NODC v1.1 profile Example netCDF File Testing Report

Mathew Biddle
NOAA's National Centers for Environmental Information (NCEI)
Cooperative Institute for Climate and Satellites - Maryland
Silver Spring, MD

This document provides a brief summary of using the NODC netCDF templates v1.1 in various online compliance checkers, software packages, and web services. The intention of this report is to provide further detail concerning the various messages a netCDF file would receive if it was in complete compliance with the NODC netCDF templates v1.1 for the profile featureType. In addition, the example data files have been imported into various software packages (Matlab, Python, and ODV) to document any inconsistencies when ingesting and plotting the data points. The commands used to import and plot the data in the software packages have also been included.

The data files used in this report can be found at:
http://data.nodc.noaa.gov/ncei/example/data/netcdf/v1.1/
and in the THREDDS catalog:
http://data.nodc.noaa.gov/thredds/catalog/example/v1.1/catalog.html

Version control

Version	Date	Author	Comments
0.9	2016-09-30	M. Biddle	Initial draft of documentation.
1.0	2016-10-11	M. Biddle	Updated documentation with feedback from NCEI netCDF working group.

Below is an outline of how this document is constructed:

Template Feature Type: (the feature type used in testing, hyperlink to file)

Checker: (compliance checker where the issue arose, hyperlink to checker)

Specific check: (includes score and date the check was ran on)

- **Issue #1**:
    - Possible resolution
- **Issue #2:**
    - Possible resolution

Specific check:

- **Issue #1**:
    - Possible resolution
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Checker:

Specific check:

- **Issue #1**:
    - Possible resolution
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Specific check:

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    - Possible resolution
- **Issue #2:**
    - Possible resolution

Access Site: (the access site used for the protocols below, e.g. THREDDS)

Protocol: (the access protocol tested, e.g. OPeNDAP Dataset Access Form)

- Result of test

Protocol:

- Result of test

Software Package: (name of software package, e.g. Matlab)

- Opening/Importing the file.
    - Result of the test, including code.
- Plotting the data
    - Result of test, including code and plots.

Profile:

IOOS Compliance Checker:

CF 1.6 (156/164) ran on 09/28/2016:

- **Cell_methods: The name field does not match a dimension, area or coordinate.**
  - The contents of the cell_methods attribute should be "lon: point lat: point" instead of "longitude: point latitude: point".
  - CF 1.6 section 7.3.4 states that it is fine for a cell method to reference a standard name (such as longitude) even though there is no coordinate designated as longitude, but it does not allow for naming a dimension. It also allows for using the name 'area', but it forbids using a standard name or 'area' if that name corresponds to a scalar coordinate variable name or a dimension name that doesn't have a corresponding 1D coordinate variable of the same name.
  - The ability to use a standard name is important for cases where each cell represents an integral over a coordinate that is not present in the file, such as Hovmöller diagram grids (time vs latitude or longitude).
- **The variable instrument1 does not have associated coordinates**
  - Expected, as the instrument variable doesn't need to have coordinates.
- **The variable platform1 does not have associated coordinates**
  - Expected, as the platform variable doesn't need to have coordinates.
- **Variable sal has a non-space-time dimension after space-time-dimensions**
  - §2.4 Dimension order - "All other dimensions should, whenever possible, be placed to the left of the spatiotemporal dimensions."
  - File is sal(profile,z)
  - This is an error in the checker, the developers are aware of the problem (https://github.com/ioos/compliance-checker/issues/284) and are working to resolve it (https://github.com/ioos/compliance-checker/milestone/8).
- **Variable temp has a non-space-time dimension after space-time-dimensions**
  - §2.4 Dimension order - "All other dimensions should, whenever possible, be placed to the left of the spatiotemporal dimensions."
  - File is temp(profile,z)
  - This is an error in the checker, the developers are aware of the problem (https://github.com/ioos/compliance-checker/issues/284) and are working to resolve it (https://github.com/ioos/compliance-checker/milestone/8).

