

NASA Global Change Master Directory/International Directory Network

Keyword Management Service Application Program Interface

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Contents

- 1 REST paths
 - 1.1 Concept Resource
 - 1.2 Concepts - Root
 - 1.3 Concepts - By Pattern
 - 1.4 Concepts - By Concept Scheme + Pattern
 - 1.5 Concepts Operations Resource
- 2 Authentication
- 3 Governance of Keywords

Keyword Management Service (KMS) is a RESTful web service for maintaining keywords (science keywords, platforms, instruments, data centers, locations, projects, services, resolution, etc.) in the GCMD/IDN system. It allows access to the keywords maintained in the Keyword Management System as SKOS Concepts (RDF) or as XML <Concept /> objects. Simple Knowledge Organization System (SKOS) is a standard defined for representation of thesauri, classification schemes, taxonomies, subject-heading systems, or any other type of controlled vocabulary. SKOS is built upon RDF and RDFS, and its main objective is to enable easy publication of controlled structured vocabularies for the Semantic Web. SKOS is currently developed within the W3C framework. Attributes of a SKOS RDF Concept Here is a list of attributes associated with a SKOS Concept:

SKOS concept

- concept scheme (e.g., science keywords, platforms, instruments, etc.)
- concept id (globally unique, read only)
- broader - list of broader concepts
- narrower - list of narrower concepts
- related - list of related concepts
- definition- one per language
- pref label - preferred, one per language
- pref symbol - image of the concept, second phase but interface should support it's addition
- alt labels - list, multiple per language
- alt symbol - image, second phase but interface should support it's addition
- hidden labels - list (common misspellings), second phase?
- change note - list of changes, human and computer inserted sorted by time
 - date - computer managed
 - note

REST paths

Accessing and updating the SKOS concepts is made possible through the following list of REST-based paths.

Concept Resource

complete details of the concept with the given conceptId

URL	/concept/{conceptId}
Method	GET
HTTP Accepts	<ul style="list-style-type: none">▪ application/rdf+xml▪ application/xml
Path Params	<ul style="list-style-type: none">▪ conceptId
Query Params	<ul style="list-style-type: none">▪ version▪ format:<ul style="list-style-type: none">▪ "xml"▪ "rdf (default)"
Returns	<ul style="list-style-type: none">▪ media types: "application/xml", "application/rdf+xml"▪ Error code: 404 Not Found (identifier not found)

Examples:

Response in format RDF using <http://gcmdservices.gsfc.nasa.gov/kms/concept/0d7a2c62-d0b0-4a13-8412-d7cc8d68aeff?format=rdf>

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#">
  <gcmd:termsOfUse xmlns:gcmd="http://gcmd.gsfc.nasa.gov/">
    See http://gcmd.nasa.gov/r/1/TermsOfUse
  </gcmd:termsOfUse>
  <skos:Concept rdf:about="0d7a2c62-d0b0-4a13-8412-d7cc8d68aeff"
    xml:base="http://sandbox-qal.gsfc.nasa.gov/kms/concept/"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#">
    <skos:inScheme rdf:resource=
      "http://sandbox-qal.gsfc.nasa.gov/kms/concepts/concept_scheme/chronounits"/>
    <skos:prefLabel xml:lang="en">CRETACEOUS</skos:prefLabel>
    <skos:broader rdf:resource="a0bd8bda-adb6-4ea2-ae02-5caef1557ad6"/>
</skos:Concept>
```

Concepts - Root

Returns list of all root concepts (that are at the top of the hierarchy) as conceptBriefs

URL	/concepts/root
Method	GET
HTTP Accepts	<ul style="list-style-type: none">▪ application/rdf+xml▪ application/xml
Path Params	<ul style="list-style-type: none">▪ none
Query Params	<ul style="list-style-type: none">▪ version▪ format<ul style="list-style-type: none">▪ "xml"▪ "rdf (default)"
Returns	<ul style="list-style-type: none">▪ media types:<ul style="list-style-type: none">▪ "application/xml"▪ "application/rdf+xml"

Examples:

Response in format RDF using url <http://gcmdservices.gsfc.nasa.gov/kms/concepts/root?format=rdf>:

