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INTEGRATED OBSERVING SYSTEMS

IMPLEMENTATION-COORDINATION TEAM ON INTEGRATED OBSERVING SYSTEM (ICT-IOS)
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REPORTS OF THE OPAG-IOS EXPERT TEAMS AND RAPPORTEURS

REPORT OF THE INTER-PROGRAMME EXPERT TEAM ON OBSERVING SYSTEM DESIGN AND EVOLUTION (IPET-OSDE)

(Submitted by John Eyre (United Kingdom), Chair, IPET-OSDE)

SUMMARY AND PURPOSE OF DOCUMENT

This document provides a report of the work of the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) since the seventh Session of the ICT-IOS, together with subsequent progress, and recommendations.

ACTION PROPOSED

The Meeting is invited to note the information contained in this document when discussing how it organises its work and formulates its recommendations.

Appendix A Terms of Reference of the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE)

Appendix B Updated Work Plan with status of the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE)

DISCUSSION

1. Introduction

The Inter Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) was established by CBS at its 50th Session (Jakarta, Sept 2012). Most of the tasks assigned to IPET-OSDE follow on from those previously conducted under the old Expert Team on the Evolution of Global Observing Systems (ET-EGOS). All its Terms of Reference (Appendix A) and all the elements of its Work Plan (Appendix B) are related to WIGOS goals and activities.

Since the inception of IPET-OSDE, work has progressed to consolidate the membership of the new IPET and to continue work on the Actions list from the last meeting of ET-EGOS (ET-EGOS-7, May 2012).

The first full meeting of IPET-OSDE (IPET-OSDE-1) took place in Geneva from 31 March to 3 April 2014, i.e. immediately prior to ICT-IOS-8.

2. Achievements

In relation to its Terms of Reference (Appendix A), the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) has achieved the following:

1. ToR (a): *Review and report on the observational data requirements of application areas[1] within the scope of WIGOS.*
Points of Contact for RRR Application Areas have continued to provide the Secretariat with updates to observational data requirements held in the OSCAR database:
http://www.wmo-sat.info/oscar/requirements .
Progress was reviewed at IPET-OSDE-1 and a set of Actions for further updates to the database was agreed.

2. ToR (b): *Review and report on the capability of both surface-based and space-based systems that are components or candidate components of the evolving observing systems within the scope of WIGOS.*
The Secretariat has continued to maintain and update the space-based capabilities side of the OSCAR database:
http://www.wmo-sat.info/oscar/spacecapabilities .
Work on the surface-based capabilities side will be conducted as part of the transfer of the database management to Meteo-Swiss. The procedures and responsibilities associated with these activities were reviewed by IPET-OSDE-1.

3. ToR (c): *Carry out the rolling requirements review of application areas leading to Statements of Guidance concerning the extent to which present and planned observing systems meet user requirements for observations.*
4. ToR (d): *Review the implications of the Statements of Guidance concerning the*

[1] WMO Application Areas include Global Numerical Weather Prediction (NWP), High Resolution NWP, Nowcasting and Very Short-Range Forecasting (NVSRF), Seasonal to Inter-Annual Climate Prediction (SIAF), Aeronautical Meteorology, Atmospheric Chemistry, Ocean Applications, Agricultural Meteorology, Hydrology and Water Resources, Climate monitoring (GCOS), Climate applications (other aspects, CCl), Space Weather, and GTOS (non GCOS requirements of GTOS)

strengths and deficiencies in the existing observing systems and evaluate the capabilities of new observing systems and possibilities for improvements and efficiencies.
RRR Points of Contact have continued to review and, where necessary, revise the gap analyses (Statements of Guidance) for their respective Application Areas:
http://www.wmo.int/pages/prog/www/OSY/GOS-RRR.html#SOG .
Progress was reviewed at IPET-OSDE-1. Several new draft Statements of Guidance were provided for the meeting and these will now be reviewed by the Chair with support from the Team.

5. ToR (e): *Carry out impact studies of real and hypothetical changes to observing systems with the assistance of NWP centres.*
The Report on the 5th WMO Workshop on "The impact of various observing systems on NWP" (May 2012) was completed and made available on the WMO website:
http://www.wmo.int/pages/prog/www/CBS-Reports/IOS-index.html
For more detail on these activities, see the Report of the Co-rapporteurs on scientific evaluation of impact studies undertaken by NWP centres.