ACDD 1.1 (66/75) ran on 09/28/2016:

- **Neither 'acknowledgment' nor 'acknowledgement' attributes present**
  - Ignore. File contains "acknowledgement"
  - This is an error in the checker and has been changed, it has yet to be published in the web checker (https://github.com/ioos/compliance-checker/pull/262).
- **Var instrument1 missing attr standard_name**

- ○ Ignore, instrument1 doesn't need standard_name attribute.
- ○ There is no requirement for any variable to have a standard name. If the quantity being measured doesn't have one it doesn't have one. This should be treated as informational.
- **Var instrument1 missing attr units**
  - ○ Ignore, instrument1 doesn't need units attribute.
- **Var profile missing attr standard_name**
  - ○ Ignore, profile doesn't need standard_name attribute.
  - ○ There is no requirement for any variable to have a standard name. If the quantity being measured doesn't have one it doesn't have one. This should be treated as informational.
- **Var profile missing attr units**
  - ○ Ignore, profile doesn't need units attribute.
- **Attr geospatial_bounds not present**
  - ○ Not necessary for profile data sets as it is one point in space.
- **Attr time_coverage_duration not present**
  - ○ Not necessary for profile data sets as it is one point in time.
- **Attr time_coverage_resolution not present**
  - ○ Not necessary for profile data sets as it is one point in time.
- **Attr geospatial_lat_resolution not present**
  - ○ Not necessary for profile data sets as it is one point in space.
- **Attr geospatial_lon_resolution not present**
  - ○ Not necessary for profile data sets as it is one point in space.

NCEI Profile Orthogonal 1.1 (125/128) ran on 06/17/2016:

- **geospatial_lat_resolution should exist and not be empty.**
  - ○ Not necessary for point data set as it is one point in space.
- **geospatial_lon_resolution should exist and not be empty.**
  - ○ Not necessary for a profile data set as it is one point in space.
- **sea_name attribute should exist and should be from the NODC sea names list: Cordell Bank National Marine Sanctuary is not a valid sea name**
  - ○ Checker is looking at https://github.com/lukecampbell/cc-plugin-ncei/blob/base/cc_plugin_ncei/data/seanames.csv for seanames. it only includes those with IHB codes. Thus, it will never include "Coastal Waters" or "Marine Sanctuaries"
  - ○ The problem has been reported at https://github.com/ioos/cc-plugin-ncei/issues/8 and is being investigated. This check can be ignored.

Jet Propulsion Laboratory Metadata Compliance Checker:

ACDD 1.1 Checker (75/120) ran on 09/28/2016:

- **"There was a problem downloading your file. The server may be too busy or the file may not exist. URL: http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184721.757749.nc"**
  - ○ Issue with the checker using OPeNDAP links.
  - ○ Downloading the file and testing against that file works.

- ○ Bug with the checker.
- **check for a comma separated value failed because "keywords" might not be comma separated.**
  - ○ Ignore as keywords is comma separated
  - ○ The list in the keywords attribute uses the GCMD convention for describing keywords, to find more information about GCMD keywords, see http://gcmd.nasa.gov/learn/keywords.html.
- **Time_coverage_duration all 2 failed**
  - ○ Ignore as profile is only one time instance so duration is moot.
- **check for existence failed because "time_coverage_resolution" does not exist**
  - ○ Ignore as profile is only one time instance so resolution is moot.
- **check for existence failed because "geospatial_bounds" does not exist**
  - ○ Ignore as profile is only one time instance so geospatial_bounds is moot.
- **check for value in a set of possible values failed because "cdm_data_type" not in possible_values...allowed values are (vector, grid, textTable, tin, stereoModel, video)**
  - ○ Currently using Station, which is not in the list provided.
  - ○ The templates use "Profile" which is also not in the list provided.
  - ○ Recommend using textTable for this attribute.
- **check for existence failed because "geospatial_*_resolution" does not exist**
  - ○ Ignore as point is only one lat/lon instance so resolution is moot.
- **Coverage_content_type all 20 failed.**
  - ○ Profile, z, time, lat, lon, sal, temp, instrument1, platform1, and crs are failing this check. ACDD 1.1 states we should have this, however, our templates do not.
  - ○ This is an error in the NODC templates v1.1, every geophysical variable should have an attribute 'coverage_content_type' with the appropriate ISO 19115-1 code.
- **check for existence failed because "crs:long_name" does not exist**
  - ○ Ignore because crs is not required to have long_name attribute.
- **standard_name 12 out of 20 passed**
  - ○ Not all variables require a standard_name attribute, in this case profile, instrument1, platform1, and crs are not required to have standard_name attributes. So the standard_name checks are not required for those variables.
- **units 12 out of 20 passed**
  - ○ Not all variables require a units attribute, in this case profile, instrument1, platform1, and crs are not required to have units attributes. So the units checks are not required for those variables.

