EVALUATION OF WMO-CBS WIND PROFILER SURVEY

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Contents

1. Introduction

1.1. History[1]

Radar wind profilers (WPR) are Doppler radars designed for measuring the vertical profile of the wind vector in the lowest 5 - 20 km of the atmosphere (depending on the operating frequency), on timescales ranging from seconds to hours. WPR are also able to provide additional information about the atmospheric state through the profiles of backscattered signal intensity and frequency spread (spectral width) of the echo signal.

After the first successful demonstration of clear-air wind measurements by Woodman and Guillen (1974) the potential capabilities of this technique for meteorological applications became suddenly apparent (Larsen and Röttger (1982)) and dedicated meteorological profiler systems were suggested (Hogg et.al. (1983)). Not long after that, a small experimental wind profiler network in Colorado (Strauch et.al. (1984)) was established.

A brief historical overview of wind-profiling radars is given by van Zandt (2000). The first truly operational network, called the Wind Profiler Demonstration Network (WPDN), was completed in May 1992. Later it became known as the NOAA National Profiler Network (Weber et.al. (1990), Barth et.al. (1994)). While the first systems used mostly operating frequencies in the VHF or lower UHF range, higher frequency (so-called boundary layer) profilers were also developed and later commercialized by a technology transfer to the private sector, see Ecklund et.al. (1988) and Carter et.al. (1995).

WPR's are widely used in operational meteorology and atmospheric research. Major meteorological field experiments make regular use of WPR, e.g. METCRAX (Whiteman et al. (2008)), T-REX (Grubisic et.al. (2008)), NAME (Higgins et.al. (2006)), IHOP (Weckwerth et.al. (2004)), BAMEX (Davis et.al. (2004)), CASES (Poulos et.al. (2002)) or MCETEX (Keenan et.al. (2000)).

In a more operational setting, WPR measurements have been used either directly in subjective weather forecasting and case studies (Dunn (1986), Kitzmiller and McGovern (1990), Beckman (1990), Edwards et.al. (2002), Crook and Sun (2004), Bond et.al. (2006), Wagner et.al. (2008)), or automated in data assimilation for

[1] This summary is extracted from the COST Action ES0702 EG-CLIMET – Final Report, 2013 (http://cfa.aquila.infn.it/wiki.eg-climet.org/index.php5/Radar_wind_profiler). References cited in text above can be found in this report.

numerical weather prediction (Smith and Benjamin (1993), Bouttier (2001), Andersson and Garcia-Mendez (2002), Benjamin et.al. (2004), St.James and Laroche (2005), and Ishihara et.al. (2006)).

Their particular advantages are a high temporal resolution and the capability to provide unambiguous profiles independently of the used assimilation system. Furthermore, measurements can be made under almost all weather conditions.

Due to the potential of WPR's to provide high-resolution observations, they are especially well suited to describe the atmospheric state at the mesoscale (Browning (1989), Park and Zupanski (2003), Browning (2005)) where the current observation coverage is still quite incomplete in space, time and also state variables of the models, see e.g.Carbone et.al. (2009). It is very unlikely, that the models can always generate the correct mesoscale atmospheric state without proper initial data. The current experience with high-resolution models has shown that even a 12-24 hour deterministic prediction of some intense convective precipitation systems can drastically fail. For example, Gallus et.al. (2005) reported an intense derecho event accompanied by a well-organized band of heavy rainfall that they were not able to simulate although a range of different models, different parameterizations and initial conditions were used.

While both the numerical models and the global observation system are constantly evolving, impact studies are regularly performed to assess the usefulness of WPR and other observations in various NWP models. This task is quite challenging and the results depend on the number of observations available, their quality, the error specification and also on the particular meteorological situation. For example, Amstrup (2008) used DMI-HIRLAM to assess the impact of various terrestrial observing systems in 2005. While it was found that the impact from the very few wind profilers used is generally negligible, there was also a case identified where the assimilation of only three WPR in Alaska showed a very positive impact in an extreme weather situation near the Faeroe islands. Experiences gained with a high resolution (COSMO-2 model, grid spacing 2.2 km) by MeteoSwiss indicate that WPR data are especially beneficial for short range forecasts at smaller scales. It was found that the assimilation of three ground based remote sensing stations (equipped with a 1290 MHz low tropospheric wind profiler and microwave radiometer) substantially improved the quality of COSMO-2 forecasts (Calpini et.al. (2011)).

