CEOS OpenSearch

Best Practice Document

Version 1.3

CEOS Document

[CEOS-OPENSEARCH-BP-V1.3]

Revision History

Date	Version	Sections affected	Changes
2014-12-17	1.0(draft)	All	Draft release for public comment period
2015-05-29	1.0	All	Official release
2015-06-10	1.0.1	CEOS-BP-007	Changed to recommend startIndex over startPage in CEOS-BP-007
2016-01-13	1.1 D1	All	Conversion from Google Doc to MS-Word using styles to generate Table of content, list of figures and list of tables. Appendix added listing open issues for which agreement is still needed. Use of "param:" namespace prefix made consistent in several examples.
		Section 1.4	Section revised to strengthen applicability of OGC specifications (as per WGISS-40 MoM §4.3.1.4).
		Section 1.4.3	Section with namespace prefix mappings added to remove ambiguity about meaning of namespace prefixes used in the normative part (and its examples) of the text, e.g. meaning of "dc:" in CEOS-BP-011.
		Section 2.2	Third bullet added to CEOS-BP-002 to indicate how inconsistencies between <Url> template and <Parameter> elements should be handled.
		Section 2.2.1	Section "Free Text Keyword" about CEOS-BP-002 expanded to also apply to other parameters than "searchTerms" (e.g. eo:platform), and propose the same mechanism to define expected behavior of wildcards in search parameters (eo:platform="SPOT*") to cover the corresponding point in (as per WGISS-40 MoM §4.3.1.4). Reworded to also cover mechanism proposed in CEOS-DG-005 which existed in the text (as an example), but was not identified as a separate requirement.
		Section 2.2.2	CEOS-DG-006 added as a requirement.
		Section 2.2.3	CEOS-BP-101 added (Query element in OSDD).

Date	Version	Sections affected	Changes
		Section 2.2.3	CEOS-BP-004 updated to clarify which requirements are to be met before a server can advertise to be CEOS OpenSearch Best Practice compliant.
		Section 2.3	Expected behavior specified when count=0, which is allowed by the specification (CEOS-BP-005B).
		Section 2.3	Guidance added for search parameter name to be used when searching by satellite name (CEOS-BP-005C). Guidance for search parameter value in case of satellite name added.
		Section 2.3	CEOS-DG-007B added derived from original CEOS-DG-007.
		Section 2.3	CEOS-DG-014 added, but split in 014B and 014B to clarify how fixed part of URL corresponding to "keys" of optional parameters should be handled.
		Section 2.3	Sentence added after CEOS-BP-009 to clarify that use of "." as separator is not normative.
		Section 2.4	CEOS-DG-018 added (rel="first", …).
		Section 2.4	CEOS-BP-012B added. Use of rel="via" in Atom feed to indicate provenance of search results in case of syndication/aggregation.
		Section 2.4	CEOS-DG-020 (Minimum Bounding Rectangle) added as optional (nice-to-have).
		Section 2.4	CEOS-BP-014 updated to clarify representation of multi-polygon and multi-* footprints with GeoRSS GML.
		Section 2.4	CEOS-BP-015B added with guidance on how to return multiple quicklook/browse images corresponding to a single granule.
		Section 2.4	CEOS-BP-016 (rel="enclosure") reworded to clarify that it applies to granule level searches only.
		Section 2.4	CEOS-DG-021 added (dc:date).
		Section 2.4	CEOS-DG-022 (atom:link types) and CEOS-DG-022B added (type attribute). CEOS-BP-012 split in two separate requirements CEOS-BP-012A and CEOS-BP-012C for "metadata" and "documentation".

Date	Version	Sections affected	Changes
2016-01-28	1.1 D2	Table 3	Reference to RFC 6906 ("profile" Link), INSPIRE Guidance document and schema.org added.
		Section 2.2.1	Info URI scheme used in "href" attribute to refer to "masked" relation identifier as Info URI are valid URI as per http://www.ietf.org/rfc/rfc4452.txt.
		Section 2.4	CEOS-BP-016B added (data access with multiple files), compliant with [INSPIRE] TG Requirement 32. CEOS-BP-010: wording simplified.
		Annex C	Subsections C1 and C2 created and JSON-LD example added.
			Internal ESA review comments (Email 21/01/2016 01:20) resolved:
		All	Typos corrected.
		Section 1.3	ADV-1: Subsection "Document terms and definitions" added.
		Section 1.4.1	ADV-4: [OpenSearch] moved to top of table. ADV-6: "encodings" replaced by "metadata model".
		Section 2.2.3	ADV-9: Note added referring to NASA CWIC-SMART automated test tool which rely on a similar convention. ADV-11: Issue added about possible support for multiple conformance levels and different encoding, for discussion with the group.
		Section 2.3	Wording of CEOS-BP-005 updated ("shall").
		Section 2.4	Wording of CEOS-BP-011 updated ("shall").
		Section 2.4	ADV-17: Link type attribute (CEOS-DG-022B) made mandatory. Reference to [INSPIRE] Technical Guidance Req. 30 added.
2016-03-08	1.1 D3		Agreed review comments discussed at teleconf 2 March 2016 integrated.
		All	JGA-01: resto2 to be replaced with resto in URLs.
		Section 2.4	NASA-7: update CEOS-DG-018 to allow for both "prev" and "previous" and add proposed responses for border cases.
		Section 2.2.1	NASA-8: Issue 2 – "href attributes should be URI" removed.

Date	Version	Sections affected	Changes
		Section 2.2.3	NASA-9: CEOS-BP-101 - Remove Note 4 and add caveat to use "best example".
		Section 2.4	NASA-10: downgrade requirement CEOS-DG-022B to recommended. Note 9 removed and converted into explanatory text.
		Section 2.2.3	CWIC-1: CEOS-BP-004 updated with three compliance levels and "Issue 5" removed.
		Section 2.4	CWIC-3: CEOS-BP-015B updated. Added possibility of rel=icon" and reword text about attribute unique combination.
2016-04-18	1.1 D4		Finalisation after WGISS-41 on 14th – 17th March
		Table of Content	Updated
		Section 2	Table 6 updated with renumbered requirements
		Section 2.1	CEOS-DG-005 renumbered as CEOS-BP-002B
		Section 2.2.2	CEOS-DG-006 renumbered as CEOS-BP-002C
		Section 2.2.3	CEOS-BP-101 renumbered as CEOS-BP-003B
		Section 2.3	CEOS-DG-007B renumbered as CEOS-BP-005D
		Section 2.3	CEOS-DG-014A renumbered as CEOS-BP-005E
		Section 2.3	CEOS-DG-014B renumbered as CEOS-BP-005F
		Section 2.4	CEOS-DG-018 renumbered as CEOS-BP-011B
		Section 2.4	CEOS-DG-022 renumbered as CEOS-BP-012D
		Section 2.4	CEOS-DG-022B renumbered as CEOS-BP-012E
		Section 2.4	CEOS-DG-021 renumbered as CEOS-BP-013B
		Section 2.4	CEOS-DG-020 renumbered as CEOS-BP-014E
2016-05-24	1.1		Comments received on version 1.1D4 resolved:
		Section 2	CWIC-3: Typo in Table 6 corrected.

Date	Version	Sections affected	Changes
		Section 2.4: CEOS-BP-011B	CWIC-2: equivalence of startIndex and startPage in href attribute explained and startPage example added.
		Section 3.2.4.1	CWIC-1: Info for IDN/CWIC updated from "O" to "G".
		Section 3.2.8	CWIC-1: Info for CWIC updated to indicate support for startIndex.
2016-10-14	1.1.1	All	OGC 13-026r5 replaced by OGC 13-026r8 which was approved by OGC in August 2016.
		Table 4	Editorial: prefixes corrected to start with lower case character instead of uppercase.
		Table 7	Media types aligned with section 8.2.2 of [OGC 13-026r8]
		CEOS-BP-015B	scheme attribute of media:category in example updated as per [OGC 13-026r8].
2017-06-13	1.2	All	Comments received on version 1.1.1 text resolved
		CEOS-BP-004B	New recommended requirement to specify indexOffset/pageOffset values
		CEOS-BP-014E	Order of georss:box values specified.
		CEOS-BP-009B	New Optional requirements added about "Handling unsupported request parameter"
2020-11-12	1.3	Section 2.2.3	Changed section 2.2.3 to "Temporal range" and added CEOS-BP-002D
		CEOS-BP-002D	New recommended requirement for specifying temporal range
		Section 2.2.4	Section 2.2.3 renumbered to Section 2.2.4
		Table 6	Updated Table 6 – List of Best Practices to include CEOS-BP-002D
		CEOS-BP-003	Updated BP to include a new recommended attribute regarding service level search query URL

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1 Introduction

This document provides server implementation best practices for EO OpenSearch search services that allow for standardized and harmonized access to metadata and data for CEOS agencies, including CWIC and FedEO.
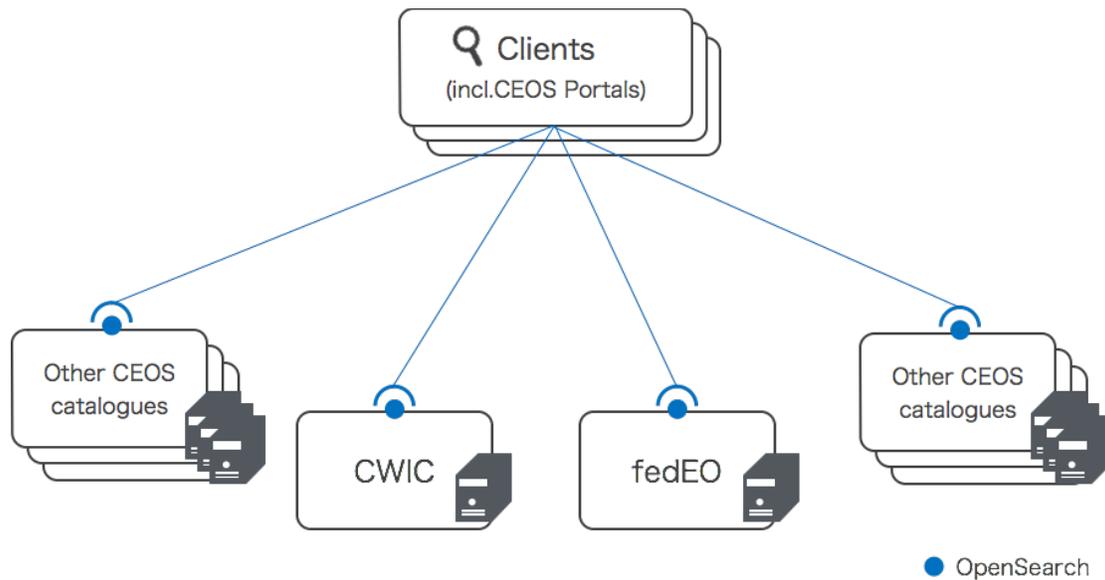
Figure 1: CEOS OpenSearch

1.1 Purpose of the document

The purpose of this document is to achieve the following

- Promote the use of the OpenSearch standard as a means of data discovery for Earth Data providers
- Define the expectations and requirements of candidate OpenSearch implementations
- Remove ambiguity in implementation where possible
- Facilitate the aggregation of results between disparate Earth Data providers via OpenSearch common standards
- Allow for clients to access search engines via an OpenSearch Description Document (OSDD) with no a priori knowledge of the interface
- Facilitate smooth integration between related OpenSearch implementations, such as a dataset resource collection that refers to granule resource collections from another provider

1.2 Project Members

This document has been developed by the CEOS OpenSearch Project Team of the Committee on Earth Observation Satellites (CEOS) Working Group on Information Systems and Services (WGISS).

The project team members are listed below.

