WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR INSTRUMENTS AND METHODS OF OBSERVATION

EXPERT TEAM ON STANDARDIZATION

First session

Geneva, Switzerland

26 – 29 November 2012

FINAL REPORT

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EXECUTIVE SUMMARY

This first session of the CIMO Expert Team on Standardization was held from 26 to 29 November 2012 at the WMO Headquarters in Geneva, Switzerland.

The meeting followed up on the matter of the Siting Classification for Surface Observing Station on Land that was published in the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8, CIMO Guide). It agreed on a way to provide clarifications on how to interpret and apply the classification through a question and answer website. It also reviewed the process for further developing this classification as a common WMO-ISO standard and recommended that ISO TC146/SC5 adopt it "as is" through the ISO Fast-track procedure.

The meeting reviewed a number of draft standards, including the Sustained Performance Classification for Surface Observing Station on Land, a draft metadata standard and a draft Classification of Rain Intensity Measurement Instruments Based on their Accuracy under Standardised Calibration Tests.

The meeting also addressed the matter of collaboration with ISO for the update of solar radiation standards under ISO TC180/SC1, which is chaired by one member of CIMO ET-Standardization.

The meeting reviewed draft updates of various CIMO Guide chapters.

Finally, the meeting reviewed its workplan to ensure it supports the development of the WIGOS contributing to the activities listed in the WIGOS Implementation Plan (WIP). It noted that all its activities were clearly linked to one or more activities of the WIP and included an additional action to support the development of the WIGOS regulatory material more explicitly.

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GENERAL SUMMARY

1. ORGANIZATION OF THE SESSION

1.1 Opening of the Session

1.1.1 The first session of the CIMO Expert Team (ET) on Standardization was opened on Monday, 26 November 2012 at 9:00, by Mr Brian Howe, Chairperson of ET-Standardization.

1.1.2 The list of participants is given in Annex I.

1.2 Adoption of the Agenda

The meeting adopted the Agenda as reproduced at the beginning of this report.

1.3 Working Arrangements for the Session

The working hours and tentative timetable for the meeting were agreed upon.

2. REPORT OF THE CHAIRPERSON

2.1 Mr Brian Howe presented a summary of the activities of the CIMO Expert Team on Standardization. He noted that the Siting Classification for Surface Observing Stations on Land had been discussed in Brussels, Belgium during the Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (TECO-2012, 16-18 Oct. 2012) and had raised a lot of interest from participants. Furthermore, ISO is also interested in joining the development of this classification.

2.2 He recalled that the WMO Secretariat was available to support the ET and encouraged ET members to make use of this opportunity to organize conference calls to progress the ET tasks.

2.3 He informed the meeting that he had also been appointed as Chairperson of the WIGOS Task Team on Metadata (TT-MD). The activities of that WIGOS TT-MD will be very relevant to the work of ET-Standardization, as metadata is part of ET-Standardization workplan. He will ensure appropriate coordination between both groups.

3. WIGOS DEVELOPMENT

3.1 The meeting was informed about the status of development of WIGOS, which is one of the priority areas of WMO. It was also informed in more details about the WIGOS Implementation Plan (WIP), which identifies 10 key activity areas and activities needed to be carried out in the coming years to support the development of WIGOS. The ET was invited to identify which of the WIP activities it could support, and to align its workplan accordingly. It was stressed that Congress had requested all Technical Commissions to realign their workplans to support WIGOS activities.

3.2 The meeting recalled that Congress had requested CBS and CIMO to lead the WIGOS development. It noted that WIGOS was not aiming at establishing a new network, but at deriving more value from the available data, for example through the use of metadata, standardization and improving data compatibility. The meeting recognized that the scope of ET-Standardization activities is very much in line with the activities identified in the WIP, in particular its tasks on metadata and standards development.

3.3 The WMO Technical Regulations (WMO-No. 49) include standard practices that WMO Members have the obligation to follow as well as recommended practices that WMO Members are strongly invited to follow, while the WMO Guide to Meteorological Instruments and Methods of Observation (WMO-No. 8, CIMO Guide) is providing non-biding guidance to Members. The WMO Technical Regulations are presently being updated in the context of the development of the

WIGOS Regulatory Material. This provides an opportunity to identify parts of the CIMO Guide that should be put into the WMO Technical Regulations and become obligations to Members, and also which other practices should be included as recommended practices in the Technical Regulation with a view to updating them to the status of standard practices at a later stage. The meeting decided to include a task in its workplan to support the WIGOS Task Team on Regulatory Material in identifying material from the CIMO Guide that would be suitable for inclusion in the WMO Technical Regulations. It noted that such material would have to be well accepted among Members to be suitable for inclusion in the Technical Regulations.

3.4 The meeting noted that CIMO Testbeds and Lead Centres could contribute to the development of WIGOS and recommended to the Management Group to invite them all to take an active role in this development.

3.5 The meeting reviewed the WIP and its workplan to verify whether its activities were in-line with the WIP and to identify possible other activities that it should engage in. The meeting clarified the wording of some of its tasks to better reflect their link to WIGOS and identified to which WIP activities each of its tasks are contributing. (see revised ET Workplan in Annex VIII).

4. SITING CLASSIFICATION

4.1 Update of the classification in collaboration with ISO

4.1.1 The meeting was informed that the Secretary-General of WMO had approached the Secretary-General of ISO to propose specific projects for collaboration, among others, the development of a common ISO/WMO standard based on the Siting Classification for Surface Observing Stations on Land that is published in the CIMO Guide (WMO-No. 8, Part I, Ch. 1, Annex 1.B).

4.1.2 ISO Technical Committee 146 “Air Quality”, Sub-committee 5 “Meteorology” (TC146/SC5) had already shown interest to participate in this effort at the time of the fifteenth session of CIMO (Helsinki, Finland, 2010). The ISO Central Secretariat welcomed this proposal and agreed that it would fall under the responsibility of TC146/SC5. Jenny Pellaux from the ISO Central Secretariat explained to the meeting that the details of the procedure to be followed for this development would depend on whether ISO TC146/SC5 would be willing to adopt it “as is” following the fast-track procedure, or whether it would request the further development of the standard as a common work item. In such a case, a working group would have to be established to revise the classification before it could be approved by ISO.

4.1.3 During the WMO Technical Conference on Meteorological and Environmental Instruments and Methods of Observation (Brussels, Belgium, 16-18 October 2012) a discussion session was organized on the subject of the siting classification (SC). This discussion was very well attended. A number of NMHSs reported on their experience with the implementation of the classification in their services and showed a great support to the SC in general. It was agreed that this classification was needed and useful, but that there was a need for some clarifications on how to implement it.

4.1.4 Following the outcomes of the TECO-2012 discussion, the CIMO Management Group, at its tenth session (Brussels, Belgium, 19-20 October 2012) provided guidance to ET-Standardization: 1) the focus of the work should be first placed on clarifying the use and the purpose of the siting classification, for example by adding a preamble and footnotes, and 2) the actual values/classes should not be changed at present. (However this would possibly have to be reconsidered once ISO TC146/SC5 will have reviewed the standard and decided whether it agreed to follow the fast-track procedure for its adoption “as is”.)

4.1.5 In view of the general support to the classification expressed by NMHSs during TECO-2012, and of the guidance received by the CIMO Management Group, the meeting felt that the needed clarifications did not require a revision of the classification, but could be provided in another manner, as explained below. It therefore recommended that ISO TC146/SC5 strive at approving this standard “as is” through the ISO fast track procedure.

4.1.6 The meeting noted that the publication of the siting classification in the CIMO Guide was sufficient to meet the needs of the meteorological community. However, it felt that the added-value that could be gained by having this standard published as a common ISO/WMO standard would be to reach out to other communities, interested in meteorological measurements, but which are not necessarily aware of the existence of the CIMO Guide. This is also relevant in view of the strong interest that the general public has to provide and to share meteorological measurements.

4.1.7 Indeed numerous persons and organizations are willing to contribute data of various quality. Some NMHSs are now starting to make use of such data, which have a large potential, but require careful treatment as their quality is generally not known.

4.2 **Guidance material on the application and use of the classification**

4.2.1 The meeting reviewed in details the points that had been raised during the TECO-2012 discussion session. It decided to develop a list of questions and answers to address those points, which could be posted on the CIMO website (http://www.wmo.int/pages/prog/www/IMOP/IMOP-home.html) and enlarged as new clarifications are seeked, or new issues identified. The first version of this list is provided in Annex II. This list would provide a means to clarify use of the classification and guidance on how to implement it based on Members needs. The meeting agreed that it would develop answers to new questions submitted to ET-Standardization. The meeting welcomed the proposal from Mr Leroy to share the list of questions and answers that has already been collected within Météo-France and to serve as a focal point for answering questions.

4.2.2 The meeting recognized that implementing the classification pushed network managers to think about the sites of their stations and about ways to improve them. The meeting also stressed that it would neither be realistic nor sensible to want to have class 1 stations everywhere and that stations with other values can be very valuable depending on the applications they are used for. As finding a perfect site is frequently impossible, in many cases it is better to have some observations that need more care in use than no observation at all.

4.2.3 The meeting agreed that the siting classification had several objectives, as follows:

- To improve the selection of a site and the location of a sensor within a site, to optimize its representativeness, by giving some “objective” criteria for the selection.
- To help in the construction of a network and the selection of its sites.
  - Not only for meteorological services.
  - To avoid bad positioning of instruments.
- To document the site representativeness with an easy to use criteria:
  - It is clear that a single number is not enough to fully document the environment and representativeness of a site. More additional information is necessary for that (map, pictures, description of the surroundings …).
  - Despite this numerical value, the site classification is not only a ranking system. Class 1 sites are preferred, but sites with other values are still valuable for many applications.
- To help users to consider metadata when using observation data. When metadata is a complex piece of information, it is quite difficult to use and discourage the users to use it.

The meeting recommended including these objectives in the general text of the CIMO Guide, Part I, Chapter 1, where the siting classification is introduced.

4.2.4 The meeting recognized that different methods could be used to assess a site and define the classes of each sensor. Indeed various methods were reported during TECO-2012, as well as during the meeting. The meeting therefore decided that it would be more valuable to share the various practices in use rather than developing a generic document on the subject. The meeting requested the ET members to share the material (procedures, tools, software, etc.) they have on how they assess a site and encouraged other NMHSs to also share their expertise, as it becomes available, so that it could be posted on the CIMO website for the use of all WMO Members. The meeting agreed to review the material proposed for sharing before it would be posted on the CIMO website and recommended that a contact person be identified in each document to provide clarifications on the method used for Members.

4.2.5 One of the tasks of the ET was to develop guidance on how to use the ratings obtained by the classification. The meeting addressed this matter and recognized that this was strongly dependent on the detailed purpose for which the data would be used. It concluded that developing such guidance would not be appropriate.