A Survey on wind profilers has been conducted by WMO to determine the current status of implementation of operational WPR systems. Several reasons justified the establishment of this survey, including:

- developing a comprehensive web-based database of WPR network metadata and planning information,
- assisting in determining the potential for wider international exchange of WPR data,
- gathering WPR information that might be utilized in determining requirements for access to and protection of radio-frequency spectrum allocation, and
- identifying and sharing common issues/problems and potential solutions gathered within the questionnaire.

This report provides a brief analysis of the response of WMO Members to the CBS Expert Team on Surface Based Observations (ET-SBO) survey on wind profiler radars.

The survey, which was sent to WMO Members on 3 December 2013, is provided as Appendix 1 to this document.

1.2. Overview of the questionnaire and spread sheet

The questionnaire consists of two parts: a general questionnaire and a series of questions related to specific metadata related to radar wind profilers. The questionnaire follows the organization illustrated in Figure 1.

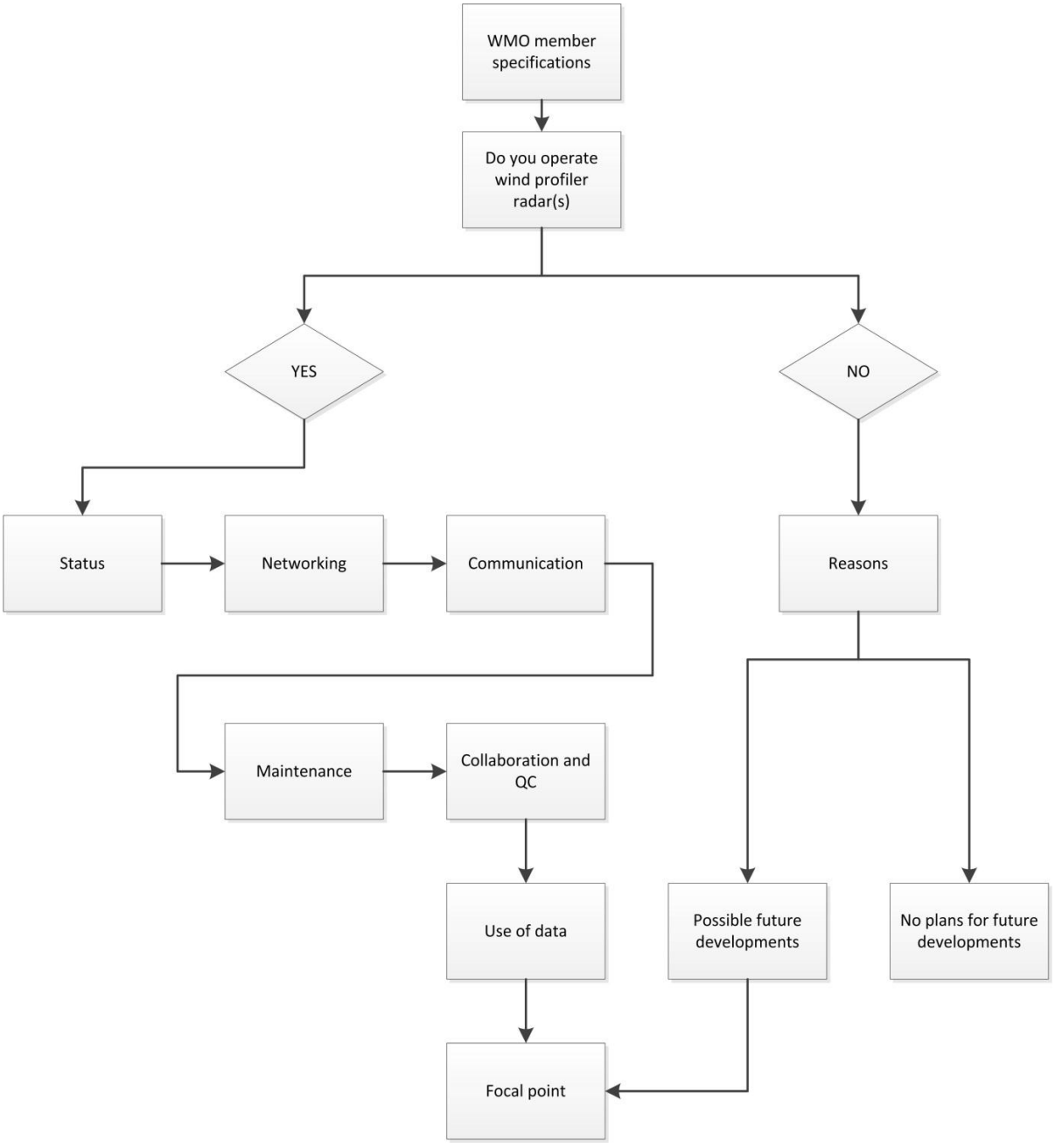


Figure 1. Organization of the questionnaire on wind profilers and related chapters.

