**WORLD METEOROLOGICAL ORGANIZATION**

**INTER-COMMISSION COORDINATION GROUP**

**ON THE WMO INTEGRATED GLOBAL OBSERVING SYSTEM**

***TASK TEAM ON WIGOS METADATA***

***Ad hoc Workshop***

***on WIGOS Metadata for space-based observations***

Geneva, Switzerland, 29 September – 1 October 2015

**FINAL REPORT**

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***DRAFT***



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Chairperson, Publications Board

World Meteorological Organization (WMO)

7 bis, avenue de la Paix Tel.: +41 (0)22 730 84 03

P.O. Box No. 2300 Fax: +41 (0)22 730 80 40

CH-1211 Geneva 2, Switzerland E-mail: Publications@wmo.int

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**Executive Summary**

 The ad hoc workshop on WIGOS Metadata for space-based observations, in the scope of the Inter-Commission Coordination Group on the WMO Integrated Global Observing System (ICG-WIGOS) Task Team on WIGOS Metadata (TT-WMD) was held at WMO headquarters in Geneva, Switzerland, from 29 September to 1 October 2015. The session was Chaired by Mr J. Klausen (Switzerland) co-Chair, TT-WMD.

 Following the decisions and guidance by Cg-17 and EC-67 the workshop aimed at ensuring full applicability of the [WIGOS Metadata Standard (WMDS)](http://library.wmo.int/pmb_ged/wmo_1157_en.pdf). Some satellite experts were invited to represent different groups, such as the CBS/OPAG-IOS IPET-SUP (Inter-Programme Expert Team on Satellite Utilization and Products), CBS/OPAG-IOS ET-SAT (Expert Team on Satellite Systems) and EUMETSAT (European Organisation for the Exploitation of Meteorological Satellites).

 As a major outcome the workshop concluded that the WMDS is applicable and should be used by the meteorological satellites community, after a few additions and small adjustments that were identified. Specific results of the workshop include the following: for space-based observations the WMDS should be applicable to both level one and level two data; a few additional metadata elements are needed in the WMDS to accommodate all the fields currently existing in OSCAR/Space database; some use cases should be developed and included in the WMDS, to illustrate the usage of the WMDS to space-based observations.

 The results of the workshop serve as input for discussions during 4th session of TT-WMD to be held from 20-23 October 2015 at Alanya, Turkey. The workshop developed a list of actions to be developed, some by the satellite experts, and others by TT-WMD in order to ensure full applicability of the WMDS to all observations from space-based systems.

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**General summary**

1. **ORGANIZATION OF THE MEETING**

The Ad hoc Workshop on WIGOS Metadata for Space-based Observations, in relation to the work of the Task Team on WIGOS Metadata (TT-WMD) of the Inter-Commission Coordination Group on the WMO Integrated Global Observing System (ICG-WIGOS) was opened by the Mr Jörg Klausen (Switzerland) co-Chair of TT-WMD, at 11:00 hours on Tuesday, 29 September 2015, at the WMO Headquarters in Geneva.

Mr Peiliang Shi, Director of the WMO Information System Branch, welcomed the participants to the WMO Headquarters. He mentioned the approval by Congress 17 of the WIGOS Metadata Standard (WMDS) and praised the TT-WMD for the work developed so far; Dr P.Shi recalled the participants the importance of this workshop to verify the special needs of metadata for space-based observations in order to ensure that the WMDS is fully applicable and used by the meteorological satellites community. He further mentioned that the expected outcomes of this workshop should constitute a significant contribution for the fourth session of TT-WMD (20-23 October, Alanya, Turkey).

1. **INTRODUCTION/BACKGROUND**

Mr J.Klausen referred to the need of engaging the experts of space-based observations in the further development of the WMDS, as the only way to ensure integration of metadata from all types of observations. He mentioned the feedback from CBS/OPAG-IOS IPET-SUP (Inter-Programme Expert Team on Satellite Utilization and Products), that TT-WMD received in 2014, regarding a previous version of the WMDS, and the need to revisit those comments.

Mr Jérôme Lafeuille mentioned the OSCAR/Space database which focuses on instruments and referred to the need to articulate with the work of CGMS (Coordination Group for Meteorological Satellites).