CF 1.6 Checker (156/177) ran on 09/28/2016:

- **lat is not allowed to have an axis attr as it is not a coordinate var.**
  - ○ Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html for more information on coordinate variables.
  - ○ According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - ○ This is an expected result and is an error in our templates. The variables lat, lon, and time should not have axis attributes.
- **lon is not allowed to have an axis attr as it is not a coordinate var**

- ○ Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html for more information on coordinate variables.
  - ○ According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - ○ This is an expected result and is an error in our templates. The variables lat, lon, and time should not have axis attributes.
- **time is not allowed to have an axis attr as it is not a coordinate var**

  - ○ Our templates define this variable as an auxiliary coordinate variable, since the variable does not have the same name as the dimension. See http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html for more information on coordinate variables.
  - ○ According to CF conventions, auxiliary coordinate variables are not allowed to have axis attributes.
  - ○ This is an expected result and is an error in our templates. The variables lat, lon, and time should not have axis attributes.
- **Units attribute required for profile variable**

  - ○ Ignore, as profile is a container variable and doesn't need to contain a units attribute.

- **units are 0.001, standard_name units should be 1e-3**

  - ○ Ignore, as 0.001 = 1e-3.

- **units are degree_Celsius, standard_name units should be K**

  - ○ Ignore, degree_Celsius is a UDUNIT and is sufficient in this context.

- **The profile dimension for the variable lat does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**

  - ○ Technically, no coordinate variables exist in the file. (according to http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html)
  - ○ The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The profile dimension for the variable lon does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**

  - ○ Technically, no coordinate variables exist in the file. (according to http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html)
  - ○ The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The profile dimension for the variable profile does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**

  - ○ Technically, no coordinate variables exist in the file. (according to http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html)
  - ○ The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **Sal/Temp cell_methods_name all 3 failed "The name field does not appear in the allowable types.","The name field does not match the dimension.","The name field does not match the reserved words "interval", "area", or "comment.""**

- ○ The contents of the cell_methods attribute should be "lon: point lat: point" instead of "longitude: point latitude: point".
- **The profile dimension for the variable sal/temp does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - ○ Technically, no coordinate variables exist in the file. (according to http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html)
  - ○ The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **Coordinate time's dimension, obs, is not a coordinate variable**

  Coordinate lat's dimension, obs, is not a coordinate variable

  Coordinate lon's dimension, obs, is not a coordinate variable

  Coordinate z's dimension, obs, is not a coordinate variable
  - ○ Technically, no coordinate variables exist in the file. (according to http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html)
  - ○ The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.
- **The profile dimension for the variable time does not have an associated coordinate variable, but is a Lat/Lon/Time/Height dimension.**
  - ○ Technically, no coordinate variables exist in the file. (according to http://www.unidata.ucar.edu/software/netcdf/workshops/2011/datamodels/NcCVars.html)
  - ○ The checker wants to find a variable that has the same name as a dimension, however, for a point data set this is unreasonable. We identified one dimension which gets used as the primary dimension.

THREDDS:

OPeNDAP Dataset Access Form:

- On a Linux command line, ran:

```
ncdump -h
http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184721.757749.nc
```

- Functions as expected.

HTTPServer:

- On a Linux command line, ran:

```
wget
http://data.nodc.noaa.gov/thredds/fileServer/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184721.757749.nc
```

```
ncdump -h NODC_profile_template_v1.1_2016-09-22_184721.757749.nc
```

- Functions as expected.

WCS:

- Functions as expected.

WMS:

- Functions as expected.

