Open Geospatial Consortium

Date: 2024-05-06

Reference number of this Document: OGC 24-018r1

Version: 1.1.0

Category: OpenGIS© Interface Standard

Editor: Peter Baumann, Jinsongdi Yu

**OGC® Web Coverage Service Interface Standard -   
Interpolation Extension**

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Document type: OGC Standard

Document subtype: Interface

Document stage: Draft

Document language: English

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Preface

OGC® Web Coverage Service Interface Standard - Interpolation Extension (this document) specifies parameters to the OGC Web Coverage Service (WCS) *GetCoverage* request which give control over interpolation of a coverage during its server-side processing.

Suggested additions, changes, and comments on this draft document are welcome and encouraged. Such suggestions may be submitted through the OGC Change Request process.

Terms and definitions

This document uses the standard terms defined in Subclause 5.3 of the OGC Web Services Common standard [2] which is based on the ISO/IEC Directives, Part 2, Rules for the structure and drafting of International Standards. In particular, the word “SHALL” (not “must”) is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

Submitting organizations

The following organizations have submitted this Interface Specification to the Open Geospatial Consortium, Inc.:

* Constructor University
* Fuzhou University
* NRCan

Document Contributor Contact Points

|  |  |
| --- | --- |
| **Name** | **Organization** |
| Peter Baumann | Constructor University |
| Jinsongdi Yu | Fuzhou University |
| Graham Wilkes | NRCan |

Changes to the OGC Abstract Specification

The OGCAbstract Specification does not require any changes to accommodate the technical contents of this document.

Future Work

Among the topics for future development are the following items:

* None foreseen currently

Foreword

The WCS Interpolation extension is dependent on requirements specified in the WCS Core Standard [OGC 17-089r1] and the Coverage Implementation Schema (CIS) Standard 1.0 [OGC 09-146r8] onwards.

This document includes one normative Annex.

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

*Recipients of this document are requested to submit, with their comments, notification of any relevant patent claims or other intellectual property rights of which they may be aware that might be infringed by any implementation of the standard set forth in this document, and to provide supporting documentation.*

Introduction

The OGC *Web Coverage Service (WCS) –Interpolation Extension* defines an extension to the WCS Core [OGC 17-089r1] to control interpolation during processing of a *GetCoverage* request. This affects all operations that require interpolation, such as subsetting, scaling and Coordinate Reference System (CRS) transformation.

Note As such, this Interpolation Extension has impact on the operational behaviour described in other WCS extensions, such as subsetting.

The set of interpolation types supported is usually a property of a coverage. In reality, interpolation can be even more localized and constitute a property of particular coverage axes and on particular bands. For example, a coverage may undergo linear interpolation along lat/long axes and nearest neighbour interpolation along the time axis.

However, fine-grained modelling interpolation would impose a severe load on WCS implementations and backend services. Server implementation is significantly complicated by a dynamic per-axis choice of interpolation methods applied. Reporting interpolation capabilities with individual coverages would lead to more metadata, and would substantially complicate client-side handling of this information.

Therefore, a mixed approach is adopted in this WCS Interpolation Extension. In the core conformance class, one interpolation method can be selected by the client which subsequently gets applied along all coverage axes simultaneously. In an optional conformance class, *interpolation-per-axis*, the implementation can override by axis the different interpolation method to be applied.

Interpolation methods available are reported by the service in its *GetCapabilities* response. A normative enumeration of specific interpolation techniques is provided in OGC Abstract Topic 6.1 (which is identical to ISO 19123-1) [1]; The OGC Naming Authority (OGC-NA) may normatively establish URLs for these interpolation methods.

An implementation of the WCS Interpolation Extension does not automatically mean that interpolation parameters provided with a request have an effect. Only for operations involving interpolation – such as subsetting, scaling or reprojection – will such parameters affect the result.

OGC® Web Coverage Service Interface Standard - Interpolation Extension

# Scope

This OGC WCS Interpolation Extension (*Interpolation Extension*) defines how a client can control interpolation(s) performed by a server during *GetCoverage* interpolation, should an interpolation be specified as part of the request evaluation.

# Conformance

This document establishes the following requirements and conformance classes:

* *interpolation*: [https://www.opengis.net/spec/WCS\_service-extension\_ interpolation/1.1/req/interpolation](https://www.opengis.net/spec/WCS_service-extension_%20interpolation/1.1/req/interpolation). The corresponding conformance class is *interpolation*: <https://www.opengis.net/spec/WCS_service-extension_interpolation/1.1/conf/interpolation>.

This is the mandatory core conformance class of this extension.