```
<?xml version="1.0" encoding="UTF-8"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#">
  <gcmd:termsOfUse xmlns:gcmd="http://gcmd.gsfc.nasa.gov/">
    See http://gcmd.nasa.gov/r/1/TermsOfUse
  </gcmd:termsOfUse>
  <skos:Concept rdf:about="5a7a033c-c1f0-40c2-949c-4b4be4410ce6"
    xml:base="http://sandbox-qa1.gsfc.nasa.gov/kms/concept/"
    xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#">
    <skos:inScheme rdf:resource="
      http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/chronounits"/>
    <skos:prefLabel xml:lang="en">Chronostratigraphic Units</skos:prefLabel>
    <skos:narrower rdf:resource="a0f8c033-b9e2-49e8-bc61-c39c962edff2"/>
    <skos:narrower rdf:resource="af145656-986a-4969-bb77-6e5b2cff1ede"/>
    <skos:narrower rdf:resource="c7626c29-a1d3-4d0c-a263-616fe060f164"/>
    <skos:narrower rdf:resource="4407ca3c-3dc0-402c-bfc3-4dabd23f283a"/>
  </skos:Concept>
  ...
```

</rdf:RDF>

Concepts - By Pattern

list of all concepts that match given pattern across all concept schemes

URL	/concepts/pattern/{pattern}
Method	GET
HTTP Accepts	<ul style="list-style-type: none">▪ application/xml▪ application/rdf+xml
Path Params	<ul style="list-style-type: none">▪ pattern
Query Params	<ul style="list-style-type: none">▪ version▪ format<ul style="list-style-type: none">▪ "xml"▪ "rdf" (default)
Returns	<ul style="list-style-type: none">▪ media types▪ "application/xml"▪ "application/rdf+xml"

Examples:

Request for RDF using <http://gcmdservices.gsfc.nasa.gov/kms/concepts/pattern/OCEANS?format=rdf>

```
<?xml version="1.0" encoding="utf-8" standalone="yes"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#">
  <gcmd:termsOfUse xmlns:gcmd="http://gcmd.gsfc.nasa.gov/">
    See http://gcmd.nasa.gov/r/1/TermsOfUse
  </gcmd:termsOfUse>
  <skos:Concept xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#"
    rdf:about="91697b7d-8f2b-4954-850e-61d5f61c867d"
    xml:base="http://gcmdservices.gsfc.nasa.gov/kms/concept/">
    <skos:inScheme rdf:resource=
      "http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/sciencekeywords" />
    <skos:prefLabel xml:lang="en">OCEANS</skos:prefLabel>
    <skos:broader rdf:resource="10206308-a9dd-41e8-ba40-056c1160842a" />
    <skos:narrower rdf:resource="251c87cd-03b3-464f-8390-8ede2fec28fc" />
    <skos:narrower rdf:resource="a031952d-9f00-4ba5-9966-5f87ab9dfdd4" />
```

