SISPEC:2021 ISO 19115 metadata profile

This document defines the technical specifications required for describing hyperspectral measurements of snow surface compliant to guidelines listed by field spectroscopy and snow research communities. This document is not a reviewed standard and may not be referred to as a recognized standard. It is subject to change without notice. However, this document is a draft in preparation for official reviews by international organizations on this particular technology topic. Recipients of this document are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

Document type: standard candidate draft
language: English

i. Abstract

The SISPEC ISO 19115 metadata profile is a summary of conventions that supports efficient exchange of hyperspectral measurements performed on snow surfaces.

ii. Keywords

The following are keywords to be used by search engines and document catalogues: snow, ice, hyperspectral measurements, spectral signature, ISO 19115.

iii. Author organizations

The following institutes of the National Research Council of Italy (CNR) prepared this document: Institute of Atmospheric Pollution Research (IIA) and the Institute of Polar Sciences (ISP).

iv. Authors

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1. Changelog

Date	Editors	Description
10/6/2021	Boldrini E, Salzano R, Salvatori R	First release

2. Introduction

This technical specification defines the metadata profile required for documenting hyperspectral measurements of snow surface compliant to guidelines listed by field spectroscopy and snow research communities. Moreover the profile takes into account INSPIRE Metadata Implementing Rules.

The SISPEC community profile includes metadata elements from:

- **ISO 19115-1:2014 Geographic information — Metadata — Part 1: Fundamentals**
  - Elements related to dataset general description
- **ISO 19115-2:2019 Geographic information — Metadata — Part 2: Extensions for acquisition and processing**
  - Elements related to acquisition information
- **SISPEC:2021 SISPEC ISO 19115 metadata profile (present document)**
  - Extended metadata elements from field spectroscopy and snow research communities

3. Metadata profile table

The next table lists all the elements that are included in the SISPEC metadata profile. For each of them is reported:
- Source specification
  - Technical specification where the element is defined
- Element name
  - The name of the metadata element, as appearing in the source specification
- Obligation/Condition
  - The obligation/condition of the element (elements in **bold** have a more stringent obligation in SISPEC profile with respect to ISO 19115 standard)
- Domain
  - The type of element
- Example value
  - An example value for the element

Element definitions are purposely not included in the profile table, please consult the referenced source specification.

From:	Element name	Obligation / Condition	Domain	Example value
ISO 19115-2:2019	MI_Metadata	Mandatory	-	
ISO 19115-1:2014	metadataIdentifier	Optional	-	
ISO 19115-1:2014	MD_Identifier	**Mandatory**	-	
ISO 19115-1:2014	authority	Optional	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	

ISO 19115-1:2014	title	Mandatory	Free text	National Research Council of Italy
ISO 19115-1:2014	code	Mandatory	Free text	https://niveos.cnr.it/SISpec/metadata/332b.xml
ISO 19115-1:2014	defaultLocale	**Mandatory**	-	
ISO 19115-1:2014	PT_Locale	**Mandatory**	-	
ISO 19115-1:2014	language	Mandatory	LanguageCode <<CodeList>>	eng
ISO 19115-1:2014	characterEncoding	Mandatory	MD_CharacterSetCode <<CodeList>>	utf8
ISO 19115-1:2014	metadataScope	**Mandatory**	-	
ISO 19115-1:2014	MD_MetadataScope	**Mandatory**	-	
ISO 19115-1:2014	resourceScope	Mandatory	MD_ScopeCode <<CodeList>>	dataset
ISO 19115-1:2014	contact	Mandatory	-	
ISO 19115-1:2014	CI_Responsibility	**Mandatory**	-	
ISO 19115-1:2014	role	Mandatory	CI_RoleCode <<CodeList>>	pointOfContact
ISO 19115-1:2014	party	Mandatory	-	
ISO 19115-1:2014	CI_Organisation	**Mandatory**	-	
ISO 19115-1:2014	name	**Mandatory**	Free text	National Research Council of Italy

ISO 19115-1:2014	contactInfo	**Mandatory**	-	
ISO 19115-1:2014	CI_Contact	**Mandatory**	-	
ISO 19115-1:2014	address	**Mandatory**	-	
ISO 19115-1:2014	CI_Address	**Mandatory**	-	
ISO 19115-1:2014	electronicMailAddress	**Mandatory**	Free text	info@niveos.cnr.it
ISO 19115-1:2014	individual	Optional	CI_Individual	
ISO 19115-1:2014	CI_Individual	**Mandatory**	-	
ISO 19115-1:2014	name	**Mandatory**	Free text	Roberto Salzano
ISO 19115-1:2014	dateInfo	Mandatory	-	
ISO 19115-1:2014	CI_Date	**Mandatory**	-	
ISO 19115-1:2014	date	Mandatory	ISO 8601 Date	2021-05-03
ISO 19115-1:2014	dateType	Mandatory	CI_DateTypeCode <<CodeList>>	revision
ISO 19115-1:2014	spatialRepresentationInfo	Optional	-	
ISO 19115-1:2014	MD_GridSpatialRepresentation	**Mandatory**	-	
ISO 19115-1:2014	numberOfDimensions	Mandatory	Integer	3
ISO 19115-1:2014	axisDimensionProperties	Optional	-	
ISO 19115-1:2014	MD_Dimension	**Mandatory**	-	
ISO 19115-1:2014	dimensionName	Mandatory	MD_DimensionNameTypeCode <<CodeList>>	row

ISO 19115-1:2014	dimensionSize	Mandatory	Integer	1
ISO 19115-1:2014	resolution	Optional	Measure	uom='meters' value='3'
ISO 19115-1:2014	dimensionTitle	Optional	Free text	Latitude
ISO 19115-1:2014	dimensionDescription	Optional	Free text	Latitude is positive northward; its units of degree_north (or equivalent) indicate this explicitly. In a latitude-longitude system defined with respect to a rotated North Pole, the standard name of grid_latitude should be used instead of latitude. Grid latitude is positive in the grid-northward direction, but its units should be plain degree.
ISO 19115-1:2014	cellGeometry	Mandatory	MD_CellGeometryCode <<CodeList>>	point
ISO 19115-1:2014	transformationParameterAvailability	Mandatory	Boolean	false
ISO 19115-1:2014	referenceSystemInfo	**Mandatory**	-	
ISO 19115-1:2014	MD_ReferenceSystem	**Mandatory**	-	
ISO 19115-1:2014	referenceSystemIdentifier	**Mandatory**	-	
ISO 19115-1:2014	MD_Identifier	**Mandatory**	-	
ISO 19115-1:2014	code	Mandatory	Anchor	xlink:href='http://www.opengis.net/def/crs/EPSG/8.5/4979

				value='http://www.opengis.n et/def/crs/EPSG/8.5/4979'
ISO 19115-1:2014	metadataExtensionInfo	**Mandatory**	MD_MetadataExtension Information	Fixed to xlink:href="https://essi-lab.eu/schemas/SISPEC/SI SPEC-extension-information.xml"
ISO 19115-1:2014	identificationInfo	Mandatory	-	
ISO 19115-1:2014	MD_DataIdentification	**Mandatory**	-	
ISO 19115-1:2014	citation	Mandatory	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	Spectral reflectance obtained in-situ at MT. Abbot (Antarctica) in November 1998
ISO 19115-1:2014	date	**Mandatory**	-	
ISO 19115-1:2014	CI_Date	**Mandatory**	-	
ISO 19115-1:2014	date	Mandatory	ISO 8601 Date	2021-05-20
ISO 19115-1:2014	dateType	Mandatory	CI_DateTypeCode <<CodeList>>	creation
ISO 19115-1:2014	edition	Optional	Free text	1.0
ISO 19115-1:2014	identifier	**Mandatory**	-	
ISO 19115-1:2014	MD_Identifier	**Mandatory**	-	