Mr Leon Majewski mentioned the multidisciplinary of satellite observations and the variety of users leading to different needs of metadata; He also mentioned the importance of interoperable systems.

Mr Stephan Bojinski presented some key questions for the discussion: the level of granularity of space-based observations to be described by the WMDS, and the relation to the WIS discovery metadata.

Mr Steve Foreman stated that the WMDS is about the meaning of observations, not about finding them (WIS) and they should be applicable to all types of observations.

Mr J.Klausen mentioned the experience from developing GAW-SIS (Global Atmosphere Watch Station Information System) a metadata database integrated with OSCAR. He noted that orbit is one of the specific parameters for satellites that are not currently described by WMDS, the metadata element for geospatial location being based on latitude/longitude coordinates, which is not adequate to describe orbits. He also mentioned that the WMDS is a semantic standard, the formalization of which has recently started by IPET-MDRD (CBS OPAG/ISS Inter-Programme Expert Team on Metadata and Data Representation Development) in a joint meeting together with TT-WMD co-chairs, last June in Melbourne, Australia.

Mr J.Lafeuille raised some questions about the practical implementation of the WMDS, such as who (space agencies, Members) and how; Mr Luis Nunes recalled that space agencies act on behalf of WMO Members, who are responsible for supplying information about their observing networks, e.g. to the OSCAR/Surface which is corresponds to one repository of global metadata, according to the WMDS.

Mr Lars Peter Riishojgaard mentioned the GRUAN (GCOS Reference Upper-Air Network) as surface-based observations that are post-processed, leading to changes in metadata, in a similar way of satellite products.

Mr L.Majewski stated that considering space-based observations the WMDS should be applicable to both data level one and data level two.

1. **REVIEW OF THE OSCAR/Space ALIGNMENT WITH THE WMDS,**

**INCLUDING THE CURRENT REVISION OF THE “INSTRUMENT CHARACTERIZATION”**

Mr J.Lafeuille delivered a presentation on the OSCAR/Space online database for space-based capabilities (<http://www.wmo-sat.info/oscar/spacecapabilities>) and described the new instrument characterization schema as a scientific and objective tool for the assessment of the variables/products generated by instruments on-board of satellites.

Mr L.P.Riishojgaard noted the importance of such a characterization schema for the gap analysis process.

Mr L.Nunes mentioned that the WMDS requires a timestamp for every metadata record/change; Mr J.Lafeuille noted that the way OSCAR/Space manages changes of metadata over time, doesn’t allow for historical analysis of the metadata time series.

The instrument frequencies, as well as the telecommunication frequencies for data transmission from satellites, were discussed, and it was agreed that these fields, existing in OSCAR/Space, need to be captured by WMDS. The way those elements could be included in the WMDS depends on the kind of search required for users of this metadata; It was mentioned that searchable fields need encoded data according to standard formats.

It was also mentioned that the OSCAR/Requirements contains the primary list of geophysical variables to be considered for WMDS.

Mr J.Lafeuille mentioned the need to ensure compatibility of OSCAR/Space with the WMDS and the need to have “machine-to-machine” mechanisms for the exchange of metadata.

Mr S.Bojinski introduced the Product Access Guide (PAG), a webpage maintained by WMO to facilitate access to satellite-based geophysical datasets (mostly "level 2" products or higher): <http://www.wmo-sat.info/product-access-guide/>. He also mentioned the “Product Access Guide Concept and Specifications V 1.0” document (<http://www.wmo.int/pages/prog/sat/documents/SAT-GEN_PAG-concept-v1.0-final.pdf>) which lists the minimum metadata that shall be associated with each product in a product collection (specification S9, page 10).

It was suggested that OSCAR/Space structure should relate the WMO application areas to the instruments, instead of relating them to the satellites.

The meeting developed a table with the results of mapping the OSCAR/Space metadata fields against the WMDS elements, which is presented in Appendix II.

It was noted that the rating of variables, such as produced by the OSCAR/Space instrument characterization, is not captured by the WMDS.

Mr L.Majewski mentioned the need to distinguish metadata of different channels from the same instrument; Mr J.Klausen concluded that the WMDS should be expanded to include the channels and their frequencies, noting that the satellite community should provide the definitions for these additional elements.

