is about 400 Mb in size.

14.2.3 Medium name

Geobase portal http and ftp

14.2.4 Other delivery information

PKZIP compression software is used to reduce file size.

14.3 Reference to product specification scope

Global (See 7.2)

15 Metadata

15.1 Metadata general

The National Standard makes use of the North American Profile for Geographic Information Metadata and is based on the US FGDC metadata. The Metadata in this dataset complies with the FGDC CSDGM Metadata and the CAN/CGSB 171.100 NAP Metadata Standard and may be provided in both forms.

15.2 Reference to product specification scope

Global (See 7.2)

Withdrawn/Retirée

Appendix A

(normative)

Abstract test suite

A.1 Test case for selecting control sectors

- a) Test purpose: Orthoimages are produced from control entities. Verify that control entities are located in predefined sectors in the image to ensure good and equitable distribution.
- b) Test method: Check that all control entities are located in predefined sector in the image. These sectors are the base sectors, the sectors with minimum (ZMIN) and maximum (ZMAX) elevation, and the sectors with adjacent images superimposed. The based sectors are located in the image corners and in the middle of the east and the west boundaries.
- c) Reference: Section 6 and 11
- d) Test type: Basic.

A.2 Test case for selecting control entities

- a) Test purpose: Orthoimages are produced from control entities. Verify that control entities are the most accurate control data available and are conformal to the defined rules.
- b) Test method: Check that the selected control entities are conformal to the given priority according the accuracy. The usual priority ranking is: GPS source for the National Road Network (NRN), provincial vector data, accurate National Topographic Data Base (NTDB) data, federal aerotriangulation data, and other sources. Also to prevent inaccuracies, these control entities shall comply with certain well-defined rules. For example, entities corresponding to lakes and islands shall not be selected if the expanse of water is not stable. Indeed, these entities shall not be selected if a dam is located nearby or if there are adjacent wetlands or sand. Since the water level can vary over time, these situations can affect the quality of control point accuracy. The entities are selected for stability over time so that they can be reused for geometric correction of images in the future.
- c) Reference: Section 6 and 11
- d) Test type: Basic.

A.3 Test case for number of control entities per sector

- a) Test purpose: Orthoimages are produced from control entities. Verify that there are three control entities per sector.
- b) Test method: Check that there are three control entities per sector after bad points are eliminated.
- c) Reference: Section 11
- d) Test type: Basic.

A.4 Test case for control entities accuracy according mathematical model

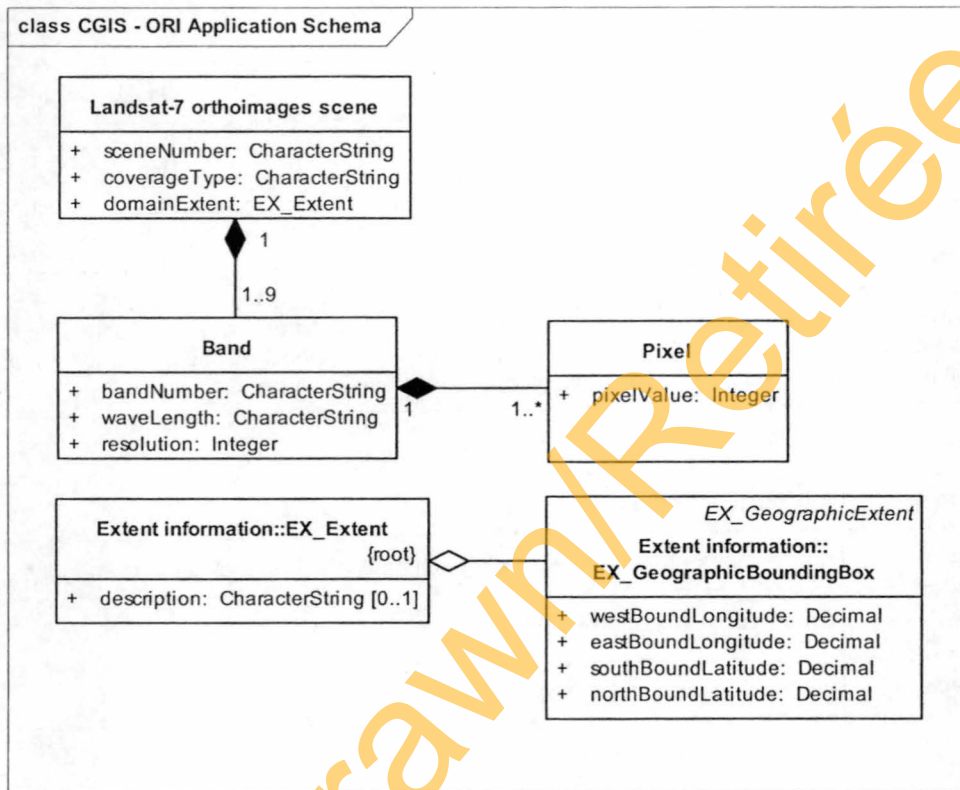
- a) Test purpose: Verify the control entities accuracy.
- b) Test method: Compute of a mathematical correction model and check that an image not contains more than 5% of control entities with a residual more than three standard deviations. The mathematical correction model used to orthorectify Landsat 7 images was the "Toutin's model". The decision to use this mathematical model was based on the fact that it provides a rigorous geometric correction method that takes into account all distortions
- c) Reference: Section 11
- d) Test type: Basic.

