# **Annex** C **– GML Data Product** F**ormat (encoding)**

< < This section will provide examples of S-412 data files, guidance for encoding data files, structure for data files, the complete application schema, etc > >

## E.1.0 Introduction

S-412 uses the S-100 profile of GML (part 10B) to encapsulate data. This annex specifies the interchange format to facilitate the moving of files containing data records between computer systems. It defines a specific structure which can be used to transmit files containing data type and data structures specific to S-412.

**Data Sources**

S-412 Weather Overlay data can be categorized into one of two types, depending on the source of production. These are:

* Model-based prediction, and
* Model-based human forecast

A model-based prediction is directly produced by a two- or three-dimensional numerical weather prediction (NWP) model, an ocean numerical model, or a wave numerical model. These models produce simulations that are the result of representing the atmosphere or ocean (and its waves) mathematically as a fluid in motion.

A model-based forecast is an assessment of the future state of the atmosphere with respect to precipitation, clouds, winds, temperature, and other parameters, often using model-based predictions as guidance. These forecasts are typically produced by human meteorologists.

## E.2.0 GML (vector)

Open Geospatial Consortium (OGC) GML encoding (ISO 19136) shall be used for point, curve, and/or surface geometric primitive feature collections.

### E.2.1 Data Format

The data format shall follow the S-100 profile of GML (part 10B).

### E.2.2 GML Application Schema

The S-412 GML application schema (S412.xsd) can be accessed at the following public domain website: [S-41X Marine Weather Overlays](https://ocean.weather.gov/S-41X/index.php) [ocean.weather.gov/s412/](about:blank). The S-412 GML application schema follows the general S-412 application schema (UML diagrams in 4.2 Application Schema). It also imports and follows the S-100 GML application schema (s100gmlbase.xsd, S100\_gmlProfile.xsd, and S100\_gmlProfileLevels.xsd), which are linked to and comply with GML and xlink schema.

### E.2.3. Encoding Examples

S-412 compliant GML encoding examples can be accessed at the following public domain website: [S-41X Marine Weather Overlays](https://ocean.weather.gov/S-41X/index.php) [ocean.weather.gov/s412/](about:blank). These GML files (.gml) validate against the S-412 GML application schema (S412.xsd;) using a generic XML validator such as xmllint. The GML files also validate against the S-412 feature catalogue. Below are S-412 GML encoding examples of a) a header, and b) a surface feature..

#### E.2.3.1 Header

The following is an example of header information that shall go at the beginning of the GML file. The header information shall be compliant with S-100 schema, namely s100gmlbase.xsd.

1. **<?xml** version="1.0" encoding="UTF-8"**?>**
2. **<S412:DataSet** **gml:id=**"testMetareaWarningsWind.gml"
3. **xmlns:S412=**"<http://www.iho.int/S412/gml/0.1.0>" **xmlns:S100=**"http://www.iho.int/s100gml/5.0" **xmlns:gml=**"http://www.opengis.net/gml/3.2" **xmlns:xlink=**"http://www.w3.org/1999/xlink">
4. **<gml:boundedBy><gml:Envelope** srsName="http://www.opengis.net/def/crs/EPSG/0/4326"**>**
5. **<gml:lowerCorner>**-90.0000 -180.0000**</gml:lowerCorner>**
6. **<gml:upperCorner>**90.0000 180.0000**</gml:upperCorner>**
7. **</gml:Envelope>**
8. **</gml:boundedBy>**
9. **<DatasetIdentificationInformation>**
10. **<S100:encodingSpecification>**S-100 Part 10b**</S100:encodingSpecification>**
11. **<S100:encodingSpecificationEdition>**1.0**</S100:encodingSpecificationEdition>**
12. **<S100:productIdentifier>**S-412**</S100:productIdentifier>**
13. **<S100:productEdition>**0.1.0**</S100:productEdition>**
14. **<S100:applicationProfile>1</S100:applicationProfile>**
15. **<S100:datasetFileIdentifier>**testMetareaWarningsWind.gml**</S100:datasetFileIdentifier>**
16. **<S100:datasetTitle>**Sample S-412 GML Encoding**</S100:datasetTitle>**
17. **<S100:datasetReferenceDate>**2024-04-04**</S100:datasetReferenceDate>**
18. **<S100:datasetLanguage>**eng**</S100:datasetLanguage>**
19. **<S100:datasetTopicCategory>**climatologyMeteorologyAtmosphere**</S100:datasetTopicCategory>**
20. **<S100:datasetPurpose>**weather update**</S100:datasetPurpose>**
21. **<S100:updateNumber>**0**</S100:updateNumber>**
22. **<S412:members>**
23. … FEATURE COLLECTION HERE …
24. **</S412:members>**
25. **</S412:DataSet>**