1. **REVIEW OF THE WMDS (WIGOS METADATA STANDARD) - DISCUSS THE RESULTS OF THE REVIEW (TO BE) DONE BY SATELLITE EXPERTS**

Mr. Guillaume Aubert delivered a presentation on the Submission Information Package (SIP) for the EUMETSAT long-term archive. He mentioned the metadata for “Earth Observation Products” being OGC compliant with some extensions to the ISO O&M (Observations and Measurements) Standard. The SIP applies to granular data, i.e. 3 minutes sampled data.

It was suggested that a mapping exercise should be made between the SIP metadata fields and the WMDS elements and that the documentation regarding this schema should be made available to the participants in this workshop. Mr G.Aubert noted that this mapping should benefit to have beforehand the developed uses cases for satellite observations.

The meeting reviewed the comments provided by IPET-SUP to the TT-WMD in 2014, about a previous version of the WMDS; The results of the discussions concerning these comments are listed below:

* Comment 1 = agreed, this is a task to be developed;
* Comments 2 and 3 = agreed, the notes should be improved to better explain how element 1-04 applies to space-based observations; Also the development of some use cases to add to the WMDS, was agreed, as a way to illustrate the usage of the WMDS to space-based observations;
* Comments 4, 5 = ok, nothing to add;
* Comment 6 = agreed and done, vocabulary changed in code table 5-04;
* Comment 7 = checked, this relates to the implementation of element 7-04, which should be taken in a simple way;
* Comment 8 = already included;
* Comment 9 = relates to the implementation of element 8-01, which should be taken in a simple way;
* Comment 10 = already included;
* Comment 11 = relates to the implementation of element 8-05, which should be taken with some flexibility for space-based observations;
* Comment 12 = there could be more than one owner of the observation/dataset;
* Comment 13 = a new entry should be added to code table 9-02: “No limitation”
* Comment 14 = already included.

The meeting also agreed to correct and expand the code table 3-08 of the WMDS, some of the changes were made on session, but some more should be made after input from Mr S.Bojinski.

Ms Lihang Zhou joined the workshop on videoconference, via WebEx connection, and her first statement was to consider the WMDS a good document to be used as a standard for satellite observations; Then she guided the participants through her comments on the WMDS. From the discussions the following conclusions were reached:

* Comments 1, 2 = agreed, to be added to the WMDS by TT-WMD;
* Comment 3 = agreed, this is an implementation issue;
* Comments 4, 5 = agreed, it is recognized that code table 1-01 is far from being comprehensive; It needs to be reviewed and the OSCAR/Surface table of variables should be considered;
* Comment 6 = agreed, TT-WMD to better describe the meaning of matrix;
* Comment 7 = TT-WMD to remove the column “Mode of Observation (I, V, P)”;
* Comment 8 = agreed, definitions are to be completed by TT-WMD to code table 2-01;
* Comment 9 = agreed, definitions are to be completed by TT-WMD to code table 4-01;

Ms L.Zhou mentioned that NOAA draft Standards document for satellite data delivery and integration which includes a chapter on metadata that refers to NETCDF format; She promised to prepare a use case for the application of the WMDS by the NOAA satellites.

The process of updating/expanding the WMDS was discussed and Mr S.Foreman mentioned that the fast track procedure could be used, through which the PRs are consulted by correspondence; The same applies to the approval of the implementation schema (based on the logical data model being developed by IPET-MDRD), which will be essential for the development and publication of guidance material for the Members to implement the WMDS.

1. **IDENTIFICATION OF ISSUES AND ACTIONS NEEDED TOWARDS THE FULL APPLICABILITY OF THE WMDS TO THE SPACE-BASED OBSERVATIONS**

In order to check the applicability of the WMDS to space-based observations the meeting considered a set of examples of satellites/instruments and worked on developing the contents for each of the WMDS elements; The results are presented in [Appendix III](file:///%5C%5CCumulus-lx%5Cusr%5CUSERS%5Clfnunes%5CMy%20Documents%5CWIGOS_MetaData%5CTT-WMD-3%5CTT-WMD-3_Final-Report_Geneva_1-4_December2014.docx#Appendix_III), and its analysis revealed several elements that should not be applicable to space-based observations. Some conclusions are listed below:

* Code table 5-02 needs to be developed; Mr J.Klausen will share the OSCAR list for “Measuring/observing methods”;
* A new entry “Stand by” needs to be added to code table 3-09;
* Element 5-05 needs clarification; This is an action for TT-WMD;
* Code table 5-08 needs to be reviewed/expanded
* For the elements dealing with calibration:
	1. it was agreed that they apply only to major changes; for very frequent changes on parameters, a specific link to external source should be provided;
	2. the notes should be improved to better explain what is expected in these elements for space-based observations, including what is mentioned in a) above;
* It was agreed that the following elements are not applicable for space-based observations, a nil reason being acceptable (n/a): 5-10, 5-11, 5-12, 5-13; (for 5-12 the reason being that the geospatial location is the same as the platform);
* The following code tables should be revisited by TT-WMD: 3-09, 5-04, 5-14;
* An URL could be accepted for element 4-04, besides code table 4-04;

Mr Karl Monnik joined the workshop on videoconference, via WebEx connection. He was briefed on the progress of the workshop and he noted the critical importance of guidance for Members implementation of the WMDS, so for each metadata elements clear description and guidance should be developed. He added that discussions should focus on the purpose of the WMDS.

Some more results were reached by the discussion, as listed below:

* It was agreed that element 5-02 should allow for multiple instruments, so TT-WMD should take an action on this.
* For element 5-04 the entry “testing/commissioning” should be added;
* The following elements are not applicable for space-based observations, a nil reason being acceptable (n/a): 5-05, 5-06\*, 5-14, 5-15, 6-01\*, 6-02, 6-03\*, 6-05, 6-06, 6-07, 6-08, 7-01\*;

(\* for space-based observations an URL could be provided)

1. **CONCLUSIONS AND RECOMMENDATIONS**

The meeting recognized the benefits of all observing systems, surface and space-based, adopting the WMDS to ensure interoperability. It was recognized that a strengthened collaboration between WIGOS and WIS metadata development would allow for an optimized the implementation of the WMDS.

To ensure that the space-based community embraces the WMDS it was also recognized that it needs to be improved, according to what was discussed, to allow for an easy use and understanding by the space agencies; It was agreed to promote the (improved) WMDS in the major satellite-related events to come, such as the CGMS session in mid-2016.

It was mentioned that the work of TT-WMD should focus on the varying dynamics of certain elements and how these should be addressed in the future.

The list of agreed actions, with deadlines and responsible, is provided in [Appendix IV](#Appendix_IV).

The workshop was considered very fruitful and the feedback from satellite experts valuable.

1. **ANY OTHER BUSINESS**

Nothing to report.

1. **CLOSURE OF THE MEETING**

Mr L.Nunes, on behalf of WMO Secretariat, thanked the experts for their participation and wished safe return to their home countries.

Mr J.Klausen, also thanked the participants for their contribution and closed the session at 12:54 hours, on Thursday, 1 October 2015.

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**Appendix I**

**LIST OF PARTICIPANTS**

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| **Dr Jörg Klausen**(Co-Chair, TT-WMD) | MeteoSwissKrähbühlstrasse 588044 ZürichSwitzerlandTel.: +41 (0)44 256 9223Fax: +41 (0)44 256 9278Email: joerg.klausen@meteoswiss.ch  | Present from:29.Sep-1.Oct |
| **Mr Karl Monnik**(Co-Chair, TT-WMD) | Bureau of Meteorology700 Collins StreetG.P.O. Box 1289KMELBOURNE, VIC 3001AustraliaTel.: +61 (3) 9669 4205 Fax: +61 (2) 9669 4168Email: k.monnik@bom.gov.au  | Not present:Participated via WebEx on 1.Oct (AM - Geneva) |
| **Mr Leon Majewski**(Satellite expert) | Bureau of Meteorology700 Collins StreetG.P.O. Box 1289KMELBOURNE, VIC 3001AustraliaTel.: +61 (3) 9669 4205 Fax: +61 (2) 9669 4168Email: l.majewski@bom.gov.au  | Present from:29.Sep-1.Oct |
| **Mr Guillaume Aubert**(Satellite expert) | EUMETSATPostfach 100555D-64205 DARMSTADTGermanyFax: +49 6151 807 426 Tel: +49 6151 807 7196 Email: guillaume.aubert@eumetsat.int  | Present from:30.Sep-1.Oct |
| **Mrs Lihang Zhou**(Satellite expert) | National Oceanic and Atmospheric Administration, Satellite and Information Service, Center for Satellite Applications and Research (STAR)Camp Springs, Maryland, USAEmail: lihang.zhou@noaa.gov  | Not present:Participated via WebEx on 30.Sep (PM - Geneva) |

