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Imagery Metadata

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Contents

Page

Tables

Page

i. Preface

This document was initially prepared as an Interoperability Program Report under the Image Handling for Decision Support (IH4DS) thread of OGC Web Services interoperability initiative Phase 2 (OWS 2). This document is now released as an OGC Discussion Paper. The previous version of this document was numbered 04-081; the current version is now renumbered 05-015 after approval and final editing in 2005.

Interoperability Program Report OGC 03-17, Image Handling Metadata, showed how the metadata specified by ISO 19115 could be combined with that specified in the FGDC Extensions for Remote Sensing, hereafter Remote Sensing Extensions (RSE), to define metadata for image files. This paper discusses testing of the implementation of ISO and FGDC standards for metadata. In particular, metadata using ISO 19139, an implementation specification for ISO 19115 Metadata, was served. This experience with real data provided information on whether the specifications of 19139 could be implemented in practice and what additional implementation specifications needed to be added.

Suggested additions, changes, and comments on this draft are welcome and encouraged. Such suggestions may be submitted by OGC portal message, email message, or by making suggested changes in an edited copy of this document.

ii. Submitting organizations

The following organizations submitted this document to the Open Geospatial Consortium Inc.

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iv. Revision history

Date	Release	Editor	Primary clauses modified	Description
2004-08-20	2004-08-23	Barry M. Schlesinger	6.2 Required core metadata 8. Modifications Needed to ISO Standards	Minor revision to wording and tables in Clause 6.2. Material for Clause 8 is newly added. Changes to Bibliography are editorial only
2004-09-10	2004-09-10	Barry M. Schlesinger	7.2, 8, Annex A	Added annex containing Hurricane Isabel MODIS metadata used in demonstration; revised analysis of this metadata to apply to version used; expanded discussion of recommendations on ISO standards
2004-10-01	2004-10-05	Barry M. Schlesinger	7.3, Annex B, Annex C	Added DIMAP description and comparison to ISO 19115 and annexes containing SPOT metadata in ISO 19139 used in demonstration and excerpt from DIMAP data quality file, from contribution by Didier Giacobbo.
2005-01-27	2005-01-27	Barry M. Schlesinger	Reformatting and editorial corrections	Edited as approved Discussion Paper

v. Changes to the OGC Abstract Specification

The OGC™ Abstract Specification does not require changes at this time to accommodate the technical contents of this document. However, Topic 11, metadata, may need revision in the future to accommodate the content of ISO 19115, part 2, both the revisions in the existing draft and the revisions recommended in this document.

vi. Future work

Improvements in this document are desirable to illustrate additional test implementations and to support changes in standards and specifications as they occur.

Foreword

Progress in the definition of metadata and specifications for its implementation continues. Under ISO/TC 211, an XML implementation of ISO 19115 Metadata is being developed: ISO 19139. That technical specification will prescribe how the abstract UML model in ISO 19115 can be converted into an XML model. Also under ISO TC 211 Geographic information, development of standards that support elements in the RSE not in ISO 19115 has begun. ISO 19115, part 2, provides imagery-related metadata elements, among them descriptions of algorithms and processing, of ground pixel properties, and of mission/platform/sensor identification. A part 2 of 19139 to provide XML implementation for this metadata will be developed when ISO has accepted 19115, part 2. ISO 19130 Sensor and data model specifies metadata describing geolocation and describing sensor properties needed when using a sensor model, a description of the sensor configuration, to provide geolocation information. SensorML, which has been under development at the University of Alabama, Huntsville, will specify an implementation for 19130. The present document will describe metadata for tests of the 19139 implementation specifications. This document will not cancel or replace any existing documents; however, the results may be used as a basis for comments to the project teams or editing committees active in developing and reviewing the existing standards.

There are three annexes, all informative. Two present XML that was used in the interoperability tests of OWS 2. The other shows how DIMAP provides data quality XML, which was not used in the interoperability testing because of incompatibilities with ISO 19139.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The Open Geospatial Consortium Inc. shall not be held responsible for identifying any or all such patent rights.

Introduction

Special XML schemas have been created for individual data sets, based on ISO 19115 and a general schema for the RSE. However, a generalized metadata XML schema should be available where possible; it should not be necessary to create special schemas for each data set. ISO 19139 can serve as such a general XML implementation specification for 19115. This implementation needs to be tested in practice. In addition, the new ISO standards are incorporating much, if not all, of the metadata not in 19115 that the RSE contain. XML schemas for these metadata need to be developed that are based upon the abstract model in the ISO standards. All of these implementations need to be tested in practice. This Report describes such tests and the results. It also describes to what extent metadata on which the test metadata are based are supported by 19139, to what extent they are supported by metadata specified in the new ISO standards or the RSE, and to what extent new metadata elements are needed.

Imagery Metadata

1 Scope

This OGC™ document gives guidelines for the use of ISO and FGDC standards in defining metadata elements to accompany imagery. It is applicable in its principles to the description of metadata for any imagery. Because many of the standards cited are still draft standards, albeit advanced drafts, and still subject to change, the guidelines will be valid strictly only at the time of the release of this document and for some period after. As standards evolve, the guidelines will need to be evaluated in the light of the changes in the standards.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

Federal Geographic Data Committee *Content Standard for Digital Geospatial Metadata: Extensions for Remote Sensing Metadata, FGDC-STD-012-2002*

ISO 19115:2003, *Geographic information – Metadata*

ISO/DIS 19123, *Geographic Information — Schema for coverage geometry and functions*

OGC 03-017, *OWS 1.2 Image Handling Metadata*

OGC 04-016r2, *OWS Common Implementation Specification, March 2004*

OGC 04-046r2 *ISO 19111 revision draft*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply:

3.1
class
description of a set of objects that share the same attributes, operations, methods, relationships, and semantics [ISO 19103]

3.2
coordinate reference system
coordinate system that is related to the real world by a datum [ISO 19111]

3.3
coordinate system
set of mathematical rules for specifying how coordinates are to be assigned to points [ISO 19111]

3.4
coverage
feature that acts as a function to return one or more feature attribute values for any direct position within its spatiotemporal domain [ISO 19123]

3.5
data
reinterpretable representation of information in a formalised manner suitable for communication, interpretati
[ISO/IEC 2382-1]

3.6
datum
parameter or set of parameters that serve as a reference or basis for the calculation of other parameters [ISO 19111]

3.7
geolocation
mathematical correspondence between position in grid coordinates and position in geodetic coordinates [based upon ISO 19130, editorial changes only]

3.8
grid
network composed of two or more sets of curves in which the members of each set intersect the members of the other sets in a systematic way that divides a space [ISO 19115]

3.9
gridded data
data whose spatial values are positions on a grid coordinate system [ISO 19129]

3.10
image
gridded coverage whose attribute values are a numerical representation of a physical parameter [ISO 19101-2]

NOTE The physical parameters are the result of measurement by a sensor or a prediction from a model.\

3.11
imagery
set of images [ISO 19101-2]

3.12
metadata
data about data [ISO 19115]

3.13
metadata element
discrete unit of metadata [ISO 19115]

3.14
quality
totality of characteristics of a product that bear on its ability to satisfy stated and implied needs [ISO 19101]

3.15
rectified grid
grid for which there is a linear relationship between the grid coordinates and the coordinates of an external coordinate reference system [ISO 19123]

NOTE If the coordinate reference system is related to the earth by a datum, the grid is a georectified grid.

3.16
referenceable grid
grid associated with a transformation that can be used to convert grid coordinate values to values of coordinates referenced to an external coordinate reference system [ISO 19123]

NOTE If the coordinate reference system is related to the earth by a datum, the grid is a georeferenceable grid.