The second component of the survey involved a request for those Members that have operational WPR networks to provide the metadata for these systems within an Excel spreadsheet. At the time of the compilation of this report, only two metadata sets had been returned to WMO. Therefore, an analysis of this information is not provided within this report.

The survey questions and the metadata template used in the survey are provided in Appendices 1 and 2 respectively.

2. Distribution and responses

The WEB-based questionnaire was accessible via an online survey application implemented by the WMO and based on the questionnaire developed by ET-SBO. A formal letter (3 December 2013[2]) encouraged the WMO Members to complete the survey by 15 January 2014. Out of 185 WMO Members, 46 answered (~25%). The list of countries which provided an answer can be found in Table 1.

Argentina	Australia	Bahrain
Belize	Benin	Canada
Chile	China	Cook Islands
Cyprus	Denmark	Ecuador
Gabon	Guatemala	Hungary
Iceland	Indonesia	Iran
Ireland	Israel	Japan
Kenya	Macao China	Mali
Mauritius	Monaco	Mongolia
Netherlands	Pakistan	Peru
Guinea Conakry	Republic of Korea	Republic Dominica
Serbia	Singapore	Slovak Republic
Spain	Sweden	Switzerland
Tanzania	Tunisia	Ukraine
United Kingdom	Uzbekistan	Venezuela

Table 1. List of Countries having answered the questionnaire.

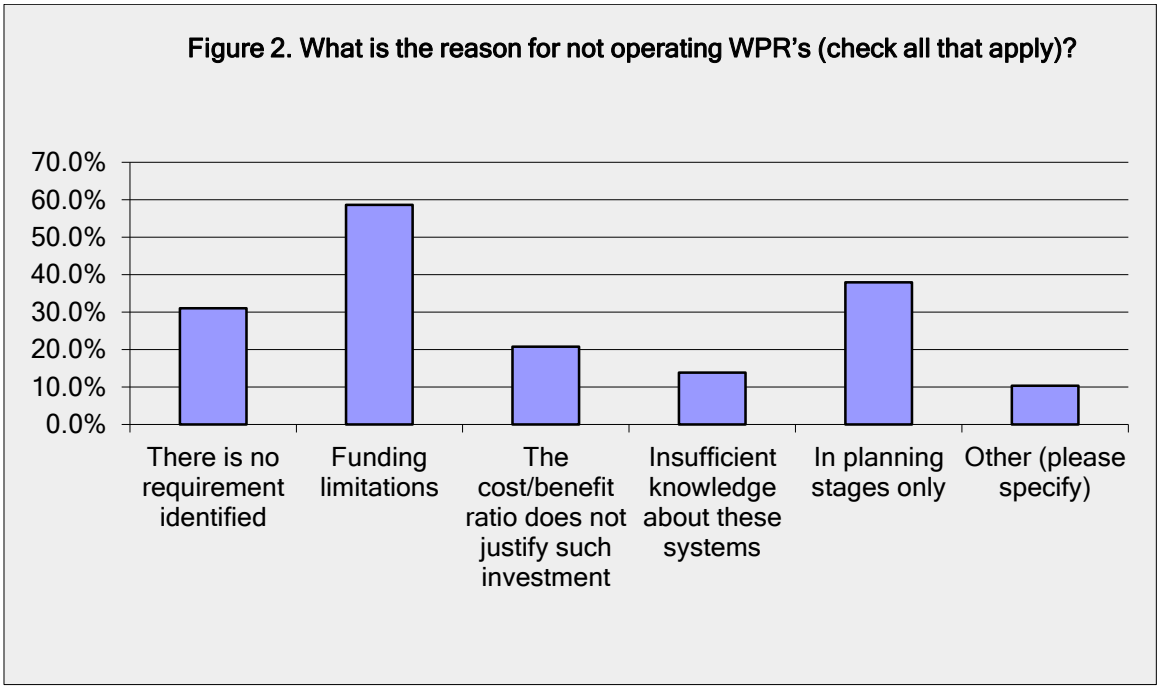
The systematic analysis of all questions can be found in Appendix 3. The evaluation in Chapter 3 consists of a selection of questions considered of higher interest accompanied by a short comment.