JAXA	Yoshiyuki Kudo
	Satoko Miura
CNES	Jérôme Gasperi
	Richard Moreno
ESA	Pier Giorgio Marchetti
	Giuseppe Troina
	Yves Coene
	Philippe Mougnaud
	Andrea Della Vecchia
NASA	Andrew Mitchell
	Yonsook Enloe
	Doug Newman
	Christopher Lynnes
NOAA	Martin Yapur
	Kenneth McDonald
CCMEO	Patrick King

1.3 Terminology

Document terms and definitions

The word "shall" (not "must") is the verb form used to indicate a requirement to be strictly followed to conform to this standard.

Terminology referring to data granularity

Earth observation (EO) satellite data usually falls into two types in the context of granularity - collection and granule.

Granule

A granule is the finest granularity of data that can be independently managed. A granule usually matches the individual file of EO satellite data.

Collection

A collection is an aggregation of granules sharing the same product specification. A collection typically corresponds to the series of products derived from data acquired by a sensor on board a satellite and having the same mode of operation.
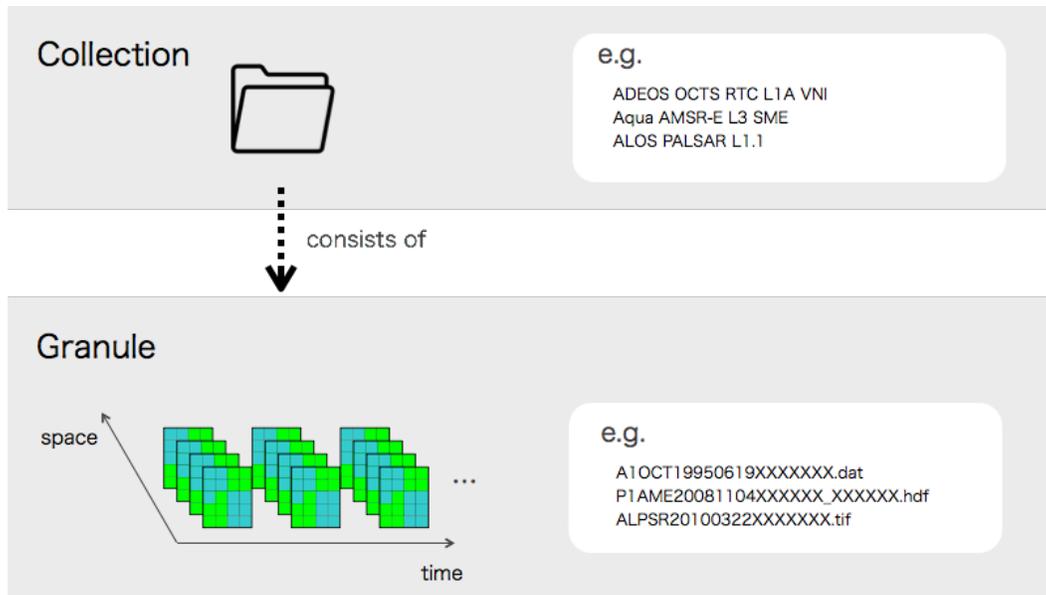
Figure 2: EO satellite data granularity

Table 1 shows how agencies use different terminology when referring to these two granularities.

Terminology (Fig 2)	ISO terms (i.e. ISO19115-2)	Agency dependent terminology
collection	dataset series	collection (CNES, NASA) dataset (JAXA) dataset series (ESA) product (JAXA)
granule	dataset	dataset (ESA) granule (NASA) product (ESA, CNES) scene (JAXA)

Table 1 – Terminology mapping for collections and granules

Since the agencies share the common notion of this two level hierarchy, the difference does not adversely affect the harmonization effort of this activity.

The terminology "collection" and "granule" - are used throughout this document.

CWIC (CEOS WGISS Integrated Catalog)

The Working Group on Information Systems and Services is a subsidiary body supporting the Committee on Earth Observing Satellites (CEOS). WGISS promotes collaboration in the development of systems and services that manage and supply these observatory data.

CEOS IDN (CEOS International Directory Network)

An international effort developed to assist researchers in locating information on available collections and services. The directory is sponsored as a service to the Earth science community.

FedEO (Federated Earth Observation Missions)

FedEO provides interoperable access, following ISO/OGC interface guidelines, to Earth Observation metadata.

OGC (Open Geospatial Consortium)

OGC is an international industry consortium of private companies, government agencies and universities participating in a consensus process to develop publicly available interface standards.

1.4 Specifications and references

1.4.1 Applicable Documents

OpenSearch implementations within CEOS shall comply with a number of specifications.

Conformance to these specifications helps achieve consistent level of implementation across CEOS agencies and systems. Those specifications are enumerated in Table 2

Acronym	Title	Reference	Issue
[OpenSearch]	OpenSearch Specification, 1.1, Draft 5	http://www.opensearch.org/Specifications/OpenSearch/1.1/Draft_5	1.1 Draft 5
[OGC 10-032r8]	OpenSearch Geo and Time extensions	https://portal.opengeospatial.org/files/?artifact_id=56866	r8, 14/04/2014

[OGC 13-026r8]	OpenSearch Extension for Earth Observation Products	http://docs.opengeospatial.org/is/13-026r8/13-026r8.html	r8, 06/07/2016.
[Param]	OpenSearch Parameter Extension – 1.0 Draft 2	http://www.opensearch.org/Specifications/OpenSearch/Extensions/Parameter/1.0/Draft_2	1.0 Draft 2
[Relevance]	OpenSearch Relevance Extension	http://www.opensearch.org/Specifications/OpenSearch/Extensions/Relevance/1.0/Draft_1	1.0 Draft 1
[Atom]	Atom syndication format	IETF RFC4287, http://tools.ietf.org/html/rfc4287	

Table 2 – List of applicable specifications

The Geo and Time extensions [OGC 10-032r8] specify a series of query parameters that can be used to geographically and temporally constrain search results. Parameters include: bounding box, geometry, and start/end of a temporal extent. It also defines a set of response elements to be used to express geographical and temporal context in the search results.

The extension for EO Products [OGC 13-026r8] defines query parameters that allow the filtering of search results with the fields that are unique to EO products, e.g. platform (satellite), sensor, processing center, etc. The OpenSearch query parameters defined in this document are aligned with O&M EO Profile [OGC 10-157r4] that describes EO products metadata.

The OpenSearch Parameter Extension [Param] sets rules to describe valid range and entries for query parameters in OSDD. This extension is not an OGC standard.

Reading these specifications may require understanding of the following related specification as well.

- O&M EOP Profile [OGC 10-157r4]

The O&M (Observations and Measurements) EO Profile [OGC 10-157r4] defines the metadata model required to describe metadata of Earth Observation (EO) data. The underlying O&M standard (ISO 19156 and OGC 10-025r1) defines a conceptual schema encoding for observations, and for features involved in sampling when making observations.

1.4.2 Reference Documents

Reference documentations are as follows.

Acronym	Title	Reference	Issue
[OGC 10-157r4]	Earth Observation Profile of Observations and Measurements	http://docs.opengeospatial.org/is/10-157r4/10-157r4.html	r4.
[FedEO-CPG]	FedEO Client Partner Guide	PDGS-FEDEO-SPB-ICD-15-1174, https://wiki.services.eoportal.org/tiki-download_wiki_attachment.php?attId=4065	Issue 1.1, 22/12/2015
[CWIC-OBP]	CWIC OpenSearch Best Practices	https://wiki.earthdata.nasa.gov/download/attachments/28541363/CWIC%20Open%20Search%20Best%20Practices.docx?version=3&modificationDate=1394136508686&api=v2	
[CWIC-ODPG]	CWIC OpenSearch Data Partner Guide	http://ceos.org/document_management/Working_Groups/WGISS/Projects/CWIC/OpenSearch/CWIC_OpenSearch_Data-Partner-Guide.doc	
[CWIC-OCPG]	CWIC OpenSearch Client Partner Guide	http://ceos.org/document_management/Working_Groups/WGISS/Projects/CWIC/OpenSearch/CWIC_OpenSearch_Client-Guide.doc	
[Referrer]	OpenSearch Referrer Extension	http://www.opensearch.org/Specifications/OpenSearch/Extensions/Referrer/1.0	Issue 1.0 Draft 1
[RFC6906]	RFC 6906, The "profile" Link Relation Type	https://tools.ietf.org/html/rfc6906	
[INSPIRE]	Technical Guidance for the implementation of INSPIRE Download Services.	http://inspire.ec.europa.eu/documents/Network_Services/Technical_Guidance_Download_Services_v3.1.pdf	Issue 3.1, 09/08/2013
[schema.org]	Getting started with schema.org	https://schema.org/docs/gs.html	

Table 3 – List of reference documents

1.4.3 Namespace prefix conventions

Namespace prefixes used in the requirements section and corresponding examples in current document map to the namespaces according to the mappings defined in [OGC 10-032r8] and [OGC 13-026r8]. The prefixes are not normative and are merely chosen for convenience; they

may appear in examples without being formally declared, and have no semantic significance. The namespaces to which the prefixes correspond are normative, however.

Prefix	Namespace URI	Specification
atom	http://www.w3.org/2005/Atom	The Atom Syndication Format Common 1.0 – RFC-4287
dc	http://purl.org/dc/elements/1.1/	Namespace Policy for the DCMI[a]
eo	http://a9.com/-/opensearch/extensions/eo/1.0/	OpenSearch Extension for EO
geo	http://a9.com/-/opensearch/extensions/geo/1.0/	OpenSearch Geo Extension
georss	http://www.georss.org/georss	GeoRSS Specification
gml	http://www.opengis.net/gml	GML specification
os	http://a9.com/-/spec/opensearch/1.1/	OpenSearch 1.1 Specification
time	http://a9.com/-/opensearch/extensions/time/1.0/	OpenSearch Time Extension
[a] See <http://dublincore.org/documents/dcmi-namespace/>.		

Table 4 – List of namespace prefix mappings

The following namespace prefixes are used as well.

Prefix	Namespace URI	Specification
param	http://a9.com/-/spec/opensearch/extensions/parameters/1.0/	[Param]
referrer	http://www.opensearch.org/Specifications/OpenSearch/Extensions/Referrer/1.0	[Referrer]

Table 5 – List of additional namespace prefix mappings

1.5   What is OpenSearch?

OpenSearch is a collection of simple formats for the sharing of search results.

The OpenSearch specification defines a descriptor document (OSDD) format that can be used to describe a search engine so that it can be used by search client applications.

