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OGC[®] Testbed 10 Engineering Report: Aviation Dissemination of Weather Data

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OGC® Testbed 10 Engineering Report: Aviation Dissemination of Weather Data

Abstract

This OGC document provides an analysis of the mapping between the NOAA Web Gridded Document Service (WGDS) and the OGC Web Coverage Service (WCS) and describes an adapter which translates WCS 2.0 requests to WGDS requests and then translates WGDS responses to WCS 2.0 responses.

This Engineering Report was prepared as a deliverable for the OGC Testbed 10 (Testbed-10) initiative, specifically the Testbed 10 Aviation Thread.

Keywords

ogcdoc, ogc document, wcs, wgds, Testbed10, aviation, weather

1 Introduction

1.1 Scope

This Engineering Report (ER) describes the results of the Aviation Thread of OGC Testbed 10, Aviation Dissemination of Weather Data.

This ER reports:

- An analysis to which extent Web Gridded Document Service (WGDS) functionality, models and operation parameters map to elements of the WCS 2.0 model and the GML Application Schema for Coverages.
- The development of a service adapter for the WGDS that is based on the WCS 2.0 model and the GML Application Schema for Coverages.

1.2 Document contributor contact points

All questions regarding this document should be directed to the editor or the contributors:

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1.3 Revision history

Date	Release	Editor	Primary clauses modified	Description
01/29/14	1.0	Mark Hughes		Initial release
03/20/14	1.1	Ronald Berger	7.6.4	Correction of getCoverage response XML

1.4 Forward

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

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

2 References

The following documents are referenced in this document. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the normative document referred to applies.

- OGC 06-121r3, *OGC® Web Services Common Standard*
- OGC 09-146r2, *OGC® GML Application Schema – Coverages*
- OGC 07-011, *OGC® Abstract Specification Topic 6: Schema for coverage geometry and functions*
- OGC 09-110r4 - *OGC WCS 2.0 Interface Standard- Core: Corrigendum*
- OGC 09-153r1 - *OGC Web Coverage Service 2.0 Primer: Core and Extensions Overview (2.0)*

- OGC 12-040 - OGC Web Coverage Service Interface Standard - Range Subsetting Extension

3 Terms and definitions

For the purposes of this report, the definitions specified in Clause 4 of the OWS Common Implementation Standard [OGC 06-121r3] shall apply. In addition, the following terms and definitions apply.

3.1 Web Coverage Service (WCS)

The Web Coverage Service Interface Standard (WCS) defines Web-based retrieval of coverages – that is, digital geospatial information representing space/time-varying phenomena. A WCS provides access to coverage data in forms that are useful for client-side rendering, as input into scientific models, and for other clients. A WCS allows clients to choose portions of a server's information holdings based on spatial constraints and other query criteria.

3.2 Web Gridded Document Service (WGDS)

The WGDS will conform to the basic service model of a Web Coverage Service (WCS). The backing store will be gridded data from NDFD and National Digital Guidance Database. WGDS will respond to the WCS operations GetCapabilities, DescribeCoverage, and GetCoverage. Responses to the GetCoverage operation will be XML documents encoded in OGC compliant Weather Exchange Model (WXXM) XML. In general, responses to GetCoverage operations will be valid at a single point on the NDFD grid.

3.3 Coverage

The concept of a coverage is central to the representation of many common weather observations and forecasts. Weather datasets that fall into the category of coverages include point measurements, wind profiles, model grids, and time series measurements at a single point. Of particular interest to aviation are weather properties observed or forecast along a trajectory, which can also be represented as a coverage. Coverages are defined in ISO 19123

3.4 UML notation

Diagrams that appear in this standard are presented using the Unified Modeling Language (UML) static structure diagram, as described in Subclause 5.2 of [OGC 06-121r9].

4 Conventions

4.1 Abbreviated terms

AIM	Aeronautical Information Management
AIXM	Aeronautical Information Exchange Model
CSML	Climate Science Modelling Language
DWML	Digital Weather Markup Language
GIS	Geographic Information Systems
GML	Geography Markup Language
GMU	George Mason University
OGC	Open Geospatial Consortium
OWS-10	OGC Web Services Initiative, Phase 10 (Renamed to Testbed 10)
REST	Representational State Transfer
SOAP	Simple Object Adapter Protocol
SWIM	System Wide Information Management
UML	Unified Modeling Language
WCPS	Web Coverage Processing Service
WCS	Web Coverage Service
WFS	Web Feature Service
WMS	Web Map Service
WSDL	Web Services Description Language
WXCM	Weather Conceptual Model
WXSM	Weather Exchange Schema
WXXM	Weather Exchange Model

Table 1 Abbreviated Terms

4.2 UML notation

Most diagrams that appear in this standard are presented using the Unified Modeling Language (UML) static structure diagram, as described in Subclause 5.2 of [OGC 06-121r3].

5 Overview

In 2004, the NOAA's National Weather Service (NWS) created its Digital Services Program to meet their customers' increasing need for digital weather, water, and climate services. The foundation of this program is the National Digital Forecast Database (NDFD). NDFD is a set of gridded forecasts of sensible weather elements. It contains a seamless mosaic of digital forecasts from NWS field offices working in collaboration with the National Centers for Environmental Prediction (NCEP). A companion to NDFD is the National Digital Guidance Database (NDGD) which contains guidance forecasts in gridded formats that are interoperable with NDFD.

This NDFD web service services millions of hits each day. Unfortunately, it is not OGC compliant. None of the established service models appears to fully support the functional requirements. The closest match seems to be Web Coverage Service (WCS). In response to this gap, the NWS has developed the Web Gridded Document Service (WGDS).

The WGDS implements a service model that is reminiscent of the Web Coverage Service, i.e., the WGDS responds to operations similar to `getCapabilities`, `describeCoverage`, and `getCoverage`.

This document describes how to provide an OGC-compliant Web Coverage Service (WCS) HTTP GET method-based interface based on the WGDS SOAP API. OGC WCS defines three basic operations: `GetCapabilities`, `DescribeCoverage` and `GetCoverage`. The GMU team was assigned the task to implement an adapter which converts a standardized WCS request/response to a WGDS request/response.

6 Analysis of WGDS functionality

6.1 The usability and suitability of WGDS schema and encoded documents

The schemas defined by the WGDS are

- [WGDS.xsd](#) (top level)
- [wgdsGetCapabilities.xsd](#)
- [wgdsDescribeCoverage.xsd](#)
- [wgdsGetCoverage.xsd](#)

Although these schemas do not conform to the WCS 2.0 standard, they are similar and the content can be extracted and mapped to the WCS counterpart. This ER demonstrates how this is done in the adapter presented below.

6.2 WFDS in comparison to established OGC standards

WGDS uses the concept of a “product” to describe the four different data products to be served, and for each product, a list of matched data will be returned in the DescribeCoverage response. Each matched data is treated as coverage, and is assigned a unique coverage identifier. This violates the OGC specification because the multiplicity of the coverage identifier is one (mandatory). Based on the OGC WCS specification, the coverage identifier is required and is mandatory in the GetCapabilities response. But the WGDS GetCoverage response does NOT contain such coverage identifier information.

