

Geneva, Switzerland, 9-12 July, 2013

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

(Submitted by the Chair and the Secretariat)

SUMMARY AND PURPOSE OF DOCUMENT

To provide the Session with a summary of the proceedings, outcomes and recommendations of the workshop.

ACTION PROPOSED

The Session is invited to review and consider the information contained and the recommendations made in the document.

Annexes

1. Recommendations of the Workshop
2. Proposed Terms of Reference for a WMO CBS task Team on Weather Radar Data Exchange

References

3. Final Report of the Workshop on Regional & Global Exchange of Weather Radar Data
http://www.wmo.int/pages/prog/www/CBS-Reports/documents/Final_Report_Workshop_Radar_Data_Exchange_Exeter_April_2013.pdf
 4. Document Plan for the Workshop on Regional & Global Exchange of Weather Radar Data
http://www.wmo.int/pages/prog/www/OSY/Meetings/ET-SBO_Workshop_Radar_Data_Ex/Doc_Plan.html
-

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

1. Background on the Workshop

The Workshop on Regional & Global Exchange of Weather Radar Data was held over 24-26 April 2012 at the Rougemont hotel, Exeter, UK and was chaired by the Chair of ET-SBO, Mr Stuart Goldstraw. There were 18 participants from around the world representing WMO Regional Associations, radar operators, data users and data exchange experts and the list of participants is provided as an annex to the Final Report of the Workshop.

The aims and objectives for the workshop had been approved by ICT-IOS-7 in July 2012 and CBS-XV in September 2012. However the challenge was substantial as: the user community has varied and evolving requirements; the operating communities have a wide range of technological, political and financial challenges and there are already numerous successful bi-lateral and multi-lateral exchange agreements already in place. Understanding the current situation in terms of requirements, exchange agreements and constraints is an issue in itself. But this will be necessary in order for the next step actions that will be developed to be appropriate.

The three key drivers for holding the workshop were:

1) Action G48 of the CBS Implementation Plan for Evolution of the GOS:

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.

Who: CBS (leading the action), CIMO, CHy in coordination with NMSs/NMHSs, agencies operating weather radars, in collaboration with RAs.

Time-frame: Continuous.

Performance indicator: Volume of radar data which are exchanged globally and regionally.

2) A lack of guidance within the Manual on the GOS in relation to requirements and practices for operation of weather radar systems and, in particular, the international exchange of weather radar data. Whilst WMO members have invested between one & two billion US dollars in the current operational weather radar networks globally less than 150 words are currently included in WMO No.544.

3) Evidence presented at the most recent (May 2012) and previous WMO Workshops on Impacts of Various Observing Systems on NWP, for example: "The results of recent impact studies provide strong support for exchange of more observations between regions, and between countries within regions: e.g. ground-based GPS data, radar data, hourly surface observations and MODE-S data at airports". [Final Report of the Fifth WMO Workshop on the Impact of Various Observing Systems on Numerical Weather Prediction, Page 5]

2. Summary of the Workshop

[This section is largely based on the abstract submitted to AMS 26th Conference on Radar Meteorology, Michelson et al.]

The workshop considered current and future requirements of weather radar data by reviewing the requirements of WMO Applications Areas currently documented within the WMO Observing Systems capabilities Analysis and Review Tool (OSCAR) and also by specifically requesting the input of regional and global NWP and the hydrological and climate communities on their current and likely future requirements for weather radar data. NWP requirements and current uses of radar were found to be varied, for example, ECMWF's model assimilates US composite precipitation rate products, while Météo France assimilates polar reflectivities from the French network in the AROME model.

The climate and hydrological communities emphasised the importance of facilitating archival of and access to data outside real-time frameworks. Overall, it was made clear that meteorological data users and application areas would derive significant benefit from a wider and internationally standardized approach to radar data exchange and data management and availability.

The workshop reviewed the current status of regional and global data exchange activities relating to weather radar systems and networks, including an (incomplete) assessment of the relative maturity and successfulness of existing exchange mechanisms. Data exchange, mostly of higher-order radar data products is already occurring in most WMO Regions (and in some place between Regions) using a wide range of file formats. Polar radar data are exchanged only in a few places – most notably, within the network of European national meteorological services (EUMETNET) community. Data and products are exchanged both passively and actively using a range of different techniques.

The review of the current data exchange models in operation (both of radar and other observing systems) highlighted the challenges, the strengths, the weaknesses and their respective suitability for wider adoption as potential international solutions and standards. The participants also undertook a review and analysis of the regional perspective of the constraints and barriers to increased weather radar data exchange including both the technical and political elements and, in response, determined opportunities that may exist to overcome these barriers. Willingness and agreement to exchange radar-based information is mostly regulated through bilateral agreements, although multilateral exchange agreements also exist.

An important outcome of the Workshop was the recommendation that a Task Team should be formed within CBS to have the responsibility for coordination, development and finalization of agreed and approved standards for the international exchange of weather radar data. The task team would take into consideration the great progress achieved by EUMETNET in harmonizing operationally, real-time exchanged weather radar data under its Operational Programme for the Exchange of Weather Radar Information (OPERA), recognizing the advanced status and success of the data exchange model and mechanisms already established under that program.

The workshop also considered existing and identified possible new pilot projects or studies that might be supported by WMO and its Members as a way of promoting, furthering and improving international and regional exchange of weather radar data.

3. Recommendations from the Workshop

The recommendations made at the workshop are provided as Annex I to this document.

Recommendations of the Workshop

No.	Report Section	Recommendation	Responsibility	Action
1	2.1	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.
2	2.2	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.
3	2.4	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: <ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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.
4	2.4	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

No.	Report Section	Recommendation	Responsibility	Action
5	3.1.2	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.
6	3.1.2	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.
7	3.1.2	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.
8	3.1.2	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.
9	3.1.6	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.
10	3.1.6	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.

No.	Report Section	Recommendation	Responsibility	Action
11	3.2	<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.
12	3.3	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
13	4.1	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.
14	4.2	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

No.	Report Section	Recommendation	Responsibility	Action
15	5.4	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 .
16	5.4	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.
17	5.4	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.
18	7.1	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.
19	7.1	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.

No.	Report Section	Recommendation	Responsibility	Action
20	7.1	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 Regions 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	Chair ET-SBO to consider incorporation of the coordination and initialisation 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.

Annex II

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

1. Gather requirements for information (data, metadata and products) from weather radars to be exchanged globally on a regular basis.
2. Develop a data model based on the requirements and, if feasible, harmonized with the existing and future development of METCE.
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 NWP and climate activities.
7. Using ODIM_BUFR as a basis, develop, review and coordinate approval of required BUFR sequences for global exchange of radar data on the GTS.
8. Elaborate compliance between ODIM_H5 and netCDF CF Conventions, especially regarding GIS compatibility.