CryoLand

GMES Service Snow and Land Ice

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This document provides the preliminary design for the products planned to be delivered by CryoLand. This includes the products for the seasonal snow, glaciers and lake / river ice. The document includes the technical specification of the meta data format and the format of raster and vector data of the various snow, glacier and lake/ river ice products. Metadata describing the CryoLand products are given according to INSPIRE specifications. Additionally the specifications of the products like spatial and temporal resolution, latency time of product delivery are summarized following the User Requirement Document Version 1 and the coding convention of the various CryoLand products is specified.

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1.6	07.11.2013	Adding new code for no SCAW estimate	Table 2.3	G. Bippus / ENVEO

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1. INTRODUCTION

1.1 Purpose of the document

This report has the aim to provide the specifications for the products planned to be generated within the CryoLand project. This includes the products for the seasonal snow, glaciers and lake / river ice. The product specifications include the technical specification of file formats of raster and vector files, as well as the specification of metadata information (content and format). Additionally the specification of the products (e.g. pixel size, observation frequency, latency of product delivery, etc.) is given based on the URD.

1.2 Outlines

Section 2 provides a technical template format for the products, defining the file name conventions and the structure of the product files, including file formats and metadata specifications. The metadata format is conformal with the INSPIRE directive. All products will be stored in product catalogues and will contain specific files for raster and vectors, metadata file, browse file etc.

In the following sections, the formats and specifications for the individual products are described in detail. Snow products are presented in section 3, section 4 specifies lake and river ice products and format definitions for glacier products are given in section 5.

In Appendix A, several optional tags for the usage in an INSPIRE conformal metadata file are listed. Code lists for several mandatory and optional tags used in the INSPIRE structure are given in Appendix B. In Appendix C, an example for a filled metadata file in xml structure is presented.

1.3 Acronyms

AMSRE	Advanced Microwave Scanning Radiometer – EOS
ASAR	Advanced Synthetic Aperture Radar
ASTER	Advanced Spaceborne Thermal Emission and Reflection Radiometer
ATSR	Along Track Scanning Radiometer
BDL	Product Bundle
BGIS2000	Ball's Global Imaging System 2000
C	Conditional
CI	Citation

CSK	COSMO–SkyMed
DQ	Data Quality
DS	Dataset
ETM+	Enhanced Thematic Mapper Plus
FIA	Flood Inundation Area
FLG	Flags
FS – 2	FORMOSAT–2
FSC	Fractional Snow Cover
GE – 1 / – 2	GeoEye – 1 / – 2
GIS	GeoEye Imager System
GLA	Glacier Area
GLIMS	Global Land Ice Measurements from Space
GLL	Glacier Lakes
GLO	Glacier Outline
GLS	Snow / Ice Area on Glaciers
GLV	Glacier Velocity
HR	High Resolution
HRG	High Resolution Geometric
HRVIR	High Resolution Visible – Infrared
IK – 2	Ikonos – 2
IR	Infrared
L5TM	Landsat 5 TM
L7ETM	Landsat 7 ETM+
LCF	Lace Ice Snow Cover Fraction
LI	Lineage
LIC	Lake Ice Concentration
LIE	Lake Ice Extent, Lake Ice Classification
LSD	Lake Ice Snow Depth

LST	Lake Surface Temperature
M	Mandatory
MD	Metadata
mdf	metadata file
MERIS	Medium Resolution Imaging Spectrometer
MOD	MODIS on Terra, descending node
MODIS	Moderate Resolution Imaging Spectroradiometer
MULT1	Multi – sensor fusion 1
MYD	MODIS on Aqua, ascending node
O	Optional
OLCI	Ocean Land Colour Instrument
OPT	Optical Sensor
OSA	Optical Sensor Assembly
PAN	Panchromatic
pgf	product generation file
pvf	product volume file
QBIRD	Quickbird
REIS	RapidEye Earth Imaging System
REYE1 / –5	RAPIDEYE 1 – 5
RIE	River Ice Extent
RIJ	River Ice Jams
RS	Reference System
RSAT1/2	RADARSAT – 1 / – 2
RSI	Remote Sensing Instrument
SAR	Synthetic Aperture Radar
SCA	Snow Covered Area
SCAW	Wet Snow Covered Area
SCL	Snow Cover on Lake Ice

SDL	Snow Depth on Lake Ice
SEN–1 / –2 / –3	Sentinel – 1 / – 2 / – 3
SGS	Snow Grain Size
SLSTR	Sea and Land Surface Temperature Radiometer
SRAL	SAR Radar Altimeter
SSA	Snow Surface Albedo
STS	Snow Temperature on Surface
SSW	Snow Surface Wetness
SWE	Snow Water Equivalent
SWIR	Shortwave Infrared
TDX – 1	TanDEM – X
THEOS	THEOS
TIR	Thermal Infrared
TM	Thematic Mapper
TSX – 1	TerraSAR–X
URD	User Requirement Document
VHR	Very High Resolution
VNIR	Visible and Near Infrared
WV – 1 / – 2	WorldView – 1 / – 2
XML	Extended Markup Language

2. TECHNICAL SPECIFICATION OF PRODUCTS

In this chapter we suggest a template format for all products that will be produced in the project. The format is designed for raster products (maps) but similar templates could also be designed for other product types like vectors (e.g. shape files), in situ measurements or statistical aggregated products.

2.1 Filename conventions

The filename consists of a basename and extension, which specify the type of the file:

- Browse images
- Data files (raster, vector, tables)

Additionally, there are 3 text (xml, txt) files:

- Product Volume File (basename_pvf.xml)
- MetaData File (basename_mdf.xml)
- Product Generation File (basename_pgf.txt)

The basename of the products should be specified in a way that makes it easy to understand the type of product, the date etc. Although a catalogue service probably will make use of xml – meta file for indexing, it is often useful for users to use the filename to identify the products, at least when they download products.

The basename is of the form:

PPP_RES_YYYYMMDDhhmm[ss]_[YYYYMMDDhhmm[ss]]_SENSOR_AREACODE_PROCVER

where

- PPP …. is the product code
- RES …. Is the pixel size of the product in m, km or degree (optional for snow products)
- YYYYMMDDhhmm[ss] …. Is the start date and time of the product; seconds are optional
- [YYYYMMDDhhmm[ss]] …. Is the end date or the product; seconds are optional. This is only used if more than 1 satellite image is used for generating the product (e.g. for aggregated products)
- SENSOR …. Is the used EO sensor
- AREACODE …. Is the code for a certain area. The area code can either be a literal name, e.g. PanEurope or global (optional for snow products), or, for regional or local products, the Lat,

Lon coordinates of the upper left corner of the imagery in decimal degrees (– 90S to +90N; 0 to 360): e.g. 47.12N_13.30E

- PROCVER …. Specifies the processor code and version (optional), e.g. SYKEV1.0

Examples:

- FSC_250m_201103041123_MOD_PanEurope_ENVEOV1.0
- FSC_1km_201103041123_201103111052_MODIS_PanEurope_CRYLFSCV1.0 weekly aggregated snow map

The allowed values for the fields PPP and SENSOR are specified in the sections 2.2.4.2.2 and 2.2.4.2.3, respectively. The version number of the PROCVER should be restricted to one decimal (e.g. V1.0, V2.1) in order to keep the length of the base name restricted.

2.2 Product description

The product consists of the following files:

- Product volume file (.xml)
- Product data files (raster: .tif / vector: .shp, .shx, .dbf, .prj)
- Browse product files (.jpg)
- Product metadata file (.xml)
- Product generation file (.txt)
- Quality files (.tif)

All corresponding files are stored in a directory:

Figure 2.1. CryoLand products catalogue structure.

2.2.1 *Product volume file (basename_pvf.xml)*

The product volume file has the aim to provide a table of contents of the files of a product, which allows the completeness of the product to be checked, e.g. it includes a list of the file names. Additionally it provides basic information on the product itself.

This text file gives the basic information on the product and provides information on the filenames and presence of the data products, metadata file, quality products and browse products.

Table 2.1:
Key names in product volume file.

Key Name	*Example*
Product	Glacier outlines
Processing date	2011 – 05 – 13
Processing facility	Geomatica 10.2, IRSL 2.1, QGIS 1.6
Metadata file	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0_mdf.xml
Data file 1	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0.shp
Data file 2	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0.shx
Data file 3	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0.dbf
Data file 4	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0.prj
Quality file 1	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0_qual_001.tif
Quality file 2	–
…	…
Browse product 1	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0_001.jpeg
Browse product 2	GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0_001.jpegw
..	…

2.2.2 *Data file*

Data files depend on the product type and might be of the type:

- Raster file
- Vector file
- Tables (statistical information)

2.2.2.1 Raster products

Raster files contain digital numbers which are related to a classification code (e.g. snow free, water, etc.) or to physical quantities (e.g. fractional snow cover, ice velocity). Colours are used for visualisation only, e.g. in browse images. Raster products are provided in a GDAL compatible file format, using preferably the GeoTIFF format.

2.2.2.1.1 Product coding definition

The products are stored as digital numbers (8 bit format). Each pixel in the products will be coded according to an appropriate convention:

This convention uses the value 0 for values outside the area of interest, the values 1 – 99 for mask values and the values 100 – 200 for measured values. The range 201 – 249 is reserved for binary product classifications such as glacier products, or wet/dry snow. The values 250 – 255 are reserved for error codes, including the value 254 for values outside the valid range and 255 for no data values. The GEOTIFF confidence product is scaled between 0 and 100% confidence based on models.

Table 2.2:
Product coding convention.

Code range	*Comments*
0	Outside area of interest.
1 – 99	This range is reserved for masks used in the products.
100 – 200	This range depends on the relevant retrieved product. The fractional snow cover (0 – 100%) is mapped linearly to the range 100 – 200 (code=SWE+100). In a similar way, SWE 0 – 400mm is mapped linearly from 0 – 100 (code=SWE/4.0+100). Other products will have similar transformation formulas. The legend for this range is optional (but should preferably be equal for the same product type).
201 – 249	This range contains certain binary classifications, as glacier products and further classified products such as wet/dry snow, lake ice etc.
250 – 253	Reserved for error coding.
254	Data out of valid range.
255	No data value.

Table 2.3:
Common product coding for CryoLand products.

Code range	*Class*	*Relevant products*
0	Outside area of interest	ALL
20	Sea mask	ALL
21	Lake mask	ALL
22	River mask	Snow and lake products
30	Cloud mask	FSC, SCA, STS, SSA, SSW, LIE, LIC, LCF, LST, GLO, GLA, GLS, GLL
35	Radar Shadow / Foreshortening	ALL from radar EO data
50	Bare ground, free of snow	ALL
70	Glacier mask	ALL

Code range	*Class*	*Relevant products*
80	Forest mask	Snow products
81	Dense forest mask	SWE,FSC
82	Snow in forest (binary)	FSC Alpine Area
90	Urban area	FSC
91	Mountains	SWE
100 - 200	Product range; e.g. FSC: 0 – 100% →100 – 200	FSC, SWE, SGS, STS, LST, LIC, SDL, SSA
209	Dry snow or bare ground (no SCAW estimate)	SCAW
210	Snow covered area (dry + wet snow)	SCA, SCL, LIE
211	Dry, cold snow (SAR)	SCAW, SSW
212	Dry-to-moist snow, stable conditions (SAR)	SSW
213	Dry-to-moist snow, increasing grain size	SSW
214	Moist snow, stable conditions	SSW
215	Moist snow, increasing grain size	SSW
216	Wet snow	SCAW, SSW
217	Fractional snow cover (no SSW/STS estimate)	SSW, STS
218	Reserved for further SSW class	SSW
219	Reserved for further SSW class	SSW
220	Lake ice	LIE
221	River ice	RIE
222	Ice jam	RIJ
223	Flooded area	FIA
224	Water (in lake ice product)	LIE, SCL
225	Partial snow / White ice cover	LIE
230	Snow area on glacier	GLS
231	Glacier ice	GLS
232	Nunataks, internal rocks	GLO, GLA, GLS
250, 252 - 253	Reserved for error coding.	ALL
251	Polar night	ALL from optical EO data
254	Input data error	ALL
255	No data	ALL

2.2.2.2 Vector files

According to the URD, products stored as vectors will be provided in shapefile format. A shapefile consists of four files with the same base name but with different extensions:

- .shp: this file contains the polygons, lines, and points
- .dbf: this file contains the associated attributes and statistical information (cf. Section 2.2.2.3)
- .shx: this is an index file
- .prj: this file contains the full projection information of the shape file

2.2.2.3 Statistical products

Statistical products are provided additionally to individual products, for example the area – altitude distribution of a glacier additionally to the glacier outlines, or the temporal developments of the fractional snow cover at individual locations additionally to the product fractional snow cover.

- Statistical products could be stored as tables in CVS format.
- Statistical information of vector files are partly included in the associated attribute table (.dbf)

2.2.3 *Browse product*

This is a low resolution browse product for viewing purposes of the product.

- Format for raster:
  - JPG or PNG
- Format for vector:
  - KML or KMZ
  - JPG or PNG (additionally)

2.2.4 *Product metadata file (basename_mdf.xml)*

Each dataset needs a metadata file. The metadata includes information about:

- File identification
- Classification of spatial data and services
- Keyword
- Geographic location
- Temporal reference
- Quality and validity
- Conformity

- Constraints related to access and use
- Responsible organisation
- Metadata on metadata

2.2.4.1 Metafile data format

The main reason of the metadata is to describe the products so that they can be found by users searching for them. It is not meant to describe the products in detail in metadata.

According to INSPIRE Art.3 /point 6 metadata are defined as: "information describing spatial data sets and spatial data services and making it possible to discover, inventory and use them."

The metadata file specification of CryoLand is coordinated with the FP7 Freshmon project. The tables below give the general structure and the tag definitions of the metadata file.

Table 2.4:
Structure of metadata file.

Metadata group	*Comment*
fileIdentifier	Unique file identification number provided by the catalogue service
language	Language used within the datasets, from ISO 639 – 2 Language code list
hiearchyLevel	Scope of which metadata applies (e.g. dataset, service)
metadataStandardName	Reference to the used standard
metadataStandardVersion	Reference to used standard version
contact	Organization, full contact information (phone, address, mail)
dateStamp	Date of metadata file creation
spatialRepresentationInfo	Spatial Representation from ISO 19115: definition of spatial grid dimensions and cell geometry
referenceSystemInfo	Spatial reference identification, EPSG codes
metadataExtensionInfo	Metadata extension information for linking additional keyword values to the product
identificationInfo	Product information and processing description
distributionInfo	Data format information and data distribution specifications
dataQualityInfo	Data quality information and product accuracy

2.2.4.2 Tags in metadata file

In the following tables the individual mandatory tags in each metadata file group are described in detail. Tags can be mandatory (M) or conditional (C). Optional tags of the metadata groups are

provided in Appendix A – Optional Tags in metadata file. The following abbreviations occur in the path names, and refer to the ISO 19115 standards:

- MD: Metadata
- DQ: Data quality
- DS: Dataset
- LI: Lineage
- CI: Citation
- RS: Reference system

Setting the MD_characterSetCode tag in the metadata file is optional, but should be defined as 'UTF-8' to ensure that all umlaut characters work.

Table 2.5:
General tags in the metadata file. The elements 'metadata language' and 'resource type' are listed at the beginning of the file, the element 'Metadata date' follows after the 'contact' group.

Metadata element	*Obligatory*	*XPath*	*Comment*
Metadata language	C / M	language/LanguageCode/	Language used in the metadata, use value from ISO 639 – 2 Language code list
Resource Type	C / M	hierarchyLevel/MD_ScopeCode	Scope of which metadata applies (use value from list: Table B.4, MD_ScopeCode)
Metadata date	M	dateStamp	Date of metadata file creation

Table 2.6:
Tags in the metadata file group "contact".

Metadata element	*Obligatory*	*XPath*	*Comment*
Organisation name	M	contact/CI_ResponsibleParty/organisationName	Organisation name
Mail address	M	contact/CI_ResponsibleParty/CI_Contact/ electronicMailAddress	Email address of contact person
Contact role	M	contact/CI_ResponsibleParty/role/CI_RoleCode	Role of contact (use value from list: Table B.6, CI_RoleCode)

Table 2.7:
Tags in the metadata file group "spatialRepresentationInfo".