3.17
spatial reference system
description of position in the real world [ISO 19112]

4 Conventions

4.1 Symbols (and abbreviated terms)

CD	Committee Draft
DIMAP	Digital Image MAP
DTD	Document Type Description \
DTS	Draft Technical Specification
ECS	EOSDIS Core System

EOSDIS	Earth Observing System Data and Information System
FGDC	Federal Geographic Data Committee
HDF-EOS	Hierarchical Data Format – Earth Observing System
ISO	International Organization for Standardization
MODIS	MODerate resolution Imaging Spectroradiometer
OGC	Open Geospatial Consortium
RSE	Remote Sensing Extensions
TC	Technical Committee
UML	Unified Modeling Language
XML	eXtended Markup Language
XSLT	eXtensible Stylesheet Language Transformations
WD	Working Draft

4.2 Document terms and definitions

This document uses the specification terms defined in Subclause 5.3 of [OGC 04-016r2].

5 Existing standards

5.1 General metadata standards

5.1.1 ISO 19115 Geographic information — Metadata

ISO 19115 was approved by ISO as an International Standard in 2003. It was designed to be the general metadata standard applicable to all data sets with geographic information. Most elements are applicable to any kind of geographic information, but a number of its metadata elements have specific applicability to imagery:

– Geolocation information for georectified and georeferenceable grids

– Description of attributes, including wavelength bands of observation

– Conditions under which measurements were made

– Identification and description of browse graphic files

– Positional accuracy of gridded data

ISO 19115 is the first standard that should be examined when developing metadata. It specifies a set of core elements, some required and some optional. The required elements are mostly catalogue information and use information. Optional elements describe the data, its history, and availability. Geographical images are coverages, presenting values of one attribute or more at all points of a discrete or continuous grid. For the user to interpret such information requires a description of the grid and the spatial reference system in which in which the points are located, the attributes, and if the data are geographically located, geolocation information to determine the geographic information in which such a grid is located. Such information is included in the optional elements.

5.1.2 ISO 19139 Geographic information — Metadata — XML schema implementation

Early drafts of ISO 19115 contained implementation information in the form of an annex with a Document Type Description (DTD). However, as ISO 19115 was developing, practice in the usage of XML was shifting from the use of DTDs to XML schema. Rather than delay progress of the ISO standard any further, it was decided to produce a separate technical specification with an XML schema that could be used to generate XML for ISO 19115 compliant metadata. This project was approved as ISO 19139.

ISO TC 211 has approved the first committee draft as a draft technical specification describing the rules used for deriving XML schemas from the ISO TC 211 abstract UML models. It describes how different types of UML structures are implemented in XML: classes, attributes, associations, and generalizations. Clause 6.4.8 presents a detailed description of how to implement codelists. XML implementations from ISO 19136 Geography Markup Language are used to implement abstract classes from other ISO TC 211 standards, in particular, ISO 19107 Geographic Information — Spatial schema and ISO 19108 — Temporal Schema. Other elements are implemented within 19139 from ISO 19103 — Conceptual schema language, ISO 19109 — Rules for Application Schema, and 19118 — Encoding. ISO provides an XML schema called smXML, and, for information, provides two sample XML files compliant with that schema, one for the required core metadata and one for all the core metadata. This document should govern XML implementation of 19115.

5.2 Standards for imagery and remote sensing

5.2.1 Introduction

ISO 19115 and its implementation do not provide all the metadata elements needed to describe imagery. A goal of this study is to determine what additional metadata is needed and where it is to be found. Three standards are available to provide additional metadata.

5.2.2 FGDC Content Standard for Digital Geospatial Metadata: Extensions for Remote Sensing Metadata

Creation of this standard was originally motivated by a comparison between the ECS Core Metadata and the FGDC Content Standard for Digital Geospatial Metadata. The comparison revealed that the FGDC standard lacked many metadata elements needed to describe remote sensing data and imagery. The Remote Sensing Extensions (RSE) were

developed to define such metadata elements. As ISO 19115 was being developed at the same time, a number of the elements in the RSE were adapted into ISO 19115. However, there were a number of subjects in the RSE that were not covered in ISO 19115:

– Identification information for missions, platforms, and sensors

– Orbital or flight information

– Information on the algorithm and/or processing used to generate the data

– Full details about wavelength bands observed

– Conditions during acquisition

– Geolocation information for georeferenceable but not georectified rasters.

– Sensor properties needed to derive a sensor model for geolocation.

ISO project teams are now developing standards that support many of these elements

5.2.3 ISO 19115-2 Geographic Information — Metadata— Part 2: Extensions for imagery and gridded data

This standard extends the ISO metadata standard to incorporate elements that are needed for the description of imagery and gridded data. The most recent working draft (WD) includes elements in many areas from the RSE:

– Information on the algorithm and/or processing used to generate the data

– Conditions during acquisition

– Dimensions and positions of individual cells

– Information that is not in ISO 19115 about the wavelength bands

– Identification information for missions, platforms, and sensors

Additional individual elements from the RSE that would naturally have belonged to existing classes in ISO 19115 have been added. Because of the UML requirements, they have been added as attributes of new subclasses of the existing classes. New classes have been added to describe targets for observation and planning for observing those targets. Contributions of additional elements from the military and intelligence communities are anticipated. Production of a new WD awaits contributions of such elements and resolution of possible areas of overlap with ISO 19130.

5.2.4 ISO 19130 Geographic Information —Sensor and data model for imagery and gridded data

The purpose of this standard is to describe the information required for geolocation, the geometric calibration of imagery, in the georeferenceable case, the case in which

georeferencing information is available but the grid is not rectified; given the location of a point in an image grid and geographic coordinates and the dimensions of one grid cell, one cannot necessarily determine the geographic location of any other point on the image grid. The cell sizes almost always vary.

The standard specifies the information required to support geolocation of georeferenceable imagery, including a sensor description and associated physical information defined by a sensor model, fitting functions, and ground control points. It describes how the sensor measurements and the geolocation information are logically associated. Some of this information was in the RSE, but 19130 provides more detail in a number of areas.

Areas of 19130 are associated with 19115-2. The georeferencing information of 19130 is a component of the georeferencing description of ISO 19115-2. Control points can be used both to determine geolocation as part of the georeferencing description and to check the accuracy of georectified data. Information on the source instrument or sensor may or may not be useful for geolocation purposes. Information that is required for geolocation purposes should be part of 19130; other sensor/instrument information should be part of 19115-2. The ISO 19130 editing committee and the ISO 19115-2 development group are working together to resolve where any given element belongs.

A committee draft (CD) for ISO 19130 was issued in January 2004. An editing committee to review the comments on that draft began meeting in May 2004 in Kuala Lumpur, Malaysia and continued in September 2004 in Lanham, Maryland, where all comments were resolved. After the document has been revised in response to the decisions of the editing committee, the significant changes will require that a new CD be issued for ballot.

6 Core metadata

6.1 Introduction

ISO 19115 identifies a set of core metadata from the many metadata elements it defines. There is a set of required elements, most of which are essentially catalogue elements that identify the dataset, tell the user what it is about, and tell the user how to get it. A few elements are mandatory under certain conditions. All dataset metadata must include these elements. A set of optional elements is defined, whose use will increase interoperability. The following clauses describe the core metadata in detail.