ISO 19115-1:2014	authority	Optional	-	
ISO 19115-1:2014	CI_Citation	Optional	-	
ISO 19115-1:2014	title	Mandatory	Free text	International DOI Foundation
ISO 19115-1:2014	code	Mandatory	Free text	https://doi.org/10.1109/5.77 107343
ISO 19115-1:2014	abstract	Mandatory	Free text	SISpec is a database containing spectroradiometric, snow and ancillary (environmental and meteorological) data acquired in polar environments. The project is the result of the co-operation of different expertise, and its main objective is to contribute to the knowledge of the interaction between microphysics characteristic of the snow cover and its reflection properties of the solar incident radiation and to study glacial environment and particularly to monitor the snow/ice covers by multispectral remote sensing data. Field surveys were performed in Antarctica, in the region where the Italian research station of Terra Nova Bay is located, the

				climatic characteristics and the low human impact allow to study snow/ice surfaces without impurities and with different characteristics with respect to those of the Arctic and the Alpine regions, where seasonal melting of the snow cover occur
ISO 19115-1:2014	pointOfContact	**Mandatory**	-	
ISO 19115-1:2014	CI_Responsibility	**Mandatory**	-	
ISO 19115-1:2014	role	Mandatory	CI_RoleCode <<CodeList>>	originator
ISO 19115-1:2014	party	Mandatory	-	
ISO 19115-1:2014	CI_Organisation	**Mandatory**	-	
ISO 19115-1:2014	name	**Mandatory**	Free text	National Research Council of Italy
ISO 19115-1:2014	contactInfo	**Mandatory**	-	
ISO 19115-1:2014	CI_Contact	**Mandatory**	-	
ISO 19115-1:2014	address	**Mandatory**	-	
ISO 19115-1:2014	CI_Address	**Mandatory**	-	
ISO 19115-1:2014	electronicMailAddress	**Mandatory**	Free text	info@niveos.cnr.it
ISO 19115-1:2014	onlineResource	Optional	-	

ISO 19115-1:2014	CI_OnlineResource	**Mandatory**	-	
ISO 19115-1:2014	linkage	Mandatory	Free text	www.niveos.cnr.it
ISO 19115-1:2014	individual	Optional	CI_Individual	
ISO 19115-1:2014	spatialRepresentationType	**Mandatory**	MD_SpatialRepresentationTypeCode <<CodeList>>	grid
ISO 19115-1:2014	spatialResolution	**Mandatory**	-	
ISO 19115-1:2014	MD_Resolution	**Mandatory**	-	
ISO 19115-1:2014	distance	Mandatory	Distance	uom='meters' value='3'
ISO 19115-1:2014	topicCategory	**Mandatory**	Code list	environment
ISO 19115-1:2014	extent	**Mandatory**	-	
ISO 19115-1:2014	EX_Extent	**Mandatory**	-	
ISO 19115-1:2014	geographicElement	**Mandatory**	-	
ISO 19115-1:2014	EX_GeographicBoundingBox	**Mandatory**	-	
ISO 19115-1:2014	westBoundLongitude	Mandatory	**Decimal, two decimal places required by INSPIRE**	163.5303
ISO 19115-1:2014	eastBoundLongitude	Mandatory	**Decimal, two decimal places required by INSPIRE**	163.5303

ISO 19115-1:2014	southBoundLatitude	Mandatory	**Decimal, two decimal places required by INSPIRE**	-74.7005
ISO 19115-1:2014	northBoundLatitude	Mandatory	**Decimal, two decimal places required by INSPIRE**	-74.7005
ISO 19115-1:2014	temporalElement	**Mandatory**	-	
ISO 19115-1:2014	EX_TemporalExtent	**Mandatory**	-	
ISO 19115-1:2014	extent	Mandatory	-	
ISO 19136-1:2020	TimePeriod	**Mandatory**	-	beginPosition = 1998-11-19T02:10:00Z endPosition = 1998-11-19T02:10:00Z
ISO 19115-1:2014	verticalElement	Optional	-	
ISO 19115-1:2014	EX_VerticalExtent	Optional	-	
ISO 19115-1:2014	minimumValue	Mandatory	Real	650
ISO 19115-1:2014	maximumValue	Mandatory	Real	650
ISO 19115-1:2014	verticalCRSId	Optional	-	
ISO 19115-1:2014	MD_ReferenceSystem	**Mandatory**	-	
ISO 19115-1:2014	referenceSystemIdentifier	**Mandatory**	-	
ISO 19115-1:2014	MD_Identifier	**Mandatory**	-	
ISO 19115-1:2014	code	Mandatory	Free text	EPSG:4979

ISO 19115-1:2014	additionalDocumentation	Optional	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	Casacchia, R; Salvatori, R; Cagnati, A; Valt, M; Ghergo, S 2002. Field reflectance of snow/ice covers at Terra Nova Bay, Antarctica. Int. J. Remote Sensing vol.23, no.21, 4563-4667 DOI:10.1080/01431160110 113863
ISO 19115-1:2014	resourceMaintenance	Optional	-	
ISO 19115-1:2014	MD_MaintenanceInformation	**Mandatory**	-	
ISO 19115-1:2014	maintenanceAndUpdateFrequency	**Mandatory**	MD_MaintenanceFrequencyCode <<CodeList>>	Complete
ISO 19115-1:2014	graphicOverview	Optional	-	
ISO 19115-1:2014	MD_BrowseGraphic	**Mandatory**	-	
ISO 19115-1:2014	fileName	Mandatory	Free text	spectrum of the 332b field measurement
ISO 19115-1:2014	fileDescription	Optional	Free text	the file shows the spectral reflectance between 350 and 2500 nm
ISO 19115-1:2014	fileType	Optional	Free text	spectrum
ISO 19115-1:2014	linkage	Optional	-	

ISO 19115-1:2014	CI_OnlineResource	**Mandatory**	-	
ISO 19115-1:2014	linkage	Mandatory	Free text	https://niveos.cnr.it/SISpec/spectrum/332b.jpg
ISO 19115-1:2014	descriptiveKeywords	**Mandatory**	-	
ISO 19115-1:2014	MD_Keywords	**Mandatory**	-	
ISO 19115-1:2014	keyword	Mandatory	Free text	snow
ISO 19115-1:2014	thesaurusName	**C / at least one keyword from the GEMET thesaurus should be present**	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	GEneral Multilingual Environmental Thesaurus
ISO 19115-1:2014	date	**Mandatory**	-	
ISO 19115-1:2014	CI_Date	**Mandatory**	-	
ISO 19115-1:2014	date	Mandatory	ISO 8601 Date	2021-01-21
ISO 19115-1:2014	dateType	Mandatory	CI_DateTypeCode <<CodeList>>	publication
ISO 19115-1:2014	resourceConstraints	**Mandatory**	-	Needed at least two resourceConstraints

				elements by INSPIRE: 1) limitations on public access 2) conditions applying to access and use.
ISO 19115-1:2014	MD_LegalConstraints	**Mandatory**	-	
ISO 19115-1:2014	accessConstraints	**Mandatory**	MD_RestrictionCode <<CodeList>>	otherRestrictions
ISO 19115-1:2014	otherConstraints	**Mandatory**	Anchor	xlink:href='http://inspire.ec.europa.eu/metadata-codelist/LimitationsOnPublicAccess/noLimitations
ISO 19115-1:2014	resourceConstraints	**Mandatory**	-	Needed at least two resourceConstraints elements by INSPIRE: 1) limitations on public access 2) conditions applying to access and use.
ISO 19115-1:2014	MD_LegalConstraints	**Mandatory**	-	
ISO 19115-1:2014	useConstraints	**Mandatory**	MD_RestrictionCode <<CodeList>>	otherRestrictions
ISO 19115-1:2014	otherConstraints	**Mandatory**	Anchor	xlink:href='http://inspire.ec.europa.eu/metadata-codelist/ConditionsApplyingToAccessAndUse/noConditionsApply
ISO 19115-1:2014	defaultLocale	**Mandatory**	-	
ISO 19115-1:2014	PT_Locale	**Mandatory**	-	