5. SUSTAINED PERFORMANCE CLASSIFICATION

5.1 The meeting recalled that Michel Leroy presented the sustained performance classification for surface observing stations on land that he had developed recognizing the importance of maintenance and calibration information in data exchange. The classes of this classification are marked with letters to avoid confusion with the siting classification and range from A to D to differentiate it from the siting classification. This classification provides information on how networks are maintained for each parameter. Therefore, generally, the rating of a kind of a station in the network would be the same for a given parameter, if the maintenance of all the stations of this kind within the network is the same. It is seen to be a complement to the siting classification.

5.2 This classification had been discussed by the third session of the Ad-Hoc Working Group on the WIGOS Pilot Project (Geneva, Switzerland, 8 – 9 October 2009), which had recommended that it be further developed and tested before being submitted for approval to CIMO. The classification, as agreed on by the Ad-Hoc Working Group, has been successfully implemented and tested by Météo-France.

5.3 The meeting reviewed and improved the classification as provided in Annex III. The meeting recognized that applying this classification was simpler than the siting classification, as it will mostly apply to a network in general. It also recognized that most stations would not be reaching the class A level.

5.4 Additional parameters could be included in the classification. The meeting recommended waiting for the results of the WMO Solid Precipitation Intercomparison Experiment (SPICE) to develop the classification for solid precipitation and for snow on the ground. It welcomed the offer of Heikki Turtiainen to develop and provide a proposal for present weather. Additional parameters that should be considered for inclusion in the classification are solar duration and cloud base.

5.5 The meeting requested all ET-Standardization members to review the classification in details together with the help of their colleagues and to provide comments and proposals for modification to Brian Howe by 15 January 2013. He would collate them and distribute it among the team. The meeting decided to have a teleconference on Tuesday 29 January 2013 at 13:00 (UTC+1), to review the comments and to agree on a version of the classification that would be appropriate for inclusion in the next edition of the CIMO Guide. The meeting recommended that the classification be shared with all CIMO ET-Chairs, requesting them to review the proposal with their ET and to provide feedback as appropriate by 15 January 2013, as well as to the persons which took part in the TECO-2012 discussion session on the siting classification. Those interested to join the teleconference would be welcome to do so.

6. STANDARD RELATED TO RAINFALL INTENSITY MEASUREMENTS

6.1 A reliable quantitative knowledge of the liquid atmospheric precipitation at a specific site on the territory, or over more or less extended regions (catchment basins), is fundamental to a number of investigation threads within the atmospheric and hydrological applications. Until now, most of the information available was the total accumulated rainfall over periods of time from 3 to 6 hours. However, the investigation of rapidly evolving events at the local to regional scale, with potential tremendous impact at the ground and e.g. civil protection consequences, requires information about rainfall intensity. It is worth noting that the time scales required for calculation of rain intensity at the ground are much shorter than in traditional applications. The design and management of urban drainage systems, flash flood forecasting and mitigation, transport safety measures, and in general most of the applications where rainfall data are sought in real-time, call for enhanced resolution in time (and space) of such information, even down to the scale of one minute in many cases.

6.2 The report of the WMO Laboratory and Field Intercomparisons of Rainfall Intensity Gauges (WMO/TD-No. 1304 and WMO/TD-No. 1504) provided relevant information in this context and led to the inclusion of a standard procedure for laboratory calibration of catchment type rainfall intensity gauges in the CIMO Guide.

6.3 The meeting recalled that the outcome of the CIMO Laboratory and Field Intercomparisons of rainfall intensity gauges had also led to the development of standards related to the measurement of rainfall intensity and that CIMO XV had recommended their further development, possibly as common WMO-ISO standards. Until now, a technical report has been published by CEN and two standards have been published by the Italian Standardization Organization, and the British Standards Institution, respectively. The former two are based on the material published in the CIMO Guide (Part I, Chapter 6, Annex 6C). The standard from the Italian Standardization Organization further developed it, by including classes of instruments.

6.4 The meeting was informed that calibration equipment for catching type rainfall gauges was now available on the market and enabled users to calibrate their gauges for the whole range of use, rather than doing a single point calibration, which could lead to large underestimation at high intensities.

6.5 The ET discussed the background, rationale and content of a draft standard classification of rainfall intensity gauges based on standardized calibration procedures (see Annex IV) prepared by Mr Luca Lanza. This standard is technology independent as it is based on the expected uncertainty of the instruments in laboratory conditions. It should be noted that it is applicable to catching type gauges only as, at this stage, it is not possible to provide appropriate controlled laboratory conditions for the characterization of non-catching type gauges. The meeting decided to further develop this standard by correspondence towards preparing e a final document to be included as an update of the CIMO Guide (as replacement of Part I, Chapter 6, Annex 6C).

6.6 The meeting recommended that the WMO Secretariat approaches the Italian National Association for Standardization to clarify copyright issues in view of developing the international standard based on the standard UNI 11452:2012 as mentioned above. The ET recognized that it would focus its work at its stage within the WMO community, but would consider further developing it later as a common ISO-WMO standard as it would also be relevant to other communities, like the engineering community, which is not necessarily aware of the existence of the CIMO Guide. The meeting recommended that WMO informs ISO of this plan.

6.7 The meeting was informed that ISO TC113 “Hydrometry” had had the topic of rainfall intensity on the agenda of its last meeting, but that it had finally not been discussed.

6.8 The meeting was also informed that though rainfall intensity is a variable mentioned in the WMO Technical Regulations, Volume III that is maintained by the WMO Technical Commission for Hydrology (CHy), CHy had no plan to develop a standard itself on this subject and welcomed the CIMO initiative to address this matter. The meeting invited Mr Arduino to coordinate with CHy, to ensure CHy experts review the draft standard and contribute to its further development.

7. METADATA STANDARDS

7.1 Mrs Michiko Otsuka presented a draft metadata catalogue (for sensors, observing technologies and stations) provided in Annex V, using terminology used in the CIMO Guide and in the Guide to the Global Observing System (WMO-No. 488, GOS Guide), and building up on the work done by the CIMO Expert Team on Surface Technology and Measurement Technique (ET-ST&MT) before CIMO-XV. The meeting recognized that the topic of metadata was a critical element for the development of WIGOS and that it would have to be addressed by a number of groups, among other by the WIGOS Task Team on Metadata. Therefore, the role of CIMO ET-Standardization is to cover the aspects of metadata relevant to instruments and methods of observation only.

7.2 In the GOS Manual and Guide, the metadata are listed according to the following elements: station information, individual instrument information, data-processing information, data handling information, and data transmission information. The meeting agreed that CIMO should cover the first two elements including the metadata related to instruments, observing methods, siting and exposure. The meeting recognized that some data-processing information could also be covered by CIMO when they are linked to the method of observation, such as the retrieval of cloud cover from a ceilometer.

7.3 The first task is to develop a list of observing methods to include in the metadata catalogue. This was started by extracting information about some observing techniques and types of instruments for each parameter mostly from the text of the CIMO Guide. Also, some additional entries were included to better characterize the siting and exposure of the instruments that can have a great impact on data quality. The meeting recognized that the range of metadata elements that can possibly affect data quality is enormous and that they need to be prioritized to remain manageable.

7.4 The level of details that the metadata should cover raised intense discussions. Though it would be desirable that the metadata would allow to reconstruct the information and reprocess the data at a later stage, it was recognized that this could probably only be achieved in few cases, like for radiosondes. It was agreed that the instrument type, serial number and its software version were extremely important, but in the case a reconstruction would be needed in the future, the manufacturers would be the repository for some of the required information. It was also recognized that the level of details needed was depending on the type of instrument (mercury vs electronic thermometer). The meeting also debated on the need to include calibration information going beyond the date of the last calibration, like the calibration uncertainty, the range of the calibration. The meeting recommended including the class of the siting classification, as well as the date at which it was estimated in the metadata, and the version of the classification it refers to.

7.5 Fully developing the metadata catalogue for all types of observations for which CIMO is setting standards would require a considerable amount of work. Therefore, the meeting agreed that the ET should first concentrate on the development of the catalogue for a few basic variable (like temperature, humidity) and possibly also on an upper-air system (radiosonde) and possibly also on one more advanced remote-sensing systems to test the concept and share it with other group and the WIGOS TT-MD. As Mr Howe will also be chairing the WIGOS-TT-MD, it was agreed he would provide feedback and guidance to Mrs Otsuka to ensure the work of CIMO on Metadata is aligned and appropriately contributing to the development of the WIGOS Metadata Standard pursued by WIGOS-TT-MD.

7.6 The list of observing methods and type of instruments in the draft metadata catalogue still needs improvement to cover a wide range of observing practices both in the present and the past. Therefore, the meeting requested all the ET members to provide their suggestion (and those of their colleagues) for inclusion in the catalogue by 31 January 2013 so that a consolidated version of the catalogue could be provided to the meeting of the WIGOS-TT-MD, scheduled for March 2013.

7.7 The meeting recognized that the parameters going to be used in the catalogue needed to be used consistently throughout WIGOS and therefore needed to be clearly defined. A starting point could be to use the nomenclature of the parameters used in the existing BUFR tables.

7.8 Volume A is specifying the minimum required metadata to be exchanged internationally. The meeting agreed that some additional metadata information should be shared internationally. Though it would be desirable to exchange the full range of metadata needed to characterize the observations, the meeting recognized that it was unrealistic to exchange so much information. It agreed that the catalogue should include all the information that Members should be encouraged to record, but that only a subset of that information should be recommended for international exchange, at least at present.

7.9 The meeting recommended to the CIMO Management Group that once the concept would be further developed, the CIMO Testbed and Lead Centre should be invited to contribute to testing its implementation.

7.10 The archival of the metadata was considered to be another point of concern to ensure it could be delivered to the users. The meeting agreed that it would be valuable if practices such as how to establish a metadata database and how to prioritize the metadata elements according to user's needs would be helpful to guide NMHSs in storing and delivering the metadata effectively or restoring their station histories.

8. COLLABORATION WITH ISO TC 180 – UPDATE OF ISO RADIATION STANDARDS

8.1 The meeting was informed that one of the ET-Standardization members, Wolfgang Finsterle, had been appointed as Chairman of the ISO Technical Committee 180 "Solar Energy" Sub-Committee 1 "Climate – Measurement and Data" (TC180/SC1). The meeting was presented with the list of standards that are being addressed by ISO TC180/SC1 and on their respective status (see Annex VI). Mr Finsterle informed the meeting that he was planning to personally lead some of the tasks to update these standards.

8.2 The meeting noted that these standards had been developed mainly by the meteorological community and considered whether there would be a need to further develop them as common ISO/WMO standards. It recognized that the primary user of these standards was the meteorological community and that it was well represented within ISO TC180/SC1. The risk that the revised standard would not properly address WMO requirements is therefore minimal. However, developing these standards as common ISO/WMO standards would likely require additional work and time to coordinate the approval process between both organizations, in particular as the process is new and has not been fully tested yet. In order to make best use of the available resources, the meeting therefore requested that Mr Finsterle keep ET-Standardization members and the Management Group informed of the progresses and to alert them in case issues of relevance to WMO would arise during the review of the standards. The meeting further recommended to the Management Group to monitor these developments, but not to develop common ISO/WMO standards at this stage.