6.2 Required core metadata

Table 1 shows the required core metadata, with the hierarchy as prescribed by ISO 19115. It is in a form that will allow users to structure their metadata according to the requirements. Also, by substituting their own metadata into the matrix, they will be able

Table 1 — Required core metadata elements

Class	ISO element	Value	Remarks
MD_Metadata			
	language		For *metadata,* required if not defined by the encoding
	characterSet		For *metadata,* required if neither ISO/IEC 10646-1 nor defined by encoding
	dateStamp		Metadata creation date in ISO 8601 format
contact:CI_ResponsibleParty			Contact for *metadata*
	organisation/individual/position/Name		
	role		owner, originator, etc.
MD_Identification			
	abstract		
citation:CI_Citation			
	title		name by which the data set is known; not an identifier code
date:CI_Date			
	date		
	dateType		creation, revision, etc.
MD_DataIdentification			
	language		For *data*
	characterSet		For *data,* required if ISO/IEC 10646-1 is not used
	topicCategory		elevation, environment, inlandWaters, etc.
extent:EX_Extent			Required for a dataset/granule (MD_Metadata.hierarchyLevel=dataset)
EX_GeographicExtent			Either EX_GeographicBoundingBox or EX_GeographicDescription must be present
EX_GeographicBoundingBox			Bounds in decimal degrees.
	westBoundLongitude		
	eastBoundLongitude		
	southBoundLatitude		
	northBoundLatitude		
EX_GeographicDescription			
geographicIdentifier:MD_Identifier			

Class	ISO element	Value	Remarks
	code		a character string

to determine whether or not their metadata is compliant. The first column contains class names and those elements whose data type is a class. The second column shows the names of those elements whose data type is not a class and therefore have a value. The third column is blank in this table and can be used to fill in values from a metadata file being checked for compliance. The fourth column contains remarks, some of which are elaborated on in the remainder of this clause. The rationale for requiring some metadata elements also is discussed. Required core metadata must have actual values corresponding to the required data type; they cannot be blank. Annex E.1 of ISO 19139 contains a sample XML instance document for the mandatory ISO 19115 metadata elements.

Both MD_Metadata and MD_DataIdentification have language and character set requirements; that in MD_Metadata is for the metadata and that in MD_DataIdentification is for the data. The language and character set for the data and metadata need not be the same, and therefore both sets must be provided. In the case of metadata, the format used to encode the metadata may prescribe what language and character set are used; in such a case, the information need not be provided in the metadata. For both metadata and data, the default character set is ISO/IEC 10646-1; if that character set is not used, the character set must be provided.

Dates for both metadata and data must be provided. In MD_Metadata, there is a date stamp for the metadata. In the citation provided as part of MD_Identification, there is a production, publication, or revision date for the data in MD_Identification. These dates are not necessarily the same. In some cases, one set of metadata may be provided for multiple sets of data, which may have been produced, published or revised at different times. The need for an associated date of origin is not restricted to digital or geographic data. Users who derive results from reprocessed data need to know the processing version of the data they are using. When examining changes with time, the user must know that that results for both periods were processed in the same way and that observed changes with time are not artifacts of the processing.

The topic category is required so that the potential user can discover whether or not the data is likely to be in a subject area interest before expending the time to obtain and read the data set

For metadata that describe geographic datasets, the geographic location for the geographic data must be provided. This information can be provided in one of two ways. There may be a description of the area using text, or there may be a geographic bounding box. A bounding box is a square in latitude and longitude containing the entire geographic area of the data. It need not coincide with the boundaries of the data area; in fact, it normally will not, and the data will be in a smaller area inside it.

6.3 Core metadata for OWS 2

Table 2 shows a more complete list of core metadata elements, in particular those that are relevant to OWS 2. This clause is a discussion of that list. Discussion already in clause 6.2 and relevant only to the mandatory core elements is not repeated. While the presence of these metadata elements is optional, they must be used in the way prescribed in 19115 if they are present. There is a new column for Obligation (Obl.), which tells whether the element is mandatory (M), optional (O), or mandatory only under certain electronically manageable conditions. Some of the elements in classes that are optional are listed as mandatory or conditional. A mandatory listing for such an element means that the element must be present if the class is present; a conditional listing means that the element must be present if the class is present and the conditions are satisfied. The elements are not globally mandatory. If the class of which they are a member is absent, they will be absent. If a class is absent, perhaps in the context of being the data type of an optional element, then its subclasses, aggregation components, and their elements should not be present with blank values or values such as “not available” or “unknown”.

Not all elements in optional classes of core metadata are themselves part of the core metadata. The table does not specifically list all such elements. Generally, when such elements exist but are not specifically listed, there is a note in the table to that effect.

Annex E.2 of ISO 19139 provides an XML instance document including all the core metadata elements.

The metadata standard name should be the universally recognized name of the metadata standard, such as ISO 19115 or the FGDC Content Standard for Digital Geospatial Metadata, not some local name given to the standard. Similarly, the version should not be a local designation but a universally recognized name such as that of a profile.

Note that there is separate contact information for the data and metadata. The metadata contact is a required element and identifies the party responsible for the metadata. The point of contact that is part of MD_Identification identifies the entity associated with data and provides contact information. The roles may be different. The metadata contact might be the resource provider, custodian, or distributor. The data contact might be the originator or the principal investigator.

Vertical extent information is optional, but if it is present, both the maximum and minimum value must be provided. Similarly, temporal extent information is optional. This metadata element refers to ISO 19108. The temporal extent must be one of two subtypes. It may be a TM_Instant, a specific moment, either an exact time given by date, time, or both, or an indefinite time defined by its occurrence relative to another time. It may be instead a TM_Period, an interval with a beginning and an end.

The reference system can be furnished in one of two ways. The metadata may provide the projection, ellipsoid and datum. If it does not do so, then a code to identify the

Table 2 — Expanded core metadata elements

Class	ISO element	Value	Obl.	Remarks
MD_Metadata				
	language		C	For *metadata,* required if not defined by the encoding
	characterSet		C	For *metadata,* required if neither ISO/IEC 10646-1 nor defined by encoding
	dateStamp		M	Metadata creation date in ISO 8601 format
	fileIdentifier		O	
	metadataStandardName		O	Name of Metadata standard used; e.g., ISO 19115
	metadataStandardVersion		O	Of the standard in the metadataStandardNameElement
contact:CI_ResponsibleParty				Contact for *metadata*
	organisation/individual/position/Name		M	
	role		M	owner, originator, etc.
MD_Identification				
	abstract		M	
pointOfContact:CI_ResponsibleParty			O	Contact for *data*
	organisation/individual/position/Name		M	
	role		M	owner, originator, etc.
citation:CI_Citation				
	title		M	
date:CI_Date				
	date		M	
	dateType		M	creation, revision, etc.
MD_DataIdentification				
	spatialRepresentationType		O	grid, textTable, video, etc.
	language		M	For *data*
	characterSet		C	For *data,* required if ISO/IEC 10646-1is not used
	topicCategory		M	elevation, environment, inlandWaters, etc.
spatialResolution:MD_Resolution			O	Either equivalentScale or distance must be present
	distance		C	
equivalentScale:MD_RepresentativeFraction			C	
	denominator		M	

Class	ISO element	Value	Obl.	Remarks
extent:EX_Extent			M	Required for a dataset/granule (MD_Metadata.hierarchyLevel=dataset)
EX_GeographicExtent			M	Either EX_GeographicBoundingBox or EX_GeographicDescription must be present
EX_GeographicBoundingBox			C	
	westBoundLongitude		M	
	eastBoundLongitude		M	
	southBoundLatitude		M	
	northBoundLatitude		M	
EX_GeographicDescription			C	
geographicIdentifier:MD_Identifier			M	
	code		M	a character string
	codespace		O	a character string
EX_VerticalExtent			O	
	minimumValue		M	
	maximumValue		M	
EX_TemporalExtent			O	
extent:TM_Primitive			M	ISO 19108; abstract, one or more of two subclasses is instantiated
TM_GeometricPrimitive				abstract, one or more of two subclasses is instantiated
TM_Instant				
position:TM_Position				Union: one of four elements is present
	date8601		C	
	time8601		C	
	dateTime8601		C	
anyother:TM_TemporalPosition			C	
	indeterminatePosition		O	unknown, now, before, or after
TM_Period				
TM_Instant			O	two instances: beginning and end
DQ_DataQuality			O	
LI_Lineage			O	
LI_Source			O	all elements optional
LI_ProcessStep			O	