Metadata element	*Obligatory*	*XPath*	*Comment*
Number of product dimension	M	spatialRepresentationInfo/ MD_GridSpatialRepresentation/numberOfDimensions	Product dimension (e.g. '2' for 2-D raster)

Metadata element	*Obligatory*	*XPath*	*Comment*
x - axis definition	M	spatialRepresentationInfo/ MD_GridSpatialRepresentation/ axisDimensionProperties/MD_Dimension/ dimensionName/MD_DimensionNameTypeCode	Dimension Name Type Code: row (use value from list: Table B.3, MD_DimensionNameTypeCode)
x – axis dimension size	M	spatialRepresentationInfo/ MD_GridSpatialRepresentation/ axisDimensionProperties/MD_Dimension/ dimensionSize	Width of the image (number of pixels)
y – axis definition	C / M if product dimension > 1	spatialRepresentationInfo/ MD_GridSpatialRepresentation/ axisDimensionProperties/MD_Dimension/ dimensionName/MD_DimensionNameTypeCode	Dimension Name Type Code: column (use value from list: Table B.3, MD_DimensionNameTypeCode)
y – axis dimension size	C / M if product dimension > 1	spatialRepresentationInfo/ MD_GridSpatialRepresentation/ axisDimensionProperties/MD_Dimension/ dimensionSize	Height of the image (number of pixels)
z – axis definition	C / M if product dimension = 3	spatialRepresentationInfo/ MD_GridSpatialRepresentation/ axisDimensionProperties/MD_Dimension/ dimensionName/MD_DimensionNameTypeCode	Dimension Name Type Code: vertical (use value from list: Table B.3, MD_DimensionNameTypeCode)
z – axis dimension size	C / M if product dimension = 3	spatialRepresentationInfo/ MD_GridSpatialRepresentation/ axisDimensionProperties/MD_Dimension/ dimensionSize	Vertical extent of the image
Cell geometry code	M	spatialRepresentationInfo/ MD_GridSpatialRepresentation/cellGeometry/ MD_CellGeometryCode	Cell geometry (use value from list: Table B.3, MD_CellGeometryCode)
Transformation parameter availability	M	spatialRepresentationInfo/ MD_GridSpatialRepresentation/cellGeometry/ transformationParameterAvailability/Boolean	Either ‘false’ or ‘true’

Table 2.8:
Tags in the metadata file group “referenceSystemInfo”.

Metadata element	*Obligatory*	*XPath*	*Comment*
Title of spatial reference system	M	referenceSystemInfo/MD_ReferenceSystem/ referenceSystemIdentifier/RS_Identifier/authority/ CI_Citation/title	Name of the spatial reference system of the image (e.g. EPSG Geodetic Parameter Dataset)
Date of code publication	M	referenceSystemInfo/MD_ReferenceSystem/ referenceSystemIdentifier/RS_Identifier/authority/ CI_Citation/date/CI_Date/date	Publication date of the used reference system (e.g. publication date of the EPSG code list)
Date type code	M	referenceSystemInfo/MD_ReferenceSystem/ referenceSystemIdentifier/RS_Identifier/authority/ CI_Citation/date/CI_Date/dateType/CI_DateTypeCode	Type code of the availability of the spatial reference system (use value from list: Table B.6, CI_DateTypeCode)

Metadata element	*Obligatory*	*XPath*	*Comment*
Edition of spatial reference system	M	referenceSystemInfo/MD_ReferenceSystem/ referenceSystemIdentifier/RS_Identifier/authority/ CI_Citation/edition	Edition of spatial reference system
Cited responsible party	M	referenceSystemInfo/MD_ReferenceSystem/referenceSystemIdentifier/RS_Identifier/authority/CI_Citation/citedResponsibleParty/CI_ResponsibleParty/organisationName	Name of cited responsible party for the spatial reference system (e.g. EPSG)
Role of the cited responsible party	M	referenceSystemInfo/MD_ReferenceSystem/ referenceSystemIdentifier/RS_Identifier/authority/ CI_Citation/citedResponsibleParty/ CI_ResponsibleParty/role/CI_RoleCode	Role of the cited responsible party for the spatial reference system (use value from list: Table B.6, CI_RoleCode)
Spatial reference code	M	referenceSystemInfo/MD_ReferenceSystem/ referenceSystemIdentifier/RS_Identifier/code	Used EPSG code (e.g. “32633” for UTM zone 33 / WGS 84)

Table 2.9:
Tags in the metadata file group “metadataExtensionInfo”.

Metadata element	*Obligatory*	*XPath*	*Comment*
URL	C / M	Metadata/ExtensionInfo/ MD_MetadataExtensionInformation/ extensionOnLineResource/CI_OnlineResource/ linkage/URL	URL to extended Metadata information
Extension file name	C / M	Metadata/ExtensionInfo/ MD_MetadataExtensionInformation/ extensionOnLineResource/CI_OnlineResource/name	Name of file containing extended information
Extension description	C / M	Metadata/ExtensionInfo/ MD_MetadataExtensionInformation/ extensionOnLineResource/CI_OnlineResource/ description	Description of extended information

Table 2.10:
Tags in the metadata file group “identificationInfo”.

Metadata element	*Obligatory*	*XPath*	*Comment*
Resource title	M	identificationInfo/MD_DataIdentification/citation/ CI_Citation/title	Title of the product (e.g. Snow water equivalent, Fractional snow cover MODIS (500m 2010-03-17))
Product date	M	identificationInfo/MD_DataIdentification/citation/ CI_Citation/date/CI_Date/date/Date	Date of product creation, revision, etc.
Date type code	M	identificationInfo/MD_DataIdentification/citation/ CI_Citation/date/CI_Date/dateType/CI_DateTypeCode	Type code of the product at the given date (use value from list: Table B.6, CI_DateTypeCode)
Unique Resource Identifier	M	identificationInfo/MD_DataIdentification/citation/ CI_Citation/identifier/RS_Identifier/code	Unique image identifier

Metadata element	*Obligatory*	*XPath*	*Comment*
Unique Company Identifier	M	identificationInfo/MD_DataIdentification/citation/ CI_Citation/identifier/RS_Identifier/codeSpace	Company where resource image is available
Resource abstract	M	identificationInfo/MD_DataIdentification/abstract	Brief narrative summary of the content
Organisation of contact person	M	identificationInfo/MD_DataIdentification/pointOfContact /CI_ResponsibleParty/organisationName	Organisation name of the contact person
Contact email address	M	identificationInfo/MD_DataIdentification/pointOfContact /CI_ResponsibleParty/contactInfo/CI_Contact/address/ CI_Address/electronicMailAddress	Email address of contact person
Role of contact	M	identificationInfo/MD_DataIdentification/pointOfContact /CI_ResponsibleParty/role/CI_RoleCode	Role of contact person (use value from list: Table B.6, CI_RoleCode)
Keyword value	M	identificationInfo/MD_DataIdentification/descriptiveKeywords/MD_Keywords/keyword	For datasets and series at least one keyword of GEMET thesaurus shall be documented (use value from list: Table B.7)
Originating controlled vocabulary	M	identificationInfo/MD_DataIdentification/ descriptiveKeywords/MD_Keywords/thesaurusName/ CI_Citation/title	Title of a controlled vocabulary the keywords are taken from. (e.g. “GEMET - INPSIRE Spatial Data Themes”)
Publication date of the thesaurus	M	identificationInfo/MD_DataIdentification/ descriptiveKeywords/MD_Keywords/thesaurusName/ CI_Citation/date_CI_Date/date	Publication date of GEMET INSPIRE Thesaurus (“2008-06-01”)
Type code of the thesaurus	M	identificationInfo/MD_DataIdentification/ descriptiveKeywords/MD_Keywords/thesaurusName/ CI_Citation/date_CI_Date/dateType/CI_DateTypeCode	Type code of the thesaurus (“publication”), use alternatively a value from the ISO19139 list
Spatial Resolution	M	identificationInfo/MD_DataIdentification/ spatialResolution/MD_Resolution/distance/Distance	Spatial resolution in meters or degrees (define units as “m” and “d”, respectively)
Resource language	M (in ISO 19115) / O (in INSPIRE)	identificationInfo/MD_DataIdentification/language/ LanguageCode	Language used within the datasets, use value from ISO 639 – 2 Language code list
Topic Category	C	identificationInfo/MD_DataIdentification/topicCategory	Main theme(s) of the dataset (use value from list: Table B.1, MD_TopicCategoryCode); mandatory if hierarchy level = ‘dataset’
Geographic bounding box, west bound longitude	C	identificationInfo/MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicBoundingBox/westBoundLongitude	West bound longitude in decimal degrees; mandatory if no bounding polygon or geographic description
Geographic bounding box, east bound longitude	C	identificationInfo/MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicBoundingBox/eastBoundLongitude	East bound longitude in decimal degrees; mandatory if no bounding polygon or geographic description
Geographic bounding box, south bound latitude	C	identificationInfo/MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicBoundingBox/southBoundLongitude	South bound longitude in decimal degrees; mandatory if no bounding polygon or geographic description
Geographic bounding box, north bound latitude	C	identificationInfo/MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicBoundingBox/northBoundLongitude	North bound longitude in decimal degrees, mandatory if no bounding polygon or geographic description

Metadata element	Obligatory	XPath	Comment
Bounding polygon	C	identificationInfo/MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_BoundingPolygon/polygon	Bounding polygon of the area extent, mandatory if no bounding box or geographic description
Geographic description	C	identificationInfo/MD_DataIdentification/extent/ EX_Extent/geographicElement/ EX_GeographicDescription/geographicIdentifier	Geographic identifier of area extent; mandatory if no bounding box or bounding polygon
Temporal extent *	M	identificationInfo/MD_DataIdentification/extent/ EX_Extent/temporalElement/EX_TemporalExtent/ extent/TimePeriod/beginPosition & [..]/endPosition	Give an interval of dates or an individual date (e.g.<beginDate>1977-03-10T11:45:30 <endDate>2005-01-15T09:10:00) Dates according to ISO 8601

*) At least one temporal reference is required.

Table 2.11:
Tags in the metadata file group “distributionInfo”.

Metadata element	Obligatory	XPath	Comment
Distribution format name	M	distributionInfo/MD_Distribution/distributionFormat/ MD_Format/name	Product file format
Distribution format version	M	distributionInfo/MD_Distribution/distributionFormat/ MD_Format/version	Version of file format
Distribution format specification	C	distributionInfo/MD_Distribution/distributionFormat/ MD_Format/specification	Detailed product specification, if any, used to define this product file
Resource locator	M	distributionInfo/MD_Distribution/transferOptions/ MD_DigitalTansferOptions/onLine/CI_OnlineResource/ linkage/URL	URL to obtain more information, mandatory if linkage to the service is available
File transfer size	M	distributionInfo/MD_Distribution/transferOptions/ MD_DigitalTansferOptions/transferSize	File size for data transfer in MB (e.g. 131.7)

Table 2.12:
Tags in the metadata file group “dataQualityInfo”.

Metadata element	Obligatory	XPath	Comment
Degree	C	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/result/ DQ_ConformanceResult/pass	Information on the degree of conformity. true if conformant, false if not conformant

2.2.4.2.1 Additional tags

To achieve all necessary requirements for the project, the following additional tags are needed.

To expand the ISO 19115 standard an interface “Metadata Extension Element” was used.

Table 2.13:
Additional mandatory tags realised with keywords.

Metadata tag	*Meaning*
Product	product name (product naming conventions are defined in Table 2.14)
Sensor	Name of the sensor/s that is used (sensor naming conventions are defined in Table 2.15).
ServiceProvider	Name of the service provider: e.g. EOMAP, SYKE, WI, BC. Full name is allowed.

2.2.4.2.2 Products

Table 2.14 gives the allowed product type (PPP) abbreviations to be used in the metadata file.

Table 2.14:
Product type abbreviations.

Abbreviation	*Description*
BDL	Product bundle
FIA	Flood inundation area
FLG	Flags
FSC	Fractional snow cover
GLA	Glacier area
GLL	Glacier lake
GLO	Glacier outlines
GLS	Glacier snow / ice map
GLV	Glacier velocity map
LIE	Lake ice extent, Lake Ice Classification
LST	Lake surface temperature
RIE	River ice extent
RIJ	River ice jams
SCA	Snow covered area, snow extent
SCAW	Snow covered area, wet snow extent
SCL	Snow cover on lake ice
SDL	Snow depth on lake ice
SGS	Snow grain size
SSA	Snow surface albedo
STS	Snow temperature on surface
SSW	Snow surface wetness
SWE	Snow water equivalent

2.2.4.2.3 Sensors

Table 2.15 lists the abbreviations of sensors to be used in the basename and in the metadata file. This list includes many of the currently working sensors and additionally some missions which are planned to be launched in the near future.

Table 2.15:
Sensor abbreviations.

Abbreviation	*Satellite*	*Sensor*
AMSRE	Aqua	AMSR-E (PMI)
ASAR	Envisat	ASAR (C-Band)
ASTER	Terra	ASTER (VNIR, SWIR, TIR)
CSK	COSMO–SkyMed	SAR2000 (X-Band)
ENVSAR	Envisat	ASAR (C-Band)
ERS-1	ERS–1	SAR (C-Band), ATSR
ERS-2	ERS–2	SAR (C-Band), ATSR
FS-2	FORMOSAT–2	RSI (PAN, VNIR)
GE-1	GeoEye–1	GIS (PAN, VNIR)
GE-2	GeoEye–2 (launch planned in 2012)	GIS (PAN, VNIR)
IK-2	Ikonos-2	OSA (PAN, VNIR)
L5TM	Landsat 5	TM (VNIR, SWIR, TIR)
L7ETM	Landsat 7	ETM+ (VNIR, SWIR, TIR, PAN)
MCD	MODIS sensor fusion	MODIS Terra & MODIS Aqua
MERIS	Envisat	MERIS (VIS, IR)
MOD	Terra	MODIS (VNIR, SWIR, TIR), descending node
MULT1	Multisensor fusion 1	ASAR&MODIS
MYD	Aqua	MODIS (VNIR, SWIR, TIR), ascending node
QBIRD	Quickbird	BGIS2000
REYE1	RAPIDEYE1	REIS (VNIR)
REYE2	RAPIDEYE2	REIS (VNIR)
REYE3	RAPIDEYE3	REIS (VNIR)
REYE4	RAPIDEYE4	REIS (VNIR)
REYE5	RAPIDEYE5	REIS (VNIR)
RSAT1	RADARSAT-1	SAR (X-Band)
RSAT2	RADARSAT-2	SAR (C-Band)
SEN-1	Sentinel-1	SAR (C-Band)
SEN-2	Sentinel-2 (launch planned in 2012)	VNIR

Abbreviation	*Satellite*	*Sensor*
SEN-3	Sentinel-3 (first launch planned in 2013)	SLSTR, OLCI, SRAL (Ku-, C-Band)
SPOT4	SPOT4	HRVIR (PAN, VNIR)
SPOT5	SPOT5	HRG (PAN, VNIR)
TDX-1	TanDEM-X	SAR
THEOS	THEOS	PAN, VNIR
TSX-1	TerraSAR–X	SAR
WV-1	WorldView–1	WV60 (PAN, VNIR)
WV-2	WorldView–2	WV110 (PAN, VNIR)

2.2.4.2.4 Service provider

We do not restrict the number of capitals, so every partner may use his full name if desired.

2.2.5 *Product generation file (basename_pgf.txt)*

This file contains information about how the product has been generated instead that information can be put into a separate processing info file.

- Product version
- Processor information
  - Software
  - Software version
  - Processing date
  - Processing facility
- Algorithm information
  - Algorithm name
  - Software
  - Software version
- Auxiliary data used for processing
  - DEM: source, version
  - Land cover information
    - Forest mask
    - Water mask

        - Transmissivity map
        - Glacier mask
        - Etc.
    - In-situ data available?: Yes / No
    - If in-situ data are available
        - Kind of in-situ data
        - Acquisition date of in-situ data
        - Source of in-situ data
- Quality Products
    - Uncertainty raster
    - Confidence raster
    - Age of pixels
    - Number of observations (for aggregated products)

2.2.6 *Quality measures products*

The quality products will be stored as GeoTIFF files. Separate coding conventions would apply for these products. E.g. the product range 100 – 200 would signify different things for a confidence map and an "age of pixel" map. Also "uncertainty", "relative error" and "standard deviation" requires a scaling between 100 – 200 and the range in question.