The OpenSearch response elements can be used to extend existing syndication formats, such as RSS and Atom, with the extra metadata needed to return search results. Figure 3 shows a diagram of client and server interaction of OpenSearch.
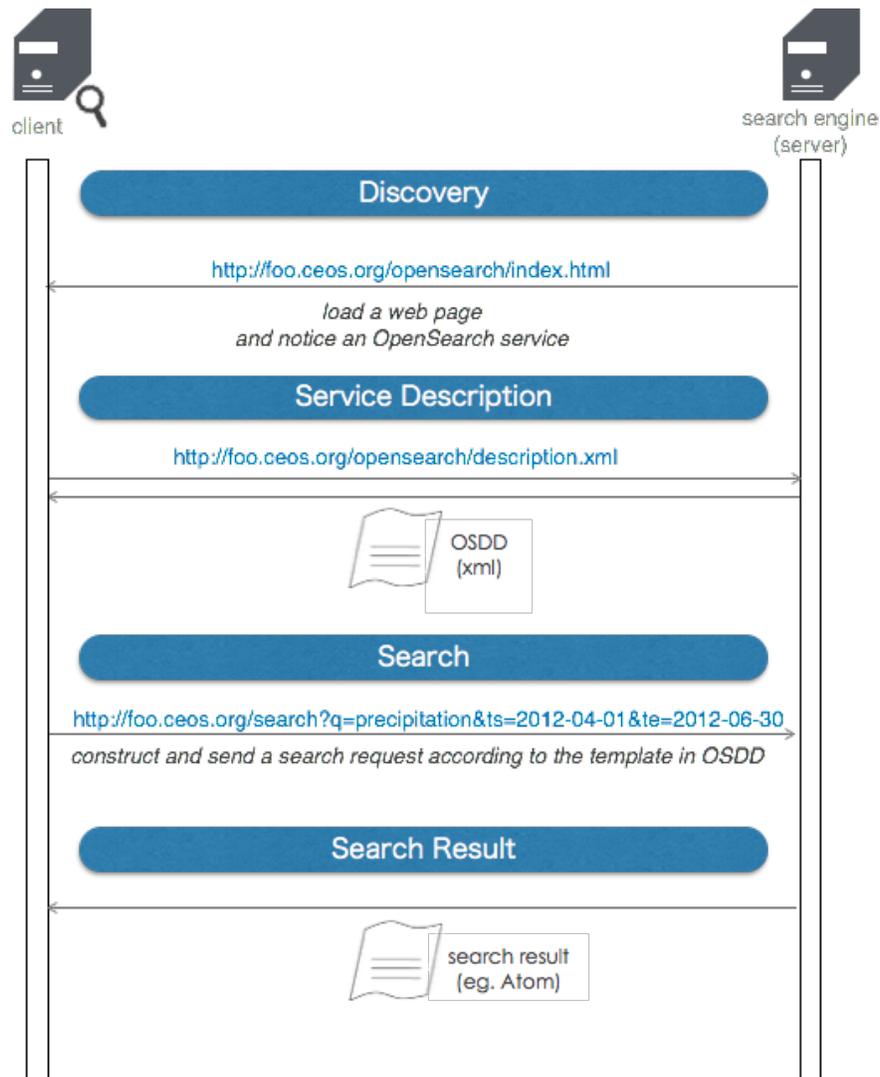
Figure 3: OpenSearch client-server interaction

Discovery

A client can learn of support for an OpenSearch service by looking at the html header of a server's web page. A link element with a rel attribute equal to "search" shows the location of the OSDD in the value of "href" attribute as shown below.

```
<html>

<head>

<link rel="search"

type="application/opensearchdescription+xml"

title="Foo Search Engine"

href="http://foo.ceos.org/xxx/description.xml">   ... URL to OSDD

...
```

Description of Service

The client uses the OSDD to learn about the OpenSearch API of the server. The OSDD contains parameterized URL templates that indicate how the search client should make search requests. The URL template can be repeated for each combination of relation and search result output format that the service supports.

```
<OpenSearchDescription

 xmlns="http://a9.com/-/spec/opensearch/1.1/"

 xmlns:os="http://a9.com/-/spec/opensearch/1.1/"

 xmlns:atom="http://www.w3.org/2005/Atom"

 xmlns:time="http://a9.com/-/opensearch/extensions/time/1.0/"

 xmlns:geo="http://a9.com/-/opensearch/extensions/geo/1.0/"

 xmlns:eo="http://a9.com/-/opensearch/extensions/eo/1.0/"

 xmlns:param="http://a9.com/-/spec/opensearch/extensions/parameters/1.0/"

 xmlns:dc="http://purl.org/dc/elements/1.1/">

...

<description>This service is ...</description>

...

<Url type="application/atom+xml" rel="results"
template="http://...search/atom?q={searchTerms}&ts={time:start}&te={time:end
}"/>

<Query role="example" searchTerms="water"
```

```
        time:start="2012-04-01"
                time:end="2012-06-30"/>
...
</OpenSearchDescription>
```

Search

A client constructs the request URL by replacing each {xxx} in the URL template with a value. It then sends that request to the server using HTTP GET. For example:

```
<Url type="text/html"
 template="http://...search?q={searchTerms}&ts={time:start}&te={time:end?}/>
```

can be used to construct a url as follows,

```
http://...search?q=water&ts=2012-04-01&te=2012-06-30
```

Optional template parameters are described with a "?" such as {xxx?} and can be left empty or removed.

Search Response

OpenSearch doesn't define or require any specific encoding format for the search response. Instead, it defines a set of search-related metadata elements which can be inserted into existing encoding formats. Typically, list-based XML syndication formats - such as RSS 2.0 and Atom 1.0 - are used.

The OpenSearch response elements include:

        totalResults: number of total results

        startIndex: index number corresponding to the first entry item returned

        itemsPerPage: number of results returned

        Query: search query to get the same search response

Below is an example of a search response in Atom, to the free keyword search "water".

Notice the three OpenSearch elements appear inside the feed element.

```
<feed xmlns=http://www.w3.org/2005/Atom

xmlns:os="http://a9.com/-/spec/opensearch/1.1/">
```

```
<title>OpenSearch response to" water"</title>

<id>http://example.ceos.org/search?q=water</id>

<author><name>Taro Yamada</name></author>

<os:totalResults>231</os:totalResults>

<os:startIndex>51</os:startIndex>

<os:itemsPerPage>50</os:itemsPerPage>
<os:Query role="request" searchTerms="water" time:start="2012-04-01"
time:end="2012-06-30" />

<entry>

 <title>Water Resource Management Guideline</title>

 <id>http://aaa.ceos.org/waterResource/guideline/v001</id>

 <link href="http://aaa.ceos.org/waterResource/guideline/v001"/>

</entry>

<entry>

...

</entry>

<entry>

...

 </entry>

<entry>

...

 </entry>

</feed>
```

2 CEOS OpenSearch Best Practices

This chapter goes through best practices that have been derived from OpenSearch server implementations at CEOS agencies and projects.

The list of best practices are summarized in the table below.

ID	Category	Title	Requirement Level
CEOS-BP-001	Two step search	Support of two step search	Recommended
CEOS-BP-002	OSDD	Support of OpenSearch Parameter Extension (Draft 2)	Recommended
CEOS-BP-002B	Free Text Keyword	Free text parameters	Recommended
CEOS-BP-002C	Geometry	Advertising supported geometry types	Requirement
CEOS-BP-002D	Temporal range	Specify temporal range	Recommended
CEOS-BP-003		rel attribute of the URL in OSDD	Recommended
CEOS-BP-003B		Query element in OSDD	Recommended
CEOS-BP-004	BP Compliance Declaration	CEOS OpenSearch Best Practice identifier	Recommended
CEOS-BP-004B		indexOffset/pageOffset attribute of the URL in OSDD [Recommended]	Recommended
CEOS-BP-005	Search Request	Supported search parameters	Requirement
CEOS-BP-005B		Search with count=0	Optional
CEOS-BP-005C		Search with satellite name	Optional
CEOS-BP-005D		Client identification	Recommended
CEOS-BP-005E		Preserving URL template parameters	Requirement
CEOS-BP-005F		Optional template parameters	Requirement
CEOS-BP-006		Multi-words for searchTerms	Recommended
CEOS-BP-007		Use of startIndex over startPage	Recommended
CEOS-BP-008		Search with geo:name	Recommended
CEOS-BP-009		Output encoding format in search URL	Optional
CEOS-BP-009B		Handling unsupported request parameter	Optional
CEOS-BP-010	Search Response	Output encoding format support (atom)	Requirement

CEOS-BP-011		Support of dc:identifier in search response to allow for search-by-ID	Requirement
CEOS-BP-011B		Result set navigation	Recommended
CEOS-BP-012		Metadata representation in search response	Recommended
CEOS-BP-012B		Provenance information	Optional
CEOS-BP-012C		Reference to documentation	Recommended
CEOS-BP-012D		Relation attribute values	Recommended
CEOS-BP-012E		Link type attribute	Recommended
CEOS-BP-013		atom:summary	Recommended
CEOS-BP-013B		Dublin Core date	Recommended
CEOS-BP-014		GeoRSS	Recommended
CEOS-BP-014B		GeoRSS multi-polygon footprint	Recommended
CEOS-BP-014C		GeoRSS multi-point footprint	Recommended
CEOS-BP-014D		GeoRSS multi-line footprint	Recommended
CEOS-BP-014E		Minimum-bounding rectangle	Optional
CEOS-BP-015		Browse Image	Recommended
CEOS-BP-015B		Multiple browse images	Optional
CEOS-BP-016		Data access	Recommended
CEOS-BP-016B		Data access to multiple files	Optional
CEOS-BP-017	Exceptions	Exception codes	Recommended

Table 6 – List of best practices

2.1 Two Step Search

CEOS-BP-001 - Support of two step search [Recommended]

One serious hurdle to overcome in searching for data is the great number of data items to account for in responses, as well as the expected number of successful "hits" for a query. In ordinary web searches, the searcher is usually looking for a small number of web pages or documents. Relevance ranking typically does a good job of presenting these successful hits near the top of the returned list, followed by single point-and-click retrievals. However, when searching for Earth science data covering large time periods or spatial areas, a user will often specify a set of

constraints to find an appropriate data collection together with space-time criteria for files within that data collection. Often, the precision of the data collections returned for the search is low, with many spurious hits. However, the space-time precision of the files is often quite high: that is, the user truly wants to use all the data files of a desirable data collection set that fall within the space-time region of interest. Thus, searching for all data satisfying both dataset content and space-time region at the same time can produce a great many spurious hits, i.e., all the files for data collections that are *not* desired.

The 2-step search consists of a collection level search and the subsequent granule level search (or file-level search) as Figure 4 shows.
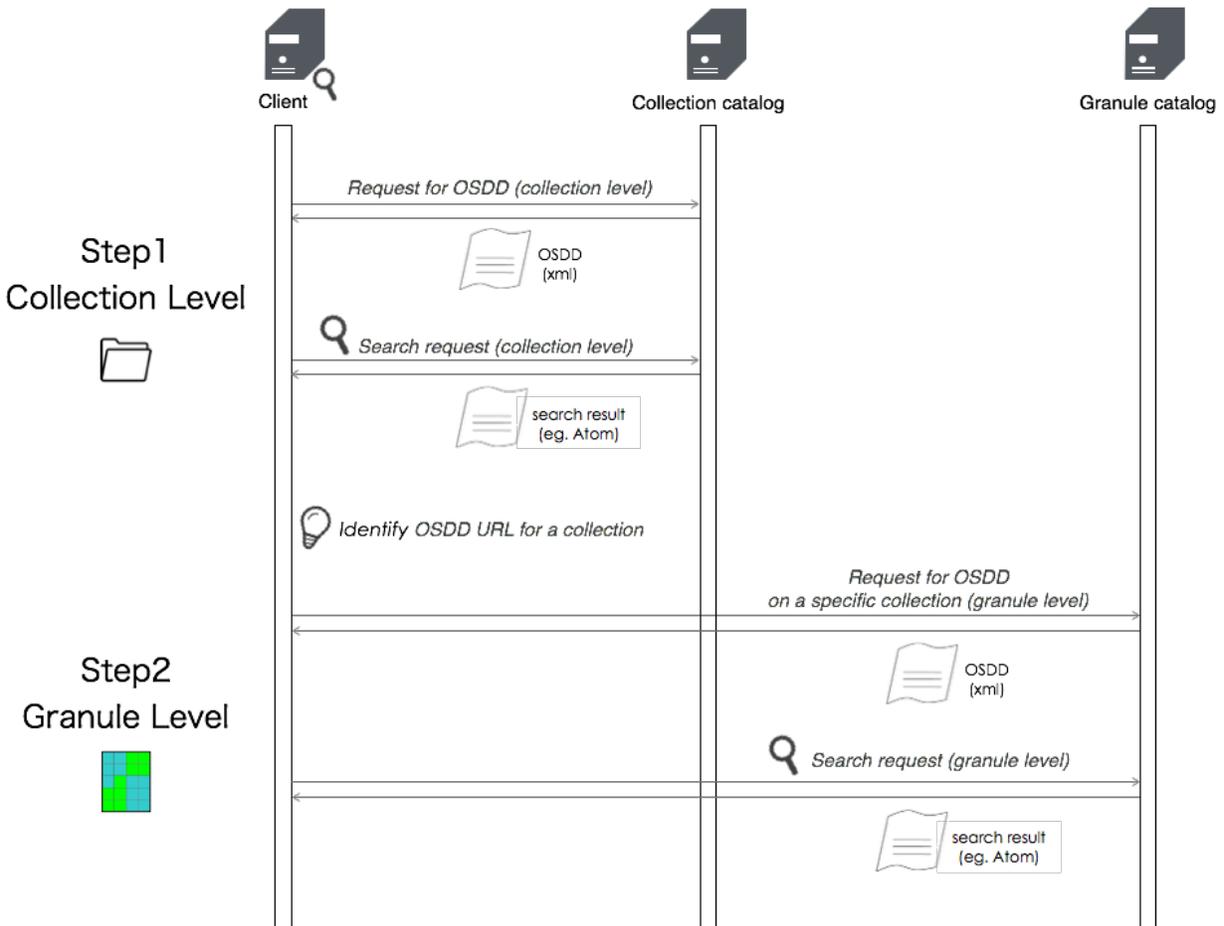
Figure 4: 2 Step Search Diagram

In order to provide a well-defined search path from a collection of interest to granules associated with that collection, we advocate the use of two-step searching leveraging the following:

1. Link elements of relation search (rel='search') within collection entries. These links point to a granule-level OSDD specific to the collection entry

2. Granule level OSDDs that can be tailored to a specific collection

The key requirement of this approach is an identifier that both the collection and granule resource understand as uniquely describing the collection.