Class	ISO element	Value	Obl.	Remarks
	description		M	additional optional elements
MD_ReferenceSystem			O	
referenceSystemIdentifier:RS_Identifier			C	required if projection, ellipsoid and datum from MD_CRS are not present
	code		M	inherited from MD_Identifier
	codeSpace		O	inherited from MD_Identifier, a character string
	version		O	
authority:CI_Citation			O	
MD_CRS			O	
	projection		O	
	ellipsoid		O	
	datum		O	
MD_Distribution			O	
MD_Format			C	Required if MD_Distributor.distributorFormat not documented
	name		M	
	version		M	
MD_DigitalTranferOptions			O	All elements optional, describe size and how available
	unitsOfDistribution		O	Tiles, layers, geographic areas in which data is available
	transferSize		O	Size, in megabytes, of a unit of the transport format used
online:CI_OnLineResource			O	
	linkage		M	URL
	protocol		O	Connection protocol
	applicationProfile			
	name			
	description			
	function			e.g., download, search, order
offline:MD_Medium				
	name			e.g., CD-ROM, DVD, 3.5-inch floppy, hardcopy
	density			
	densityUnits			
	volumes			
	mediumFormat			e.g., CPIO, tar, ISO 9660
	mediumNote			

coordinate system must be provided. Providing the code space in which the coordinate system is defined will help the user to identify the coordinate system corresponding to the code.

The core distribution metadata is the format. In the 19115 standard, it may be provided along with the distributor contact information or separately. The distributor contact information is not core metadata.

7 OWS 2 metadata examples

7.1 Introduction

This clause shows how the tables above can be used in evaluating the compliance of individual sets of metadata to 19115. It does so by analyzing two sets of metadata used in the OWS 2 exchanges: HDF-EOS metadata for MODIS measurements related to Hurricane Isabel and DIMAP metadata based on Spot Image. The analyses point out where the metadata are not in compliance with 19115 and where the metadata contain elements that are not supported in 19115. The possibility of support for such elements in other standards, such as the RSE and the developing 11915, part 2 and 19130, is investigated.

There are two ways in which OWS metadata that is supported by ISO 19115 may be out of compliance. One is a difference between the formal requirements of the standard for elements and the data types of those elements: a difference in syntax. Such a difference might cause problems in attempting to reconcile the file with the XML schema to which it are intended to conform and might cause problems in attempts to read the file. The other is a difference in which the elements and their content meet the formal structural requirements for reading files, and are thus formally in conformance with the schema, but where the values of the elements do not provide the information required by ISO 19115: a semantic difference. For interoperability testing purposes in OWS 2, only the syntax need be correct.

7.2 HDF-EOS metadata

7.2.1 Introduction

Annex A contains a sample of the XML metadata files used in the OWS 2 demonstration, with metadata describing MODIS measurements of Hurricane Isabel. Table 3 contains a tabulation and comparison of that file with the prescriptions of ISO 19115 and 19139. The ways in which the OWS file is out of compliance are mentioned in the Remarks column. Because this XML file may be used as a model, it is important to note content that will need to be different for actual applications.

The implementation of codelists in this XML file is inconsistent. The lack of consistency arises largely because it is not at present possible to implement codelists as 19139 specifies. In 19139, the specification is to provide codes through reference to a register and the name of the entry in the register. The numerical value and an alternate name,

perhaps in a language other than English, are provided. At the moment, such registers do not exist. The one given in 19139 is only sample text, not the name of an actual register. Thus it will not be possible to implement that provision of 19139 as is intended in the technical specification until a metadata codelist register exists. Files like this one can then be brought into better conformance with the standard.

Table 3 — Hurricane Isabel MODIS metadata for testing

Class	ISO Element	Value	Remarks
MD_Metadata			
	fileIdentifier	MOD09GHK.004_HurricaneIsabelMOD09GHKHEG	
	characterSet	utf8	Corresponds to the code of 004 in MD_CharacterSetCodeList
	dateStamp	2004-05-10	
	metadataStandardName	ISO19139	
	metadataStandardVersion	F06R1	This should be a version of the standard, e. g. CD1. What is F06R1?
contact:CI_ResponsibleParty			Contact for *metadata*
	individualName	Cristina Bories	
	organisationName	unknown	Optional element; need not be present if value is unknown
	positionName	NASA Synergy Project	This value is really the name of the responsible organization rather than the position held by the responsible party and ought to be under organisationName with positionName blank
	role	publisher	Corresponds to a code of 010 in CI_RoleCode
contactInfo:CI_Contact			This element is optional: therefore subelements need not be present; either with unknown or {blank} values
phone:CI_Telephone			
	voice	unknown	
	facsimile	unknown	
address:CI_Address			
	deliveryPoint	unknown	
	city	unknown	
	postalCode	unknown	
	country	unknown	
MD_Identification			

Class	ISO Element	Value	Remarks
	abstract	Coverage MOD_Grid_L2g_2d of file MOD09GHK.A2003261.h11v04.004.2003269033744	The value is an identifier, not a brief narrative summary of the contents of the resource, as required by the standard
citation:CI_Citation			
	title	MOD09GHK.A2003261.h11v04.004.2003269033744_MOD_Grid_L2g_2d	
	alternateTitle	Coverage MOD_Grid_L2g_2d of file MOD09GHK.A2003261.h11v04.004.2003269033744	The value is neither a short name for the title nor in a different language, in conflict with the requirements of the standard.
date:CI_Date			At least one known date is required
	date	unknown	Content does not fit required data type of Date
	dateType	publication	Corresponds to a value of CI_DateTypeCode of 002
	date	unknown	Content does not fit required data type of Date
	dateType	creation	Corresponds to a value of CI_DateTypeCode of 001
	date	unknown	Content does not fit required data type of Date
	dateType	revision	Corresponds to a value of CI_DateTypeCode of 003
MD_DataIdentification			
	language	en	For *data*
	topicCategory	007	
		010	
extent:EX_Extent			
EX_GeographicExtent			
EX_GeographicBoundingBox			
	westBoundLongitude	-108.90066786	

Class	ISO Element	Value	Remarks
	eastBoundLongitude	-78.324437349	
	southBoundLatitude	39.99999999	
	northBoundLatitude	49.999999996	
EX_TemporalExtent			
extent:TM_Primitive (19108)			
TM_GeometricPrimitive			
TM_Period			
begunBy:TM_Instant			
position:TM_Position			
	dateTime8601	2003-09-18T15:55:00Z	
endedBy:TM_Instant			
position:TM_Position			
	dateTime 8601	2003-09-18T19:55:00Z	
MD_Keywords			
	keyword	MOD09GHK.A2003261.h11v04.004.2003269033744_MOD_Grid_L2g_2d	The description of "keyword" is "commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject." This information is a data set name or identifier, not a description of the subject of the data.
DQ_DataQuality			
	scope	017	Undefined code. 005 dataset would appear to be appropriate
DQ_Element			
	measure description	Percent of Missing Data	Could change to fraction
DQ_Completeness			
DQ_CompletenessOmission			
result:DQ_QuantitativeResult			
	valueType	?	Should be present, with value "probability".
	valueUnit	MOD_Grid_L2G_2d	This is not a unit. Unit must come from ISO 19103, probably UomScale
	value	0.	Value of 0. would also be valid if measure were of type probability
MD_MaintenanceInformation			

