

Technical specifications for accessing web mapping services



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Introduction

The web mapping services described in this document provide access to ocean forecast data for the estuary and Gulf of St. Lawrence generated by the Canadian Hydrographic Service, from the three-dimensional numerical model, and other partners, such as Environment Canada.

These services include:

- A WMS that produces dynamic images of the data according to the specified parameters.
- A WFS that allows the raw data behind the images to be obtained.
- A WCS service that allows only the raw data from raster layers to be obtained.

These various services are available through a web referencer service that indicates the availability of data layers. End users can obtain information on these available layers. Note that all dates and times are in UTC.

You can also directly access the raw data from forecast models through a data exporting service.

Raw data exporting service

The raw data exporting service allows the user to receive customized forecasts, meaning it is possible to specify the output format (HDF5, NetCDF, or text), the desired type of data, the originating model for the forecasts, and their date.

This exporting service is accessed through the *GET* and *POST* methods, while specifying the parameters as in the following example:

Example request:

<http://ws.ns-shc.gc.dfo-mpo.gc.ca/OO-CurrentsIceWeb/ExportData?model=stle&format=text&data=u,v&dates=20111222000000,20111223000000>

You will receive a file, "STLEdata.ini", containing the u and v current data from the STLE model for midnight on Dec. 22, 2011 to midnight on Dec. 23, 2011.

Parameters required for the request to be completed

<i>model</i>	Contains one single model name in lowercase from among the following four values: nemo, stle, g5 or mogsl.
<i>format</i>	Contains one single data format in lowercase from among the following three values: hdf5, netcdf or text.
<i>data</i>	Contains a combination of data types, in lowercase and separated by commas as needed, from among the following seven values: u, v ,speedmms, speedknots, direction, concentration, thickness

Specifying the date for desired forecasts

Of course, only one date can be used at a time.

Parameter	Definition
<i>dates</i>	List of requested forecast times, separated by commas. <i>Example:</i> 20110829000000,20110830000000
<i>datemin</i> and <i>datemax</i>	<i>datemin</i> = Lower bound (inclusive); <i>datemin</i> must be lower than or equal to <i>datemax</i> <i>datemax</i> = Upper bound (inclusive) The forecasts between the two bounds will be retrieved.

The required date format is "yyyyMMddhhmmss".

There must be no date earlier than the minimum permitted date (*acquire.servlet.pasttimelimit*). Requests for future dates are limited to 48 hours after the processing time (*acquire.servlet.futurehoursdurationlimit*).

The names of retrieved files will differ based on the requested format.

For *HDF5*: [model name]data.h5

For *NetCDF*: [model name]data.nc

For *text*: [model name]data.ini

The service is available at the following address: <http://ws.ns-shc.qc.dfo-mpo.gc.ca/OO-CurrentsIceWeb/ExportData>

Format of files retrieved by the file service

HDF5 format (Hierarchical Data Format version 5)

The HDF5 format is simple. It essentially contains the following:

- **Data mask:** a two-dimensional array called the `mask` where each element, an entire byte, has a value of 1 or 0. A 1 means that, in the file's other arrays, elements in the same location have a value drawn from the models. A 0 indicates that there is no data.
The following metadata can be obtained for the `mask`: `land`, `water`, `units`, `forecastDateTime` and `generatedDateTime`.
- **Groups:** Each group contains arrays with the same forecast date. This determines the group's name, which follows this format: "yyyyMMdd_hhmmss".
The arrays in these groups are named for the type of data they contain. They include the following:
 - **direction:** current's orientation in degrees (clockwise from geographic north, represented by single precision floating points).
 - **speed:** current's speed in mm/s, represented by single precision floating points.
 - **u:** current's eastward speed in mm/s, represented by 4-byte signed integers.
 - **v:** current's northward speed in mm/s, represented by 4-byte signed integers.
 - **concentration:** concentration of ice, represented by single precision floating points. The possible values range from 0 to 1.
 - **thickness:** thickness of ice in metres, represented by single precision floating points.