8.3 The meeting recalled that ISO 9060 was based on an older version of the CIMO Guide and recommended that it be updated to match the improved recommendations/practices/nomenclarture included in the latest version of the CIMO Guide.

8.4 The meeting recommended that representatives of WMO World and Regional Radiation Centres (WRC and RRC) take an active role in the review of the TC180/SC1 standards through their respective national body, or through WMO, to ensure that WMO interests are properly covered in the review process.

9. UPDATE OF THE CIMO GUIDE

9.1 A few proposals for update of the CIMO Guide were presented to the meeting, which agreed to recommend the following modifications for the next update of the CIMO Guide:

Operational Measurement Uncertainty Requirements and Instrument Performance (CIMO Guide, Part I, Chapter 1, Annex 1D)

9.2 The meeting reviewed the entries related to radiation and agreed to include additional radiation variables in the table, as provided in Annex VII.

9.3 Mr LU stressed that the confidence interval of the uncertainties is recommended as 95 per cent in Part I, Chapter 1, Annex 1D, while in Part I, Chapter 7 "Measurement of Radiation" a confidence interval of 66% is used. The meeting agreed that all uncertainties should be expressed in 95 per cent confidence interval (with coverage factor k=2) including type A uncertainty and type B uncertainty. The meeting requested Mr LU to update Part 1, Chapter 7 accordingly.

Modification of Part I, Chapter 5 "Measurement of Surface Wind" and other Chapters relevant for the siting classification

9.4 The Ad-Hoc Working Group on the CIMO Pilot Project had recommended developing an update of Chapter 7 “Measurement of Surface Wind” to ensure consistency between that chapter and the siting classification and to clarify the cases in which a correction could be applied. The meeting agreed to include this modification as well as a table summarizing the classification of wind observing sites based on their siting and exposure.

9.5 The meeting recommended adding a line providing the reference to the siting classification in each of the chapter treating a variable covered by the siting classification. However, the meeting felt it was not needed to include summary tables, similar to that provided for wind in each chapter as the case of wind measurements was special, being the only variable for which a correction can be applied under certain circumstances. (See also recommendation to modify Part I, Chapter 1, provided in Para. 4.2.3 of this report.)

Station coordinates

9.6 The point to which the elevation of the station refers is clearly defined in the CIMO Guide, while the longitude and latitude are not so precisely defined. Following a request for clarification by some experts the meeting reviewed the need to specify the point to which the latitude and longitude of a station refer more precisely. The meeting noted that the longitude and latitude had to be provided with a resolution of one second. The meeting was of the opinion that there was no need to request Members to follow a specific practice, but agreed to include the following sentence as a recommendation: “If a higher resolution of the coordinates is desired, then the same practice can be followed, as provided below for the elevation.”

10. OTHER BUSINESS

10.1 The meeting recalled that one of its tasks was to finalize the guidelines to assist in automation of manual stations, which was presently being worked on by another CIMO expert to widen its scope. The meeting therefore invited all ET members to share expertise in this subject with Mike Molyneux in view of incorporating them in the document. The meeting felt that the content of the document would not require an update of the CIMO Guide at this stage, but that it would be sufficient to reference it in the relevant CIMO Guide chapter.

10.2 Some ET members reviewed the CIMO Guide on the need to develop additional guidance specific to climate observations to meet the required quality and traceability of climate observations. They carried out this review in collaboration with their colleagues using climate observations and using the GCOS Essential Climate Variables (ECVs) to identify climate variables of importance. Their conclusion was that most of the surface variables are already well covered by the CIMO Guide and that no addition was required. However, the meeting recognized that some groups were working on this subject and that it would be worth monitoring the developments led by the GCOS Reference Upper-Air Network (GRUAN), BRSN and Meteomet communities in view of incorporating relevant findings in the CIMO Guide, as they arise.

10.3 One aspect not covered by the GCOS ECVs was the impact of differences in siting between regions on measurements by similar instruments and the impacts of changes in siting on the Historic Record (i.e. updates to WMO/TD No 589 - 1993). The meeting recommended to include explicitly the GCOS Climate Monitoring Principles in the CIMO Guide.

10.4 The meeting was presented with a request from a group from Sweden to clarify which pressure reduction formula should be used to compare barometer readings taken at stations having different altitudes. This issue has been recurrent since the creation of WMO and until now, WMO has not recommended a particular method, except in the case of low-level stations. The reduction of pressure to mean sea level has been of particular relevance for drawing weather maps for use by forecasters. However, nowadays, forecasters are making increased use of numerical models and satellite images. Numerical models are fed with the measurements of station level pressure rather than pressure reduced at mean see level. The meeting recognized that requesting the use of only one formula, though desirable, would have significant impact on Members as it would require them to identify and modify all the places in which those formulas are used. The meeting felt that this topic needed to be addressed in a broader context, in collaboration with CAS, CBS and possibly CAeM. The meeting therefore recommended to the CIMO Management Group to consider submitting this issue for consideration to the President of Technical Commissions in the broader context of the update of the WMO Technical Regulations and the legacy of the International Meteorological Tables (WMO-No. 188. TP. 94, 1966, http://library.wmo.int/opac/?lvl=notice_display&id=5552&code=!!code!!&emprlogin=!!login!!&date_conex=!!date_conex!!), or to the WIGOS Task Team on Regulatory Material. This ET recognized that it would be better supporting the development of WIGOS in concentrating on its other work items, at present.

10.5 The meeting revised its workplan to incorporate the decisions taken during this meeting, as provided in Annex VIII.

11. DRAFT REPORT OF THE SESSION

The meeting reviewed the draft report of the session and decided to finalize it by correspondence.

12. CLOSURE OF THE SESSION

The session closed on Thursday, 29 November 2012 at 17:15 hours.

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ANNEX I

LIST OF PARTICIPANTS

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ANNEX II

QUESTIONS AND ANSWERS RELATED TO THE USE AND IMPLEMENTATION OF THE SITING CLASSIFICATION (SC)

The purpose of this material is to start a working document for the socialisation of the SC. It will give the Expert Team and those asking key questions at TECO-2012 an opportunity to become more familiar with the expectations of the SC. Further questions and answers can be added. However, some answers may take a little time. This is live document at first and it is not expected that this will be formally published. Once answers are well accepted they may be put in the guide intro to the SC but won't be used to change the approved SC unless other issues require an update.

1. What is the purpose of the Siting Classification (SC)

- It gives an estimation of how well the siting of an instrument meets the siting recommendations provided in the CIMO Guide.
- To make network planners and installers consider good practice under circumstances where compromise is needed. It aims to give some acceptable "middle ground" in between perfect and unacceptable. It should be stated that it is intended to be quite simple, as detailed metadata and quality assurance techniques exist to handle the very granular and dynamic items. In addition it is the general trend to declare the outcomes of processes in use. It is more beneficial to share the classification of parameters rather than imply that all meet the conditions of the guide.
- It enables NMHSs to rapidly assess the value of stations from partner networks.
- Users, such as climate researchers using the data get a quick idea of how representative the data may be of the region. They also get an idea of the history of the station. The higher the number, the more detailed examination of the metadata will be required to ascertain the usefulness of the data for the desired purpose.

2. Evidence of impact

Work is emerging to clarify the impact suggested by 'uncertainty' suggested in the SC. These may lead to changes in future as the evidence improves. For example, there is well developed literature on the impacts of wind shading but less on other topics. The SC has prompted some studies into the impacts of sites with respective scores and the details will take some time to be clear. (see literature references below).

The suggested ‘uncertainty’ is given to document the order of magnitude of the errors which may arise for a given class. It doesn’t mean that all the measurements are affected by such an error. Some influence factors may minimize the errors due to siting, such as moderate or high wind for temperature measurements, zero or low winds for precipitation measurements. Nevertheless, other meteorological parameters are not taken into account for the SC, to keep it simple and static (see also 5.).

3. What is the significance of the numbering system

There has been some debate on the use of numbers in the SC. This is a good and convenient system. A colour system or one based on text only could have been chosen. The numbers should not be taken to mean that higher class stations are of low value, as there may be very good reasons for the site exposure depending on the purpose for which that station was established (specific vs general purpose, mountain stations, agricultural stations, safety reasons, …). However, we acknowledge that the use of numbers can easily lead one to suggest a ranking. This is not the purpose and should be avoided. For some time the measurement experts have taken different requirements for different users, and this may be more pronounced in emergency circumstances when higher (number) classes may still be highly valuable for some applications, the SC reflects this. Because many sites have been chosen to serve the needs of many users, it is likely that many sites will not be class 1 for all parameters.

4. What tools and software can be found to help making SCs practical and efficient?

The CIMO Expert Team on Standardization will gather, review and link to tools and software, that have been found useful by users.

5. Should some parameters be considered in conjunction?
This has been well discussed, but it has been decided that the SC should remain quite simple and these will not be used. Also, considering parameters in conjunction would make it a dynamic rather than a static classification, depending on the conditions on the site.

6. How much work will it take?
This will depend on how readily it can be fitted to other new or existing work. However, currently it has been suggested (personal communication UK) that for a new site it may take an add 20 minutes on top of the previous work of about 3 hours. In Météo-France, the typical time needed to classify a station is two hours. It may be proposed that existing systems will have a long window to classify. The amount of time depends also strongly on the equipment used to assess the site.
(If other institutes want to share experience, please provide it to CIMO ET-Standardization.)

7. Some surfaces have little or no vegetation - are these included?
The SC states “ground covered with natural and low vegetation representative of the region”. What is important is to have ground representative of the **natural** state of the region, including the low vegetation of that region. If you are located in a region where there is no vegetation, then the ground surface in the vicinity of the site has to be representative of that region, with no vegetation.

8. Sometimes the sensor changes height above the surface when snow accumulates, what about these?
As long as the snow does not bury the sensor and screen, and height information is available this has no impact on the SC. The class of a site is intended to be a static number (during a year). If there is a risk that the sensor could be buried under snow, it should be mounted higher.

9. Would it help to declare the purpose of the site?
(For example this is a highway site).This has been discussed but it was thought too complex for the SC, many sites have multiple uses, these will increase over time. This information may be available in other metadata of the site.
The class helps to know whether the data are likely to be representative of a larger area.

10. Very few sites will be class 1 for wind since the SC requires a clear radius of 300m.
This is understood but evidence show that a wind impact can be detected at this range. Amendment of the CIMO Guide has been agreed by CIMO ET-Standardization (28-Nov-2012) to clarify that.