To make it OGC-compliant, the products shall be treated as virtual coverages, and will be listed in the GetCoverage response.

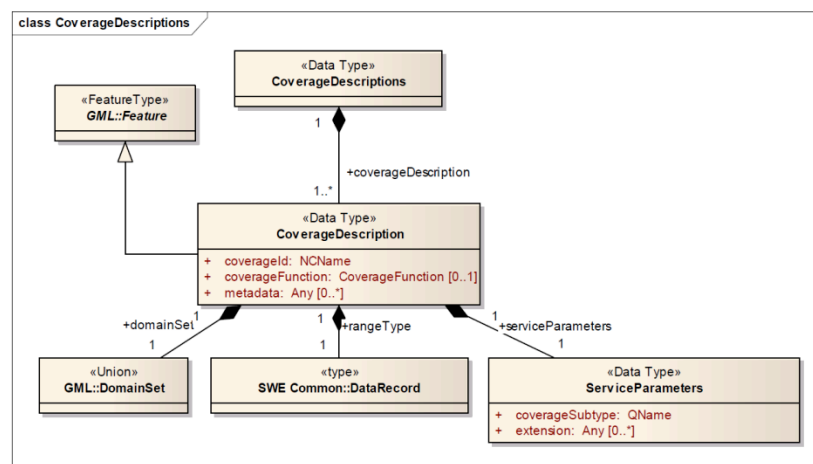


Fig. 1 CoverageDescriptions UML class diagram (OGC 09-110r3)

7 Description of the Service Adaptor

7.1 How to send a coordinate list to the DescribeCoverage operation

The inputs to the WGDS describeWGDESCoverage request are:

1. One of the 4 types of product coverage identifiers: time-series meteogram, glance meteogram, 12 hourly summary, 24 hourly summary.
2. List of latitude/longitude point(s) user requests data for.

The WCS specification does not define a parameter to send coordinates (point only) transparently. The parameter “subset” will be used to specify the coordinates of interest. For example:

```
subset=point,EPSG:4326(38,-99)&subset=point,EPSG:4326(18,-66)
```

Multiple “subset” parameters can be encoded in the HTTP Get request, each one is corresponding to one point. The order of the coordinates is: (latitude, longitude), separated by comma.

7.2 How to return the weather element in WCS DescribeCoverage response

The element “rangeType “, with the definition “Range structure description of this coverage”, is a mandatory element defined in the DescribeCoverage response. The weather elements are important attributes for each product. The response to DescribeCoverage will include the weather element as a field in a <rangeType> element.

The following XML segment is a sample of a rangeType:

```
<gmlcov:rangeType>
<swe:DataRecord>
<swe:field name="maxt">
<swe:Category>
<swe:identifier>maxt</swe:identifier>
<swe:description>Conus Maximum Temperature (maxt)</swe:description>
</swe:Category>
</swe:field>
<swe:field name="mint">
<swe:Category>
<swe:identifier>mint</swe:identifier>
<swe:description>Conus Minimum Temperature (mint)</swe:description>
</swe:Category>
</swe:field>
<swe:field name="temp">
<swe:Category>
<swe:identifier>temp</swe:identifier>
<swe:description>Conus Temperature (temp)</swe:description>
</swe:Category>
</swe:field>
<swe:field name="dew">
<swe:Category>
<swe:identifier>dew</swe:identifier>
<swe:description>Conus Dew Point Temperature (dew)</swe:description>
</swe:Category>
</swe:field>
```

```

<swe:field name="appt">
<swe:Category>
<swe:identifier>appt</swe:identifier>
<swe:description>Conus Apparent Temperature (appt)</swe:description>
</swe:Category>
</swe:field>
<swe:field name="qpf">
<swe:Category>
<swe:identifier>qpf</swe:identifier>
<swe:description>Conus Qualitative Precipitation Forecast
(qpf)</swe:description>
</swe:Category>
</swe:field>
<swe:field name="icons">
<swe:Category>
<swe:identifier>icons</swe:identifier>
<swe:description>Conus Weather Conditions Icons (icons)</swe:description>
</swe:Category>
</swe:field>
</swe:DataRecord>
</gmlcov:rangeType>

```

If the product is a "time-series meteogram", a user can choose as many different weather elements as they want returned (up to 49 weather elements, dependent on sector or geographic area lat/lon chosen is in). If the product is one of the other 3 types, a user cannot choose different weather elements. This means certain elements are returned all the time (default).

If the product is a "glance meteogram", all these elements are returned all the time (default): Max Temp, Min Temp, Cloud (sky) Coverage, Weather, Icons, and Hazards.

If the product is a "12 hourly summary" or a "24 hourly summary", all these elements are returned all the time (default): Max Temp, Min Temp, 12 Hourly Probability of Precipitation, Weather (summarized form), Icons (Summarized), and Hazards (Summarized across 12 or 24 hour forecast periods (6AM to 6AM for a 24 hourly summary product; 6AM to 6PM, then 6PM to 6AM, repeating for a 12 hourly summary product)).

7.3 How to expose the parameters of a WGDS getWGDESCoverage in a WCS GetCoverage request

The WGDS getWGDESCoverage operation supports multiple inputs which are inconsistent with the WCS GetCoverage interface.

The inputs to the getWGDESCoverage request are:

1. One of the 4 types of product identifier: time-series meteogram, glance meteogram, 12 hourly summary, 24 hourly summary.
2. A list of latitude/longitude point(s) user requests data for.
3. Time Info in dateTime form (2013-08-01T08:00:00).
4. XMLDocType: DWML or WXXM

- 5. Unit: The Unit defaults to English ("e") U.S. standard units if the XMLDocType chosen is "WXXM"

It's a major issue to expose these parameters in WCS GetCoverage request without breaking the WCS specification.

The following table describes the mapping relation between the native WGDS API and the WCS API.

WGDS SOAP API	WCS Adapter API
list of coordinates	using "subset" parameter, for example: <i>subset=point,EPSG:4326(lat,long)</i>
weather elements	using "rangeType" parameter, for example: <i>rangeSubset=maxt;mint</i>
date and time	using "subset" parameter, for example: <i>subset=phenomenonTime("2006-08-01T00:00:00","2014-08-22T00:00:00")</i>
XMLDocType	using "format" parameter, for example: <i>format=WXXM</i>
Unit	N/A

Table 2 Mapping between WGDS API and WCS API

7.4 GetCapabilities

The input to the getWGDSCapabilities request is: The name of the service: "WGDS"

The following figure illustrates how the WCS adapter supports the WCS GetCapabilities operation.