3. SPECIFICATION OF SNOW PRODUCTS

All products follow the basic template for products provided in Chapter 2.

Table 3.1:
Overview on preliminary specifications for snow products. These baseline specifications might be adapted to users' needs and to availability of EO data.

Product	*Product Identifier*	*Horizontal Resolution **	*Priority*	*Temporal Resolution **	*Latency Time*	*File Format*	*EO sensor(s)*	*Producing Partner*
Fractional snow cover	FSC	(50m) 250 m 500 m 1000 m	1	Daily, full year	6 h	raster	(SEN-2) MOD SAR	SYKE, Norut, KSAT, NR, ENVEO
Snow extent	SCA	250 m 500 m	1	Daily, full year	6 h	raster	MOD	NR, Norut, ENVEO
Wet snow extent	SCAW	100 m 250 m	1	Weekly	6 h	raster	SAR	Norut, FMI, NR, ENVEO
Snow water equivalent	SWE	25 km 10 km	1	Daily	36 h	raster	AMSRE	FMI
Snow surface wetness	SSW	1 km	2	Daily	6 h	raster	MOD	NR, KSAT
Snow temperature on surface	STS	1 km	3	Daily	6 h	raster	MOD	NR, KSAT
Snow grain size	SGS	25 km 10 km	3	Daily	12 h	raster	AMSRE	FMI, NR
Snow surface albedo	SSA	250 m 1000 m	3	Daily	6 h	raster	MOD	ENVEO

*) Depending on users application, coverage (local, regional, continental) and EO data availability.

3.1 Fractional snow cover

The fractional snow cover (FSC) product provides the areal fraction of snow covered ground for grid cells of the target region. The snow products based on MODIS level1b data have a spatial resolution of 250 m to 1 km. Multi-sensor combination of SAR and MODIS data are proposed for certain regions, but require the availability of SAR and medium resolution optical data. For operational use the main SAR sensor will be Sentinel-1. MODIS-data are daily received and snow maps are automatically processed, with human assistance for cloud mask verification/modification before product release. Snow maps are released on daily basis, however depending of the cloudiness. The product can be

provided with a spatial resolution of 50 m to 1 km, depending on the user's need and availability of EO data.

3.2 Snow covered area

The snow covered area (SCA), also named snow extent, product can be derived from optical or SAR sensors. The optical snow extent product may be derived from the fractional snow cover product (e.g. threshold FSC = 40%) or directly from level 1 products using a binary classification. The product provides a map of snow and snow free classes and is provided as raster file.

3.3 Wet snow extent

The wet snow extent (SCAW) product can be derived from SAR, optical data and, on a coarse scale from passive microwave data. It provides a classification of "wet snow". In the case of SAR post-processing steps are needed to map dry snow areas. The product is provided as raster file.

3.4 Snow water equivalent

The CryoLand snow water equivalent (SWE) product is based on passive microwave observations and weather station observations collected by ECMWF. The product is generated by an assimilation process resulting in maps of SWE estimates (in EASE-Grid format) over the northern hemisphere, covering all land surface areas with the exception of mountainous regions and glaciers. A semi-empirical snow emission model is used for interpreting the passive microwave (radiometer) observations through model inversion to the corresponding SWE estimates. The SWE product is provided in spatial resolution of 25 km on a daily basis covering the Northern Hemisphere. The methodology provides the snow water equivalent in millimetres which can also be used to determine snow depth and snow mass. The regions with dry snow are determined using the assimilation of passive radiometer data and weather station measurements. Regions with wet snow cover the SWE estimate is calculated by applying Kriging interpolation on snow depth measurements at weather stations. The SWE product is provided as raster file.

3.5 Snow surface wetness

The snow surface wetness (SSW) product provides an estimate of the wetness conditions of the snow surface, including the temporal development of the wetness. The product is based on temporal monitoring of the development of snow grain size and surface temperature using optical observations. The resolution of the product is 1000 m. The product is available as raster file.

3.6 Snow temperature on surface

The snow temperature on the surface (STS) product is based on thermal satellite measurements, corrected for atmospheric attenuation. The resolution of the product is on the order of 1000 m. The product is available as raster file and provides temperature in degree Celsius.

3.7 Snow grain size

The snow grain size (SGS) product can be provided by passive microwave sensors (coarse scale) or by optical sensors (10 km scale). The maturity of the two products is different. The SGS retrieved from optical data is the optical, effective grain size.

3.8 Spectral snow surface albedo

The spectral snow surface albedo (SSA) is based on atmospherically and topographically corrected optical satellite data as MODIS or Landsat. The vertical profile of the atmospheric layering and an accurate digital elevation model are required as auxiliary data for the corrections. The product resolution is in the order of 250 m and 1000 m, depending on the user's need and the availability of EO data. The product is provided as raster file.

3.9 Product coding

The coding conventions for the snow products, and required transformation formulas are summarized in Table 3.2. Binary classification codes of Table 2.3 are used.

Table 3.2:
Coding and transformation formulas for snow products.

Product	*Product abbreviation*	*Code range*	*Transformation formula*	*Comments*
Fractional snow cover	FSC	100 – 200	Code = FSC + 100	FSC will be provided as percentage (0 – 100%)
Snow extent	SCA	50 / 210	50 = No snow 210 = Snow	Binary classification codes
Wet snow extent	SCAW	50 / 211 / 216	50 = No snow 211 = Dry snow 216 = Wet snow	Binary classification codes
Snow water equivalent	SWE	100 – 200	Code = (SWE / 4.0) + 100	SWE (0 – 400 mm) will be provided as percentage (0 – 100%)
Snow surface wetness	SSW	211 – 219	Categorical (cf. Table 2.3)	SSW will be provided as a set of categories for wetness and snowmelt speed

Product	*Product abbreviation*	*Code range*	*Transformation formula*	*Comments*
Snow temperature on surface	STS	100 - 200	Code = 200 + 2 * STS	Temperature in degree Celsius, steps of 0.5°C (range: 0°C : – 50°C)
Snow grain size	SGS	100 – 200	Code = SGS * k + 100 where k = 0.05 mm	SGS will be provided in mm range: 0.00 – 5.00 mm)
Spectral snow albedo	SSA	100 – 200	Code = SSA + 100	SSA will be provided as percentage (0 – 100%)

4. LAKE AND RIVER ICE PRODUCTS

The thematic product requirements of the lake and river ice products are assessed in CryoLand user workshops (see URD Deliverable 2.1) and on the requirements specified by international organisations (e.g. IGOS 2007). Table 4.1 summarizes the main requirements for the products from the URD and specifies three-letter codes for each product. The codes will be used throughout the project.

Table 4.1:
Overview on preliminary specifications for lake ice products.

Product	*Product Identifier*	*Horizontal Resolution*	*Priority*	*Temporal Resolution*	*Latency Time*	*File Format*	*EO sensor(s)*	*Producing Partner*
Lake ice classification regional	LIE	500 m	2	Daily	6 h	raster	MOD	SYKE
Lake ice classification local	LIE	100 m	2	Weekly	6 h	raster	ASAR	Norut
Lake ice snow cover fraction	LCF	250 m	1	Daily	6 h	raster	MOD	SYKE, Norut
Snow depth on lake ice	SDL	25 km	3	Daily	12 h	raster	AMSRE	FMI
Lake ice concentration	LIC	250 m	3	Daily	6 h	raster	MOD	NR, KSAT
Lake surface temperature	LST	1 km	3	Daily	6 h	raster	MOD	NR, KSAT
River ice extent	RIE	30 m	2	On request	6 h	raster	TSX-1 RSAT2	Norut
River ice jams	RIJ	30 m	3	On request	6 h	raster	TSX-1 RSAT2	Norut
Flood inundation area	FIA	30 m	3	On request	6 h	raster	TSX-1 RSAT2	Norut
Lake Ice Classification	LIE	250 m	1	Daily	6 h	raster	MODIS	SYKE, FMI

4.1 Lake ice classification

Lake ice classification (LIE) will be produced with optical as well as SAR sensors.

4.1.1 *Optical data*

The lake ice classification from optical data is under development at SYKE. SYKE will provide lake ice extent for several large lakes: Lake Peipsi in Estonia and Lake Ladoga, Lake Onega in Russia. Only binary information will be provided i.e. ice/no ice classification, snow/white ice cover, with land areas and clouds masked. The method for obtaining binary information is based on a box-classifier utilizing the surface reflectance data at wavelengths 545-565nm (band 4) and 1628-1652 nm (band6) as well as surface brightness temperature at 10.780-11.280 µm (band 31). Top-of-atmosphere values are used. The product is based on daily Terra/MODIS data (level 1b calibrated reflectances and surface brightness temperatures with 500 m and 1 km nominal resolution, respectively. The resolution of the product is 0.005^{o}x0.005^{o} grid (Latitude, longitude WGS-84).

4.1.2 *SAR data*

Lake ice extent from SAR data is under development at Norut for the moment. Norut will provide lake ice extent for several lakes in Finland (defined together with FMI and SYKE) and possibly also Lake Vänaren in Sweden, Lake Mjøsa in Norway and Russian lakes Onega and Ladoga. The map provides only binary information (ice, open water while land areas are masked). The method use C-band SAR data (single or dual polarization) and is currently developed for the Envisat ASAR WSM product. The nominal resolution of the product is 100 m (or approximately 0.001ox0.001o grid in WGS-84 lat-long coordinates).

4.2 Snow cover on lake ice

The product snow cover on lake ice provides information on snow burden on the ice. A percentage number for unit area is given, describing the areal fraction of snow cover over the ice-covered pixel. Hence pixel with no snow over the ice gets value 0%, while ice-covered pixel fully covered by snow gets value 100%. The product does not distinguish between open-water and 0% snow coverage on ice. The method is based on Terra/MODIS level1b calibrated radiances (QKM with nominal resolution of 250 m).

4.3 Snow depth on lake ice

The CryoLand snow depth on lake ice product is a prototype product with a more detailed specification to be added later on. The product is based on SAR-data, passive microwave data or a combination of the two depending on user requirements regarding spatial and temporal resolution.

The baseline prototype product is based on the CryoLand SWE product which is derived using passive microwave and weather station data. The resulting SWE data is fed into a model utilizing land-use data, radiometer brightness temperature observations, climatological data and statistical analysis to

determine the snow depth on lakes with a significant spatial extent when compared with the spatial resolution of the radiometer.

4.4 Lake ice concentration

The lake ice concentration (LIC) product provides the ice cover fraction per pixel. It is based on optical sensors of moderate resolution (100 m – 1000 m). The product is available as raster file.

4.5 Lake surface temperature

The lake surface temperature (LST) product is based on thermal satellite measurements, corrected for atmospheric attenuation. The resolution of the product is on the order of 1000 m. The product is available as raster file and provides temperature in degree Celsius.

4.6 River ice extent

The river ice extent product is derived from high resolution SAR (< 30 m).

4.7 River ice jams

The river ice jams product is derived from high resolution SAR (< 30 m).

4.8 Flood inundation area

The flood inundation area product is derived from high resolution SAR (< 30 m).

4.9 Lake Ice Classification

The lake ice classification product is derived daily from MODIS data (250 m). The product has been introduced as new primary lake ice product at the 2nd Annual Progress Meeting in Helsinki, Finland, on 23 January 2013. This product replaces the preliminary defined Lake Ice extent product from optical satellite data. The product is provided as raster file and contains 4 binary classes.

4.10 Product coding

The lake ice products, the associated codes and required transformation formulas for several of the products are summarized in Table 4.2. Binary classification codes are used from Table 2.3.

Table 4.2:
Coding and transformation formulas for lake products.

Product	*Product abbreviation*	*Code range*	*Transformation formula*	*Comments*
Lake ice extent	LIE	100 – 200 for MOD products; 220 for ASAR products	Code = LIE + 100 (for MOD products)	LIE derived from MODIS data will be provided as percentage (0 – 100%); LIE derived from ASAR data will be provided using a binary classification code
Snow cover on lake ice	SCL	50 / 210	50 = Bare Ground, free of snow / 210 = Snow	Binary classification codes
Snow depth on lake ice	SDL	100 – 200	Code = SDL * k + 100 where k = 0.05	SDL will be provided in mm (range: 0.00 – 5.00 mm)
Lake ice concentration	LIC	100 – 200	Code = LIC + 100	LIC will be provided as percentage (0 – 100%)
Lake surface temperature	LST	100 – 200	Code = 180 + 2 * SST	Temperature in degree Celsius, steps of 0.5°C (range: +30°C : – 40°C)
River ice extent	RIE	221	–	Binary classification code
River ice jams	RIJ	222	–	Binary classification code
Flood inundation area	FIA	223	–	Binary classification code
Lake Ice Classification (4 classes)	LIE	50 / 210 / 220 / 224 / 225	50 = Bare ground, free of snow 210 = Snow covered ice 220 = Clear ice 224 = Open water 225 = Partial snow / White ice	Binary classification codes

5. GLACIER PRODUCTS

In order to be compatible with international initiatives on glacier information, the CryoLand glacier products will be made available according to the GLIMS (Global Land Ice Measurements from Space) standards. More information on GLIMS is available at http://www.glims.org.

The glacier products to be provided within CryoLand are:

- Glacier area (raster) and outline (vector)
- Glacier ice velocity (raster)
- Snow / ice area on glaciers (raster, vector)
- Glacier lakes (vector)

The thematic product requirements of the products are assessed in CryoLand user workshops (see URD Deliverable 2.1) and on the requirements specified by international organisations (e.g. IGOS 2007). Table 5.1 summarizes the main requirements for the products from the URD. It should be noted that the specifications strongly depend on the application for which the products are needed.

Table 5.1:
Overview on baseline specifications for glacier products. Specifications depend on availability of EO data. VHR OPT = very high resolution optical satellite imagery; VHR SAR = very high resolution SAR data.

Product	*Product Identifier*	*Horizontal Resolution*	*Priority*	*Temporal Resolution*	*Latency Time*	*File Format*	*EO sensor(s)*	*Producing Partner*
Glacier outline	GLO	30 m	1	Annually	3 months	vector	VHR OPT	ENVEO
Glacier area	GLA	30 m	1	Annually	3 months	raster	VHR OPT	ENVEO
Glacier velocity	GLV	50 m – 500 m	3	Annually (3 months) *	3 months	raster	VHR SAR	ENVEO
Snow / ice area on glaciers	GLS	30 m – 250 m	2	Annually ** (monthly)	3 months	vector / raster	VHR SAR + OPT	ENVEO
Glacier lakes	GLL	30 m	2	Annually (weekly) ***	3 months	vector	VHR SAR + OPT	ENVEO, GAMMA

*) for selected glaciers (e.g. glacier surges, etc.)
**) depends on application: annually e.g. for climate studies; monthly e.g. for glacier runoff.
***) in the case of hazards high temporal repeat observations are needed.

Glacier products provided as raster are stored in GeoTIFF format, using the UTM projection on the WGS 84 ellipsoid, as required by the users. The spatial resolution of the products mainly depends on

the data base used for the product generation, and can vary between 30 m and 500 m. For the storage of raster products the specifications given in Chapter 2.2 are used. Some of the glacier products are provided as vectors, stored in shape file format.

The projection of the product is the same as that of the EO data used for the processing line, which is usually Geographic (Lat / Lon) or UTM WGS 84. The associated projection definition of the shape file is stored in a .prj file. Meeting GLIMS standards requires the projection of the data in geographic coordinates on the WGS 84 ellipsoid.