11. Will the SC depend on the assessor?
It should not. To reduce subjectivity in site assessment, staff need to be trained to ensure consistent applications of the SC. (See also point 4 above on tools and software)

12. If large snow piles can be made near the site - how is this assessed?
The SC is a static parameter so it is assessed as frequently as annually but not changed on a seasonal basis. Metadata and quality assessment techniques should be used.

ANNEX III

Sustained Performance Classification for Surface Observing Stations on Land

(Status: 29 November 2012)

A primary quality factor of a measurement is the set of “intrinsic” characteristics of the equipment used. They are the characteristics related to the design of the instrument. They are known from the manufacturer documentation and/or from laboratory or field tests. The actual performances are sometimes worse than the announced performances, depending on the “objectivity” of the manufacturer. The statement of achievable measurement uncertainty included in Part I, Chapter 1, Annex 1D of WMO-No. 8 (Guide to Meteorological Instruments and Methods of Observation, hereafter called CIMO Guide) should be used to check the possible validity of the uncertainty announced by the manufacturer. When writing technical specifications to buy equipment, it is necessary to have in mind the achievable measurement uncertainty: even requesting only the state-of-the-art achievable uncertainty may result in high costs and/or some exaggeration of their instrument’s performances by some manufacturers. Therefore, it is highly recommended to be aware of the possible performances (with associated costs) before issuing technical specifications. A value analysis may lead to specify lower performances than the “required measurement uncertainty” and the “achievable measurement uncertainty” found in Part I, Chapter 1, Annex 1D of WMO-No. 8. Test and intercomparison reports of instruments are very valuable tools to specify and select an instrument with objective information.

Once an instrument is selected and its performance characteristics known, it is necessary to maintain the level of performance during operation. Preventive maintenance and calibration are therefore necessary and must be performed to maintain the desired measurement uncertainty.
When delivering observations for various applications (mainly forecasts and climatology), it should be possible to state the “guaranteed” (for example with a 95% level of confidence) uncertainty of a measurement. It is not always done and using “by default” the “achievable measurement uncertainty” of WMO-No. 8, Annex 1D is not recommended.

In order to document the performance characteristics of the various surface observing networks, this document defines a classification, called "sustained performance classification" including the uncertainty of the instrument and the periodicity of preventive maintenance and calibration. This classification ranges from A (instrument well maintained following the WMO/CIMO required measurement uncertainty and stated achievable measurement uncertainty, in particular Annex 1D of the CIMO Guide) to D (no maintenance and calibration organized), with an additional class E for unknown characteristics and maintenance.

This classification is related to a network, considering the instruments used and the maintenance organization applied for this network. So, it is a “structural” classification. It doesn’t mention the information of what has been made on a particular day on a particular site.

The five levels are:

- Class A: WMO/CIMO required measurement uncertainty or achievable measurement uncertainty when higher. Maintenance and calibration are organized to keep this uncertainty in the field and over time. When the required measurement uncertainty is smaller than the achievable accuracy, the latter is indicated.
- Class B: Lower specifications, but still considered as quite “good”, often having a good value to money ratio and more affordable in practice. Maintenance and calibration are organized to keep this uncertainty in the field and over time.
- Class C: Specifications and/or maintenance and calibration procedures lower than class B, but known and applied. Maintenance and calibration are still organized.
- Class D: Specifications lower than class C or no maintenance and calibration organized.

- Class E: Unknown performances and/or unknown maintenance procedures.

Typical conditions to get and maintain the stated accuracy are indicated in the list below.

For any Class, in order to be compliant with the Class, all parameters must be fulfilled.

This list is meant to cover commonly measured parameters, especially when they are expected to be also provided by third-party networks.

When calibration is mentioned, it has to be understood as calibration against an instrument traceable to SI units and including the uncertainty of the calibration.

Depending on the climatological conditions, sensors may have to be heated to prevent them from being affected by snow, icing and freezing phenomena.

Parameter	Class A	Class B	Class C	Class D
Air temperature	**0.2°C** (achievable measurement uncertainty). Temperature probe with uncertainty below or equal 0.05 °C (in laboratory conditions, over the measuring range). Uncertainty of the acquisition system < 0.02 °C. High performance artificially ventilated screen. Laboratory calibration of the temperature probe every year.	**0.5 °C** Temperature probe with uncertainty below 0.25°C (corresponds of class A of IEC 751 standard, Pt100 platinum probe). Acquisition uncertainty < 0.1°C. Radiation screen with known characteristics and over-estimation of Tx (daily max. temperature) < 0.25°C in 95% of cases. Laboratory calibration of the temperature probe on a regular and planned time interval based on the characteristic of the temperature probe used.	**1.0°C** Temperature probe with uncertainty < 0.4°C, with good stability, such as Pt100. Acquisition uncertainty < 0.2°C. Radiation screen with known characteristics and over-estimation of Tx < 0.7°C in 95% of cases.	**> 1°C** Temperature probe and/or acquisition system uncertainty lower than for class C. Unknown radiation screen or with "unacceptable" characteristics (for example, over-estimation of Tx > 0.7°C in 5% of cases).
Relative humidity	**3%** (achievable measurement uncertainty). Performance verified over the full range of humidity and a temperature range typical for the location of the station. Acquisition uncertainty < 0.2%. Calibration every 6 months, in laboratory.	**6%** Sensor specified for ± 6%, over a temperature range typical for the location of the station. Acquisition uncertainty < 1%. Calibration every year, in laboratory.	**10%** Sensor specified for ± 10%, over a temperature range typical for the location of the station. Acquisition uncertainty < 1%. Calibration every two years in laboratory.	**> 10%** Sensor with performances or specifications worst than ± 10% over the common temperature conditions or Calibration not organized.
Atmospheric pressure	**0.3 hPa** (achievable measurement uncertainty). Sensor with a numeric output. Influence of dynamic pressure due to wind reduced by a static head. Yearly calibration in laboratory.	**0.5 hPa** Sensor with a numeric output. Sensor specified for ± 0.5 hPa, including possible drift between calibrations. Two-year calibration in laboratory.	**1 hPa** Sensor specified for ± 1 hPa, including possible drift between calibrations. Calibration organized for this uncertainty.	class C zed.

Wind	Wind speed: **10% (or 0.5 m/s)** Starting threshold (for wind speed) ≤ **0.5 m/s** wind direction: **5°** Calculation of wind parameters following WMO recommendations: 4 Hz samples, gust over a 3 seconds period. Yearly control of bearings, for rotating anemometers. Yearly calibration. Note : wind speed uncertainty could be reduced to 5% for wind energy. To be changed if 5% is introduced in the CIMO guide. Sensor heated (if the climatological conditions require it)	Wind speed: **10% (or 0.5 m/s)** Starting threshold (for wind speed) ≤ **1 m/s** wind direction: **10°** Calculation of wind parameters following WMO recommendations, with the possible difference concerning gust calculation: min. 1 Hz sampling, gust calculated over a period ≤ 3 s. Yearly control of bearings, for rotating anemometers.	Wind speed: **15% (or 0.5 m/s)** Starting threshold (for wind speed) ≤ **2 m/s** wind direction: **10°** Two-year control/maintenance of the mechanical status of sensors.	Wind speed: > **15%** (or **1 m/s**) Wind Direction: > **20°** Starting threshold (for wind speed) > **2 m/s**. Or no regular maintenance organized.
Precipitation (liquid). To be aligned with the standardization proposed in Item 6 (Luca G. Lanza)	The larger of **5%** and **0.1 mm.** (achievable measurement uncertainty). Reported resolution better than or equal to 0.1 mm. If any, error related to precipitation intensity corrected. Use of a wind shield. Daily control of the collecting funnel for rain gauges using a funnel or equivalent parallel measurement control. 6 months calibration for tipping bucket rain gauges.	The larger of **5%** and **0.2 mm.** Reported resolution better than or equal to 0.2 mm. If any, error related to precipitation intensity corrected or at least known. 6 months calibration for tipping bucket rain gauges. Weekly control of the collecting funnel for rain gauges using a funnel or equivalent parallel measurement control.	The larger of **10%** and **0.5 mm.** Unknown error related to precipitation intensity. Calibration period of tipping bucket rain gauges lower than 18 months. A preventive maintenance is defined and applied.	> **10%** or no control and adjustment methods defined or no regular maintenance organized.

Precipitation (solid)	To be developed following the completion of SPICE			
Snow depth	To be developed following the completion of SPICE			
Global solar radiation	Pyranometer of high quality (acc. to CIMO Guide). **5%** for daily total. Ventilated sensor. Calibration every two years. Regular cleaning of the sensor (at least weekly and daily in case of lithometeor deposition). Sensor heated (if the climatological conditions require it)	Pyranometer of high quality (acc. to CIMO Guide). No ventilation. Calibration every two years. Regular cleaning of the sensor (at least weekly).	Pyranometer of good quality (acc. to CIMO Guide) No ventilation. Calibration every five years. No regular cleaning of the sensor.	Uncertainty > 10% for daily total or sensor not using a thermopile. Or Calibration not organized
Visibility (MOR)	**50 m** below 600 m, **10%** between 600 and 1500 m, **20%** above 1500 m. All, in 95% of cases in homogenous visibility conditions (ratio of standard deviation to mean value over 10 minutes < 0.1). 3 months calibration (or periodicity recommended by the manufacturer, if lower). At least, weekly cleaning of the optics.	The larger of **20%** and **50 m**, up to 10000 m. In 90% of cases in homogenous visibility conditions. 6-months calibration (or periodicity recommended by the manufacturer). For forward scatter meters, full control of the calibration chain: reference transmissometer, transfer control forward scatter meter, calibration plates. Use of internal warning from the sensor to clean the optics.	The larger of 40% and 100 m, up to 10000 m. Yearly calibration. Defined calibration chain (and applied !).	Specifications lower than for class C or No control and adjustment methods defined or No regular maintenance organized.
Temperature above or below ground level. (calibration practice may vary because of difficulty to	Not specified by WMO. **0.5°C** Laboratory calibration of the temperature probe every 2 years, for temperature above ground.	**1°C** Temperature probe with uncertainty < 0.25°C (corresponds to class A of IEC 751 standard, Pt100 platinum probe). Acquisition uncertainty < 0.1°C. Laboratory calibration of the	**1.5°C** Temperature probe with uncertainty < 0.4°C. Acquisition uncertainty < 0.2°C.	class C or Height (or depth) of measurement unknown.

burry probe at the same location)		temperature probe on a regular and planned time interval based on the characteristic of the temperature probe used, for temperature above ground..		

ANNEX IV

CLASSIFICATION OF RAIN INTENSITY MEASUREMENT INSTRUMENTS BASED ON THEIR ACCURACY UNDER STANDARDISED CALIBRATION TESTS

1. Scope

A classification is defined for rain intensity measurement instruments, based on their demonstrated performance in the laboratory, and standardised calibration tests are described for use in assessing the accuracy of catching-type rain gauges both in the laboratory and in the field.