The advantages of this approach are as follows:

- A client can navigate from dataset to granule with only an understanding of the OpenSearch specification
- A server can link between datasets and granules using any set of unique identifiers they choose. For example, identifier plus version
- It allows the client to determine what search parameters are available to the user at the granule level using the OSDD

For example, a collection level search result looks something like this:

```
<feed>

    ...

    <entry>

        <title>Collection A</title>

        <link rel="search" type="application/opensearchdescription+xml"
href="http://foo.ceos.org/search/osdd.xml?collectionId=collection_a" />

        ...

    </entry>


    <entry>

        <title>Collection B</title>

        <link rel="search" type="application/opensearchdescription+xml"
href="http://foo.ceos.org/search/osdd.xml?collectionId=collection_b" />

        ...

    </entry>

    …
</feed>
```

The value of href attribute of the link element with the rel attribute equal to "search", in this case, *http://foo.ceos.org/search/osdd.xml*?collectionId=collection_a, for the collection A, is the URL to

the OSDD specific to collection A.

Looking for the OSDD in each result entry, a client can be directed to URL template(s) usable for the collection's granule level search.

The URL template for the granule search contains a search parameter dedicated to the specific collection, which is hard-coded and not meant to be replaced by the client when constructing a query.

E.g.

```
<Url type="application/atom+xml" rel="results"
template="http://../search/collection.atom?collectionId=collection_a&q={sear
chTerms}&ts={time:start}&te={time:end}&bbox={geo:box}>
```

Notice "collection_a" is not enclosed in braces.

2.2 OSDD

CEOS-BP-002- Support of OpenSearch Parameter Extension (Draft 2) [Recommended]

The Parameter Extension explicitly advertises the valid values and ranges of search parameters. Thus, it reduces the risk of ambiguity and error.

CEOS recommends the support of the OpenSearch Parameter Extension with the following constraints:

1) "value" attributes should always be set to facilitate the client task (i.e. avoid to parse the <Url> templates)

2) other attributes (i.e. "minimum", "maximum") and options elements should be provided only when it makes sense

3) In case of inconsistency[1] between the Parameter extension annotations and the <Url> template in the OSDD, the <Url> template prevails.

---

[1] Examples of "inconsistencies" are when the <Url> template includes a parameter for which no <param:Parameter> is specified or when a search parameter is mandatory or optional in the <Url> template, but the corresponding <param:Parameter> element does not have a corresponding "minimum" or "maximum" attribute or such attributes with contradicting values.

2.2.1 Free Text Keyword

CEOS-BP-002B – Free text parameters [Recommended]

For conveying the server's support of free text keyword searches (e.g. searchTerms), the server should declare adherence to a specific, existing standard within the parameter definition using the Parameter Extension and an Atom link referring to a profile [RFC6906].

See below for an example.

```
<param:Parameter name="q" value="{searchTerms}">

      <atom:link rel="profile"
href="http://lucene.apache.org/core/2_9_4/queryparsersyntax.html"
title="This parameter follows the Lucene free text search implementations"
/>

</param:Parameter>
```

This tells a client to refer to the href link for the notation rule of free text keyword searches (q) the server complies with. In this case, Apache Lucene is used.

A similar convention can be used by an OpenSearch server to advertise its support for relational modifiers (e.g. wild cards such as "*" or "?"). The OpenSearch specifications (in contrast to the more elaborate OASIS SearchRetrieve specifications[2]), do not specify the expected behavior of a server in such cases. To allow clients to know whether a string passed as a parameter value can contain wild cards or relational operators, the Parameter extension can be used.

In the example below, the server advertises its support for the "masked" relation modifier defined at the URL provided. This allows a client to pass eo:platform parameters with wild cards such as "SPOT*" and receive hits for SPOT-4, SPOT-5.

```
<param:Parameter name="platform" value="{eo:platform}">

      <atom:link rel="profile" href="info:srw/cql-context-set/1/cql-
v2.0#masked" title="This parameter supports wild cards" />

</param:Parameter>
```

In the example below, the server explicitly states that is does not support the "masked" relation modifier (i.e. wildcards) for the eo:platform search parameter.

---

[2] OASIS SearchRetrieve specifications (available at http://docs.oasis-open.org/search-ws/searchRetrieve/v1.0/os/part5-cql/searchRetrieve-v1.0-os-part5-cql.html) use the notion of context-sets defining different kinds of relation modifiers. An example context set with useful conventions is `info:srw/cql-context-set/1/cql-v2.0` which defines the "masked" and "unmasked" modifiers.

```
<param:Parameter name="platform" value="{eo:platform}">

      <atom:link rel="profile" href="info:srw/cql-context-set/1/cql-
v2.0#unmasked" title="This parameter does not support wild cards" />

</param:Parameter>
```

2.2.2 Geometry

For conveying the server's support condition of a geometry (geo:geometry) parameter, the server should declare adherence to a specific, existing standard within the parameter definition using the Parameter Extension.

CEOS-BP-002C – Advertising supported geometry types [Requirement]

An OpenSearch server with {geo:geometry} search capabilities shall advertise supported geometry types with the Parameter extension and via Atom links referring to geometry type profiles.

```
<param:Parameter name="geometry" value="{geo:geometry}">

   <atom:link rel="profile" href="http://www.opengis.net/wkt/LINESTRING"
title="This service accepts WKT LineStrings"/>

      <atom:link rel="profile" href="http://www.opengis.net/wkt/POINT"
title="This service accepts WKT Point"/>

   <atom:link rel="profile" href="http://www.opengis.net/wkt/POLYGON"
title="This service accepts WKT Polygons"/>

   <atom:link rel="profile"
href="http://www.opengis.net/wkt/MULTILINESTRING" title="This service
accepts WKT Multi-LineStrings"/>

      <atom:link rel="profile" href="http://www.opengis.net/wkt/MULTIPOINT"
title="This service accepts WKT Multi-Point"/>

   <atom:link rel="profile" href="http://www.opengis.net/wkt/MULTIPOLYGON"
title="This service accepts WKT Multi-Polygons"/>

</param:Parameter>
```

This explains that a server supports point, line and polygon among other geometry types, and the convention can be found in the value of href.

2.2.3 Temporal range

An OpenSearch API implementation may need to convey a maximum range for a temporal search filter. It can specify that constraint in the OSDD using the parameter element using one of the {time:start and time:end} parameters : the option to define a relativeTo and maxPeriod attribute to one of these parameters allows the server to communicate to an OpenSearch client a maximum termporal range. The range is defined such that the relativeTo attribute will name the other corresponding temporal parameter or vice versa, and such that the maxPeriod attribute is defined as a string value consistent with ISO_8601 duration (https://www.iso.org/standard/40874.html). This construct is only useful when the two parameters in question (the parameter that defines maxPeriod and the parameter it is relativeTo) describe points in time as per the OpenSearch time extension.

CEOS-BP-002D – Specify temporal range [Recommended]

```
<Parameter xmlns:time="http://a9.com/-/opensearch/extensions/time/1.0/"
      name="start"
      value="{time:start}"
      pattern="[0-9]{4}-[0-9]{2}-[0-9]{2}T[0-9]{2}:[0-9]{2}:[0-9]{2}(\.[0-
9]+)?(Z|[\+\-][0-9]{2}:[0-9]{2})"
  />


<Parameter xmlns:time="http://a9.com/-/opensearch/extensions/time/1.0/"
      name="end"
      value="{time:end}"
      maxPeriod="P6M"
      relativeTo="{time:start}"
      pattern="[0-9]{4}-[0-9]{2}-[0-9]{2}T[0-9]{2}:[0-9]{2}:[0-9]{2}(\.[0-
9]+)?(Z|[\+\-][0-9]{2}:[0-9]{2})" />
```

2.2.4 Other requirements

CEOS-BP-003 - rel attribute of the URL in OSDD [Recommended]

CEOS recommends the use of rel attribute of Url element in OSDD in the following manner[3].

- rel="collection" to advertise collection level search query URL

---

[3] As per http://www.ietf.org/rfc/rfc6573.txt.

- rel="results" (default) to mean granule level search query URL
- rel="service" to mean service level search query URL

If rel attribute is not specified, it is assumed that its value is "results".

CEOS-BP-003B – Query element in OSDD [Recommended]

For testability purposes, CEOS recommends that an OSDD should at least contain one Query element of role 'example' when presenting an Atom response which returns representative results.

In case the OSDD contains multiple <Url> templates or <Url> templates for both collection and granule level search, the Query element shall refer to a collection level search with Atom response.

In case the OSDD contains only <Url> templates for collection level search, the Query element shall refer to a collection level search with Atom response. In case the OSDD contains only <Url> templates for granule level search, the Query element shall refer to a granule level search with Atom response.

Implementers are recommended to include a search query example which will return a response with the largest possible set of features, e.g. quick look images, access to data etc.

CEOS-BP-004 - CEOS OpenSearch Best Practice identifier [Recommended]

CEOS recommends adding a string (as defined below) indicating the server conformance level in the <Tags> element of the OSDD. This can be used by an OpenSearch client to detect which requirements level the server conforms to.

- CEOS-OS-BP-V1.1/L1: Compliant with all server requirements labeled as [Requirement] in Table 6 of the current specification.

- CEOS-OS-BP-V1.1/L2: Compliant with all server requirements labeled as [Requirement] and [Recommended] in Table 6 of the current specification.

- CEOS-OS-BP-V1.1/L3: Compliant with all server requirements labeled as [Requirement], [Recommended] and [Optional] in Table 6 of the current specification.

CEOS-BP-004B - indexOffset/pageOffset attribute of the URL in OSDD [Recommended]

CEOS recommends the use of indexOffset/pageOffset attribute of URL element in OSDD in the following manner:

- indexOffset="0/1" to advertise the offset of startIndex

- pageOffset="0/1" to advertise the offset of startPage

2.3 Search Request

CEOS-BP-005 - Supported search parameters [Requirement]

OpenSearch Geo and Time extension [OGC 10-032r8] gives a list of fundamental search parameters sufficient to constrain a search by time and space. The OpenSearch Extension for EO Products [OGC 13-026r8] complements it with optional parameters specific to EO data.