[2] WMO E-correpondence copy in English : https://www.wmo.int/edistrib_exped/index.php?dir=grp_prs%2F_en%2F2013%2F2013_12%2F&download=2013-12-03-PR-6731-OBS-OSD-WPR-Questionnaire_en.pdf

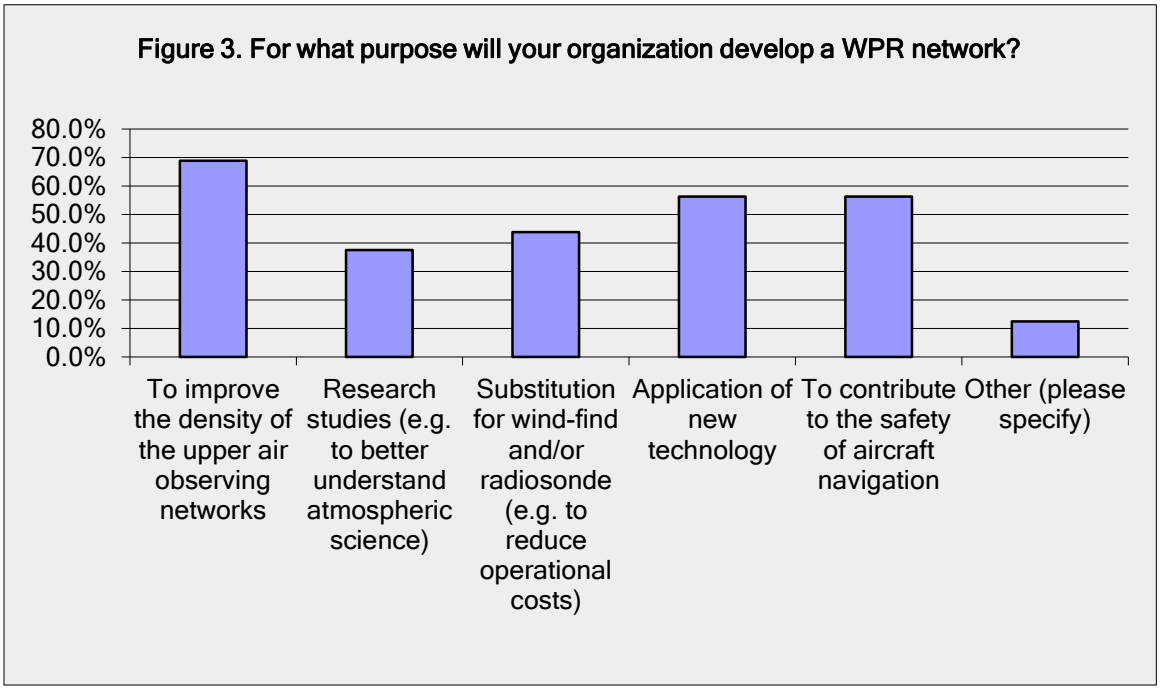
3. Evaluation of questionnaire replies

3.1. Countries not operating WPR's

Out of the 46 Members who answered, 37% are operating at least one WPR. For the 63% remaining Members, financial constraints remain the main reason for not operating such systems (Figure 2).



From the 63% who are not operating such a system, 55% are planning to use WPR's (31% within 2 years, 44% within 5 years, and 25% within 10 years). The purposes for developing a WPR network is shown in Figure 3. They are diverse with a slight majority for an improvement of the density of upper-air observing networks.