This classification does not relate to the physical principle exploited for the measurement nor it refers to the technical characteristics of the instrument assembly, but it solely bases on the resulting accuracy of the measured rainfall intensity.

For catching-type gauges, procedures and suitable equipment are described to perform laboratory and field tests in steady state conditions aimed at the calibration and metrological confirmation of rain intensity measurement instruments.

2. Other relevant international standards

EN/TR 16469:2012	*Hydrometry - Measurement of the rainfall intensity (liquid precipitation): requirements, calibration methods and field measurements*
EN 13798:2010	*Hydrometry - Specification for a reference raingauge pit*
ISO/TS 25377:2007	*Hydrometric uncertainty guidance (HUG)*
ISO 14001:2004	*Environmental management systems - Requirements with guidance for use*
ISO 14004:2004	*Environmental management systems - General guidelines on principles, systems and support techniques*
EN ISO 9000:2005	*Quality management systems - Fundamentals and vocabulary*
EN ISO 9001:2008	*Quality management systems - Requirements*
EN ISO 9004:2009	*Managing for the sustained success of an organization - A quality management approach*
CEI 70099:2008	*International vocabulary of metrology - Basic and general concepts and associated terms*
ENV 13005:2000	*Guide to the expression of uncertainty in measurement*
EN ISO 10012:2004	*Requirements for measurement processes and measuring equipment*
EN ISO/IEC 17025:2005	*General requirements for the competence of testing and calibration laboratories*

3. Other relevant national standards

UNI 11452-2012	*Hydrometry – Measurements of Rainfall Intensity (liquid precipitation): Metrological requirements and test methods for catching type gauges.*
BS 7843-3:2012	*Acquisition and management of meteorological precipitation from a gauge network.*

4. Terms and definitions

Terms and definitions as from CEI 70099:2008, ENV 13005:2000, EN ISO 10012:2004 are endorsed, together with the following further terms and definitions.

…

5. Classification of rain intensity measurement instruments

5.1 Criteria for rain gauge classification

Rain gauge instruments used to measure liquid precipitation intensity at the ground shall be attributed a suitable class, based on their specific accuracy performance, expressed in terms of the maximum observed error with respect to a known, constant reference intensity at the temporal resolution of one minute. The condition that the time constant of the instrument is contained within the same interval in time is also relevant to this aim for weighing type gauges.

The reference to be used in assessing the instrument's performance is a known and constant (steady) continuous/discontinuous volumetric flow of *purified* water named "reference flow rate", Q_{ref} , whose levels (or states) are obtained by means of the methodology described under par 5.4 below and provided in input to the instrument under test.

Each level, or state, is equivalent to a reference liquid precipitation intensity, which depends on the physical characteristics of the single gauge, i.e. on the surface area of the catching device, or collector, Ω. The reference equivalent rainfall intensity I_{ref} associated with a given level Q_{ref} of the reference flow rate, is obtained as:

$$I_{ref} = Q_{ref} / \Omega \qquad (1)$$

The required performance in measuring liquid precipitation intensity are determined – within the range of intensity values where compliance with a given class is to be assessed –based on the assessment of the measurement accuracy expressed in terms of the percentage relative error e_{rel} [%],calculated as:

$$e_{rel}[\%] = \frac{I_{mis} - I_{ref}}{I_{ref}} \cdot 100 \qquad (2)$$

where:

I_{mis} = the measured liquid precipitation intensity
I_{ref} = the reference equivalent intensity

In case of weighing gauges, performance are also determined based on the so-called step response, expressed in terms of the instrument time constant, i.e. the amount of time that is required by the instrument to measure 63,2%of the reference intensity value (see Figure1).

Note that, in case of tipping-bucket rain gauges, the measurement accuracy is also subject to sampling errors due to the finite size of the bucket.

The required performance must be fulfilled with reference to measurements performed at the temporal scale of one minute, based on the statistical calculation of the sample average relative error $m_{e.rel}$ and the associated sample standard deviation $s_{e.rel}$ evaluated over a minimum sample set of 30 minutes (so that statistics are calculated over at least 30 values of the one-minute relative error) per each level of the reference intensity (in steady state conditions).

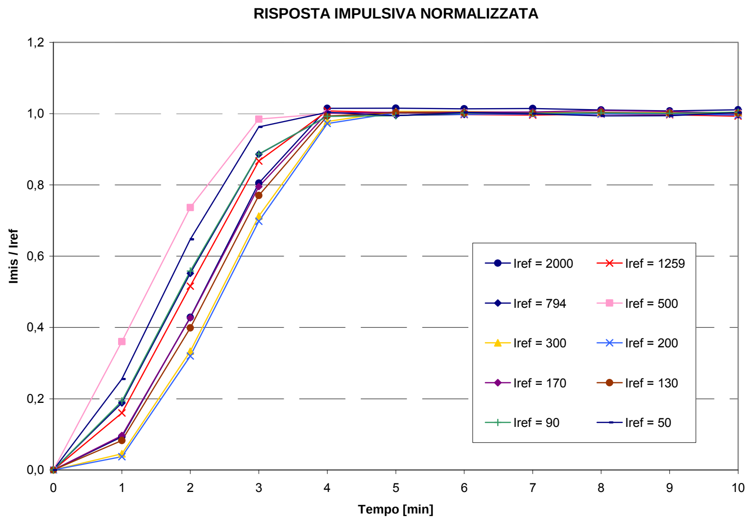


Figure 1: Sample step response determination for a weighing rain gauge with a time constant larger than one minute at various equivalent reference intensities.

Performance are deemed acceptable when the average value and the 10° and 90° percentiles (i.e. 80%of all recorded values) of the percentage relative error fall within the accuracy limits requested for each single Class. The accuracy of the instrument, for each single reference intensity, is evaluated through estimates of variables that are indicative of trueness and repeatability of consecutive intensity measurements. Therefore, the interval containing 80% of the percentage relative errors shall be evaluated in the form:

$$R = \{q_{10}^{e}, q_{90}^{e}\} \quad (3)$$

where:

q^{e}_{10}: 10° percentile;

q^{e}_{90}: 90° percentile.

In case the errors can be assumed to have a Gaussian-like distribution, this interval can be expressed as:

$$R = \{\mu_{e.rel} + k \cdot \sigma_{e.rel}, \mu_{e.rel} - k \cdot \sigma_{e.rel}\}$$

(4)

where:

k numeric constant depending on the probability distribution of the errors (in case of the Gaussian distribution, $k \approx 1,28$);

$\sigma_{e.rel}$ standard deviation of the percentage relative error (indicating the repeatability of the measurement);

$\mu_{e.rel}$ the expected value (indicating the trueness of the measurement);

and assuming:

$s_{e.rel}$ the estimator of the standard deviation of the percentage relative error;

$m_{e.rel}$ the estimator of the expected value of the percentage relative error.

Attribution of the class to each rainfall intensity measurement instrument, within the range of rain intensity values where this is requested, shall be performed according to the limits reported below:

Class	Maximum Permissible Error (MPE)	Step response time (*)
A	±3%	< 1 minute
B	±5%	< 1 minute
C	±5% ±10%	≥ 1 minute < 1 minute
(*) Relevant for weighing gauges only		

Table 1 – Maximum permissible errors (MPE) and step response time for the various classes.

Class A: Class A rainfall intensity gauges shall demonstrate to have maximum errors in measuring the reference rainfall intensity at the temporal resolution of 1 minute less or equal to ±3% provided, in case of the weighing gauges, they fulfil the criterion of having a step response time contained within the same interval in time.

Class B: Class B rainfall intensity gauges shall demonstrate to have maximum errors in measuring the reference rainfall intensity at the temporal resolution of 1 minute less or equal to ±5%provided, in case of the weighing gauges, they fulfil the criterion of having a step response time contained within the same interval in time.

Class C: Class C rainfall intensity gauges shall demonstrate to have maximum errors in measuring the reference rainfall intensity at the temporal resolution of 1 minute less or equal to ±5%, but they do not fulfil, in case of the weighing gauges, the criterion of having a step response time contained within the same interval in time. In alternative, they shall demonstrate to have maximum errors in measuring the reference rainfall intensity at the temporal resolution of 1 minute less or equal to ± 10% provided, in case of the weighing gauges, they fulfil the criterion of having a step response time contained within the same interval in time.

Instruments that are demonstrated to have maximum errors in measuring the reference rainfall intensity at the temporal resolution of 1 minute larger than ±10% can not be classified according to the present standard.

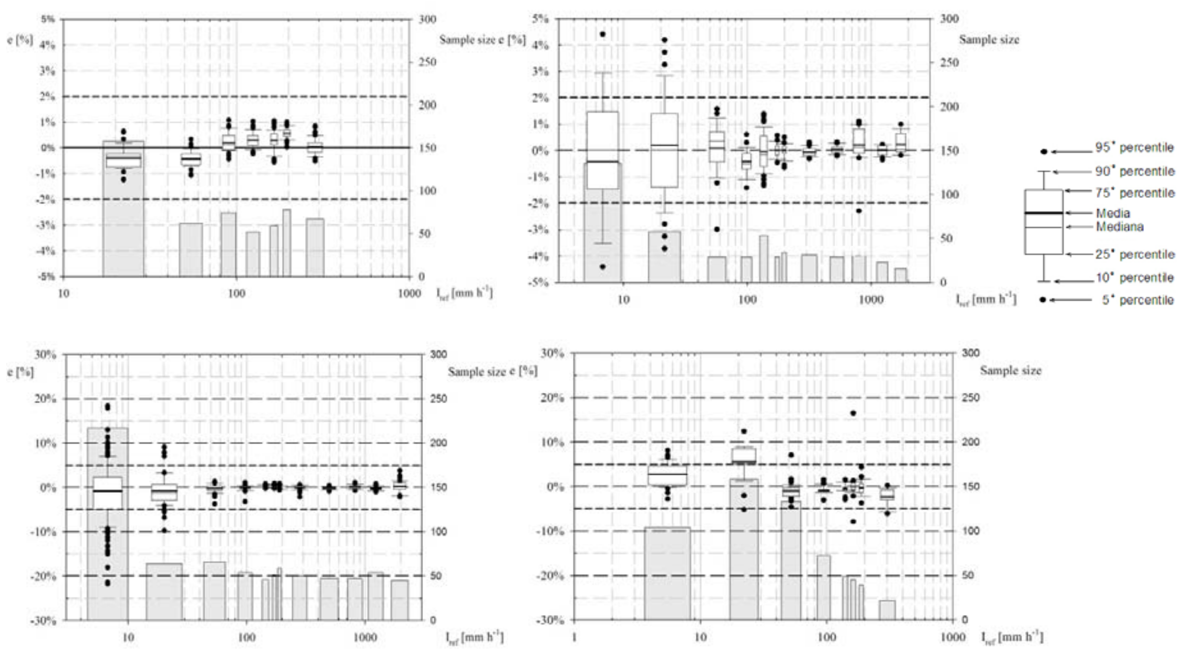


Figure2: Example of the non-parametric distribution of the observed relative errors, at various equivalent reference intensities, after tests performed on various rain intensity gauges: Class A tipping-bucket rain gauge (top left);weighing gauge of Class B at the lower intensity and Class A for the higher intensities (top right) and time constant lower than one minute; a weighing gauge of Class C for intensities higher than 20 $mm \cdot h^{-1}$and time constant larger than one minute(bottom left);Class C tipping bucket rain gauge (bottom right). The background grey histogram indicates the number of minutes available during the test (the sample size) per each reference intensity.

