

WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

OPAG ON INTEGRATED OBSERVING SYSTEMS

**EXPERT TEAM ON SURFACE BASED OBSERVATIONS
FIRST SESSION**

Geneva, Switzerland

9 to 12, July, 2013

FINAL REPORT

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GENERAL SUMMARY

1 OPENING AND ORGANIZATION OF THE SESSION

- 1.1 The First Session of the Expert Team on Surface Based Observations (ET-SBO) of the WMO Commission for Basic Systems (CBS), Open Programme Area Group on Integrated Observing Systems (OPAG-IOS) was opened by the Chair of the team Mr Stuart Goldstraw and, on behalf of the WMO Secretariat, the Chief of the Observing Systems Division, Dr Miroslav Ondras at 9:30am on the 9 July 2013.
- 1.2 Dr Ondras welcomed the members of the Expert Team to Geneva and briefly discussed the role and work program of the team over the coming CBS inter-session period (2013 – 2016), particularly emphasizing the importance of the resolution of the Executive Council (EC-LXIV, June 2013) on the WIGOS Framework Implementation Plan (WIP) as a key deliverable under WMO Expected Result 4¹ (Resolution 36, Cg-XVI) and in response to the direction by Congress (Cg-XVI) to implement WIGOS (Resolution 50). The Expert Team was reminded of the first item under its Terms of Reference to contribute to the implementation of the WIGOS framework and encouraged to identify those aspects and tasks of the WIP where it might make the most effective contribution in consultation with the lead and coordination WIGOS teams appointed by EC and CBS.
- 1.3 An agenda for the meeting was adopted (see above) with a minor modification to that submitted within document 1.1, with the addition of item 3.3.

2 REPORT OF THE CHAIR

- 2.1 The Chair, Mr Stuart Goldstraw welcomed the members of the Expert Team to the first meeting of ET-SBO and provided a brief summary of how the Expert Team was formed, through the development of its Terms of Reference during ICT-IO-7 and how the Membership was selected to ensure a well balanced team. Not all the members of the Expert Team could attend the first meeting but with such a large team such logistical challenges were inevitable. The importance of having Expert Team members from all the Regional Association Areas and such a wide range of technical disciplines was highlighted as vitally important and would lead to the successful delivery of the work plan.
- 2.2 Mr Goldstraw thanked the Secretariat and other invited experts for providing the time to inform the Expert Team of the many aspects of observations related activity that required their attention in the coming years, most especially WIGOS and the wide range of tasks associated with its operational implementation. Indeed the wide range of inputs reinforced the fact that ET-SBO had a considerable volume of work to undertake over the current CBS inter-session period.
- 2.3 Mr Goldstraw introduced the high-level work plan which had been developed following the approval of ET-SBO Terms of Reference at CBS-XV. The work plan had been approved by Jochen Dibbern, the OPAG IOS Co-chair and it was noted Jochen was attending ET-SBO-1 to provide guidance. The most important task of this Session was to turn the top level work plan into a detailed work plan that identified specific tasks, with specific members and an agreed timeline for the delivery of the activities. The session had been structured to provide the participants and team members with information and presentations relevant to the work program that could be reviewed and discussed in the early part of the meeting in plenary, leading to detailed planning could be undertaken in the later part of the meeting in breakout groups. The result of this detailed planning is the updated detailed work plan at Annex IV.
- 2.4 The high-level work plan consisted of 8 sections to reflect the 8 Terms of Reference approved by CBS for ET-SBO. Each of the top level work plan items had been summarized

¹ Expected Result 4. Enhanced capabilities of Members to access, develop, implement and use integrated and interoperable Earth- and space-based observation systems for weather, climate and hydrological observations, as well as related environmental and space weather observations, based on world standards set by WMO.

by a set of short descriptions to make describing the work of the Expert Team easy to communicate and provide a focus for the activities and tasks to be undertaken. The eight work plan descriptions were:

- Helping WIGOS Succeed
- Improving Technical Documents
- Status of Implementation
- Meeting User Requirements
- Delivering the EGOS-IP
- Promoting Best Practice
- Purposeful Horizon Scanning
- Reporting Progress to ICT-IOS

The details of each top level work plan item will be discussed further in section 6.

- 2.5 It was recognized that the commitment of time by the members of ET-SBO was critical to the successful delivery of the work plan. As part of the nomination and selection process an assumption on ET members availability had been made, with Core members being able to devote 15 working days a year and Associated members being able to devote 10 working days a year. It was therefore assumed that approximately 600 working days would be available to the expert team work plan activities over the following three years.
- 2.6 To ensure a maximum amount of time was available to undertake the work plan activities it was proposed that the entire team would meet only twice during the inter-sessional period. The first session of ET-SBO, would have the main focus and outcome to develop the detailed work program and the second would be expected to take place towards the end of 2015 or early in 2016 to review the status of the work program, finalise tasks and compile the necessary reports to OPAG-IOS and CBS. It was expected that subgroups might meet during the period to address specific work plan items but only those staff directly involved would be engaged in such meetings. To maximize resources and efficiency, meetings would usually be via teleconference and WebEx, with face to face meetings held only if convenient or necessary. It was expected that a subgroup meeting on 'Improving Technical Documents' would be required in the near future to confirm updates being formally proposed for WMO No. 544 The Manual on the GOS.
- 2.7 It was highlighted that ET-SBO was formed from two previously existing Expert Teams, the Expert Team on Automatic Weather Stations (ET-AWS) and the Expert Team on Surface Based Remotely Sensed Observations (ET-SBRSO). Therefore a number of tasks already started by these groups would form part of the detailed work plan.
- 2.8 Finally, Mr Goldstraw reminded the Expert Team members that it was important to enjoy their time together, as building friendships and participating in international collaborative activities in the meteorological community is important and beneficial to WMO Members. ET-SBO is undertaking vitally important work for the WMO community and it is important this should be both enjoyable and productive.

3 WIGOS IMPLEMENTATION PLAN AND IMPACTS ON THE WORK PLAN OF ET-SBO

The Session was informed about progress made on the WIGOS Framework Implementation Plan (WIP) and were invited to consider how the work of the various coordination and task teams and sub-groups could be aided by the advice, expertise and work input of ET-SBO.

3.1 WIGOS-IP and its relevance to the work of ET-SBO

- 3.1.1 Dr Miroslav Ondras made a presentation on the WIP and the various activities and tasks that are underway or will be undertaken towards the establishment of the WIGOS

framework. Under the WIGOS framework, WIGOS is defined as consisting of all WMO observing systems, thus integrating the observing systems of the Global Observing System (GOS), the observing component of the Global Atmosphere Watch, the Hydrological Observing System (including WHyCOS) and the observing component of the Global Cryosphere Watch. Dr Ondras emphasized that WIGOS is being implemented as a framework for enabling the integration, interoperability, optimized evolution and best-practice operation of the WIGOS component systems and subsystems, using and exploiting the WMO Information System (WIS), leading to continuous and reliable access to an expanded set of environmental data and products, and associated metadata.

- 3.1.2 Under version 2.0 of the WIP adopted by EC-65 (May 2013), there are 10 Key Activity Areas for which about 35 implementation activities have been identified, to be addressed by WMO Members, RAs, TCs and other parties. Of the Key Areas, it was suggested that ET-SBO should provide expertise under the specific activity areas of Observing System Operation & Maintenance, Quality Management, Standardization, System Interoperability and Data Compatibility and the WIGOS Operational Information Resource.
- 3.1.3 The Expert Team was recommended to consider integrating into its work, a range of activities under these WIP key activity areas, focused on the surface-based land observing systems of the GOS and possibly including:
- Revision and development of regulatory material associated with the work of TT-WRM and SG-RM;
 - Development of the concept and technical aspects of the Regional Basic Observing Network to be possibly applied by the RAs;
 - Assistance and input into improving and further implementing the operation of the Rolling Review of Requirements process using the Observing Systems Capability Analysis and Review tool (OSCAR);
 - Assistance in review of quality management regulations, practices and processes;
 - Development and documentation of guidance material associated with standards and best practice;
 - Development of components of the WIGOS Information Resource; and,
 - Contribution to the process to standardize WIGOS metadata.

3.2 ICG-WIGOS and its Task Teams

- 3.2.1 Dr Ondras informed the session that, under Res. 50 (Cg-XVI), the various bodies of WMO were required to play a role in implementing WIGOS, with Regional Associations having responsibility for the development of regional implementation plans for the coordination of WIGOS implementation activities and the promotion of WIGOS capacity-building and outreach activities, while the Technical Commissions have responsibility for guiding the technical aspects of WIGOS implementation, including the development of standards and regulatory material. To lead and guide the development of these plans and activities, EC had established a working structure of teams² under the Inter-commission Coordination Group on WIGOS (ICG-WIGOS), with task teams on regulatory material (TT-WRM), metadata (TT-WMD) and quality management (TT-WQM). While the Expert Team was encouraged to contribute to the WIP through the activities recommended above (item 3.1), it was important to ensure that activities specifically related to the WIP were coordinated through ICG-WIGOS and its task teams and through the relevant CBS WIGOS-related teams, with the latter being the primary source of leadership and coordination for WWW and the GOS.

² <http://www.wmo.int/pages/prog/www/wigos/icg-wigos.html>

3.2.2 Mr Russell Stringer, Chair of TT-WRM, made a presentation to the Session on the work program and progress made by the ICG-WIGOS Task Team on WIGOS Regulatory Material (TT-WRM), explaining the approach being undertaken by the team to develop the WIGOS regulatory material, including the regulations for WIGOS within the WMO Technical Regulations (TRs) and the development of the Manual and Guide on WIGOS. It was pointed out that the team was working within a tight timeframe that required an initial draft of the updated TRs and the Manual on WIGOS to be available by November 2013 and a mature draft finalized for submission to EC by April 2014. Mr Stringer recommended that the Expert Team might consider a contribution to the work of TT-WRM by undertaking to:

- 1) Review the Manual and Guide on the GOS and identify those parts and sections that might: a) be deleted as no longer relevant; b) require updating; and c) be relevant for inclusion in the revised Manual or Guide on WIGOS;
- 2) Identify and/or compile new standard practices to be specified and/or incorporated into the WIGOS regulatory material; and,
- 3) Review draft regulations upon request by TT-WRM and IPET-WIFI SG-RM.

3.2.3 Mr Stephen Foreman (WMO Secretariat) made a presentation to the Session on the work program and progress made by the ICG-WIGOS Task Team on WIGOS Metadata (TT-WMD) towards the definition and standardization of requirements for metadata associated with WIGOS observing systems and reported that the first meeting of the task team had been held in Geneva in March 2013³. The task team was working towards the definition of the WIGOS Core Metadata set, based on a set of mandatory and conditional categories that have been defined, by March 2014. It was recommended that the Expert Team might contribute to this work by testing the metadata definition for surface-based land systems of the GOS.