ISO 19115-1:2014	language	Mandatory	LanguageCode <<CodeList>>	eng
ISO 19115-1:2014	characterEncoding	Mandatory	MD_CharacterSetCode <<CodeList>>	utf8
ISO 19115-1:2014	contentInfo	**Mandatory**	-	
ISO 19115-2:2019	MI_CoverageDescription	**Mandatory**	-	
ISO 19115-2:2019	attributeDescription	Mandatory	**RecordType; link to main attribute description.**	xlink:href="https://mmisw.org/ont/cf/parameter/surface_bidirectional_reflectance" xlink:title="Surface bidirectional reflectance">The surface called "surface" means the lower boundary of the atmosphere. "Bidirectional_reflectance" depends on the angles of incident and measured radiation. Reflectance is the ratio of the energy of the reflected to the incident radiation. A coordinate variable of radiation_wavelength or radiation_frequency can be used to specify the wavelength or frequency, respectively, of the radiation."
ISO 19115-2:2019	attributeGroup	Optional	-	

ISO 19115-2:2019	MD_AttributeGroup	**Mandatory**	-	
ISO 19115-2:2019	contentType	Mandatory	MD_CoverageContentTypeCode <<CodeList>>	physicalMeasurement
ISO 19115-2:2019	attribute	Optional	-	
ISO 19115-2:2019	MI_Band	**Mandatory**	-	
ISO 19115-2:2019	name	Optional	-	
ISO 19115-1:2014	MD_Identifier	**Mandatory**	-	
ISO 19115-1:2014	authority	Optional	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	CF Standard Name Table
ISO 19115-1:2014	onlineResource	Optional	-	
ISO 19115-1:2014	CI_OnlineResource	**Mandatory**	-	
ISO 19115-1:2014	linkage	Mandatory	Free text	https://cfconventions.org/Data/cf-standard-names/77/build/cf-standard-name-table.html
ISO 19115-1:2014	code	Mandatory	Free text	surface_bidirectional_reflectance

ISO 19115-1:2014	description	Optional	Free text	The surface called "surface" means the lower boundary of the atmosphere. "Bidirectional_reflectance" depends on the angles of incident and measured radiation. Reflectance is the ratio of the energy of the reflected to the incident radiation. A coordinate variable of radiation_wavelength or radiation_frequency can be used to specify the wavelength or frequency, respectively, of the radiation.
ISO 19115-2:2019	boundMax	Optional	Real	2500
ISO 19115-2:2019	boundMin	Optional	Real	350
ISO 19115-2:2019	boundUnits	Optional	GML DerivedUnit	identifier="nm" codeSpace="UCUM" derivationUnitTerm uom="m" derivationUnitTerm exponent="-9"
ISO 19115-2:2019	toneGradation	Optional	Integer	2151
ISO 19115-1:2014	distributionInfo	**Mandatory**	-	
ISO 19115-1:2014	MD_Distribution	**Mandatory**	-	

ISO 19115-1:2014	distributionFormat	**Mandatory**	-	
ISO 19115-1:2014	MD_Format	**Mandatory**	-	
ISO 19115-1:2014	formatSpecificationCitation	Mandatory	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	NetCDF CF-1.7, ACDD-1.3, SISPEC-1.0
ISO 19115-1:2014	edition	Optional	Free text	3
ISO 19115-1:2014	onlineResource	Optional	-	
ISO 19115-1:2014	CI_OnlineResource	**Mandatory**	-	
ISO 19115-1:2014	linkage	Mandatory	Free text	http://www.opengis.net/doc/IS/netcdf-binary/1.0
ISO 19115-1:2014	transferOptions	Optional	-	
ISO 19115-1:2014	MD_DigitalTransferOptions	Optional	-	
ISO 19115-1:2014	onLine	Optional	-	
ISO 19115-1:2014	CI_OnlineResource	Optional	-	
ISO 19115-1:2014	linkage	Mandatory	Free text	https://niveos.cnr.it/SISpec/data/332b.nc
ISO 19115-1:2014	protocol	Optional	Free text	HTTP
ISO 19115-1:2014	name	Optional	Free text	332b

ISO 19115-1:2014	description	Optional	Free text	Spectral reflectance NetCDF-SISPEC encoded data
ISO 19115-1:2014	function	Optional	CI_OnLineFunctionCode <<CodeList>>	download
ISO 19115-1:2014	dataQualityInfo	**Mandatory**	-	
ISO 19115-1:2014	DQ_DataQuality	**Mandatory**	-	
ISO 19115-1:2014	scope	Mandatory	-	
ISO 19115-1:2014	MD_Scope	**Mandatory**	-	
ISO 19115-1:2014	level	Mandatory	MD_ScopeCode <<CodeList>>	dataset
ISO 19115-1:2014	report	Mandatory	-	
ISO 19115-1:2014	DQ_DomainConsistency	**Mandatory**	-	
ISO 19115-1:2014	result	Mandatory	-	
ISO 19115-1:2014	DQ_ConformanceResult	**Mandatory**	-	
ISO 19115-1:2014	specification	Mandatory	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	COMMISSION REGULATION (EU) No 1089/2010 of 23 November 2010 implementing Directive 2007/2/EC of the European Parliament and of

				the Council as regards interoperability of spatial data sets and services
ISO 19115-1:2014	date	Optional	-	
ISO 19115-1:2014	CI_Date	**Mandatory**	-	
ISO 19115-1:2014	date	Mandatory	ISO 8601 Date	2010-12-08
ISO 19115-1:2014	dateType	Mandatory	CI_DateTypeCode <<CodeList>>	publication
ISO 19115-1:2014	explanation	Optional	Free text	This data set is conformant with the INSPIRE Implementing Rules for the interoperability of spatial data sets and services
ISO 19115-1:2014	pass	Mandatory	Boolean	true
ISO 19115-1:2014	resourceLineage	**Mandatory**	-	
ISO 19115-1:2014	LI_Lineage	**Mandatory**	-	
ISO 19115-1:2014	statement	**Mandatory**	Free text	averaged measurements
ISO 19115-1:2014	processStep	Optional	-	
ISO 19115-1:2014	LE_ProcessStep	**Mandatory**	-	
ISO 19115-1:2014	description	Mandatory	Free text	average
ISO 19115-1:2014	rationale	Optional	Free text	average between different measurements

ISO 19115-2:2019	acquisitionInformation	**Mandatory**	-	
ISO 19115-2:2019	MI_AcquisitionInformation	**Mandatory**	-	
ISO 19115-2:2019	scope	Mandatory	-	
ISO 19115-1:2014	MD_Scope	**Mandatory**	-	
ISO 19115-1:2014	level	Mandatory	MD_ScopeCode <<CodeList>>	dataset
ISO 19115-2:2019	instrument	**Mandatory**	MI_Instrument	
ISO 19115-2:2019	MI_Instrument	**Mandatory**	-	
ISO 19115-2:2019	citation	**Mandatory**	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	Fieldspec FSP350-2500P (Analytical Spectral Device inc.)
ISO 19115-1:2014	onlineResource	Optional	-	
ISO 19115-1:2014	CI_OnlineResource	**Mandatory**	-	
ISO 19115-1:2014	linkage	Mandatory	Free text	https://www.malvernpanalytical.com/en/products/product-range/asd-range/fieldspec-range
ISO 19115-2:2019	identifier	Mandatory	-	
ISO 19115-1:2014	MD_Identifier	**Mandatory**	-	