Attribution of the Class to any specific instrument can be limited to cover a reduced measurement range with respect to the entire operational range of the instrument, which can be classified differently over different measuring ranges. For example, one instrument could be attributed Class B between 2 and 50 $mm \cdot h^{-1}$, and Class A at higher rainfall rates.

The performance class that is required in order to fulfil the objectives of the usage envisaged for a given instrument is defined by the user, also with reference to the following indications:

Class A	*Scientific research, urban meteo-hydrology, civil protection (e.g.flash floods), climatology of extreme events, climate change, traffic safety (e.g. aquaplaning)*, *etc.*
Class B	*Agronomic applications, General climatology, Water Resources Management, etc.*
Class C	*Qualitative determinations (high, low, medium intensity), etc.*

Instruments that do not fulfil any of the above classification criteria, should not be considered as suitable for liquid precipitation intensity measurements.

5.2 Check of the balancing of the buckets

With reference to the tipping-bucket rain gauges alone, the attribution of any Class is subject to passing a specific test to check the correct balancing of the two buckets, as described under item 5.5.3 of this document.

5.3 Consistency of the information content

The measured values to be used in the assessment of the performance of a rainfall intensity measurement instrument and for attributing a given Class are those provided as output from the instrument, i.e. the indications of the variable “precipitation intensity” (or similarly named), at the resolution of one minute in time. Any other measurement of precipitation provided by the instrument must be consistent with that information: in particular, the possible additional variable “rainfall depth” values (or similarly named) must be consistent with the integral in time of the measured precipitation intensity except for a reasonable numerical approximation of the data. If the consistency of the information content is not fulfilled, the instrument can not be attributed any class according to the present document.

5.4 Characteristics of the device for generating the equivalent reference intensity

5.4.1 Overview

This section defines specifications for the device used to generate the reference equivalent rainfall intensity and how tests shall be performed to assess the performance, with reference to the procedures for calibration/metrological confirmation of catching-type gauges in the laboratory, already defined in the WMO recommendations [3].

5.4.2 Metrological characteristics of the device for generating the reference equivalent intensity

The laboratory equipment to be used in order to generate the reference equivalent intensity shall be able to provide to the collector of the catching-type gauge under test with a known and constant flow rate for a sufficient period of time to guarantee completion of the test, and, in any case, such that a duration of at least 30 minutes is allowed for each test.

The capacity of generating a constant flow rate shall be such to cover the entire operational range of measurement of the instruments under test.

The assessment of the flow rate actually generated and the equivalent precipitation intensity expressed in $mm \cdot h^{-1}$, shall be performed by measuring the volume of water provided to the instrument and the corresponding time window. The determination of the flow rate shall be characterised by a value of the extended uncertainty equal to 1% with a coverage level of 95%.

5.5 Testing procedure

5.5.1 **Dynamic** *calibration*

The testing device shall be able to acquire the signal in output from the rain gauge at least at a temporal resolution $\Delta t = 1$ min, or to record the time stamp corresponding to the issuing of each impulse and the number of impulses per minute.

The reference rainfall intensity values to be used for testing the rain gauge shall be selected among the following: 2, 20, 50, 90, 130, 170, 200, 300, 500, 800, 1200, 2000 $mm \cdot h^{-1}$, together with the maximum value declared by the manufacturer, if larger than 2000 $mm \cdot h^{-1}$(up to 2000 $mm \cdot h^{-1}$if the maximum value is not declared).

The number of reference rainfall intensities to be generated per each test is a function of the operational range declared by the manufacturer and shall not be less than 3 within the range 0-300 $mm \cdot h^{-1}$ *and* not less than 5 if the operational field of measurement is larger.

The accuracy of the generated reference intensities shall be contained within the following limits:

- 1.5 – 4 $mm \cdot h^{-1}$ for the test at 2 $mm \cdot h^{-1}$;
- +/- 25% for the test at 20 $mm \cdot h^{-1}$;
- +/- 10% for the higher intensities.

The test report shall contain, in the form of a table, the average value $m_{e.rel}$ and the 10° and 90° percentilesq^e_{10}, $q^e_{90}$of the percentage relative error distribution e_{rel} [%], per each value of the tested reference intensity.

A dynamic error curve can be determined either theoretically or in the form of a best fit regression on the observed data using to this aim a second order polynomial or a power law function.

In case of tipping-bucket rain gauges, at some reference intensities, “storage” conditions may occur for the water inside the instrument’s collector. In such conditions, water is accumulated in the collector before it is conveyed to the counting device (the tipping bucket), therefore resulting in a different flow rate than the reference one, which depends on the depth of water and the size of the outflow orifice. The occurrence of storage shall be visually detected and annotated.

5.5.2 Step response (time constant)

In case of weighing gauges, the instrument response to a step input shall be also assessed at the same reference intensities used in the dynamic calibration test. Data shall be acquired at the temporal resolution of one minute and the duration of the test shall be ≥ 10 min.

The synchronisation delay between the starting of the test and the starting of data acquisition shall be less than 1 sec, which therefore represents the maximum lag between the measurement of time reported by the instrument and the one reported by the equipment used to generate the reference flow rate.

The test report shall contain, in the form of a table, the value of the intensity measured by the instrument per each minute of the test, and the corresponding value of the time constant τ per each equivalent reference intensity value. In order to evaluate τ, data can be subject to some regression with the objective of obtaining the (possibly normalised) step response curve of the instrument under test.

5.5.3 Balancing of the buckets

In case of tipping-bucket rain gauges, checking of the correct balancing of the buckets shall be performed at the same equivalent reference intensity used in the dynamic calibration/metrological confirmation test.

With the aim of reducing the duration of the tests, but still covering a wide range of rainfall intensity values, checking of the balancing of the buckets shall be performed at least at 3 reference equivalent intensity values: 20, 90 and 200 mm/h.

The laboratory equipment to be used to generate the equivalent reference intensities shall be able to provide the collector of the catching-type gauge under test with a known and constant flow rate for a sufficient period of time to ensure completion of the test and, in any case, such that at least 30 tippings can be observed per each bucket (buckets are hereinafter indicated as “left” and “right” at the sole scope of distinguishing them from each other).

The test consists in measuring the time of tipping Δt_b of the bucket identified by subscript *b*. This variable shall be evaluated as the difference between the instant in time when bucket *b* is suddenly moved to the filling position and the instant corresponding to the next movement. The relative difference (e_b) between the average time of tipping of bucket *b* alone (m_b) and the overall average (m) shall be evaluated as:

$$e_b[\%] = \frac{m_b - m}{m} \cdot 100$$

The balancing checking test shall be considered as passed, per each single reference intensity and per each of the two buckets, if the relative difference is less than ± 5% (i.e. $|e_b|$< 5%).

As for the bucket stability, therefore the repeatability of the times of tipping of the single bucket, the following conditions shall be requested:

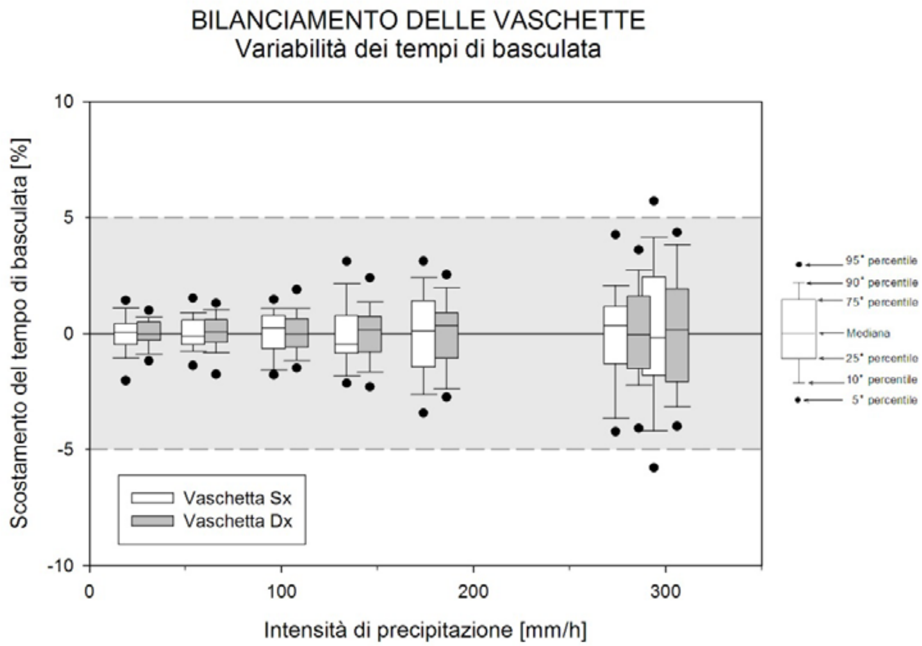
$$k \cdot CV = \frac{k \cdot s_b}{m_b} < 0.05$$

where:

k:	numeric constant depending on the probability distribution of Δt_b (in case the distribution cab be assumed as Gaussian, $k \approx 1,28$);
CV	the sample coefficient of variation ($CV = s_b/m_b$);
m_b	the sample average of the times of tipping of bucket *b* alone;
s_b	the sample standard deviation.

NOTE: The requirement is that the 10° and 90° percentiles of Δt_b, i.e. the 80% of the times of tipping, fall within a range of ± 5% ($k \cdot CV$< 0.05).

The test report shall contain, in the form of a table, the relative difference e_b [%] and the value of *kCV* for the two buckets at the equivalent reference intensity values.



FigureIII.1: Example of the non-parametric analysis of relative deviations from the average of the times of tipping of the left (Sx) and right (Dx) bucket for a well balanced instrument, where the 80% of the values is well within the ± 5% limits, over the entire operational range of measurement of the instrument.

5.5.4 Metrological confirmation

Rainfall intensity measurement instruments are subject, under ordinary operational conditions, to a progressive decay of their performance, the magnitude of which also depends on the environmental conditions where the instrument is operating.

For this reason, the attribution of the class to a rainfall intensity measurement instrument shall have a duration that is appropriate for the envisaged use of the instrument itself and periodic calibration shall be therefore envisaged within the framework of an established procedure of metrological confirmation. This procedure shall be elaborated according to the relevant provisions of the EN ISO 10012:2004.