```

<skos:narrower rdf:resource="346cade5-801a-4afc-9652-48d02905bc4f" />
<skos:narrower rdf:resource="e3b178eb-2d47-41db-aba1-43a05e9e9256" />
<skos:narrower rdf:resource="e3bef663-6116-4f15-995c-38c7cdc9652c" />
<skos:narrower rdf:resource="a04804d5-1064-48fd-a7a7-8da8e10399e1" />
<skos:narrower rdf:resource="1ee8a323-f0ba-4a21-b597-50890c527c8e" />
<skos:narrower rdf:resource="ca154e02-a226-4cc7-8e4a-4474e7eb1eeb" />
<skos:narrower rdf:resource="6eb3919b-85ce-4988-8b78-9d0018fd8089" />
<skos:narrower rdf:resource="457883c4-b30c-4d26-bed8-6c2887ebbc90" />
<skos:narrower rdf:resource="c16bda61-353b-4668-af2f-bbb98785b6fa" />
<skos:narrower rdf:resource="bfa56100-6fb5-4e49-9633-298fa3b45508" />
<skos:narrower rdf:resource="f27ad52c-3dfd-4788-851a-427e60ae1b8f" />
<skos:narrower rdf:resource="0517aelf-7617-4f3b-80cb-649178032825" />
<skos:narrower rdf:resource="a46016d7-e571-403a-ab37-7223fd74e68e" />
<skos:narrower rdf:resource="d73e969a-4b66-4713-8d63-fa3cbb1e25e3" />
<skos:narrower rdf:resource="bb04ee83-bf49-4f96-898d-20bb6e92bc93" />
<skos:narrower rdf:resource="ce4b2c6e-3d69-4cf1-8416-c36e5f9b1b2c" />
<skos:narrower rdf:resource="b6fd22ab-dca7-4dfa-8812-913453b5695b" />
<skos:narrower rdf:resource="63bc0693-52eb-4ebd-a39e-e77e96409072" />
<skos:narrower rdf:resource="68f93a0c-1525-4f5a-9545-5d94191a3dbf" />
</skos:Concept>
<skos:Concept xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  rdf:about="75aed409-af9f-430b-ba97-4b92cbfcf3a5"
  xml:base="http://gcmdservices.gsfc.nasa.gov/kms/concept/">
  <skos:inScheme rdf:resource=
    "http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/providers" />
  <skos:prefLabel xml:lang="en">AU/OCEANS</skos:prefLabel>
  <skos:altLabel xml:lang="en">
    National Oceans Office, Department of the Environment and Heritage,
    Australian Government
  </skos:altLabel>
  <skos:broader rdf:resource="03e2acdd-67f7-4380-8c82-53aeb1d4730e" />
</skos:Concept>
<skos:Concept xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  rdf:about="dbff9ea9-3b00-4cd4-b3ed-21790a797207"
  xml:base="http://gcmdservices.gsfc.nasa.gov/kms/concept/">
  <skos:inScheme rdf:resource=
    "http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/isotopiccategory" />
  <skos:prefLabel xml:lang="en">OCEANS</skos:prefLabel>
  <skos:broader rdf:resource="4c715ec3-7f1b-432b-b393-f9a971a77664" />
</skos:Concept>
</rdf:RDF>

```

Concepts - By Concept Scheme + Pattern

Returns list of all concepts within specified concept scheme that match given pattern

URL	/concepts/concept_scheme/{conceptScheme}/pattern/{pattern}
Method	GET
HTTP Accepts	<ul style="list-style-type: none"> ■ Accept:application/rdf+xml ■ Accept:application/xml
Path Params	<ul style="list-style-type: none"> ■ conceptScheme: chronounits,

	<p>discipline, horizontalresolutionrange, idnnode, instruments, isotopiccategory, locations, platforms, projects, providers, rucontenttype, sciencekeywords, temporalresolutionrange, verticalresolutionrange</p> <ul style="list-style-type: none"> ▪ pattern
Query Params	<ul style="list-style-type: none"> ▪ version ▪ format <ul style="list-style-type: none"> ▪ "xml" - same as "Accept:application/xml" ▪ "rdf" (default) - Accept:application/rdf+xml ▪ "csv" - report
Returns	<ul style="list-style-type: none"> ▪ media types <ul style="list-style-type: none"> ▪ "application/xml" ▪ "application/rdf+xml"

Example:

Request for RDF format: http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/discipline/pattern/water?format=rdf

Example of response:

```

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<rdf:RDF xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  <gcmd:termsOfUse xmlns:gcmd="http://gcmd.gsfc.nasa.gov/">
    See http://gcmd.nasa.gov/r/1/TermsOfUse
  </gcmd:termsOfUse>
  <skos:Concept xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#"
    rdf:about="7209c13f-eee0-4dd0-ada8-732900b58e61"
    xml:base="http://gcmdservices.gsfc.nasa.gov/kms/concept/">
    <skos:inScheme rdf:resource=
      "http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/discipline"/>
    <skos:prefLabel xml:lang="en">FRESHWATER ECOLOGY</skos:prefLabel>
    <skos:broader rdf:resource="d4d928d7-099b-4d4a-8f97-c92a09cdf8a7"/>
  </skos:Concept>
  <skos:Concept xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
    xmlns:skos="http://www.w3.org/2004/02/skos/core#"
    rdf:about="386b6504-2d13-442d-8ffa-9fab8d82f3a4"
    xml:base="http://gcmdservices.gsfc.nasa.gov/kms/concept/">
    <skos:inScheme rdf:resource=
      "http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/discipline"/>
    <skos:prefLabel xml:lang="en">FRESHWATER</skos:prefLabel>
    <skos:broader rdf:resource="e0b60b65-5850-4165-ba4b-e68adefd249b"/>
  </skos:Concept>
</rdf:RDF>

```

Request for CSV format: http://gcmdservices.gsfc.nasa.gov/kms/concepts/concept_scheme/discipline/pattern/water?format=csv

Example of response:

```
Terms Of Use: See http://gcmd.nasa.gov/r/1/TermsOfUse
Keyword Version: Jun122012
Discipline_Name,Subdiscipline
"EARTH SCIENCE","FRESHWATER"
"ECOLOGY","FRESHWATER ECOLOGY"
```

Concepts Operations Resource

Returns: byte[] - Report as PDF file

URL	/concepts/operations/update_report/
Method	GET
HTTP Accepts	<ul style="list-style-type: none">▪ */*
Path Params	<ul style="list-style-type: none">▪ none
Query Params	<ul style="list-style-type: none">▪ verion▪ startDate▪ endDate▪ userId
Returns	<ul style="list-style-type: none">▪ media types: "application/pdf", "application/xml"

Example: http://gcmdservices.gsfc.nasa.gov/kms/concepts/operations/update_report/?userId={userid}&version=DRAFT&startDate=2012-01-01&endDate=2012-05-01

Authentication

In order to access these web services, you will be required to provide credentials in the form of a “userid” and “password” using GCMD standard HTTP authentication. Please contact <mailto:GSFC-GCMDUSO@mail.nasa.gov> for a link to the location to download examples of

clients that connect to these RESTful services using HTTP authentication. Below is a simple example using Java that provides credentials and queries several of the services offered.

```
package gov.nasa.gsfc.gcmd.kms.conceptapp.server;

import sun.misc.BASE64Encoder;

import java.net.*;
import java.io.*;
import java.util.Properties;
import java.util.Enumeration;
/**
 * Global Change Master Directory
 * Keyword Management Service Client
 *
 * @author Christopher D. Gokey
 * Created: Jan 5, 2012
 */
public class SimpleJavaClient {
    private static String userId = "{user id}";
    private static String password = "{password}";

    public static void main(String argv[]) throws Exception {

        // Setup the password authenticator.
        Authenticator.setDefault(new Authenticator() {
            protected PasswordAuthentication getPasswordAuthentication() {
                return new PasswordAuthentication(userId,password.toCharArray());
            }
        });

        SimpleJavaClient client = new SimpleJavaClient();
        String scheme = "sciencekeywords";
        String pattern = "snow*";
        String id = "fde70d8c-d64c-4784-971d-589eedfc42d1";

        client.getRootConcepts(scheme);
        client.getConcept(id);
        client.getConcepts(pattern);
        client.getConcepts(scheme, pattern);
        client.getConceptsForOwl(scheme);
    }

    // Path: GET /concepts/pattern/{pattern}
    // Retrieves all concepts for the given pattern where the prelabel contains pattern.
    // Returns this in RDF format
    private void getConcepts(String pattern) throws IOException {
        String content = fetchContent("http://localhost:8080/kms/concepts/pattern/"+pattern+
            "?format=rdf", "application/xml");
        System.out.println(content);
    }

    // Path: GET /concepts/concept_scheme/{conceptScheme}/pattern/{pattern}
    // Retrieves all concepts for the given pattern in the specified concept scheme where the
    // prelabel contains pattern.
    // Returns this in XML format (not RDF).
    private void getConcepts(String scheme, String pattern) throws IOException {
        String content = fetchContent("http://localhost:8080/kms/concepts/concept_scheme/"+
            scheme+"/pattern/"+pattern+"?format=rdf", "application/xml");
        System.out.println(content);
    }