6. ToR (f): *Monitor and report progress against the new version of the Implementation Plan for Evolution of Global Observing Systems, based on the "Vision for the GOS in 2025"; identify new actions as necessary, taking into account developments within WIGOS, including those of the observations and monitoring pillar of the GFCS.*
Progress on Actions in EGOS-IP was reviewed at IPET-OSDE-1. The Team proposed, for each Action in the EGOS-IP, the name of an OPAG-IOS Team or other body who would be responsible for providing a summary of progress. It is planned to collate this information and to provide a first report on progress later in 2014. Attention will also be given to the provision of baseline information against which future progress will be judged.

7. ToR (g): *Promote activities which enhance progress against the Implementation Plan for Evolution of Global Observing Systems;*
EGOS-IP has been made available in English, French, Spanish and Russian:
http://www.wmo.int/pages/prog/www/OSY/gos-vision.html#egos-ip .
EGOS-IP has now been translated into Chinese; the Team is very grateful to Dr Wenjian Zhang for his considerable personal efforts towards this achievement.

8. ToR (h): *Propose updates to the "Vision for the GOS in 2025", in response to evolving user requirements and observing system capabilities.*
A list of proposed updates to the vision is maintained at:
http://www.wmo.int/pages/prog/www/OSY/Documentation/Vision2025.html

9. ToR (i): *Propose guidance regarding observing system network design principles*.
The 1st Workshop on Observing System Design (OSDW-1) was organised under the auspices of IPET-OSDE, and it was held in Geneva, 12-14 November 2014. A full report on the meeting is available at:
http://www.wmo.int/pages/prog/www/CBS-Reports/IOS-index.html .
The main outcome of the meeting was material to form the basis for a set of WIGOS "Principles" for Observing System Network Design (OSND) and also high-level guidance elaborating these principles. Since OSDW-1, further progress has been made to develop this material into a set of draft Principles and associated Guidance. This document was made available for comment to 3rd session of the Inter-Commission

Coordination Group on WIGOS (ICG-WIGOS) Task Team on Regulatory Material (Geneva, 25-29 November 2013), and to the 3rd session of the ICG-WIGOS (Geneva, 10-14 February 2014). The OSND Principles were developed further by IPET-OSDE-1 and submitted for inclusion in the draft WIGOS Manual. The roadmap for further development of the associated Guidance material **will be considered by ICT-IOS-8** (see Doc.7.1).

10. ToR (j): *Prepare documents to assist Members, Technical Commissions, and Regional Associations, summarizing the results from the above activities.*
See documents cited above.

11. ToR (k): *Provide advice and support to the Chairperson of OPAG-IOS on development and implementation of WIGOS.*
Input provided as requested.

3. Issues

3.1 RRR databases (OSCAR). A major achievement of the WMO Secretariat, with guidance from ET-EGOS, was the creation of the Observing System Capabilities Analysis and Review tool (OSCAR): http://www.wmo-sat.info/oscar/. This tool integrates work over many years on user requirements for observations and on the capabilities of present and planned observing systems to meet these requirements. This tool and the databases behind it are key components within the WMO Rolling Review of Requirements (RRR) for observations and, as such, they form important components of WIGOS. They constitute a unique repository of observational requirements and of capabilities of (currently) space-based observing systems, and they are one of the tangible and visible "successes" of WIGOS to date. They have gained wide-ranging visibility through the excellent work of Secretariat. It is now planned to move the management of the database from the Secretariat to Meteo-Swiss. Progress on this activity was considered by IPET-OSDE-1, including plans to ensure the continued support for and availability of the databases during the transitional period, and the continued development of their content. The procedures and responsibilities associated with these activities were also reviewed – see INF.5.

3.2 Global Framework for Climate Services (GFCS). GFCS may generate observational user requirements that go beyond those already stated by GCOS. IPET-OSDE has been tasked to work with GFCS on these requirements and the WIGOS response to them. The Team has been awaiting input from GFCS in order to start this work. Until such time, statements suggesting that WIGOS is "responding to the requirements of GFCS" should be made with care. However, at IPET-OSDE-1, the Team was pleased to hear the plans of GCOS for an update of its Adequacy Reports and Implementation Plan over the next few years, and also for plans to work closely with GFCS in order to expand the observational user requirements of GCOS to respond to service requirements of GFCS. IPET-OSDE would therefore expect to receive from GCOS detailed updates on observational user requirements for climate monitoring and for other climate applications in support of GFCS. The Team agreed to review the new material from GCOS as it becomes available.