* *interpolation-per-axis*: <https://www.opengis.net/spec/WCS_service-extension_interpolation/1.1/req/interpolation-per-axis>. The corresponding conformance class is *interpolation-per-axis*: <https://www.opengis.net/spec/WCS_service-extension_interpolation/1.1/conf/interpolation-per-axis>.

The standardisation target of all requirements and conformance classes defined in this Standard are WCS implementations (currently: servers).

Requirements URIs defined in this document are relative to <https://www.opengis.net/spec/WCS_service-extension_interpolation/1.1/req>, conformance test URIs defined in this document are relative to <https://www.opengis.net/spec/WCS_service-extension_interpolation/1.1/conf>.

Annex A defines the Conformance Test Suite lists the conformance tests which SHALL be exercised on any software artefact claiming to implement WCS.

# Normative references

This *OGC WCS Interpolation Extension* Standard consists of this document and an XML Schema. The complete Standard is identified by OGC URI <https://www.opengis.net/spec/WCS_service-extension_interpolation/1.1>. This document is identified by OGC URI <https://www.opengis.net/doc/IS/WCS_service-extension_interpolation/1.1>.

The complete Standard is available for download from <https://www.opengeospatial.org/standards/wcs>. Additionally, the XML Schema is posted online at <https://schemas.opengis.net/wcs/interpolation/1.1> in the OGC schema repository. In the event of a discrepancy between bundled and schema repository versions of the XML Schema files, the schema repository SHALL be considered authoritative.

The normative documents listed in Table 1 contain provisions that, through reference in this text, constitute provisions of this Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

Table 1 — Conformance class dependencies

|  |  |  |
| --- | --- | --- |
| **Interpolation conformance class** | **Dependency document** | **Dependency conformance class** |
| *Interpolation* | OGC 09-110, *OGC®**Web Coverage Service 2.0 Interface Standard - Core*, version 2.0 | *Core* |
| *interpolation-per-axis* | This Standard | *Interpolation* |

# Terms and definitions

For the purposes of this document, the terms and definitions given in the above references apply. In addition, the following terms and definitions apply. An arrow ““ indicates that the following term is defined in this Clause.

## Interpolation (of a coverage)

Estimation of a – non-existing – new range value of a coverage for a location in the coverage which is situated between positions containing range values

# Conventions

## UML notation

Unified Modelling Language (UML) static structure diagrams appearing in this specification are used as described in Subclause 5.2 of OGC Web Services Common [OGC 06-121r9].

## Data dictionary tables

The UML model data dictionary is specified as a series of tables. The contents of the columns in these tables are described in Subclause 5.5 of [OGC 06-121r9]. The contents of these data dictionary tables are normative, including any table footnotes.

## 5.3 Namespace prefix conventions

The following namespaces are used in this Standard. The prefix abbreviations used constitute conventions used here, but are **not** normative. The namespaces to which the prefixes refer are normative.

Table 2 — Namespace mappings

|  |  |  |
| --- | --- | --- |
| **Prefix** | **Namespace URI** | **Description** |
| xsd | <https://www.w3.org/2001/XMLSchema> | XML Schema namespace |
| gml | <https://www.opengis.net/gml/3.2> | GML 3.2.1 |
| cis | <https://www.opengis.net/cis/1.1> | Coverage Implementation Schema 1.1 |
| wcs | <https://www.opengis.net/wcs/2.0> | WCS 2.0 Core |
| int | <https://www.opengis.net/wcs/interpolation/1.1> | WCS Interpolation Extension |

## 5.4 Multiple representations

When multiple representations of the same information are given in an OGC Standard these are consistent. Should this not be the case then this is considered an error, and the XML schema SHALL take precedence.

# *Interpolation* requirements class

## Overview

This Clause 6 establishes the Interpolation Extension core conformance class, *interpolation*. Clients and servers supporting this requirements class allow choosing an interpolation method to be applied whenever interpolation takes place during *GetCoverage* request evaluation. The interpolation method chosen is applied simultaneously along all axes.

## Modifications to *GetCapabilities*

A server announces support of the *interpolation* conformance class to a client by adding the URL identifying this extension to the list of supported extensions delivered in the Capabilities document.

1. **interpolation/interpolation-identifier:**A WCS service implementing conformance class *interpolation* of the Interpolation Extension **SHALL** include the following URI in the Profile element of the ServiceIdentification in a *GetCapabilities* response:  
    http://www.opengis.net/spec/WCS\_service-extension\_interpolation/1.1/conf/interpolation
2. **interpolation/capabilities:**  
   The response to a successful *GetCapabilities* request **SHALL** adhere to Figure 1, Table 2, and the XML schema defined for this Interpolation Extension.