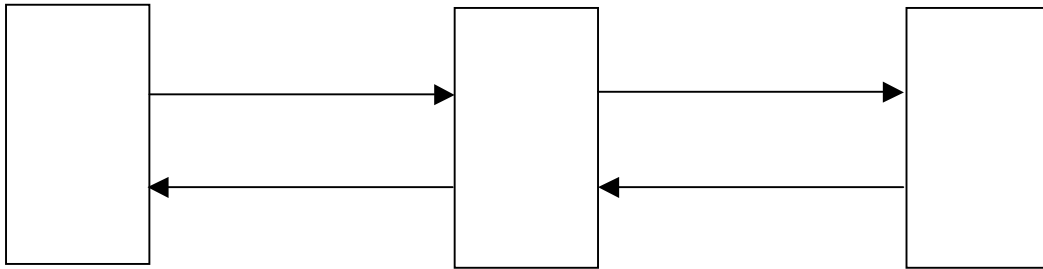


Fig. 2 WCS Adapter implementation scenario – GetCapabilities operation

7.4.1 WCS GetCapabilities request – HTTP GET

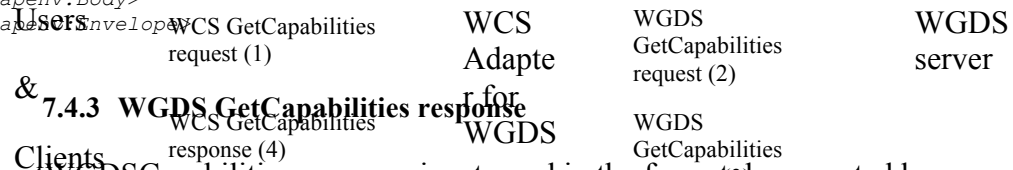
The client sends a HTTP GET request for WCS capabilities as follows:

<http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=GetCapabilities>

7.4.2 WGDS GetCapabilities request – SOAP

The adapter maps the WCS GetCapabilities request to the WGDS SOAP getWGDSCapabilities request:

```
<soapenv:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/"
  xmlns:wgds="http://' . $_SERVER['SERVER_NAME'] . '/php-code/WXXMgen/wsd1/WGDS.wsd1">
  <soapenv:Header/>
  <soapenv:Body>
  <wgds:getWGDSCapabilities
    soapenv:encodingStyle="http://schemas.xmlsoap.org/soap/encoding/">
  <!-- getWGDSCapabilities input is the name of the service: "WGDS" -->
  <service xsi:type="xsd:string">WGDS</service>
  </wgds:getWGDSCapabilities>
  </soapenv:Body>
</soapenv:Envelope>
```



7.4.3 WGDS GetCapabilities response for WGDS

The getWGDSCapabilities response is returned in the format documented here:

http://www.mdl.nws.noaa.gov/~WGDS/examples/getWGDSCapabilities/wgds_response/getcapabilities.xml.txt

7.4.4 WCS response

The WCS adapter converts the WGDS response to a WCS GetCapabilities response:

```
<?xml version="1.0" encoding="UTF-8"?>
<wcs:Capabilities version="2.0.0" xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0"
  xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:ows="http://www.opengis.net/ows/2.0" xmlns:swe="http://www.opengis.net/swe/2.0"
  xmlns:wcs="http://www.opengis.net/wcs/2.0"
  xmlns:wcese="http://www.opengis.net/wcese/1.0"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.opengis.net/wcs/2.0
  http://schemas.opengis.net/wcs/2.0/wcsAll.xsd">
  <ows:ServiceIdentification>
  <ows:Title>NNEW Web Gridded Document Service 1.0 (WGDS)</ows:Title>
  <ows:Abstract>This is a trimmed down implementation of the WCS 1.1.2 specification (see
    www.opengeospatial.org). The intent of the OGC Web Gridded Document Service
    (WGDS) is
    to provide gridded national digital forecast data, in four different formats,
    returned in an OGC compliant WXXM document.</ows:Abstract>
  <ows:ServiceType>WGDS</ows:ServiceType>
  <ows:ServiceTypeVersion>2.0.0</ows:ServiceTypeVersion>
  <ows:Fees>None</ows:Fees>
  <ows:AccessConstraints>None</ows:AccessConstraints>
  </ows:ServiceIdentification>
  <ows:ServiceProvider>
  <ows:ProviderName>Meteorological Development Laboratory (MDL)</ows:ProviderName>
  <ows:ServiceContact>
  <ows:IndividualName>Paul Hershberg</ows:IndividualName>
  <ows:PositionName>MDL WGDS POC</ows:PositionName>
  <ows:ContactInfo>
  <ows:Phone>
  <ows:Voice>301-713-0056 x132</ows:Voice>
  </ows:Phone>
  <ows:Address>
  <ows:DeliveryPoint>W/OST24</ows:DeliveryPoint>
  <ows:DeliveryPoint>1325 East-West Highway</ows:DeliveryPoint>
  <ows:City>Silver Spring</ows:City>
  <ows:AdministrativeArea>Maryland</ows:AdministrativeArea>
  <ows:PostalCode>20910</ows:PostalCode>
  <ows:Country>U.S.</ows:Country>
  <ows:ElectronicMailAddress>Paul[dot]R[dot]Hershberg[at]noaa[dot]gov</ows:ElectronicMailAd
  dress>
  </ows:Address>
  <ows:OnlineResource xlink:type="simple" xlink:href="http://www.weather.gov"/>
  <ows:HoursOfService>9x6x365</ows:HoursOfService>
  <ows:ContactInstructions>email</ows:ContactInstructions>
  </ows:ContactInfo>
  <ows:Role>Service provider</ows:Role>
  </ows:ServiceContact>
  </ows:ServiceProvider>
  <ows:OperationsMetadata>
  <ows:Operation name="GetCapabilities">
  <ows:DCP>
  <ows:HTTP>
  <ows:Get xlink:href="http://129.174.131.8:9003/ows10/adapter.do?"
  xlink:type="simple"/>
  </ows:HTTP>
  </ows:DCP>
  </ows:Operation>
  <ows:Operation name="DescribeCoverage">
  <ows:DCP>
  <ows:HTTP>
  <ows:Get xlink:href="http://129.174.131.8:9003/ows10/adapter.do?"
  xlink:type="simple"/>
```



```

</ows:HTTP>
</ows:DCP>
</ows:Operation>
<ows:Operation name="GetCoverage">
<ows:DCP>
<ows:HTTP>
<ows:Get xlink:href="http://129.174.131.8:9003/ows10/adapter.do?"
xlink:type="simple"/>
</ows:HTTP>
</ows:DCP>
</ows:Operation>
</ows:OperationsMetadata>
<wcs:ServiceMetadata>
<wcs:formatSupported>wxm</wcs:formatSupported>
</wcs:ServiceMetadata>
<wcs:Contents>
<wcs:CoverageSummary>
<wcs:CoverageId>time-series_meteogram</wcs:CoverageId>
<wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
<wcs:CoverageSummary>
<wcs:CoverageId>glance_meteogram</wcs:CoverageId>
<wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
<wcs:CoverageSummary>
<wcs:CoverageId>12_hourly_summary</wcs:CoverageId>
<wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
<wcs:CoverageSummary>
<wcs:CoverageId>24_hourly_summary</wcs:CoverageId>
<wcs:CoverageSubtype>RectifiedDataset</wcs:CoverageSubtype>
</wcs:CoverageSummary>
</wcs:Contents>
</wcs:Capabilities>

```



7.5 DescribeCoverage

The following figure illustrates how the WCS adapter supports the WCS DescribeCoverage operation.