ISO 19115-1:2014	code	Mandatory	Free text	serial number 634
ISO 19115-2:2019	type	Mandatory	Free text	Spectroradiometer
ISO 19115-2:2019	otherPropertyType	**Mandatory**	RecordType; fixed link to NCML schema variable element	xlink:href="https://www.unidata.ucar.edu/schemas/netcdf/ncml-2.2.xsd#xpointer(//element[@name='variable'])"/
ISO 19115-2:2019	otherProperty	**Mandatory**	Record; NCML schema description of the instrument variable, including detailed instrument properties	See "Instrument otherProperty example" sub section below
ISO 19115-2:2019	operation	Optional	-	
ISO 19115-2:2019	MI_Operation	**Mandatory**	-	
ISO 19115-2:2019	description	Optional	Free text	Field survey close to the Terra Nova Bay, Italian Antarctic Station
ISO 19115-2:2019	citation	Optional	-	
ISO 19115-1:2014	CI_Citation	**Mandatory**	-	
ISO 19115-1:2014	title	Mandatory	Free text	TLR_GIS
ISO 19115-2:2019	status	Mandatory	MD_ProgressCode <<CodeList>>	completed
ISO 19115-2:2019	type	Optional	MI_OperationTypeCode <<CodeList>>	real

[ISO 19115-2:2019](#)	platform	**Mandatory**	-	
[ISO 19115-2:2019](#)	MI_Platform	**Mandatory**	-	
[ISO 19115-2:2019](#)	description	Mandatory	Free text	tripod
[ISO 19115-2:2019](#)	instrument	Mandatory	MI_Instrument	
[ISO 19115-2:2019](#)	objective	Optional	-	
[ISO 19115-2:2019](#)	MI_Objective	**Mandatory**	-	
[ISO 19115-2:2019](#)	identifier	Mandatory	-	
[ISO 19115-1:2014](#)	MD_Identifier	**Mandatory**	-	
[ISO 19115-1:2014](#)	code	Mandatory	Anchor	xlink:href='https://data.aad.gov.au/aadc/gaz/scar/display_name.cfm?gaz_id=114527
[ISO 19115-2:2019](#)	type	Optional	MI_ObjectiveTypeCode <<CodeList>>	survey
[ISO 19115-2:2019](#)	objectiveOccurence	Mandatory	-	
[ISO 19115-2:2019](#)	MI_Event	**Mandatory**	-	
[ISO 19115-2:2019](#)	identifier	Mandatory	-	
[ISO 19115-1:2014](#)	MD_Identifier	**Mandatory**	-	
[ISO 19115-1:2014](#)	code	Mandatory	Anchor	xlink:href='https://data.aad.gov.au/aadc/gaz/scar/display_name.cfm?gaz_id=114527
[ISO 19115-2:2019](#)	trigger	Mandatory	MI_TriggerCode <<CodeList>>	manual

ISO 19115-2:2019	context	Mandatory	MI_ContextCode <<CodeList>>	acquisition
ISO 19115-2:2019	sequence	Mandatory	MI_SequenceCode <<CodeList>>	instantaneous
ISO 19115-2:2019	time	Mandatory	ISO 8601 time position	1998-11-19T02:10:00Z
ISO 19115-2:2019	environmentalConditions	Optional	**SISPEC_Environment alRecord**	See section below
SISPEC:2021	**SISPEC_EnvironmentalRecord**	**Mandatory**	**Class (See metadata table definition in the next section)**	See section below