3.2.4 Mr Dean Lockett made a presentation on the progress made by the ICG-WIGOS Task Team on WIGOS Regulatory Material on developing and documenting the quality management framework for WIGOS within the WMO regulatory material and also on the tasks related to quality management in the WIP. While the Task Team on WIGOS Quality Management (TT-WQM) was yet to be formed under ICG-WIGOS, work had progressed on task 5.1.1 of the WIP towards developing the structure and some of the content of the regulations related to quality management within the draft Manual on WIGOS under the leadership of Mr Pierre Bessemoulin, TT-WRM. The quality management framework for WIGOS would be primarily based on the WMO Quality Management Framework (WMO Technical Regulations, Volume IV) and rely on the implementation of quality management systems by NMHSs and WIGOS partner organizations for the operation of the meteorological services and observing systems, based on standards and guidelines maintained by WMO. The second task within the WIP, 5.1.2, was the “examination of current quality management practices being used by WMO observing programmes”, with the deliverable of a “report on QM practices used with identification of areas for improvement.” Both these tasks had scope for considerable assistance and input by ET-SBO, with the following activities recommended for consideration as a component of the team’s work program.

For WIP Task 5.1.1:

- 1) In consultation with TT-WRM and SG-QM, review the draft regulations for WIGOS quality management QMS for WIGOS in section 2.6 and identify requirements for SBO systems under:
 - a. Section 3.6 (under “Common attributes specific to the surface based subsystem of WIGOS”); and,

³ Final Report: http://www.wmo.int/pages/prog/www/WIGOS-WIS/reports/TT-WMD-1_Final-Report_Geneva_2013.doc

- b. Section 7.6 (under “Global Observing System (GOS) of WWW”).
- 2) In consultation with TT-WRM and SG-QM, review the GOS with respect to quality management practices and identify:
 - a. Sections that might be incorporated into the WIGOS manual or guide.
 - b. Sections requiring update or review.
 - c. New regulatory material to be added or developed.

For WIP Task 5.1.2, in consultation with and reporting to SG-QM:

- 3) Undertake or coordinate a review of quality management practices for surface-based land observing systems/networks focusing on the key aspects of quality management: quality control and quality assurance, making recommendations for improvement; and,
- 4) Undertake or coordinate a review of GOS quality monitoring and fault management practices, processes and procedures (e.g. procedures of and for Lead Centers, Monitoring Centers, silent stations, missing data, feedback mechanisms, etc), making recommendations for improvement.

3.3 IPET-WIFI and its Task Teams

- 3.3.1 Dr Jochen Dibbern, Chair of IPET-WIFI, made a presentation to the Session on the work programs of the CBS Inter-Programme Expert Team on WIGOS Framework Implementation (IPET-WIFI) and its subgroups⁴, highlighting how these teams would contribute to the WIP and, in particular, how ET-SBO might in turn contribute to this work as a component of its own work program in line with its terms of reference.
- 3.3.2 The IPET-WIFI subgroups were currently comprised of the Sub-Group on Regulatory Material (SG-RM), the Sub-Group on Metadata (SG-MD) and the Sub-Group on Quality Management (SG-QM), each of which were to be responsible for tasks and activities for which ET-SBO could be expected to provide input by way of either revision of regulatory and guidance material or through direct contribution to its specification or compilation. In particular, it was recommended that ET-SBO consider contribution to the following activities of the IPET-WIFI subgroups:

SG-RM

- Assisting or reviewing the transcription of material from the Manual on the GOS into the WIGOS regulatory material for surface based observing systems
- Planning the transition and eventual phase out of the Manual on the GOS and planning the structure and content of the WIGOS Guide
- Reviewing and updating the technical regulations related to the GOS and surface based observing systems

SG-MD

- Review the Metadata specification in term weather radar systems and wind profiler systems
- To make proposals on maintaining Metadata

SG-QM

- Contribute to the review of current QM practices used within the GOS
- Contribute to the development of a Fault Management System

⁴ IPET-WIFI ToR: http://www.wmo.int/pages/prog/www/OSY/WorkingStructure/OPAG-IOS_TOR.htm#_wif

3.3.3 It was agreed that the Expert Team would undertake a review of all the recommended activities associated with the WIP and the related WIGOS EC and CBS work teams and groups within a Breakout Group later during the meeting (see item 6.3 below).

4 OUTCOMES AND RECOMMENDATIONS OF THE WORKSHOP ON REGIONAL AND GLOBAL EXCHANGE OF WEATHER RADAR DATA

4.1 Mr Dean Lockett made a presentation providing a summary of the outcomes and recommendations of the CBS/OPAG-IOS Workshop on Regional and Global Exchange of Weather Radar Data, which was held in Exeter, UK, over 24-26 April⁵.

4.2 The Expert Team recognized the success of the workshop and also the need to review and determine appropriate actions associated with the 20 recommendations that were made, the most significant of which was the recommendation to form a CBS Task Team to undertake to work on the advancement of the development and finalization of WMO standards for the international exchange of weather radar data in line with Action G48 of the CBS Implementation Plan for Evolution of the GOS⁶.

4.3 The Session agreed that the recommendations from the workshop should be reviewed by the Expert Team in a Breakout Group later in the meeting, which would also have the specific task to review and finalize proposed terms of reference and membership for a task team to be submitted to ICT-IOIS and CBS management for consideration.

5 ACTIVITIES AND OUTCOMES OF OTHER TEAMS AND PROGRAMMES RELEVANT TO ET-SBO

5.1 Inter Programme Expert Team on Observing System Design and Evolution (IPET-OSDE)

5.1.1 Mr Etienne Charpentier (WMO Secretariat) provided a presentation to the session on the work program and activities of the Inter Programme Expert Team on Observing System Design and Evolution (IPET-OSDE) and on the development of the related tools for the WIGOS Information Resource, including the Observing Systems Capability Analysis and Review tool (OSCAR) associated with the WIGOS Rolling Review of Requirements. The Session was informed that the Implementation Plan for the Evolution for the Global Observing System (EGOS-IP), which is responding to the Vision of the GOS in 2025 was adopted by CBS-15 through Recommendation 6, and came into force with its adoption by EC-65 (May 2013) of Resolution 4.4/2 (CBS-15 report). The EGOS-IP includes a total of 115 actions, including 13 over-arching and cross-cutting actions, 59 surface-based observing systems' related actions, 35 space-based observing systems' related actions, and 8 space weather related actions. While IPET-OSDE was responsible for monitoring the progress of the implementation of the actions of the EGOS-IP, ET-SBO was encouraged to undertake a role under its Terms of Reference (d and e) in actively contributing to both the RRR process and assisting Members and the Technical Commissions in implementing and delivering the outcomes of the relevant EGOS-IP actions. It was recommended in particular that ET-SBO consider contributions to the following activities:

- 1) Review of the global actions of the EGOS-IP relevant to surface-based land systems, identification of those which the team can contribute and incorporation of appropriate activities and actions into the ET-SBO work program;
- 2) Review the representation of the capabilities of surface-based land systems in the specification for the functional requirements for OSCAR;

⁵ Final Report of the Workshop: http://www.wmo.int/pages/prog/www/CBS-Reports/documents/Final_Report_Workshop_Radar_Data_Exchange_Exeter_April_2013.pdf

⁶ Action: Define weather radar data to be exchanged at regional and global levels, propose frequency of exchange of those data and develop a weather radar data processing framework, in concert with development of products based on national, regional, global requirements.

- 3) Contribute to the review and development of relevant tools and information associated with the WMO Information Resource (WIR);
- 4) Contribute to the work of IPET-OSDE in developing guidelines on observing system network design principles.

5.2 Spectrum Management and the Work of CBS SG-RFC

- 5.2.1 Mr David Thomas (WMO Secretariat) provided a document and presentation on the work of the CBS Steering Group on Radio Frequency Coordination, emphasizing the key role this group plays in representing the interests of WMO Members in having and retaining access to radio-frequency spectrum for the critical and widespread meteorological observing system and data communications applications that rely upon such access.
- 5.2.2 The meeting was informed that, while management of radio-frequency spectrum is essentially a national responsibility there is a need for an international framework for Radio Regulations and a forum for reaching and maintaining agreements on such regulations. The management of the radio-frequency spectrum on an international level is one of the main tasks of the International Telecommunication Union (ITU). The ITU at its World Radiocommunication Conferences (WRCs) establishes and maintains international treaties - Radio Regulations (RR) related to allocation, coordination and use of the radio-frequency spectrum in the effective way to ensure maximum and efficient use of this limited resource.
- 5.2.3 The WMO strategy to address this important activity is divided into four areas:
- 1) Participation of WMO experts, through and coordinated by the CBS SG-RFC, in ITU processes related to the modification of the ITU Radio Regulations;
 - 2) SG-RFC in coordination with the Open Programme Area Group on Integrated Observing System (OPAG-IOS) leading the monitoring of emerging and critical issues affecting the needs of radiofrequency spectrum for WMO observing systems, taking necessary action including submission of documents to national and international regulatory processes;
 - 3) Continuation of building the capacity of NMHSs to be able to effectively participate in national radio-frequency coordination issues, including representing national meteorological and related needs in regional and global radiofrequency coordination processes; and,
 - 4) Coordination and collaboration with other international, regional, non-government and commercial organizations involved in the Earth observations and environmental services to forward requirements and issues for a common benefit to all.
- 5.2.4 It was recommended that the Expert Team might contribute to the processes associated with radio frequency coordination by ensuring that any radio frequency concerns and issues are directed and represented to SG-RFC and also by reviewing the next WMO Preliminary Position Paper to be submitted to the ITU World Radiocommunication Conference 2015 (WRC-15) to be held in November 2015 and providing feedback to the SG-RFC on surface based systems components.

5.3 Collaboration and Interaction with CBS/IPET-DRMM

- 5.3.1 Dr Stephen Foreman made a brief presentation to the Session on some particular aspects of the work of the Inter-Programme Expert Team on Data Representation Maintenance and Monitoring, that has responsibility for WMO standards associated with both traditional alphanumeric codes (SYNOP, TEMP, etc) and Table Driven Code Forms (BUFR, GRIB, CREX). This team met very recently over 1-5 July in Tokyo and identified a number of surface-based land data representation issues which ET-SBO might be able to offer assistance in resolving:
- 1) IPET-DRMM has ceased supporting changes to WMO alpha-numeric codes, which means that the migration to table-driven code (TDCF) formats by WMO Members should be strongly encouraged and that manufacturers and suppliers of observing systems should be encouraged to migrate to the use of TDCF formats as the preferred standard.

