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WORKSHOP ON RADAR DATA EXCHANGE

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CONSTRAINTS TO INCREASED WEATHER RADAR DATA EXCHANGE

Options for overcoming the constraints as presented in item 3.1 docs

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SUMMARY AND PURPOSE OF DOCUMENT

To identify ways and means to overcome the constraints and issues associated with the exchange of weather radar data.

ACTION PROPOSED

Workshop participants are invited to note the information contained in the document.

WRDE Barriers and Way Forward

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V2

Introduction

This document is a strawman document and is created based on general knowledge and from the results of the Region IV survey. This document should be updated after review of other surveys and discussions at the WRDE workshop.

Barriers

The barriers to Regional or Global basis can be listed in a rough prioritized order and include:

- Basic knowledge of radar
- Telecommunication Capacity
- Product vs Raw Data Requirements and Priorities
- Technical Capacity
- Intellectual Property

Basic Knowledge of Weather Radar

In the survey of Region IV, only 14 of 25 NHMS' could be positively identified as having weather radars. However, radars are expensive (capital cost), require a high level of technical expertise to support and maintain (O&M and skill force) which preclude procurement or operations. Capital procurement is less of an issue as it seems that donors (such as European Commission or other donors) can be found. Ongoing support, sparring, ability to diagnose and replace parts and calibrate are challenges for all and these costs outweigh the initial capital procurement costs.

Radars require a high level of technical knowledge, skill to use in forecasting. Many NHMS' do not have the service requirements for short-fuse applications nor therefore the "seat of the pants" service culture for the provision of heavy rain/flash floods, landslides, strong winds and hail. This is the heart of the U.S. and Canadian requirements. However, the use in the surveillance or tracking of hurricanes and tropical or synoptic storms is prevalent in all NHMS'.

One limitation to the efficient and effective use of weather radar is the lack of training for forecasters but also technical staff. Even in a country such as Canada, many

forecasters complain about the lack of knowledge of the use of the Doppler capability of radar even 10 years after installation, let alone the latest and more complex dual-polarization feature. EUMETCAL surveys have revealed that even when technical and basic knowledge of Doppler is known, its application in weather forecasting is a gap. Dual-polarization is just being introduced in the latest EUMETCAL course.

Technical support is always in short supply. There are very few independent technical training opportunities except that provided by commercial vendors. The Turkish meteorological service has provided technical training with the support of WMO. Highly competent technical experts have often been "home grown" and takes 5+ years or more.

Caribbean Radar Network project, the radars were installed but the planned training program was cut. One response indicated that all aspects of post-installation support is lacking and is needed.

Without the knowledge of the value of weather radar nor the ability to maintain and use it, there will be no stated requirement for weather radar data exchange for forecast or NWP applications. *"One doesn't know what one doesn't know."*

Telecommunication Capacity

It is not totally clear about the telecommunication capacity between NHMS'. This has been a stated limitation in Africa but it is not clear as to the situation globally. In one of the survey responses, telecommunications was mentioned as the main limitation in Region IV.

In Panama, radar products in compact BUFR format are posted on a internet site for others to retrieve. In this model, not all products need to be retrieved, to preclude the need for wide bandwidth.

In other responses, the GTS was used as the "pipe" used to exchange data. This is available to all NHMS but the bandwidth topology is not known by the author. A review of the GTS topology would probably indicate that this telecommunication mechanism would be sufficient.

Exchange Requirements

Raw data exchange is not prevalent. While the impetus is for regional or global data assimilation, knowledge of the requirements for this application would be useful. What specifically is needed to be exchanged: (i) low level reflectivity images, products or data

(can be reprojected at optimal resolution), (ii) raw unprocessed or processed data, (iii) frequency of data.

Data quality will be a major issue. It is not quite clear who will do the radar data quality corrections and adjustments, calibration responsibilities and metadata.

"What should be exchanged, what quality, what metadata"

Technical Capacity

The key to exchange will be the "radar data model". That is, what is needed to properly describe the data and all its variants, as well as the metadata to keep track of changes in the raw data processing for downstream analysis and use in applications.

The format is probably the least important aspect of this. It matters little whether it is BUFR, netCDF, HDF5. What really matters is consistency in terminology, parameter names, and implementation or encoding concepts. For example, the same radar data model for a "volume scan" could be implemented as a single data element (a 3D volume) or as a sequence of data elements (a collection of 2D elements). Is it precipitation rate or "accumulation over a hour" in inches/millimeters etc.

Each NHMS has its own organizational structure and the responsibility for radar data exchange will be different in each organization. Internal priorities may delay the data exchange but should not be a long term barrier as long as there is a consistent and long-term vision.

If there are requirements to convert data to a "common format", this can pose an additional delay as conversion applications need to be added to the processing chain and many organizations do not have the capacity to make or implement the changes in a timely matter. Depending on the tools available, if conversion routines need to be developed by the NHMS even according to a "standard". There will be inevitable bugs. A mitigation strategy would be to develop a library of converters (easier said than done).

Manufacturers could provide "common formats". But radars are implemented every 15 or more years and obsolete and unsupported hardware and software plus the time to change radars would make this a very long process. It may take this long to implement anyway and it may not be the limiting factor.

However, the exchange of radar data in "native" format is probably the safest, the most expedient and desirable solution. Regional radar data processing centers (or NWP centers) could convert them if they want and implement the data quality processing for each radar type, environment and system.

Intellectual Property/Ownership

The greatest barrier may be the IP issue and role and responsibility issue.

The radar data may not belong to the NHMS for sharing. It may belong to another agency such as aviation, hydro-electric or other authority.

There may not be a open data sharing policy for a variety of issues.

Some NHMS' may not want to release data that might be potentially embarrassing or challenged.

This may not be a solvable problem.

The Way Forward

Barrier	Way Forward
Vision of what data to exchange. Is it products, data, sweeps, volume scans?	<ul style="list-style-type: none"> • It is any “raw” polar coordinate volume scans of various data quality to be exchanged. Not products that can not be mosaiced. (Note that sweeps etc may be acceptable but complicates the vision. It is up to the end-use to be aware.) • Adopt an adequate radar data model with QC metadata. This is not quite clear what is achievable and needed.
Vision of exchange mechanism	<p>It can be pulled by a regional centre or global centre using internet.</p> <ul style="list-style-type: none"> • It can be pushed to a region and a global data centre using internet or GTS.
Intellectual Property	<ul style="list-style-type: none"> • Co-opt the NHMS by offering to fund the capital cost of the radars (see Carribean Radar Network project) and make data exchange one of the criteria. • Publicize the mutual benefits of exchange. That is, regional mosaics will be available; better forecasts will result with DA. • Otherwise ignore.
Technical Capacity	<ul style="list-style-type: none"> • Training is needed at various levels (management, forecaster, software) to understand why exchange is needed. • All manufacturers can produce

	<p>volume scans with various QC applied.</p> <ul style="list-style-type: none"> • State a format for manufacturers to include as exchange option. • Exchange in native format if common exchange format is not available. • Minimize technical development by storing data on a local ftp site (password protected) for others to pick up. • Have software capacity at regional or global centre to convert to common format if required. • Regional or global QC software (must handle various stages of the QC problem), mosaicing software, archival and retrieval capability for WMO members.
<p>Ownership and Data Format</p>	<ul style="list-style-type: none"> • Need to define and need to be able to modify as improvements are available. • Need WMO ownership • Need technical responsive global maintenance to prevent multiple flavors from developing. Need experts for rapid decision making (vs years, vs committees) • Use "open" native formats if data format IP and support issues can not be resolved (IMHO, the biggest problem)