#### The dataset shall follow the header information (ending at line 21 in the example above) and shall precede the ending </S412:DataSet> tag (line 25 in the example above). The dataset shall consist of a feature collection, denoted by a series of <S412: members></S412: members> and <imembers></imembers> elements, as indicated in the examples below.

#### E.2.3.3 Surface Feature

##### E.2.3.3.1 Surface Feature not crossing the 180° meridian

The following is an example of a surface feature encoding, with its simple attributes, complex attributes and their sub-attribute(s), and the surface geometric primitive element:

1. <S412:windWarning gml:id="STORM00000ST\_01">
2. <S412:maximumDisplayScale>10000000</S412:maximumDisplayScale>
3. <S412:minimumDisplayScale>1000</S412:minimumDisplayScale>
4. <S412:issuedDateTime>2024-04-02T18:39:38</S412:issuedDateTime>
5. <S412:dateTimeRange>
6. <S412:dateTimeStart>2024-04-02T18:00:00</S412:dateTimeStart>
7. <S412:dateTimeEnd>2024-04-03T19:00:00</S412:dateTimeEnd>
8. </S412:dateTimeRange>
9. <S412:windWarningThreshold>3</S412:windWarningThreshold>
10. <S412:beaufortForce>10</S412:beaufortForce>
11. <S412:dataProviderInformation xlink:href="#DATAPROVIDER\_01"/>
12. <S412:geometry>
13. <S100:polygonProperty>
14. <S100:Polygon weatherWarningNumber="STORM00000ST\_01">
15. <gml:exterior>
16. <gml:LinearRing>
17. <gml:posList> 42.31 -32.50 42.31 -32.25 42.30 -32.00 42.25 -31.97 42.07 -31.75 42.00 -31.68 41.87 -31.50 41.75 -31.28 41.73 -31.25 41.69 -31.00 41.73 -30.75 41.75 -30.63 41.82 -30.50 41.89 -30.25 41.94 -30.00 41.94 -29.75 41.88 -29.50 41.75 -29.40 41.66 -29.25 41.59 -29.00 41.61 -28.75 41.50 -28.67 41.26 -28.50 41.25 -28.47 41.00 -28.47 40.84 -28.25 40.84 -28.00 41.00 -27.84 41.25 -27.84 41.50 -27.84 41.55 -27.75 41.75 -27.58 41.82 -27.50 41.80 -27.25 41.80 -27.00 41.75 -26.94 41.50 -26.94 41.25 -26.91 41.16 -27.00 41.00 -27.18 40.93 -27.25 40.94 -27.50 40.75 -27.69 40.50 -27.65 40.35 -27.50 40.25 -27.30 40.00 -27.30 39.75 -27.30 39.54 -27.50 39.54 -27.75 39.54 -28.00 39.75 -28.16 40.00 -28.16 40.09 -28.25 40.00 -28.32 39.75 -28.32 39.57 -28.50 39.57 -28.75 39.50 -28.83 39.25 -28.79 39.04 -29.00 39.04 -29.25 39.00 -29.30 38.91 -29.50 38.87 -29.75 38.87 -30.00 