From these specifications, an OpenSearch CEOS implementation shall support the following minimum set of search parameters for both "collection" and "granule" levels:

- *count*
- *searchTerms (optional for "granule level" search)*
- *startIndex or startPage*
- *geo:uid*
- *geo:box*
- *time:start*
- *time:end*

Note regarding the {geo:geometry} parameter : the option of polygon in the geometry parameter raises practical issues with HTTP GET requests. Polygons can contain an arbitrary number of vertices which, when expressed as a constraint in a HTTP GET request, may exceed the URL length limits of some HTTP servers. This would suggest that HTTP POST should also be supported in some instances. However, this is not recommended since it would 1) add an unwanted degree of complexity to the specification and 2) using POST to request data would violate a RESTful implementation - POST should be used to "create" a resource on the server not to get a "resource". As a consequence CEOS recommends the use of HTTP GET only for search request with appropriate HTTP error message (i.e. HTTP 414) when URI is too long.

CEOS-BP-005B - Search with count=0 [Optional]

The count parameter shall support non-negative values according to [OpenSearch]. OpenSearch servers shall return a search response without Atom entries when count=0 is specified the request, but preserve other information in the search response (Atom feed) such as os:totalResults.

CEOS-BP-005C - Search with satellite name [Optional]

OpenSearch servers supporting collection (or granule) searches based on satellite name are recommended to pass the satellite name via the {eo:platform} search parameter defined in [OGC 13-026r8].

To avoid name mismatches (e.g. "SPOT 5" versus "SPOT5" versus "SPOT-5" or "SEASAT 1" versus "Seasat"), implementations are encouraged to support names as defined in the SKOS

description of satellite and missions is in the Global Change Master Directory (See skos:prefLabel of the platform as defined in http://gcmdservices.gsfc.nasa.gov/static/kms/platforms/platforms.rdf).

CEOS-BP-005D – Client identification [Recommended]

OpenSearch servers wishing to identify clients via a client-supplied identifier (e.g. for purposes of server-side metrics generation) shall request this information through the {referrer:source}[4] OpenSearch parameter or a non-variable search parameter in the URL template.

```
<Url type="application/atom+xml"
 template="http://...search?q={searchTerms}&clientId={referrer:source}/>
```

Consequently, if a client abides by the contract of the URL template in the example above, all queries to the API will contain the clientId parameter.

CEOS-BP-005E – Preserving URL template parameters [Requirement]

OpenSearch clients shall preserve any non-variable search parameters given to them by the URL template in the OSDD for building a search request.

The actual search request shall correspond to the URL template retrieved from the OSDD with mandatory OpenSearch parameters replaced by an actual value and optional parameters (i.e. with "?") replaced by an empty string or the key/value pairs of optional parameters removed.

For example: considering the URL template below, with a non-variable parameters (collectionId and clientId) and optional parameter {time:end?}.

```
<Url type="application/atom+xml"
 template="http://...search?
collectionId=collection_a&q={searchTerms}&ts={time:start}&te={time:end?}&cli
entId=foo/>
```

Applying the above URL template, clients can make the following valid request:

```
http://...search?collectionId=collection_a&q=water&ts=2012-04-01&te=2012-06-
30&clientId=foo
```

CEOS-BP-005F – Optional template parameters [Requirement]

OpenSearch servers shall treat the following as equivalent,

---

[4] http://www.opensearch.org/Specifications/OpenSearch/Extensions/Referrer/1.0

- Values of optional parameter that are empty (i.e. the key is present but the value is absent)

- key/value pairs of optional parameters that are removed (i.e. both key and value are absent).

E.g. The optional parameter {time:end?} can be left empty or the actual parameter "te=" can be removed also.

For example, with optional parameter left empty the request would be thus,

```
http://...search?collectionId=collection_a&q=water&ts=2012-04-
01&te=&clientId=foo
```

With optional parameter removed.

```
http://...search?collectionId=collection_a&q=water&ts=2012-04-
01&clientId=foo
```

In all cases, the non-variable part of the URL template (i.e. `http://...search?collectionId=collection_a&clientId=foo`) is present.

Note: The use of a mandatory clientId parameter is a typical use case for such non-variable URL component.

CEOS-BP-006 - Multi-words for searchTerms [Recommended]

OpenSearch specifications do not define or suggest any convention for the notation of multiple keywords used in searchTerms parameter. However, consistent notation rules for expressing a phrase and logical operators are important from a user's (i.e. client's) perspective.

For example, what is the right way to make a phrasal search for "air temperature"? One can imagine a client could be bewildered with an enormous results hits when the query was interpreted as "air OR temperature" at the server, for example.

The parameter extension can partially resolve this by advertising the rules of searchTerms construction in the OSDD. (See section 2.2.1 for details)

Without the parameter extension, the following interpretation is the default.

- white space-delimited words not enclosed in double quote " " represents logical AND
  (e.g.) q=air temperature   :   air AND temperature

- whitespace delimited words enclosed in double quote " " represents phrasal search
  (e.g.) q="air temperature"   :   "air temperature" in one phrase

Note the examples are not URL encoded.

CEOS-BP-007 - Use of startIndex over startPage [Recommended]

The OpenSearch specification allows the use of either startIndex and startPage for pagination control.

We recommend using startIndex over startPage. The reason for this is that startPage is not defined in the OpenSearch specification as a valid response element whereas startIndex is. Although this is probably an oversight, adherence to specification is essential in Best Practices.

startIndex should take precedence when both startPage and startIndex are supplied in a search request by a client.

CEOS-BP-008 - Search with geo:name [Recommended]

We recommend supporting geo:name and optionally, geo:radius. If geo:name is supported but geo:radius is not, it is recommended that the search be interpreted as a point search.

The geo:name can be resolved by Gazetteer. The most common one used by CEOS agencies is geonames.org (http://api.geonames.org/searchJSON).

When a server supports geo:radius the default value should be specified in the OSDD within the "title" attribute of the corresponding Parameter element (example below)

```
<param:Parameter name="radius" value="{geo:radius}" title="Expressed in
meters. Default value is 10000"/>
```

CEOS-BP-009 - Output encoding format in search URL [Optional]

CEOS recommends the specification of encoding format by resource extension in the search URL. While the "type" attribute of the URL element identifies the encoding format supported by a service, specification within the url itself allows for greater usability (bookmarking for example)

```
http://foo.ceos.org/search/collection.atom?collectionId=Landsat_8&amp;startP
age=1&amp;count=10&amp;timeStart=&amp;timeEnd=&amp;geoBox=
```

Implementations can apply the resource extension using a different separator as well. The use of "." is not normative. The example below is using the resource extension mechanism, with a "/" as separator.

```
http://foo.ceos.org/ATS_NR__2P/atom?count=10
```

CEOS-BP-009B – Handling unsupported request parameter [Optional]

To find relevant responses and alleviate some frustration for clients who may not always check the OSDD before formulating a query, a server or gateway shall ignore the unsupported request parameters and process the query as if they were not present. The server, to report about the considered search parameters, should return an <os:Query role="request" ../> element with only the parameters taken into account.

2.4 Search Response

CEOS-BP-010 - Output encoding format support [Requirement]

CEOS OpenSearch implementations shall support Atom [Atom] as a mandatory format, as required by OpenSearch Geo and Time Extension [OGC 10-032r8.

CEOS-BP-011 - Support of dc:identifier in search response to allow for search-by-ID [Requirement]

The dc:identifier element in the search result shall allow navigating from search results to a single entry inside these results using the OpenSearch parameter {geo:uid} as described in [OGC 10-032r8].

This makes the following use cases possible,

- Put a link on a Web site pointing to a single (OpenSearch) catalog item (using a URL) to illustrate a particular event (e.g. an earthquake in the Himalaya)
- The ability to bookmark and retrieve a single item

CEOS-BP-011B – Result set navigation [Recommended]

CEOS OpenSearch implementations should provide navigation links for the first (rel="first"), previous (rel="prev" or "previous"), current (rel="self"), next (rel="next") and last pages (i.e. rel="last") of a result set (if applicable) using the rel attribute as defined in [OGC 10-032r8] and [RFC5988][5] and shown below.

The table below indicates which navigation links should be included in a result set for a number of border cases.

Use cases	rel="first"	rel="previous" or rel="prev"	rel="self"	rel="next"	rel="last"
First page of result set	Yes	No	Yes	Yes (if not last page)	Yes

---

[5] [OGC 10-032r8] only mentions "self", "prev", "previous", "next". "last" and "first" are defined in RFC5988.

Middle pages of result set	Yes	Yes	Yes	Yes	Yes
Last page of result set	Yes	Yes (if not first page)	Yes	No	Yes
Empty result set	No	No	Yes	No	No

E.g.

```
<feed>

      …

<os:totalResults>55</os:totalResults>

<os:itemsPerPage>10</os:itemsPerPage>

<os:startIndex>31</os:startIndex>


      <link href="foo.gov/opensearch/datasets.atom?
startIndex=1&numberOfResults=10" rel="first" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startIndex=21&numberOfResults=10" rel="prev" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startIndex=31&numberOfResults=10" rel="self" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startIndex=41&numberOfResults=10" rel="next" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startIndex=51&numberOfResults=10" rel="last" type="application/atom+xml"/>

      …

</feed>
```

The structure of href attribute of the Atom:link is irrelevant to the client as long as the semantic (e.g. next set of results) is preserved by the link returned by the server. The client is not supposed to "parse" the URL returned by the server. The server can thus return a link to, for example, the next page of the result set using a link with startIndex (i.e. startIndex=41) or an equivalent link with startPage (i.e. startPage=5).

The example below using startPage is equivalent to the previous example using startIndex.

```
<feed>

      …

<os:totalResults>55</os:totalResults>

<os:itemsPerPage>10</os:itemsPerPage>

<os:startIndex>31</os:startIndex>


      <link href="foo.gov/opensearch/datasets.atom?
startPage=1&numberOfResults=10" rel="first" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startPage=3&numberOfResults=10" rel="prev" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startPage=4&numberOfResults=10" rel="self" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startPage=5&numberOfResults=10" rel="next" type="application/atom+xml"/>

      <link href="foo.gov/opensearch/datasets.atom?
startPage=6&numberOfResults=10" rel="last" type="application/atom+xml"/>

      …

</feed>
```

CEOS-BP-012 - Metadata representation in search response [Recommended]

Although the Atom format allows any foreign (or user-defined) elements to be included and OpenSearch Extension for EO Products [OGC 13-026r8] along with O&M EOP Profile [OGC 10-157r4] suggests many options for metadata fields, CEOS OpenSearch implementations are encouraged to rely on atom:link@rel="alternate" or atom:link@rel="via" for detailed representation of the metadata. (The "via" relation should be preferred to convey the authoritative resource or the source of the information from where the atom:entry is made.)

CEOS-BP-012B – Provenance information [Optional]

CEOS OpenSearch implementations using syndication/aggregation of results provided by third-party catalogs are recommended[6] to include provenance information (at Atom Feed) level using an atom:link element with rel="via" and an href attribute referring to the original result set.

The above is only applicable if the original result set is accessible through an HTTP URL.

---

[6] See http://www.openarchives.org/rs/1.0/resourcesync#RePub.