Figure 1 presents the UML diagram of the extended Capabilities document. Table 2 details the components added.



Figure 1 — Capabilities UML diagram   
with InterpolationMetadata component

Table 3 — Components of Int::InterpolationMetadata structure

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Definition** | **Data type** | **Multiplicity** |
| interpolationSupported | Identifier(s) of interpolation method(s) supported by the server | List of anyURI | zero or more (optional) |

1. **interpolation/wcsServiceMetadata:**  
   The response to a successful *GetCapabilities* request **SHALL** contain an InterpolationMetadata element.

Example The following list is returned in the Capabilities document of a server supporting nearest-neighbor, linear, and quadratic interpolation (the URLs in the following example are fictitious; see OGC-NA for actually standardized interpolation URIs):

<int:InterpolationMetadata>  
 <int:InterpolationSupported>  
 http://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor  
 </int:InterpolationSupported>  
 <int:InterpolationSupported>  
 <https://www.opengis.net/def/interpolation/OGC/1/linear>  
 </int:InterpolationSupported>  
 <int:InterpolationSupported>  
 http://www.opengis.net/def/interpolation/OGC/1/quadratic  
 </int:InterpolationSupported>  
</int:InterpolationMetadata>

1. **interpolation/wcsServiceMetadata-interpolationMethods:**  
   The interpolationSupported item(s) delivered in the ServiceMetadata element of the response to a successful *GetCapabilities* request **SHALL** consist of a pairwise distinct list of URLs.

Note The above requirement tentatively does not constrain the admitted URLs to those defined in the \*-interpolation requirements classes of this Standard. This allows vendors to support further types of interpolation. However, implementations should use the interpolation URLs for those interpolation types this standard provides definitions for.

## Modifications to *DescribeCoverage*

None.

## Modifications to *GetCoverage*

### Modifications to the *GetCoverage* request

The *GetCoverage* request is extended with a parameter, globalInterpolation that specifies what interpolation technique is to be applied by the server when preparing the *GetCoverage* response. This interpolation is applied uniformly on all axes of the resulting coverage.

Note In the requirements class defined in Clause 7 a more fine-grain interpolation specification per axis will be added; the representation in this UML diagram has been prepared for this, explaining why it could be simplified theoretically. Further, the pertaining XML Schema of this Interpolation Extension contains all variants.

1. **interpolation/GetCoverage-request:**  
   A *GetCoverage* request **SHALL** adhere to Figure 2, Table 3, and the XML schema defined for this Interpolation Extension.



Figure 2 — GetCoverage with *interpolation* support UML diagram

Table 4 — Components of Int::InterpolationMethod structure

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Definition** | **Data type** | **Multiplicity** |
| globalInterpolation | Interpolation method to be applied on all axes during *GetCoverage* result preparation | anyURI | Zero or one (optional) |

### 6.4.2 Modifications to the *GetCoverage* response

Interpolation affects the result of *GetCoverage* in some clearly defined situations, namely slicing, scaling and CRS transformation. In all other cases, no interpolation is applied and the globalInterpolation parameter has no effect.

The globalInterpolation parameter is optional. If omitted the server is free to choose some interpolation method, as if the extension is not implemented.

If the *GetCoverage* request contains slicing along one or more axes and the slice points coincide with direct positions then the behaviour is identical to the WCS Core behavior. In addition to slicing at direct positions, it is possible to also slice at positions in the neighbourhood of direct positions. In this case, for each such position the range values are obtained by applying the selected interpolation method.

1. **interpolation/GetCoverage-response-slicing:**  
   The contents of the response to a successful *GetCoverage* request containing one or more slicing operations where the slice points do not coincide with direct positions but are situated in a neighborhood of direct positions **SHALL** be obtained by computing range values for the non-direct positions through interpolation. The interpolation method to be applied is governed by the requirements specified in the WCS Interpolation Standard.

Note The definition of neighborhood is outside the scope of this Standard. It is expected that the Coverage Implementation Schema will be enhanced with a field of validity concept for expressing allowed neighborhoods. Depending on such a definition, the neighborhood may stretch some distance beyond the outermost direct position of a coverage, i.e., beyond its minimum bounding box.

The globalInterpolation parameter can be used to enforce application of some particular interpolation method.