3.3 Implementation Plan for the Evolution of Global Observing Systems (EGOS-IP). EGOS-IP, responding to the Vision for Global Observing Systems in 2025,

represents a major achievement under the umbrella of WIGOS. One of the roles of IPET-OSDE is to monitor progress against the Actions in EGOS-IP, and this will be done. However (in the opinion of the Chair) this is not sufficient; it should be the role of IPET-OSDE, with the support of OPAG-IOS and WIGOS as a whole, not only to monitor progress but actively to promote it. This issue is discussed in more detail in Doc.7(1).

3.4 Lessons learnt from AMMA. The experiences of the AMMA observation network are interesting in several respects: (i) they show how it is possible to make substantial improvements to an observational network in a group of developing countries with an input of resources which (at least by the standards of developed countries) is comparatively modest; (ii) they show the importance of providing support and coordination, and of the effectiveness of appropriate support; (iii) they show the dangers of withdrawing coordination and support, in terms of the subsequent degradation of the network; and (iv) they provide a very good illustration of the type of problems that WIGOS is attempting to solve. The Team noted that new quantity and quality monitoring tools are planned under WIGOS, and these should help to identify problems to find ways to address them. Substantial improvements should be realized with relatively small investments. The Team agreed that efforts should be made through ICG-WIGOS and appropriate Teams to identify more precisely what is needed in order to achieve those improvements. IPET-OSDE is ready to assist if needed.

3.5 Atmospheric chemistry/composition. Noting that the SoG for Atmospheric Chemistry has not been updated for 10 years, there was significant progress at IPET-OSDE-1 to clarify the way forward. Whilst there are a number of Atmospheric Composition applications that the GAW Programme is mandated to support, there are others, e.g. operational air quality forecasting, that fall outside its area of responsibility. As a consequence an essential first step is the clear identification of those Atmospheric Composition application areas that fall under the mandate of the GAW Programme and those that do not. GAW is forming a Task Team to support the establishment and evaluation of observational requirements for application areas under the responsibility of the GAW Programme. A first activity of this Task Team is expected to be a clear identification of those application areas to be addressed. In the specific case of operational Air Quality Forecasting, which is not covered by GAW, **ICT-IOS is requested to support** the creation of a new RRR Application Area. Since this area of activity is under the formal responsibility of OPAG-DPFS, it is requested that this issue is raised with CBS Management, and that a potential Point of Contact is identified. A similar approach will be needed for other Atmospheric Composition application areas which are not being addressed by the GAW programme.

3.6 Global Cryopshere Watch (GCW). Interaction with GCW moved forward at IPET-OSDE-1. The Team noted and concurred with the following recommendations from GCW:

- GCW will identify application areas for each variable in the IGOS Cryosphere list. New application areas for RRR may be suggested, noting that GCW itself is not an application area as it is too broad.
- Requirements for non-cryosphere variables will be identified for some application areas, as appropriate.
- GCW may engage the cryosphere community to update the IGOS Cryosphere requirements (although this would be a major endeavour).

- GCW will work with the application areas and the PSTG to clarify their needs and to resolve any ambiguities and inconsistencies in cryosphere requirements.

3.7 Global Terrestrial Observing System (GTOS). The Team noted that, although the relationship between WMO and GTOS has evolved, with some aspects now considered by GCOS, there has been no progress in establishing other sub-applications or user requirements for this area. In an attempt to make progress on some terrestrial applications, the Chair proposed to contact leaders of the Global Land/Atmosphere System Study of the Global Energy and Water Exchanges Project (GEWEX/GLAS).

3.8 Land transport. The WMO Secretariat reported to IPET-OSDE-1 on recent WMO efforts to address requirements for land transportation. WMO intends to pursue an integrated approach to the meteorological services to transport sector, based on experience in specific sub-sectors such as aviation and marine. The Team noted that the anticipated services for land transportation will probably require input from NWP and other existing Application Areas. Before deciding whether there is a need for a new Application Area for the land transportation sector, one would have to assess whether there is a direct need for observations by these applications. It invited the group in charge of elaborating a strategy for land transportation requirements to consider these points.

3.9 Cost-benefit studies. IPET-OSDE-1 discussed cost-benefit studies for observing systems. It reviewed a proposed strategy from the Chair for assessing the cost-effectiveness of observing systems. The elements of the "cost-benefit chain" are described in the strategy. Two elements of this chain are the assessment of costs of observing systems and the assessment of the impact of observations on a given application. Together they allow the impact per cost of observations for this application to be assessed. This process is illustrated in the draft strategy using an example in which impact per cost is evaluated for global NWP. The extensions of this general approach to other applications areas and to other elements of the cost-benefit chain are also discussed in the strategy. The Team considered how the suggestions in this draft strategy might be taken forward, and suggested actions (i) to improve the estimates/guesses of observing system costs and to generalize the results to more than one NWP centre; (ii) to promote the development of appropriate metrics for other Application Areas; and (iii) to extend beyond impact per cost assessments to other parts of the cost-benefit chain, and eventually to an integrated assessment of cost-benefit over many applications and services. The Team strongly supported efforts in this regard, and agreed that its ideas should be promoted at the ICG-WIGOS level.