The metadata available for the arrays is as follows: `Minimum_Longitude`, `Maximum_Longitude`, `Minimum_Latitude`, `Maximum_Latitude`, `Delta_Longitude`, `Delta_Latitude`, `Number_Of_Cells_West_East`, `Number_Of_Cells_South_North`, `Product` and `Organization`

The screenshot shows the HDFView application interface. On the left, a file tree displays a hierarchy of groups for different forecast dates: 20110310_190000, 20110310_200000, 20110310_210000, 20110310_220000, and 20110310_230000. The main window displays two data tables. The first table, titled 'direction', shows values for cells 32-36. The second table, titled 'speed', shows values for cells 91-97.

	32	33	34	35	36
66	0.0	0.0	0.0	0.0	0.0
67	0.0	0.0	0.0	0.0	0.0
68	55.13	48.09406	55.459908	66.501434	55.581835
69	9975	48.483273	62.44719	66.80141	65.71954
70	7133	53.070232	57.016163	61.843807	57.707115
71	7574	57.264774	58.584312	51.940983	50.792797
72	787	55.268307	58.412357	53.32565	46.344723

	4	
91	0.0	0.0
92	0.0	0.0
93	0.0	0.0
94	0.0	0.0
95	0.0	0.0
96	0.0	68.7
97	19.849434	327

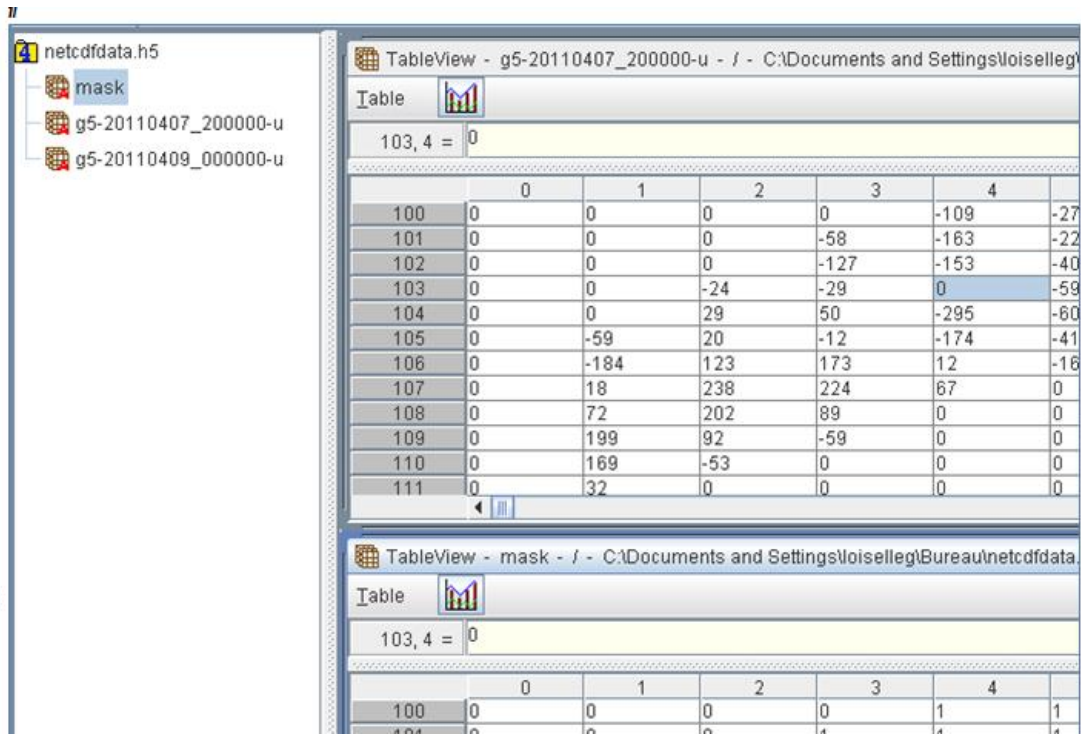
Current forecast HDF5 file displayed in HDFView

NetCDF format (Network Common Data Form)

The type of file produced is NetCDF-3. Unlike NetCDF-4 and HDF5, this file type does not use the "group" concept. Forecast arrays are all on the same level and are distinguished by their names. First, there is the

mask, under the name "mask". All the other arrays follow this name format: [model]-yyyy-MMdd_hhmmss, where [model] is STLE, G5, etc.

The data themselves are represented in the same manner as in HDF5 files. Note that the HDFView application allows the user to read NetCDF files.