1. **interpolation/GetCoverage-response:**  
   The contents of the response to a successful *GetCoverage* request containing an Int::globalInterpolation parameter with value m **SHALL** be obtained by applying interpolation method m any time interpolation takes place during preparation of the response, and along every axis of the coverage being processed.
2. Note This interpolation is applied uniformly along all axes of the coverages.**interpolation/GetCoverage-admissible-interpolation:**In a *GetCoverage* request, if an Int::globalInterpolation parameter is provided then this **SHALL** be one of the interpolation methods listed in the coverage addressed.

## Exceptions

Table 5 — Exception codes for use of Interpolation

|  |  |  |  |
| --- | --- | --- | --- |
| **exceptionCode value** | **HTTP code** | **Meaning of exception code** | **locator value** |
| InterpolationMethod­NotSupported | 404 | interpolation parameter indicated is not supported by this server (i.e., URL is not known to this server) | interpolation request parameter value |

## Encodings

### 6.6.1 GET/KVP Encoding

1. **interpolation/GetCoverage-getkvp:**  
   In a *GetCoverage* request using the GET/KVP protocol as specified in WCS KVP Protocol Binding Extension [OGC 09-147r3] (or a later version), an Int::global­Inter­pol­at­ion parameter **SHALL** be represented as  
    INTERPOLATION=m  
   where m is an interpolation method identifier.

Example The following KVP fragment resembles a valid interpolation request parameter:

…& INTERPOLATION=  
 http://www.opengis.net/def/interpolation/OGC/1/linear &…

### 6.6.2 XML/POST Encoding

1. **interpolation/GetCoverage-xmlpost:**  
   In a *GetCoverage* request using the XML/POST protocol as specified in WCS XML/POST Protocol Binding Extension [OGC 09-148r1], an Int::globalInter­polation parameter **SHALL** be represented by a GML int:globalInt­er­polation element.

Example The XML fragments below resemble the same example cases as the GET/KVP fragment above.

<int:Interpolation>  
 <int:globalInterpolation>  
 http://www.opengis.net/def/interpolation/OGC/1/linear  
 </int:globalInterpolation/>  
</int:Interpolation>

### 6.6.3 SOAP Encoding

1. **interpolation/GetCoverage-soap:**  
   In a *GetCoverage* request using the SOAP protocol, an Int::global­Inter­­pol­at­ion parameter **SHALL** be represented by a GML int:globalInterpolation element.

Example See previous subclause.

# *Interpolation-per-axis* requirements class

## Overview

This Clause establishes the optional Interpolation Extension requirements class, *interpolation-per-axis*. This requirements class specifies how to request and obtain coverages where individual interpolation modes can be applied independently to each axis of the coverage under processing. For those axes where no interpolation is specified in the *interpolation-per-axis* structures, the default interpolation method passed in the core parameter, Int::glo­bal­Interpolation, applies.

## Modifications to *GetCapabilities*

1. **interpolation-per-axis/identifier:**A WCS service implementing requirements class *interpolation-per-axis* of this Interpolation Extension **SHALL** include the following URI in the Profile element of the ServiceIdentification in a *GetCapabilities* response:  
    http://www.opengis.net/spec/WCS\_service-extension\_interpolation/1.0/conf/interpolation-per-axis

## Modifications to *DescribeCoverage*

None.

## Modifications to *GetCoverage*

### 7.4.1 Modifications to the *GetCoverage* request

1. **interpolation-per-axis/getCoverage-request:**  
   The Int::InterpolationPerAxis parameter in a *GetCoverage* request, if present, **SHALL** have a structure as defined in Figure 3 and Table 6.  
   **Dependency:**   
   Clause 6, [http://www.opengis.net/doc/IS/WCS\_service-extension\_interpolation/1.0/Clause-6](http://www.opengis.net/doc/ISx/WCS_service-extension_interpolation/1.0/Clause-6)



Figure 3 — GetCoverage with *interpolation-per-axis* support UML diagram

Individually for each axis of the coverage, separate interpolation methods can be indicated.

1. **interpolation-per-axis/getCoverage-axes:**  
   The Int::InterpolationPerAxis parameters in a *GetCoverage* request, if present, **SHALL** consist of an unordered sequence of Int::Inter­polat­ion­PerAxis elements with a structure as defined in Table 6.

Table 6 — Components of Int::InterpolationAxis structure

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Definition** | **Data type** | **Multiplicity** |
| axis | Coverage axis along which the interpolation method is to be applied | anyURI | one (mandatory) |
| Interpolation­Method | Interpolation method to be applied along the specified axis during *GetCoverage* result preparation | anyURI | one (mandatory) |

Each axis in the CRS of the coverage can appear at most once, to avoid ambiguities.