According to GLIMS standards, a set of four mandatory shape files ensures the storage of all relevant information about an analysis and the results. These shapefiles are:

- session.shp: the polygon or point in this shape file contains either the outline or the centre point of the analysed region. The associated attribute table contains general information on the analysis and the analyst.
- images.shp: the polygon in this shape file contains the boundaries of the images used as data base for the analysis. The associated attribute table contains all information on the used data base.
- glaciers.shp: this shape file contains the centroids of the analysed glacier outlines. In the associated attribute table each glacier is uniquely defined by an ID described by its centre coordinates in decimal geographical coordinates in the form GnnnnnnEmmmmm[N|S], with [N|S] means “either North or South”. The values of the longitude ‘nnnnnn’ range in [000000; 359999] and these of the latitude ‘mmmmm’ in [00000; 90000] (Raup & Khalsa, 2010). Three decimal places are suitable to identify each glacier. The glacier ID is also used to relate individual segments to a glacier.
- segments.shp: in this shape file 2D or 3D polygons of the glacier outlines, internal rocks etc. are stored. The associated attribute table contains all information on the individual glaciers, and accuracy information on the analysis.

In the following tables the required and additionally provided attributes of the shapefiles required for data transfer to the GLIMS data base are described. The maximum allowed length of the attribute headers is 10 signs.

Table 5.2:
Attributes of the mandatory shapefile session.shp after the GLIMS standard.

Shapefile	*Attribute*	*Format*	*Mandatory*	*Attribute description*
session.shp	RC_ID	int	YES	Identification number of the Regional Centre
	analy_time	timestamp	YES	Time analysis was done

Shapefile	Attribute	Format	Mandatory	Attribute description
	data_src	text	YES	Description of data source
	proc_desc	text	YES	Description of processing
	anlst_surn	varchar(50)	YES	Surname of analyst
	anlst_givn	varchar(50)	YES	Given name of analyst
	3d_desc	text	YES	Description of how 3-D information was derived
	src_time	timestamp	NO	Timestamp for the data acquisition

Table 5.3:
Attributes of the mandatory shapefile glaciers.shp after the GLIMS standard.

Shapefile	Attribute	Format	Mandatory	Attribute description
glaciers.shp	ID	varchar(20)	YES	Unique glacier ID in the form GnnnnnnEmmmmm[N|S]
	name	varchar(40)	NO	Name of glacier, if one exists
	src_time	timestamp	NO	As-of time for this glacier. This overrides src_time in "session".
	prim_class	smallint	NO	Classification of glaciers, currently 10 valids from WGI
	form	smallint	NO	Form of glaciers, currently 10 valids from WGI
	front_char	smallint	NO	Enumerated field, 6 valids from WGI
	long_char	smallint	NO	Enumerated field, 6 valids from WGI
	mass_src	smallint	NO	Enumerated field, 4 valids from WGI
	tongue_act	smallint	NO	Enumerated field, 9 valids from WGI
	width_m	float	NO	Representative width of glacier (meters)
	length_m	float	NO	Representative length of glacier (meters)
	area_km2	float	NO	Representative total area of glacier (km²)
	abarea_km2	float	NO	Area of ablation zone of glacier (km²)
	speed_myr	float	NO	Representative speed (m/a)
	snwln_elev	float	NO	Transient snow line elevation (meters)
	wgms_id	varchar(14)	NO	World Glacier Monitoring Service (WGMS) ID, if assigned
	local_id	varchar(20)	NO	Glacier ID used by RCs
	parent_id	varchar(20)	NO	Reference for parent glacier ID
	image_id1	int	NO	Subercedes value(s) in "images" for this glacier. These are to be the same kind of IDs as orig_id in the images file.
	image_id2	int	NO	Ditto. A glacier may have bridged multiple images.
	image_id3	int	NO	Ditto. A glacier may have bridged multiple images.
	image_id4	int	NO	Ditto. A glacier may have bridged multiple images.
	image_id5	int	NO	Ditto. A glacier may have bridged multiple images.

Shapefile	Attribute	Format	Mandatory	Attribute description
	map_id1	int	NO	Subercedes value(s) in “maps” for this glacier. These are to be the same kind of IDs as user_map_id in the maps file.
	map_id2	int	NO	Ditto. A glacier may have bridged multiple images.
	map_id3	int	NO	Ditto. A glacier may have bridged multiple images.
	map_id4	int	NO	Ditto. A glacier may have bridged multiple images.
	map_id5	int	NO	Ditto. A glacier may have bridged multiple images.

Table 5.4:
Attributes of the mandatory shapefile segments.shp after the GLIMS standard.

Shapefile	Attribute	Format	Mandatory	Attribute description
segments.shp	category	varchar(32)	YES	Can be one of: glac_bound, centerline, snow_line, intrnl_rock, pro_lake, supra_lake, debris_cov
	ID	varchar(20)	YES	Glacier ID (G...) or tiepointregion ID (T...)
	type	varchar(30)	YES	"m" (measured) or "a" (arbitrary)
	loc_unc_x	numeric(11,4)	YES	Local (within-image) location uncertainty, in meters
	loc_unc_y	numeric(11,4)	YES	Local (within-image) location uncertainty, in meters
	glob_unc_x	numeric(11,4)	YES	Global (geographic) location uncertainty, in meters
	glob_unc_y	numeric(11,4)	YES	Global (geographic) location uncertainty, in meters
	label	varchar(32)	NO	Is this segment on a terminus? Cloud? Edge of data? Etc.
	left_mat	char(3)	NO	Material to the left of the segment: glacier, nonglacier, ice, rock, snow, vegetation, water. Left is defined as the inside of the polygon (polygons go counter-clockwise)
	right_mat	char(3)	NO	Material to the right of the segment: glacier, nonglacier, ice, rock, snow, vegetation, water. Right is defined as the outside inside of the polygon (polygons go counter-clockwise)
	left_feat	char(3)	NO	Feature (higher level of abstraction) on left: selection from valids: glacier, lake, etc. Left is defined as the inside of the polygon (polygons go counter-clockwise)
	right_feat	char(3)	NO	Feature (higher level of abstraction) on right: selection from valids: glacier, lake, etc. Right is defined as the outside inside of the polygon (polygons go counter-clockwise)

Table 5.5:
Attributes of the shapefile images.shp after the GLIMS standard. This shapefile is mandatory except the shapefile ‘maps.shp’ is used.

Shapefile	Attribute	Format	Mandatory	Attribute description
images.shp	inst_name	varchar(80)	YES	Instrument name (e.g. ETM+, ASTER)
	orig_id	int	YES	Original ID of image (e.g. EROS Data Centre granule ID)

Shapefile	Attribute	Format	Mandatory	Attribute description
	acq_time	timestamp	YES	Time of image acquisition, in 'YYYY-MM-DD' or 'YYYY-MM-DD hh:mm:ss' format
	imgctrlon	numeric(11,4)	YES	Longitude of image centre, in decimal degrees
	imgctrlat	numeric(11,4)	YES	Latitude of image centre, in decimal degrees
	image_id	int	NO	ID of image within GLIMS (populated on ingest at NSIDC)
	inst_id	int	NO	Instrument ID (valid IDs: ASTER = 1, SPOT5 = 2, Landsat7 = 3, SPOT4 = 4, SPOT3 = 5, TM5 = 6, ERS-1 SAR = 7, ERS-2 SAR = 8, Ikonos = 9, Ikonos2 = 10, Quickbird = 11)
	imglocurl	varchar(120)	NO	Location (URL) of image
	imglon_unc	numeric(11,4)	NO	Uncertainty of image georeferencing – lon (m)
	imglat_unc	numeric(11,4)	NO	Uncertainty of image georeferencing – lat (m)
	image_azim	numeric(7,4)	NO	Orientation of image (degrees east of north)
	cloud_pct	numeric(3,0)	NO	Cloud severity (0 to 100%, 100% being totally cloudy)
	sun_azim	numeric(7,4)	NO	Sun azimuth (degrees east of north)
	sun_elev	numeric(7,4)	NO	Sun elevation (degrees from horizon)
	inst_zen	numeric(7,4)	NO	Zenith angle of instrument pointing (degrees, 0 = nadir)
	inst_azim	numeric(7,4)	NO	Azimuth of instrument pointing (degrees east of north)
	projection	varchar(30)	NO	Name of projection used during digitizing of glaciers

Table 5.6:
Attributes of the shapefile maps.shp after the GLIMS standard. This file is mandatory except the shapefile 'images.shp' is used.

Shapefile	Attribute	Format	Mandatory	Attribute description
maps.shp	usr_map_id	int	YES	Analyst-assigned ID for the map. Should start with "RCnn", where nn is the RC number, or some other similar RC-specific marker.
	regionname	varchar(50)	YES	Name of region covered by the map
	asof_date	timestamp	YES	As-of date for the content of the map
	map_title	text	NO	Title or name of the map
	auth_pub	text	NO	Author or publisher of the map
	pub_date	date	NO	Date the map was published
	pub_loc	text	NO	Name of the city, nation or location where map was published
	scale	varchar(50)	NO	Scale of the map, expressed e.g. as 1:10000
	units	varchar(20)	NO	Units used in the map for contours, etc
	proj	varchar(100)	NO	Projection of the map, including some parameters such as UTM zone
	series_ed	varchar(50)	NO	Series or edition of the map
	sheet	varchar(20)	NO	Sheet identifier for this map
	comment	text	NO	Free text field for comments or additional information

The type for products derived by automated processing or manually mapping from a data source is defined as measured, abbreviated by 'm' in the type column. Arbitrary data, abbreviated by 'a', are segments mapped without any data base, for example if a part of the glacier is obscured by clouds.

Further information can be stored in additional shapefiles. A list of the shapefiles supported by the GLIMS data base is presented in Table 5.7.

Table 5.7:
Shapefiles supported by the GLIMS data base.

Shapefile name	*Mandatory*	*Shapefile Type*	*Geometry*
session.shp	YES	Point, PointZ, Polygon or PolygonZ	Outline of region, or point in the middle of region
glaciers.shp	YES	Point or PointZ	Point location of glacier
segments.shp	YES	PolyLine (arc), PolyLineZ (arcz), Polygon or PolygonZ	Line segments
images.shp	YES if no maps	Polygon	Polygon of image footprint, or part of mosaic made up from this image
maps.shp	YES if no images	Polygon or Point	Polygon or point of map location
vec_sets.shp	NO	Point, PointZ, Polygon or PolygonZ	Centre of mass (point) of vector set, or convex hull around vectors
vec_points.shp	NO	PolyLine (arc) or PolyLineZ (arcz)	Two-point vector arcs
histograms.shp	NO	Point or PointZ	Point at centre of glacier
ancillary.shp	NO	Polygon or Point	Polygon or point of auxiliary data location
point_meas.shp	NO	Point or PointZ	Point measurements

The shapefiles "vec_sets" and "vec_points" of GLIMS provide the storage of displacement vectors, as for example glacier velocity fields. The contents of the associated attribute tables are listed in the following two tables.

Table 5.8:
Attributes of the shapefile vec_sets.shp after the GLIMS standard.

Shapefile	*Attribute*	*Format*	*Mandatory*	*Attribute description*
vec_sets.shp	vel_set_id	int	YES	Local ID, not stored in database
	anal_id1	int	YES	Analysis ID for first time
	anal_id2	int	YES	Analysis ID for second time
	num_vecs	text	NO	Number of vectors in the vector set
	p1_loc_lon	real	YES	First point, local uncertainty, longitude

Shapefile	Attribute	Format	Mandatory	Attribute description
	p1_loc_lat	real	YES	First point, local uncertainty, latitude
	p1_glb_lon	real	YES	First point, global uncertainty, longitude
	p1_glb_lat	real	YES	First point, global uncertainty, latitude
	p2_loc_lon	real	YES	Second point, local uncertainty, longitude
	p2_loc_lat	real	YES	Second point, local uncertainty, latitude
	p2_glb_lon	real	YES	Second point, global uncertainty, longitude
	p2_glb_lat	real	YES	Second point, global uncertainty, latitude

Table 5.9:
Attributes of the shapefile vec_points.shp after the GLIMS standard.

Shapefile	Attribute	Format	Mandatory	Attribute description
vec_points.shp	vel_set_id	int	YES	Local ID, not stored in database
	speed	real	YES	Speed in m/yr
	azimuth	numeric(7,4)	YES	Azimuth of vector (degrees east of north)

Kml or kmz files are useful to browse for glacier products stored in vector format in GoogleEarth. Additionally, JPG or PNG can be provided for browsing glacier products.

The following tables show examples of the mandatory GLIMS attribute tables of an analysis of glacier outlines.

Table 5.10:
Example of attribute table associated to the session shapefile.

RC_ID	analy_time	data_src	proc_desc	anlst_surn	anlst_givn	3d_desc
514	2008-04-31	2003-08-23	Glacier outlines were manually mapped.	Bippus	Gabriele	The DEM of the SRTM was used to derive elevation information.

Table 5.11:
Example of attribute table associated to the glaciers shapefile.

glacier_id	glacier_name	wgms_id	local_id	parent_id
G011128E47086N	Lisenser Ferner	–	–	–
G011128E47046N	Alpeiner Ferner	–	–	–

Table 5.12:
Example of attribute table associated to the segments shapefile.

category	*glacier_id*	*type*	*loc_unc_x*	*loc_unc_y*	*glob_unc_x*	*glob_unc_y*	*left_mat*	*right_mat*
glac_bound	G011128E47086N	m	15	15	22.5	22.5	ice	rock
intrl_rock	G011128E47086N	m	15	15	22.5	22.5	ice	rock
glac_bound	G011128E47046N	m	15	15	22.5	22.5	Ice	rock
intrl_rock	G011128E47046N	m	15	15	22.5	22.5	ice	rock

Table 5.13:
Example of attribute table associated to the images shapefile.

inst_id	*inst_name*	*orig_id*	*acq_time*	*imgctrlon*	*imgctrlat*	*cloud_pct*	*projection*
1	ASTER	AST_L1A.003:2023826479	2003-08-23 10:20:54	11.10986	47.35084	2	UTM 32 / WGS 84
1	ASTER	AST_L1A.003:2023826475	2003-08-23 10:21:03	10.90901	46.82557	7	UTM 32 / WGS 84

5.1 Glacier area

Glacier area maps are stored as raster files in GeoTIFF format. Storage specifications for raster files are described in Chapter 2.2.

The standard projection of glacier areas derived from EO data is UTM WGS 84. Conversion in other projections as geographic coordinates is suggested for regions located at margins of UTM zones or for large spatial extents. The spatial resolution of the glacier extent map depends on the data base used for the processing line and can thus vary between 10 m and 30 m.

In order to derive glacier outlines (GLO) the glacier extent maps are converted from raster to vectors. All boundaries included in the glacier outlines derived from a raster map have to be closed polygons. The resulting vectors have the same projection and resolution as the basic raster file. The outlines are stored in shapefile format according to the GLIMS standards. The mandatory attribute fields of the mandatory shapefiles listed in Table 5.7 have to be filled. As the examples in Table 5.10 to Table 5.13 show, there are much more attribute fields, which are not mandatory, but provide the storage of additional data. If such information is not available, these fields can stay empty.

5.2 Glacier velocity

Glacier velocity maps (GLV) are stored as raster files. The individual velocity components are stored in different bands of the resulting raster, as specified in Table 5.14.

Table 5.14:
Raster bands describing glacier velocity fields.

Band	Attribute	Mandatory / Optional	Type	Units	Comments
1	velX	M	double	m / day	Horizontal velocity component in X- direction (towards East: positive)
2	velY	M	double	m / day	Horizontal velocity component in y- direction (towards North: positive)
3	velZ	O	double	m / day	Vertical velocity component (upwards is positive)
4	velMag	O	double	m / day	Magnitude of velocity
5	velDir	O	double	m / day	Direction of velocity (North direction is 0)

The following processing options can be provided:

- Slope parallel velocity: assumption of slope parallel motion (requires a DEM for projection of observed displacement on slope)
- Horizontal: assumption of only horizontal motion
- Vertical: assumption of only horizontal motion
- 3 D: retrieval of 3 D velocity component from multiple passes

According to the user requirements the selected standard projection of the raster is UTM projection on the WGS 84 ellipsoid. The spatial resolution of this product depends on the used data base and the observed glacier, and ranges between 50 m and 500 m. Storage specifications for raster files are described in Chapter 2.2.

5.3 Snow / ice area on glaciers

The boundaries between snow and ice areas on glaciers (GLS) are stored in shapefile format. According to the user requirements the selected standard projection of the shapefile is UTM projection on the WGS 84 ellipsoid. The spatial resolution of this product depends on the used data base and ranges between 10 m and 30 m. A reprojection into geographic coordinates is required if the data are stored according to GLIMS standards. Snow / ice boundaries are stored as 2D or 3D lines in the segments shapefile. The glacier IDs are used to relate information about snow / ice areas to individual glaciers.