- 2) System developers and operators should be encouraged to develop and make use of WMO standardized BUFR templates (validated by IPET-DRMM) and ensure that all required data and metadata are encoded. Manufacturers and suppliers should be encouraged to submit sample messages to IPET-DRMM for validation.
- 3) IPET-DRMM have a requirement to identify experts to assist with:
 - a. the development of a BUFR template(s) for vertical wind profiling radars and lidars with the aim of defining the minimal number of BUFR templates that can serve the encoding requirements of all such observing system applications; and,
 - b. modification of the radiosonde BUFR template for aspects of metadata encoding;
- 4) There is an identified requirement to define a standard for the determination of radiosonde-derived winds over the Polar Regions.

5.4 Collaboration and Interaction with CIMO and its Teams

- 5.4.1 Dr Isabelle Ruedi made a presentation on the OPAG and work team structure of CIMO and outlined the activities and tasks of some teams that may be relevant to current or future plans or activities. In particular, the following teams and activities were identified as having areas of common interest and objectives to ET-SBO:

OPAG on Standards and Intercomparison

ET on Standardization

- Is developing guidance and training documentation concerning the siting classification, previously prepared in consultation with CBS/ET-AWS.
- Is developing a sustained performance classification addressing instruments, calibration and maintenance.
- Contributing to TT-WMD in development of the WIGOS core interpretation metadata.

ET on New In-situ Technologies

- Undertaking review and standardization of AWS algorithms.
- Guidelines for installation of AWS in extreme climate conditions.

ET on Intercomparisons.

- Undertaking the Solid Precipitation Intercomparison Experiment (SPICE).
- Undertaking the RQQI – Radar Quality Control and Quantitative Precipitation Intercomparison.
- Following up on the Yangjiang Radiosonde Intercomparison.
- Coordination of regional radiosonde intercomparisons.

OPAG on Remote Sensing and New Technologies

ET on Operational Remote Sensing

- Compiling guidance on operation of wind profilers.
- Contributing to the Radar Data Quality Control (RQQI Intercomparison).
- Undertaking evaluation of accuracy of radar and lightning data.
- Undertaking performance evaluation of lightning detection systems.
- Developing guidance on improved performance of weather radars in mountainous regions.

- Evaluating benefits of dual polarization radars.
- Developing best practices for ensuring optimal radar performance.
- Undertaking intercomparison of radar/gauge/satellite rainfall data and development of transfer functions.

ET on New Technology and Test Beds

- Developing guidance on meteorological use of GNSS.
- Developing guidance on operational use of passive microwave profilers.
- Development of lidar standards (with ISO).
- Other New Remote Sensing Technologies – Development Status.
- SI Traceability of Remotely Sensed Atmospheric Profiles

5.4.2 It was agreed by the Expert Team members that closer coordination with CIMO task teams and bodies should be a priority for the team and also reflected in the work plan under tasks associated with Terms of Reference item (g).

5.5 GCOS

5.5.1 Tim Oakley, the GCOS Implementation Manager, gave a presentation on the work of GCOS, much of which is focused on the vision of GCOS – ‘The vision of GCOS is that all users have access to the climate observations, data records and information which they require to address pressing climate-related concerns. GCOS users include individuals, national and international organizations, institutions and agencies. The role of GCOS is to work with partners to ensure the sustained provision of reliable physical, chemical and biological observations and data records for the total climate system – across the atmospheric, oceanic and terrestrial domains, including hydrological and carbon cycles and the cryosphere’.

5.5.2 Whilst GCOS is concerned with all the 50 Essential Climate Variables (ECVs), for this expert team, those variables from the Atmospheric domain are the most relevant, in particular those observed from the GSN (GCOS Surface Network) and GUAN (GCOS Upper Air Network). The recent report from the Atmospheric Observation Panel on Climate (AOPC) was submitted as an information paper to the meeting and those actions which were relevant to the ET-SBO Terms of Reference and work plan were discussed in more detail. The areas that were considered to be of relevance to GCOS and ET-SBO were as follows:

- Collaboration – linking GCOS with CBS/CIMO & WIGOS
- Network review/design
- Metadata & Regulatory Material
- Monitoring centres and practices
- Telecommunications, coding and data availability
- Network ‘gaps’, complementary observations and expanding networks/third party data.
- Quality Management

5.5.3 Tim Oakley thanked the meeting for the opportunity to represent GCOS and he looked forward to working with the experts on a number of the agreed activities in the work plan.

6 WORK PLAN AND TASKS

6.1 Status of Previous Tasks

Outstanding actions from ET-AWS

- 6.1.1 The work plan from ET-AWS was reviewed by Karl Monnik to identify which actions require further attention. The actions concerning support for WIGOS have been absorbed by a number of other teams. TT-WMD is developing a metadata specification which will incorporate the most important aspects of WMO Publication No. 9, Volume A, as well as updating AWS metadata catalogues for real-time exchange. Technical document contributions (instruments and methods of observations; network information exchange; quality assurance) will be addressed through IPET-WIFI subgroups (Regulatory Material, Metadata & Quality Management).
- 6.1.2 ET-AWS had contributed to the development of a “N-Minute” BUFR Template which would allow the transmission on the GTS of high-frequency (sub-hourly) land surface-data from an AWS. This template incorporates additional metadata for AWS systems and would eventually become the standard for exchange of AWS data. The template was presented at the First meeting of the Inter-Programme Expert Team on Data Representation Maintenance and Monitoring (IPET-DRMM-I), held in Tokyo, 1-5 July 2013. The template requires validating and it is recommended that ET-SBO ensures that this process is carried out by suitable validation partners under the coordination of IPET-DRMM.
- 6.1.3 The AWS related documents in the Guide to the GOS concerning Annex III.1 Functional Specifications for Automatic Weather Stations, and Annex III.2 Basic set of Variables to be Reported by Standard Automatic Weather Stations for Multiple Users, should be updated by the ET-SBO subgroup tasked with reviewing regulatory material. Furthermore, the subgroup updating regulatory material land based surface stations should incorporate previous ET-AWS feeder documents regarding developing requirements and standards for a robust AWS suitable for less developed, remote and extreme environmental conditions.
- 6.1.4 The task to develop requirements and guidance for automated observations to address differences and deficiencies of AWS following the migration from manual observations has not yet been addressed. This should be incorporated into the work plan activities for ET-SBO associated with revising and updating the WMO technical documentation.
- 6.1.5 The task to develop training material for the siting classification of surface observing stations was being addressed by CIMO ET on Standardization and it was recommended that ET-SBO might contribute collaboratively as necessary on this work.

Previous Work Undertaken By the Expert Team on Surface-Based Remotely-Sensed Observations

WMO Radar Database

- 6.1.6 The Session was informed about the previous collaborative work by the CBS Expert Team on Surface-Based Remotely-Sensed Observations (ET-SBRSO) and the CIMO Expert Team on Operational Remote Sensing to survey Members on their operation of weather radar systems and to collect radar metadata, which led to the establishment of the WMO Radar Database (WRD)⁷.
- 6.1.7 The WRD is now operated and administratively maintained by the Turkish State Meteorological Services (TSMS) on behalf of WMO. The metadata within the database is maintained by WMO Member Focal Points for Weather Radar Metadata on a 3-monthly basis according to specified procedures⁸. The radar metadata can also be readily transferred to other applications or databases that might require automated access to it, such as OSCAR.

Wind Profiler Survey

⁷ WMO Radar Database online site: <http://wrd.mgm.gov.tr/default.aspx?l=en>

⁸ Responsibilities of Focal Points for Maintenance of Weather Radar Metadata: http://www.wmo.int/pages/prog/www/WRO/index_en.html#WRFPP_Resp

6.1.8 Mr Dean Lockett presented a summary of the status of the previous task of ET-SBRSO to survey Members and collect metadata on wind profiler radar (WPR) systems. This work was previously led by Mr Amaury Caruzzo, who submitted a document (6.1.3) outlining the work that had been done to date. The survey was drafted, reviewed and revised by ET-SBRSO and approved (final version provided in document 6.1.3) to be implemented at the second session of ET-SBRSO in November 2011. While the intention was to undertake the survey in 2012, this did not occur and it was recommended that ET-SBO resumes this task with the aim of implementing and analyzing the results of the survey and metadata collection in 2014. It was recommended that the process undertaken should be modeled on the successful approach taken to the collection of weather radar data and that standard WMO tools for surveys and collection of metadata are utilized, with the aim of operationally maintaining the WPR metadata in the future.

6.2 ET-SBO Member Reports and Recommendations

Feedback from ET-SBO Members on Terms of Reference and Work Plan

- 6.2.1 Before ET-SBO session, Mr Goldstraw circulated a short document providing his view on the Terms of Reference, the high level Work Plan for ET-SBO and requesting that team members provide a response to some questions about the ToR and the work plan. It was revealed that, whilst many found the explanatory document of some value there was still a requirement for further explanation in order to provide team members with a better understanding of the work program to be undertaken.
- 6.2.2 Whilst the original ambition was to circulate an updated version of the explanatory document during the session, it became clear from the feedback collected that a major update of the document by the Chair was required. Importantly however, this experience highlighted the need to provide more and better explanatory material to assist team members and place the work they are undertaking into context. Mr Goldstraw agreed an update of the description document would be produced and this has been reflected in the detailed work plan.

Helping WIGOS Succeed

- 6.2.3 Within the definition of WIGOS as a whole it could be argued that all the activities undertaken by ET-SBO are helping WIGOS succeed but in the context of this Terms of Reference and its associated work plan item, 'Helping WIGOS Succeed' relates directly to tasks assigned to ET-SBO to assist in the expected outcome of WIGOS being declared operational by the next Cg in 2015.
- 6.2.4 During the meeting it was agreed that, to avoid confusion and potentially conflicting requests for activities from the Expert Team the full Term of Reference would materially, although informally, changed from: "Contribute to the implementation of WIGOS by undertaking those tasks assigned to it by the OPAG IOS Chair from the WIGOS Framework Implementation Plan" to: "Contribute to the implementation of WIGOS by undertaking those tasks assigned to it by the CBS/IOS IPET WIFI Chair from the WIGOS Framework Implementation Plan."
- 6.2.5 It was agreed a break out session would be undertaken to identify the specific tasks ET-SBO would undertake to enable this work plan item to be delivered. The meeting was particularly grateful to Russell Stringer, Karl Monnik, Steve Foreman and Dean Lockett for providing guidance as to the key tasks that ET-SBO could assist with in the coming months.
- 6.2.6 Given the importance of this work plan item it was agreed that approximately 100 days of effort should be assigned to the related tasks, as detailed in the updated work plan provided within [Annex IV](#).