NCML:
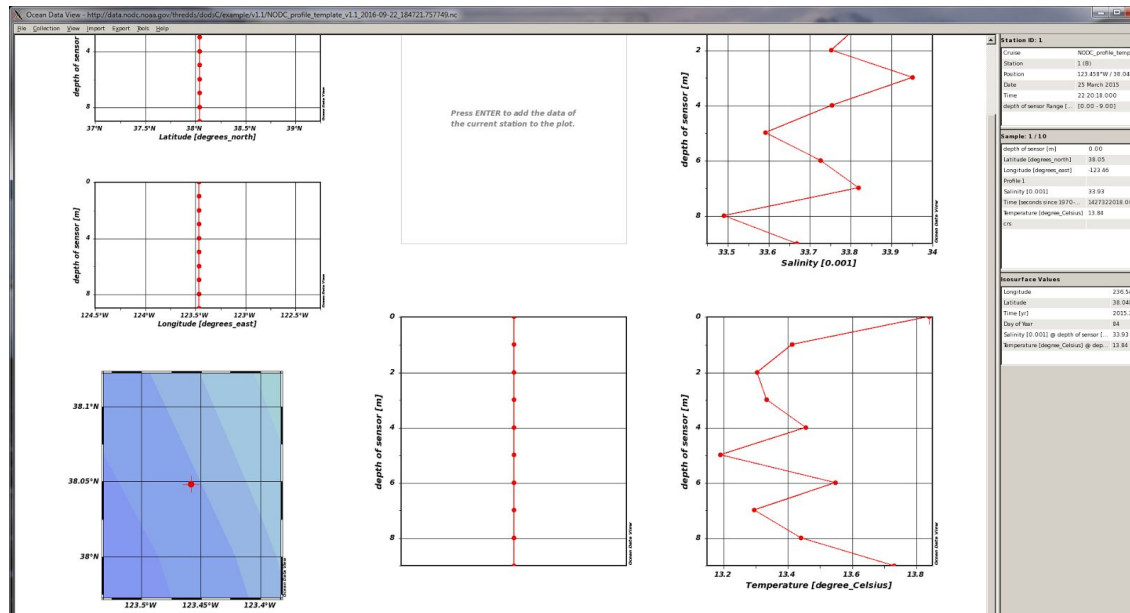
- Functions as expected.

UDDC:

- Functions as expected.

ISO:

- Functions as expected.

Ocean Data View (4.5.0):

- **Open Remote:**
  - Url: http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184721.757749.nc
  - Select Primary Variable: depth of sensor
  - Works as expected.
- **Plotting the data:**
  - Plots as expected.

Matlab (R2015a):

- Importing:
  - Imports data as expected:

```
url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184721.757749.nc';
nc = ncinfo(url);
for i=1:length(nc.Variables) g=sprintf('%i ', nc.Variables(i).Size);
fprintf('%11s %s\n',nc.Variables(i).Name,g);
end
    profile 1
       time 1
        lat 1
        lon 1
          z 10
instrument1 64
  platform1 64
        crs 1
        sal 10 1
       temp 10 1
```
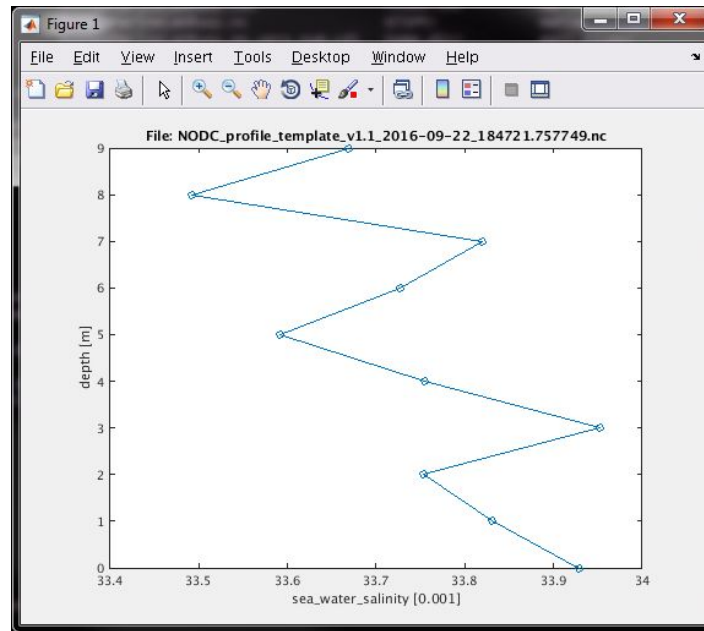
- Plotting the data:
  - Works as expected

```
url='http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22
_184721.757749.nc';
ncid = netcdf.open(url);
x1 = netcdf.getVar(ncid,8);
y1 = netcdf.getVar(ncid,4);

plot(x1,y1,'o-')
xlabel(sprintf('%s [%s]',netcdf.getAtt(ncid,8,'standard_name'),...
    netcdf.getAtt(ncid,8,'units')),'Interpreter','none');
ylabel(sprintf('%s [%s]',netcdf.getAtt(ncid,4,'standard_name')...
```

```
        ,netcdf.getAtt(ncid,4,'units')),'Interpreter','none');
file = strsplit(url,'/');
title(sprintf('File: %s',file{end}),'Interpreter','none');
```