1. **interpolation-per-axis/getCoverage-axes-pairwise-distinct:**  
   In a *GetCoverage* request containing Int::InterpolationPerAxis parameters, all axis values **SHALL** be pairwise distinct.
2. **interpolation-per-axis/getCoverage-existing-axis:**  
   The axis value of each Int::InterpolationPerAxis parameter in a *GetCoverage* request **SHALL** be identical to the axis­Abbrev element of some CRS axis of the CRS identified by the srsName attribute in the gml:Envelope element of the coverage generated.

Note Interpolation always is done towards a target structure (such as an output grid). In presence of an OUTPUTCRS parameter according to the WCS CRS Extension [OGC 11-053]. Therefore, interpolation has to be expressed on the axes of the CRS indicated in OUTPUTCRS. Otherwise, the coverage’s Native CRS is used.

### 7.4.2 Modifications to the *GetCoverage* response

1. **interpolation-per-axis/getCoverage-response:**  
   The contents of the response to a successful *GetCoverage* request containing n>0 Int::Int­er­pol­ationPerAxis parameters consisting of a1,…,an axis identifiers and m1,…,mn interpolation methods **SHALL** be obtained by applying interpolation method mi on axis ai any time interpolation takes place during preparation of the *GetCoverage* response; for those axes not appearing in this list, the method indicated in the int:globalInterpolation parameter **SHALL** be applied.

Example The following is a valid GET/KVP request snippet (see Subclause 7.6) specifying that in general (such as lat, long, height, or whatever axis is present in the coverage) linear interpolation is to be applied, only along the time axis nearest-neighbor is requested (assuming the coverage addressed contains such a temporal axis):

…& INTERPOLATION=  
 https://www.opengis.net/def/interpolation/OGC/1/linear  
 & INTERPOLATIONPERAXIS=phenomenon-time,  
 https://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor  
 &…

## Exceptions

Table 7 — Exception codes for use of InterpolationPerAxis

|  |  |  |  |
| --- | --- | --- | --- |
| **exceptionCode value** | **HTTP code** | **Meaning of exception code** | **locator value** |
| NoSuchAxis | 404 | One or more axis names indicated in the request are not defined in the domain of the output coverage | axis request parameter value |
| InterpolationMethod­NotSupported | 404 | One or more interpolation methods indicated in the request are not supported by this server | first offending interpolation request parameter value |

## Encodings

### 7.6.1 GET/KVP Encoding

1. **interpolation-per-axis/getCoverage-getkvp:**  
   In a *GetCoverage* request using the GET/KVP protocol as specified in WCS GET/KVP Protocol Binding Extension [OGC 09-147r2], an Int::Interpolation parameter containing n>0 (Int::axis, Int::inter­pol­at­ionMethod) components (a1:m1),…,(an:mn) **SHALL** be represented as  
    INTERPOLATIONPERAXIS=a1,m1  
    & …  
    & INTERPOLATIONPERAXIS=an,mn

Example The following KVP fragment resembles a valid interpolation request:

…& INTERPOLATION=  
 https://www.opengis.net/def/interpolation/OGC/1/linear  
 & INTERPOLATIONPERAXIS=lat,  
 https://www.opengis.net/def/interpolation/OGC/1/quadratic  
 & INTERPOLATIONPERAXIS=long,  
 https://www.opengis.net/def/interpolation/OGC/1/quadratic  
 & INTERPOLATIONPERAXIS=height,  
 https://www.opengis.net/def/interpolation/OGC/1/cubic  
 & INTERPOLATIONPERAXIS=phenomenon-time,  
 https://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor  
 &…

### 7.6.2 XML/POST Encoding

1. **interpolation-per-axis/getCoverage-xmlpost:**  
   In a *GetCoverage* request using the XML/POST protocol as specified in WCS XML/POST Protocol Binding Extension [OGC 09-148r1], the Int::InterpolationPerAxis parameters, if present, **SHALL** be represented by GML int:InterpolationPerAxis elements.

Example The XML fragments below resemble the same example cases as the GET/KVP fragment above.