Improving Technical Documents

- 6.2.7 A short document and flow chart was prepared to guide the process for reviewing, updating and generating new content for WMO Technical documents. This included both a short process for small changes, and a much more thorough process for more substantial changes.
- 6.2.8 Four areas requiring substantial attention to review, update and generate new content for technical documents (the Manual for the GOS No. 544, and the Guide for the GOS No. 488) were identified. These are: (i) radar related, (ii) wind profiler related, (iii) upper air synoptic stations, (iv) surface synoptic (land based, manual and AWS), and (v) GNSS Total Water Vapour related. It was noted that the documentation task for the wind profiler would be better served by delaying this until after the wind profiler questionnaire had been distributed and the results analysed. Furthermore, there is no expertise regarding lightning detection systems within the group.
- 6.2.9 Specifically regarding WIGOS Regulatory Material, during the initial review of the Manual on the GOS, aspects which can be updated by October 2013 relating to WIGOS should be submitted to IPET-WIFI Sub-Group on Regulatory Material for review and submission.
- 6.2.10 These activities were further considered by the Session as part of the breakout group work (see below).

Status of Implementation

- 6.2.11 The Expert Team recognized the importance of maintaining an understanding of the status of implementation of all operational, or soon to be operational, observing networks. Traditionally the status of RBSN and RBCN stations, both surface and upper air, was monitored via regular analysis of GTS reports and CBS nominated Global Monitoring Centres. However, as the breadth of operational observing systems has expanded, there has been a need to expand the Members' understanding.
- 6.2.12 The establishment of the successful WMO Radar Metadata Database, hosted by the Turkish State Meteorological Service was recognized as an excellent example of expanded operational implementation monitoring. However it was noted a number of other observing networks have become operational in recent years but no formal implementation status monitoring is being undertaken.
- 6.2.13 To ensure an achievable development of the Status of Implementation work plan activities could be delivered, it was agreed the completion of the Wind Profiler Survey would be a priority task in this area. Details of which can be found in the break out group reports and in the detailed work plan.
- 6.2.14 A significant change to the methodology by which Volume A [Weather Reporting (WMO-No. 9) Volume A – Observing Stations] information is being collected and stored is expected to enable an improved process for assessment of the 'Status of Implementation' of other observing systems falling within the remit of ET-SBO. Once this migration has been undertaken a work plan activities will be triggered to ensure a routine report of 'Status of Implementation' can be generated by ET-SBO.
- 6.2.15 It was agreed that approximately 60 days of effort should be assigned to this work plan activity although the detailed effort assignment would not be clear until the Volume A facility within OSCAR had been established.

Meeting User Requirements

- 6.2.16 During the Expert Team meeting little time was able to be invested in determining how this work plan item could be delivered. The Chair and the team made the decision that rather than adding an unreasonable workload to the Expert Team members during the meeting the methodology for delivering the activities associated with this ToR would be developed in close consultation with Expert Team members via email and WebEx meetings.

6.2.17 In light of other resource requirements it was suggested that only 30 days of effort should be assigned to this work plan item.

Delivering the EGOS-IP

6.2.18 The new Implementation Plan for the Evolution of the Global Observing Systems (EGOS-IP) was developed by ET-EGOS and approved by CBS-XV. The team agreed that ET-SBO was responsible for supporting some of the actions in the 'Delivering the EGOS-IP' work plan item but it was also recognized there were more actions that required attention than resources available to complete them. It would therefore be necessary to undertake a process to agree which actions should be a priority for ET-SBO activity.

6.2.19 It was noted that ET-SBO were already contributing to the delivery of one EGOS-IP action as the Workshop on Weather Radar Data Exchange and the subsequent proposed Task Team activities were contributing to action G48. In light of existing and ongoing commitment to this activity, it was noted that a careful selection process for other EGOS-IP actions to be supported would be required. To address this issue, a process and selection criteria was developed by Breakout Group 6 (see [Annex III](#)).

6.2.20 In contributing to the successful delivery of the EGOS-IP, it was agreed ET-SBO would be making the most visible contribution to improvements to the global observing systems, however it was also noted that some of these activities may take many years to deliver and the timeframe for action selection should not be confined to only the current CBS inter-sessional period but a longer term strategic overview should be taken.

6.2.21 It was agreed that approximately 150 days of team resource will be allocated to this work plan item as it is expected the Expert Team will be contributing to more than one EGOS-IP action.

Promoting Best Practice

6.2.22 Mr Henry Karanja presented a document outlining a possible approach and suggested activities that might be undertaken by the Expert Team in meeting the requirement to promote best practices and monitor the status of operation of surface-based observing systems. The session agreed that the team should assess in a breakout group the various activities in this area that were suggested, including:

- Review of quality management and quality monitoring practices in support of WIGOS implementation;
- Revision and development of requirements for monitoring of surface-based observing systems;
- Development of a portal within the WIR for documenting availability of quality monitoring information and practices; and,
- Development of a portal within the WIR for documenting observing system best practices.

Purposeful Horizon Scanning

6.2.23 The team agreed that ET-SBO had a responsibility to be aware of those observing systems that will potentially become operational in the next few years. The key to this would be to engage closely with the relevant CIMO Expert Teams and the wider research community. Richard Ice, a core member of ET-SBO unfortunately could not attend the meeting but had confirmed with the Chair his was willing to be the Lead for and coordinate work related to this activity.

- 6.2.24 The deliverables associated with this activity will consist of annual summary reports compiled by the Lead and derived from ET-SBO member contributions tasked with making assessments of the maturity of potential future observing systems and their suitability for operational implementation.
- 6.2.25 It was agreed that approximately 40 days of effort will be assigned to this work plan activity.

Reporting Progress to ICT-IOS

- 6.2.26 Mr Goldstraw explained that it will be necessary for ET-SBO, through a bi-annual Chair's report, to report progress on its work plan activities to ICT-IOS. The timing of ICT-IOS meetings is such that progress reports will be required in early 2014 and 2016 to ensure that ICT-IOS members have sufficient time to read the reports and carefully consider proposed actions and recommendations.
- 6.2.27 The reporting process to ICT-IOS would also be the mechanism by which proposed changes or updates to regulatory material and technical documents are submitted for consideration and approval.
- 6.2.28 The success of ET-SBO and its work will be judged by the quality and quantity of outputs that will be available for ICT-IOS-8 in early 2014 and ICT-IOS-9 in early 2016. Hence a number of work plan items identified in the detailed work plan at Annex IV have a March 2014 or March 2016 delivery date.

6.3 Detailed Planning on Tasks

- 6.3.1 The Session agreed to divide into breakout groups to consider in detail, the activities and tasks that should be undertaken by the Expert Team in order to meet the ToR and to provide considered input into the development and refinement of the ET-SBO work plan. Three breakout sessions, each of 2 groups were held and considered the following areas of work:
- 1) Helping WIGOS succeed
 - 2) Weather Radar Exchange Task Team
 - 3) Wind Profiler Information Gathering
 - 4) Improving Technical Documents
 - 5) Quality Management / Quality Monitoring
 - 6) EGOS-IP Review
- 6.3.2 A summary of the work and outcomes of each breakout session is provided in [Annex III](#).
- 6.3.3 The work undertaken in the breakout groups was summarized in the plenary by the leaders of each breakout session and this detailed information was used to review, revise and update the work plan of the Expert Team. The updated work plan is provided in [Annex IV](#).

7. ANY OTHER BUSINESS

7.1 Mr Goldstraw highlighted the need for the ET-SBO members to remain in contact after the meeting, especially and initially to ensure the delivery of feedback as part of the 'Helping WIGOS Succeed' work plan items that are required in October and November. It was therefore suggested that regular teleconferences / WebEx sessions were needed to ensure progress could be monitored. The first WebEx sessions would be held during the period 25-27 September, to be scheduled and coordinated by the Secretariat. Team Members would be provided with further details and agendas prior to the sessions.

8. CLOSURE OF THE SESSION

The Chair of the expert team thanked all those that participated in the Meeting and closed the session at 3:45pm on Friday 12 July, 2013.

ANNEX I

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ANNEX II

Terms of Reference of the Expert Team on Surface-Based Observations

- (a) Contribute to the implementation of WIGOS by undertaking those tasks assigned to it by the OPAG IOS Chair from the WIGOS Framework Implementation Plan;
- (b) Develop and update relevant elements of the Manual and the Guide on the GOS in the context of WIGOS, with initial priority on weather radar and AWSs;
- (c) Monitor and assess the status of planned and operational surface-based observing systems and ensure this is adequately described in Volume A and metadata database(s) of Members' observing system capabilities;
- (d) In collaboration with IPET-OSDE, assess the contribution of current and planned SBO systems to meeting user requirements for all Application Areas;
- (e) Facilitate the delivery of those EGOS-IP actions identified as priorities for OPAG-IOS;
- (f) Monitor the status of operational networks of SBO systems, promote best practice among WMO Members and provide advice on operational matters;
- (g) Assess the potential contribution of new and emerging SBO technologies in meeting the Vision for the GOS in 2025, in collaboration with CIMO;
- (h) Provide advice and support to the Chairperson of OPAG-IOS on the implementation of the WIGOS framework and its operational aspects.

ANNEX III

SUMMARY OF THE WORK OF BREAKOUT GROUPS

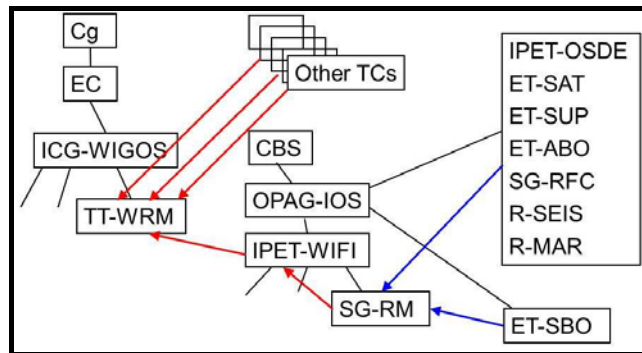
Breakout Group 1: Helping WIGOS succeed

Led by Russell Stringer

ToR for the Group:

- 1) Review WIGOS IP (Table of actions) and identify specific tasks for ET-SBO
- 2) Consider the request for support during the WIGOS presentations and identify highest priority tasks.
- 3) Develop a work plan (Tasks, Task Owners, Timeline) for ToR 1 to add to the ET Work Plan
- 4) Assign a scribe and write a brief summary report for the Final Report.

The breakout group 1 noted that many teams are working on WIGOS framework implementation, including input from many other Technical Commissions and the gathering of input from across CBS, as per the following diagram that had been used in the presentation on WIGOS Regulatory Material.



The breakout group 1 decided to focus attention on how to contribute to the work of CBS IPET-WIFI, specifically its three Sub-Groups.

The presentation on IPET-WIFI (by Jochen Dibbern) had already provided suggestions on how ET-SBO can help the three Sub-Groups. These were reviewed, then more detail was developed in relation to each Sub-Group.