CEOS-BP-012C – Reference to documentation [Recommended]

In the same context, atom:link@rel="describedby" should be used to reference to the documentation (a file with human-readable information about the resource).
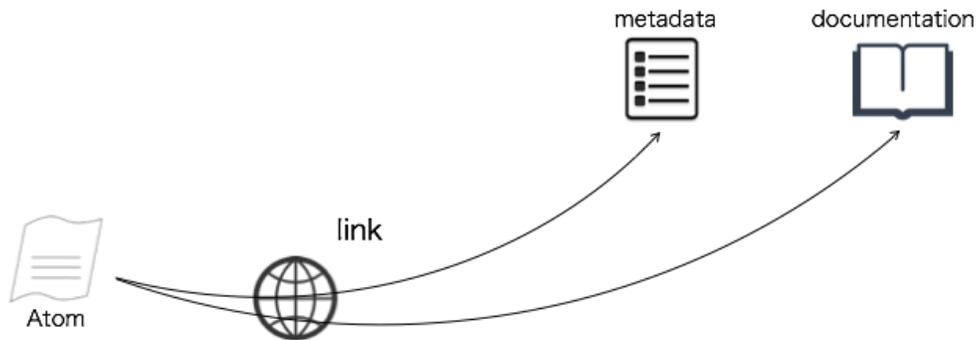
Figure 5: Referencing Metadata and Documentation

For example,

```
<link rel="alternate" href="http://foo.ceos.org/foo/dataset_abc.xml"
type="application/vnd.iso.19139+xml"/>

<link rel="describedby" href="http://foo.ceos.org/foo/dataset_abc.html"
type="text/html"/>
```

Table 7 defines the MIME types to be used to reference various metadata formats.

Metadata format	MIME Type
ISO 19139	application/vnd.iso.19139+xml
ISO 19139-2	application/vnd.iso.19139-2+xml
ISO 19115-3	application/vnd.iso.19115-3+xml
OGC 10-157r3	application/gml+xml;profile=http://www.opengis.net/spec/EOMPOM/1.0
OGC 10-157r4	application/gml+xml;profile=http://www.opengis.net/spec/EOMPOM/1.1

Dublin core[7]	application/xml
Markdown	text/x-markdown

Table 7 – MIME types for metadata formats

CEOS-BP-012D – Relation attribute values [Recommended]

CEOS OpenSearch implementations are recommended to use the following relation attribute values when describing artifacts associated with a resource (Atom entry):

Artifact	Definition	Relation	See also	Example
Metadata	file with (usually) structured information about corresponding data files	alternate or via	CEOS-BP-012	<link href="foo.xml" rel="alternate"/>
Browse	image of the data typically used for making data request decisions	icon	CEOS-BP-015	<link href="sample.gif" rel="icon"/>
Documentation	file with (human-readable[8]) information about the resource	describedby	CEOS-BP-012C	<link href="foo.pdf" rel="describedby"/>
Data	link representing a data file or other science data resource; may be large in size	enclosure	CEOS-BP-016	<link href="foo.hdf" rel="enclosure"/>
OSDD	link to an OpenSearch Description Document; useful for recursive searching	search	CEOS-BP-001	<link href="osdd.xml" rel="search"/>

Table 8 – Relation attribute values

CEOS-BP-012E – Link type attribute [Recommended]

CEOS OpenSearch implementations shall specify the media (MIME) type of the artifact associated with a resource by specifying the "type" attribute of the Atom link element[9].

This requirement allows a client to determine which resource type a HATEOAS Atom link refers to. E.g. a "describedby" link may point to a human readable representation or to an ISO 19139 service metadata file of the INSPIRE Download service. Clients can make this distinction by checking the media type provided in the "type" attribute.

---

[7] According to the XML schema http://www.loc.gov/standards/sru/recordSchemas/dc-schema.xsd

[8] The "type" attribute of the Atom link shall determine whether the resource is human-readable.
[9] This requirement ensures compliance with TG Requirement 30 in [INSPIRE].

CEOS-BP-013 - atom:summary [Recommended]

The default value for atom:summary is "text" - i.e. if MIME type is not specified then the client should assume that it is of type "text". Otherwise MIME type should be specified according to Table 7. Summaries of type 'text/html", should be correctly escaped. We recommend that CEOS OpenSearch implementations have "useful" information in the actual metadata and not only in atom:summary. The canonical source of information should be described in the metadata (atom:link or feed/entry) and not in the atom:summary.

CEOS-BP-013B – Dublin Core date [Recommended]

For representing temporal extents of entries in the search result, we recommend you use a Dublin Core date (dc:date) element as per [OGC 10-032r8] for representing either,

- A single date

- A single date-time

- A date-time range

- An open-ended date-time range

CEOS-BP-014 - GeoRSS [Recommended]

For representing geographical extent in GeoRSS in the search result, we recommend (when applicable) using "GeoRSS Simple" over "GeoRSS GML".

When not applicable (e.g. footprint made of multiple polygons), "GeoRSS GML" (i.e. <georss:where>) should be used (even though the strict application of GeoRSS GML does not allow representing a multi-polygon. Only allows four simple GML root elements to appear under georss:where.See http://www.georss.org/xml/1.0/georss.xsd for further information.

CEOS-BP-014B – GeoRSS multi-polygon footprint [Recommended]

For representing geographical extent consisting of a multiple polygons in GeoRSS in the search result, it is recommended to use "GeoRSS GML" with a <gml:MultiSurface> element containing multiple <gml:Polygon> elements.

E.g.

```
<georss:where>
<gml:MultiSurface gml:id="MULSF01" srsName="EPSG:4326">
<gml:surfaceMembers>
<gml:Polygon xmlns:gml="http://www.opengis.net/gml" gml:id="POLN1004F1">
<gml:exterior>
<gml:LinearRing>
<gml:posList srsDimension="2">42.80386 7.22599 51.65319 4.44298 58.690876
```

```
1.600294 63.93042 -1.190491 69.113703 -5.017015 72.515489 -8.589162
75.839731 -13.639094 79.017327 -21.416325 80.505193 -27.095671 81.875982 -
34.701757 83.060111 -45.048111 83.947141 -58.914241 84.394294 -76.114221
84.297169 -94.390703 83.680793 -110.571486 82.675037 -123.155644 81.415609 -
132.447313 79.997781 -139.300653 78.479783 -144.461335 76.896266 -148.453273
73.608796 -154.206101 71.926502 -156.353166 68.5144 -159.740891 65.059909 -
162.325304 61.577619 -164.395098 56.319203 -166.882324 51.031772 -168.896467
35.062954 -173.502794 5.86342 -180 -21.10288 -180 7.040615 -173.900731
23.088247 -169.974902 37.250369 -165.628752 47.742935 -161.263581 52.917102
-158.434729 56.325915 -156.176491 59.690156 -153.507183 62.993884 -
150.281098 67.778891 -143.898159 70.79027 -138.083214 72.21513 -134.50441
74.827617 -125.523104 76.967397 -113.376084 78.371187 -97.57291 78.705462 -
88.558317 78.760132 -79.236134 78.034898 -61.41943 77.302514 -53.606223
75.280825 -40.766619 72.742141 -31.245854 69.880667 -24.184437 66.815004 -
18.828798 63.615602 -14.64938 58.654358 -9.850203 53.567708 -6.203163
48.399967 -3.299028 41.425982 -0.178961 42.80386 7.22599</gml:posList>

</gml:LinearRing>

</gml:exterior>

</gml:Polygon>

<gml:Polygon xmlns:gml="http://www.opengis.net/gml" gml:id="POLN1004F2">

<gml:exterior>

<gml:LinearRing>

<gml:posList srsDimension="2">5.86342 180 -13.180367 175.749402 -27.402929
172.044313 -37.983457 168.635021 -46.70575 165.032035 -53.583872 161.287771
-60.31448 156.214145 -65.198574 150.919337 -68.325776 146.238267 -69.833011
143.408601 -72.68634 136.414694 -74.003946 132.064691 -76.316313 121.114386
-77.994851 106.595877 -78.752838 88.93359 -78.408579 70.635228 -77.840638
62.263658 -76.073449 48.176348 -73.70415 37.605582 -70.955567 29.784574 -
68.833389 25.410055 -71.395897 10.531073 -73.798945 13.549547 -77.064662
19.409287 -78.635454 23.484612 -80.138583 28.76103 -81.53812 35.77544 -
82.773822 45.282798 -83.747956 58.115927 -84.324346 74.475206 -84.379346
92.704855 -83.89886 109.640667 -82.992149 123.200212 -81.799327 133.306555 -
80.426659 140.749386 -78.940803 146.321501 -77.381562 150.602066 -75.772914
153.979897 -72.461612 158.973041 -67.361744 163.939913 -60.437968 168.253072
-51.682985 171.934458 -39.323454 175.681849 -21.10288 180 5.86342
180</gml:posList>

</gml:LinearRing></gml:exterior>

</gml:Polygon>

</gml:surfaceMembers>

</gml:MultiSurface>

</georss:where>
```

CEOS-BP-014C – GeoRSS multi-point[10] footprint [Recommended]

For representing geographical extent consisting of a multiple points in GeoRSS in the search result, it is recommended to use "GeoRSS GML" with a <gml:MultiPoint> element containing multiple <gml:Point> elements.

E.g.

```
<georss:where>

<gml:MultiPoint gml:id="MULTIPOINTN10051">

<gml:pointMember xmlns:gml="http://www.opengis.net/gml">

<gml:Point gml:id="POINTN100511">

  <gml:pos srsDimension="2">49.695066 -136.337212</gml:pos>
</gml:Point>

</gml:pointMember>

<gml:pointMember xmlns:gml="http://www.opengis.net/gml">

<gml:Point gml:id="POINTN100512">

  <gml:pos srsDimension="2">49.699539 -136.322377</gml:pos>
</gml:Point>

</gml:pointMember>

</gml:MultiPoint>

</georss:where>
```

CEOS-BP-014D – GeoRSS multi-line[11] footprint [Recommended]

For representing geographical extent consisting of a multiple lines in GeoRSS in the search result, it is recommended to use "GeoRSS GML" with a <gml:MultiGeometry> element containing multiple <gml:LineString> elements.

E.g.

```
<georss:where>

<gml:MultiGeometry gml:id="MULGN10051">

<gml:geometryMembers>

<gml:LineString xmlns:gml="http://www.opengis.net/gml" gml:id="IDLSN100511">

<gml:posList srsDimension="2">-34.7796 102.055 -39.7836 100.515 -44.2692
98.9729 -48.3553 97.3886 -51.9754 95.7923 -55.3822 94.068 -58.412 92.2924 -
61.1428 90.4304 -63.6322 88.4441 -65.8898 86.3242 -67.9982 83.9763 -69.8558
```

---

[10] E.g. applicable for observations by the ENVISAT GOMOS (spectrometer) sensor.
[11] E.g. applicable for observations by the ENVISAT RA2 (altimeter) sensor.

```
81.5103 -71.5184 78.8761 -73.0474 75.9704 -74.3819 72.9188 -75.614 69.5145 -
76.7237 65.7785 -77.9708 60.4664 -79.0444 54.4087 -79.9152 47.7539 -80.6
40.4392 -81.1113 32.2753 -81.4307 23.3304 -81.5365 14.3493 -81.4318 5.02661
-81.1431 -3.30081 -80.6707 -11.1964 -80.0251 -18.4329 -79.2102 -24.9842 -
78.226 -30.8705 -77.0688 -36.1379 -75.7236 -40.8685 -74.1629 -45.1503 -
73.2589 -47.2138 -72.3029 -49.1436 -71.2517 -51.0222 -70.1403 -52.7826 -
68.9422 -54.4681 -67.6573 -56.0757 -66.3226 -57.5657 -64.8832 -59.0038 -
63.3576 -60.3703 -61.7367 -61.6756 -59.9729 -62.9543 -58.1039 -64.1764 -
54.0024 -66.4875 -49.3644 -68.6552 -44.8535 -70.4491 -39.7916 -72.203 -
34.1674 -73.9239 -27.8413 -75.6594 -21.7536 -77.1911 -14.7287 -78.8462
10.7406 -84.4874 20.603 -86.7673 30.2014 -89.2029 38.2408 -91.5353 42.4808 -
92.9324 46.3141 -94.3356 49.8689 -95.7931 53.1354 -97.306 56.143 -98.8914
58.8823 -100.545 61.3447 -102.255 63.6636 -104.118 66.1536 -106.482 68.3495
-108.991 70.3257 -111.72 72.0557 -114.616 73.5855 -117.724 74.9991 -121.234
76.2585 -125.092 77.3546 -129.258 78.3368 -133.933 79.1907 -139.099 79.9051
-144.681 80.502 -150.861 80.9664 -157.523 81.2974 -164.657 81.4918 -172.36
81.5337 -180</gml:posList>

</gml:LineString>

<gml:LineString xmlns:gml="http://www.opengis.net/gml/3.2"
gml:id="IDLSN100512">

<gml:posList srsDimension="2">81.5337 180 81.4334 172.547 81.1894 165.185
80.8255 158.488 80.3222 152.047 79.7197 146.336 78.9612 140.832 78.0981
135.945 77.1125 131.509 76.0023 127.49 74.7475 123.806 73.3589 120.476
71.7874 117.381 70.0151 114.507 68.0696 111.896 65.832 109.403 63.451
107.187 61.3014 105.475 58.5991 103.615 55.742 101.919 52.7419 100.365
49.454 98.8658 45.7702 97.3789 41.7777 95.9426 37.3975 94.5253 29.3939
92.238 19.8126 89.8302 10.317 87.6446 -13.1049 82.4689 -24.0868 79.8694 -
33.8473 77.2688 -38.0684 76.0048 -42.0022 74.718</gml:posList>

</gml:LineString>

</gml:geometryMembers>

</gml:MultiGeometry>

</georss:where>
```