Additionally, snow / ice area maps on glaciers are provided as raster file in GeoTIFF format using the specifications described in Chapter 2.2. The spatial resolution of the raster file is in the range of 30 m – 250 m, depending on the user's need and the availability of EO data.

5.4 Glacier lake

The glacier lake (GLL) product is provided as vector and stored in shapefile format with UTM projection on the WGS 84 ellipsoid, as required by the user group. The spatial resolution is between 10 m and 30, depending on the used data base. Closed polygons of glacier lakes are stored in the segments shapefile according to the GLIMS standards. The format of this shapefile is described in the beginning of Chapter 5. The glacier IDs are used to relate information about lakes to individual glaciers.

5.5 Product coding of raster files

Glacier products stored as raster files and the associated codes are summarized in Table 5.15.

Table 5.15:
Coding and transformation formulas for glacier products stored as raster.

Product	*Product abbreviation*	*Code range*	*Transformation formula*	*Comments*
Glacier area	GLA	70	–	Binary classification code
Glacier velocity	GLV	–	–	Velocity components are stored in raster bands, as defined in Table 5.14
Snow / ice area on glacier	GLS	230 – 232	230 = Snow on glacier 231 = glacier ice 232 = internal rocks, nunataks	Binary classification codes

5.6 Product coding of vector files

5.6.1 *Glacier outlines*

According to GLIMS standards, glacier boundaries are coded as category “glac_bound” in the “segments” shapefile. Internal rocks on glaciers are specified as “intrnl_rock” in the “segments” shapefile. Debris covered areas on glaciers have to be mapped separately. Such areas are defined by the category “debris_cov” in the “segments” shapefile.

5.6.2 *Glacier velocity*

According to GLIMS standards, glacier velocities are stored as displacement vectors in the “vec_sets” or “vec_points” shapefiles.

5.6.3 *Snow / ice area on glaciers*

The snow / ice areas as vectors are mapped and stored as polylines. To define the snow / ice boundaries in the associated attribute tables, the field “category” in the “segments” attribute table has to be filled by the entry “snow_line”. If only the information about the elevation of the snow / ice boundary should be stored additional to a glacier, but without mapping or storing polylines, the field “snwln_elev” of the “glaciers” attribute table should be used.

5.6.4 *Glacier lake*

According to GLIMS standards, glacier lakes in the front of a glacier are defined in the “segments” shapefile by the category “pro_lake”. If a lake is located on a glacier, the polygon of this lake is defined by the category “supra_lake” in the “segments” shapefile.

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6. REFERENCES

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APPENDIX A – OPTIONAL TAGS IN METADATA FILE

Table A.1:
Optional tags for the general metadata block.

Metadata element	*XPath*	*Comment*
File identifier	fileIdentifier	Unique file identifier for this metadata file, provided by the catalogue service
Metadata character set	characterSet/MD_CharacterSetCode	Character coding of metadata (use value from list: Table B.1, MD_CharacterSetCode; default for CryoLand: "UTF-8")
Metadata standard name	metadataStandardNane	Reference to the used standard (ISO19115)
Metadata standard version	metadataStandardVersion	Reference to used standard version (2003/Cor.1:2006(E), ICS 35.240.70)

Table A.2:
Optional tags in the metadata group "contact".

Metadata element	*XPath*	*Comment*
Contact name	contact/CI_ResponsibleParty/CI_Contact/individualName	Contact person
Contact position	contact/CI_ResponsibleParty/CI_Contact/positionName	Position of contact person
Phone	contact/CI_ResponsibleParty/CI_Contact/CI_Telephone/ voice	Phone number of contact person
Fax	contact/CI_ResponsibleParty/CI_Contact/CI_Telephone/ facsimile	Fax number of contact person
Delivery point	contact/CI_ResponsibleParty/CI_Contact/address/ CI_Address/deliveryPoint	Street, house number
City	contact/CI_ResponsibleParty/CI_Contact/address/ CI_Address/city	City
Postal Code	contact/CI_ResponsibleParty/CI_Contact/address/ CI_Address/postalCode	Postal code
Country	contact/CI_ResponsibleParty/CI_Contact/address/ CI_Address/country	Country

Table A.3:
Optional tags in the metadata group "identificationInfo"

Metadata element	*XPath*	*Comment*
Name of contact person	identificationInfo/MD_DataIdentification/pointOfContact/ CI_ResponsibleParty/individualName	Name of contact person
Position of the contact person	identificationInfo/MD_DataIdentification/pointOfContact/ CI_ResponsibleParty/positionName	Position of the contact person in the company

Metadata element	*XPath*	*Comment*
Keyword value	identificationInfo/MD_DataIdentification/ descriptiveKeywords/MD_Keywords/keyword	Additional, product related descriptive keyword
Keyword type code	identificationInfo/MD_DataIdentification/ descriptiveKeywords/MD_Keywords/type/ MD_KeywordTypeCode	Type of keyword (use value from list: Table B.1, DS_InitiativeTypeCode)
Spatial Resolution in equivalent scale	identificationInfo/MD_DataIdentification/ spatialResolution/MD_Resolution/equivalentScale/ MD_RepresentativeFraction/denominator	Spatial resolution in equivalent scale, mandatory if "Distance" is not defined
Resource constraints in usage	identificationInfo/MD_DataIdentification/ resourceContraints/MD_Constraints/useLimitation	Limitations for usage
Legal constraints in product access	identificationInfo/MD_DataIdentification/ resourceContraints/MD_LegalConstraints/ accessConstraints/MD_RestrictionCode	Restriction code (use value from list: Table B.2, MD_RestrictionCode)

Table A.4:
Optional tags in the metadata group "dataQualityInfo"

Metadata element	*XPath*	*Comment*
Scope code	dataQualityInfo/DQ_DataQuality/scope/DQ_Scope/level/ MD_ScopeCode	Scope code (use value from list: Table B.2, MD_ScopeCode)
Consistency check	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/measureIdentification/ RS_Identifier/code	Report, if the data set is consistent with another data set
Reference data set for consistency check	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/measureIdentification/ RS_Identifier/codeSpace	Reference data set for consistency check
Specification	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/result/DQ_ConformanceResult/ specification/CI_Citation/title	Title of conformance result
Date of consistency check	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/result/DQ_ConformanceResult/ specification/CI_Citation/date/Date	Date of consistency check
Date type code	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/result/DQ_ConformanceResult/ specification/CI_Citation/dateType/CI_DateTypeCode	Date type code (use value from list: Table B.6, CI_DateTypeCode)
Explanation	dataQualityInfo/DQ_DataQuality/report/ DQ_DomainConsistency/result/DQ_ConformanceResult/ explanation	Explanation to the conformance check
Lineage	dataQualityInfo/DQ_DataQuality/lineage/LI_Lineage/ statement	General explanation of the data producer's knowledge about the lineage of a dataset.
Process steps	dataQualityInfo/DQ_DataQuality/lineage/LI_Lineage/ processStep/LI_ProcessStep/description	Information about single process steps. N process steps can be described.

APPENDIX B – CODE LISTS ACCORDING TO INSPIRE AND ISO 19115 STANDARDS

The following tables show the code lists of several optional, conditional and mandatory elements in the metadata file. These lists are from the ISO extension ISO19115:2003/Cor.1:2006(E) (TC 211), which is available free of charge for personal used after registration from http://iso.org. Full ISO standards can also be order from this site after registration, but are only available for a fee. If a list is defined as enumeration this is mentioned additionally within brackets in the table header. Abbreviations M, O and C indicate if setting a value from the list is mandatory, optional or conditional.

Table B.1:
ISO 19115 code lists for the metadata group "Identification information" – part 1/2.

MD_CharacterSetCode (C / M when ISO 10646 – 1 not used; metadata character set: (O)	*MD_TopicCategoryCode (Enumeration) (C / M if hierarchy level = 'dataset')*	*DS_InitiativeTypeCode (M)*	*DS_AssociationTypeCode (O)*
ucs2	farming	campaign	crossReference
ucs4	biodata	collection	largerWorkCitation
utf7	boundaries	exercise	partOfSeamlessDatabase
utf8	climatologyMeteorology Atmosphere	experiment	source
utf16		investigation	stereoMate
8859part1	economy	mission	
8859part2	elevation	sensor	
8859part3	environment	operation	
8859part4	geoscientificInformation	platform	
8859part5	health	process	
8859part6	imageryBaseMapsEarthCover	program	
8859part7	intelligenceMilitary	project	
8859part8	inlandWaters	study	
8859part9	location	task	
8859part10	oceans	trial	
8859part11	planningCadastre		
(reserved for future use)	society		
8859part13	structure		

MD_CharacterSetCode (C / M when ISO 10646 – 1 not used; metadata character set: (O)
8859part15
8859part16
jis
shiftJIS
eucJP
usAscii
ebcdic
eucKR
big5
GB2312

MD_TopicCategoryCode (Enumeration) (C / M if hierarchy level = 'dataset'))
utilitiesCommunication

Table B.2:
ISO 19115 code lists for the metadata groups "Identification information" – part 2/2 (left columns) and "Data quality information" (right column).

MD_KeywordTypeCode (O)
discipline
place
stratum
temporal
theme

MD_SpatialRepresentationTypeCode (O)
vector
grid
textTable
tin
stereoModel
video

MD_ProgressCode (O)
completed
historicalArchive
obsolete
onGoing
planned
required
underDevelopment

MD_RestrictionCode (O)
copyright
patent
patentPending
trademark
license
intellectualPropertyRights
restricted
otherRestrictions

MD_EvaluationMethodTypeCode (O)
directInternal
directExternal
indirect

Table B.3:
ISO 19115 code lists for the metadata group “Spatial representation information”.

MD_DimensionName TypeCode (M)
row
column
vertical
track
crossTrack
line
sample
time

MD_PixelOrientation Code (Enumeration) (M)
center
lowerLeft
lowerRight
upperRight
upperLeft

MD_TopologyLevel Code (M)
geometryOnly
topology1D
planarGraph
fullPlanarGraph
surfaceGraph
fullSurfaceGraph
topology3D
fullTopology3D
abstract

MD_CellGeometry Code (M)
point
area

MD_GeometricObject TypeCode (O)
complex
composite
curve
point
solid
surface

Table B.4:
ISO 19115 code lists for the metadata groups “Maintenance information” (left)
and “Content information” (right).

MD_MaintenanceFrequency Code (O)
continual
daily
weekly
fort nightly
monthly
quarterly
biannually
annually
asNeeded
irregular
notPlanned
unknown

MD_ScopeCode (C / M if hierarchy level is not = ‘dataset’)
attribute
attributeType
collectionHardware
collectionSession
dataset
series
nonGeographicDataset
dimensionGroup
feature
featureType
propertyType
fieldSession
software
service
model
tile

MD_CoverageContent TypeCode (O)
image
thematicClassification
phyiscalMeasurement

MD_ImagingConditionCode (O)
blurredImage
cloud
degradingObliquity
fog
heavySmokeOrDust
night
rain
semiDarkness
shadow
snow
terrainMasking

Table B.5:
ISO 19115 code lists for the metadata groups “Distribution information” (left)
and the “Metadata extension information” (right).

MD_MediumFormatCode (O)
cpio
tar
highSierra
iso9660
iso9660RockRidge
iso9660AppleHFS

MD_ MediumNameCode (M)
cdRom
dvd
dvdRom
3halfInchFloppy
5quarterInchFloppy
7trackTape
9trackTape
3480Cartridge
3490Cartridge
3580Cartridge
4mmCartridgeTape
8 mmCartridgeTape
1quarterInchCartridgeTape
digitalLinearTape
onLine
satellite
telephoneLink
hardcopy

MD_ObligationCode (Enumeration)
Mandatory (M)
Optional (O)
conditional (C)

MD_DataTypeCode (O)
class
codelist
enumeration
codelistElement
abstractClass
aggregateClass
specifiedClass
datatypeClass
interfaceClass
unionClass
metaClass
typeClass
characterString
integer
association

Table B.6:
ISO 19115 code lists for the metadata group “Citation and responsible party information”.

CI_DateTypeCode (M)
creation
publication
revision

CI_OnLineFunctionCode (O)
download
information
offlineAccess
order
search

CI_RoleCode (M)
resourceProvider
custodian
owner
user
distributor
originator
pointOfContact
principalInvestigator

CI_PresentationFormCode (O)
documentDigital
documentHardcopy
imageDigital
imageHardcopy
mapDigital
mapHardcopy
modelDigital
modelHardcopy

CI_RoleCode (M)
processor
publisher
author

CI_PresentationFormCode (O)
profileDigital
profileHardcopy
tableDigital
tableHardcopy
videoDigital

Table B.7:
INSPIRE Spatial Data Themes.

INSPIRE Spatial Data Themes (http://www.eionet.europa.eu/gemet/inspire_themes?langcode=en)	
Addresses	Hydrography
Administrative units	Land cover
Agricultural and aquaculture facilities	Land use
Area management / restriction / regulation zones and reporting units	Meteorological geographical features
Atmospheric conditions	Mineral resources
Bio-geographical regions	Natural risk zones
Buildings	Oceanographic geographical features
Cadastral parcels	Orthoimagery
Coordinate reference system	Population distribution
Elevation	Production and industrial facilities
Energy resources	Protected sites
Environmental monitoring facilities	Sea regions
Geographical grid system	Soil
Geographical names	Species distribution
Geology	Statistical units
Habitats and biotopes	Transport networks
Human health and safety	Utility and governmental services

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APPENDIX C – EXAMPLE OF METADATA FILE

6.1 Metadata for Glacier Outline Product

The following example shows the metadata structure for the product “glacier outlines” derived from a SPOT 5 scene of 2009-09-01 over the Glocknergruppe in the Austrian Alps.