Contributing to the work of the Sub-Group on Regulatory Material

Starting ideas:

1. Review Manual on the GOS for obsolete material (to be updated or deleted)
2. Review Manual on the GOS for missing material about current operational practices
3. Compose new material as new operational practices are developed and established

After discussion, the following action was identified for ET-SBO:

Review the following sections of the Manual on the GOS: Part III (Surface-based sub-system) except 2.5 (aircraft observations for ET-ABO) and 2.7 (marine related observations for R-MAR).

When: by Oct 2013.

Reviewers to address the following questions:

- Which aspects are still relevant or not, OR I don't understand it, OR no comment,
- Suggest updated text,
- Is there something missing that should be in this section.

Still to be completed:

Draw up a list of all the subsections of Part III of the Manual on the GOS to be reviewed, then put 2 names against each to do the review.

Contributing to the work of the Sub-Group on MetaData

Starting ideas:

- review the draft metadata core profile
- identify mechanisms to share updated metadata (ie. Maintaining the metadata)

After discussion, the following action was identified for ET-SBO:

Use several specific surface-based observing systems to road-test the draft metadata core profile. This will reveal how easy and obvious it is to evaluate the specified metadata for each specific observing system.

When: commence after full (beta-) version of core profile available (Aug 2013), complete by Nov 2013.

Follow-up: after the road tests, review the lessons learnt (for example, is it any clearer which aspects will need to be reported in real time with the data itself rather than updated periodically on an accessible database; is terminology clear and understandable).

List of all the operational observing systems as identified in the Manual on the GOS and name against each one:

Radiosonde & Upper Air = Tim Oakley, Seong Chen PARK, Islam Ameen, Henry Karanja

Wind profilers = Dominique Ruffieux

Weather radars = (Jean-Luc Cheze, Daniel Michelson)

AWS & Manual Observations = Karl Monnik, Edmundo Lucas, Seong Chen PARK, Islam Ameen, Henry Karanja

RIC = Islam Ameen

Contributing to the work of the Sub-Group on Quality Management

Starting ideas:

- Contribute to review of existing QM practices
- Contribute to development of global Fault Management System

The discussion was mostly around observations data monitoring. It was noted that the recent workshop held at ECMWF drew attention to the potential advantages of a single global Lead Centre for monitoring the quality of surface based observations.

After discussion, the following actions were identified for ET-SBO:

x. Document all currently operational quality monitoring centres for WMO / CBS / GOS surface-based observations exchanged globally together with their analysis methods and reports.

Who: xxxx

When: Mar 2014

(notes: quality monitoring done nationally within countries is beyond the scope of this item; it would helpful to provide a clear link to this information eg. Through the WIR)

x. Improve quality monitoring (in addition to the current quantity monitoring) of WMO / CBS / GOS surface-based observations exchanged globally by:

- Achievable steps as follows: x, x, x.

Aiming in the longer term to:

- Review the current centres and if necessary develop the proposed role and terms of reference for a single global “WMO Lead Centre for Quality Monitoring of Land Surface Observations”, evolving from the role currently performed by the six Regional centres,
- Develop a specification for the analysis and reporting required from the centre/s.

Note: the quality monitoring is to be done in the context of the goals and targets (standards) for WMO / CBS / GOS land surface observations.

Who: xxxx

When: Mar 2014

(note: quality monitoring done nationally within countries is beyond the scope of this item)

(not covered: further task on Fault Management System – this includes a need for description of best practices in the use and follow-up triggered by the reports from monitoring centres)

ATTACHMENT

Sections of the Manual on the GOS to be reviewed by Oct 2013:

Manual on the Global Observing System Volume I
(Annex V to WMO Technical Regulations)
Global Aspects
WMO-No. 544
2010 edition

SUB-SECTION	Reviewer	Co-Reviewer	Comments
PART III. SURFACE-BASED SUBSYSTEM			
1. Composition of the subsystem			
2. Implementation of elements of the subsystem			
2.1 Networks of observing stations			
2.1.1 General			
2.1.2 Global networks			
2.1.3 Regional networks			
2.1.4 National networks			
2.2 Observing stations	Islam Ameen	Karl Monnik, Edmundo Lucas, Seong Chen PARK, Islam Ameen, Henry Karanja	
2.3 Surface synoptic stations	Islam Ameen	As above	
2.3.1 General	Islam Ameen	As above	
2.3.2 Land stations	Islam Ameen	See list in TOR 2 tasks	
2.3.3 Sea stations	Islam Ameen	See list in TOR 2 tasks	
2.4 Upper-air synoptic stations	Henry Karanja	Tim Oakley, Seong Chen PARK, Islam Ameen, Henry Karanja	
2.5 Aircraft meteorological stations			

2.6 Aeronautical meteorological stations	Islam Ameen	Karl Monnik, Edmundo Lucas, Seong Chen PARK, Islam Ameen, Karanja	
2.7 Research and special-purpose vessel stations			
2.8 Climatological stations	Islam Ameen	Karl Monnik, Edmundo Lucas, Seong Chen PARK, Islam Ameen, Karanja	
2.9 Global Climate Observing System Surface Network (GSN) stations	Islam Ameen	As above	
2.11 Agricultural meteorological stations	Islam Ameen	As above	
2.12 Special stations			
2.12.1 General			
2.12.2 Weather radar stations	Daniel Michelson	Jean-Luc Cheze, Daniel Michelson	
2.12.3 Radiation stations			
2.12.4 Wind profiler stations	Dominique Ruffieux	nil	
2.12.5 Atmospheric detection stations			
2.12.6 Meteorological reconnaissance aircraft stations	Henry Karanja	Tim Oakley, Seong Chen PARK, Islam Ameen, Henry Karanja	
2.12.7 Meteorological rocket stations	Henry Karanja	Tim Oakley, Seong Chen PARK, Islam Ameen, Henry Karanja	
2.12.8 Global Atmosphere Watch (GAW) stations			
2.12.9 Planetary boundary-layer stations	Henry Karanja	Tim Oakley, Seong Chen PARK, Islam Ameen, Henry Karanja	
2.12.10 Tide-gauge stations			
3. Equipment and methods of observation			
3.1 General requirements of a meteorological station			
3.2 General requirements of instruments			
3.3 Surface observations	Islam Ameen	Karl Monnik, Edmundo Lucas, Seong Chen	

		PARK, Islam Ameen, Henry Karanja	
3.3.1 General	Islam Ameen	As above	
3.3.2 Atmospheric pressure	Islam Ameen	As above	
3.3.3 Air temperature	Islam Ameen	As above	
3.3.4 Humidity	Islam Ameen	As above	
3.3.5 Surface wind	Islam Ameen	As above	
3.3.6 Clouds	Islam Ameen	As above	
3.3.7 Weather	Islam Ameen	As above	
3.3.8 Precipitation	Islam Ameen	As above	
3.3.9 Sea surface temperature	Islam Ameen	As above	
3.3.10 Waves	Islam Ameen	As above	
3.3.11 Radiation	Islam Ameen	As above	
3.3.12 Soil temperature	Islam Ameen	As above	
3.3.13 Soil moisture	Islam Ameen	As above	
3.3.14 Evapotranspiration	Islam Ameen	As above	
3.3.15 Evaporation	Islam Ameen	As above	
3.3.16 Sunshine duration	Islam Ameen	As above	
3.4 Upper-air observations	Henry Karanja	Tim Oakley, Seong Chen PARK, Islam Ameen, Henry Karanja	
Attachment 111.1. Standard set of metadata elements for automatic weather station installations.	Islam Ameen	Karl Monnik, Edmundo Lucas, Seong Chen PARK, Islam Ameen, Henry Karanja	

Breakout Group 2: Weather Radar Exchange Task Team

Led by Daniel Michelson

ToR for the Group:

- 1) Review ToR for Task Team
- 2) Develop a draft Work Plan for the TT
- 3) Proposed Membership (where members should come from - 4 to 5 people max.)
- 4) Develop a work plan (Tasks, Task Owners, Timeline) for ToR 5 to add to the ET Work Plan
- 5) Assign a scribe and write a brief summary report for the Final Report.

Review of Terms of Reference for the Task Team on Weather Radar Data Exchange

The group considered and reviewed the Terms of Reference for a the Task Team proposed as a recommendation of the Workshop on the Regional and Global Exchange of Weather Radar Data. It was agreed that formation of the task team should be recommended to OPAG-IOS.

Some changes to the ToR for the task team were made and the updated ToR are proposed below, with changes having been made to items 1, 2, 3 and 7.

Proposed Terms of Reference for a WMO CBS task Team on Weather Radar Data Exchange

- 1) Gather requirements for information (data, metadata, products, timeliness and frequency) from weather radars to be exchanged globally on a regular basis along with requirements on recommended transmission methods.
- 2) Develop and document a data model based on the requirements.
- 3) Identify and recommend appropriate data formats for operational and scientific exchange.
- 4) Express the data model using approved data format(s), taking into account the considerable progress achieved by EUMETNET OPERA in harmonizing operationally exchanged real-time weather radar data with the OPERA Data Information Model (ODIM).
- 5) Coordinate with IPET-MDRD and IPET-DRMM to ensure that the data model and data representations are consistent and compatible with WMO standards and practices.
- 6) Make recommendations on requirements for documentation and training materials to support WMO Members in the application and use of the data model and data representations to be used for the global exchange of weather radar information to support data users.
- 7) Using ODIM_BUFR as a basis, develop, review and coordinate approval of required BUFR sequences for global exchange of radar data.
- 8) Elaborate compliance between ODIM_H5 and netCDF CF Conventions, especially regarding GIS compatibility.

It was agreed that membership criteria for the TT be that the team constitutes representation from:

- An appropriate geographic distribution from the Regional Associations,
- Weather radar expertise from CIMO,
- Radar data exchange expertise from EUMETNET OPERA
- Data representation expertise from IPET-MDRD and/or IPET-DRMM.

Potential team members were identified at the breakout group meeting. Daniel Michelson was proposed as the TT lead, pending the team's official creation, and he was charged with the initial responsibility of contacting the potential team members informally to gauge their ability and willingness to participate.

Annotated recommendations of the WxR workshop

The recommendation of the breakout group is given in the column “Follow-up”.