<int:Interpolation>  
 <int:globalInterpolation>  
 https://www.opengis.net/def/interpolation/OGC/1/linear  
 </int:globalInterpolation>  
 <int:InterpolationPerAxis>  
 <int:axis>lat</int:axis>  
 <int:interpolationMethod>  
 https://www.opengis.net/def/interpolation/OGC/1/quadratic  
 </int:interpolationMethod>  
 </int:InterpolationPerAxis>  
 <int:InterpolationPerAxis>  
 <int:axis>long</int:axis>  
 <int:interpolationMethod>  
 https://www.opengis.net/def/interpolation/OGC/1/quadratic  
 </int:interpolationMethod>  
 </int:InterpolationPerAxis>  
 <int:InterpolationPerAxis>  
 <int:axis>height</int:axis>  
 <int:interpolationMethod>  
 https://www.opengis.net/def/interpolation/OGC/1/cubic  
 </int:interpolationMethod>  
 </int:InterpolationPerAxis>  
 <int:InterpolationPerAxis>  
 <int:axis>phenomenon-time</int:axis>  
 <int:interpolationMethod>  
 https://www.opengis.net/def/interpolation/OGC/1/nearest-neighbor  
 </int:interpolationMethod>  
 </int:InterpolationPerAxis>  
</int:Interpolation>

### 7.6.3 SOAP Encoding

1. **interpolation-per-axis/getCoverage-soap:**  
   In a *GetCoverage* request using the SOAP protocol as specified in WCS SOAP Protocol Binding Extension [OGC 09-149r1], the int::InterpolationPerAxis parameters, if present, **SHALL** be represented by GML int:InterpolationPerAxis elements.

Example See previous subclause.

# Bibliography

1. OGC 07-011r2, Ab*stract Specification Topic 6.1: Schema for Coverage Geometry and Functions – Part 1: Fundamentals*, version 2.0 (identical to ISO 19123-1:2023)
2. A. Whiteside, J. Greenwood (eds.): OGC Web Services Common Implementation Specification, version 2.0.0, OGC 06-121r9, <https://portal.ogc.org/files/?artifact_id=38867>

# Annex A (normative) Abstract test suite

An implementation of the WCS Interpolation Extension must satisfy the following system characteristics to be conformant with this Standard.

Test identifiers below are relative to [https://www.opengis.net/spec/WCS/2.0/WCS\_service-extension\_interpolation/1.0/conf](http://www.opengis.net/spec/WCS/2.0/WCS_service-extension_interpolation/1.0/conf).

* 1. Conformance Test Class: *interpolation*

The OGC URI identifier of this conformance class is:  
<https://www.opengis.net/spec/WCS/2.0/conf/WCS_service-extension_interpolation/1.0/conf/interpolation>.

Interpolation/interpolation identifier

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| Test id: Test Purpose: | **interpolation/interpolation-identifier:** A service implementing the Interpolation Extension class *interpolation* **SHALL** include the following URI in the Profile element of the ServiceIdentification in a *GetCapabilities* response:  http://www.opengis.net/spec/WCS\_service-extension\_interpolation/1.1/conf/interpolation |
| Test method: | Send a *GetCapabilities* request to server under test, verify that the response contains a Profile element with said URI.  Test passes if result is as expected. |

Interpolation/capabilities

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| Test id: Test Purpose: | **interpolation/capabilities:** The response to a successful *GetCapabilities* request **SHALL** adhere to Figure 1, Table 2, and the XML schema defined for the WCS Interpolation Extension. |
| Test method: | Send a *GetCapabilities* to server under test, and check for proper response.  Test passes if result is as expected. |

Interpolation/wcs ServiceMetadata

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| Test id: Test Purpose: | **interpolation/wcsServiceMetadata:** The response to a successful *GetCapabilities* request **SHALL** contain an InterpolationMetadata element. |
| Test method: | Send a *GetCapabilities* request to server under test, verify that the response contains an InterpolationMetadata element.  Test passes if result is as expected. |

Interpolation/wcs ServiceMetadata interpolation Methods

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| Test id: Test Purpose: | **interpolation/wcsServiceMetadata-interpolationMethods:** The interpolationSupported item(s) delivered in the ServiceMetadata element of the response to a successful *GetCapabilities* request **SHALL** consist of a pairwise distinct list of URLs. |
| Test method: | Send a *GetCapabilities* request to server under test, check that the interpolationSupported item(s) of the response consist of a pairwise distinct list of URLs.  Test passes if result is as expected. |

Interpolation/interpolation GetCoverage request

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| Test id: Test Purpose: | **interpolation/GetCoverage-request:** A *GetCoverage* request **SHALL** adhere to Figure 2, Table 3, and the XML schema defined for the WCS Interpolation Extension. |
| Test method: | Send *GetCoverage* requests testing server response on the cases distinguished in said reference. Check for proper response.  Test passes if expected result is delivered. |