Class	ISO Element	Value	Remarks
	maintenanceAndUpdateFrequency	continual	Corresponds to a value of 001for MD_MaintenanceFrequencyCode
	maintenanceNote	further update is anticipated	
	maintenanceNote	reprocessed	
MD_ReferenceSystem			
referenceSystemIdentifier:RS_Identifier			Only one instance of referenceSystemIdentifier appears to be allowed, with only one coordinate reference system (CRS) for a given image. If a CRS has multiple names, one should be used and the codespace in which is defined should be listed.
	code (inherited from MD_Identifier)	GDA 94	Geocentric Datum of Australia?
	codespace	EPSG:4326	This is a code and code space, which should be separate elements
MD_ContentInformation			
MD_CoverageDescription			
	attributeDescription	MOD_Grid_L2g_2d	The description of this element is “description of the attribute described by the measurement value” i.e. what the image represents. The value given is a data set name.
	contentType	Coverage Information	Value is improper type; it should be an entry from MD_CoverageTypeCode, a numerical representation of it (image), or thematic

7.2.2 Syntax differences

The data type for CI_Citation.CI_Date.date is a Date, which should be in ISO 8601 date format, not the character string “unknown”.

The <TimeInstant> element is misnamed <TimeIstant> in two places.

There are two instances of MD_ReferenceSystem.referenceSystemIdentifier. Only one is permitted. Multiple names for the same reference system can be handled through multiple instances of MD_ReferenceSystem, using a different codespace for each of the two names. The “code” element for one of these instances contains both code and codespace.

The code and codeSpace for MD_ReferenceSystem.referenceSystemInformation.RS_Identifier should be separate elements, not combined into one.

7.2.3 Semantic differences

The value for metadataStandardVersion should be a version of ISO 19139, such as CD1. F06R1 is not.

If optional elements have unknown values, they need not be present with values of ‘unknown”.

NASA Synergy Process is the name of an organisation, not of a position, and should be listed under organisationName. The element positionName might contain the position Cristina Bories holds within the NASA Synergy Project.

For a number of elements, some variant of the file identifier is used as a place holder where the standard requires descriptive information about the data set or its quality: MD_Identification.abstract, MD_Keyword.keyword, DQ_QuantitativeResult.valueUnit, and MD_CoverageDescription.attributeDescription.

MD_Identification.CI_Citation.alternateTitle is supposed to be either a short name for the title or in a different language. The alternate title in the dataset is neither but appears to be a variant of the file identifier...

The code given for DQ_DataQuality.scope is 017, which is undefined in ISO 19115. A new code appears unnecessary, as a code of 005, for “dataset”, would appear to be appropriate.

There is no direct support in ISO 19103 for a percentage value. The probability data type runs from 0. to 1. and could be used for the same quality measure. The units would correspond to uomScale.

The element MD_CoverageDescription.contentType must have a code value from the MD_CoverageContentType codelist, indicating whether the attributes are values in physical units of the quantity being measured, meaningful numerical representations of a physical parameter, or a code value with physical meaning. A value of “Coverage Information” does not provide the information required by this element, as all of these types of attributes may be displayed in a coverage. Information about the coverage attributes is needed.

In addition, there is no MD_SpatialRepresentation metadata explaining how to obtain the geographic location of the data points. While such metadata is not required by ISO

19115, it needs to be present if the distributor intends that the user be able to obtain the geographic location of the data.

7.3 DIMAP metadata

7.3.1 Introduction

Both the DIMAP metadata and ISO 19115 have a dictionary of terms to describe datasets. Those dictionaries are based on a hierarchical approach. The use of hierarchy and groupings allows users to select elements for their own needs.

To publish the DIMAP metadata, for instance, Spot Image uses keywords. The keywords are fully documented, the data types are specified, and the value range can be checked. The keywords are themselves organised semantically together in Groups. A Group can be composed of keywords and/or other sub-groups. This hierarchical approach is equivalent to the ISO 19115 approach, with the 19115 classes equivalent to DIMAP groups.

The DIMAP metadata is focussed on raster datasets. Therefore, one will find many keywords dedicated to this sort of layer. Nevertheless, except for certain particular aspects of raster description, such as geopositioning by ground control points, image interpretation or image display, the DIMAP groups have counterparts in ISO 19115. Ground control points are covered in ISO 19130.

7.3.2 Comparison of DIMAP with ISO 19115

7.3.2.1 Overview

Table 4 shows the parallels and differences between DIMAP Groups and the ISO 19115 classes. Cases where content in one case has no parallel in the other are labelled “no equivalent”.

For the OWS 2 demonstration, a sample XML metadata file, with metadata describing SPOT product acquired over the San Diego region was created. Table 5 shows how the contents of this particular file map to the ISO 19115 format. The contents of the file itself are in Annex B. XSLT can be used to transform one to the other. Differences are noted in the Remarks column.

The reader will note that the same responsible party information appears three times. The three separate instances are needed, because they may refer to different parties. The contact under MD_Metadata is a party responsible for the metadata information. The point of contact under MD_Identification is a party associated with the data. The distribution contact under MD_Distributor is a party from whom the data may be obtained. While all these functions are carried out by the same organisation under Spot Image, they need not be filled by the same individual, position, or organisation. Hence separate instances are necessary. The responsible individual, position, organisation and their role are required for each instance of CI_ResponsibleParty. The full contact information under CI_Contact is not and might not be repeated for all instances of CI_ResponsibleParty.

Table 4 —Hierarchical comparison between DIMAP groups and ISO UML Classes

DIMAP groups	Type of information	ISO 19115 UML class
Metadata_ID	Description	MD_Metadata
Dataset_ID		*MD_Identification* , MD_BrowseGraphic MD_Constraints, CI_Citation
Dataset_Frame		EX_Extent
Dataset_Use		*MD_Identification*
Production		*MD_Identification*
Dataset_Components		No equivalent
Quality_Assessment		DQ_DataQuality
Vector_Attributes		No equivalent
No equivalent		MD_MaintenanceInformation
No equivalent		MD_ApplicationSchemaInformation
No equivalent		MD_PortrayalCatalogueReference
Raster_Dimensions		MD_SpatialRepresentation
Data Processing		MD_ContentInformation
Raster_CS	Rendering	*MD_SpatialRepresentation*
Raster Encoding		MD_ContentInformation
Coordinates Reference System	Coordinates	MD_ReferenceSystem
Geoposition		No equivalent
Map_Declination		No equivalent
Dataset_Sources	Lineage	DQ_DataQuality
Dataset_Access	Exploitation	MD_Distribution
Image_Display		No equivalent
Image_Interpretation		No equivalent

Table 5 — Reference3D Spot metadata for testing in ISO 19115 form

Class	ISO element	Value	Remarks
MD_Metadata			
	dateStamp	2003-11-26	Metadata creation date in ISO 8601 format
	metadataStandardName	ISO 19115	
contact:CI_ResponsibleParty			Contact for *metadata.*
	organisationName	Spot Image	
	role	http://metadata.dgiwig.org/codelistRegistry?CI_RoleCode "owner"	
contactInfo:CI_Contact			
phone:CI_Telephone			
	voice	+33(0)5 62 19 40 40	
	facsimile	+33(0)5 62 19 40 11	
address:CI_Address			
	city	TOULOUSE	
	administrativeArea	5 rue des Satellites	This information is the address line for the location and should be deliveryPoint. administrative area would be the province name
	postalCode	31030	
	country	FRANCE	
onlineResource:CI_OnlineResource			
	linkage	www.spotimage.fr	
	function	http://metadata.dgiwig.org/codelistRegistry?CI_OnlineFunctionCode "information"	
MD_Identification			
	abstract	Reference3D is a worldwide database mainly made of data originating from the SPOT5 satellite HRS instrument. Each dataset comprises three layers: - the digital elevation model (DEM) layer; DEM format is DTED; - the digital orthoimage layer; - the data quality (including data lineage)	Linked to the product. Change for each
pointOfContact:CI_ResponsibleParty			Contact for *data.* Inherited by MD_DataIdentification.