4. Recommendations

None at present - recommendations may be proposed by IPET-OSDE-1.

5. Proposal for the Terms of Reference of the IPET

No changes are proposed by the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) to its Terms of Reference at this point.

6. Work plan

The updated Work Plan with status for the Inter-Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) for the period 2012-2016 is at Appendix B.

APPENDIX A

TERMS OF REFERENCE OF THE INTER-PROGRAMME EXPERT TEAM ON OBSERVING SYSTEM DESIGN AND EVOLUTION (IPET-OSDE)

(a) Review and report on the observational data requirements of application areas[2] within the scope of WIGOS;

(b) Review and report on the capability of both surface-based and space-based systems that are components or candidate components of the evolving observing systems within the scope of WIGOS;

(c) Carry out the rolling requirements review of application areas leading to Statements of Guidance concerning the extent to which present and planned observing systems meet user requirements for observations;

(d) Review the implications of the Statements of Guidance concerning the strengths and deficiencies in the existing observing systems and evaluate the capabilities of new observing systems and possibilities for improvements and efficiencies;

(e) Carry out impact studies of real and hypothetical changes to observing systems with the assistance of NWP centres;

(f) Monitor and report progress against the new version of the Implementation Plan for Evolution of Global Observing Systems, based on the "Vision for the GOS in 2025"; identify new actions as necessary, taking into account developments within WIGOS, including those of the observations and monitoring pillar of the GFCS;

(g) Promote activities which enhance progress against the Implementation Plan for Evolution of Global Observing Systems;

(h) Propose updates to the "Vision for the GOS in 2025", in response to evolving user requirements and observing system capabilities;

(i) Propose guidance regarding observing system network design principles;

(j) Prepare documents to assist Members, Technical Commissions, and Regional Associations, summarizing the results from the above activities;

(k) Provide advice and support to the Chairperson of OPAG-IOS on development and implementation of WIGOS.

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[2] WMO Application Areas include Global Numerical Weather Prediction (NWP), High Resolution NWP, Nowcasting and Very Short-Range Forecasting (NVSRF), Seasonal to Inter-Annual Climate Prediction (SIAF), Aeronautical Meteorology, Atmospheric Chemistry, Ocean Applications, Agricultural Meteorology, Hydrology and Water Resources, Climate monitoring (GCOS), Climate applications (other aspects, CCl), Space Weather, and GTOS (non GCOS requirements of GTOS)

APPENDIX B

UPDATED WORK PLAN WITH STATUS FOR THE INTER-PROGRAMME EXPERT TEAM ON OBSERVING SYSTEM DESIGN AND EVOLUTION (IPET-OSDE) FOR THE PERIOD 2012-2014

Id	*Priority*	*Objective*	*Outcome*	*Deliverable*	*Activity*	*Leader*	*Due*	*OtherETs*	*Effort*	*StatusReport*
1	1	To contribute to the implementation of WIGOS, including WIGOS Manual, and provide relevant advice and support to the chairperson of ICT-IOS	Address relevant items of WIGOS Implementation Activities agreed by Congress XVI, and then ICG-WIGOS	Relevant WIP activities addressed	Meeting	Chair IPET-OSDE	Ongoing	ICG-WIGOS, IPET-WIFI		GOS Manual and Guide to be reviewed, and made consistent with WIGOS Manual and Guide while avoiding duplication Input provided to the TT-WRM
2	1	Survey and collate user requirements for observations for WMO and WMO-sponsored programmes	Review and update WMO database of observational user requirements, through Points of Contact for application areas.	OSCAR/Requirements up to date	Review by FPs	Chair IPET-OSDE	Ongoing / Annual review			Ongoing; PoCs regularly contacted for updates