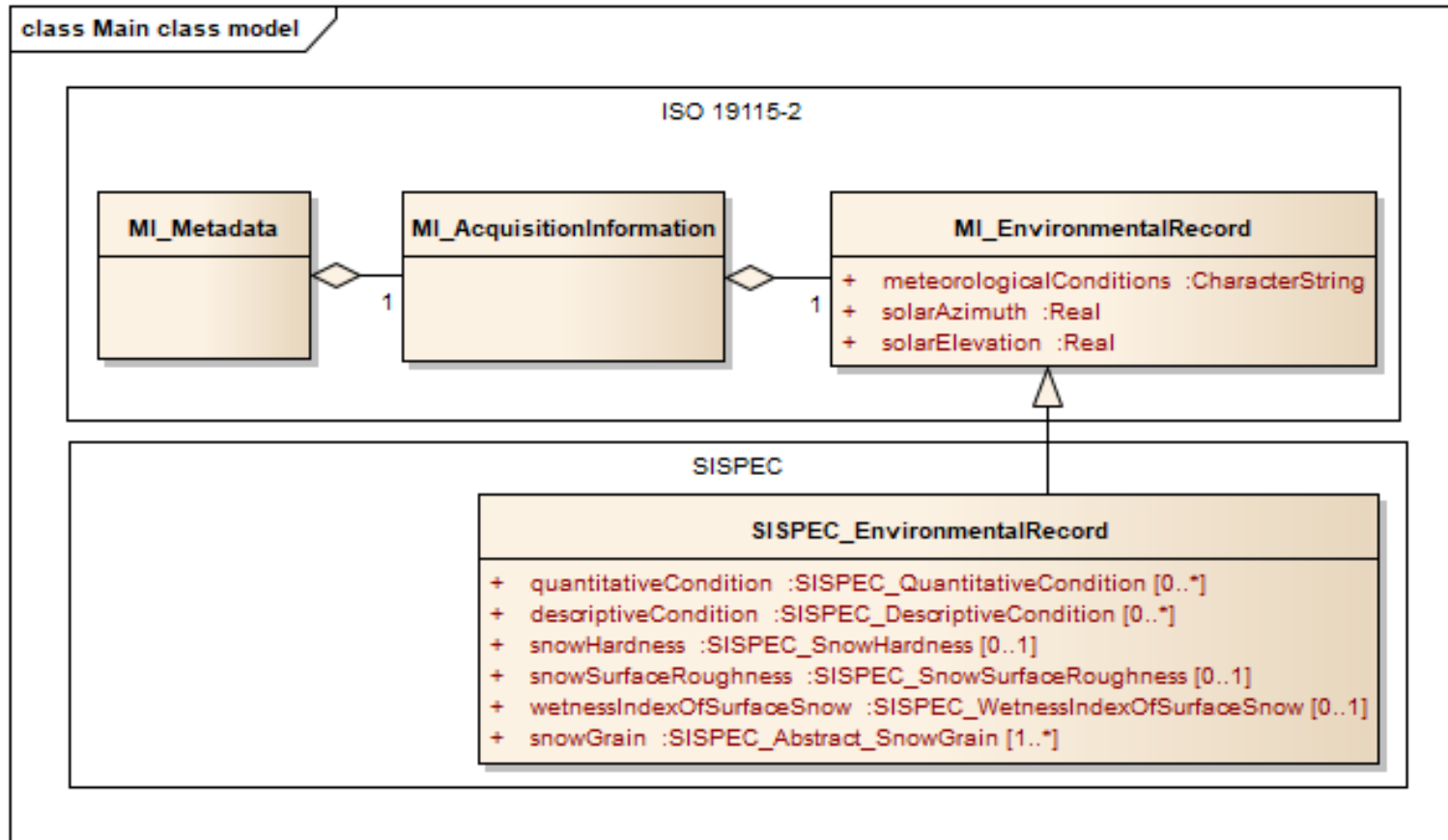## 3.1 Instrument otherProperty example

The following is the sample NCML encoding of the possible additional instrument properties:

```
<ncml:variable xmlns:ncml="http://www.unidata.ucar.edu/namespaces/netcdf/ncml-2.2"
xsi:schemaLocation="http://www.unidata.ucar.edu/namespaces/netcdf/ncml-2.2 https://www.unidata.ucar.edu/schemas/netcdf/ncml-2.2.xsd"
name="reflectance">
<ncml:attribute name="instrument_foreoptics" value="fiber"/>
<ncml:attribute name="instrument_field_of_view" value="25"/>
<ncml:attribute name="instrument_calibration_reference" value="Spectralon"/>
<ncml:attribute name="instrument_distance" value="50"/>
<ncml:attribute name="instrument_zenith_angle" value="0"/>
<ncml:attribute name="instrument_goniometer" value="FIGIFIGO"/>
<ncml:attribute name="instrument_internal_scans" value="100"/>
<ncml:attribute name="instrument_averaged_readings" value="10"/>
<ncml:attribute name="instrument_azimuth_angle" value="180"/>
<ncml:attribute name="instrument_calibration_date" value="1998-01-10"/>
<ncml:attribute name="instrument_calibration_data"
```

```
value="https://niveos.cnr.it/SISpec/data/calibration/cal_19980110.txt"/>
<ncml:attribute name="instrument_calibration_radiance"
value="https://niveos.cnr.it/SISpec/data/calibration/rad_19980110.txt"/>
<ncml:attribute name="instrument_calibration_irradiance"
value="https://niveos.cnr.it/SISpec/data/calibration/irr_19980110.txt"/>
<ncml:attribute name="instrument_dark_current_correction" value="yes"/>
<ncml:attribute name="instrument_gain_array" value="1, 52, 27"/>
<ncml:attribute name="instrument_offset_array" value="0, 2073, 2086"/>
<ncml:attribute name="instrument_scan_duration" value="100"/>
<ncml:attribute name="instrument_signal_to_noise" value="400"/>
<ncml:attribute name="instrument_spectral_resolution" value="2"/>
<ncml:attribute name="instrument_fwhm" value="1.2"/>
<ncml:attribute name="instrument_time_white_reference" value="600"/>
<ncml:attribute name="instrument_time_dark_current" value="600"/>
<ncml:attribute name="instrument_software_name" value="FR"/>
<ncml:attribute name="instrument_software_version" value="1.0"/>
<ncml:attribute name="instrument_raw_data_format" value="raw data format asd"/>
<ncml:attribute name="instrument_spectral_bandwith" value="2"/>
<ncml:attribute name="instrument_wavelength_range" value="350, 2500"/>
</ncml:variable>
```
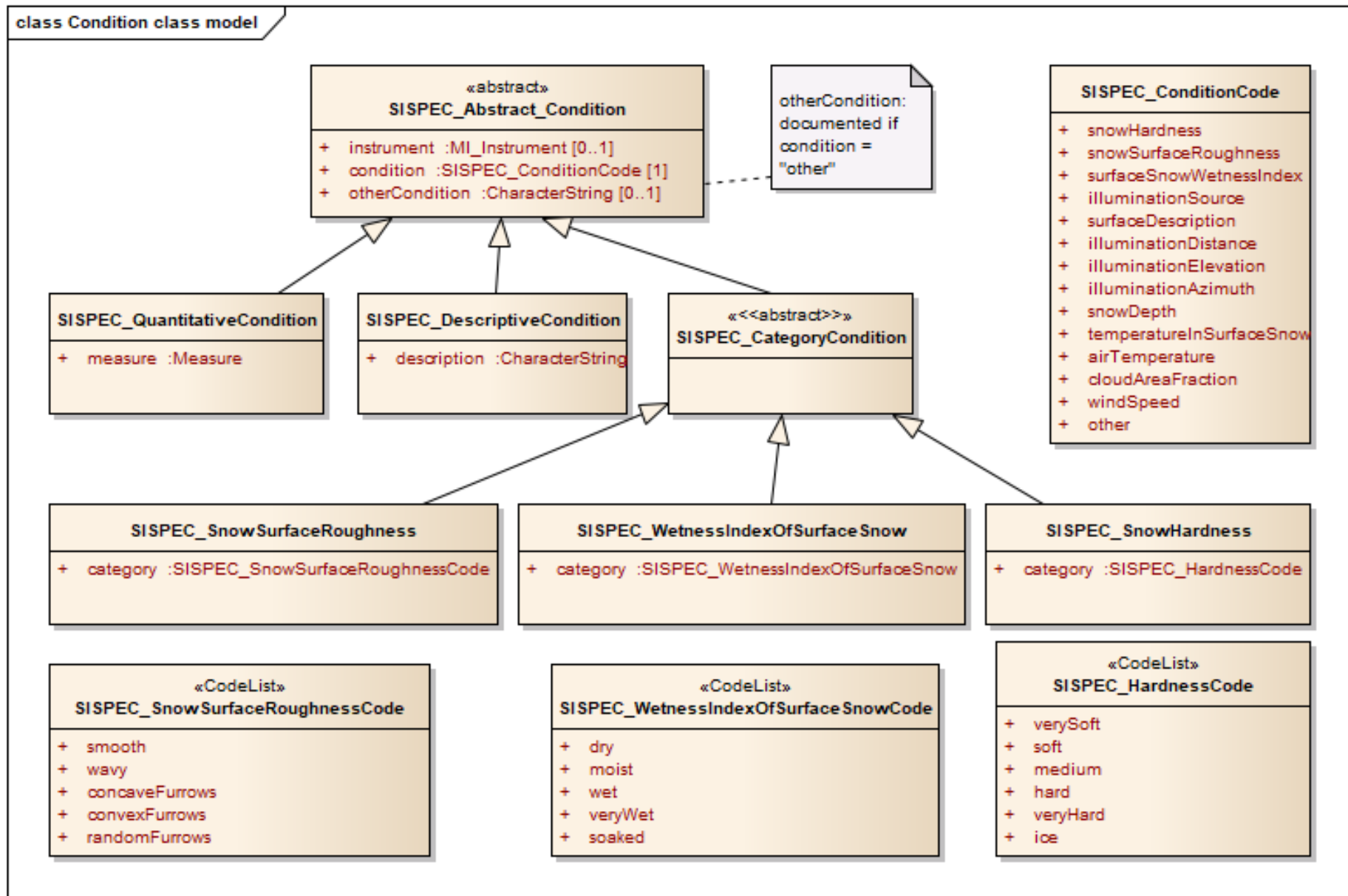
4. Extended metadata elements

The following class diagrams show the extended metadata elements.