No.	Recommendation	Responsibility	Action	Follow-up
1	The current requirements statements in OSCAR to be reviewed and if necessary updated in light of information provided to Workshop.	ET-SBO	Chair to discuss with Chair IPET-OSDE & WMO Sec best way to update entries in OSCAR based on Workshop Rep findings.	Action to be taken by ET Chair.
2	It was recommended that CBS (via ET-SBO) should investigate the possibility of forming a similar body for weather radar observations and NWP applications to that servicing the Satellite community for products and data processing requirements	CBS, ET-SBO, CIMO	Chair of ET-SBO to address through OPAG-IOS and CBS; Require consultation with CIMO and the team on RQQI and GCOS.	Action to be taken by ET Chair.
3	CBS (via ET-SBO) should investigate the possibility of forming a body for weather radar observations similar to EUMETSAT CAF or SAF's that should also explore the climatological uses of radar data and elaborate further recommendations to that end. These should encompass: 1. Quality control indicators as an integral part of the available radar precipitation data; 2. Development of consistent radar precipitation databases for use in hydro-climatological studies 3. Global proliferation of the understanding with all radar operating NMHSs that there is a use for raw (L2) data beyond the real-time applications demanding for their permanent storage.	CBS, ET-SBO	1. As for Recommendation 1, ET-SBO to consult with relevant stakeholders. 2. ET-SBO and proposed Task Team to ensure QC indicators included in data model. 3. ET-SBO to consider action required on archival of radar data for climate and hydrological requirements.	Quality indicators and provision for accommodating moments from dual-polarization radars are implicitly included in the TT ToR #4.

No.	Recommendation	Responsibility	Action	Follow-up
4	CBS (via ET-SBO) is invited to determine a proper mechanism to involve GCOS into the process and the future activities on the issue of global and regional exchange of radar data. It is also invited to take advantage of GOCS experience in setting and documenting standards for Essential Climate Variables (ECVs) like precipitation.	CBS, ET-SBO	Chair of ET-SBO to address through ET-SBO and IPET-OSDE	Action to be taken by ET Chair.
5	Standardised exchange models for weather radar data will need to take into account latency requirements for both now-casting and other applications with less stringent requirements on transmission frequency. In order to improve the timeliness of radar data exchange for high frequency data exchange, it was recommended that data transmission should be done by using streaming data techniques, which means "uploading while scanning".	CBS, ET-SBO	ET-SBO to ensure this recommendation is considered and addressed by the team tasked with developing the data model. Note: This is likely really an internal radar to radar processing centre issue and not a regional or global exchange issue.	"Streaming" techniques, or transmission of data ray-by-ray, are identified as being effective in alleviating bandwidth bottle-necks in domestic networks, ie. getting data from site to central processing facility. This is not considered relevant at the international level. Other issues of latency and frequency are identified in amended TT ToR #1.
6	With respect to future radar technology developments, e.g., dual-polarization technique, consideration should be made for the exchange of this data.	CBS, ET-SBO	ET-SBO to ensure this recommendation is addressed in by the team tasked with developing the data model.	Provision for accommodating moments from dual-polarization radars is implicitly included in the TT ToR #4.
7	To ensure the accuracy of radar data, it was recommended that WMO organize experts to develop standardised quality control and calibration schemes that are able to take into account the different radar systems in operation in different countries.	CBS, ET-SBO	As for recommendation 1.	Clear link with radar activities in CIMO, to be addressed through appropriate CIMO representation in the TT membership.
8	Envisaging that data policy issues may be a significant limiting factor and that some agreements may initially allow the exchange of radar products only, consideration should be given to the comprehensive exchange of these product format and quality standards, as well.	CBS, ET-SBO	ET-SBO to ensure this recommendation is addressed in by the team tasked with developing the data model.	Implicitly included primarily in TT ToR #2 and #3. Important that constraints imposed by data policy not compromise the quality or information content in data as opposed to products.

No.	Recommendation	Responsibility	Action	Follow-up
9	The long-standing operation of regional and international data exchange mechanisms within RA VI provide examples of working data models and existing data formats that should be considered by CBS as a basis for global standardization.	CBS, ET-SBO	ET-SBO to ensure this recommendation is addressed in by the team tasked with developing the data model.	Included in TT ToR #4, #7, and #8.
10	Further investigation into radar data exchange arrangements and agreements outside of the EUMETNET domain should be undertaken.	CBS, ET-SBO	Chair ET-SBO to incorporate this activity into Work Plan of ET-SBO.	Outside the scope of the TT's ToR as currently formulated.
11	<p>Consideration should be given to adding the following features to the WRD:</p> <ul style="list-style-type: none"> • The metadata should be modified so as to enable the maintenance of a historical record of radar metadata; for example, the database would establish periods of time for which particular site or system configurations or calibrations were valid; • Support for inclusion of future installations planned; • Keep a record of access by FPs and provide a facility for FPs to indicate they have checked the data and it is deemed to be up-to-date and correct; • Metadata or information on data exchange arrangements and agreements, including bilateral, regional or international data exchange and dissemination. 	CBS, ET-SBO, Turkey Met. Service	Chair ET-SBO to consider incorporation of this activity into Work Plan of ET-SBO and work with TSMS to update the WMO Radar Database.	Outside the scope of the TT's ToR as currently formulated.

No.	Recommendation	Responsibility	Action	Follow-up
12	The tables (Annex V) could be circulated and used both to complete the global picture and to update it periodically when new data exchange is initiated somewhere. The OPERA data exchange matrix could also be used in each region to provide more detail. A link between this kind of information and that available in the WMO Radar Database could also be explored.	ET-SBO	Chair ET-SBO to consider incorporation of this activity into Work Plan of ET-SBO	Outside the scope of the TT's ToR as currently formulated.
13	While it is recognized that BUFR is a standard for which the official use is governed by WMO and that HDF5 is endorsed but not yet governed by the WMO, it is recommended that WMO and CBS consider adopting ODIM_H5 as a WMO standard for representation of radar data.	CBS, ET-SBO	Chair ET-SBO to ensure this recommendation is made to CBS via OPAG-IOS and take the recommendation into consideration in finalising the Terms of Reference for development of the data exchange model.	Accommodated in TT ToR #4 and #8.
14	A WMO Task Team established to investigate and implement a weather radar data model should consider elaboration of METCE to accommodate weather radar data and represent them using ODIM as a starting point.	CBS, ET-SBO	Chair ET-SBO to ensure this recommendation is made to CBS via OPAG-IOS and take into consideration the proposed Terms of Reference developed in Annex VII	Removed reference to METCE in TT ToR #2; this point was generalized.
15	It was recommended by the Workshop participants that a Task Team is formed, possibly under the direction of CBS ET-SBO and charged with the responsibility of addressing a requirement for the development of global standard for representing weather radar data in support of global data exchange.	CBS, ET-SBO	Chair ET-SBO to ensure this recommendation is made to CBS via OPAG-IOS and take into consideration the proposed Terms of Reference developed in Annex VII .	Done. A break-out group formed and the formation of a "TT WxR" was recommended with a high priority assigned to it.

No.	Recommendation	Responsibility	Action	Follow-up
16	The task team should recognize and take into consideration the considerable progress achieved by EUMETNET OPERA in harmonizing operationally exchanged real-time weather radar data with the OPERA Data Information Model (ODIM) and it is recommended that the Task Team should utilize this data model as the basis and starting point for the development and finalization of a WMO standard for global radar data exchange.	CBS, ET-SBO	Chair ET-SBO to ensure this recommendation is made to CBS via OPAG-IOS.	Accommodated in TT ToR #4, #7, and #8.
17	The task team should contain appropriate representatives from Regional Associations, weather radar experts, communications experts, and data model experts. Participation of representatives from other WMO bodies, such as ET-CTS and IPEG-DRMM, is also desirable. WMO and CBS should also ensure that relevant observing systems operators, manufacturers and applications and data user communities are informed of the task team's role and outputs.	CBS, ET-SBO	Chair ET-SBO to ensure this recommendation is made to CBS via OPAG-IOS.	Agreed to these principles in the breakout group. Partly accommodated in TT ToR #5. Nominated TT Lead charged with forming such a group.
18	It was proposed that a pilot project should be established to work towards the definition and implementation of data exchange protocols between Region II (TMS) and Region VI (ODYSSEY) with the concept to perhaps first be tested with the exchange of composite products. This project should be overseen by the CBS ET-SBO.	CBS, ET-SBO	Chair ET-SBO to consider incorporation of this activity into the Work Plan of ET-SBO. ET-SBO to ensure that this activity is consistent with existing plans for radar data exchange under Regional WIGOS Implementation Plans.	Pilot projects are identified as being valuable, but lie outside scope of the TT WxR.
19	The Workshop agreed with representatives of Regions II and V to recommend the establishment of a pilot project for exchange of weather radar data among ASEAN members under the ASEAN ASMB. A draft proposal was developed by Mr Kamiluddin in consultation with Mr Adriyanto and is provided within Annex VIII .	CBS, ET-SBO	Chair ET-SBO to consider incorporation of the monitoring of this activity into the Work Plan of ET-SBO. ET-SBO to ensure that this activity is consistent with existing plans for radar data exchange under Regional WIGOS Implementation Plans.	Activity lies outside the scope of the TT.

No.	Recommendation	Responsibility	Action	Follow-up
20	Given the current interest with Brazil and other countries in Region III in the national and international integration of radar networks, the Workshop agreed with representatives of Region III to recommend the establishment of a Pilot Project for exchange of weather radar data among Region III Members and that this is considered and progressed through coordination by CBS/ET-SBO.	CBS, ET-SBO	<p>Chair ET-SBO to consider incorporation of the coordination and initialisation of this activity into the Work Plan of ET-SBO.</p> <p>ET-SBO to ensure that this activity is consistent with existing plans for radar data exchange under Regional WIGOS Implementation Plans.</p>	Activity lies outside the scope of the TT.

Breakout Group 3: Wind Profiler Information Gathering

Led by Dominique Ruffieux

ToR for the Group:

- 1) Develop a timeline for the completion of the questionnaire / survey up to and including the point of a report for ICT-IOS.
- 2) Propose who will lead on the delivery of this task and which other ET members could be involved.
- 3) Identify the key tasks required for the delivery of the questionnaire / analysis of results & report to ICT-IOS.

Some supporting information captured below.

- Complete the outstanding actions associated with the Wind Profiling Radar Survey including results analysis;
- Limited final review of the survey
- Determine method for undertaking survey (preferably use existing WMO mechanisms)
- Publishing and launch of the Survey
- Establish a suitable Metadata Database for the information obtained from the Wind Profiling Radar Survey;
- Establish an active points of contact (PoC) listing for operational Wind Profiling Radar Networks;
- Management of responses – chasing members whom we know of Wind Profilers in operation but have not completed the survey
- Review of output and production of a status report – ideally I would like the status report to go to ICT-IOS in mid 2014.

Second work plan item to be discussed:

Review content of WMO No.9 Vol A including Radiosonde catalogue and ensure it is fit for purpose and up to date, noting any future plans for changes in light of WIGOS and in particular the WIGOS Information Resource. Review survey and determine action for proceeding.

