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| WORLD METEOROLOGICAL ORGANIZATION  COMMISSION FOR BASIC SYSTEMS  -----------------------------  THIRD MEETING OF  INTER-PROGRAMME EXPERT TEAM ON CODES MAINTENANCE  MARRAKECH, MOROCCO, 15 - 19 APRIL 2019 |  | IPET-CM-III / Doc. 10.2  02.04.2018  -------------------------  ITEM 10.2  ENGLISH ONLY |

COLLABORATION WITH OTHER ORGANIZATIONS AND TECHNICAL BODIES

WMO Programmes needs for CF conventions

*Submitted by Secretariat*

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**Summary and Purpose of Document**

Needs for netCDF and CF conventions in WMO Programmes have been collected during IPET-DD-1 in Zagreb and discussed at the workshop of World Meteorological Centres. There was consensus on the necessity to have some working arrangements with the CF community and a level of WMO governance to address the issues that cannot be resolved within the CF conventions. IPET-DD proposed a workshop on WMO and CF conventions to agree on common working practices with CF community and consolidate WMO needs. The workshop proposal was endorsed and supported by the Workshop of World Meteorological Centers.

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**ACTION PROPOSED**

Examine the needs of CF conventions by the WMO Programmes and support the workshop on WMO and CF conventions.

**DISCUSSIONS**

**IPET-DD session on CF conventions**

During the first meeting of the Inter-Programme Expert Team on Data representation Development (IPET-DD) in February in Zagreb the needs on NetCDF and CF conventions by some WMO Programmes were presented. There were documents and presentations by the Chair of the Inter-Programme Expert Team on Operational Weather Radar (IPET-OWR), a representative for the Global Cryosphere Watch (GCW) programme, Eumetsat for the satellite programmes, ECMWF for the NWP community. A detailed description of the topic can be found in IPET-DD final report ( <http://wiswiki.wmo.int/tiki-download_file.php?fileId=5445> ).

The aim of IPET-DD session on netCDF and CF convention was to establish the requirements for CF based data representation in WMO Programmes and to decide if there is a need to establish some framework in WMO to support those requirements.

**Operational weather radar**

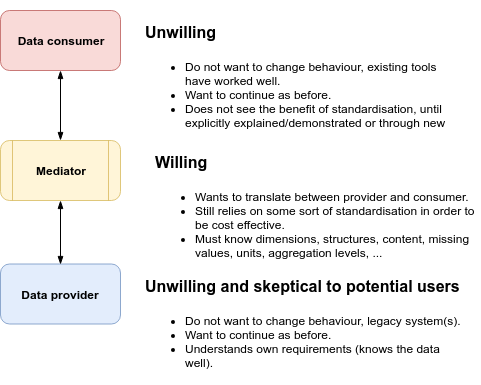
Daniel Michelson, Chair of IPET-OWR, presented the new format for radar and lidar data in radial coordinates (CfRadial2) based on netCDF-CF standards. The format is based on CF conventions and CfRadial2 has been proposed to the CF conventions governance to be accepted as part of the CF conventions. However the process of acceptance is not progressing at the moment and it is not clear if CfRadial2 will be accepted by the CF governance committee.

IPET-DD recognises the importance of having a new data format for operational radar and agrees that CfRadial2 has to be included in the Manual on Codes as a standard for the exchange of operational weather radar data.

IPET-DD recognises also the complexity of introducing a data representation based on netCDF and CF convention, being this the first format with this characteristics, and proposed IPET-OWR to use the format for experimental exchange with the aim to consolidate the data representation and exchange practices.

**Global Cryosphere Watch**

Øystein Godøy from Norwegian Meteorological Institute joined the meeting via webex to represent the needs of the WMO Global Cryosphere Watch Programme regarding netCDF and the CF convention. The main reason for the use of netCDF is in a very inhomogeneous community based on researchers with a big difficulty in changing the tools that are commonly used for the data production. The proposed solution is a data portal that is going to act as a mediator between the provider and the consumer as shown in the following picture.



The data portal is able to convert data to BUFR to exchange data on GTS, but a standardisation of the metadata both for discovery and use purposes is needed to enable interoperability. For this purpose CF convention is used, but it is considered too wide for the use in operational systems and there is a requirement to produce narrower CF profiles to be maintained by WMO for the benefit of GCW Programme and similar needs can be envisaged for other WMO Programmes. However the definition and maintenance of CF profiles by WMO can easily deviate from the CF conventions if they are developed independently and without coordination with CF governing committee. Therefore a collaboration with CF community is seen as beneficial to avoid making conflicting standards that are difficult to reconcile.