Class	ISO element	Value	Remarks
	organisationName	Spot Image	
	role	http://metadata.dgiwig.org/codelistRegistry?CI_RoleCode "owner"	
contactInfo:CI_Contact			
phone:CI_Telephone			
	voice	+33(0)5 62 19 40 40	
	facsimile	+33(0)5 62 19 40 11	
address:CI_Address			
	city	TOULOUSE	
	administrativeArea	5 rue des Satellites	This information is the address and should be deliveryPoint. administrative area would be the province name
	postalCode	31030	
	country	FRANCE	
citation:CI_Citation			Inherited by MD_DataIdentification
	title	SPOTView N32W118	
date:CI_Date			
	date	2003-11-26	
	dateType	http://metadata.dgiwig.org/codelistRegistry?CI_DateTypeCode "creation"	
	OtherCitationDetails	Spot Image 2003 – IGN France 2003	
MD_BrowseGraphic			Inherited by MD_DataIdentification
	fileName	OR_T.jpg	
	fileDescription	thumbnail	
	fileType	JPEG	
MD_BrowseGraphic			Inherited by MD_DataIdentification
	fileName	OR_Q.jpg	
	fileDescription	quicklook	
	fileType	JPEG	
MD_Format			Inherited by MD_DataIdentification
	name	GeoTIFF	
	version	1.0	
	specification	GeoTIFF1.0 ReferenceManual	
MD_DataIdentification			
	language	eng	For *data*

Class	ISO element	Value	Remarks
	topicCategory	imageryBaseMapsEarthCover	Should be from the codelist under MD_TopicCategoryCode:elevation, environment, inlandWaters, etc, not a generalised character string..
	spatialRepresentationType	http://metadata.dgiwig.org/codelistRegistry?CI_SpatialReprentationTypeCode "grid"	
spatialResolution:MD_Resolution			
equivalentScale:MD_RepresentativeFraction			
	denominator	50000	
extent:EX_Extent			
EX_GeographicExtent			not GeographicElement
EX_GeographicBoundingBox			Values should be in real format, e. g. 32.0. See examples in 19139
	westBoundLongitude	-119	
	eastBoundLongitude	-118	
	southBoundLatitude	32	
	northBoundLatitude	33	
MD_Contraints			
MD_LegalConstraints			
useConstraints:MD_RestrictionCode		http://metadata.dgiwg.org/codelistRegistry?MD_RestrictionCode "001"	The appropriate element (and possibly code) should be used.
DQ_DataQuality			
scope:DQ_Scope			
	level	http://metadata.dgiwig.org/codelistRegistry?MD_ScopeCode "dataset"	
LI_Lineage			
LI_Source			
	description	SEGMENT HRS2 S	
sourceCitation:CI_Citation			
	title	SEGMENT HRS2 S	
date:CI_Date			
	date	2003-07-30	

Class	ISO element	Value	Remarks
	dateType	http://metadata.dgiwig.org/codelistRegistry?CI_DateTypeCode "creation"	
identifier:RS_Identifier			
	code	S5S2S0307301844141	Inherited from MD_Identifier
sourceExtent:EX_Extent			
EX_GeographicExtent			
EX_GeographicBoundingBox			
	westBoundLongitude	-118.26	
	eastBoundLongitude	-116.64	
	southBoundLatitude	31.87	
	northBoundLatitude	33.48	
LI_Source			
	description	SEGMENT HRS2 S	
sourceCitation:CI_Citation			
	title	SEGMENT HRS2 S	
date:CI_Date			
	date	2003-06-29	
	dateType	http://metadata.dgiwig.org/codelistRegistry?CI_DateTypeCode "creation"	
identifier:RS_Identifier			
	code	S5S2S0306291840249	Inherited from MD_Identifier
sourceExtent:EX_Extent			
EX_GeographicExtent			
EX_GeographicBoundingBox			
	westBoundLongitude	-117.54	
	eastBoundLongitude	-115.64	
	southBoundLatitude	30.89	
	northBoundLatitude	33.48	
LI_Source			
	description	DEM from HRS stereo segments and other sources	
MD_SpatialRepresentation			
MD_GridSpatialRepresentation			
	numberOfDimensions	2	

Class	ISO element	Value	Remarks
	cellGeometry	http://metadata.dgiwig.org/codelistRegistry?MD_CellGeometryCode "area"	
	transformationParameterAvailability	false	
axisDimensionProperties:sequence<MD_Dimension>			
	dimensionName	http://metadata.dgiwig.org/codelistRegistry?MD_DimensionNameTypeCode "column"	
	dimensionSize	21606	
	dimensionName	http://metadata.dgiwig.org/codelistRegistry?MD_DimensionNameTypeCode "row"	
	dimensionSize	21606	
MD_SpatialRepresentation			
MD_Reference_System			
referenceSystemIdentifier:RS_Identifier			
	code	4326	
	codeSpace	EPSG	
MD_ContentInformation			
MD_CoverageDescription			
	attributeDescription	?	This element has type recordType : it describes strucutre and the data type, e.g., real, integer. of the attributes in the range of the coverage (image) whose values are provided at all points in the spatial grid. The type is documented in ISO 19103.
	contentType	http://metadata.dgiwig.org/codelistRegistry?MD_CoverageContentTypeCode "image"	
MD_ImageDescription			
processingLevelCode:MD_Identifier			
	code	http://metadata.dgiwg.org/codelistRegistry?MD_CoverageContentTypeCode "image"	
MD_DistributionInformation			
MD_Distributor			

Class	ISO element	Value	Remarks
distributorcontact:CI_ResponsibleParty			Contact for *metadata.*
	organisationName	Spot Image	
	role	http://metadata.dgiwig.org/codelistRegistry?CI_RoleCode "owner"	
contactInfo:CI_Contact			
phone:CI_Telephone			
	voice	+33(0)5 62 19 40 40	
	facsimile	+33(0)5 62 19 40 11	
address:CI_Address			
	city	TOULOUSE	
	administrativeArea	5 rue des Satellites	This information is the address line for the location and should be deliveryPoint. administrative area would be the province name
	postalCode	31030	
	country	FRANCE	
onlineResource:CI_OnlineResource			
	linkage	www.spotimage.fr	
	function	http://metadata.dgiwig.org/codelistRegistry?CI_OnlineFunctionCode "information"	
MD_Format			
	name	GEOTIFF	
	version	1.0	
MD_DigitalTransferOptions			
online:CI_OnlineResource			
	linkage	OR.TIFF	This keyword is intended to provide. The path notation should provide the complete URL/URI, not a filename relative to a local file.
	function	http://metadata.dgiwig.org/codelistRegistry?CI_OnlineFunctionCode "download"	

The implementation of codelists formally follows the prescription of 19139, through reference to a register and the name of the entry in the register. At the moment, however, there is no register containing codelists. The ones given here and in 19139 are only sample text. It will not be possible to implement that provision of 19139 as is intended in the technical specification until a metadata codelist register exists.