The main new class in the SISPEC package is SISPEC_EnvironmentalRecord, which directly extends MI_EnvironmentalRecord from ISO 19115-2 to add environment conditions that are useful to characterize SISPEC datasets and snow grain descriptions.

class Condition class model

«abstract»
SISPEC_Abstract_Condition

+ instrument :MI_Instrument [0..1]
+ condition :SISPEC_ConditionCode [1]
+ otherCondition :CharacterString [0..1]

otherCondition:
documented if
condition =
"other"

SISPEC_ConditionCode

+ snowHardness
+ snowSurfaceRoughness
+ surfaceSnowWetnessIndex
+ illuminationSource
+ surfaceDescription
+ illuminationDistance
+ illuminationElevation
+ illuminationAzimuth
+ snowDepth
+ temperatureInSurfaceSnow
+ airTemperature
+ cloudAreaFraction
+ windSpeed
+ other

SISPEC_QuantitativeCondition

+ measure :Measure

SISPEC_DescriptiveCondition

+ description :CharacterString

«<>»
SISPEC_CategoryCondition

SISPEC_SnowSurfaceRoughness

+ category :SISPEC_SnowSurfaceRoughnessCode

SISPEC_WetnessIndexOfSurfaceSnow

+ category :SISPEC_WetnessIndexOfSurfaceSnow

SISPEC_SnowHardness

+ category :SISPEC_HardnessCode

«CodeList»
SISPEC_SnowSurfaceRoughnessCode

+ smooth
+ wavy
+ concaveFurrows
+ convexFurrows
+ randomFurrows

«CodeList»
SISPEC_WetnessIndexOfSurfaceSnowCode

+ dry
+ moist
+ wet
+ veryWet
+ soaked

«CodeList»
SISPEC_HardnessCode

+ verySoft
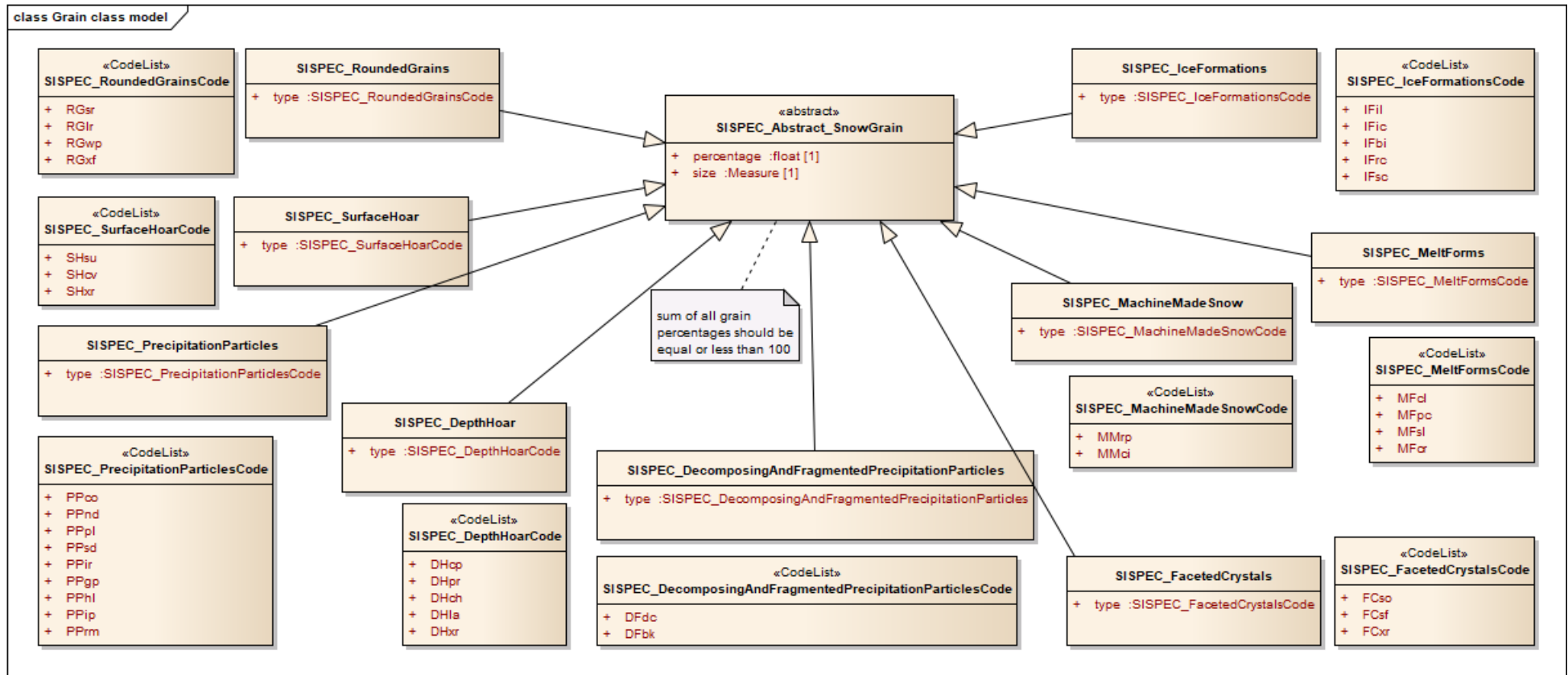+ soft
+ medium
+ hard
+ veryHard
+ ice

SISPEC_Abstract_Condition is the base class for conditions of three main types (quantitative, descriptive or category). SISPEC_Abstract_Condition contains general properties, such as the instrument used and the condition name (from a codelist of supported condition names named SISPEC_ConditionCode). Additional conditions can also be included, by documenting the condition field with the "other" value and documenting the name in the "otherCondtion" field.

SISPEC_QuantitativeCondition class is used to document conditions that consists in a measure.

SISPEC_DescriptiveCondition class is used to document conditions that consists in a textual description.

SISPEC_CategoryCondition abstract class is used to document conditions that consists in a category chosen from a codelist. Actual category conditions, such as SISPEC_SnowSurfaceRoughness adds the category metadata element to let document the category from its code list.

One or more SISPEC_Abstract_SnowGrain classes should be documented. SISPEC_Abstract_SnowGrain abstract class contains general properties, such as the size of the grains and the percentage of the snow grain type with respect of the total. Actual classes, such as SISPEC_IceFormations adds a type codelist, selecting the exact class of snow grain type from the correspondent code list (example given SISPEC_IceFormationsCode)

The following tables defines the newly defined metadata elements according to ISO 19115 metadata extension methodology

Table 1: SISPEC environmental record

	Name	Definition	Obligation / Condition	Max. occ.	Data type	Domain	Parent Entity	Rule	Rationale	Source
1	**SISPEC_Envi ronmentalRe cord**	**environmental conditions, including the ones related to SISPEC**	**M**	**1**	**Specified Class (MI_Enviro nmentalRe cord)**	**Lines 2-10**	**MI_Meta data**	**New metadata classs**	**It extends MI_Environ mentalRecor d, in order to document additional environment al conditions characterizi ng SISPEC data**	**SISPEC :2021**
2	meteorological Conditions	meteorological conditions in the photo area, in particular clouds, snow and wind	O	1	CharacterSt ring	Free Text	SISPEC_ Environm entalReco rd	-	-	ISO-19115-2:2019

3	solarAzimuth	clockwise angle in degrees from north to the centre of the sun's disc	O	1	Real	Real	SISPEC_ EnvironmentalReco rd	-	-	ISO-19115-2:2019
4	solarElevation	angle between the horizon and the centre of the sun's disc	O	1	Real	Real	SISPEC_ EnvironmentalReco rd	-	-	ISO-19115-2:2019
5	snowHardnes s	categorical condition describing the snow hardness	O	1	Class	SISPE C_Sno wHardn ess (Table 2)	SISPEC_ EnvironmentalReco rd	New metadata class	To describe snow hardness according to specific categories	SISPEC :2021
6	snowSurfaceR oughness	categorical condition describing the snow surface roughness	O	1	Class	SISPE C_Sno wSurfac eRoughness (Table 2)	SISPEC_ EnvironmentalReco rd	New metadata class	To describe snow hardness according to specific categories	SISPEC :2021

7	wetnessIndexOfSurfaceSnow	categorical condition describing the wetness index of surface snow	O	1	Class	SISPEC_WetnessIndexOfSurfaceSnow (Table 2)	SISPEC_EnvironmentalRecord	New metadata class	To describe snow hardness according to specific categories	SISPEC:2021
8	descriptiveCondition	condition that has a description as its result.	O	N	Class	SISPEC_DescriptiveCondition (Table 2)	SISPEC_EnvironmentalRecord	New metadata class	To document conditions expressed as descriptions	SISPEC:2021
9	quantitativeCondition	condition that has a quantity as its result.	O	N	Class	SISPEC_QuantitativeCondition (Table 2)	SISPEC_EnvironmentalRecord	New metadata class	To document conditions expressed as quantities	SISPEC:2021
10	snowGrain	condition describing present snow grain	1	N	Class	SISPEC_Abstract_SnowGrain (Table 3)	SISPEC_EnvironmentalRecord	New metadata class	To document snow grain conditions	SISPEC:2021