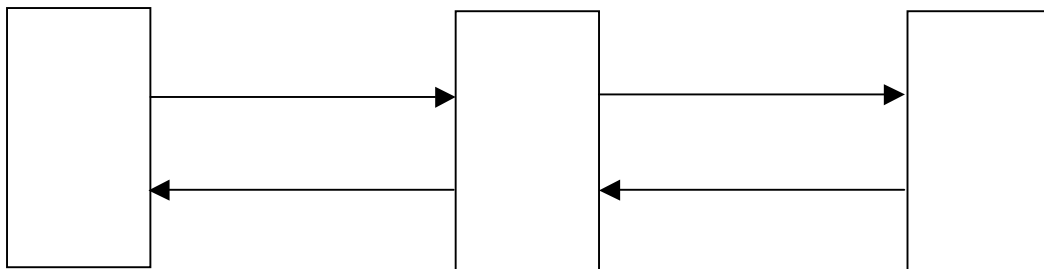


Fig. 3 WCS Adapter implementation scenario – DescribeCoverage operation

The coverage identifiers were adjusted to make a valid NCName. The following table lists the mapping from WGDS native product identifier to WCS coverage identifier.

WCS Coverage	WGDS Product	Sample WCS Rerquest
--------------	--------------	---------------------

Identifier	Identifier	
time-series_meteogram	time-series meteogram	http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=DescribeCoverage&coverageId=time-series_meteogram&subset=point,EPSG:4326(38,-99)&subset=point,EPSG:4326(18,-66)
glance_meteogram	glance meteogram	http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=DescribeCoverage&coverageId=glance_meteogram&subset=point,EPSG:4326(38,-99)&subset=point,EPSG:4326(18,-66)
12_hourly_summary	12 hourly summary	http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=DescribeCoverage&coverageId=12_hourly_summary&subset=point,EPSG:4326(38,-99)&subset=point,EPSG:4326(18,-66)
24_hourly_summary	24 hourly summary	http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=DescribeCoverage&coverageId=24_hourly_summary&subset=point,EPSG:4326(38,-99)&subset=point,EPSG:4326(18,-66)

Table 3 Mapping from WGDS native product id to WCS coverage id

7.5.1 WCS DescribeCoverage request – HTTP GET

The client sends a HTTP GET request for WCS DescribeCoverage as follows:

[http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=DescribeCoverage&coverageId=time-series_meteogram&subset=point,EPSG:4326\(38,-99\)&subset=point,EPSG:4326\(18,-66\)](http://129.174.131.8:9003/ows10/adapter.do?service=WCS&version=2.0&request=DescribeCoverage&coverageId=time-series_meteogram&subset=point,EPSG:4326(38,-99)&subset=point,EPSG:4326(18,-66))

To enable the client to specify a list of latitude/longitude points for the spot of interest, the “subset” parameter was used in the WCS DescribeCoverage request.

7.5.2 WGDS DescribeCoverage request

The adapter composes and sends a WGDS SOAP `wgdsDescribeCoverage` request:

```
<soap:Envelope xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xsi:schemaLocation="..wgdsDescribeCoverage.xsd"
xmlns:ns="http://www.opengis.net/wcs/1.1"
xmlns:soap="http://www.w3.org/2003/05/soap-envelope">
<!-- xmlns:ns="http://www.opengis.net/wcs/1.1"
xmlns:ns1="http://www.opengis.net/ows/1.1"
xmlns:gml="http://www.opengis.net/gml"> -->
<soap:Header/>
<soap:Body>
<ns:DescribeCoverage service="WGDS" version="1.0">
<ns:Identifier>meteogram</ns:Identifier>
<ns:Identifier>37.99,-112.2 18,-66</ns:Identifier>
<!-- With this lat/lon list user gives us, we call degrib to find the sector's these
points fall into. This will
determine the list of element's returned in the describeCoverage response:
```

```

    "/home/nextgen/bin/degrib -Sector -pnt 37.99,-112.2 18,-66" (only applies to
    meteogram request) -->
  </ns:DescribeCoverage>
</soap:Body>
</soap:Envelope>

```

The coverage identifier specified in the WCS DescribeCoverage could be converted to corresponding identifier in a WGDS SOAP request.

7.5.3 WGDS DescribeCoverage response

The wgdsDescribeCoverage response is returned in the format documented here:

http://www.mdl.nws.noaa.gov/~WGDS/examples/describeWGDSCoverage/wgds_respon_sedescribecoverage_meteogram.xml.txt

7.5.4 WCS DescribeCoverage response

The WCS adapter converts the WGDS response to a WCS DescribeCoverage response:

```

<?xml version="1.0" encoding="UTF-8"?>
<wcs:CoverageDescriptions xmlns:ogc="http://www.opengis.net/ogc"
  xmlns:ows="http://www.opengis.net/ows/2.0" xmlns:wcs="http://www.opengis.net/wcs/2.0"
  xmlns:gmlcov="http://www.opengis.net/gmlcov/1.0" xmlns:swe="http://www.opengis.net/swe/2.0"
  xmlns:gml="http://www.opengis.net/gml/3.2" xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="www.opengis.net/wcs/2.0 http://schemas.opengis.net/wcs/2.0/wcsAll.xsd">
  <wcs:CoverageDescription gml:id="cd_20140110_180146">
  <wcs:CoverageId>time-series_meteogram</wcs:CoverageId>
  <gml:domainSet>
  <gml:TimePeriod gml:id="tp_20140110_180146">
  <gml:beginPosition>2014-01-10T18:01:00</gml:beginPosition>
  <gml:endPosition>2015-06-28T18:44:00</gml:endPosition>
  </gml:TimePeriod>
  </gml:domainSet>
  <gmlcov:rangeType>
  <swe:DataRecord>
  <swe:field name="maxt">
  <swe:Category>
  <swe:identifier>maxt</swe:identifier>
  <swe:description>Conus Maximum Temperature (maxt)</swe:description>
  </swe:Category>
  </swe:field>
  <!-- multiple field elements here -->
  <swe:field name="cumw50">
  <swe:Category>
  <swe:identifier>cumw50</swe:identifier>
  <swe:description>Puertori Probability of Tropical Cyclone Wind Speed Above
    50 Knots (Cumulative) (cumw50)</swe:description>
  </swe:Category>
  </swe:field>
  <swe:field name="cumw64">
  <swe:Category>
  <swe:identifier>cumw64</swe:identifier>
  <swe:description>Puertori Probability of Tropical Cyclone Wind Speed Above
    64 Knots (Cumulative) (cumw64)</swe:description>
  </swe:Category>
  </swe:field>
  </swe:DataRecord>
  </gmlcov:rangeType>
  <wcs:ServiceParameters>
  <wcs:CoverageSubtype>MultiPointCoverage</wcs:CoverageSubtype>
  <wcs:nativeFormat>Unknown</wcs:nativeFormat>
  </wcs:ServiceParameters>
  </wcs:CoverageDescription>
</wcs:CoverageDescriptions>

