

**WORLD METEOROLOGICAL ORGANIZATION**

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**COMMISSION FOR BASIC SYSTEMS**  
OPEN PROGRAMME AREA GROUP ON  
INTEGRATED OBSERVING SYSTEMS

ITEM: 6

**SECOND AD HOC IPET-OSDE WORKSHOP ON  
OBSERVING SYSTEM NETWORK DESIGN**

Original: ENGLISH

GENEVA, SWITZERLAND, 2-4 FEBRUARY  
2015

**COMMENTS FROM GRUAN WG MEMBERS THAT COULD BE USED FOR DEVELOPING  
OSND GUIDANCE MATERIAL**

*(Submitted by John Eyre (United Kingdom))*

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**SUMMARY AND PURPOSE OF DOCUMENT**

The document provides comment from GRUAN leaders that could be used for developing OSND guidance material.

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**ACTION PROPOSED**

The Meeting is invited to note the information contained in this document when considering its recommendations.

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- Appendix:**
- A.** Email comments from, and response, to GRUAN leaders
  - B.** Comments from GRUAN leaders on draft OSND principles

## **DISCUSSION**

1. The GRUAN community has some specific expertise relevant to observing system design. Following the GRUAN-GSICS-GNSSRO WIGOS Workshop on "Upper Air Observing System Integration and Application", Geneva, 6-8 May 2014, and to ensure that the GRUAN community was given an explicit invitation to comment on the draft OSND Principles, the latest available draft was forwarded to leaders of the GRUAN community for comment on 30 May 2105.
  2. On 6 June 2014, general collated comments were received from leaders of the GRUAN community, and also their detailed comments on the draft OSND Principles. These are presented in Appendix A and Appendix B respectively.
  3. On 19 June 2014, some responses to these comments were sent, and these also appear in Appendix B.
  4. Some of the comments received from GRUAN leaders derived from the fact that, initially, they were only invited to comment on the draft OSND Principles themselves and they did not see the associated draft guidance material developed at OSDW1. The associated draft guidance material was also made available to GRUAN leaders on 19 June 2014. This prompted some further dialogue but no more substantive issues emerged.
  5. The comments received from GRUAN contain some very good points. However, in my view, they are best addressed not by modifying or expanding the OSND Principles themselves; they represent valuable input material to help improve and extend the next layer of guidance material.
  6. Specifically, they highlight the use in the OSND Principles of the word "sustainable" and point out a possible ambiguity.
  7. The comments from GRUAN leaders should be taken into account by OSDW2.
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## APPENDIX A

### EMAIL COMMENTS FROM AND RESPONSE TO GRUAN WG

Email from Peter Thorne, on behalf of Peter Throne, Greg Bodeker and Holger Voemel, to John Eyre, 6-6-2104

Dear John,

Many thanks for the opportunity to comment upon this draft. Holger, Greg and myself have quickly emailed around thoughts and a document version which you will find attached.

Firstly I would note that similar issues - in particular the tiered networks - were a topic of the recent AOPC network meeting and there may well be useful information in there that may help to shape your further thinking on the matter. <http://www.wmo.int/pages/prog/gcos/Publications/gcos-182.pdf> - see pages 10-11.

Personally I would lead with the tiered networks point and perhaps develop this further. It makes clear that there is a recognition that we can design a GOS that does not have to bankrupt the NMSs and that not every observation need be the same or even for the long-term. That by targeting different observations for different purposes we can still have an observing system that delivers benefits to all users be they interested in NRT or delayed mode applications. We need a few reference quality stations. We need a larger number of long-term and carefully maintained (actively managed) stations to provide regional context for monitoring, process understanding, and sustained NRT operations. Then we need myriad additional observations for a huge range of applications but these not be long-term or maintained to as high a standard although they clearly do need to be fit-for-purpose. This to an NMS or national government is less likely to be seen as an insurmountable budgetary challenge I suspect.

There are a number of additional comments and tracked changes suggestions (I edited in Holger's so where it is my edits they may arise from my thoughts or Holger's) in the attached. We would be more than happy to clarify any queries or provide feedback on any future versions if that would prove useful.

Peter

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Reply from John Eyre, 19-67 2014.

Dear Peter, Greg and Holger,

Many thanks for this very helpful input.

I can now see that it would have been more helpful on my part if I had shared with you another document, to show you where we are planning to go with the OSND work over the next year or two - please find attached the relevant document that we discussed at the IPET-OSDE meeting in April. As well as the background in the introductory part of the document, you will see that it contains 3 Appendices:

- A: This is the proposed OSND Principles (only) - I sent you a revised version of this (revised at IPET-OSDE-1), because this is the only part that we have been asked to submitted (so far) for inclusion in the WIGOS Manual.
- B: This contains the OSND Principles AND a draft of some guidance material that we are developing "underneath" these Principles.
- C: Some other material that we believe is not directly relevant to network design but is relevant to wider aspects of observing system design.