3.2. Countries operating WPR's

3.2.1 Status and networking

Seventeen Members who answered the questionnaire are operating one or more WPR'S (Table 2).

Country	Number of wind profilers
Australia	10
China	42
South Korea	10
Hungary	2
Indonesia	2
Iceland	2
Ireland	2
Japan	33
The Netherlands	1
Pakistan	1
Republica Dominica	1
Singapore	1
Spain	1
Switzerland	4
Tunisia	1
United Kingdom	6
Uzbekistan	3
Total	122

Table 2. List of countries operating wind profiler radars

The majority of these systems are stable and operational (63%) with some still in expansion or modernization. The Members operate WPR's mainly to improve the density of the upper air observing network and to contribute to the safety of aircraft navigation (Figure 4). It was noted that the purposes for possible future

developments (Figure 3) correspond very well with those identified as the purpose for implementing the currently operational networks.

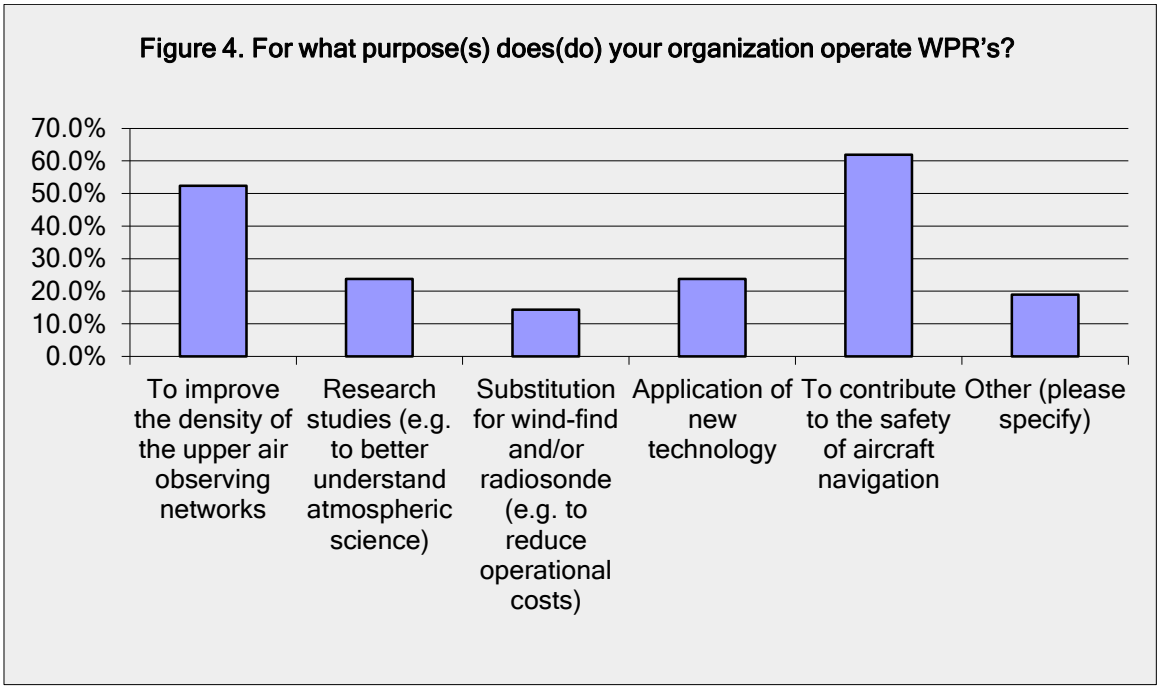


Figure 4. For what purpose(s) does(do) your organization operate WPR's?

To support the installation of WPR's, the Members obtain support mainly from Manufacturers and Consulting companies, and thirdly, from other National Meteorological Hydrological Services (NMHS's). Two thirds of the systems installed within a network are fixed systems.

Additionally, 58% of organizations have plans to install additional WPR systems. The main reasons for an extension are shown in Figure 5.