```


7.6.3 WGDS GetCoverage response

An example of a wgdsGetCoverage response is as follows:

```
<?xml version="1.0" encoding="UTF-8"?>
<SOAP-ENV:Envelope xmlns:SOAP-ENC="http://schemas.xmlsoap.org/soap/encoding/"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema"
  xmlns:SOAP-ENV="http://schemas.xmlsoap.org/soap/envelope/">
<SOAP-ENV:Body>
<wgds:getWGDSCoverageResponse
  xmlns:wgds="http://' . $_SERVER['SERVER_NAME'] . '/php-code/WXXMgen/wsd/WGDS.wsd">
<wgdsGetCoverageOutput>
<ns12:Coverages xsi:schemaLocation="..wgdsGetCoverage.xsd" version="1.1.1"
  xmlns:wgds="http://127.0.0.1:8082/php-code/WXXMgen/schema/WGDS.xsd"
  xmlns:ns3="http://wcsri.ral.ucar.edu/pubsub/subscription-service"
  xmlns:ns4="http://docs.oasis-open.org/wsn/t-1"
  xmlns:ns5="http://docs.oasis-open.org/wsrp/bf-2"
  xmlns:ns6="http://www.w3.org/2005/08/addressing"
  xmlns:ns7="http://docs.oasis-open.org/wsn/b-2"
  xmlns:ns8="http://wcsri.ral.ucar.edu/iso19139"
  xmlns:ns9="http://www.opengis.net/ows/1.1"
  xmlns:ns10="http://wcsri.ral.ucar.edu/owsExtension"
  xmlns:ns11="http://www.w3.org/1999/xlink"
  xmlns:ns12="http://www.opengis.net/wcs/1.1"
  xmlns:ns13="http://www.opengis.net/gml"
  xmlns:ns14="http://www.w3.org/2001/SMIL20/"
  xmlns:ns15="http://www.opengis.net/gml/3.2"
  xmlns:ns16="http://www.isotc211.org/2005/gmd"
  xmlns:ns17="http://www.isotc211.org/2005/gco"
  xmlns:ns18="http://www.isotc211.org/2005/gmx"
  xmlns:ns19="http://www.isotc211.org/2005/srv"
  xmlns:ns20="http://www.isotc211.org/2005/gts" xmlns:ns21="http://www.java/lang"
  xmlns:ns22="http://www.wcs.opengis.net/wsd"
  xmlns:ns23="http://docs.oasis-open.org/wsrp/r-2"
  xmlns:ns24="http://www.w3.org/2001/SMIL20/Language">
<ns12:Coverage>
<wx:FeatureCollection gml:id="id0"
  xsi:schemaLocation="http://www.eurocontrol.int/wx/1.1
  ../..WXXM/schemas/1.1/wx/wx.xsd"
  xmlns:nawx="http://www.faa.gov/nawx/1.4"
  xmlns:xlink="http://www.w3.org/1999/xlink"
  xmlns:gml="http://www.opengis.net/gml/3.2"
  xmlns:om="http://www.opengis.net/om/1.0/gml32"
  xmlns:wx="http://www.eurocontrol.int/wx/1.1">
<wx:featureMember>
<wx:Forecast gml:id="id1">
<om:samplingTime>
<gml:TimePeriod gml:id="id2">
<gml:beginPosition>20140110T000000Z</gml:beginPosition>
<gml:endPosition>20140118T000000Z</gml:endPosition>
</gml:TimePeriod>
</om:samplingTime>
<om:procedure
  xlink:href="urn:fdc:mdl-nextgen.nws.noaa.gov:Dataset:NDFD"/>
<om:observedProperty xlink:href="wxont:weather"/>
<om:featureOfInterest>
<wx:AreaOfInterest gml:id="id3">
<gml:location>
<gml:Point gml:id="id4">
<gml:pos>38.000000 -99.000000</gml:pos>
</gml:Point>
</gml:location>
</wx:AreaOfInterest>
</om:featureOfInterest>
<om:result>
<wx:FeatureCollection gml:id="id5">
<wx:featureMember>
<wx:PointTimeSeriesCoverage gml:id="id6">
<wx:domainSet>
<nawx:ExtPointTimeSeriesDomain gml:id="id7">
<wx:timePeriod gml:id="id8">
<gml:beginPosition>20140110T000000Z</gml:beginPosition>
<gml:endPosition>20140111T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id9">
<gml:beginPosition>20140111T000000Z</gml:beginPosition>
```

```

<gml:endPosition>20140112T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id10">
<gml:beginPosition>20140112T000000Z</gml:beginPosition>
<gml:endPosition>20140113T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id11">
<gml:beginPosition>20140113T000000Z</gml:beginPosition>
<gml:endPosition>20140114T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id12">
<gml:beginPosition>20140114T000000Z</gml:beginPosition>
<gml:endPosition>20140115T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id13">
<gml:beginPosition>20140115T000000Z</gml:beginPosition>
<gml:endPosition>20140116T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id14">
<gml:beginPosition>20140116T000000Z</gml:beginPosition>
<gml:endPosition>20140117T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id15">
<gml:beginPosition>20140117T000000Z</gml:beginPosition>
<gml:endPosition>20140118T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:location>38.000000, -99.000000</wx:location>
</nawx:ExtPointTimeSeriesDomain>
</wx:domainSet>
<wx:rangeSet>
<gml:ValueArray gml:id="id16">
<gml:valueComponent
xlink:title="Daily Maximum Temperature"
xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">45 54 58 53 49 53 49
47</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
<wx:domainSet>
<nawx:ExtPointTimeSeriesDomain gml:id="id17">
<wx:timePeriod gml:id="id18">
<gml:beginPosition>20140110T120000Z</gml:beginPosition>
<gml:endPosition>20140111T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id19">
<gml:beginPosition>20140111T120000Z</gml:beginPosition>
<gml:endPosition>20140112T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id20">
<gml:beginPosition>20140112T120000Z</gml:beginPosition>
<gml:endPosition>20140113T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id21">
<gml:beginPosition>20140113T120000Z</gml:beginPosition>
<gml:endPosition>20140114T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id22">
<gml:beginPosition>20140114T120000Z</gml:beginPosition>
<gml:endPosition>20140115T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id23">
<gml:beginPosition>20140115T120000Z</gml:beginPosition>
<gml:endPosition>20140116T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>