7.3.2.2 Syntax differences

The data type of MD_DataIdentification is the codelist MD_TopicCategoryCode, not text as in the XML file. One or more elements from the codelist should be selected.

The class aggregated into EX_Extent is EX_GeographicExtent, not EX_GeographicElement.

Values of latitude and longitude are real numbers, not integers, and should be written with a decimal point.

The element MD_CoverageDescription.attributeDescription has no content. A coverage consists of the values of one or more attributes at the points on a spatial domain. The attribute description provides the structure of the attribute records and the data types of the components.

The data type of CI_OnlineResource.linkage is URL, including the full path name and the transfer protocol designation. It is not simply the same of a local file presented as a character string.

7.3.2.3 Semantic differences

In the addresses, the street address, 5 rue des Satellites, is listed under adminstrativeArea. The administrative area would be a province name. The appropriate element for the street address is deliveryPoint.

7.3.3 DIMAP Quality information

DIMAP uses an abstract set of keywords to describe quality assessment parameters. An array of such parameters is used to provide information on the quality of the dataset. Each entry in this array provides a meaning and a value. The list of parameters is highly dependent upon the data producer and the type of product. Therefore, the data producers must produce documentation specifically applicable to the products they can generate. At the top of the group, the keyword “QUALITY_TABLES” provides the unique name of the quality table fully describing the parameters that the producer maintains. Annex C provides an example of how metadata is handled within DIMAP.

Table 6 shows how the DIMAP metadata might be expressed using the requirements of ISO 19115. In a collection of metadata, ISO 19115 allows a selection of different quality measures through the use of instances of the subclasses of DQ_Element with different names, measures, and identifier. There is no mechanism to define an overall heading for a table with a particular selection of elements.

There are also differences in structure and nomenclature. DIMAP uses QUALITY_PARAMETER_DESC to name the quality measure, which corresponds to the ISO 19115 element nameOfMeasure. The 19115 element measureDescription is

Table 6 — Comparison of DIMAP quality info with ISO 19115

DQ_Element			
	nameOfMeasure	Block triangulation Z-points, amount (version 1.0)	a count is referred to as “number”; an “amount” refers to a bulk quantity; number of loaves of bread, amount of flour. Replace “amount” with “number”
measureIdentification:MD_Identifier			
	code	igne:REF_3D_Z_NUMBER	
result:DQ_Result			
DQ_QuantitativeResult			
	value	61	
	valueUnit		missing; mandatory even for a pure number
DQ_Element			
	nameOfMeasure	Block triangulation XY mean, residuals, (version 1.0)	
measureIdentification:MD_Identifier			
	code	igne:REF_3D_XY_MEAN	
result:DQ_Result			
DQ_QuantitativeResult			
	value	0.0	
	valueUnit	pixel	should be a separate XMLentry
DQ_Element			
	nameOfMeasure	Block triangulation XY Standard Deviation (version 1.0)	
measureIdentification:MD_Identifier			
	code	igne:REF_3D_XY_SIGMA	
result:DQ_Result			
DQ_QuantitativeResult			
	value	0.0	
	valueUnit	Pixel	should be a separate XML item

DQ_Element			As the test is pass/fail (true/false), the result better fits the definition of a conformance result than of a quantitative result.
	nameOfMeasure	Mosaic feature matching (version 1.0)	
measureIdentification:MD_Identifier			
	code	REF_3D_MOS_MISMATCH	
result:DQ_Result			
DQ_QuantitativeResult			
	value	FALSE	FALSE is not a quantitative value
	valueUnit		Quantitative values have units; FALSE has no units.
DQ_Element			
	nameOfMeasure	Mosaic feature deviation (version 1.0)	
measureIdentification:MD_Identifier			
	code	igne:REF_3D_MOS_DEVIATION	
result:DQ_Result			
DQ_QuantitativeResult			
	value	0.0	

intended to provide more detailed information on the quality measure. DIMAP combines the value of the parameter and its units into one element; ISO lists them as two separate elements. Finally, DIMAP describes a true-false test in the same way as one with a quantitative value, whereas under ISO 19115, it would be a conformance result and handled differently from the quantitative results.

This quality information is optional and was not needed for the first test of the ISO 19139 implementation in 19115 form. Because of the lack of parallelism of the data structure and the absence of an obvious implementation of the quality table form in ISO 19115, it was not included in the test data set. Ways in which the DIMAP parameters can be expressed using the structure of DQ_Element and ways to support the quality table structure in 19115 part 2 need to be explored.

8 Proposed modifications to ISO standards

8.1 Introduction

In the course of examining the data sets being adapted for use in testing, a number of element not supported by ISO 19139 were found. In particular, several elements in the original Spot Image DIMAP data are not supported by ISO 19115 or ISO 19115-2. Rather than define new XML schema, it was regarded as preferable to first test 19139, and, consequently, elements that were not supported by 19139 were removed from the data sets. However, future studies should incorporate these elements. ISO 19139-2 will incorporate the new elements in 19115-2. The remainder of this clause recommends material for 19115-2 that is not there now.

8.2 Source Content

Metadata suppliers may want to provide information about the source data rather than just citations. ISO 19115 supports the following items of information about the source data:

– Either a description of the extent of the data using EX_Extent or a verbal description (one of the two is required)

– Scale

– Spatial reference system

– Citation

– Description of how it was produced

ISO 19115-2 adds additional information about the source;

– Processing level

– Identifier

– Resolution or sampling distance

For DIMAP, the primary product is a mosaic constructed of different pictures. A geographic grid is applied to this mosaic but not to the pictures used to construct it. The conditions under which the pictures were taken vary from one to the other, e.g., the time of observation, solar position and view angles. The distributors wish to provide the information for these individual pictures. The primary data is the mosaic, while the three contributing pictures are source data sets. There is no support in the current structure for describing this content information under LI_Source/LE_Source.

One might consider providing the identifiers for the pieces of the mosaic in LI_Source.inputDataset and have separate metadata instances for the individual pictures in the mosaic. MD_Metadata can have multiple instances of MD_Identification and

multiple instances of MD_Content. There is, however, no obvious way to connect an instance of MD_Content with the appropriate instance of MD_Identification.

Multiple instances of MD_Metadata can be used, one for the mosaic and one for the individual data set. The information common to the mosaic as a whole and to all the source elements would be in the MD_Metadata instance corresponding to the mosaic. The elements that contain information that applies to each individual source element would be in the source element metadata. The relation of the source data sets to the mosaic can be shown using the MD_AggregateInformation.associationType element with the code for source. Under this approach, the mandatory elements of MD_Metadata and the elements of MD_Identification that are the same for all the data sets must still appear in the mosaic and in all the source datasets.

If the content information could be supported by LE_Source, it would be possible to include the content for the individual pictures in the overall mosaic metadata, and not require a repetition of the standard elements for the metadata. A way of accomplishing this goal would be to add an element for content to LE_Source, with its data type the class MD_Content.

8.3 Product Types

Some data producers have a fixed set of product types they distribute. This information would be a useful component under CI_Citation, but the only place that it fits in the current structure is the miscellaneous otherCitationDetails. A separate element to support it could be added. If possible, it might be generalized to apply in contexts other than data set citations.

8.4 Job Identifiers

In LE_Processing, the element “identifier” is used to describe the processing package used in generating the data. It is a citation that would provide the name and date for the package that produced the data. However, an identifier for the individual job that produced the package is also sometimes supplied. The appropriate type for such an element would be MD_Identifier, because job ID is a code rather than a name and the date is already handled by the LI_ProcessStep.dateTime element. The name “identifier’ is a better fit to this element than to the one currently bearing its name. That element might be renamed “package”.