Interpolation/interpolation GetCoverage response slicing

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| Test id: Test Purpose: | **interpolation/GetCoverage-response-slicing:** The contents of the response to a successful *GetCoverage* request containing one or more slicing operations where the slice points do not coincide with direct positions but are situated in a neighborhood of direct positions **SHALL** be obtained by computing range values for the non-direct positions through interpolation, whereby the interpolation method to be applied is governed by this WCS-Interpolation standard. |
| Test method: | Send a *GetCoverage* request to the service under test containing one or more slicing operations where the slice points do not coincide with direct positions but are situated in a neighborhood of direct positions, verify that the result is obtained by computing range values for the non-direct positions through interpolation, whereby the interpolation method to be applied is governed by this WCS-Interpolation standard.  Test passes if expected result is delivered. |

Interpolation/interpolation GetCoverage response

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| Test id: Test Purpose: | **interpolation/GetCoverage-response:** The contents of the response to a successful *GetCoverage* request containing an Int::globalInterpolation parameter with value m **SHALL** be obtained by applying interpolation method m any time interpolation takes place during preparation of the response, and along every axis of the coverage being processed. |
| Test method: | Send a *GetCoverage* request containing an int::global­Inter­pol­at­ion parameter to server under test, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation/interpolation GetCoverage admissible interpolation

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| Test id: Test Purpose: | **interpolation/GetCoverage-admissible-interpolation:** In a *GetCoverage* request, if an Int::globalInterpolation parameter is provided then this **SHALL** be one of the interpolation methods listed in the coverage addressed. |
| Test method: | Send a *GetCoverage* request containing an int::global­Inter­polation parameter with its value set to one of the interpolation methods listed in the coverage addressed, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation/interpolation per axis GetCoverage getkvp

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| Test id: Test Purpose: | **interpolation/GetCoverage-getkvp:** In a *GetCoverage* request using the GET/KVP protocol as specified in [OGC 09-147r2], an Int::globalInterpolation parameter **SHALL** be represented as  INTERPOLATION=m where m is an interpolation method identifier. |
| Test method: | Send a Get/KVP *GetCoverage* request containing an int::global­Inter­polation parameter represented as  INTERPOLATION=m to server under test, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation/interpolation per axis GetCoverage xmlpost

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| Test id: Test Purpose: | **interpolation/GetCoverage-xmlpost:** In a *GetCoverage* request using the XML/POST protocol as specified in [OGC 09-148r2], an Int::globalInter­polation parameter **SHALL** be represented by a GML int:globalInt­er­polation element. |
| Test method: | Send a XML/POST *GetCoverage* request containing an Interpolation::InterpolationMethod parameter represented by an int::Int­er­­polationMethod element, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation/interpolation per axis GetCoverage soap

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| Test id: Test Purpose: | **interpolation/GetCoverage-soap:** In a *GetCoverage* request using the SOAP protocol, an Int::global­Inter­­pol­at­ion parameter **SHALL** be represented by a GML int:globalInterpolation element. |
| Test method: | Send a SOAP *GetCoverage* request containing an Interpolation::InterpolationMethod parameter represented by an int::Int­er­­polationMethod element, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation-per-axis/identifier

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| Test id: Test Purpose: | **interpolation-per-axis/identifier:** A WCS service implementing requirements class *interpolation-per-axis* of the WCS Interpolation Extension **SHALL** include the following URI in the Profile element of the ServiceIdentification in a *GetCapabilities* response:  http://www.opengis.net/spec/WCS\_service-extension\_interpolation/1.0/conf/interpolation-per-axis |
| Test method: | Send a *GetCapabilities* request to server under test, verify that the response contains a Profile element with said URI.  Test passes if result is as expected. |

Interpolation-per-axis/getCoverage request

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-request:** The int::InterpolationPerAxis parameter in a *GetCoverage* request, if present, **SHALL** have a structure as defined in Figure 3 and Table 6. **Dependency:**  Clause 6, http://www.opengis.net/doc/IS/WCS\_service-extension\_interpolation/1.0/Clause-6 |
| Test method: | Send *GetCoverage* requests testing server response on the cases distinguished in said reference, and check for proper response.  Test passes if expected result is delivered. |

Interpolation-per-axis/getCoverage axes

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-axes:** The Int::InterpolationPerAxis parameters in a *GetCoverage* request, if present, **SHALL** consist of an unordered sequence of Int::Inter­polat­ion­PerAxis elements with a structure as defined in Table 6. |
| Test method: | Send *GetCoverage* requests testing server response on the cases distinguished in said reference, and check for proper response.  Test passes if expected result is delivered. |