```

```

<wx:timePeriod gml:id="id24">
<gml:beginPosition>20140116T120000Z</gml:beginPosition>
<gml:endPosition>20140117T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:location>38.000000, -99.000000</wx:location>
</nawx:ExtPointTimeSeriesDomain>
</wx:domainSet>
<wx:rangeSet>
<gml:ValueArray gml:id="id25">
<gml:valueComponent
xlink:title="Daily Minimum Temperature"

xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">25 31 28 32 28 32
25</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
</wx:PointTimeSeriesCoverage>
</wx:featureMember>
</wx:FeatureCollection>
</om:result>
</wx:Forecast>
</wx:featureMember>
<wx:featureMember>
<wx:Forecast gml:id="id26">
<om:samplingTime>
<gml:TimePeriod gml:id="id27">
<gml:beginPosition>20140110T000000Z</gml:beginPosition>
<gml:endPosition>20140118T000000Z</gml:endPosition>
</gml:TimePeriod>
</om:samplingTime>
<om:procedure
xlink:href="urn:fdc:mdl-nextgen.nws.noaa.gov:Dataset:NDFD"/>
<om:observedProperty xlink:href="wxont:weather"/>
<om:featureOfInterest>
<wx:AreaOfInterest gml:id="id28">
<gml:location>
<gml:Point gml:id="id29">
<gml:pos>18.000000 -66.000000</gml:pos>
</gml:Point>
</gml:location>
</wx:AreaOfInterest>
</om:featureOfInterest>
<om:result>
<wx:FeatureCollection gml:id="id30">
<wx:featureMember>
<wx:PointTimeSeriesCoverage gml:id="id31">
<wx:domainSet>
<nawx:ExtPointTimeSeriesDomain gml:id="id32">
<wx:timePeriod gml:id="id33">
<gml:beginPosition>20140110T000000Z</gml:beginPosition>
<gml:endPosition>20140111T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id34">
<gml:beginPosition>20140111T000000Z</gml:beginPosition>
<gml:endPosition>20140112T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id35">
<gml:beginPosition>20140112T000000Z</gml:beginPosition>
<gml:endPosition>20140113T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id36">
<gml:beginPosition>20140113T000000Z</gml:beginPosition>
<gml:endPosition>20140114T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id37">
<gml:beginPosition>20140114T000000Z</gml:beginPosition>
<gml:endPosition>20140115T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id38">
<gml:beginPosition>20140115T000000Z</gml:beginPosition>
<gml:endPosition>20140116T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>

```

```

</wx:timePeriod>
<wx:timePeriod gml:id="id39">
<gml:beginPosition>20140116T000000Z</gml:beginPosition>
<gml:endPosition>20140117T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id40">
<gml:beginPosition>20140117T000000Z</gml:beginPosition>
<gml:endPosition>20140118T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:location>18.000000, -66.000000</wx:location>
</nawx:ExtPointTimeSeriesDomain>
</wx:domainSet>
<wx:rangeSet>
<gml:ValueArray gml:id="id41">
<gml:valueComponent
xlink:title="Daily Maximum Temperature"

xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">79 83 85 82 81 81 81
84</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
<wx:domainSet>
<nawx:ExtPointTimeSeriesDomain gml:id="id42">
<wx:timePeriod gml:id="id43">
<gml:beginPosition>20140110T120000Z</gml:beginPosition>
<gml:endPosition>20140111T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id44">
<gml:beginPosition>20140111T120000Z</gml:beginPosition>
<gml:endPosition>20140112T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id45">
<gml:beginPosition>20140112T120000Z</gml:beginPosition>
<gml:endPosition>20140113T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id46">
<gml:beginPosition>20140113T120000Z</gml:beginPosition>
<gml:endPosition>20140114T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id47">
<gml:beginPosition>20140114T120000Z</gml:beginPosition>
<gml:endPosition>20140115T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id48">
<gml:beginPosition>20140115T120000Z</gml:beginPosition>
<gml:endPosition>20140116T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id49">
<gml:beginPosition>20140116T120000Z</gml:beginPosition>
<gml:endPosition>20140117T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:location>18.000000, -66.000000</wx:location>
</nawx:ExtPointTimeSeriesDomain>
</wx:domainSet>
<wx:rangeSet>
<gml:ValueArray gml:id="id50">
<gml:valueComponent
xlink:title="Daily Minimum Temperature"

xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">72 74 74 74 74 74
74</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
</wx:PointTimeSeriesCoverage>
</wx:featureMember>
</wx:FeatureCollection>

```



```

</om:result>
</wx:Forecast>
</wx:featureMember>
</wx:FeatureCollection>
</nsl2:Coverage>
</nsl2:Coverages>
</wgdsGetCoverageOutput>
</wgds:getWGSDSCoverageResponse>
</SOAP-ENV:Body>
</SOAP-ENV:Envelope>

```

7.6.4 WCS GetCoverage response

The native response is missing the namespace “xmlns:xsi”, and had an invalid namespace of “xmlns:wgds”. The WCS Adapter has corrected these issues. The following XML is the sample response from a WCS GetCoverage operation.

```

<?xml version="1.0" encoding="UTF-8"?>
<wx:FeatureCollection gml:id="id0" xsi:schemaLocation="http://www.eurocontrol.int/wx/1.1
../WXXM/schemas/1.1/wx/wx.xsd" xmlns:nawx="http://www.faa.gov/nawx/1.4"
xmlns:xlink="http://www.w3.org/1999/xlink" xmlns:gml="http://www.opengis.net/gml/3.2"
xmlns:om="http://www.opengis.net/om/1.0/gml32" xmlns:wx="http://www.eurocontrol.int/wx/1.1">
<wx:featureMember>
<wx:Forecast gml:id="id1">
<om:samplingTime>
<gml:TimePeriod gml:id="id2">
<gml:beginPosition>20140110T000000Z</gml:beginPosition>
<gml:endPosition>20140118T000000Z</gml:endPosition>
</gml:TimePeriod>
</om:samplingTime>
<om:procedure xlink:href="urn:fdc:mdl-nextgen.nws.noaa.gov:Dataset:NDFD"/>
<om:observedProperty xlink:href="wxont:weather"/>
<om:featureOfInterest>
<wx:AreaOfInterest gml:id="id3">
<gml:location>
<gml:Point gml:id="id4">
<gml:pos>38.000000 -99.000000</gml:pos>
</gml:Point>
</gml:location>
</wx:AreaOfInterest>
</om:featureOfInterest>
<om:result>
<wx:FeatureCollection gml:id="id5">
<wx:featureMember>
<wx:PointTimeSeriesCoverage gml:id="id6">
<wx:domainSet>
<nawx:ExtPointTimeSeriesDomain gml:id="id7">
<wx:timePeriod gml:id="id8">
<gml:beginPosition>20140110T000000Z</gml:beginPosition>
<gml:endPosition>20140111T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id9">
<gml:beginPosition>20140111T000000Z</gml:beginPosition>
<gml:endPosition>20140112T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id10">
<gml:beginPosition>20140112T000000Z</gml:beginPosition>
<gml:endPosition>20140113T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id11">
<gml:beginPosition>20140113T000000Z</gml:beginPosition>
<gml:endPosition>20140114T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id12">
<gml:beginPosition>20140114T000000Z</gml:beginPosition>
<gml:endPosition>20140115T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id13">
<gml:beginPosition>20140115T000000Z</gml:beginPosition>
<gml:endPosition>20140116T000000Z</gml:endPosition>