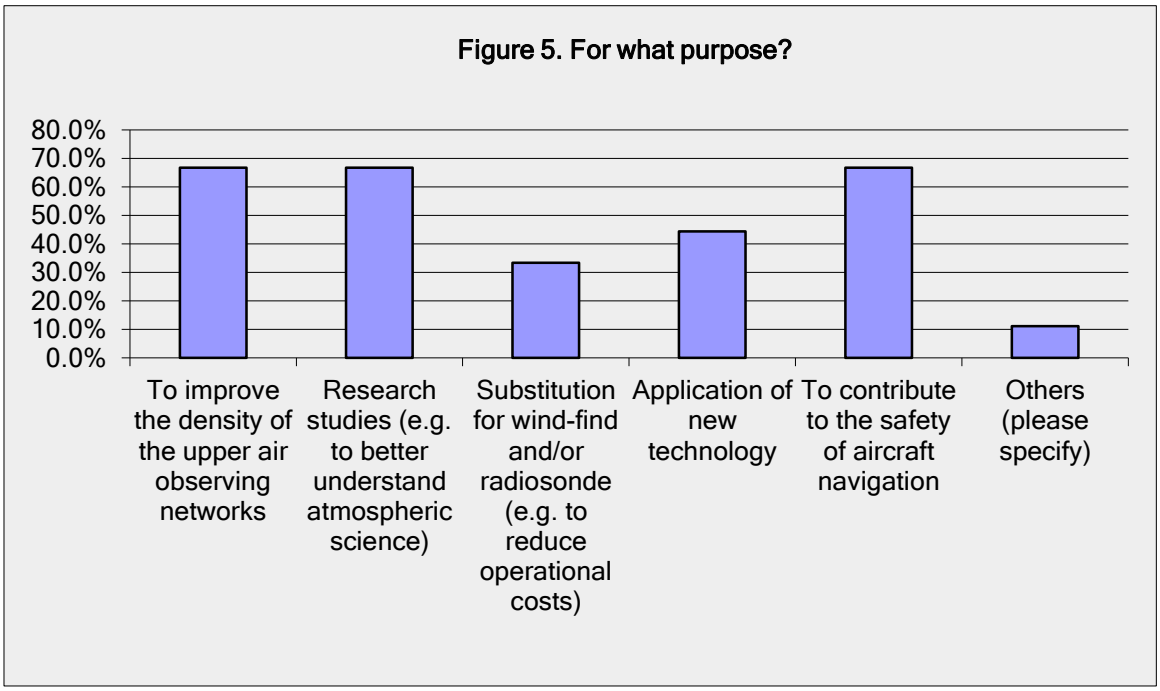


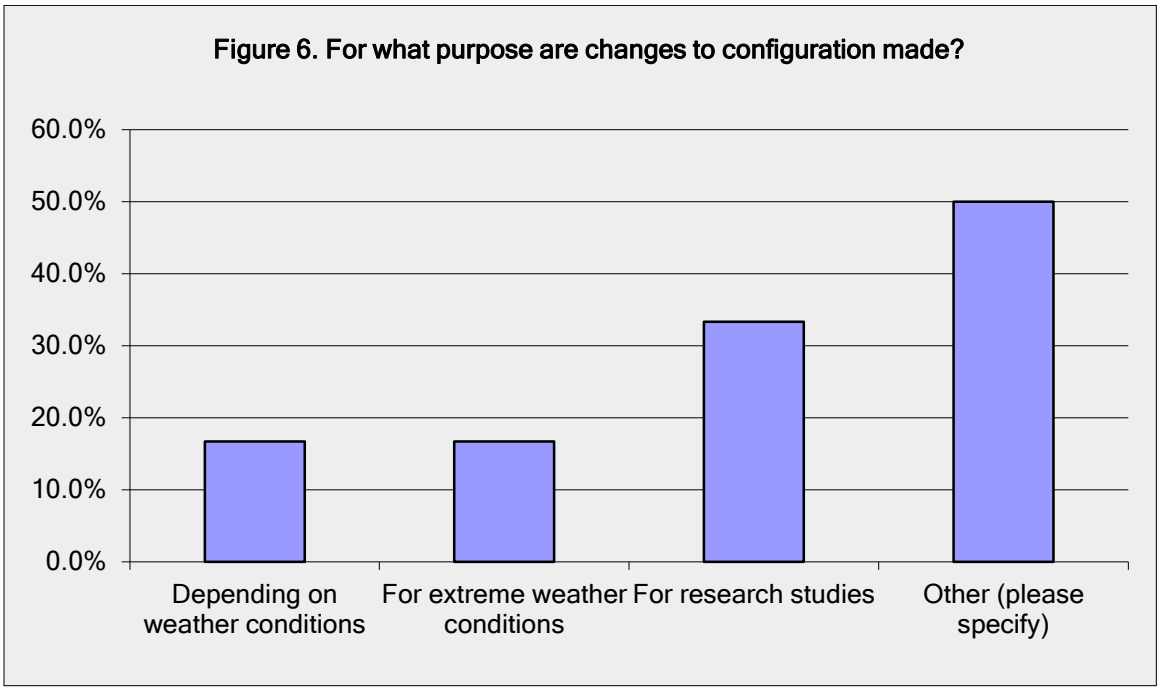
Figure 5. For what purpose?