The metadata file is named “GLO_200909011016_SPOT5_47.27N1_12.35E_ENVEOV1.0_mdf.xml”, according to the naming convention defined in Section 2.1.

```
<?xml version="1.0" encoding="UTF-8"?>
<gmd:MD_Metadata xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd"
        xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
        xmlns:xs="http://www.w3.org/2001/XMLSchema"
        xmlns:xlink="http://www.w3.org/1999/xlink"
        xmlns:sch="http://www.ascc.net/xml/schematron"
        xmlns:gts="http://www.isotc211.org/2005/gts"
        xmlns:gss="http://www.isotc211.org/2005/gss"
        xmlns:gsr="http://www.isotc211.org/2005/gsr"
        xmlns:gml="http://www.opengis.net/gml"
        xmlns:gmd="http://www.isotc211.org/2005/gmd"
        xmlns:gco="http://www.isotc211.org/2005/gco">


  <!-- GENERAL -->
  <!-- General metadata file information -->
  <!-- This file identifier is unique for this metadata file. It will be provided by the catalogue service-->
  <gmd:fileIdentifier>
    <gco:CharacterString>GLO_10m_200909011016_SPOT5_Glocknergruppe_ENVEO2.10.0.tif</gco:
  CharacterString>
  </gmd:fileIdentifier>

  <gmd:language>
    <gmd:LanguageCode
    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resourc
    es/Codelist/ML_gmxCodelists.xml#LanguageCode"
    codeListValue="eng">eng</gmd:LanguageCode>
  </gmd:language>

  <gmd:hierarchyLevel>
    <gmd:MD_ScopeCode
    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resourc
    es/Codelist/ML_gmxCodelists.xml#MD_ScopeCode"
    codeListValue="dataset">dataset</gmd:MD_ScopeCode>
```

```
</gmd:hierarchyLevel>

<!-- Date when the metadata was created the first time -->
<gmd:dateStamp>
  <gco:Date>2011-09-21</gco:Date>
</gmd:dateStamp>

<!-- CONTACT -->
<!-- Full contact information can be given here -->
<gmd:contact>
  <gmd:CI_ResponsibleParty>
    <gmd:organisationName>
      <gco:CharacterString>ENVEO IT GmbH</gco:CharacterString>
    </gmd:organisationName>

    <gmd:contactInfo>
      <gmd:CI_Contact>
        <gmd:address>
          <gmd:CI_Address>
            <gmd:country>
              <gco:CharacterString>Austria</gco:CharacterString>
            </gmd:country>
            <gmd:electronicMailAddress>
              <gco:CharacterString>info@enveo.at</gco:CharacterString>
            </gmd:electronicMailAddress>
          </gmd:CI_Address>
        </gmd:address>
      </gmd:CI_Contact>
    </gmd:contactInfo>

    <gmd:role>
      <gmd:CI_RoleCode
      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/reso
      urces/Codelist/gmxCodelists.xml#CI_RoleCode"
      codeListValue="pointOfContact">pointOfContact</gmd:CI_RoleCode>
    </gmd:role>
  </gmd:CI_ResponsibleParty>
</gmd:contact>

<!-- SPATIAL REFERENCE -->
<!-- Spatial Representation taken from ISO 19115 not mandatory in INSPIRE -->
<gmd:spatialRepresentationInfo>
  <gmd:MD_GridSpatialRepresentation>

    <gmd:numberOfDimensions>
```

```
      <gco:Integer>2</gco:Integer>
    </gmd:numberOfDimensions>

    <gmd:axisDimensionProperties>
      <gmd:MD_Dimension>
        <gmd:dimensionName>
          <gmd:MD_DimensionNameTypeCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/r
          esources/Codelist/gmxCodelists.xml#MD_DimensionNameTypeCode"
          codeListValue="row" />
        </gmd:dimensionName>

        <gmd:dimensionSize>
          <!-- width of the image (number of pixels) -->
          <gco:Integer>7713</gco:Integer>
        </gmd:dimensionSize>
      </gmd:MD_Dimension>
    </gmd:axisDimensionProperties>

    <gmd:axisDimensionProperties>
      <gmd:MD_Dimension>
        <gmd:dimensionName>
          <gmd:MD_DimensionNameTypeCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/r
          esources/Codelist/gmxCodelists.xml#MD_DimensionNameTypeCode"
          codeListValue="column" />
        </gmd:dimensionName>
        <gmd:dimensionSize>
          <!-- height of the image (number of pixels) -->
          <gco:Integer>7651</gco:Integer>
        </gmd:dimensionSize>
      </gmd:MD_Dimension>
    </gmd:axisDimensionProperties>

    <gmd:cellGeometry>
      <gmd:MD_CellGeometryCode
      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/reso
      urces/Codelist/gmxCodelists.xml#MD_CellGeometryCode" codeListValue="area" />
    </gmd:cellGeometry>

    <gmd:transformationParameterAvailability>
      <gco:Boolean>false</gco:Boolean>
    </gmd:transformationParameterAvailability>
  </gmd:MD_GridSpatialRepresentation>
</gmd:spatialRepresentationInfo>


<!-- Reference System Info taken from ISO 19115 not mandatory in INSPIRE -->
<gmd:referenceSystemInfo>
```

```
<gmd:MD_ReferenceSystem>
  <gmd:referenceSystemIdentifier>
    <gmd:RS_Identifier>
      <gmd:authority>
        <gmd:CI_Citation>

          <gmd:title>
            <gco:CharacterString>EPSG Geodetic Parameter Dataset</gco:CharacterString>
          </gmd:title>

          <gmd:date>
            <gmd:CI_Date>
              <!-- This date refers to the publication of the EPSG codelist -->
              <gmd:date>
                <gco:Date>2010-03-31</gco:Date>
              </gmd:date>
              <gmd:dateType>
                <gmd:CI_DateTypeCode
                CodeList="http://www.isotc211.org/2005/resources/codeList.xml#CI_DateTypeCo
                de"
                codeListValue="publication" />
              </gmd:dateType>
            </gmd:CI_Date>
          </gmd:date>

          <gmd:edition>
            <gco:CharacterString>7.5</gco:CharacterString>
          </gmd:edition>

          <gmd:citedResponsibleParty>
            <gmd:CI_ResponsibleParty>
              <gmd:organisationName>
                <gco:CharacterString>EPSG</gco:CharacterString>
              </gmd:organisationName>
              <gmd:role>
                <gmd:CI_RoleCode
                codeList="http://www.isotc211.org/2005/resources/codeList.xml#CI_RoleCode"
                codeListValue="publisher" />
              </gmd:role>
            </gmd:CI_ResponsibleParty>
          </gmd:citedResponsibleParty>
        </gmd:CI_Citation>
      </gmd:authority>

      <!-- The epsg code of the used CRS shall be given here -->
      <gmd:code>
        <gco:CharacterString>32633</gco:CharacterString>
      </gmd:code>
    </gmd:RS_Identifier>
  </gmd:referenceSystemIdentifier>
```

```
    </gmd:MD_ReferenceSystem>
  </gmd:referenceSystemInfo>


  <!-- METADATA EXTENSION INFO -->
  <!-- The following block links to the keyword extension to have additional keyword values -->
  <gmd:metadataExtensionInfo>
    <gmd:MD_MetadataExtensionInformation>
      <gmd:extensionOnLineResource>
        <gmd:CI_OnlineResource>

          <gmd:linkage>
            <gmd:URL>http://www.cryoland.eu/sites/default/files/MD_MetadataExtensionInformati
            on.xml</gmd:URL>
          </gmd:linkage>

          <gmd:name>
            <gco:CharacterString>extendedElementInformation</gco:CharacterString>
          </gmd:name>

          <gmd:description>
            <gco:CharacterString>OnLine Resource for extending the existing codelist with further
            elements.</gco:CharacterString>
          </gmd:description>

        </gmd:CI_OnlineResource>
      </gmd:extensionOnLineResource>
    </gmd:MD_MetadataExtensionInformation>
  </gmd:metadataExtensionInfo>



  <!-- IDENTIFICATION INFO -->
  <gmd:identificationInfo>
    <gmd:MD_DataIdentification>
      <gmd:citation>
        <gmd:CI_Citation>
          <gmd:title>
            <gco:CharacterString>Glacier outlines, Austria, SPOT5 (10m, 2009-09-
            01)</gco:CharacterString>
          </gmd:title>
          <!-- Date of revision identifies when the resource was examined or re-examined and
          improved or amended  -->
          <gmd:date>
            <!-- Date of creation identifies when the resource was brought into existence -->
            <gmd:CI_Date>
              <gmd:date>
                <gco:Date>2011-05-13</gco:Date>
```

```
        </gmd:date>


        <gmd:dateType>
          <gmd:CI_DateTypeCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schem
          as/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
          codeListValue="creation">creation</gmd:CI_DateTypeCode>
        </gmd:dateType>
      </gmd:CI_Date>
    </gmd:date>


    <!-- Give a value that is uniquely identifying an object within a namespace/codespace   -->
    <gmd:identifier>
      <gmd:RS_Identifier>
        <!-- The code is an alphanumeric value identifying an instance in the namespace. -->
        <gmd:code>
          <gco:CharacterString>SPOT5_063255_200909011016</gco:CharacterString>
        </gmd:code>

        <!-- Codespace is like a namespace. -->
        <gmd:codeSpace>
          <gco:CharacterString>ENVEO</gco:CharacterString>
        </gmd:codeSpace>
      </gmd:RS_Identifier>
    </gmd:identifier>
  </gmd:CI_Citation>
</gmd:citation>

<gmd:abstract>
  <gco:CharacterString>GLO_SPOT5_063255_20090901</gco:CharacterString>
</gmd:abstract>

<gmd:pointOfContact>
  <gmd:CI_ResponsibleParty>
    <gmd:organisationName>
      <gco:CharacterString>ENVEO IT GmbH</gco:CharacterString>
    </gmd:organisationName>

    <gmd:contactInfo>
      <gmd:CI_Contact>
        <gmd:address>
          <gmd:CI_Address>
            <gmd:electronicMailAddress>
              <gco:CharacterString>gabriele.bippus@enveo.at</gco:CharacterString>
            </gmd:electronicMailAddress>
          </gmd:CI_Address>
        </gmd:address>
```

```
      </gmd:CI_Contact>
    </gmd:contactInfo>

    <gmd:role>
      <gmd:CI_RoleCode
      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_RoleCode"
      codeListValue="pointOfContact">pointOfContact</gmd:CI_RoleCode>
    </gmd:role>
  </gmd:CI_ResponsibleParty>
</gmd:pointOfContact>



<!-- The following two keywords are taken from the GEMET thesaurus. One keyword from the GEMET is necessary.  -->
<gmd:descriptiveKeywords>
    <gmd:MD_Keywords>
      <gmd:keyword>
        <gco:CharacterString>Orthoimagery</gco:CharacterString>
      </gmd:keyword>

      <gmd:keyword>
        <gco:CharacterString>Environmental monitoring facilities</gco:CharacterString>
      </gmd:keyword>

      <gmd:thesaurusName>
        <gmd:CI_Citation>
          <gmd:title>
            <gco:CharacterString>GEMET - INSPIRE Spatial Data Themes</gco:CharacterString>
          </gmd:title>

          <gmd:date>
            <gmd:CI_Date>
              <!-- Date of the publication of the thesaurus. No changes here. -->
              <gmd:date>
                <gco:Date>2008-12-05</gco:Date>
              </gmd:date>

              <gmd:dateType>
                <gmd:CI_DateTypeCode
                codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
                codeListValue="publication">publication</gmd:CI_DateTypeCode>
              </gmd:dateType>
            </gmd:CI_Date>
          </gmd:date>
        </gmd:CI_Citation>
      </gmd:thesaurusName>
    </gmd:MD_Keywords>
```

```
</gmd:descriptiveKeywords>


<!-- The following 4 keywords refer to the keyword extension -->
<!-- Keyword for the sensor. MOD, MYD, MERIS, REYE1, REYE2,..., WV-2 -->
<gmd:descriptiveKeywords>
  <gmd:MD_Keywords>
    <gmd:keyword>
      <gco:CharacterString>SPOT5</gco:CharacterString>
    </gmd:keyword>
    <gmd:type>
      <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Ke
      ywordTypeCode"
      codeListValue="sensor" />
    </gmd:type>
  </gmd:MD_Keywords>
</gmd:descriptiveKeywords>

<!-- Keyword for the region. -->
<gmd:descriptiveKeywords>
  <gmd:MD_Keywords>
    <gmd:keyword>
      <gco:CharacterString>AT-Glocknergruppe</gco:CharacterString>
    </gmd:keyword>
    <gmd:type>
      <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Ke
      ywordTypeCode"
      codeListValue="region" />
    </gmd:type>
  </gmd:MD_Keywords>
</gmd:descriptiveKeywords>

<!-- Keyword for the product: scf,swe,lsc,glo,... -->
<gmd:descriptiveKeywords>
  <gmd:MD_Keywords>
    <gmd:keyword>
      <gco:CharacterString>glo</gco:CharacterString>
    </gmd:keyword>
    <gmd:type>
      <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Ke
      ywordTypeCode"
      codeListValue="product" />
    </gmd:type>
  </gmd:MD_Keywords>
</gmd:descriptiveKeywords>
```

```
<!-- Keyword for the service provider name -->
<gmd:descriptiveKeywords>
  <gmd:MD_Keywords>

    <gmd:keyword>
      <gco:CharacterString>ENVEO</gco:CharacterString>
    </gmd:keyword>
    <gmd:type>
      <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_KeywordTypeCode"
      codeListValue="serviceprovider" />
    </gmd:type>
  </gmd:MD_Keywords>
</gmd:descriptiveKeywords>


<!-- Information about the use limitations (INSPIRE mandatory) -->
<gmd:resourceConstraints>
  <gmd:MD_Constraints>
    <gmd:useLimitation>
      <gco:CharacterString>usage allowed within CryoLand</gco:CharacterString>
    </gmd:useLimitation>
  </gmd:MD_Constraints>
</gmd:resourceConstraints>

<gmd:resourceConstraints>
  <gmd:MD_LegalConstraints>
    <gmd:accessConstraints>
      <gmd:MD_RestrictionCode
      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#MD_RestrictionCode"
      codeListValue="otherRestrictions">otherRestrictions</gmd:MD_RestrictionCode>
    </gmd:accessConstraints>

    <gmd:otherConstraints>
      <gco:CharacterString>to be defined</gco:CharacterString>
    </gmd:otherConstraints>
  </gmd:MD_LegalConstraints>
</gmd:resourceConstraints>


<!-- Resolution given as ground sample distance GSD -->
<gmd:spatialResolution>
  <gmd:MD_Resolution>
    <gmd:distance>
      <gco:Distance uom="m">10</gco:Distance>
    </gmd:distance>
  </gmd:MD_Resolution>
</gmd:spatialResolution>
```

```
<gmd:language>
  <gmd:LanguageCode
  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/res
  ources/Codelist/ML_gmxCodelists.xml#LanguageCode"
  codeListValue="eng">eng</gmd:LanguageCode>
</gmd:language>

<!-- This topic category is mandatory. The possible values are given in the ISO19115 -->
<!-- farming, biota, boundaries, climatology/Meteorology Atmosphere, economy, elevation,
environment, geoscientificInformation, health, imagerBaseMapsEarthCover,
intelligenceMilitary, inlandWaters, location, oceans, planning Cadastre, society, structure,
transportation, utilitiesCommunication -->
<gmd:topicCategory>
  <gmd:MD_TopicCategoryCode>geoscientificInformation</gmd:MD_TopicCategoryCode>
</gmd:topicCategory>

<!-- Bounding Box is mandatory in decimal degrees (lat/lon) -->
<gmd:extent>
  <gmd:EX_Extent>
    <gmd:geographicElement>
      <gmd:EX_GeographicBoundingBox>

        <gmd:westBoundLongitude>
          <gco:Decimal>12.4</gco:Decimal>
        </gmd:westBoundLongitude>

        <gmd:eastBoundLongitude>
          <gco:Decimal>13.4</gco:Decimal>
        </gmd:eastBoundLongitude>

        <gmd:southBoundLatitude>
          <gco:Decimal>46.6</gco:Decimal>
        </gmd:southBoundLatitude>

        <gmd:northBoundLatitude>
          <gco:Decimal>47.3</gco:Decimal>
        </gmd:northBoundLatitude>
      </gmd:EX_GeographicBoundingBox>
    </gmd:geographicElement>

    <!-- Date of the satellite image (temporal extent) -->
    <gmd:temporalElement>
      <gmd:EX_TemporalExtent>
        <gmd:extent>
          <gml:TimePeriod gml:id="IDcd3b1c4f-b5f7-439a-afc4-3317a4cd89be"
            xsi:type="gml:TimePeriodType">
```

```
                <gml:beginPosition>2009-09-01T10:16:13</gml:beginPosition>
                <gml:endPosition>2009-09-01T10:16:50</gml:endPosition>
              </gml:TimePeriod>
            </gmd:extent>
          </gmd:EX_TemporalExtent>
        </gmd:temporalElement>
      </gmd:EX_Extent>
    </gmd:extent>
  </gmd:MD_DataIdentification>
</gmd:identificationInfo>



<!-- DISTRIBUTION INFO -->
<!-- provides information about the distributor of and options for obtaining the resource(s) -->
<gmd:distributionInfo>
  <gmd:MD_Distribution>
    <gmd:distributionFormat>
      <!-- The format can be given here -->
      <!-- Example for ESRI Shape Format -->
      <gmd:MD_Format>
        <gmd:name>
          <gco:CharacterString>ESRI Shapefile</gco:CharacterString>
        </gmd:name>
        <gmd:version>
          <gco:CharacterString>Version 1.0</gco:CharacterString>
        </gmd:version>
      </gmd:MD_Format>
    </gmd:distributionFormat>

    <!-- Specify a URL to the resource or a link to a contact point to get more information.  e.g.
    address of WMS can be given, a link to the company, a link to a WSDL... -->
    <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
        <gmd:onLine>
          <gmd:CI_OnlineResource>
            <gmd:linkage>
              <gmd:URL>http://cryoland.eu/</gmd:URL>
            </gmd:linkage>
          </gmd:CI_OnlineResource>
        </gmd:onLine>
      </gmd:MD_DigitalTransferOptions>
    </gmd:transferOptions>
  </gmd:MD_Distribution>
</gmd:distributionInfo>
```

```
<!-- QUALITY INFO -->
<gmd:dataQualityInfo>
  <gmd:DQ_DataQuality>
    <gmd:scope>
      <gmd:DQ_Scope>
        <gmd:level>
          <gmd:MD_ScopeCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas
          /resources/Codelist/ML_gmxCodelists.xml#MD_ScopeCode"
          codeListValue="dataset">dataset</gmd:MD_ScopeCode>
        </gmd:level>
      </gmd:DQ_Scope>
    </gmd:scope>

    <!-- This part give information whether the dataset is conformant with INSPIRE. It is a
    mechanism to evaluate the resource against a given specification.  -->
    <gmd:report>
      <gmd:DQ_DomainConsistency xsi:type="gmd:DQ_DomainConsistency_Type">
        <gmd:measureIdentification>
          <gmd:RS_Identifier>
            <gmd:code>
              <gco:CharacterString>Conformity_001</gco:CharacterString>
            </gmd:code>
            <gmd:codeSpace>
              <gco:CharacterString>INSPIRE</gco:CharacterString>
            </gmd:codeSpace>
          </gmd:RS_Identifier>
        </gmd:measureIdentification>

        <gmd:result>
          <gmd:DQ_ConformanceResult xsi:type="gmd:DQ_ConformanceResult_Type">
            <gmd:specification>
              <gmd:CI_Citation>
                <gmd:title>
                  <gco:CharacterString>COMMISSION REGULATION (EC) No 1205/2008 of 3
                  December 2008 implementing Directive 2007/2/EC of the European Parliament
                  and of the Council as regards metadata</gco:CharacterString>
                </gmd:title>
                <gmd:date>
                  <gmd:CI_Date>
                    <gmd:date>
                      <gco:Date>2008-12-04</gco:Date>
                    </gmd:date>
                    <gmd:dateType>
                      <gmd:CI_DateTypeCode
                      codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_1913
                      9_Schemas/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
                      codeListValue="publication">publication</gmd:CI_DateTypeCode>
                    </gmd:dateType>
                  </gmd:CI_Date>
```

```
            </gmd:date>
          </gmd:CI_Citation>
        </gmd:specification>

        <gmd:explanation>
          <gco:CharacterString>See the referenced specification</gco:CharacterString>
        </gmd:explanation>

        <gmd:pass>
          <gco:Boolean>true</gco:Boolean>
        </gmd:pass>
      </gmd:DQ_ConformanceResult>
    </gmd:result>
  </gmd:DQ_DomainConsistency>
</gmd:report>

<!-- Quality information can be given here -->
<gmd:lineage>
  <gmd:LI_Lineage>
    <gmd:statement>
      <gco:CharacterString>GLO_200909011016_SPOT5_47.27N_12.35E_ENVEOV1.0_pgf.txt
      </gco:CharacterString>
    </gmd:statement>
  </gmd:LI_Lineage>
</gmd:lineage>
</gmd:DQ_DataQuality>
</gmd:dataQualityInfo>
</gmd:MD_Metadata>
```