38.86 -30.25 39.00 -30.43 39.25 -30.38 39.37 -30.50 39.25 -30.58 39.00 -30.55 38.75 -30.57 38.50 -30.53 38.25 -30.54 38.00 -30.54 37.86 -30.75 37.84 -31.00 37.84 -31.25 38.00 -31.44 38.09 -31.50 38.04 -31.75 38.00 -31.82 37.75 -31.87 37.64 -32.00 37.64 -32.25 37.64 -32.50 37.55 -32.75 37.50 -32.78 37.25 -32.92 37.17 -33.00 37.17 -33.25 37.17 -33.50 37.20 -33.75 37.00 -33.85 36.75 -33.85 36.57 -34.00 36.57 -34.25 36.57 -34.50 36.66 -34.75 36.50 -34.81 36.25 -34.86 36.00 -34.97 35.98 -35.00 35.99 -35.25 35.98 -35.50 36.00 -35.54 36.25 -35.73 36.50 -35.73 36.75 -35.73 37.00 -35.60 37.25 -35.59 37.50 -35.66 37.59 -35.50 37.62 -35.25 37.75 -35.01 37.91 -35.25 38.00 -35.34 38.25 -35.40 38.35 -35.50 38.37 -35.75 38.25 -35.89 38.00 -35.89 37.75 -35.89 37.64 -36.00 37.58 -36.25 37.61 -36.50 37.50 -36.68 37.46 -36.75 37.41 -37.00 37.41 -37.25 37.45 -37.50 37.50 -37.56 37.75 -37.57 37.81 -37.75 37.81 -38.00 37.75 -38.13 37.50 -38.13 37.36 -38.00 37.25 -37.76 37.00 -37.76 37.00 -37.75 36.89 -37.50 36.89 -37.25 36.75 -37.11 36.50 -37.17 36.25 -37.16 36.19 -37.25 36.19 -37.50 36.20 -37.75 36.25 -37.80 36.50 -37.80 36.72 -38.00 36.71 -38.25 36.69 -38.50 36.75 -38.58 36.93 -38.75 36.75 -38.95 36.50 -38.95 36.25 -38.95 36.23 -39.00 36.23 -39.25 36.23 -39.50 36.25 -39.54 36.50 -39.55 36.68 -39.75 36.66 -40.00 36.75 -40.09 37.00 -40.20 37.25 -40.20 37.50 -40.13 37.70 -40.00 37.70 -39.75 37.70 -39.50 37.56 -39.25 37.75 -39.08 38.00 -39.08 38.09 -39.00 38.09 -38.75 38.09 -38.50 38.00 -38.37 37.87 -38.25 38.00 -38.19 38.25 -38.19 38.50 -38.17 38.62 -38.00 38.62 -37.75 38.66 -37.50 38.75 -37.36 38.93 -37.25 38.93 -37.00 38.93 -36.75 38.75 -36.59 38.50 -36.59 38.45 -36.50 38.50 -36.38 38.75 -36.38 39.00 -36.31 39.05 -36.25 39.15 -36.00 39.25 -35.87 39.30 -35.75 39.50 -35.57 39.75 -35.56 39.81 -35.50 39.81 -35.25 39.80 -35.00 40.00 -34.90 40.25 -34.90 40.50 -34.76 40.51 -34.75 40.51 -34.50 40.56 -34.25 40.75 -34.24 41.00 -34.15 41.09 -34.00 41.15 -33.75 41.25 -33.70 41.50 -33.66 41.60 -33.50 41.66 -33.25 41.75 -33.19 41.95 -33.00 41.95 -32.75 42.00 -32.70 42.25 -32.61 42.31 -32.50</gml:posList>
18. </gml:LinearRing>
19. </gml:exterior>
20. </S100:Polygon>
21. </S100:polygonProperty>
22. </S412:geometry>
23. </S412:windWarning>