A minority of WPR national networks are part of a larger parent network (32%), with online information available (26%). Twenty-six percent of systems additionally deploy a RASS option for temperature profiling.

3.2.2. Communication and maintenance

Real-time access to the data is available to almost 80% of the systems deployed by NMHS's, mainly via terrestrial leased or dial-up lines (75%). A backup solution for data transfer is available in 44% of the cases.

A minority of NMHS's (26%) operate their system(s) with the capability of changing the system configuration in response to the situations or conditions shown in Figure 6.



Maintenance is a critical aspect of a good WPR operation. All NMHS's maintain their systems, either via the manufacturer (40%), via a maintenance contract (20%), or else maintenance is carried out in-house (40%). The maintenance frequency varies from twice annually (32%) to annually (21%), or is undertaken on a variable basis (21%). Few estimates of the annual maintenance cost were provided and averaged $13'000 per installation.

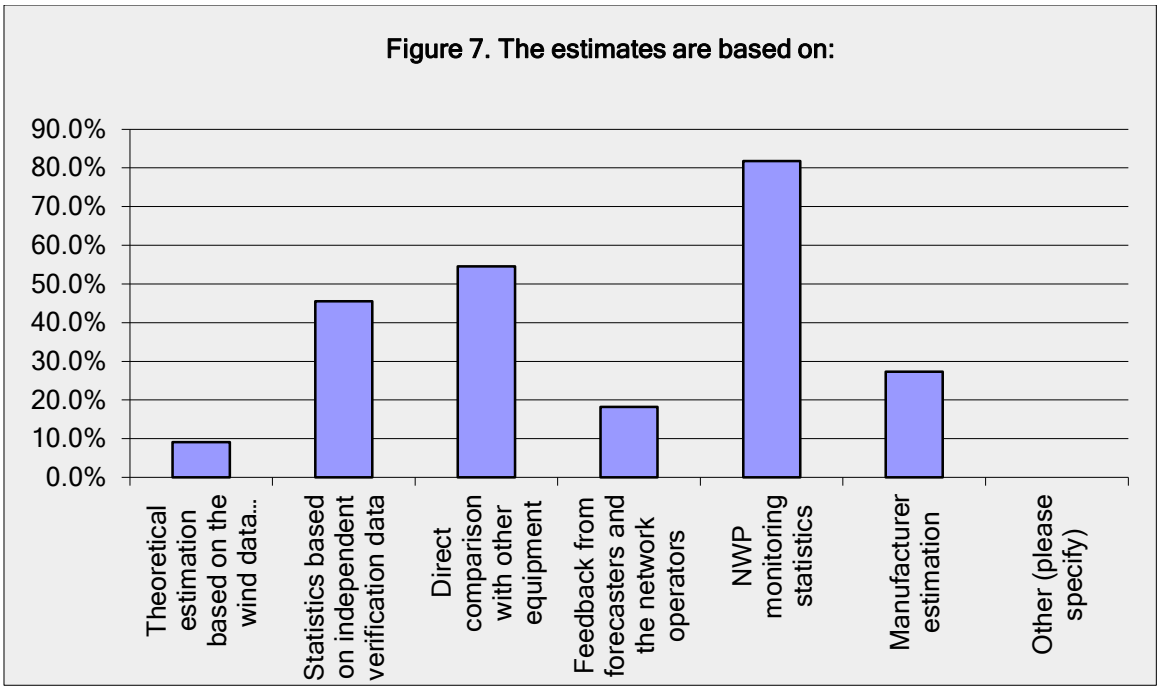
About half (42%) of the NMHS's are collaborating with other countries or manufacturers for training. The main recommendations for operation and training are:

- adequate choice of site,
- regular training of technical staff, and
- good definition of procedures (at the technical and scientific quality control levels).