NetCDF file retrieved by the exporting service

INI format (INItialization)

This is the same as the format for files produced by the STLE and G5 models.

```

1  [Header]
2  Product= Gulf forecasts database (5 km res
3  Organisation= Institute Maurice-Lamontagne
4
5  [Grid_Definition]
6  Grid_Origin= South-West Corner
7  Minimum_Longitude= -70.00000
8  Maximum_Longitude= -55.00000
9  Minimum_Latitude= 45.00000
10 Maximum_Latitude= 52.00000
11 Delta_Longitude= 5.9999999E-02
12 Delta_Latitude= 3.9999999E-02
13 Number_Of_Cells_West_East= 250
14 Number_Of_Cells_South_North= 175
15
16 [Mask]
17 Land= 0
18 Water= 1
19 Row_175= 00000000000000000000000000000000
20 Row_174= 00000000000000000000000000000000
    
```

Sections containing the information on the data

Excerpt from an ice forecast file in INI format

[Header]	Contains the "Product" and "Organization" values
[Grid_Definition]	Contains the definition of the data arrays with the following keys: Grid_Origin, Minimum_Longitude, Maximum_Longitude, Minimum_Latitude, Maximum_Latitude, Delta_Longitude, Delta_Latitude, Number_Of_Cells_West_East and Number_Of_Cells_South_North
[Mask]	Contains a mask. First, there are definitions for symbols with the keys Land and Water, and then the mask itself, separated by lines, e.g. "Row_175= 0000000..."
[Time_Definition]	Groups together the times for which there are corresponding forecasts in arrays with the key Time_X, where X is the array number, ranging from 0 to the value of the Number_Of_Forecasts key, excluding 1. The format of values is defined by Time_format.

If current data are requested, the following two sections are added:

[Current_definition]	Defines the data found in the arrays. Keys: U_component, V_component and Unit_of_Values
[Current_Forecasts]	Write_Format defines the format for array data. All other lines are the array data in this format.

If ice data is requested, the following two sections are added:

[Ice_definition]	Defines the data found in the arrays. Keys: Concentration, Thickness and Unit_of_Values
[Ice_Forecasts]	Write_Format defines the format for array data. All the other lines are array data in this format.

List of error messages from the file exporting service

Action	Message
<i>Request for source files with the desired forecast model and time interval with date as a parameter</i>	The selection contains too many data arrays. Please limit the types of data or the time interval. The maximum number of arrays that can be retrieved per request for this model is [model's <code>maxdatasets</code> value]. Current forecasts missing for [requested date value].
<i>The name and date of the requested file are invalid.</i>	Invalid group name/date:
<i>Request for source files with the desired forecast model and time interval with list of dates as a parameter</i>	The selection contains too many data arrays. Please limit the types of data or shorten the list of forecast times. The maximum number of arrays that can be retrieved per request for this model is [model's <code>maxdatasets</code> value]. Current forecasts missing for [requested date value].
<i>Wrong dates requested</i>	No data available for these dates.
<i>Inconsistency between data types according to the indicated model</i>	The [...] model does not produce data on ice concentration or thickness.
<i>Wrong format for specified file</i>	Invalid value for <code>format</code> parameter. Permitted values: <code>hdf5</code> , <code>netcdf</code> , and <code>text</code> .
<i>File format not specified</i>	The <code>format</code> parameter is required.
<i>Too many date parameters specified</i>	A minimum, a maximum, and a list of dates cannot all be indicated at once.
<i>Wrong date format</i>	Invalid date format. The required format is: <code>yyyyMMddhhmmss</code>
<i>Date not specified (at least one date must be requested)</i>	The <code>dates</code> parameter must not be left blank. There must be at least one date or a minimum and a maximum.
<i>Minimum date not specified</i>	The <code>datemin</code> parameter is missing.
<i>Wrong minimum date</i>	The <code>datemin</code> parameter is before the earliest acceptable date.
<i>Maximum date not specified</i>	The <code>datemax</code> parameter is missing.
<i>Wrong maximum date</i>	The <code>datemax</code> parameter is after the latest acceptable date.