Table 2: SISPEC environmental conditions

	Name	Definition	Obligation / Condition	Max. occ.	Data type	Domain	Parent Entity	Rule	Rationale	Source
11	**SISPEC_Ab stract_Con dition**	**a general environmental condition, defined by a condition type and the used instrument**	**Use obligation / condition from referencin g object**	**Use maxi mum occur rence from refer encin g objec t**	**Class <<Abstract >>**	**Lines 12-14**	**SISPEC_ Environm entalRec ord**	**New metadata class**	**Used to document a general environmen tal condition characterize d by a type and a instrument**	**SISPEC :2021**
12	instrument	instrument used to record the condition	O	1	Class	MI_Instr ument	SISPEC_ Abstract_ Condition	New metadata class	To document the instrument used to measure the environment al condition	SISPEC :2021
13	condition	the condition type	M	1	Class	SISPEC _Conditi onCode <<Code List>>	SISPEC_ Abstract_ Condition	New metadata class	To document the condition type choosing from a code list	SISPEC :2021
14	otherConditi on	other condition type not yet included in the condition code list	C / condition =	1	CharacterS tring	Free Text	SISPEC_ Abstract_ Condition	New metadata class	To document the condition type not from	SISPEC :2021

			"otherCondition"							the SISPEC code list	
15	**SISPEC_SnowHardness**	**hardness is the resistance to penetration of an object into snow. Hardness measurements produce a relative index value that depends on both the operator and the instrument; therefore, the device has to be specified.**	**O**	**1**	**Specified Class (SISPEC_ Abstract_ Condition)**	**Lines 12-14 and 16**	**SISPEC_ Environm entalRec ord**	**-**	**-**		**SISPEC :2021**
16	category	snow hardness categories	M	1	Class	SISPEC _Hardne ssCode <<Code List>>	SISPEC_ SnowHard ness	-	-		SISPEC :2021
17	**SISPEC_SnowSurface Roughness**	**the general appearance of the surface snow.These surface features are due to the following main processes: deposition, redistribution and erosion by wind, melting and refreezing, sublimation and evaporation, and rain.**	**O**	**1**	**Specified Class (SISPEC_ Abstract_ Condition)**	**Lines 12-14 and 18**	**SISPEC_ Environm entalRec ord**	**-**	**-**		**SISPEC :2021**

18	category	snow surface roughness categories	M	1	Class	SISPEC_SnowSurfaceRoughnessCode <<CodeList>>	SISPEC_SnowSurfaceRoughness	-	-	SISPEC:2021
19	**SISPEC_WetnessIndexOfSurfaceSnow**	**Measurements of liquid water content or wetness are expressed as either a volume or mass fraction. Both can be reported as a percent, which usually requires a separate measurement of density. A general classification of liquid water content in terms of volume fraction is given inTable 1.5 of Fierz et al 2009.**	**O**	**1**	**Specified Class (SISPEC_Abstract_Condition)**	**Lines 12-14 and 20**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**
20	category	wetness index of surface snow categories	M	1	Class	SISPEC_WetnessIndexOfSurfaceSnowCode <<CodeList>>	SISPEC_WetnessIndexOfSurfaceSnow	-	-	SISPEC:2021
21	**SISPEC_DescriptiveCondition**	**to document a descriptive condition**	**O**	**1**	**Specified Class (SISPEC_**	**Lines 12-14 and 22**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**

					Abstract_ Condition)					
22	description	description result of the observed condition	M	1	CharacterString	Free Text	SISPEC_DescriptiveCondition	-	-	SISPEC:2021
23	**SISPEC_QuantitativeCondition**	**to document a measured condition**	**O**	**1**	**Specified Class (SISPEC_Abstract_Condition)**	**Lines 12-14 and 24**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**
24	measure	quantity result of the measured condition	M	1	Class	MeasureType	SISPEC_QuantitativeCondition	-	-	SISPEC:2021

Table 3: SISPEC snow grains

	Name	Definition	Obligation / Condition	Max. occ.	Data type	Domain	Parent Entity	Rule	Rationale	Source
25	**SISPEC_Abstract_SnowGrain**	**general condition about present snow grain type**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Class <<Abstract>>**	**Lines 26-27**	**SISPEC_EnvironmentalRecord**	**New metadata class**	**Used to document snow grain condition**	**SISPEC:2021**
26	percentage	percentage of this snow grain type	M	1	Real	from 0 to 100 (sum of all percentages should be <=100)	SISPEC_Abstract_SnowGrain	New metadata class	To document the snow grain percentage	SISPEC:2021
27	size	size of this snow grain type	M	1	Class	Measure Type	SISPEC_Abstract_SnowGrain	New metadata class	To document the snow grain size	SISPEC:2021

28	**SISPEC_MachineMadeSnow**	**snow grain condition to describe machine made snow**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Specified Class (SISPEC_Abstract_SnowGrain)**	**Lines 26-27 and 29**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**
29	SISPEC_MachineMadeSnowCode	type of machine made snow	M	1	Class	SISPEC_MachineMadeSnowCode <<CodeList>>	SISPEC_MachineMadeSnow	-	-	SISPEC:2021
30	**SISPEC_PrecipitationParticles**	**snow grain condition to describe precipitation particles**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Specified Class (SISPEC_Abstract_SnowGrain)**	**Lines 26-27 and 31**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**
31	SISPEC_PrecipitationParticlesCode	type of precipitation particles	M	1	Class	SISPEC_PrecipitationParticlesCode <<CodeList>>	SISPEC_PrecipitationParticles	-	-	SISPEC:2021

32	SISPEC_D ecomposin gAndFrag mentedPre cipitationP articles	snow grain condition to describe decomposing and fragmented precipitation particles	Use obligation / condition from referencing object	Use maxi mum occur rence from refere ncing objec t	Specified Class (SISPEC_A bstract_Sn owGrain)	Lines 26-27 and 33	SISPEC_ Environ mentalRe cord	-	-	SISPEC :2021
33	SISPEC_D ecomposing AndFragme ntedPrecipit ationParticl esCode	type of decomposing and fragmented precipitation particles	M	1	Class	SISPEC_ Decompo singAndF ragmente dPrecipit ationParti clesCode <<CodeLi st>>	SISPEC_ Decompo singAndF ragmente dPrecipita tionParticl es	-	-	SISPEC :2021
34	SISPEC_R oundedGra ins	snow grain condition to describe rounded grains	Use obligation / condition from referencing object	Use maxi mum occur rence from refere ncing objec t	Specified Class (SISPEC_A bstract_Sn owGrain)	Lines 26-27 and 35	SISPEC_ Environ mentalRe cord	-	-	SISPEC :2021

35	SISPEC_RoundedGrainsCode	type of rounded grains	M	1	Class	SISPEC_RoundedGrainsCode <<CodeList>>	SISPEC_RoundedGrains	-	-	SISPEC:2021
36	**SISPEC_FacetedCrystals**	**snow grain condition to describe faceted crystals**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Specified Class (SISPEC_Abstract_SnowGrain)**	**Lines 26-27 and 37**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**
37	SISPEC_FacetedCrystalsCode	type of faceted crystals	M	1	Class	SISPEC_FacetedCrystalsCode <<CodeList>>	SISPEC_FacetedCrystals	-	-	SISPEC:2021
38	**SISPEC_DepthHoar**	**snow grain condition to describe depth hoar**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Specified Class (SISPEC_Abstract_SnowGrain)**	**Lines 26-27 and 39**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**