- Review of completeness and accuracy of WMO No.9 Volume A, including the radiosonde catalogue, reporting outcome and making recommendations for improvements, noting 'Vol A' will be changing structure and migrating into the WIR;
- Annual review of the status of Vol A. Noting this will require review of Obs Monitoring Centre outputs and close engagement with Members (via RAs?);
- Review of the algorithms proposed for the future gap analysis tools for the surface component of the capabilities database within OSCAR.

Summary of Work

Wind Profiler Survey

The following steps and actions towards the completion of the survey were proposed:

1. Check that all requirements for OSCAR metadata are included in the survey. [Dean]
2. Dean to send survey to ET-SBO email list, with specific request for review by members from USA, EU, Japan China and Australia (main operators). [mid-September]
3. Memo from D-OBS to D-DRA(Masterson) re use of Surv. Monk. and CPDB. [end-July]

4. Functional specification of requirements for the entry of the metadata (e.g. FP to enter data?. how to nominate focal points, how often to update, maintain). [Dean, Dominique end-July]
5. Decide on the survey application(s); enter survey; test run by ET; [end-October]
6. Determine process for communication request to PRs [Dean, end-October]
7. Undertake survey [start November, complete mid-December]
8. Reminder on completion [Dean, 1 December]
9. Survey analysis and report 1st draft [Dominique, Tom: end-Feb]
10. Review report [ET-SBO, end-March]
11. Finalise report [Dominique, Tom, Dean, mid-April]
12. Publish as WIGOS TR? [end-April]
13. Procedures for maintenance by FPs?
 - Survey Monkey used for the questionnaire component.
 - Country Profile Database used as interim means for entering and managing the metadata component.

2. Review of Vol A

From discussion with E. Charpentier it was determined that Vol A is now being incorporated into the OSCAR tool and MeteoSuisse has been approached regarding the hosting of the whole application. There will be a process of migration and presumably procedures for Members to maintain the data will be developed through the WIGOS IP. The ET should:

- 1) Work with IPET-OSDE and the OSCAR development team to determine how best to assist in the validation of the Vol A metadata.
- 2) Assist IPET-OSDE and the OSCAR development team in determining a framework for the maintenance of OSCAR metadata.

3. Review of Algorithms for determining Capabilities of SBO Systems

ET-SBO should undertake the following activities:

1. Obtain the current specification from E. Charpentier.
2. Review the specification of algorithms for SBO systems, most particularly focusing on weather radar.
3. Provide feedback to IPET-OSDE.

Breakout Group 4: Improving Technical Documents

Led by Karl Monnik

Summary of Work

1. Develop a governance process to review and update the Manual and Guide as appropriate.
 - updated wording in an informal document proposing a process to develop and review documentation
 - flow chart identifying (i) substantial change process (due Mar 2014 or Mar 2016); (ii) minor change process (due Mar 2014 or Mar 2016); and (iii) WIGOS RM change (Oct 2013).

2. Agree which sections of the WMO No.544 Manual on the GOS (2010) will form part of the review and update activity
 - Weather Radar Manual and Guide substantial review and update. (Daniel M, Jean Luc Cheze, KIM, CIMO rep, WRD?) (50d) Priority 1
 - Wind Profilers Manual and Guide substantial review and update (currently 36 words). (Domonique Ruffieux) (50d) Priority 2. This will be delayed until after the Profiler questionnaire has been completed.
 - Upper air synoptic stations Manual and Guide minor review of largely existing material (Henry, Tim Oakly, Edmundo, LI Wei, ASAP expert required) (30 d)
 - Surface synoptic (land based, manual & AWS) Manual and Guide medium review of largely existing material (Islam, PARK, Henry, Edmundo, Karl) (30 d)
 - GNSS Total water vapour Manual and Guide substantial review and update

Take note that for established areas in the Manual and Guide, to confirm or otherwise that the promotion, with suitable adjustment, of existing material from WMO No.488 (Guide to the GOS, 2012) forms part of the more in depth review and update.

3. Agree what level of WMO No.544 change can be delivered to ICT-IOS by:
 - October 2013 - review of elements relevant to WIGOS-RM
 - March 2014 - a quick review of WMO No. 544 validity & clarity some additional new material
 - March 2016. - complete new material for the Manual (No. 544) and Guide (No. 488) wider and more in depth review
4. Agree how much resource should be devoted to this task (in units of tens of days).
5. Agree who should be the Task lead(s) for this activity.

Breakout Group 5: Quality Management / Quality Monitoring

Led by Henry Karanja

ToR for the Group:

1. Reviewing WMO Quality Management Framework document.
2. Reviewing current Quality Management practices used within the GOS;
 1. CBS GCOS Lead Centres requested to submit their procedures to ET-SBO.
3. Evaluation of best practice in making and sharing observations
4. Documenting the best practices for members
5. Establishment of a SBO portal as part of the [WIGOS Information Resource \(WIR\)](#) to provide a centralized point of access to technical advice documents to members.
6. Populating the SBO portal with national best practice documents.
7. Review as necessary, material from the WMO Quality Management Framework and relevant regulatory documents;
8. Contribute to the development of a Fault Management System
9. Transfer of the requirements for NWP monitoring of observations from the Man on GDPFS to Man on GOS (WIGOS)

Summary of Work

1. Suggested that ET Members read the QMF but not much help in determining requirements for QMS for observing systems until interpreted in the Manual on WIGOS.
2. GOS Global and regional quality monitoring practices review:
 1. Review and briefly document (the practices and summary of how it is actually working) [20 days, Report to ET-SBO, Henry, Edmundo, Jose Mauro, Islam, December 2013]
 1. Role of Regional Lead Centres for quality monitoring (reading manuals, perhaps contacting lead centres or RA office)
 2. WMO SMM process for quantity monitoring (review documents on WMO website)
 3. Requirements for NWP monitoring of obs in the Man on the GDPFS (review relevant section Man on GDPFS)
 2. If necessary propose a new framework, requirements and procedures for quality and quantity monitoring of SBO observing systems (initially land surface systems - manual and AWS) perhaps incorporating [30 days, Report to ICT-IOS, April 2014, Henry, Edmundo, Islam]:
 1. NWP monitoring requirements
 2. requirements for reporting of the lead centre to regions and members
 3. monitoring of 5 key parameters
3. Create Best Practice Portal (described and linked from the WIR under Operations & Maintenance topic):

1. Determine requirements and mode of operation of a facility for providing members with access to best practice materials currently outside of manuals and guidelines. [5 days, Edmundo, when?]
2. Implement with the Secretariat.
4. Create Quality Monitoring Portal (linked to the WIR) listing QM online sites.
 1. Specify a structure for the portal for all WIGOS observing systems [3 days, ???].
 2. Review and identify all existing QM providers and sites for SBO observing systems. [5 days, ???]
 3. Populate the portal with assistance from the Secretariat [2 days].

Breakout Group 6: EGOS-IP Review

Led by Li Wei

ToR for the Group:

Agree the methodology the team will use to determine which EGOS-IP activities will be taken forward by ET-SBO in the next 3 years, or start in the next 3 years if the task is a longer term activity.

Summary of Work

The purpose of the Implementation Plan for the Evolution of the Global Observing System (EGOS-IP) was discussed and the team obtained an improved understanding of its purpose.

It was agreed to select a subset of EGOS-IP actions for ET-SBO to undertake a clearly defined methodology was required. The selection methodology would have three key parts:

Identify those actions that should not be undertaken by ET-SBO as they are out of scope. For example actions related to aircraft based observations are outside the scope of ET-SBO and so no activity should be undertaken on such actions.

Identify those actions where the skills and capabilities of ET-SBO could sensibly contribute exist. For example selecting an Action that related to Improving Lightning Detection Observing Networks may not be suitable as there is no declared lightning detection expert in ET-SBO.

Identify those actions which offer a balanced approach to ET-SBO work plans. This part would require a systematic scoring scheme to be used to review each remaining action. This scoring scheme would not be on a 0 to 1 scale or a high or low scale. The criteria to be used to generate a balanced list of Action items were:

- Timeframe for delivery – short term or long term

- Technology being focused upon – the range of technologies within the ToR of Et-SBO

- Global and Regional reach – whether the action will relate to global or regional initiatives

- Leading edge or capacity building – whether the action focuses on pushing the boundaries of observing or focuses on building capacity in developing countries

- Technical Documents or Physical Activities

- Others.

By using these criteria the breakout group will ensure that ET-SBO does not focus on one technology, or one type of action only but ensure there is a balance of activities.

The Break out team members would work together, via email, to assess the scores for each of the Actions in the EGOS-IP and produce a short report recommending actions to be progressed for the whole of ET-SBO in early November, to enable the tasks associated with each of the Actions identified.

Timeline of activities:

Chair of ET-SBO to produce a template worksheet and circulate to EGOS-IP breakout group members (July 2013)

Break out group members to review all EGOS-IP Actions and score each Action using each of the criteria (October 2013)

Produce a short report recommending which Actions are to have detailed Work Plan items developed to support their delivery (November 2013)

Chair ET-SBO, working with ET-SBO members develop proposals for activities to support 'Delivering the EGOS-IP' to be development (December 2013).

ANNEX IV : UPDATED WORK PLAN OF ET-SBO**WORK PLAN FOR THE ET-SBO FOR THE PERIOD 2013 – 2016
VERSION 1.3 (INCLUDES DETAILED WORK PLAN ACTIVITIES AGREED AT ET-SBO-1 12/07/13)**

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
1.	<p><u>Helping WIGOS Succeed</u></p> <p>Contribute to the implementation of WIGOS by undertaking those tasks assigned to it by the OPAG IOS Chair from the WIGOS Framework Implementation Plan [ToR a]</p> <p>Informally, as discussed at ET-SBO-1, this ToR has become:</p> <p>Contribute to the implementation of WIGOS by undertaking those tasks assigned to it by the CBS/IOS IPET WIFI Chair from the WIGOS Framework Implementation Plan.</p>	Address relevant items of WIGOS Implementation Activities assigned to ET-SBO, details to be forthcoming during work plan period, see individual task sheets for more detail.	Ongoing but major delivery in October & November 2013 and March 2014	Co-ordination Lead Chair ET-SBO for overall delivery with lead and contributors for each task identified.	On track	100 days provisionally assigned to this work plan item.
1.1		<p>Regulatory Material</p> <p>Review the following sections of the Manual on the GOS: Part III (surface-based sub-system) except 2.5 and 2.7. See Annex III Breakout Group 1 information for more detail.</p>	October 2013	Task Lead and Contributors: See the detailed attachment on pages 3 to 5 of Annex III.	On track	Significant task requiring ~20 days of effort in total.
1.2		<p>Metadata</p> <p>Use several specific surface-based observing systems to road-test the draft WIGOS metadata core profile.</p> <p>After road tests review the lessons learnt</p>	November 2013	Task Lead and Contributors: See the details in the report of Break out group 1 on page 2 for details.	On track – availability of published draft core profile will be key	Significant task requiring ~20 days of effort in total.