It is our intention that the OSND guidance material will have a tiered structure (of which I'm sure you will approve!):

- (1) starting with the Principles themselves, which should be concise,
- (2) leading on to an elaboration of each Principle - how it is to be interpreted or implemented,
- (3) leading down to all the other material in the Manual and Guide relevant to observing systems.

Most of the comments and suggestions you have sent me will be very helpful when we come to further work on (2) (probably starting at a workshop later this year). However, we will also look at them in relation to revising (1), along with the comments we receive from WMO Technical Commissions and WMO Members.

A few responses to some of your general comments:

- We have already drawn heavily on GCOS material. In fact the GCOS Monitoring Principles were one of the most important inputs to the work - it was our intention not to lose any of them but to generalise them to cover other applications where we could.

- Why addressed to Members? This line was added at the end of the process, when the text was included as part of the draft WIGOS Manual, which is addressed to WMO Members. Also recall that WMO is its Members - it is the Members who have resources to implement observing systems. All we can do centrally is to propose "rules" and guidance whereby the implementation activities are conducted in a more or less (hopefully more) coordinated way.

- Many elements of observing systems are not under the control of Members. This is appreciated and it is addressed elsewhere in the Manual, which explains how it applies to WMO programmes AND co-sponsored programmes, and the importance of the collaborations with partners. (This suggests to me that GRUAN should be invited to comment on the draft WIGOS Manual as a whole, and not just the OSND part.)

- "Sustainable" - thanks for the comments. Our main focus here was the transition from research to operations of some observing systems, and the issues that arise when networks originally implemented for research become essential for operations. So it is mainly about sustaining resources rather than continuity of particular technologies. However, I see that there is an ambiguity here that we need to address.

So many thanks again, and further comments welcome if they occur to you.

Best regards,

John

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**APPENDIX B**

**COMMENTS FROM GRUAN ON DRAFT OSND PRINCIPLES**

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**ANNEX XI**

**DRAFT OBSERVING SYSTEM NETWORK DESIGN PRINCIPLES**

*(as proposed by IPET-OSDE-1, 3 April 2014)*

**Observing System Network Design (OSND) Principles**

Members should follow the following principles when designing and evolving their observing system networks:

**1. SERVING MANY APPLICATION AREAS**

Observing networks should be designed to meet the requirements of multiple application areas within WMO and WMO co-sponsored programmes. These application areas have very distinct requirements which may be in conflict with one another requiring careful observational network design that considers all possible application areas.

**2. MEETING USER REQUIREMENTS**

Observing networks should be designed to address stated user requirements, in terms of the geophysical variables to be observed and the space-time resolution, uncertainty, timeliness and stability needed. Processes for incorporating feedback from user communities in decisions related to network design and operation must be implemented.

**3. MEETING NATIONAL, REGIONAL AND GLOBAL REQUIREMENTS**

Observing networks designed to meet national needs should also take into account the needs of the WMO at the regional and global levels. Consideration should be given to where nations might support network sites outside of their national borders that would better meet the needs of the WMO at the regional and global levels.

**4. DESIGNING APPROPRIATELY SPACED NETWORKS**

Where high-level user requirements imply a need for spatial and temporal uniformity of observations, network design should also take account of other user requirements, such as the representativeness and usefulness of the observations. Site locations within the network should, where possible, be guided by objective scientific analyses of the optimal location and operational characteristics of sites.

**5. DESIGNING COST-EFFECTIVE NETWORKS**

Observing networks should be designed to make the most cost-effective use of available resources. This will include the use of composite observing networks and the instigation of tiered network design. International coordination of network implementation may be able to substantially reduce the overall cost.

**6. ACHIEVING HOMOGENEITY IN OBSERVATIONAL DATA**

Observing networks should be designed so that the level of homogeneity of the delivered observational data meets the needs of the intended applications and users. This may be achieved through some combination of Global and regional intercomparisons, manufacturer workshops, and a mandate for the network operators to work on homogeneity.

**7. DESIGNING THROUGH A TIERED APPROACH**

Observing network design should use a tiered structure, through which information from reference observations of high quality can be transferred to, and used to improve the quality and utility of,

**Comment [GEB1]:** My first concern is that this is pitched at 'members'. It seems to rule out *a priori* proposing network design principles that are implemented at the global level. Design of a global observing system network cannot be achieved exclusively through implementation at the national/regional level.

**Comment [PT2]:** As an addition to this it perhaps should be clearer that many elements of the observing system may not be directly under members' auspices. For example the ARM program is indubitably a contribution to the global observing capabilities but is not a contribution from a member. Indeed many of the more research / reference quality sites may tend as a result of national funding architectures not to be under direct NMS auspices yet clearly these constitute a key contribution nationally, regionally and globally.

**Comment [PT3]:** Many of these applications require different things from the networks which needs to be reflected.

**Comment [GEB4]:** Clearly consultation with intended users of the network data products is required as part of the network design process. I think that this is sufficiently important that it should be stated explicitly as part of the principle.