Interpolation-per-axis/getCoverage-axes-pairwise-distinct

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-axes-pairwise-distinct:** In a *GetCoverage* request containing int::InterpolationPerAxis parameters, all axis values **SHALL** be pairwise distinct. |
| Test method: | Send *GetCoverage* requests to the service under test containing:   * two int::InterpolationPerAxis elements with different axis names. Verify that request succeeds. * two int::InterpolationPerAxis elements with identical axis names. Verify that request fails.   Test passes if expected result is delivered. |

Interpolation-per-axis/getCoverage existing axis

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| Test id: Test Purpose: | The axis value of each Int::InterpolationPerAxis parameter in a *GetCoverage* request **SHALL** be identical to the axis­Abbrev element of some CRS axis of the CRS identified by the srsName attribute in the gml:Envelope element of the coverage generated. |
| Test method: | Send *GetCoverage* requests to the service under test, with an Interpolation::InterpolationAxis parameter contains an axis element which is:   * identical to the identifier of a domain axis in the coverage addressed. Verify that request succeeds. * not identical to any domain axis identifier in the coverage addressed. Verify that request fails.   Test passes if expected result is delivered. |

Interpolation-per-axis/getCoverage response

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-response:** The contents of the response to a successful *GetCoverage* request containing n>0 Int::Int­er­pol­ationPerAxis parameters consisting of a1,…,an axis identifiers and m1,…,mn interpolation methods **SHALL** be obtained by applying interpolation method mi on axis ai any time interpolation takes place during preparation of the *GetCoverage* response; for those axes not appearing in this list, the method indicated in the int:globalInterpolation parameter **SHALL** be applied. |
| Test method: | Send a *GetCoverage* request containing, an Interpolation::Inter­pol­at­ion­Axes parameter with n>0 Interpolation::Int­er­pol­ationAxis components consisting of a1,…,an axis identifiers and m1,…,mn interpolation method, check that response is correct.  Test passes if result is as expected. |

Interpolation-per-axis/getCoverage getkvp

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-getkvp:** In a *GetCoverage* request using the GET/KVP protocol as specified in [OGC 09-147r2], an Int::Interpolation parameter containing n>0 (Int::axis, Int::inter­pol­at­ionMethod) components (a1:m1),…,(an:mn) **SHALL** be represented as  INTERPOLATIONPERAXIS=a1,m1  & …  & INTERPOLATIONPERAXIS=an,mn |
| Test method: | Send a GET/KVP *GetCoverage* request containing an Int::Interpolation parameter containing n>0 Int::Int­­er­polationAxis components represented as INTERPOLATIONPERAXIS =a1:m1,…,an:mn, where each ai is an axis identifier URL and each mi is an interpolation identifier URL, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation-per-axis/getCoverage xmlpost

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-xmlpost:** In a *GetCoverage* request using the XML/POST protocol as specified in [OGC 09-148r2], the Int::InterpolationPerAxis parameters, if present, **SHALL** be represented by GML int:InterpolationPerAxis elements. |
| Test method: | Send a valid XML/POST *GetCoverage* request containing int:: InterpolationPerAxis elements, verify that the response is not an exception.  Test passes if result is as expected. |

Interpolation-per-axis/getCoverage-soap

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| Test id: Test Purpose: | **interpolation-per-axis/getCoverage-soap:** In a *GetCoverage* request using the SOAP protocol as specified in [OGC 09-149r1], the int::InterpolationPerAxis parameters, if present, **SHALL** be represented by GML int:InterpolationPerAxis elements. |
| Test method: | Send a SOAP *GetCoverage* request containing int::Inter­polation elements, verify that the response is not an exception.  Test passes if result is as expected. |

-- end of ATS –

# Annex B (informative) Revision History

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Date | Release | Author | Paragraph modified | Description |
| 2012-06-20 | 0.0.1 | Peter Baumann | All | Created |
| 2012-08-12 | 0.0.2 | Peter Baumann | All | Formalized requirements |
| 2012-12-03 | 0.1.0 | Peter Baumann,  JinosngdiYu | Several, in particular: Annex A | Completed, added ATS |
| 2014-01-01 | 1.0.0 | Peter Baumann, Jinsongdi Yu | All | Finalized after adoption vote; removed interpolation method URL definition, as this is now supposed to be done by OGC-NA |
| 2024-06-17 | 1.1.0 | Peter Baumann, Jinsongdi Yu | Several | Added slicing interpolation support, and ATS updated accordingly |
| 2024-11-19 | 1.1.0 | Peter Baumann | several  Table 4 | Document references updated  Made parameter optional |
| 2025-02-11 | 1.1.0 | Peter Baumann | several | Addressed C Reed comments |