<i>Minimum date and maximum date are inconsistent</i>	The minimum date must not be after the maximum date.
<i>Parameter data not specified</i>	The data parameter must not be left blank. The data parameter is required.
<i>Wrong parameter data specified</i>	The data parameter's value is invalid or impossible for this model. Permitted values: u, v, speedmms, speedknots, direction, concentration
<i>Parameter model not specified</i>	The model parameter is required.
<i>Wrong model parameter</i>	Invalid value for model parameter. Permitted values: stle, etc.

WMS, WFS and WCS services

WMS (Web Map Service)

The WMS dynamically produces images with the specified parameters as a result of a *GetMap* request. They must be addressed to the URL (*Uniform Resource Locator*) of the CGI (*Common Gateway Interface*): "mapserv". To identify the possible parameters and their various values, simply see the response to the *GetCapabilities* request (XML format - *Extensible Markup Language*), by adding REQUEST=GetCapabilities to the HTTP request.

The basic address will follow this format:

<http://ws.ns-shc.gc.dfo-mpo.gc.ca/WMS/model/yyyy/mm/dd/file.map?layers=layername>

<i>model</i>	The forecast data model, e.g. st1e, g5.	
<i>yyyy/mm/dd</i>	Represents the forecast date	
<i>file</i>	Contains the definition of the layers	[model]-[yyyy][mm][dd][hh]
<i>layername</i>	Name of requested layer	[model]_[type of forecast]_[yyyy][mm][dd][hh] [MM][ss]_scale[scale]

All the basic URLs are available through the web referencer service, but this is insufficient. A few parameters must be added to obtain a satisfactory result:

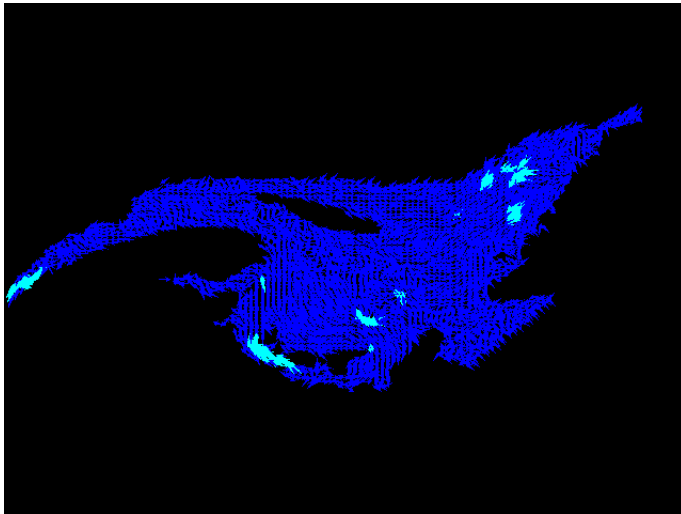
- **Version:** Version of the request. Versions 1.0.0, 1.0.7, 1.1.0 (or 1.0.8), 1.1.1, and 1.3.0 are supported. [Each corresponds to a new specification for the Open Geospatial Consortium \(OGC\)](#). The version is chosen at the client's discretion.
- **Request:** Type of request. E.g.: GetMap, GetCapabilities, GetFeatureInfo, DescribeLayer, GetLegendGraphic, etc.

GetMap request

This request allows an image to be obtained and requires the use of coordinates. For example, "&bbox=-7514065.628545966,6261721.357121641,-7200979.560689883,6574807.424977722" would be added to the request. Of course, the projection to be used must be specified, so "&SRS=EPSG:900913" would be added as well. The common lat-lon system, EPSG:4326, is also supported. Before an image can be retrieved, a specific size must be requested in pixels: "&WIDTH=256&HEIGHT=256". Finally, the output format must be added. This is done as follows: "&FORMAT=image/png". "image/jpeg", "image/tiff" (Geotiff) and "image/gif" are other possible values.

Sample request:

http://ws.ns-shc.gc.ca/WMS/g5/2011/10/12/g5-2011101213.map?layers=g5_Currentsforecasts_20111012130000_Scale1&VERSION=1.1.1&REQUEST=GetMap&bbox=-7514065.628545966,6261721.357121641,-7200979.560689883,6574807.424977722&SRS=EPSG:900913&WIDTH=256&HEIGHT=256&FORMAT=image/png

**Result of a GetMap request**

Other parameters can be added, like the background colour, transparency, etc.
For information on the various parameters and other information about the WMS:
http://mapserver.org/ogc/wms_server.html

If you are using tile mode, you must state that it will be used: "&mode=tile". Then, provide the coordinates for the tile and the chosen coordinate system. There are two: Google Maps and Virtual Earth. You can get more information on tile mode through the Internet.