39	SISPEC_DepthHoarCode	type of depth hoar	M	1	Class	SISPEC_DepthHoarCode <<CodeList>>	SISPEC_DepthHoar	-	-	SISPEC:2021
40	**SISPEC_SurfaceHoar**	**snow grain condition to describe surface hoar**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Specified Class (SISPEC_Abstract_SnowGrain)**	**Lines 26-27 and 41**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**
41	SISPEC_SurfaceHoarCode	type of surface hoar	M	1	Class	SISPEC_SurfaceHoarCode <<CodeList>>	SISPEC_SurfaceHoar	-	-	SISPEC:2021
42	**SISPEC_MeltForms**	**snow grain condition to describe melt forms**	**Use obligation / condition from referencing object**	**Use maximum occurrence from referencing object**	**Specified Class (SISPEC_Abstract_SnowGrain)**	**Lines 26-27 and 43**	**SISPEC_EnvironmentalRecord**	**-**	**-**	**SISPEC:2021**

43	SISPEC_M eltFormsCo de	type of melt forms	M	1	Class	SISPEC_ MeltForm sCode <<CodeLi st>>	SISPEC_ MeltForm s	-	-	SISPEC :2021
44	**SISPEC_Ic eFormation s**	**snow grain condition to describe ice formations**	**Use obligation / condition from referencing object**	**Use maxi mum occur rence from refere ncing objec t**	**Specified Class (SISPEC_A bstract_Sn owGrain)**	**Lines 26- 27 and 45**	**SISPEC_ Environ mentalRe cord**	**-**	**-**	**SISPEC :2021**
45	SISPEC_Ic eFormation sCode	type of ice formations	M	1	Class	SISPEC_ IceForma tionsCod e <<CodeLi st>>	SISPEC_I ceFormati ons	-	-	SISPEC :2021

5. CodeLists and enumerations

5.1 SISPEC_ConditionCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_ConditionCode		**a list of all the recognized SISPEC condition types**
1	snow hardness	snowHardness	snow hardness
2	snow surface roughness	snowSurfaceRoughness	snow surface roughness
3	surface snow wetness index	surfaceSnowWetnessIndex	surface snow wetness index
4	illumination source	illuminationSource	illumination source
5	surface description	surfaceDescription	surface description
6	illumination distance	illuminationDistance	illumination distance
7	illumination elevation	illuminationElevation	illumination elevation
8	illumination azimuth	illuminationAzimuth	illumination azimuth
9	snow depth	snowDepth	snow depth
10	temperature in surface snow	temperatureInSurfaceSnow	temperature in surface snow
11	air temperature	airTemperature	air temperature
12	cloud area fraction	cloudAreaFraction	cloud area fraction
13	wind speed	windSpeed	wind speed
14	other	other	other

5.2 SISPEC_HardnessCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_HardnessCode		**Hardness is the resistance to penetration of an object into snow. Hardness measurements produce a relative index value that depends on both the operator and the instrument; therefore, the device has to be specified.**
1	very soft	verySoft	very soft
2	soft	soft	soft
3	medium	medium	medium
4	hard	hard	hard
5	very hard	veryHard	very hard
6	ice	ice	ice

5.3 SISPEC_SnowSurfaceRoughnessCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_SnowSurfaceRoughnessCode		**the general appearance of the surface snow.These surface features are due to the following main processes: deposition, redistribution and erosion by wind, melting and refreezing, sublimation and evaporation, and rain.**
1	smooth	smooth	smooth
2	wavy	wavy	wavy
3	concave furrows	concaveFurrows	concave furrows
4	convex furrows	convexFurrows	convex furrows
5	random furrows	randomFurrows	random furrows

5.4 SISPEC_WetnessIndexOfSurfaceSnowCode <<CodeList>>

	Concept name (English)	**Code**	**Definition**
	SISPEC_WetnessIndexOfSurfaceSnowCode		**Measurements of liquid water content or wetness are expressed as either a volume or mass fraction. Both can be reported as a percent, which usually requires a separate measurement of density. A general classification of liquid water content in terms of volume fraction is given inTable 1.5 of Fierz et al 2009.**
1	dry	dry	dry
2	moist	moist	moist
3	wet	wet	wet
4	very wet	veryWet	very wet
5	soaked	soaked	soaked

5.5 SISPEC_PrecipitationParticlesCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_PrecipitationParticlesCode		**precipitation particles**
1	columns	PPco	columns
2	needles	PPnd	needles
3	plates	PPpl	plates
4	stellars, dendrites	PPsd	stellars, dendrites
5	irregular crystals	PPir	irregular crystals
6	graupel	PPgp	graupel
7	hail	PPhl	hail
8	ice pellets	PPip	ice pellets
9	rime	PPrm	rime

5.6 SISPEC_FacetedCrystalsCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_FacetedCrystalsCode		**faceted crystals**
1	solid faceted particles	FCso	solid faceted particles
2	near surface faceted particles	FCsf	near surface faceted particles
3	rounding faceted particles	FCxr	rounding faceted particles

5.7 SISPEC_MachineMadeSnowCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_MachineMadeSnowCode		**machine made**
1	round polycrystalline	MMrp	round polycrystalline
2	crushed ice particles	MMci	crushed ice particles

5.8 SISPEC_MeltFormsCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_MeltFormsCode		**melt forms**
1	clustered rounded grains	MFcl	clustered rounded grains
2	rounded polycrystals	MFpc	rounded polycrystals
3	slush	MFsl	slush
4	melt-freeze crust	MFcr	melt-freeze crust

5.9 SISPEC_DecomposingAndFragmentedPrecipitationParticlesCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_DecomposingAndFragmentedPrecipitationParticlesCode		**decomposing fragmented precipitation particles**
1	partly decomposed	DFdc	partly decomposed
2	wind-broken	DFbk	wind-broken

5.10 SISPEC_IceFormationsCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_IceFormationsCode		**ice formations**
1	ice layer	IFil	ice layer
2	ice column	IFic	ice column
3	basal ice	IFbi	basal ice
4	rain crust	IFrc	rain crust
5	sun crust	IFsc	sun crust

5.11 SISPEC_RoundedGrainsCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_RoundedGrainsCode		**rounded grains**
1	small rounded particles	RGsr	small rounded particles
2	large rounded particles	RGlr	large rounded particles
3	wind packed	RGwp	wind packed
4	faceted rounded particles	RGxf	faceted rounded particles

5.12 SISPEC_SurfaceHoarCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_SurfaceHoarCode		**surface hoar**
1	surface hoar crystals	SHsu	surface hoar crystals
2	cavity or crevasse hoar	SHcv	cavity or crevasse hoar
3	rounding surface hoar	SHxr	rounding surface hoar

5.13 SISPEC_DepthHoarCode <<CodeList>>

	Concept name (English)	Code	Definition
	SISPEC_DepthHoarCode		**depth hoar**
1	hollow cups	DHcp	hollow cups
2	hollow prisms	DHpr	hollow prisms
3	chains of depth hoar	DHch	chains of depth hoar
4	large striated crystals	DHla	large striated crystals
5	rounding depth hoar	DHxr	rounding depth hoar

4. References

- INSPIRE, 2007. Technical Guidelines for implementing dataset and service metadata based on ISO/TS 19139:2007
- ISO, 2004. ISO 19106:2004 Geographic Information — Profiles

- ISO,2014. ISO 19115-1:2014: Geographic information -- Metadata -- Part 1: Fundamentals.
- ISO, 2019. ISO 19115-2:2019: Geographic information — Metadata — Part 2: Extensions for acquisition and processing.