##### E.2.3.3.2 Surface Feature Crossing the 180° meridian

If a surface feature crosses the 180° meridian, then the feature shall be divided into multiple features on separate sides of the 180° meridian. The number of features it shall be divided into will be the number of 180° meridian crossings plus one. For example, a surface feature crosses the 180° meridian twice, so it shall be divided into 3 separate features on different sides of the 180° meridian. The following is an encoding of this situation:

# <S412:windWarning gml:id="GALE00111GE\_01">

# <S412:scaleMaximum>70000000</S412:scaleMaximum>

# <S412:scaleMinimum>1100000</S412:scaleMinimum>

# <S412:issuedDateTime>2024-03-18T11:30:07</S412:issuedDateTime>

# <S412:informationProvidedFor/>

**<S412:dateTimeRange>**

# <S412:dateTimeStart>2024-03-18T12:00:00</S412:dateTimeStart>

# <S412:dateTimeEnd>2024-03-19T13:00:00</S412:dateTimeEnd>

**<S412:/dateTimeRange>**

# <S412:windWarningThreshold>2</S412:windWarningThreshold>

# <S412:beaufortForce>8</S412:beaufortForce>

# <S412:geometry>

# <S100:polygonProperty>

# <S100:Polygon weatherWarningNumber="GALE00111GE\_01">

# <gml:exterior>

# <gml:LinearRing>

# <gml:poslist> 59.30 179.50 59.30 179.75 59.29 180.00 59.30 179.50 </gml:poslist>

# </gml:LinearRing>

# </gml:exterior>

# </S100:Polygon>

# </S100:polygonProperty>

# </S412:geometry>

# </S412:windWarning>

# <S412:windWarning gml:id="GALE00111GE\_02">

# <S412:scaleMaximum>70000000</S412:scaleMaximum>

# <S412:scaleMinimum>1100000</S412:scaleMinimum>

# <S412:issuedDateTime>2024-03-18T11:30:07<S412:/issuedDateTime>

# <S412:informationProvidedFor/>

# <S412:dateTimeRange>

# <S412:dateTimeStart>2024-03-18T12:00:00</S412:dateTimeStart>

# <S412:dateTimeEnd>2024-03-19T13:00:00</S412:dateTimeEnd>

# <S412:windWarningThreshold>2</S412:windWarningThreshold>

# <S412:beaufortForce>8</S412:beaufortForce>

# <S412:geometry>

# <S100:polygonProperty>

# <S100:Polygon weatherWarningNumber="GALE00111GE\_02">

# <gml:exterior>

# <gml:LinearRing>

# <gml:poslist> 59.25 -179.88 59.00 -179.88 58.75 -179.88 58.65 -180.00 59.25 -179.88</gml:poslist>

# </gml:LinearRing>

# </gml:exterior>

# </S100:Polygon>

# </S100:polygonProperty>

# </S412:geometry>

# </S412:windWarning>

# <S412:windWarning: gml:id="GALE00111GE\_03">

# <S412:scaleMaximum>70000000</S412:scaleMaximum>

# <S412:scaleMinimum>1100000</S412:scaleMinimum>

# <S412:issuedDateTime>2024-03-18T11:30:07</S412:issuedDateTime>

# <S412:informationProvidedFor/>

# <S412:dateTimeRange>

# <S412:dateTimeStart>2024-03-18T12:00:00</S412:dateTimeStart>

# <S412:dateTimeEnd>2024-03-19T13:00:00</S412:dateTimeEnd>

# <S412:windWarningThreshold>2</S412:windWarningThreshold>

# <S412:beaufortForce>8</S412:beaufortForce>

# <S412:geometry>

# <S100:polygonProperty>

# <S100:Polygon weatherWarningNumber="GALE00111GE\_03">

# <gml:exterior>

# <gml:LinearRing>

# <gml:poslist> 58.65 179.75 58.65 179.50 58.75 179.27 59.00 179.27 59.25 179.44 59.30 179.50 58.65 179.75 </gml:poslist>

# </gml:LinearRing>

# </gml:exterior>

# </S100:Polygon>

# </S100:polygonProperty>

# </S412:geometry>

# </S412:windWarning>