Id	*Priority*	*Objective*	*Outcome*	*Deliverable*	*Activity*	*Leader*	*Due*	*OtherETs*	*Effort*	*StatusReport*
3	1	Survey and collate observing systems capabilities for surface-based and space-based systems that are components or candidate components of WIGOS	Review and update WMO database of observing system capabilities, in collaboration with other OPAG IOS ETs and other Technical Commissions as appropriate.	OSCAR/Space & OSCAR/Surface up to date	Review by Members (coordination via NFPs)	Chair IPET-OSDE	Ongoing / Annual review	ICT-IOS, ET-ABO, ET-SBO, ICG-WIGOS/TT-WMD		Ongoing for space-based, and recorded in OSCAR/Space. Ongoing for surface-based through feedback from the NFPs although not recorded in OSCAR/Surface, which does not exist for now
4	1	Maintain Rolling Review of Requirements (RRR) for observations in several application areas, using subject area experts, including appropriate liaison with Technical Commissions and programmes and co-sponsored programmes (e.g. CAS, JCOMM,	Continue RRR process for the listed application areas and expand to new areas as required: review and update as necessary Statements of Guidance on the extent to which present/ planned observing system capabilities meet user requirements, through Points of Contact on application areas.	Statements of Guidance for all Application Areas	Application Area Contact Points; Meeting	Chair IPET-OSDE	Ongoing / Annual review			Ongoing; some SoG reviewed. Overall review by IPET-OSDE1

Id	Priority	Objective	Outcome	Deliverable	Activity	Leader	Due	OtherETs	Effort	StatusReport
		CAeM, CAgM, CHy, CCl, GCOS, GFCS, and GCW)								
5	1	Prepare and maintain reviews of observation impact studies undertaken by NWP centres and provide information for consideration by IPET-OSDE and OPAG-IOS	Rapporteurs on Impact Studies and NWP experts, review results of impact studies relevant to the evolution of observing systems. Organize and hold next NWP Impact Studies Workshop in 2016.	Findings of impact studies	Impact studies	Rapporteurs on Scientific Evaluation of Impact Studies undertaken by NWP Centres	2016: workshop			Report of the 5th NWP "Impact" workshop (Sedona, 2012) Published. Ongoing; recent findings, and proposals for new impact studies discussed at IPET-OSDE1
6	1	Promote CBS activities in support of GCOS goals	Review the implications of the progress on the GCOS Implementation Plan for the activities of CBS. Bring relevant issues to the attention of the IPET-OSDE	RRR consistent with GCOS	Meeting	Rapporteur on GCOS matters	~~2013~~ 2016			Ongoing interactions between IPET-OSDE Chair and GCOS.

Id	*Priority*	*Objective*	*Outcome*	*Deliverable*	*Activity*	*Leader*	*Due*	*OtherETs*	*Effort*	*StatusReport*
7	1	Promote CBS activities in support of GFCS goals	Review the implications of the GFCS IP for the activities of CBS. Bring relevant issues to the attention of the IPET-OSDE	RRR consistent with GFCS	Meeting	Chair IPET-OSDE	2016			Relevant activities reviewed at IPET-OSDE1. GCOS/GFCS interaction encouraged.
8	1	Promote CBS activities in support of GCW goals	Review the implications for the activities of CBS of the GCW developments, including the GCW Implementation Strategy, and the Cryosphere theme report for the IGOS partnership. Bring relevant issues to the attention of the IPET-OSDE	RRR consistent with GCW	Meeting	Chair IPET-OSDE	2016			Relevant activities reviewed at IPET-OSDE1. CBS CWP submitted to the AOS1.

Id	*Priority*	*Objective*	*Outcome*	*Deliverable*	*Activity*	*Leader*	*Due*	*OtherETs*	*Effort*	*StatusReport*
9	1	Monitor progress and actions by Members and partner Organizations per the approved Implementation Plan for the Evolution of the global observing systems (EGOS-IP), fully responding to the "Vision for the GOS in 2025",and promote activities in support of progress	Seek feedback from National Focal Points, Expert Teams, relevant Technical Commissions, and other groups on the implementation of EGOS-IP, and keep the EGOS-IP progress report up to date. Initiate and monitor activities which promote progress.	EGOS-IP progress report	Survey with FPs, TCs; meeting	Chair IPET-OSDE	Ongoing / Annual review			Ongoing. Feedback against the new EGOS-IP requested to the NFPs for 2013. Reviewed at IPET-OSDE1
10	1	Propose guidance regarding observing system network design principles	Draft guidance document on network design (to be further discussed at IPET-OSDE-1 in 2014)	Guidance document on network design	Meeting	Chair IPET-OSDE	~~End 2013~~ 2014			Workshop organized in Nov. 2013. Draft OSND principles & guidance developed, as well as roadmap. OSND Principles provided for draft WIGOS Manual.