6.2 Metadata for Fractional Snow Cover Product

The following example shows the metadata structure for the product “fractional snow cover” derived from multiple MODIS scenes of 2013-03-03 over the pan-European area.

The metadata file is named according to the naming convention defined in Section 2.1: “FSC_0.01deg_201303030745_201303031245_MOD_panEU_ENVEOV2.1.00_mdf.xml”.

```
<?xml version="1.0" encoding="UTF-8"?>
<gmd:MD_Metadata xsi:schemaLocation="http://www.isotc211.org/2005/gmd
http://schemas.opengis.net/iso/19139/20060504/gmd/gmd.xsd"
                 xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
                 xmlns:xs="http://www.w3.org/2001/XMLSchema"
                 xmlns:xlink="http://www.w3.org/1999/xlink"
                 xmlns:sch="http://www.ascc.net/xml/schematron"
                 xmlns:gts="http://www.isotc211.org/2005/gts"
                 xmlns:gss="http://www.isotc211.org/2005/gss"
                 xmlns:gsr="http://www.isotc211.org/2005/gsr"
                 xmlns:gml="http://www.opengis.net/gml"
                 xmlns:gmd="http://www.isotc211.org/2005/gmd"
```

```
                    xmlns:gco="http://www.isotc211.org/2005/gco">
<!-- GENERAL -->
<!-- CryoLand metadata template for raster products version 1.4 2012-02-24 -->
<!-- General metadata file information -->
<!-- This file identifier is unique and refers to the product including the file extension ".tif". -->
<!-- CryoLand Example: FSC_0.01d_201102041020_MOD_Alps_ENVEO2.1.00.tif -->
<gmd:fileIdentifier>
    <gco:CharacterString>FSC_0.01deg_201303030745_201303031245_MOD_panEU_ENVEOV2.1.0
    0.tif</gco:CharacterString>
</gmd:fileIdentifier>

<gmd:language>
  <gmd:LanguageCode
    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resourc
    es/Codelist/ML_gmxCodelists.xml#LanguageCode"
    codeListValue="eng">eng</gmd:LanguageCode>
</gmd:language>

<gmd:hierarchyLevel>
    <gmd:MD_ScopeCode
    codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resourc
    es/Codelist/ML_gmxCodelists.xml#MD_ScopeCode"
    codeListValue="dataset">dataset</gmd:MD_ScopeCode>
</gmd:hierarchyLevel>


<!-- CONTACT -->
<!-- Full contact information can be given here -->
<gmd:contact>
  <gmd:CI_ResponsibleParty>
    <gmd:organisationName>
      <gco:CharacterString>ENVEO IT GmbH</gco:CharacterString>
    </gmd:organisationName>

    <gmd:contactInfo>
      <gmd:CI_Contact>
        <gmd:address>
          <gmd:CI_Address>
            <gmd:country>
              <gco:CharacterString>Austria</gco:CharacterString>
            </gmd:country>

            <gmd:electronicMailAddress>
              <gco:CharacterString>info@enveo.at</gco:CharacterString>
            </gmd:electronicMailAddress>
          </gmd:CI_Address>
        </gmd:address>
      </gmd:CI_Contact>
    </gmd:contactInfo>
```

```
      <gmd:role>
       <gmd:CI_RoleCode
         codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/reso
         urces/Codelist/gmxCodelists.xml#CI_RoleCode"
          codeListValue="pointOfContact">pointOfContact</gmd:CI_RoleCode>
      </gmd:role>
     </gmd:CI_ResponsibleParty>
    </gmd:contact>

<!-- Date when the metadata was created the first time -->
<!-- CryoLand: Form: 2013-03-03 -->
    <gmd:dateStamp>
     <gco:Date>2013-03-03</gco:Date>
    </gmd:dateStamp>


<!-- SPATIAL REFERENCE -->

<!-- Spatial Representation taken from ISO 19115 not mandatory in INSPIRE -->
    <gmd:spatialRepresentationInfo>
     <gmd:MD_GridSpatialRepresentation>
      <gmd:numberOfDimensions>
       <gco:Integer>2</gco:Integer>
      </gmd:numberOfDimensions>

      <gmd:axisDimensionProperties>
       <gmd:MD_Dimension>
        <gmd:dimensionName>
         <gmd:MD_DimensionNameTypeCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/re
          sources/Codelist/gmxCodelists.xml#MD_DimensionNameTypeCode"
          codeListValue="row"></gmd:MD_DimensionNameTypeCode>
        </gmd:dimensionName>

        <gmd:dimensionSize>
        <!-- width of the image (number of pixels) -->
         <gco:Integer>5600</gco:Integer>
        </gmd:dimensionSize>
       </gmd:MD_Dimension>
      </gmd:axisDimensionProperties>

      <gmd:axisDimensionProperties>
       <gmd:MD_Dimension>
        <gmd:dimensionName>
         <gmd:MD_DimensionNameTypeCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/re
          sources/Codelist/gmxCodelists.xml#MD_DimensionNameTypeCode"
          codeListValue="column"></gmd:MD_DimensionNameTypeCode>
        </gmd:dimensionName>
```

```
        <gmd:dimensionSize>
        <!-- height of the image (number of pixels) -->
          <gco:Integer>3700</gco:Integer>
        </gmd:dimensionSize>
       </gmd:MD_Dimension>
      </gmd:axisDimensionProperties>

      <gmd:cellGeometry>
       <gmd:MD_CellGeometryCode
         codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/reso
         urces/Codelist/gmxCodelists.xml#MD_CellGeometryCode"
         codeListValue="area"></gmd:MD_CellGeometryCode>
      </gmd:cellGeometry>

      <gmd:transformationParameterAvailability>
       <gco:Boolean>false</gco:Boolean>
      </gmd:transformationParameterAvailability>
     </gmd:MD_GridSpatialRepresentation>
    </gmd:spatialRepresentationInfo>

  <!-- Reference System Info taken from ISO 19115 not mandatory in INSPIRE -->
    <gmd:referenceSystemInfo>
     <gmd:MD_ReferenceSystem>
      <gmd:referenceSystemIdentifier>
       <gmd:RS_Identifier>
        <gmd:authority>
         <gmd:CI_Citation>
          <gmd:title>
           <gco:CharacterString>EPSG Geodetic Parameter Dataset</gco:CharacterString>
          </gmd:title>

          <gmd:date>
           <gmd:CI_Date>
           <!-- This date refers to the publication of the EPSG codelist -->
            <gmd:date>
             <gco:Date>2010-03-31</gco:Date>
            </gmd:date>

            <gmd:dateType>
             <gmd:CI_DateTypeCode
               codeList="http://www.isotc211.org/2005/resources/codeList.xml#CI_DateTypeCode"
               codeListValue="publication"></gmd:CI_DateTypeCode>
            </gmd:dateType>
           </gmd:CI_Date>
          </gmd:date>

          <gmd:edition>
           <gco:CharacterString>7.5</gco:CharacterString>
          </gmd:edition>
```

```
          <gmd:citedResponsibleParty>
           <gmd:CI_ResponsibleParty>
            <gmd:organisationName>
             <gco:CharacterString>EPSG</gco:CharacterString>
            </gmd:organisationName>

            <gmd:role>
             <gmd:CI_RoleCode
               codeList="http://www.isotc211.org/2005/resources/codeList.xml#CI_RoleCode"
               codeListValue="publisher"></gmd:CI_RoleCode>
            </gmd:role>
           </gmd:CI_ResponsibleParty>
          </gmd:citedResponsibleParty>
         </gmd:CI_Citation>
        </gmd:authority>

      <!-- The epsg code of the used CRS shall be given here -->
      <!-- For CryoLand Pan-European Snow Products: -->
     <!-- Projection LAT/LON, WGS84 is defined by the EPSG code: 4326 -->
       <gmd:code>
        <gco:CharacterString>4326</gco:CharacterString>
       </gmd:code>
      </gmd:RS_Identifier>
     </gmd:referenceSystemIdentifier>
    </gmd:MD_ReferenceSystem>
   </gmd:referenceSystemInfo>


<!-- METADATA EXTENSION INFO -->

<!-- The following block links to the keyword extension to have additional keyword values -->
  <gmd:metadataExtensionInfo>
   <gmd:MD_MetadataExtensionInformation>
    <gmd:extensionOnLineResource>
     <gmd:CI_OnlineResource>
      <gmd:linkage>
       <!-- CryoLand adaptation 20110916 -->
          <gmd:URL>http://www.cryoland.eu/sites/default/files/MD_MetadataExtensionInformation
          .xml</gmd:URL>
      </gmd:linkage>

      <gmd:name>
       <gco:CharacterString>extendedElementInformation</gco:CharacterString>
      </gmd:name>

      <gmd:description>
       <gco:CharacterString>OnLine Resource for extending the existing
       codelist with further elements.</gco:CharacterString>
      </gmd:description>
     </gmd:CI_OnlineResource>
```

```
      </gmd:extensionOnLineResource>
    </gmd:MD_MetadataExtensionInformation>
  </gmd:metadataExtensionInfo>


 <!-- IDENTIFICATION INFO -->

  <gmd:identificationInfo>
   <gmd:MD_DataIdentification>
    <gmd:citation>
     <gmd:CI_Citation>
      <gmd:title>
      <!-- CryoLand Example: Fractional Snow Cover, Austria, MODIS Terra (0.01deg, 2011-02-04) -->
       <gco:CharacterString>Fractional Snow cover, pan-Europe, MODIS Terra (0.01deg, 2013-03-
       03)</gco:CharacterString>
      </gmd:title>

     <!-- Date of creation identifies when the resource was brought into existence -->
      <gmd:date>
       <gmd:CI_Date>
        <gmd:date>
        <!-- CryoLand adaptation Date must be changed for each product instance -->
        <!-- CryoLand Example: 2011-02-04 -->
         <gco:Date>2013-03-03</gco:Date>
        </gmd:date>

        <gmd:dateType>
         <gmd:CI_DateTypeCode
           codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas
           /resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
           codeListValue="creation">creation</gmd:CI_DateTypeCode>
        </gmd:dateType>
       </gmd:CI_Date>
      </gmd:date>

     <!-- Give a value that is uniquely identifying an object within a namespace/codespace   -->
      <gmd:identifier>
       <gmd:RS_Identifier>
       <!-- The code is an alphanumeric value identifying an instance in the namespace. -->
      <!-- CryoLand adaption 20120215: Provide here the original name of the satellite image used
as source. -->
       <!-- CryoLand Example: MOD02QKM.A2011040.1025.005.2011040195006.hdf -->
        <gmd:code>
         <gco:CharacterString>MOD021QM.A2013062.0745.005.NRT.hdf</gco:CharacterString>
        </gmd:code>

       <!-- Codespace is like a namespace. We could add EOMAP BC, SYKE WI, EAWAG-->
        <gmd:codeSpace>
       <!-- CryoLand adaptation 20110916 EOMAP: Enveo -->
         <gco:CharacterString>ENVEO</gco:CharacterString>
```

```
          </gmd:codeSpace>
         </gmd:RS_Identifier>
        </gmd:identifier>
       </gmd:CI_Citation>
      </gmd:citation>

      <gmd:abstract>
      <!-- CryoLand adaptation: -->
      <!-- CryoLand Example: FSC_0.01d_20110204_MOD -->
       <gco:CharacterString>FSC_0.01d_20130303_MOD_panEU using
       SCAmod</gco:CharacterString>
      </gmd:abstract>

      <gmd:pointOfContact>
       <gmd:CI_ResponsibleParty>
        <gmd:organisationName>
         <gco:CharacterString>ENVEO IT GmbH</gco:CharacterString>
        </gmd:organisationName>

        <gmd:contactInfo>
         <gmd:CI_Contact>
          <gmd:address>
           <gmd:CI_Address>
            <gmd:electronicMailAddress>
             <gco:CharacterString>info@enveo.at</gco:CharacterString>
            </gmd:electronicMailAddress>
           </gmd:CI_Address>
          </gmd:address>
         </gmd:CI_Contact>
        </gmd:contactInfo>

        <gmd:role>
         <gmd:CI_RoleCode
          codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/re
          sources/Codelist/ML_gmxCodelists.xml#CI_RoleCode"
          codeListValue="pointOfContact">pointOfContact</gmd:CI_RoleCode>
        </gmd:role>
       </gmd:CI_ResponsibleParty>
      </gmd:pointOfContact>

    <!-- CryoLand adaptation 20110916: -->
    <!-- The following two keywords are taken from the GEMET thesaurus. One keyword from the
GEMET is necessary.  -->
      <gmd:descriptiveKeywords>
       <gmd:MD_Keywords>
        <gmd:keyword>
        <!-- CryoLand adaptation: -->
         <gco:CharacterString>Orthoimagery</gco:CharacterString>
        </gmd:keyword>
```

```
      <gmd:keyword>
      <!-- CryoLand adaptation: -->
        <gco:CharacterString>Environmental monitoring facilities</gco:CharacterString>
      </gmd:keyword>

      <gmd:thesaurusName>
        <gmd:CI_Citation>
          <gmd:title>
          <!-- CryoLand adaptation: -->
            <gco:CharacterString>GEMET - INSPIRE Spatial Data Themes</gco:CharacterString>
          </gmd:title>

          <gmd:date>
            <gmd:CI_Date>
            <!-- Date of the publication of the thesaurus. No changes here. -->
              <gmd:date>
                <gco:Date>2008-12-05</gco:Date>
              </gmd:date>

              <gmd:dateType>
                <gmd:CI_DateTypeCode
                  codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schema
                  s/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
                  codeListValue="publication">publication</gmd:CI_DateTypeCode>
              </gmd:dateType>
            </gmd:CI_Date>
          </gmd:date>
        </gmd:CI_Citation>
      </gmd:thesaurusName>
    </gmd:MD_Keywords>
  </gmd:descriptiveKeywords>

<!-- The following 4 keywords refer to the keyword extension -->
<!-- CryoLand: Keyword for the sensor. MYD, MOD, MERIS, REYE1, REYE2..., WVIE2 -->
  <gmd:descriptiveKeywords>
    <gmd:MD_Keywords>
      <gmd:keyword>
      <!-- CryoLand Example: MOD -->
        <gco:CharacterString>MOD</gco:CharacterString>
      </gmd:keyword>

      <gmd:type>
        <gmd:MD_KeywordTypeCode
          codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Keyw
          ordTypeCode"
          codeListValue="sensor"></gmd:MD_KeywordTypeCode>