**Comment [PT5]:** This is one of the key benefits of actually instigating tiered networks. We don't need perfect measures everywhere – that would bankrupt the global economy. We need as good as we can get in a few places, long-term in a larger number of places and more transient in many more. That is what tiered networks design can provide in the most cost effective manner achievable.

**Comment [GEB6]:** Noting that these are treated separately in (1) and (2) above.

**Comment [PT7]:** Personally I would say that this point #7 is actually the first order point to get sign off upon and should come first. If people can recognize that there is a value in actually designing around a tiered approach that does not break the bank while maximizing bang for buck then the rest almost shakes out in the wash.

**Comment [GEB8]:** As long as this term 'information' includes skills, expertise, experience etc.

other observations. Different operating standards should be defined and implemented for different tiers of sites. At least three tiers should exist: reference, baseline and comprehensive. Reference measures should be traceable to SI or community accepted standards and include measurements of each geophysical parameter by at least two independent methods to assure quality. Baseline measures should be maintained for the long-term due to their recognized import, sufficiently dense to characterize large-scale features, and include change management and metadata retention. Comprehensive networks should ensure consistency with CBS and CIMO operational guidelines and may be more transient.

#### 8. DESIGNING RELIABLE AND STABLE NETWORKS

Observing networks should be designed to be **reliable and stable**.

**Comment [GEB9]:** Some metrics are needed here, or at least this needs to be expanded on further. What constitutes a 'reliable' network and what constitutes a 'stable network'?

#### 9. MAKING OBSERVATIONAL DATA AVAILABLE

Observing networks should be designed, and should evolve in such a way, as to ensure that the observations are made available to other WMO Members, at space-time resolutions and with a timeliness to meet the needs of regional and global applications. Provision should be made for submission of data on different timescales and in different formats / delivery modes to meet the needs of different users. Data in delayed mode may have additional quality assurance and processing and should be clearly distinguished from more NRT transmission which may be more 'provisional' in terms of the level of processing possible to meet NRT users cut-off.

**Comment [PT10]:** This segment feels somewhat redundant if you spell out the distinct tiers and their characteristics in the preceding point #7 so this point could be redacted entirely if the previous point suggested edits are accepted?

#### 10. PROVIDING INFORMATION SO THAT THE OBSERVATIONS CAN BE INTERPRETED

Observing networks should be designed and operated in such a way that the details and history of instruments, their environments and operating conditions, their data processing procedures and other factors pertinent to the understanding and interpretation of the observational data (i.e. metadata) are documented and treated with the same care as the data themselves. Networks should have defined repositories where all data, raw data, and metadata necessary for their future interpretation and if necessary reprocessing are retained for the benefit of users who are interested in delayed mode data.

#### 11. ACHIEVING SUSTAINABLE NETWORKS

Improvements in sustained availability of observations should be promoted through the design and funding of networks that are sustainable in the long term including, where appropriate, through the transition of research systems to operational status.

**Comment [PT11]:** Not all networks or measurements need be sustainable. This comes back to the tiered network design. More generally some measurements may be better as targeted / episodic / one time. Indeed there may be value to consideration of mobile facilities or dedicated campaigns to improve process understanding, model performance and sub-grid parameterisations. It would make sense to encourage such augmentations to capabilities that are finite in space and time but help answer scientifically pressing questions. If I were reading this in isolation I would infer that such a capability were undesirable which I don't think is what you mean or intend here. A network design principle would be to encourage such activities as a cost-effective way of doing business but noting that wherever feasible such measurements should be made at long-term reference quality sites to allow contextual understanding.

#### 12. MANAGING CHANGE

The design of new observing networks, and changes to existing networks, should ensure adequate consistency, quality and continuity of observations across the transition from the old system to the new. Changes that capitalize on the availability of new measurement technologies should be adopted but in such a way that the long-term homogeneity of the data record is not compromised. Possible routes are chamber tests, lab bench tests and side-by-side measurement campaigns or periods to ensure changes are well understood.

What's missing in the above?

#### 13. INTERNATIONAL MEASUREMENT METHODOLOGY COORDINATION

Homogeneity of data products across an observing network will likely require some sites to eschew local standard operating procedures and to adopt standard operating procedures mandated across the network.

#### 14. SITE ASSESSMENT AND CERTIFICATION

Sites within the network must operate to agreed standards and should be certified when operating to that standard. Regular audits should be conducted to ensure that operating standards are maintained. Consequences must be defined and implemented for sites not maintaining the required standard e.g. having their certification revoked.

**Comment [PT12]:** Arguably this solely applies to the reference quality and baseline networks. Would need an edit to this effect.

#### 15. QUANTIFYING DATA QUALITY

At some limit all measurements are imperfect indicators of the true value of the target measurand. Data are most useful if an appropriate indicator of their quality can be retained and transmitted so that they can be used appropriately by end-users. The degree of detail required depends upon the specifics of the network. For reference measurements fully quantified traceability and quantification is required. For remaining measurements more indicative informed estimation through means such as intercomparisons may suffice.

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