WFS (Web Feature Service)

The main appeal of the WFS lies in the *GetFeature* method. It allows the retrieval of the raw data behind images. The result is provided in XML format. Once again, the basic URLs are available through the web referencer service. The WFS is only available for vector layers (arrows).

WCS (Web Coverage Service)

The WCS is similar to the WFS, but is only available for raster layers (no arrows). These layers are available in the results of *GetCapabilities*, *DescribeCoverage* and *GetCoverage* requests. The basic URLs are available through the web reference service.

Web referencer service

The web referencer service can be used to determine what data is available through the WMS, WFS and WCS. A layer being available through the service necessarily implies that the associated data can also be requested through the service.

The web referencer service's address is <http://ws.ns-shc.gc.dfo-mpo.gc.ca/WebServicesCatalog>.

Communication takes place using the *Simple Object Access Protocol (SOAP)*. The user can call on a number of functions:

Methods available for the referencer service

getLayersList	Obtains available layers for a given model	
Required parameter:	modelName	Type: String
Type of output:	Array of Layer objects	
getLayer	Obtains requested layer	
Required parameter:	layerID	Type: Integer
Type of output:	Layer object	
getModelsList	Obtains all the models for which at least one layer is available	
Required parameter:	none	
Type of output:	Array of Model objects	
searchLayer	Obtains the layers of one model and one data type for which the content of forecasts at a given time is between the requested dates.	
Required parameter:	modelName	Type: String
	datatype	Type: String
	dateMin	Type: String Format: yyyyMMddhhmmss
	dateMax	Type: String Format: yyyyMMddhhmmss
Type of output:	Array of Layer objects	

Description of the content of method objects

Layer

Attribute	Type	Format	Description
<i>name</i>	String		Layer name
<i>datatype</i>	BilingualString		Layer data type
<i>forecastDate</i>	String	yyyyMMddhhmmss	Layer data forecast time
<i>scale</i>	Integer		Layer scale
<i>layerID</i>	Integer		Layer's full identification
<i>wmsURL</i>	String		Address of the layer's WMS
<i>wfsURL</i>	String		Address of the layer's WFS
<i>legendURL</i>	String		Address of the layer's legend
<i>generatedDate</i>	String	yyyyMMddhhmmss	Date that layer data was generated
<i>units</i>	BilingualString		Units used for layer data
<i>Decimationinfo</i>	BilingualString		Information on the layer's decimation
<i>wcsURL</i>	String		Address of the layer's WCS

Model

Attribute	Type	Description
<i>modelName</i>	String	Model name
<i>description</i>	BilingualString	Description of the model
<i>latitudeMin</i>	Double	Minimum latitude of the area covered by the model
<i>latitudeMax</i>	Double	Maximum latitude of the area covered by the model
<i>longitudeMin</i>	Double	Minimum longitude of the area covered by the model
<i>longitudeMax</i>	Double	Maximum longitude of the area covered by the model
<i>dateMin</i>	String	Date of the earliest available layers for this model
<i>dateMax</i>	String	Date of the latest available layers for this model
<i>datatype</i>	Array of BilingualString objects	Types of data available for this model
<i>sourceinfo</i>	BilingualString	Information on the source of the data

BilingualString

Attribute	Type	Description
<i>french</i>	String	French version of the chain of characters
<i>english</i>	String	English version of the chain of characters

This information can be obtained in WSDL format at <http://ws.ns-shc.gc.dfo-mpo.gc.ca/WebServicesCatalog?wsdl>.

List of error messages from the referencer service

Action	Message
<i>Obtaining the identifier of the layer described by the parameters</i>	-1 if this layer does not exist or more than one layer fulfills these conditions
<i>Obtaining the list of layers belonging to the model in the parameter</i>	Error when establishing connection with the database Failure to initialize connection pool Error while searching the database Error during a rollback