```

```

<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id14">
<gml:beginPosition>20140116T000000Z</gml:beginPosition>
<gml:endPosition>20140117T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id15">
<gml:beginPosition>20140117T000000Z</gml:beginPosition>
<gml:endPosition>20140118T000000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:location>38.000000, -99.000000</wx:location>
</nawx:ExtPointTimeSeriesDomain>
</wx:domainSet>
<wx:rangeSet>
<gml:ValueArray gml:id="id16">
<gml:valueComponent xlink:title="Daily Maximum Temperature"
xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">45 54 58 53 49 53 49 47</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
</wx:domainSet>
<nawx:ExtPointTimeSeriesDomain gml:id="id17">
<wx:timePeriod gml:id="id18">
<gml:beginPosition>20140110T120000Z</gml:beginPosition>
<gml:endPosition>20140111T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id19">
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<gml:endPosition>20140112T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id20">
<gml:beginPosition>20140112T120000Z</gml:beginPosition>
<gml:endPosition>20140113T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id21">
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<gml:endPosition>20140114T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id22">
<gml:beginPosition>20140114T120000Z</gml:beginPosition>
<gml:endPosition>20140115T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id23">
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<gml:endPosition>20140116T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id24">
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<gml:endPosition>20140117T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
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</nawx:ExtPointTimeSeriesDomain>
</wx:domainSet>
<wx:rangeSet>
<gml:ValueArray gml:id="id25">
<gml:valueComponent xlink:title="Daily Minimum Temperature"
xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">25 31 28 32 28 32 25</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
</wx:PointTimeSeriesCoverage>
</wx:FeatureMember>
</wx:FeatureCollection>
</om:result>
</wx:Forecast>
</wx:featureMember>
<wx:featureMember>
<wx:Forecast gml:id="id26">

```

```

<om:samplingTime>
  <gml:TimePeriod gml:id="id27">
    <gml:beginPosition>20140110T000000Z</gml:beginPosition>
    <gml:endPosition>20140118T000000Z</gml:endPosition>
  </gml:TimePeriod>
</om:samplingTime>
<om:procedure xlink:href="urn:fdc:mdl-nextgen.nws.noaa.gov:Dataset:NDFD"/>
<om:observedProperty xlink:href="wxont:weather"/>
<om:featureOfInterest>
  <wx:AreaOfInterest gml:id="id28">
    <gml:location>
      <gml:Point gml:id="id29">
        <gml:pos>18.000000 -66.000000</gml:pos>
      </gml:Point>
    </gml:location>
  </wx:AreaOfInterest>
</om:featureOfInterest>
<om:result>
  <wx:FeatureCollection gml:id="id30">
    <wx:featureMember>
      <wx:PointTimeSeriesCoverage gml:id="id31">
        <wx:domainSet>
          <nawx:ExtPointTimeSeriesDomain gml:id="id32">
            <wx:timePeriod gml:id="id33">
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              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id34">
              <gml:beginPosition>20140111T000000Z</gml:beginPosition>
              <gml:endPosition>20140112T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id35">
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              <gml:endPosition>20140113T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id36">
              <gml:beginPosition>20140113T000000Z</gml:beginPosition>
              <gml:endPosition>20140114T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id37">
              <gml:beginPosition>20140114T000000Z</gml:beginPosition>
              <gml:endPosition>20140115T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id38">
              <gml:beginPosition>20140115T000000Z</gml:beginPosition>
              <gml:endPosition>20140116T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id39">
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              <gml:endPosition>20140117T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:timePeriod gml:id="id40">
              <gml:beginPosition>20140117T000000Z</gml:beginPosition>
              <gml:endPosition>20140118T000000Z</gml:endPosition>
              <gml:duration>PT24H</gml:duration>
            </wx:timePeriod>
            <wx:location>18.000000, -66.000000</wx:location>
          </nawx:ExtPointTimeSeriesDomain>
        </wx:domainSet>
        <wx:rangeSet>
          <gml:ValueArray gml:id="id41">
            <gml:valueComponent xlink:title="Daily Maximum Temperature"
              xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
              <gml:QuantityList uom="F">79 83 85 82 81 81 81 84</gml:QuantityList>
            </gml:valueComponent>
          </gml:ValueArray>
        </wx:rangeSet>
      </wx:domainSet>
      <nawx:ExtPointTimeSeriesDomain gml:id="id42">
        <wx:timePeriod gml:id="id43">
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          <gml:endPosition>20140111T120000Z</gml:endPosition>
          <gml:duration>PT24H</gml:duration>
        </wx:timePeriod>
      </nawx:ExtPointTimeSeriesDomain>
    </wx:featureMember>
  </wx:FeatureCollection>
</om:result>

```

```

</wx:timePeriod>
<wx:timePeriod gml:id="id44">
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<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id45">
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<gml:endPosition>20140113T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id46">
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<gml:endPosition>20140114T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id47">
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<gml:endPosition>20140115T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id48">
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<gml:endPosition>20140116T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
<wx:timePeriod gml:id="id49">
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<gml:endPosition>20140117T120000Z</gml:endPosition>
<gml:duration>PT24H</gml:duration>
</wx:timePeriod>
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<wx:rangeSet>
<gml:ValueArray gml:id="id50">
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xlink:href="http://www.nws.noaa.gov/ndfd/technical.htm#elements">
<gml:QuantityList uom="F">72 74 74 74 74 74 74</gml:QuantityList>
</gml:valueComponent>
</gml:ValueArray>
</wx:rangeSet>
</wx:PointTimeSeriesCoverage>
</wx:featureMember>
</wx:FeatureCollection>
</om:result>
</wx:Forecast>
</wx:FeatureMember>
</wx:FeatureCollection>

```

8 Conclusions

Any WCS 2.0 implementation is required to implement the Core. In addition, a WCS 2.0 implementation must implement at least one protocol.

This adapter uses the HTTP GET protocol to communicate with the client and the SOAP protocol to communicate with the WGDS.

This adapter accepts WCS 2.0 requests from the client. It converts the request to WGDS protocol and sends it via SOAP. The WGDS returns a response which the adapter converts and returns it to the client as a WCS 2.0 response.

This adapter can be viewed as a layer above the WGDS which is itself a layer above the NDFD which services millions of hits per day. It makes the wealth of data in the NDFD available in an OGC compliant way.