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
1.3		<p>Quality Management</p> <p>Improve quality monitoring of WMO / CBS / GOS surface-based observations exchanged globally by:</p> <p>Review the current centres and if necessary develop the proposed role and terms of reference for a single global 'WMO Lead Centre for Quality Monitoring of Land Surface Observations' evolving from the role currently performed by the six Regional centres.</p> <p>Develop a specification for the analysis and reporting required from the centre.</p>	March 2014	Task Lead and Contributors: Not yet identified.	On track although active members need to be sourced quickly.	Significant task requiring ~20 days of effort in total.
2.	<p>Improving Technical Documents</p> <p><i>Develop and update relevant elements of the Manual and the Guide on the GOS in the context of WIGOS, with initial priority on weather radar and AWSs [ToR b]</i></p>	Review and update the technical content on Weather Radars, AWS and other high priority systems in SBOs area of responsibility currently held in Manual and Guide for the GOS, noting a new technical document structure may be implemented during the period.	March 2014 & March 2016	Co-ordination Lead: Islam Ameen	On Track	60 days provisionally allocated, 110 days recorded below.
2.1		<p>Weather Radar Review</p> <p>Update WMO No.544 to reflect the importance of Weather Radar operations in WIGOS. Details in break out group 4 report.</p>	March 2014 & March 2016	<p>Task Lead: Daniel Michelson</p> <p>Task Contributors: Jean-Luc Cheze, Jeong-Hee Kim, Oguzhan Sireci</p>	On Track	50 days of effort from ET members but others will be engaged

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
2.2		Wind Profiler Review Update WMO No.544 to reflect the importance of Wind Profiler operations in WIGOS. Details in break out group 4 report.	March 2014 & March 2016	Task Lead: Dominique Ruffieux Task Contributors: Yusuke Kajiwara, Tom Szyzborski	On Track	Effort required to be assessed after Wind Profiler Survey coment.
2.3		Upper air synoptic stations Update WMO No.544 to reflect the current status of upper air synoptic reporting operations in WIGOS. Details in break out group 4 report.	March 2014 & March 2016	Task Lead: Henry Karanja Task Contributors: Edmundo Lucas, Li Wei	On Track	30 days of effort from ET members but others will be engaged.
2.4		Surface synoptic stations Update WMO No.544 to reflect the current status of surface land reporting operations in WIGOS. Details in break out group 4 report.	March 2014 & March 2016	Task Lead: Islam Ameen Task Contributors: Seong-Chan Park, Henry Karanja, Edmundo Lucas, Karl Monnik & Kazunori Irie.	On Track	30 days of effort from ET members
2.5		AWS Technical Manual Create an AWS technical manual from all material generated by ET-AWS over the past 7 meetings and publish as a technical document under new WIGOS banner. (Karl to provide insight into this task)	?	Task Lead: Karl Monnik Task Contributors: To be confirmed	On track	Details of resources required to be confirmed by Karl.
3.	Status of Implementation Monitor and assess the status of planned and operational surface-based observing systems and ensure	Complete the outstanding actions associated with the Wind Profiler Questionnaire including results analysis. Review content of WMO No.9 Vol A including R/S catalogue and ensure it is fit for purpose and	Ongoing / Annual review	Co-ordination Lead to be identified		60 days provisionally allocated

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
	this is adequately described in Volume A and metadata database(s) of Members' observing system capabilities [ToR c]	up to date, noting any future plans for changes in light of WIGOS and in particular the WIGOS Information Resourc				
3.1		WMO Radar Metadata Database Maintenance and improvement of the WMO Radar Database, specifically the improved functionality identified at the WMO WxR Data Exchange Workshop, under recommendation 11.	Ongoing + annual report	Task Lead: Oguzhan Sireci Task Contributors: To be identified	On track	Suggest ~ 20 days devoted to this task as recommendation 11 contains a number of activities.
3.2		Wind Profiling Radar Survey Complete the outstanding actions associated with the Wind Profiler Questionnaire including results analysis. See Breakout report for details	April 2014	Task Lead: Dominique Ruffieux Task Contributors: Tom Szyzborski, Yusuke Kajiwara	On track	Suggest 30 days is allocated to this task.
3.3		Validation of 'Vol A' metadata Details of task to become clear once proposals for migration of Vol A to new framework completed.	2015?	Task Lead and Contributor: Still to be identified.	Not started	Needs close liaison with IPET-OSDE.
4.	Meeting User Requirements In collaboration with IPET-OSDE, assess the contribution of current and planned SBO systems to meeting user requirements for all Application Areas [ToR d]	Provide reports to IPET-OSDE on the suitability of each observing system in meeting each Application areas requirement Current task list includes:	Ongoing	Co-ordination Lead still to be to be identified Task Leads to be identified once details of tasks become more clear.		30 days provisionally allocated, activity not discussed in detail at ET-SBO-1. Will be followed up in remainder of 2013.

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
		Details to be obtained from IPET-OSDE (ET-EGOS-7) activity list and email correspondence between Chair ET-SBO and Etienne Charpentier.		Contributors to be identified once details of tasks become more clear.		
5.	<u>Delivering the EGOS-IP</u> Facilitate the delivery of those EGOS-IP actions identified as priorities for OPAG-IOS [ToR E]	Undertake Radar Data Exchange Workshop and ensure follow up actions triggered. Review EGOS-IP and proposed priority actions for consideration to ICT-IOS. Undertake agreed follow up actions		Co-ordination Lead: Li Wei	On track	150 days provisionally allocated.
5.1		Next steps with Weather Radar Data Exchange Action G48 WxR Data Exchange Task Team – details of ToR and workplan for TT to be found in final report in annex III pages 6 to 12.	March 2014 & March 2016 & beyond.	Task Lead: Daniel Michelson Task Contributors: Jeong-Hee KIM , others to be confirmed by email	On track	Approximately 50 days of effort to be devoted to this task.
5.2		Identify EGOS-IP Actions for ET-SBO Analyse existing EGOS-IP actions using methodology defined by ET-SBO-1 Breakout Group 6 and recommend actions to be supported by ET-SBO to ET Members.	November 2013	Task Lead: Li Wei Task Contributors: Jean-Luc Cheze & Tom Szybnorski	On track	Approximately 10 days in total should be assigned to this task.

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
5.3		Further activity to follow, based on recommendations from above, could be tasks in this section or other sections depending upon the EGOS-IP actions identified.	After December 2013	Task Leads: to be agreed Task Contributors: to be agreed		~100 days of resource available for the delivery of further actions.
6.	Promoting Best Practice Monitor the status of operational networks of SBO systems, promote best practice among WMO Members and provide advice on operational matters [ToR F]	Establish an improved source for technical advice documents "SBO Portal" as part of the WIGOS Information Resource. Populate Portal with national best practice documents. Respond to requests for advice from members	2014 for Portal then ongoing for other actions	Co-ordination lead: Henry Karanja as Vice Chair SBO All members will support this activity.		100 days of effort provisionally allocated.
6.1		Quality Management Review Document all the currently operational quality monitoring centres for WMO / CBS / GOS surface-based observations exchanged globally together with their analysis methods and reports. Note very strong link to WIGOS QM activities.	March 2014	Task Lead: Henry Karanja Task Contributors: Edmundo Lucas, Islam Ameen	On track	Significant task requiring ~20 days of effort in total. See output from Breakout Group #5 for more details.
6.2		Best Practice Portal Create a observing networks operations best practice portal, described and linked from the WIGOS Information Resource (WIR) under Operations & Maintenance topic.	November 2014	Task Lead: Edmundo Lucas	On Track	Suggested 10 days are associated with this task.

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
6.3		Quality Monitoring Portal Specify structure, review current best practice and implement a QM portal within the WIR	November 2014	Task Lead: to be identified	On Track	Suggested 10 days are associated with this task.
7.	<u>Purposeful Horizon Scanning</u> Assess the potential contribution of new and emerging SBO technologies in meeting the Vision for the GOS in 2025, in collaboration with CIMO [ToR G]	Report on the suitability of new and emerging technologies for operational network implementation. Propose updates to the Vision for the GOS. Ensure close collaboration with relevant CIMO ETs & other working groups.	2014, 2015, 2016	Co-ordination Lead: Richard Ice with all members of ET acting as contributors.	On Track	40 days provisionally allocated, needs to be reviewed in light of other changes but much of this effort is 'in kind' rather than core effort as members of ET may be traveling to technical conferences anyway.
7.1		CIMO Teams identified where close co-ordination and review of their meeting reports is required: <i>CIMO OPAG-S&I ET-A2 New In-situ Technologies;</i> <i>CIMO OPAG-RSNT ET-B1 Operational Remote Sensing;</i> <i>CIMO OPAG-RSNT ET-B2 New Technology and Test Beds;</i>	Sept 2013 End of 2013 Already met	Task leads: to be identified.	On Track On Track Missed opportunity	Report from each meeting is ~2 days of effort
7.2		<i>In addition a review of papers submitted to major scientific and technical conferences, such as:</i> <i>AMS2014, EMS, ERAD, ISTP, others to be added.</i>	Dates tbc	Task leads: to be identified.	On track	Report from each meeting is ~2 days of effort.

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
7.3		Produce Annual Report for ET-SBO members. Annual report is a synthesis of likely future operational observing systems and their potential in meeting stated requirements.	March 2014, March 2015, / March 2016	Task Lead: Richard Ice	On track	Annual report is ~2 days of effort per year.
8.	Reporting Progress to ICT-IOS Provide advice and support to the Chairperson of OPAG-IOS on the implementation of the WIGOS framework and its operational aspects [ToR H]	Deliver progress reports and recommendations for changes to operating practices, technical documents and guidance to ICT-IOS during inter-sessional period.	2014 and 2016	Task Lead: Chair ET-SBO	On track	Chair 20 days in total ~20 days in total from all ET members
8.1		Generate report of work for ICT-IOS-8. Requires input from all ET Members.	April 2014 (tbc)	Chair ET-SBO with review of report by all members.	On track	Chair 5 days ET members 0.5 days each
8.2		Attend ICT-IOS-8, report progress with work plan activities and provide feedback to ET Members	May 2014 (tbc)	Chair ET-SBO	On track	Chair 5 days
8.3		Generate report of work for ICT-IOS-9. Requires input from all ET Members.	April 2016 (tbc)	Chair ET-SBO with review of report by all members.	On track	Chair 5 days ET members 0.5 days each

No.	Task	Deliverable/Activity	Due	Responsible	Status	Comment
8.4		Attend ICT-IOS-8, report progress with work plan activities and provide feedback to ET Members	May 2016 (tbc)	Chair ET-SBO	On track	Chair 5 days