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| **WMO SECRETARIAT**  | 7 bis, avenue de la PaixCH-1211 Geneva 2 Switzerland |
| Dr Peiliang Shi | Director, WMO Information System BranchTel.: +41 22 730 82 19Fax: +41-22 730 80 21Email:  |
| Dr Lars Peter Riishojgaard | WIGOS Project ManagerTel.: +41 22 730 8193Fax: +41-22 730 80 21Email: lriishojgaard@wmo.int  |
| **Dr Jerome Lafeuille** | Chief, Space-based Observing SystemWMO Space ProgrammeTel: +41-22 730 82 28Fax: +41-22 730 80 21Email: jlafeuille@wmo.int  |
| **Dr Stephan Bojinski** | WMO Space ProgrammeTel: +41-22 730 83 19Fax: +41-22 730 80 21Email: sbojinski@wmo.int  |
| **Dr Steve Foreman** | Chief, WIS Data Representation, Metadata & Monitoring DivisionTel.: +41 22 730 8171Fax: +41-22 730 80 21Email: sforeman@wmo.int |
| **Mr Luís Nunes** | WIGOS Project OfficeTel: +41-22 730 81 38Fax: +41-22 730 80 21Email: lfnunes@wmo.int  |
| **Mr Timo Proescholdt** | WIGOS Project OfficeTel: +41-22 730 81 76Fax: +41-22 730 80 21Email: tproescholdt@wmo.int  |

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## Appendix IV

**WORKSHOP ON WIGOS METADATA FOR SPACE-BASED OBSERVATIONS - ACTIONS**

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| --- | --- | --- | --- | --- |
| **No.** | **Action/Recommendation** | **Comments** | **Deadline** | **Assigned to** |
| 1 | To add a list of Acronyms to the WMDS document | Proposed by Lihang Zhou | TT-WMD-4 | Secretariat |
| 2 | Define M, C, O before or on top of table 2 | Proposed by Lihang Zhou | TT-WMD-4 | Secretariat |
| 3 | Define/clarify the meaning of Matrix | Proposed by Lihang Zhou | TT-WMD-4 | Secretariat |
| 4 | Eliminate column “Mode of observation”, when completing code table 1-01 (entries existing in OSCAR/Surface are to be used)Circulate the OSCAR/Surface tree of variables and method to TT-WMD-4 | Proposed by Jörg Klausen | TT-WMD-4 | TT-WMD-4 |
| 5 | Complete the list of definitions in code tables 2-01, 4-01-01 and others | Proposed by Lihang Zhou | TT-WMD-4 | TT-WMD-4 |
| 6 | Circulate the NOAA draft document, which includes a section on Metadata “standard” |  | ASAPTT-WMD-4 | Lihang Zhou |
| 7 | Mapping of the Eumetsat Medatata model against the WMDS(finish examples and mention corresponding O&M element against WMDS) | For this action, it would be helpful to have the use cases for satellite use of the WMDS developed beforehand | ASAPTT-WMD-4 | Guillaume Aubert |
| 8 | Develop a use case for the application of WMDS to NOAA satellites  |  | TT-WMD-4 | Lihang Zhou; Luis to share latest version |
| 9 | Expand/complete the entries in code table 3-08 | Some changes have been made on session  | ASAP | Stephan Bojinski |
| 10 | Add notes / explanations in WMDS related to calibration / instrument section |  | TT-WMD-4 | Leon to lead |
| 11 | Update code tables according to discussions of meeting |  | TT-WMD-4 | Luis to highlight in WMDS |
| 12 | Adequate representation of TT-WMD in IPET-MDRD meeting 10-12 Nov 2015, Geneva |  |  | Guillaume to contact chair |
| 12 | Present updated WMDS / formal standard to CGMS in June 2016 |  | CGMS | WMO Space Office |