IPET-DD recognises the needs for CF profiles to be maintained by WMO, but also recognises the need to open a dialogue and collaboration with the CF community to avoid to build conflicting data representations.

**Satellite Programmes**

Guillaume Aubert made a presentation, on behalf of Daniel Lee from Eumetsat, on the position of EUMETSAT regarding CF conventions. EUMETSAT recognises the wide use of NetCDF, has plans to use it as native format for many of the future products and has recognised that CF conventions are the most suitable conventions to be used for satellite data. As early as 2008 the WMO Expert Team on Assessment of Data Representation Systems (ET-ADRS) noted that the CF Conventions are likely the most suitable standard for use in WMO systems when encoding data products in netCDF 4. The Expert Team also noted that the Conventions have certain shortcomings. The CF Conventions are already in their second decade of existence and were created when netCDF-3 was the most recent version of the netCDF format. Experience with using the Conventions have shown that:

* Many attractive features of netCDF-4 are not covered by the Conventions that would be useful for encoding data products, and
* The Conventions have evolved largely around forecast and in-situ observation data, so that improvements could be made to fit more closely with the needs of the satellite community.

In contrast to the WMO standards, the CF community does not have dedicated resources for evolving the standard and coordinating usage. This has led EUMETSAT to increase its involvement with the CF governance process.

The WMO community would profit from:

* Making use of the existing CF Conventions when encoding data products in netCDF;
* Contributing to the development of the CF Conventions using existing processes;
* Specifying a subset of the CF Conventions that would be considered appropriate for operational use in WMO;
* Considering the use of one or more additional metadata attributes that would be similar but orthogonal to the CF standard\_name attribute that would allow the unambiguous description of variables, as well as mappings between WMO and CF metadata standards, while removing any dependency between WMO and CF governance processes.

It is proposed to explore these options in a workshop involving representatives of both WMO and CF. The workshop should pursue the goal of producing clear terms of reference for future work in contributing to the evolution of the CF Conventions and governing the use of these conventions within WMO.

**ECMWF**

Sebastien Villaume explained the work that ECMWF has done to establish a CF based ECMWF profile for various types of NWP data having a GRIB representation. He explained that the base format for ECMWF is still GRIB and they don’t have plans to move to NetCDF, but there is a requirement by the users to have NetCDF for the wide use of that format in the research communities. He explained in details why the CF convention is not sufficient for operational purposes and it is too weak in the representation of time and space variables. ECMWF has setup a set of rules, that can be collected in a specific NWP profile, aimed to reduce the variability in the possible representations of a field and to define uniquely concepts that are used in the context of GRIB and for NWP purposes. The need of a NWP profile and a better way to map netCDF to GRIB is clear for the presentation.

**Workshop of World Meteorological Centres**

During the workshop of World Meteorological Centres (WMC) held in Beijing from 26 to 29 March 2019 the issue of data representations needed for the Seamless GDPFS which is covering seamlessly all time and spatial ranges in the model of the Earth System including all the components (ocean, hydrology, cryosphere, chemical composition ). There was a general representation of the need for NetCDF as the data format that is widely used in research and in user communities and a clear understanding that some regulation by WMO is needed to make the data format usable in the operational context and improve its interoperability characteristics.

**CONCLUSIONS**

IPET-DD agreed that :

* there is a need for netCDF in the WMO communities and Programmes because the format is widely used in the research community, and to reduce the research to operation time, it is a good strategy to use in operation and in research formats that are as close as possible.
* netCDF is not a good standard for interoperability purposes and that CF conventions are partially covering the lack of specific structure of netCDF.
* CF conventions are too wide to enforce full interoperability and to facilitate the operational activities, therefore in many Programmes there is the need for specific profiles that could be maintained by WMO
* defining WMO netCDF profiles can produce data representations that are in conflict with CF conventions and this is not in the interest of the communities and WMO, therefore it is important to coordinate WMO activities of development of specific netCDF profiles based on CF conventions that WMO works in close collaboration with CF community to avoid conflicting data representations.

IPET-DD proposed to WMO Secretariat to organise a workshop on “CF conventions in WMO Programmes” to bring together experts from WMO data representation and programmes activities and the CF communities with the aim to establish possible collaboration for the development of CF profiles for the use in WMO Programmes.

The workshop of WMC endorsed the initiative of having an expert team in WMO working on CF conventions and their profiles and supported the proposed workshop on CF conventions as a good initial step to establish working practices with the CF community.