Python 2.6.6:

- **Importing the data:**
  - Imports as expected.

```
import netCDF4
url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184
721.757749.nc'
f = netCDF4.Dataset(url,'r')
for v in f.variables:
    print '%11s %s %s' %(v, f.variables[v].dimensions, f.variables[v].shape)

    profile (u'profile',) (1,)
       time (u'profile',) (1,)
        lat (u'profile',) (1,)
        lon (u'profile',) (1,)
          z (u'z',) (10,)
instrument1 (u'maxStrlen64',) (64,)
  platform1 (u'maxStrlen64',) (64,)
        crs () ()
        sal (u'profile', u'z') (1, 10)
       temp (u'profile', u'z') (1, 10)
```

- **Plotting the data:**
  - Plots as expected:

```
import netCDF4
import numpy as np
import matplotlib.dates as mdates
import matplotlib.pyplot as plt
import datetime
```

```
url =
'http://data.nodc.noaa.gov/thredds/dodsC/example/v1.1/NODC_profile_template_v1.1_2016-09-22_184
721.757749.nc'
f = netCDF4.Dataset(url,'r')
var1_data = f.variables['sal'][:]
var2_data = f.variables['z'][:]

plt.plot(np.transpose(var1_data[0]),var2_data,'o-')
plt.xlabel('%s [%s]' %(f.variables['sal'].long_name, f.variables['sal'].units))
plt.ylabel('%s [%s]' %(f.variables['z'].long_name, f.variables['z'].units))
plt.grid(b=True, which='Major', color='k')
plt.title('File: %s' % url.split('/')[-1])
plt.show()
```
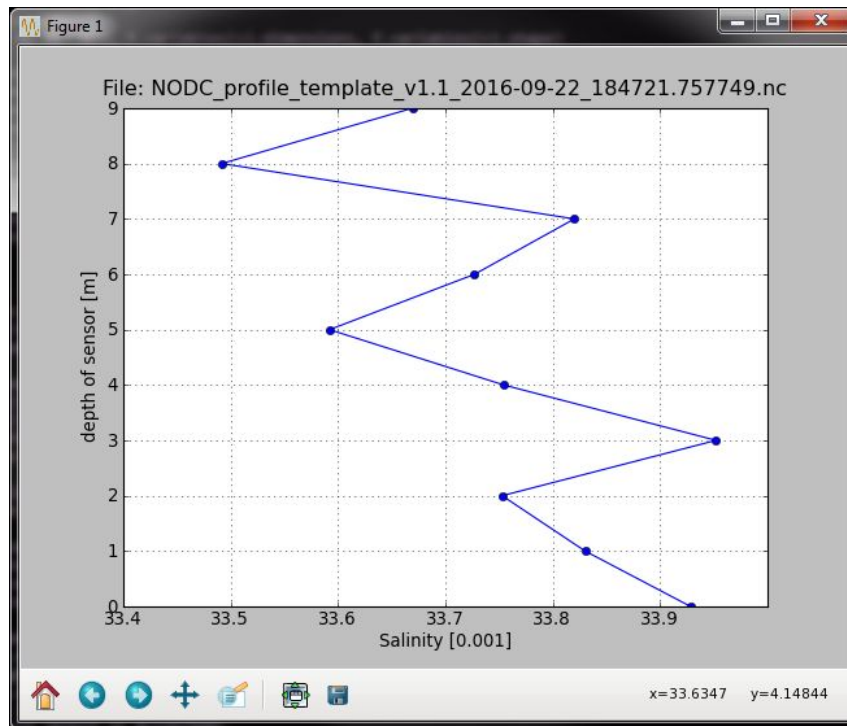

Aggregation:

- Performed a 'joinExisting' aggregation on the 'profile' dimension.
- Aggregation worked as expected.