8.5 Data Quality

ISO 19115 supports the supply of quality metadata as part of the general metadata. However, DIMAP provides quality information in a separate table. There is no data element in 19115 to give the name of such a table. To handle such a situation, the main metadata could contain a reference to the quality table, perhaps by creating an element such as dataQualityReference with a data type of CI_Citation as an optional attribute of DQ_DataQuality and adding qualityData as an additional code on CE_ReferenceType. This procedure should be considered a possibility for other major elements. Provision might also be made for a hierarchical structure within the quality metadata.

8.6 Miscellaneous

The MD_Constraints class describes the nature of legal constraints, but provides no other information about them. Optional elements should be available to describe them: for example copyright or patent holder and date, or licensing information.

The definition for MD_CoverageDescription.attributeDescription “description of the attribute measured by the measurement value” could be clearer. The point is that the attribute is the range of the coverage, the one described by the values provided over the domain of the coverage. This element describes the record structure and the data types for the attributes.

Annex A
(informative)

Sample Hurricane Isabel MODIS Metadata XML

```
 <iso:MD_Metadata>
  <iso:fileIdentifier>
<scXML:CharacterString>MOD09GHK.004_HurricaneIsabelMOD09GHKHEG</scXML:C
haracterString>
  </iso:fileIdentifier>
  <iso:characterSet>
    <scXML:CharacterString>utf8</scXML:CharacterString>
  </iso:characterSet>
  <iso:contact>
    <iso:CI_ResponsibleParty>
      <iso:individualName>
        <scXML:CharacterString>Cristina Bories</scXML:CharacterString>
     </iso:individualName>
     <iso:organisationName>
        <scXML:CharacterString>unknown</scXML:CharacterString>
    </iso:organisationName>
    <iso:positionName>
       <scXML:CharacterString>NASA Synergy
Project</scXML:CharacterString>
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Annex B
(informative)

SPOT XML Sample used by DIMAP groups

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xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns:xlink="http://www.w3.org/1999/xlink">
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        <CharacterString>Spot Image</CharacterString>
      </organisationName>
      <contactInfo>
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            <CI_Telephone>
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                <CharacterString>+33 (0)5 62 19 40 40</CharacterString>
              </voice>
              <facsimile>
                <CharacterString>+33 (0)5 62 19 40 11</CharacterString>
              </facsimile>
            </CI_Telephone>
          </phone>
          <address>
            <CI_Address>
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                <CharacterString>TOULOUSE</CharacterString>
              </city>
              <administrativeArea>
                <CharacterString>5 rue des Satellites</CharacterString>
              </administrativeArea>
              <postalCode>
                <CharacterString>31030</CharacterString>
              </postalCode>
              <country>
                <CharacterString>FRANCE</CharacterString>
              </country>
            </CI_Address>
          </address>
          <onlineResource>
            <CI_OnlineResource>
              <linkage>
                <URL>http://www.spotimage.fr</URL>
              </linkage>
              <function>
                <CI_OnLineFunctionCode codeListValue="information"
codeList="http://metadata.dgiwg.org/codelistRegistry?CI_OnlineFunctionC
ode"/>
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            </CI_OnlineResource>
          </onlineResource>
```

```
        </CI_Contact>
      </contactInfo>
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      </role>
    </CI_ResponsibleParty>
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  </metadataStandardName>
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          </title>
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2003</CharacterString>
          </otherCitationDetails>
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        <CharacterString>Reference3D is a worldwide database mainly
made of data originating from the SPOT5 satellite HRS instrument. Each
dataset comprises three layers: - the digital elevation model (DEM)
layer; DEM format is DTED; - the digital orthoimage layer; - the data
quality (including data lineage)
</CharacterString>
      </abstract>
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          <organisationName>
            <CharacterString>Spot Image</CharacterString>
          </organisationName>
          <contactInfo>
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                  <voice>
```



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Satellites</CharacterString>
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        </CI_ResponsibleParty>
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Manual</CharacterString>
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                <CharacterString>Spot Image</CharacterString>
              </organisationName>
              <contactInfo>
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40</CharacterString>
                      </voice>
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11</CharacterString>
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                    </CI_Telephone>
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Satellites</CharacterString>
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                      <postalCode>
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                      </linkage>
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ode"/>
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          </distributorContact>
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codeList="http://metadata.dgiwg.org/codelistRegistry?CI_OnlineFunctionC
ode"/>
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            </CI_OnlineResource>
          </onLine>
        </MD_DigitalTransferOptions>
      </transferOptions>
    </MD_Distribution>
  </distributionInfo>
</MD_Metadata>
```


Annex C
(informative)

DIMAP quality metadata

```
<Quality_Assessment>
   <QUALITY_TABLES version="1.0">IGN Espace</QUALITY_TABLES>
   <Quality_Parameter>
      <QUALITY_PARAMETER_DESC>Block triangulation tie-points,
amount</QUALITY_PARAMETER_DESC>
      <QUALITY_PARAMETER_CODE>igne:REF_3D_TIE_NUMBER
      </QUALITY_PARAMETER_CODE>
      <QUALITY_PARAMETER_VALUE>582</QUALITY_PARAMETER_VALUE>
   </Quality_Parameter>
   <Quality_Parameter>
      <QUALITY_PARAMETER_DESC>Block triangulation Z-points,
amount</QUALITY_PARAMETER_DESC>
      <QUALITY_PARAMETER_CODE>igne:REF_3D_Z_NUMBER
      </QUALITY_PARAMETER_CODE>
      <QUALITY_PARAMETER_VALUE>61</QUALITY_PARAMETER_VALUE>
   </Quality_Parameter>
   <Quality_Parameter>
      <QUALITY_PARAMETER_DESC>Block triangulation XY mean, residuals
      </QUALITY_PARAMETER_DESC>
      <QUALITY_PARAMETER_CODE>igne:REF_3D_XY_MEAN
      </QUALITY_PARAMETER_CODE>
      <QUALITY_PARAMETER_VALUE
unit="Pixel">0.0</QUALITY_PARAMETER_VALUE>
   </Quality_Parameter>
   <Quality_Parameter>
      <QUALITY_PARAMETER_DESC>Block triangulation XY Standard
Deviation</QUALITY_PARAMETER_DESC>
      <QUALITY_PARAMETER_CODE>igne:REF_3D_XY_SIGMA
      </QUALITY_PARAMETER_CODE>
      <QUALITY_PARAMETER_VALUE
unit="Pixel">0.26</QUALITY_PARAMETER_VALUE>
   </Quality_Parameter>
   <Quality_Parameter>
      <QUALITY_PARAMETER_DESC>Mosaic feature
matching</QUALITY_PARAMETER_DESC>
      <QUALITY_PARAMETER_CODE>igne:REF_3D_MOS_MISMATCH
</QUALITY_PARAMETER_CODE>
      <QUALITY_PARAMETER_VALUE>FALSE</QUALITY_PARAMETER_VALUE>
   </Quality_Parameter>
   <Quality_Parameter>
      <QUALITY_PARAMETER_DESC>Mosaic feature
deviation</QUALITY_PARAMETER_DESC>
      <QUALITY_PARAMETER_CODE>igne:REF_3D_MOS_DEVIATION
      </QUALITY_PARAMETER_CODE>
      <QUALITY_PARAMETER_VALUE unit="DMS">0.0</QUALITY_PARAMETER_VALUE>
   </Quality_Parameter>
</Quality_Assessment>
```

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