    // Path: GET /concept/{conceptId}
    // Retrieves the specified concept using the conceptId, returns this in RDF format.
    private void getConcept(String id) throws IOException {
        String content = fetchContent("http://localhost:8080/kms/concept/" + id +
            "?format=rdf", "application/xml");
        System.out.println(content);
    }
}
```

```

// Path: GET /concepts/root
// Retrieves all ROOT concepts for the given concept scheme.
private void getRootConcepts(String scheme) throws IOException {
    String content = fetchContent("http://localhost:8080/kms/concepts/concept_scheme/" +
        scheme + "?format=rdf", "application/xml");
    System.out.println(content);
}

// Path: GET /concepts/concept_scheme/{conceptScheme}
// Retrieves ALL concepts as owl import statements for the given concept scheme.
private void getConceptsForOwl(String scheme) throws IOException {
    String content = fetchContent("http://localhost:8080/kms/concepts/concept_scheme/"+
        scheme+"?format=owl", "application/xml");
    System.out.println(content);
}

public static String fetchContent(String urlStr, String contentType) throws IOException {
    URL url = new URL(urlStr);
    HttpURLConnection conn = (HttpURLConnection) url.openConnection();
    conn.setRequestMethod("GET");
    conn.setRequestProperty("Accept", contentType);
    return getContents(new InputStreamReader(conn.getInputStream()));
}

/**
 * Helper method
 */
static public String getContents(Reader reader) {
    StringBuilder contents = new StringBuilder();

    try {
        BufferedReader input = new BufferedReader(reader);
        try {
            String line = null; //not declared within while loop
            while ((line = input.readLine()) != null){
                contents.append(line);
                contents.append(System.getProperty("line.separator"));
            }
        } finally {
            input.close();
        }
    } catch (IOException ex){
        ex.printStackTrace();
    }

    return contents.toString();
}

public static String doPost(URL url, Properties nameValuePairs)
    throws IOException {
    URLConnection connection = url.openConnection();
    connection.setDoInput(true);
    connection.setDoOutput(true);
    connection.setUseCaches(false);

    BASE64Encoder encoder = new BASE64Encoder();
    String userPass = encoder.encode((userId+": "+password).getBytes());

    connection.setRequestProperty ("Content-Type", "application/x-www-form-urlencoded");
    connection.setRequestProperty ("Authorization", "Basic " + userPass);

    PrintWriter out = new PrintWriter(connection.getOutputStream());

    Enumeration e = nameValuePairs.keys();

    while (e.hasMoreElements()) {
        String name = (String) e.nextElement();
    }
}

```

```

        String value = nameValuePairs.getProperty(name);
        if (e.hasMoreElements())
        {
            out.print(name + "=" + URLEncoder.encode(value, "UTF-8") + '&');
        }
        else {
            out.print(name + "=" + URLEncoder.encode(value, "UTF-8"));
        }
    }

    out.close();

    BufferedReader in;
    try {
        in = new BufferedReader(new InputStreamReader(connection
            .getInputStream()));
    } catch (FileNotFoundException exception) {
        InputStream err = ((URLConnection) connection).getErrorStream();
        if (err == null)
            throw exception;
        in = new BufferedReader(new InputStreamReader(err));
    }
    StringBuffer response = new StringBuffer();
    String line;

    while ((line = in.readLine()) != null)
        response.append(line + "\n");

    in.close();
    return response.toString();
}
}

```

Governance of Keywords

Policy for creation - Keywords will be created and maintained to normalize the classification and subsequent search. Policy for sharing and reuse - Keywords should be retrieved directly from the GCMD Keyword Management Web Service and may never be copied and used in another application unless proper credit is given. Please visit the following web page for information about how to cite the GCMD keywords, <http://gcmd.nasa.gov/learn/keywords.html>. The GCMD shall provide keywords, both for the authors of the metadata, and for the purpose of locating data and data-related services by interested users. The GCMD shall publish the process for maintaining keywords.

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