Withdrawn/Retirée

Appendix B

(normative)

Application schema



Note: The method used to spatially represent a Landsat 7 orthoimage is raster data. Landsat 7 orthoimages are composed of thousands of pixels. Each pixel of information covers a portion of the Earth's surface according to its spatial resolution (spectral bands). The pixels are located in a column (north/south) and row (east/west) axis reference system. Each band has 8-bit radiometry (values from 0 to 255). Each Landsat 7 orthoimage (scene) covers an area approximately 183 km by 170 km.

Landsat 7 Band	Spectral Location	Wavelength (in μm)	Resolution (pixel size in m)
1	Blue-green	0.450 – 0.515	30
2	Green	0.525 – 0.605	30
3	Red	0.630 – 0.690	30
4	Infrared (IR)	0.750 – 0.900	30
5	Mid infrared I (MIR I)	1.550 – 1.750	30
6L	Thermal IR (Low gain)	10.400 – 12.500	60
6H	Thermal IR (High gain)	10.400 – 12.500	60
7	Mid infrared II (MIR II)	2.090 – 2.350	30
8	Panchromatic	0.520 – 0.900	15

Appendix C

(normative)

Feature Catalogue

Class:

Name	Is Abstract	Geometry
Landsat-7 orthoimages scene	No	
Definition		
Each Landsat 7 orthoimage (scene) covers an area approximately 183 km by 170 km. The method used to spatially represent a Landsat 7 orthoimage is raster data. Landsat 7 orthoimages are composed of thousands of pixels. Each pixel of information covers a portion of the Earth's surface according to its spatial resolution (spectral bands). The pixels are located in a column (north/south) and row (east/west) axis reference system.		

Attribute Section:

Attribute Name	Attribute Definition
sceneNumber	An identifier number corresponding to a track and frame of Landsat imagery. Data Type: CharacterString (6)
CoverageType	A type of coverage identified. Domain: Continuous quadrilateral grid coverage Data Type: CharacterString (100)
domainExtent	The geographic bounding box of the dataset Data Type: EX_Extent

Class:

Name	Is Abstract	Geometry
Band	No	
Definition		
A range of wavelengths which are examined.		

Attribute Section:

Attribute Name	Attribute Definition
bandNumber	Identifier of the band according to a selection of wavelengths.
	Domain: 1,2,3,4,5,6l,6h,7,8. Data Type: CharacterString (2)
waveLength	Range of minimum distance between two events of a recurring feature in a periodic sequence, such as the crests in a wave. It is represented by the Greek letter lambda.
	Data Type: CharacterString
resolution	Size (in meters) of the smallest detail identifiable on an image.
	Domain: [15,60] Data Type: Integer

Class:

Name	Is Abstract	Geometry
Pixel	No	
Definition		
In digital imaging, a pixel (or picture element) is the smallest item of information in an image. Pixels are normally arranged in a 2-dimensional grid, and are often represented using dots, squares, or rectangles. Each pixel is a sample of an original image, where more samples typically provide more-accurate representations of the original. The intensity of each pixel is variable.		

Attribute Section:

Attribute Name	Attribute Definition
pixelValue	The intensity of pixel.
	Domain: [0,255] Data Type: Integer

Class:

Name	Is Abstract	Geometry
EX_extent	No	
Definition		
The geographic area of the dataset		

Attribute Section:

Attribute Name	Attribute Definition
description	The geographic area of the dataset
	Data Type: CharacterString

Class:

Name	Is Abstract	Geometry
EX_GeographicBoundingBox	No	
Definition		
The geographic bounding box of the dataset		

Attribute Section:

Attribute Name	Attribute Definition
westBoundLongitude	The western-most coordinate of the limit of the dataset extent. The value is expressed in longitude in decimal degrees.
	Domain: [-180,180] Data Type: Angle
eastBoundLongitude	The eastern-most coordinate of the limit of the dataset extent. The value is expressed in longitude in decimal degrees.
	Domain: [-180,180] Data Type: Angle
southBoundLatitude	The southern-most coordinate of the limit of the dataset extent. The value is expressed in latitude in decimal degrees.
	Domain: [-90,90] Data Type: Angle
northBoundLatitude	The northern-most, coordinate of the limit of the dataset extent. The value is expressed in latitude in decimal degrees.
	Domain: [-90,90] Data Type: Angle

Appendix D

(informative)

Bibliography

- [1] CAN/CGSB 171.103:2010 Canadian Geographic Information Standard — Canadian Digital Elevation Data, Level 1 (CGIS – CDED1)
- [2] GeoTIFF Tagged Image File Format, <http://www.remotesensing.org/geotiff/geotiff.html>
- [3] ISO 19131:2007 Geographic Information / Geomatics – Data Product Specifications,
- [4] ISO 639-2:1998 Codes for the Representation of Names of Languages, International Standard
- [5] ISO 3166-1:1997 Codes for the representation of names of countries and their subdivisions, International Standard
- [6] ISO 19110:2005 Geographic information — Methodology for feature cataloguing, International Standard ISO/TC 211
- [7] CCSM (1984) National standards for the exchange of digital topographic data, Data Classification, Quality Evaluation and EDP File Format, Volume 1, E.M.R. Canada: 153,157
- [8] CCSM (1984) Circular Map Accuracy Standard (CMAS)
- [9] PCI Geomatics (2006), Orthorectification and Geometric Correction – Fact sheet, <http://www.pcigeomatics.com/products/pdfs/orthorectification.pdf>