CEOS-BP-014E – Minimum-bounding rectangle [Optional]

CEOS OpenSearch implementations should render spatial extents using a minimum-bounding rectangle (MBR) with a <georss:box> element in addition to the native more accurate representation of that extent with GeoRSS Simple or GeoRSS GML. The value of the georss:box element must be an array of length 4 (two lat/long pairs), with the southwesterly point followed by the northeasterly point .

Note that clients can distinguish the MBR from the native extent as georss:box is not to be used for representing a native spatial extent. The MBR shall envelop, with the minimum bounding box area, the EO acquisitions footprints, represented with GeoRSS Simple or GeoRSS GML.

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CEOS-BP-015 - Browse image [Recommended]

We recommend that CEOS OpenSearch implementations provide a URL to the granule's browse image when available, by either atom:link@rel="icon" or Media RSS (e.g. media:content/media:Category=QUICKLOOK).

CEOS-BP-015B – Multiple browse images [Optional]

We recommend that CEOS OpenSearch provide the URLs to the granule's browse images when available, by either including multiple atom:link@rel="icon" or including multiple Media RSS <media:group> elements.

In case Media RSS is used, then <media:group> elements should only group <media:content> elements which are representations of the same content. Therefore, it is recommended in this case to provide the URL to the browse images via multiple <media:group> elements as defined in [OGC 13-026r8], when a single granule has multiple browse images (See also multi-polygon footprint).

E.g.

```
<feed xmlns="http://www.w3.org/2005/Atom

xmlns:media="http://search.yahoo.com/mrss/" …>

…

<entry>

…

  <media:group>

   <media:content
url="http://foo.ceos.org/browse/ABC/2012/08/01/PASS_ABC_210671_3_32488_1.jpg
" type="image/jpeg" medium="image">

     <media:category
scheme="http://www.opengis.net/spec/EOMPOM/1.1">QUICKLOOK</media:category>

   </media:content>

  </media:group>

  <media:group>

   <media:content
url="http://foo.ceos.org/browse/ABC/2012/08/01/PASS_ABC_210671_3_32488_2.jpg
" type="image/jpeg" medium="image">

     <media:category
scheme="http://www.opengis.net/spec/EOMPOM/1.1">QUICKLOOK</media:category>

   </media:content>

  </media:group>
```

```
</entry>
```

CEOS-BP-016 - Data access [Recommended]

We recommend CEOS OpenSearch implementations use Atom link elements with an attribute of rel="enclosure" and a MIME type attribute type="xxx" for embedding data access URLs in granule level search responses.

The above data access URL should also be applied in case multiple files are available for data access through a single .ZIP file or via a Metalink[12] file. If multiple physical files cannot be grouped however, the mechanism below can be used instead.

CEOS-BP-016B - Data access to multiple files [Optional]

When data access to a granule in a granule search response is to be provided in multiple physical files, each file should be linked to via a separate Atom link element. Each of these links should have an attribute rel="section" along with a MIME type attribute type="xxx" for embedding the data access URL to each file[13].

CEOS-BP-016C - Data access for data download and order [Optional]

CEOS recommends the use of type attribute value to further distinguish data order link and data download link:

- For data order link: set the value of type attribute as "text/html"

  Example of <link> with granule order URL:
  <link rel="enclosure" type="text/html" title="" href=""/>

- For data download link: set the value of type attribute with the appropriate MIME type which is compatible with downloadable dataset format.

  Example of <link> with granule download URL:
  <link rel="enclosure" type="application/binary" title=" " href=""/>

2.5 Exceptions

CEOS-BP-017 - Exception codes [Recommended]

OpenSearch Geo and Time Extensions [OGC 10-032r8] recommends the use of HTTP status codes as following, 4xx for client errors, and 5xx for server errors.

---

[12] https://tools.ietf.org/html/rfc5854
[13] This requirement is equivalent to TG Requirement 32 in [INSPIRE].

- 400 Bad Request: The request has an invalid syntax (i.e. badly formatted geometry)
- 413 Request Entity Too Large: The request originates too many returnable hits
- 415 Unsupported media type: Media type in the request is not available or valid.
- 500 Internal Server Error: Default code for the server side for an execution error.
- 501 Not Implemented: When requesting an unimplemented feature (e.g. relation operator not supported).
- 503 Service Unavailable: When the search service is temporarily not available (due to overload or other reasons).
- 504 Gateway Timeout: When the search engine is a broker or aggregator to other services that fail to produce an answer within a giving time frame.

CEOS OpenSearch implementations are recommended to support these codes.

2.6 Future discussions

Future discussion topics include the following.

- Sorting, ranking / relevance score
- Aggregation of multiple source results at client side
- Recommended Schema.org itemtype/itemprop to be used for granule metadata and collection metadata

3 Closer look on implementations

This chapter shows comparison among implementations: CWIC, FedEO, and CNES. (other implementations may be added in the future)

3.1 Basics

3.1.1 OSDD URL

3.1.1.1 Collection Level

IDN/CWIC	https://cmr.earthdata.nasa.gov/opensearch/collections/descriptor_document.xml?clientId=<your client id here>
FedEO	http://fedeo.esa.int/opensearch/description.xml (rel="collection")
CNES	http://theia.cnes.fr/resto/api/collections/describe.xml

3.1.1.2 Granule Level (examples)

IDN/CWIC	http://cwic.wgiss.ceos.org/opensearch/datasets/osdd.xml?clientId=cwicClient http://cwic.wgiss.ceos.org/opensearch/datasets/Landsat_8/osdd.xml?clientId=cwicClient
FedEO	Option 1 (specific) http://fedeo.esa.int/opensearch/description.xml?parentIdentifier={dataset-id} Option 2 (general) http://fedeo.esa.int/opensearch/description.xml (rel="results" - default) Example 1 http://fedeo.esa.int/opensearch/description.xml?parentIdentifier=EOP%3AVITO%3AVGT_S10 Example 2: http://fedeo.esa.int/opensearch/description.xml?parentIdentifier=MIR_SC_F0_
CNES	http://theia.cnes.fr/resto/api/collections/{collection}/describe.xml where {collection} should be replaced by the name of the collection (e.g. Landsat)

3.1.2 Search URL

3.1.2.1 Collection Level

IDN/CWIC	https://cmr.earthdata.nasa.gov/opensearch/collections.atom?keyword=Landsat_8&clientId=cswOpenSearchDoc
FedEO	http://fedeo.esa.int/opensearch/request/?httpAccept=application/atom%2Bxml&query=landsat Note: parentIdentifier=EOP:ESA:FEDEO is default value for EOP:ESA:FEDEO "parentIdentifier" and can be added to request above. application/atom+xml is the default value for the httpAccept parameter.
CNES	http://theia.cnes.fr/resto/api/collections/search.atom?q=Landsat

3.1.2.2 Granule Level (examples)

IDN/CWIC	http://cwic.wgiss.ceos.org/opensearch/granules.atom?datasetId=Landsat_8&startPage=1&count=1&timeStart=2017-01-01T00:00:00Z&timeEnd=2017-02-24T23:59:59Z&clientId=foo
FedEO	http://fedeo.esa.int/opensearch/request/?httpAccept=application%2Fatom%2Bxml&parentIdentifier=EOP%3ASPOT%3AMULTISPECTRAL_10m&startRecord=1&startDate=2013-09-13T00%3A00%3A00Z&endDate=2013-09-16T10%3A00%3A59Z&instrumentShortName=HRGNb1&bbox=3.711001014709498%2C44.549828243256%2C22.617251014709005%2C52.987328243256
CNES	http://theia.cnes.fr/resto/api/collections/Landsat/search.atom?lang=en&q=images%20acquired%20in%20may%202013%20over%20Paris

3.1.3 Documents

IDN/CWIC	CWIC Client Partner Guide (OpenSearch) v0.9 CWIC Data Partner's Guide (OpenSearch) v0.9 CWIC Software Exception Handling v1.2
FedEO	FEDEO Client Partner Guide (v1.1) [FedEO-CPG]
CNES	http://github.com/jjrom/resto

3.2 Remarkable Practices

3.2.1 OSDD

3.2.1.1 Support of parameter extension

IDN/CWIC	**YES** Note: Recommended attributes are "name", "value", "title". "uiDisplay" will be an optional attribute in the future.
FedEO	**YES**
CNES	**YES**

3.2.1.2 Support of Explain operation (SRU)

The Explain document (from the OASIS SearchRetrieve standard) provides additional metadata about the search endpoint, the parameters accepted by the search endpoint and the possible response schemas. If fulfils a similar role as an OGC Capabilities document.

IDN/CWIC	**NO**
FedEO	**YES**
CNES	**NO**

3.2.2 Output encoding format in a search URL

IDN/CWIC	resource extension (e.g. description.atom) and content negotiation
FedEO	a search parameter (httpAccept). This search parameter is borrowed from the OASIS SearchRetrieve (and SRU) standard. Note : Other ways i.e. content-negotiation using HTTP header (httpAccept) and resource extension will be supported in the future. Q2 2015)
CNES	resource extension (e.g. search.atom) and content negotiation

3.2.3 Support of 2 step search

IDN/CWIC	**YES**

FedEO	**YES**
CNES	**YES**

3.2.4 Search Parameters

3.2.4.1 Supported Search Parameters

C : Supported in Collection Level search parameter,

G : Supported in Granule Level search parameter

Superscript : M : Mandatory, O : Optional, 1 : dependent on subsidiary catalog

Namespaces prefixes : Table 2 of OGC 10-032r8 and Table2 of OGC 13-026r8.