5.5.5 Verification of the calibration in the field

The verification of the calibration in the field, performed by means of suitable portable devices, can not be used for the attribution of the class to a rainfall intensity measurement instrument.

It is possible, however, to use such portable devices for checking that the instrument did maintain its performance over time, with the aim of assessing when extraordinary maintenance is required or the need arise to return to the laboratory to undertake full metrological confirmation tests.

The verification in the field of the accuracy performance of catching-type rainfall intensity gauges shall be performed with suitable devices that allow undertaking the same tests described in the present document, although using a reduced number of equivalent reference intensities (at least three values to cover the operational range declared by the manufacturer) so as to reduce the time needed to finalise the test. In particular, the devices shall be able to generate a constant flow rate for the entire duration of any single test, while the use of purely volumetric devices (providing the instrument with a fixed volume of water in an uncontrolled time interval) shall not be acceptable for the verification of rain intensity measurement performance in the field.

5.5.6 Characteristics of the Certificate of Class Attribution

The Certificate of Class attribution shall be prepared according to the provisions specified by the EN ISO 10012:2004, and shall include:

- the unambiguous description of the rain gauge under test (manufacturer, model, serial number) and of the possible data logger if associated with the rain gauge in the certification request;
- the date of the test;
- the type of certification issued (first attribution of the class, metrological confirmation);
- the description of the procedure and equipment used to undertake the tests;
- the quantification of the uncertainty associated with the determination of the reference flow rate;
- the indication of the variables describing the ambient conditions (temperature, pressure, relative humidity)and the water temperature;
- depending on the type of rain gauge, the results of the above described tests, with indication of the Class attributed to the instrument;
- the indication of the recommended frequency for metrological confirmation;
- any possible notes (e.g. observed storage, etc.).

References

[1] Lanza, L.G., Leroy, M., Alexandropoulos, C., Stagi, L. and Wauben, W. (2005). *Laboratory Intercomparison of Rainfall Intensity Gauges*. World Meteorological Organisation – Instruments and Observing Methods Rep. No. 84, WMO/TD No. 1304. (http://www.wmo.int/pages/prog/www/IMOP/publications/IOM-84_Lab_RI/IOM84_RIgauges_Sept2004-2005.pdf).

[3] WMO,2008. Draft First Supplement to the Seventh Editionof the Guide to Meteorological Instruments and Methods of Observation, WMO-No. 8, 7thed., World Meteorological Organization, Geneva, Switzerland, pp. 593. (http://www.wmo.int/pages/prog/www/IMOP/publications/CIMO-Guide/Suppl-1.html).

[4] Vuerich, E., Monesi, C., Lanza, L.G., Stagi, L. and E. Lanzinger (2009). *WMO Field Intercomparison of Rainfall Intensity Gauges.*World Meteorological Organisation – Instruments and Observing Methods Rep. No. 99, WMO/TD No. 1504, pp. 286. (http://www.wmo.int/pages/prog/www/IMOP/publications/IOM-99_FI-RI.pdf).

[5] WMO, 2001. Final Report of the Expert Meeting on Rainfall Intensity Measurements, Bratislava, Slovakia, 23-25 April 2001. (http://www.wmo.int/pages/prog/www/IMOP/reports/1999-2002/EM-Rainfall-Intensity-2001.pdf).

ANNEX V

DRAFT METADATA CATALOGUE

(Assessment of Table 1.2, Table 2.1 and Table 2.2, Appendix III in the Guide to GOS)

1. Assessment of "Table 1.2 Individual Instrument Information (required for operational purposes)"

1.1 Type of metadata

Parameters measured	*Proposed*
Principle of operation	
Siting and exposure	

1.1.1 Parameters measured (proposed)

Parameters	Variables measured
Temperature	Maximum temperature
	Minimum temperature
	(Ordinary) temperature
	Soil temperature
Atmospheric Pressure	Pressure
	Pressure tendency
Humidity	Mixing ratio
	Dewpoint temperature
	Specific humidity
	Relative humidity
	Vapor pressure
	Saturation vapor pressure
Wind	Averaged wind speed/direction
	Peak Gust
Precipitation	Amount
	Duration
	Intensity
	Type
	Snowfall
	Snow depth
Radiation	Direct solar radiation
	Global (solar) radiation
	Diffuse sky (solar) radiation
	Reflected solar radiation
	Upward long-wave radiation (downward-looking)
	Downward long-wave radiation (upward-looking)
	Total radiation
Sunshine duration	-
Present/past weather	-
Evaporation	-
Soil moisture	-
Visibility	-
Clouds	Amount
	Height of cloud base
	Type of cloud

1.1.2 Principle of operation

Method of measurement/observation	
Type of instrument	*Proposed*
Configuration	*Proposed*

Type of detection system	

1.1.2.1. Principle of operation for each parameter (*proposed*)

1.1.2.1.1. Temperature

Method of measurement/observation	Type of instrument	
Liquid-in-glass thermometers	Mercury-in-glass thermometers	
	Ethyl alcohol-in-glass thermometers	
	Others	
Mechanical thermographs	Bimetallic thermograph	
	Bourdon-tube thermograph	
	Others	
Electrical thermometers	Electrical resistance thermometers	Pure platinum
		Platinum alloys
		Nickel
		Tungsten
		Others
	Semiconductor thermometers	Disc thermistor
		Rod thermistor
		Spherical thermistor
		Others
	Thermo couples	
	Others	
Others	-	

Configuration

Radiation shield or screen	Yes/no
Type of shield or screen	
Size of shield or screen	
Artificially ventilated	Yes/no
Degree of ventilation	*[s]*

1.1.2.1.2 Atmospheric pressure

Method of measurement/observation	Type of instrument
Barometers	Mercury barometers
	Aneroid barometers
	Bourdon-tube barometers
	Others
Electronic barometers	Aneroid displacement transducers
	Digital piezoresistive barometers
	Cylindrical resonator barometers
	Others
Bareographs	Aneroid bareographs
	Others
Others	-

Configuration

Installed indoors or sheltered	Yes/no
Venting device	Yes/no

1.1.2.1.3 Humidity

Method of measurement/observation	Type of instrument
Psychrometers	Assmann aspirated psychrometers
	Screen psychrometers
	Sling/whirling psycrometers
	Others
Hygrometers	Hair hygrometers
	Chilled-mirror dewpoint hygrometers
	Lithium chloride heated condensation hygrometers (dew cells)
	Others
Electrical hygrometers	Electrical resistance hygrometers
	Electrical capacitance hygrometers
	Electromagnetic radiation absorption hygrometers
	Others
Others	-

Configuration

Radiation shield or screen	Yes/no
Type of shield or screen	
Size of shield or screen	
Artificially ventilated	Yes/no
Degree of ventilation	*[s]*

1.1.2.1.4 Surface wind

Method of measurement/observation	Type of instrument
Rotating anemometers	Cup anemometers
	Propeller anemometers
	Others
Wind-direction vanes	Wind vanes
	Others
Other anemometers	Pitot tube anemometers
	Sonic/ultrasonic anemometers
	Hot-disc anemometers
	Hot-wire anemometers
	Others
Estimation (without instrument)	Beaufort scale number
	Others
Others	-

Configuration

The height of mast or tower	*[m]*
Heating device (to prevent icing)	Yes/no

1.1.2.1.5 Precipitation

Method of measurement/observation	Type of instrument
Rain gauge	Ordinary gauges
	Weighing gauges
	Tipping-bucket gauges
	Siphoning gauges
	Float gauges
	Others
Optical method	Optical disdrometers

	Others
Drop counter method	Drop counters
Impact method	Impact disdrometers
Capacitive method	Capacitive disdromenters
Ultrasonic/laser method (measurement of snow depth)	Sonic ranging depth sensors
	Laser sensors
	Others
Manual observation for snowfall and snow depth	Rulers
	Others
Others	-

Configuration

Gauge rim diameter	*[cm]*
Heating device (to prevent icing)	Yes/no
Wind Shield	Yes/no
Type of wind shield	Single Alter wind shield
	Double Alter wind shield
	Nipher wind shield
	Tretyakov wind shield
	WMO DFIR
	Others

.1.1.2.1.6 Radiation

Method of measurement/observation	Type of instrument
Pyrheliometric method	Thermoelectric pyrheliometers
	Thermoelectric Spectral pyrheliometers
	Silver disk pyheliometers
	Others
Pyranometric method	Thermoelectric pyranometers
	Photovoltaic pyranometers
	Bimetallic pyranographs
	Others
Pyrradiometers	Pyrradiometers
	Net pyrradiometer
Pyrgeometers	Pyrgeometers
Others	

1.1.2.1.7 Sunshine duration

Method of measurement/observation	Type of instrument
Pyrheliometric method	Pyrheliometers (combined with an threshold discriminator and a time-counting device)
Pyranometric method	Pyranometers (the same as above)
Burn method	Campbell-Stokes sunshine recorders
	Jordan sunshine recorders
	Others
Contrast method	Solar-cell-type sunshine recorders
	Others
Scanning method	Rotating mirror sunshine recorders
	Others
Others	-

1.1.2.1.8 Other surface variables

Present and past weather

Method of measurement/observation	Type of instrument
Manual observations	-
Automated detection systems	Forwardscatter/backscatter present weather sensors
	Optical disdrometers
	Video Cameras
	Others

Visibility

Method of measurement/observation	Type of instrument
Manual observations	-
Automated detection systems	Transmissometers
	Forwardscatter sensors
	Lidars
	Video Cameras
	Others

Clouds

Method of measurement/observation	Type of instrument
Manual observations	-
Automated detection systems	Ceilometers
	Video Cameras
	Others

2. Assessment of "Table 2.1 Station information (required for near-real time and non-real time purposes)"

Type of metadata	
Station name	
Station index number or identifier	
WMO block and station numbers	
Geographical coordinates	
Local land-use (Agriculture, housing, industrial and commercial areas, …)	*Proposed* (ref. WMO/TD No.1186)
Category of the station *Definitions of stations as described in GOS Manual* (Surface synoptic station, reference climatological station, …)	*Proposed* (ref. GOS Manual)
Postal Address of the station or the contact person (in case of unmanned stations)	*Proposed*
The name of supervising organization or institution	*Proposed* (ref. GOS Manual)
Manned station or unmanned station	*Proposed*
…….	
Local topography description	
Topo-scale map with a scale of 1:20,000 – 1: 50,000 showing contours of elevation differences and local land use/land cover	*Proposed* (ref. CIMO Guide and WMO/TD No.1186)
Micro-scale map with a scale of 1:2,500 – 1:5,000 showing the locations of buildings and trees (with height)	*Proposed* (ref. CIMO Guide and WMO/TD No.1186)

Layout of the observation field showing the installation of instruments, the area covered by short grass or lawn ([m^2]), and the distances between installations or from nearby buildings or trees	*Proposed* (ref. CIMO Guide and WMO/TD No.1186)
Date of latest maintenance for the surface of the field such as cutting grass or mowing, renewing or patching the lawn	*Proposed* (ref. WMO/TD No.1186)
Radiation horizon mapping including marked obstacles with their heights in the neighbourhood	*Proposed* (ref. CIMO Guide, WMO/TD No.1186)
……	

When a station with a certain station number has different observing sites for different measured parameters, the station information for each of the sites should be recorded (e.g. Tokyo (47662) has a remote site 800 m away from the original location for the purpose of observing wind, radiation and sunshine duration in order to avoid the obstructions caused by nearby high story buildings. All the other parameters such as temperature, humidity or precipitation are observed at the original site).