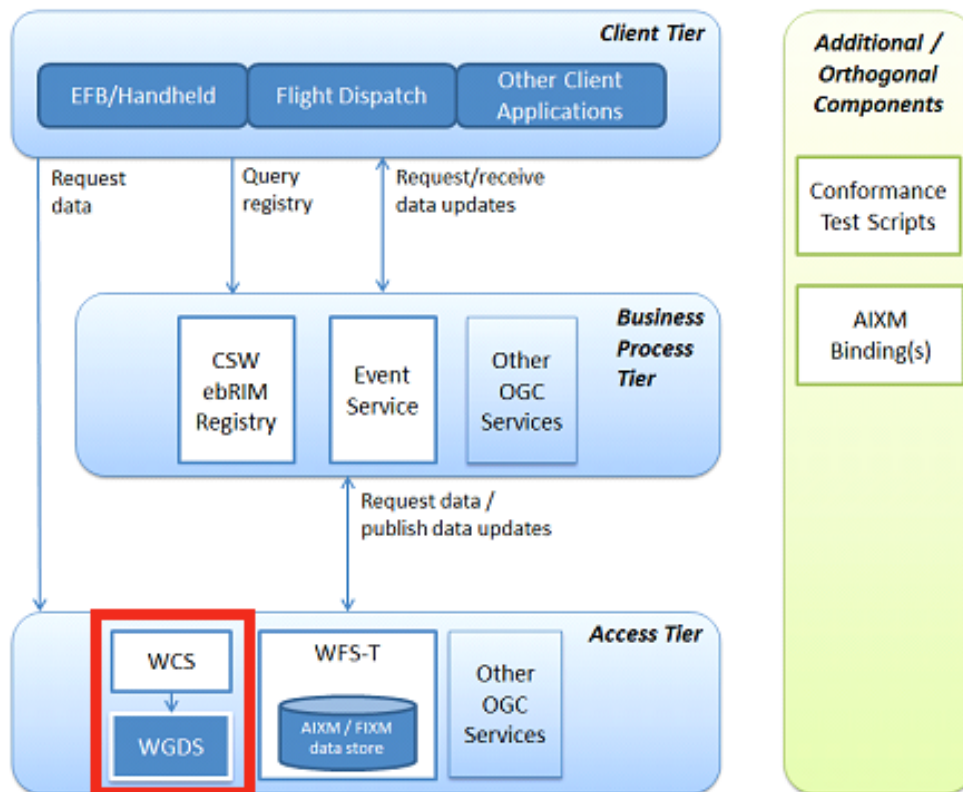


Fig. 5 The WGDS adaptor in the OGC architecture

9 Future Work

To promote awareness of National Digital Forecast Database (NDFD) data through standardized OGC-compliant interface, Weather Exchange Model (WXXM) Application Profile for WCS 2.0 will be implemented in future work.

The OGC WCS 2.0 standard defines a general interface and operations that enable interoperable access to geospatial coverages, such as sensor data, satellite imagery, digital elevation models, and climate/ocean data. The proposed WXXM Application Profile for WCS 2.0 defines an interface for interoperable access to Earth Observation data NDFD data in format of WXXM, which enables client access NOAA digital forecast data through standardized interface. The Application Profile also will propose a solution to build the connection between bounding box, specified by WCS request, and coordinate list used by WGDS server.

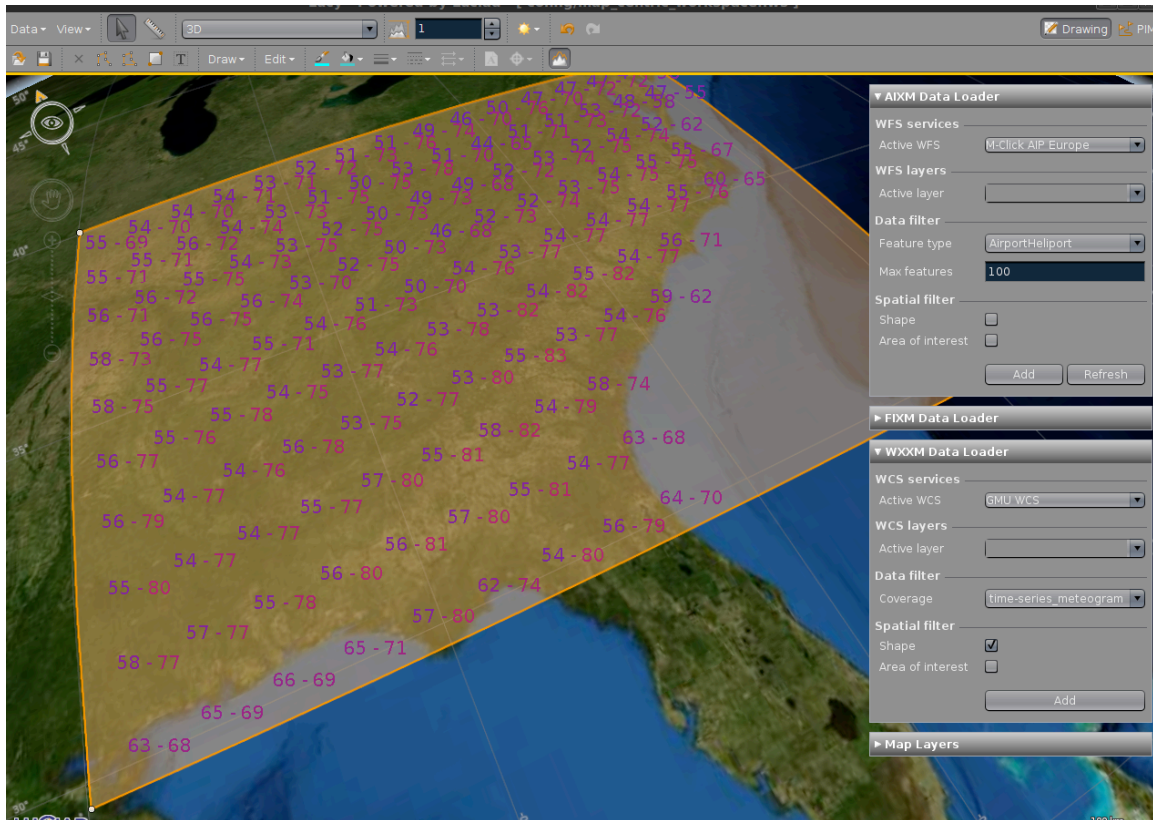


Fig. 6 Example of a BBox query sent from an aviation client

Annex A

XML Schema Documents

WGDS:

<http://www.mdl.nws.noaa.gov/~WGDS/schemas/WGDS.xsd>

<http://www.mdl.nws.noaa.gov/~WGDS/schemas/wgdsDescribeCoverage.xsd>

<http://www.mdl.nws.noaa.gov/~WGDS/schemas/wgdsGetCapabilities.xsd>

<http://www.mdl.nws.noaa.gov/~WGDS/schemas/wgdsGetCoverage.xsd>

WCS 2.0:

<http://schemas.opengis.net/wcs/2.0/wcsAll.xsd>

<http://schemas.opengis.net/wcs/2.0/wcsCommon.xsd>

<http://schemas.opengis.net/wcs/2.0/wcsDescribeCoverage.xsd>

<http://schemas.opengis.net/wcs/2.0/wcsGetCapabilities.xsd>

<http://schemas.opengis.net/wcs/2.0/wcsGetCoverage.xsd>

North American Weather Extension (NAWX):

<http://www.mdl.nws.noaa.gov/~WGDS/schemas/NAWX/1.4.0/>