      </gmd:type>
    </gmd:MD_Keywords>
  </gmd:descriptiveKeywords>
```

```
<!-- Keyword for the region. -->
  <gmd:descriptiveKeywords>
   <gmd:MD_Keywords>
    <gmd:keyword>
    <!-- CryoLand Example: pan-Europe -->
     <gco:CharacterString>pan-Europe</gco:CharacterString>
    </gmd:keyword>

    <gmd:type>
     <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Keyw
      ordTypeCode"
       codeListValue="region"></gmd:MD_KeywordTypeCode>
    </gmd:type>
   </gmd:MD_Keywords>
  </gmd:descriptiveKeywords>

<!-- CryoLand: Keyword for the product. sca,fsc,swe,scl,glo,... -->
  <gmd:descriptiveKeywords>
   <gmd:MD_Keywords>
    <gmd:keyword>
    <!-- CryoLand Example: fsc -->
     <gco:CharacterString>fsc</gco:CharacterString>
    </gmd:keyword>

    <gmd:type>
     <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Keyw
      ordTypeCode"
      codeListValue="product"></gmd:MD_KeywordTypeCode>
    </gmd:type>
   </gmd:MD_Keywords>
  </gmd:descriptiveKeywords>

<!-- Keyword for the service provider name -->
  <gmd:descriptiveKeywords>
   <gmd:MD_Keywords>
    <gmd:keyword>
    <!-- CryoLand -->
     <gco:CharacterString>ENVEO</gco:CharacterString>
    </gmd:keyword>

    <gmd:type>
     <gmd:MD_KeywordTypeCode
      codeList="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml#MD_Keyw
      ordTypeCode"
      codeListValue="serviceprovider"></gmd:MD_KeywordTypeCode>
    </gmd:type>
   </gmd:MD_Keywords>
  </gmd:descriptiveKeywords>
```

```
    <!-- Information about the use limitations (INSPIRE mandatory) -->
      <gmd:resourceConstraints>
       <gmd:MD_Constraints>
        <gmd:useLimitation>
        <!-- CryoLand Example: usage allowed within CryoLand -->
          <gco:CharacterString>Demonstration product - usage allowed within
          CryoLand</gco:CharacterString>
        </gmd:useLimitation>
       </gmd:MD_Constraints>
      </gmd:resourceConstraints>

      <gmd:resourceConstraints>
       <gmd:MD_LegalConstraints>
        <gmd:accessConstraints>
         <gmd:MD_RestrictionCode
           codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/re
           sources/Codelist/ML_gmxCodelists.xml#MD_RestrictionCode"
           codeListValue="otherRestrictions">otherRestrictions</gmd:MD_RestrictionCode>
        </gmd:accessConstraints>

        <gmd:otherConstraints>
        <!-- CryoLand Example: no other restrictions -->
          <gco:CharacterString>Copyright at ENVEO IT GmbH</gco:CharacterString>
        </gmd:otherConstraints>
       </gmd:MD_LegalConstraints>
      </gmd:resourceConstraints>

    <!-- Resolution given as ground sample distance GSD -->
      <gmd:spatialResolution>
       <gmd:MD_Resolution>
        <gmd:distance>
        <!-- CryoLand: define unit of distance (uom="m" or "d"), and spatial resolution in m or d of the
product. -->
       <!-- CryoLand: The following example shows the AGREED STANDARD for the PAN-EUROPEAN
SNOW MAP: -->
        <!-- Example 1: uom="d">0.01< -->
       <!-- Example 2: uom="m">10< -->
          <gco:Distance uom="d">0.01</gco:Distance>
        </gmd:distance>
       </gmd:MD_Resolution>
      </gmd:spatialResolution>

      <gmd:language>
       <gmd:LanguageCode
         codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/reso
         urces/Codelist/ML_gmxCodelists.xml#LanguageCode"
          codeListValue="eng">eng</gmd:LanguageCode>
      </gmd:language>
```

```
    <!-- This topic category is mandatory. The possible values are given in the ISO19115:
         farming, biota, boundaries, climatology/Meteorology Atmosphere, economy, elevation,
environment, geoscientificInformation,
         health, imagerBaseMapsEarthCover, intelligenceMilitary, inlandWaters, location, oceans,
planning Cadastre, society,
         structure, transportation, utilitiesCommunication -->
        <gmd:topicCategory>
       <!-- CryoLand -->
         <gmd:MD_TopicCategoryCode>geoscientificInformation</gmd:MD_TopicCategoryCode>
        </gmd:topicCategory>

    <!-- The BOUNDING BOX of the final product is mandatory in decimal degrees (lat/lon), EPSG:
4326. -->
    <!-- The BOUNDING BOX encloses the FOOTPRINT. -->
      <gmd:extent>
       <gmd:EX_Extent>
       <gmd:geographicElement>
        <gmd:EX_GeographicBoundingBox>
         <gmd:westBoundLongitude>
          <gco:Decimal>-11.0</gco:Decimal>
         </gmd:westBoundLongitude>

         <gmd:eastBoundLongitude>
          <gco:Decimal>45.0</gco:Decimal>
         </gmd:eastBoundLongitude>

         <gmd:southBoundLatitude>
          <gco:Decimal>35.0</gco:Decimal>
         </gmd:southBoundLatitude>

          <gmd:northBoundLatitude>
          <gco:Decimal>72.0</gco:Decimal>
         </gmd:northBoundLatitude>
        </gmd:EX_GeographicBoundingBox>
       </gmd:geographicElement>

       <gmd:geographicElement>
        <!-- The FOOTPRINT, describing the data-covered area of the final product, is mandatory. -->
        <!-- It has to be provided as all-space-delimited LAT LON (!) pairs in EPSG:4326 (decimal
degrees; closed polygon i.e first and the last coordinate pair must be identical; e.g. 5 coordinate pairs
for a rectangle).  -->
        <!-- The FOOTPRINT has to be located within, or meet exactly the BOUNDING BOX! -->
        <!-- (Example:  56.85 -0.930 71.576 -0.930 71.576 33.276 56.85 33.276 56.85 -0.930 ) -->
        <gmd:EX_BoundingPolygon>
         <gmd:polygon>
          <gml:LineString gml:id="product_footprint" srsName="EPSG:4326">
           <gml:posList>
              35 -11 72 -11 72 45 35 45 35 -11
           </gml:posList>
          </gml:LineString>
```

```
        </gmd:polygon>
       </gmd:EX_BoundingPolygon>
      </gmd:geographicElement>

      <!-- Date of the product (temporal extent) -->
       <gmd:temporalElement>
        <gmd:EX_TemporalExtent>
         <gmd:extent>
          <gml:TimePeriod gml:id="product_temporal_extent"
                  xsi:type="gml:TimePeriodType">
          <!-- TimePeriod (UTC, expressed by "Z") must meet the form: 2013-03-03Thh:mm:ssZ -->
          <!-- Example: 2011-02-04T10:20:00Z -->
           <gml:beginPosition>2013-03-03T07:45:00Z</gml:beginPosition>
         <!-- Example: 2011-02-04T10:20:00Z -->
           <gml:endPosition>2013-03-03T12:45:00Z</gml:endPosition>
          </gml:TimePeriod>
         </gmd:extent>
        </gmd:EX_TemporalExtent>
       </gmd:temporalElement>
      </gmd:EX_Extent>
     </gmd:extent>
    </gmd:MD_DataIdentification>
   </gmd:identificationInfo>


 <!-- DISTRIBUTION INFO -->

 <!-- provides information about the distributor of and options for obtaining the resource(s) -->
   <gmd:distributionInfo>
    <gmd:MD_Distribution>
     <gmd:distributionFormat>
     <!-- The format can be given here -->
      <gmd:MD_Format>
       <gmd:name>
        <gco:CharacterString>GeoTIFF</gco:CharacterString>
       </gmd:name>

       <gmd:version>
        <gco:CharacterString>Version 1.0</gco:CharacterString>
       </gmd:version>
      </gmd:MD_Format>

     <!-- Specify a URL to the resource or a link to a contact point to get more information.  e.g.
address of WMS can be given, a link to the company, a link to a WSDL... -->
     </gmd:distributionFormat>

     <gmd:transferOptions>
      <gmd:MD_DigitalTransferOptions>
      <!-- File size for data transfer in MegaBytes -->
       <gmd:transferSize>
```

```
        <gco:Real>4</gco:Real>
       </gmd:transferSize>

       <gmd:onLine>
        <gmd:CI_OnlineResource>
         <gmd:linkage>
         <!-- CryoLand adaptation 20110916 -->
          <gmd:URL>http://neso.cryoland.enveo.at/cryoland/cryoclient/</gmd:URL>
         </gmd:linkage>
        </gmd:CI_OnlineResource>
       </gmd:onLine>
      </gmd:MD_DigitalTransferOptions>
     </gmd:transferOptions>
    </gmd:MD_Distribution>
   </gmd:distributionInfo>


  <!-- QUALITY INFO -->

   <gmd:dataQualityInfo>
    <gmd:DQ_DataQuality>
     <gmd:scope>
      <gmd:DQ_Scope>
       <gmd:level>
        <gmd:MD_ScopeCode
         codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Schemas/resources/Codelist/ML_gmxCodelists.xml#MD_ScopeCode"
         codeListValue="dataset">dataset</gmd:MD_ScopeCode>
       </gmd:level>
      </gmd:DQ_Scope>
     </gmd:scope>

    <!-- This part give information whether the dataset is conformant with INSPIRE. It is a mechanism to evaluate the resource against a given specification. -->
     <gmd:report>
      <gmd:DQ_DomainConsistency xsi:type="gmd:DQ_DomainConsistency_Type">
       <gmd:measureIdentification>
        <gmd:RS_Identifier>
         <gmd:code>
          <gco:CharacterString>Conformity_001</gco:CharacterString>
         </gmd:code>

         <gmd:codeSpace>
          <gco:CharacterString>INSPIRE</gco:CharacterString>
         </gmd:codeSpace>
        </gmd:RS_Identifier>
       </gmd:measureIdentification>

       <gmd:result>
        <gmd:DQ_ConformanceResult xsi:type="gmd:DQ_ConformanceResult_Type">
```

```
        <gmd:specification>
         <gmd:CI_Citation>
          <gmd:title>
           <gco:CharacterString>COMMISSION REGULATION (EC) No
           1205/2008 of 3 December 2008 implementing Directive
           2007/2/EC of the European Parliament and of the Council as
           regards metadata</gco:CharacterString>
          </gmd:title>

          <gmd:date>
           <gmd:CI_Date>
            <gmd:date>
             <gco:Date>2008-12-04</gco:Date>
            </gmd:date>

            <gmd:dateType>
            <gmd:CI_DateTypeCode
              codeList="http://standards.iso.org/ittf/PubliclyAvailableStandards/ISO_19139_Sche
              mas/resources/Codelist/ML_gmxCodelists.xml#CI_DateTypeCode"
              codeListValue="publication">publication</gmd:CI_DateTypeCode>
            </gmd:dateType>
           </gmd:CI_Date>
          </gmd:date>
         </gmd:CI_Citation>
        </gmd:specification>

        <gmd:explanation>
         <gco:CharacterString>See the referenced specification</gco:CharacterString>
        </gmd:explanation>

        <gmd:pass>
         <gco:Boolean>true</gco:Boolean>
        </gmd:pass>
       </gmd:DQ_ConformanceResult>
      </gmd:result>
     </gmd:DQ_DomainConsistency>
    </gmd:report>

  <!-- Quality information can be given here -->
    <gmd:lineage>
     <gmd:LI_Lineage>
    <!-- Provide here the name of the product related quality file. -->
    <!-- Example: FSC_0.01d_201102041020_MOD_Alps_ENVEO2.1.00_qual_001.tif -->
      <gmd:statement>
       <gco:CharacterString>NA</gco:CharacterString>
      </gmd:statement>

    <!-- CryoLand adaption 20120215: -->
    <!-- Use the original name of the data souce without extension as ID. -->
    <!-- CryoLand example: id="MOD02QKM.A2011040.1025.005.2011040195006" -->
```

```
      <gmd:source>
       <gmd:LI_Source
       id="MOD35_L2.A2013062.0745.005.NRT,MOD35_L2.A2013062.0750.005.NRT,MOD35_L2.A20
       13062.0755.005.NRT,MOD35_L2.A2013062.0930.005.NRT,MOD35_L2.A2013062.0935.005.NR
       T,MOD35_L2.A2013062.0920.005.NRT,MOD35_L2.A2013062.0925.005.NRT,MOD35_L2.A2013
       062.1100.005.NRT,MOD35_L2.A2013062.1105.005.NRT,MOD35_L2.A2013062.1110.005.NRT,
       MOD35_L2.A2013062.1115.005.NRT,MOD35_L2.A2013062.1235.005.NRT,MOD35_L2.A20130
       62.1240.005.NRT,MOD35_L2.A2013062.1245.005.NRT">
        <!-- The FOOTPRINT, describing the data-covered area of the original satellite image, is
mandatory. -->
        <!-- It has to be provided as all-space-delimited LAT LON (!) pairs in EPSG:4326 (decimal
degrees; closed polygon i.e first and the last coordinate pair must be identical; e.g. 5 coordinate pairs
for a rectangle).  -->
        <!-- (Example:  56.85 -0.930 71.576 -0.930 71.576 33.276 56.85 33.276 56.85 -0.930 ) -->
        <gmd:sourceExtent>
         <gmd:EX_Extent>
          <gmd:geographicElement>
           <gmd:EX_BoundingPolygon>
            <gmd:polygon>
             <gml:LineString gml:id="satellite_data_footprint" srsName="EPSG:4326">
              <gml:posList>
               72.00 -11.00 30.01 -11.00 30.01 44.99 72.00 44.99 72.00 -11.00
              </gml:posList>
             </gml:LineString>
            </gmd:polygon>
           </gmd:EX_BoundingPolygon>
          </gmd:geographicElement>

          <!-- CryoLand adaption 20120215: -->
          <!-- Acquisition date of the used data base (temporal extent) -->
          <gmd:temporalElement>
           <gmd:EX_TemporalExtent>
            <gmd:extent>
             <gml:TimePeriod gml:id="Acquisition_date_and_time"
                     xsi:type="gml:TimePeriodType">
              <!-- TimePeriod (UTC, expressed by "Z") of the satellite image acquisition must meet the
form: 2013-03-03Thh:mm:ssZ -->
              <!-- Example: 2011-02-04T10:20:00Z -->
              <gml:beginPosition>2013-03-03T07:45:00Z</gml:beginPosition>
              <!-- Example: 2011-02-04T10:25:00Z -->
              <gml:endPosition>2013-03-03T12:45:00Z</gml:endPosition>
             </gml:TimePeriod>
            </gmd:extent>
           </gmd:EX_TemporalExtent>
          </gmd:temporalElement>
         </gmd:EX_Extent>
        </gmd:sourceExtent>
       </gmd:LI_Source>
      </gmd:source>
       </gmd:LI_Lineage>
```

```
      </gmd:lineage>
    </gmd:DQ_DataQuality>
  </gmd:dataQualityInfo>
</gmd:MD_Metadata>
```