Search Parameters	IDN/CWIC	FedEO	CNES
count	CG	C	G
searchTerms	C	CG^1	CG
startIndex	G	C	CG
startPage	G	CG	CG
dc:publisher		C	
dc:subject		CG^1	
dc:title		C^1	
dc:type		C^1	
time:start	CG	CG	G
time:end	CG	CG	G
geo:box	CG	CG	G
geo:geometry			
geo:lat		CG	G
geo:lon		CG	G
geo:name		CG	G
geo:radius		CG	G
geo:uid		CG	G
eo:acquisitionStation		C^{1}G^1	

Search Parameters	IDN/CWIC	FedEO	CNES
eo:acquisitionType		G[1]	
eo:acquisitionSubType		G[1]	
eo:antennaLookDirection		G[1]	
eo:archivingCenter		G[1]	
eo:cloudCover		G[1]	G
eo:completionTimeFrom AscendingNode		G[1]	
eo:compositeType		G[1]	
eo:dopplerFrequency		G[1]	
eo:frame		G[1]	
eo:illuminationAzimuthAngle		G[1]	
eo:illuminationElevationAngle		G[1]	
eo:imageQualityDegradation		G[1]	
eo:incidenceAngleVariation		G[1]	
eo:instrument		CG[1]	G
eo:maximumIncidenceAngle		G[1]	
eo:minimumIncidenceAngle		G[1]	
eo:orbitDirection		G[1]	
eo:orbitNumber		C[1]G[1]	G
eo:orbitType		G[1]	
eo:organisationName		C	G
eo:parentIdentifier	G (datasetId)	CG[1]	
eo:platformSerialIdentifier		G[1]	
eo:platform		CG[1]	G
eo:polarisationChannels		G[1]	
eo:polarisationMode		G[1]	
eo:processingCenter		C[1]G[1]	
eo:processingLevel		G[1]	G
eo:processorName		G[1]	

Search Parameters	IDN/CWIC	FedEO	CNES
eo:productionStatus		G[1]	
eo:productType		CG[1]	G
eo:resolution		G[1]	G
eo:sensorType		G[1]	
eo:sensorMode		G[1]	
eo:snowCover		G[1]	G
eo:startTimeFromAscendingNode		G[1]	
eo:swathIdentifier		G[1]	
eo:track		C[1]	
semantic:classifiedAs		C	
sru:recordSchema		CG	

3.2.5 Supported output format

IDN/CWIC	ATOM, RSS[1], HTML[1] [1] IDN only
FedEO	ATOM, RSS[1], SRU[1], RDF/XML[1], JSON-LD[2], Turtle[2], HTML[2] [1] depends on data partner [2] not advertised in operational environment.
CNES	ATOM, GeoJSON, HTML

3.2.6 Output schema support

IDN/CWIC	**NO**
FedEO	**YES** (dc, iso, O&M EOP v1.0 and v1.1)
CNES	**NO**

3.2.7 Free Keyword notation (searchTerms)

IDN/CWIC	Conveyed by Parameter Extension (Parameter/link@rel="profile")
FedEO	whitespace for AND double quote for phrase

CNES	Natural language queries (e.g. "images over Paris between may and june 2013")

3.2.8 Pagination

IDN	startPage, count
CWIC	startIndex, startPage, count
FedEO	startIndex, startPage, count
CNES	startIndex, startPage, count

3.2.9 Search Result

3.2.9.1 Browse

IDN/CWIC	link@rel="icon"
FedEO	link@rel="icon" also supports Media RSS notation (use of media:content/media:Category=QUICKLOOK)
CNES	link@rel="icon" also supports Media RSS notation (use of media:content/media:Category=QUICKLOOK)

3.2.9.2 Thumbnail

IDN/CWIC	N/A
FedEO	Media RSS notation (use of media:content/media:Category=THUMBNAIL)
CNES	Media RSS notation (use of media:content/media:Category=THUMBNAIL)

3.2.9.3 Mask Image

IDN/CWIC	N/A
FedEO	Media RSS notation (use of media:content/media:Category=MASK)
CNES	N/A

3.2.9.4 Metadata

IDN/CWIC	link@rel="via"
FedEO	link@rel="alternate" or link@rel="via"
CNES	link@rel="via"

3.2.9.5 Documentation

IDN/CWIC	link@rel="describedBy"
FedEO	link@rel="describedBy"
CNES	N/A

3.2.9.6 Data

IDN/CWIC	link@rel="enclosure"
FedEO	link@rel="enclosure"
CNES	link@rel="enclosure"

3.2.10 Error Handling

3.2.10.1 Exception Status Code (4xx, 5xx)

IDN/CWIC	Compliant with OGC OpenSearch [OGC 10-032r8]
FedEO	Compliant with OGC OpenSearch [OGC 10-032r8] and OGC OWS Common [OGC 06-121]
CNES	Compliant with OGC OpenSearch [OGC 10-032r8]

Annex A: LIST OF OPENSEARCH ENDPOINTS

This appendix shows OpenSearch endpoints of CEOS agency catalogs.

FedEO:

http://fedeo.esa.int/opensearch/description.xml

CWIC:

http://cwic.wgiss.ceos.org/opensearch/datasets/osdd.xml?clientId=<your client id here>

IDN:
https://cmr.earthdata.nasa.gov/opensearch/collections/descriptor_document.xml?clientId=<your client id here>

CNES:

http://theia.cnes.fr/api/collections/describe.xml

Annex B: EXAMPLES

This appendix contains example code snippets from CEOS agencies' implementations.

B1. OSDD (Collection Level)

IDN/CWIC

```
https://cmr.earthdata.nasa.gov/opensearch/collections/descriptor_document.xm
l?clientId=<your client id here>
```

FedEO

```
http://fedeo.esa.int/opensearch/description.xml
```

CNES

```
http://theia.cnes.fr/resto/api/collections/describe.xml
```

Annex C: SEARCH-ENGINE-FRIENDLY CATALOG

This appendix gives some hint to make a catalog Search-Engine-Friendly with schema.org

Only Atom format is required as an output format response. However, for implementations that support also HTML as an output format, it is recommended to use schema.org within the provided HTML response.

Additionally there are numerous ways in which that HTML can be designed to make it visible to search engines and, therefore, a searcher interested in earth science data.

Schema.org provides a means to expose datasets in search engine results that is explicitly geared towards earth science datasets (https://schema.org/Dataset). Implementers can mark up their HTML in a manner that allows crawlers to index their data in terms of a variety of parameters including spatial and temporal extent. The following subsections illustrate the use of the schema.org vocabulary along with microdata and JSON-LD. For more information, please refer to [schema.org].

C1. Using Microdata

For example:

```
<li itemscope itemtype='http://schema.org/Dataset'>
 <span itemprop='alternateName'>doi:10.3334/ORNLDAAC/1</span>
 <span itemprop='version' >1</span>
 <span itemprop='provider' >ORNL_DAAC</span>
 <div itemprop='description' >ABSTRACT: USGS 15 minute stream flow data for
Kings Creek on the Konza Prairie</div>
 <span itemprop='temporal' >2000-01-01T00:00:00Z/</span>
 <span itemprop='spatial' >-55.0 -180.0 90.0 180.0</span>
</li>
```

And another example :

```
<ul class='results' itemscope itemtype='http://schema.org/DataCatalog'>
   <li class="dataset" itemscope itemtype='http://schema.org/Dataset'>
    <h2 itemprop='name'>15 Minute Stream Flow Data: USGS (FIFE)</h2>
    <span class="uid">C179003030-ORNL_DAAC</span>
    <div class='dataset-identification'><span>Dataset Information:</span>
     <div class='tuple' >Short name: <span class='value short_name'
```

```
itemprop='alternateName' >doi:10.3334/ORNLDAAC/1</span></div>
    <div class='tuple' >Version ID: <span class='value version_id'
itemprop='version' >1</span></div>
    <div class='tuple' >Data center: <span class='value data_center'
itemprop='provider' >ORNL_DAAC</span></div>
  </div>
  <span><div class='temporal'><span>Temporal extent:</span><div
class='tuple'>Start: <span class='start value'>1984-12-
25T00:00:00.000Z</span></div><div class='tuple'>Stop: <span class='stop
value'>1988-03-04T00:00:00.000Z</span></div></div></span>
  <span class='temporal schema_org' itemprop='temporalCoverage' >1984-12-
25T00:00:00.000Z/1988-03-04T00:00:00.000Z</span>
  <span><div class='spatial'><span>Spatial extent:</span><div
class='tuple'>Bounding box: <span class='spatial-value value'>39.1 -96.6
39.1 -96.6</span></div><div class='tuple'>Point: <span class='spatial-value
value'>39.1 -96.6</div></span></div></span>
  <span class='spatial schema_org' itemprop='spatialCoverage' >39.1 -96.6
39.1 -96.6</span>
    <div class='dataset-identification'><span>Description:</span>
     <div class='tuple description' itemprop='description' >ABSTRACT: USGS
15 minute stream flow data for Kings Creek on the Konza Prairie</div>
    </div>
  <div>
   <span class='link-title'>Links:</span>
   <ul class='links'>
     <li><a class='dataset_link' href="http://daac.ornl.gov/cgi-
bin/dsviewer.pl?ds_id=1" itemprop='url' >Data link</a></li>
     <li><a class='dataset_link'
href="http://daac.ornl.gov/FIFE/guides/15_min_strm_flow.html" itemprop='url'
>USGS 15 minute stream flow data for Kings Creek on the Konza Prairie (VIEW
RELATED INFORMATION)</a></li>
     <li><a class='dataset_link'
href="http://gcmd.nasa.gov/getdif.htm?FIFE_STRM_15M" itemprop='url'
>doi:10.3334/ORNLDAAC/1</a></li>
     <li><a class='dataset_link'
href="https://api.echo.nasa.gov:443/catalog-
rest/echo_catalog/datasets/C179003030-ORNL_DAAC.xml" itemprop='url' >Product
metadata</a></li>
   </ul>
```

```
    </div>

    <div class="granule-search">

     <a
href="/opensearch/granules?clientId=our_html_ui&amp;dataCenter=ORNL_DAAC&amp
;dataset_cursor=1&amp;dataset_id=15+Minute+Stream+Flow+Data%3A+USGS+%28FIFE%
29&amp;dataset_number_of_results=10&amp;shortName=doi%3A10.3334%2FORNLDAAC%2
F1&amp;spatial_type=bbox


&amp;versionId=1"><span class="ui-state-default ui-corner-all open-search-
button">Granule Search</span></a>

    </div>

   </li>
```

C2. Using JSON-LD

For example

```
<html>

<head>
<title>Search Results</title>
<script type="application/ld+json">
{
 "@context" : "http://schema.org",
 "@type" : "Dataset",
 "name" : "SeaSat L-Band SAR Level-1 Ellipsoid Geocoded Precision Image
(SEA_GEC_1P)",
 "alternateName" : "SEA_GEC_1P",
 "description" : "The SEA_GEC_1P product is generated by geocoding of data
processed to the SEA_PRI_1P product specification. Products are generated in
UTM map coordinates, with output pixel spacing at 12.5 metres. Geocoding is
undertaken on the approximation that all image points lie on the surface of
the WGS84 ellipsoid adjusted for a local representative vertical datum. It
should be noted that mapping distortions will occur as a consequence of
terrain relief.",
 "provider" : {
  "@type" : "Organization",
  "name" : "ESA/ESRIN",
  "address" : {
   "@type" : "PostalAddress"
  },
  "email" : "eohelp@eo.esa.int"
 },
 "publisher" : {
  "@type" : "Organization",
  "name" : "ESA/ESRIN",
  "address" : {
   "@type" : "PostalAddress"
  },
  "email" : "eohelp@eo.esa.int"
 },
 "dateModified" : "1978-07-13T00:00:00Z",
 "keywords" : "FedEO, ESA LDS, ocean, coast, snow, ice, land, Science
Keywords > Earth Science > Spectral/Engineering > Visible Wavelengths >
Visible Imagery, Science Keywords > Earth Science > Terrestrial Hydrosphere
> Snow/Ice > Ice Extent, SEASAT 1, SAR",
 "temporalCoverage" : "1978-07-13/1978-10-10",
 "spatialCoverage" : {
  "@type" : "Place",
  "geo" : {
   "@type" : "GeoShape",
   "polygon" : "-10.0 -125.0 70.0 -125.0 70.0 20.0 -10.0 20.0 -10.0 -125.0"
  }
 }
}
</script>
</head>
</html>
```