3. Assessment of "Table 2.2 Individual instrument information (required for near-real time and non-real time purposes)"

Siting and exposure

Type of metadata	
Location	
…….	
Horizon mapping (using a clinometer and compass survey in a circle around the sensor and a fisheye lens photograph looking at the zenith)	*Proposed* (ref. WMO/TD No.1186)
Photographs in the cardinal directions taken from the instrument enclosure	*Proposed* (ref. WMO/TD No.1186)
Micro-scale sketch of the instrument enclosure	*Proposed* (ref. WMO/TD No.1186)
…….	

Calibration data

Type of metadata	
…	
Latest date of maintenance	*Proposed*
Maintenance procedure description	*Proposed*
…	
Is traceability to the international standards guaranteed? (yes/no)	*Proposed*
…	

ANNEX VI

STATUS OF ISO TC 180/SC1 STANDARDS

Standard Number	Title	Current Status
ISO/TR 9901:1990 (Ed.1)	Solar energy -- Field pyranometers -- Recommended practice for use	Committee to decide whether to review this Technical Report.
ISO 9847:1992 (Ed.1)	Solar energy -- Calibration of field pyranometers by comparison to a reference pyranometer	Systematic Review Ballot is currently open. Closing date: 2012-12-17
ISO/PWI 9060	Solar energy -- Specification and classification of instruments for measuring hemispherical solar and direct solar radiation	Edition 1 published in 1990. It has been agreed to create a proposal for a new project. Work to be started on this project.
ISO/PWI 9845-1	Solar energy -- Reference solar spectral irradiance at the ground at different receiving conditions -- Part 1: Direct normal and hemispherical solar irradiance for air mass 1,5	Edition 1 published in 1992. It has been agreed to create a proposal for a new project. Work to be started on this project.
ISO 9059:1990 (Ed.1)	Solar energy -- Calibration of field pyrheliometers by comparison to a reference pyrheliometer	Remains valid until 2013-10-15. After this date committee to decide whether to revise, confirm or withdraw the standard
ISO 9846:1993 (Ed.1)	Solar energy -- Calibration of a pyranometer using a pyrheliometer	Remains valid until 2013-10-15. After this date committee to decide whether to revise, confirm or withdraw the standard

ANNEX VII

AMENDMENT TO THE CIMO GUIDE

Revised **CIMO Guide table on radiation instrument performances**

(1) *Variable*	*(2)* *Range*	*(3)* *Reported resolution*	*(4)* *Mode of measurement observation*	*(5)* *Required uncertainty*	*(6)* *Sensor time constant*	*(7)* *Output averaging time*	*(8)* *Achievable operational uncertainty*	*(9)* *Remarks*
Global downward/upward solar radiation	Not specified	1 J/m^2	T	2%	20s	n/a	5% (daily) 8% (hourly)	Daily total exposure
Downward/Upward long-wave radiation at Earth surface	Not specified	1 J/m^2	T	5%	20s	n/a	10%	
7.2 Net radiation, radiant exposure (daily)	Not specified	1 J m^{-2}	T	0.4 MJ m^{-2} for ≤ 8 MJ m^{-2} 5% for > 8 MJ m^{-2}	20 s	n/a	~~0.4 MJ m^{-2} for ≤ 8 MJ m^{-2} 5% for > 8 MJ m^{-2}~~ 15%	Radiant exposure expressed as daily sums (amount) of (net) radiation Best achievable operational uncertainty is obtained by combining the measurements of 2 pyranometers and 2 pyrgeometers

ANNEX VIII

REVISED WORKPLAN
A1: CIMO Expert Team on Standardization (2011-2014)

No.	Task description	Person responsible	Action	Deliverable	Deadline for deliv.	Status [%]	Comments
1.	**Guidelines to assist in automation of manual observations as a contribution to WIGOS**	**M. Molyneux**	1. Finalize IOM report with guidelines 2. Examine whether parts of IOM report should be included into CIMO Guide 3. Develop update for CIMO Guide chapter	1. IOM Report 2. Report to OPAG-A Chair if update required 3. Update of CIMO Guide Chapter on AWS, if required	March 2011 Dec. 2011 2013	100% 25% Not Rqd.	CIMO-XV, para 4.8 Report ready. To be published by Secretariat. 1. Sent to Roger Late 2011. 2. Ongoing 3. Not required Aligns with WIP Action 1.1.1, 6.1.1
2.	**Develop guidance for WIGOS standards by refining the siting classification**	**M. Leroy** M. Molyneux 4. **H. Bloemink** (in collab. w. J.v.d.Meulen)	1. Develop guidance material on how to apply the classification 2. Develop guidance on how to use ratings obtained by classification 3. Collaborate with ISO through the WMO Secretariat in further developing siting classification as WMO-ISO standard 4. Develop update for CIMO Guide chapter on wind measurements in accordance with siting classification	1.1 IOM Report 1.2 Advice to OPAG-A Chair if update of CIMO Guide is required 2. Document 3. WMO-ISO standard 4. Update of CIMO Guide Chapter on wind measurements *	2012 2012 Dec 2011 TbD later Sept. 2011	20% 100%	CIMO-XV, para 4.36, 4.37 1 French text exists. Need to collaborate with other countries that have begun to apply classification. 2 3 WMO has sent a letter to ISO, dated 28th of September 2012, about the development of common ISO-WMO standards, beginning by the siting classification 4 Completed. Report provided to Isabelle April 2012. Aligns with WIP Actions 1.1.1, 4.1.2, 6.1.1, 8.1.1 and 9.1.3
3.	**Finalization of the maintenance classification for**	**M. Leroy** M. Molyneux B. Howe	1. Finalize the development of the maintenance classification	1. Document describing classification	Feb 2013	80%	CIMO-XV, para 4.36 No specific finalization since the last discussions in 2009-2010. In

No.	Task description	Person responsible	Action	Deliverable	Deadline for deliv.	Status [%]	Comments
	observing stations						Meteo-France, our initial maintenance classification has been updated, taking into account the discussions within the CIMO WG. I join the result of this updating, unfortunately in French, I have to translate it for further discussions. Aligns with WIP Actions 1.1.1, 4.1.2, 5.1.1, 6.1.1, 8.1.1 and 9.1.3
4.	**Develop WIGOS metadata standards for instruments and methods of observation**	**M. Otsuka** B. Howe (In collab with CBS ET-AWS)	1. Review existing material 2. Continue development of metadata catalogue (for sensors, observing technologies and stations) using terminology used in CIMO Guide and Guide on GOS	1. Catalogue 2. Document describing catalogue	Oct. 2012 Oct. 2013	100% 20%	CIMO-XV, para 4.3 1 Completed review of existing material Aligns with WIP Action 8.1.1
5.	**Standard for the classification of instruments for rainfall intensity measurements**	**L. Lanza** I. Dollery	1. Provide draft standard in English 2. Contact other relevant WMO programmes (in particular CHy) 3. Further develop standard to meet their requirements 4. Collaborate with ISO through the WMO Secretariat in view of publishing it as WMO-ISO standard	1. Draft standard 2. Progr. Contact & focal points nominated 3. Updated standard for inclusion in the CIMO Guide 4. (WMO-ISO standard)	Nov 2012 Jan 2013 June 2013 TBD	100% 20%	Draft standard in English is about ready. An initial version was already used under CEN/TC 318 to develop the CEN/TR 16469:2012. Updated all anticipated completion dates by one year. Aligns with WIP Actions 1.1.1, 4.1.2, 6.1.1 and 8.1.1
6.	**Collaborate with ISO TC 180 on review of radiation standards**	**W. Finsterle** LU Wenhua	1. Assess whether TC 180 standards should be published as WMO-ISO standard 2. Collaborate with ISO TC 180 through the WMO Secretariat for the review of the standards	1. Document informing MG and Secretariat on pros and cons for each standard 2. Revised standards	2012 2013	100%	CIMO-XV, para 4.33 Aligns with WIP Action 6.1.1
7	**Update CIMO Guide table on radiation instr.**	**LU Wenhua** W. Finsterle	1. Review part 7(radiation) of CIMO Guide Table 1B (Part I,	1. Revised table	Dec 2012	100%	ET-ST&MT, para.4.5

No.	Task description	Person responsible	Action	Deliverable	Deadline for deliv.	Status [%]	Comments
	performances		Chapt. I) 2. 2. Resolve differences in uncertainties noted in Ch 1 and Ch 7 (k=2 should be used)	2. Updated CIMO Guide Chapter 7	Feb 2013		Updated anticipated completion date from Jun 2012. Aligns with WIP Action 1.1.1, 6.1.2
8.	**Update of CIMO Guide following publication of Ghardaia intercomparison report**	**M. Leroy** (in collab. with ET-A3)	1. Develop an update for relevant CIMO Guide chapters on recommended standard calibration procedures, etc. according to results of intercomparison	1.1 Advice to OPAG-A Chair if update of CIMO Guide is required 1.2 Updated CIMO Guide chapter *	Dec. 2011 Mar 2013	100%	CIMO-XV, para 4.17 No progress Aligns with WIP Action 1.1.1, 6.1.1
9.	**Review CIMO Guide with respect to guidance on climate observations**	**I. Dollery** H Bloemink	1. Review CIMO Guide on need to develop additional guidance specific to climate observations to meet the required quality and traceability of climate observations.	1.1 Advice to OPAG-A Chair if update of CIMO Guide is required 1.2 Updated CIMO Guide chapter(s), if appropriate *	Apr. 2012 2013	100%	CIMO-XV, para 9.15 May 2012 – No further action required. Aligns with WIP Action 1.1.1
10.	**Contribute to the implementation of WIGOS and provide relevant advice and support to the CIMO-MG**	All	1. Ensure ET Tasks are well-aligned with the WIP Activity area Actions. 2. Provide guidance to TT-WRM on CIMO Guide contributions to the Tech Regs.	1. Updated work plan 2. Excerpts from CIMO Guide proposed for inclusion in WMO Tech Regs	1. Nov 2012 2. Sep 2013	100% 0%	Aligns with WIP Actions 1.1.1, 4.1.2, 5.1.1, 6.1.1, 8.1.1, 9.1.3

Spring 2012 Update

Fall 2012 Update.