Routine verification of the quality is made by 50% of the Members operating WPR's. The two main ways of doing it are:

- comparison with radio-soundings, and
- comparison with an analysis from a NWP model.

The estimate of the quality of the radars is performed by 56% of owners, based on various inputs (Figure 7).

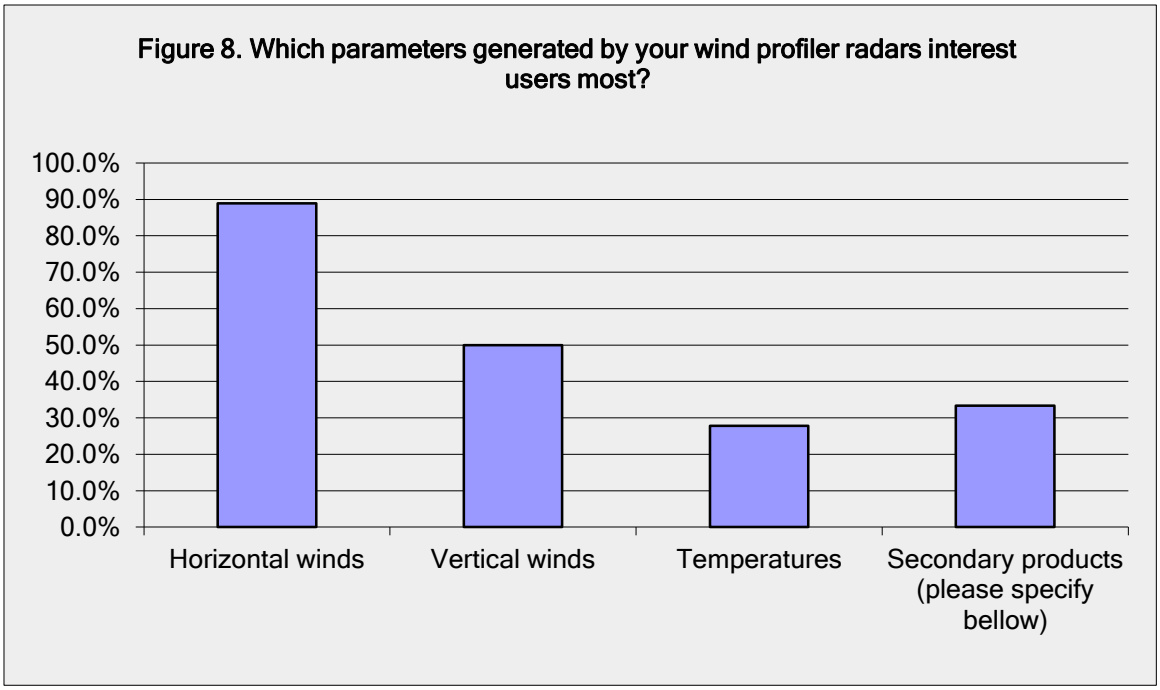


3.2.3. Use of data

Out of the 46 Members (including 37% operating at least one WPR), 40% do not make any use of WPR's data, while 20% would like to have access to these data, and the rest (40%) are using them on a regular basis. The data dissemination to users is based on the BUFR format (56%), Ascii text (25%), or HDF (6%) mainly via collaborative/cooperative agreement free of charge or under conditional free service (87%). The selections of interesting parameters generated by WPR's are shown in Figure 8. Among secondary products, the following are mentioned:

- melting level,
- cloud base/top,
- signal-to-noise ratio, and
- planetary boundary layer.

Metadata are available to users for 28% of the cases, not available for 50%, and will be made available shortly (within 2 years) in 22% of the cases. It was noted that 22% of NMHS's are aware of other institutions operating WPR's, mainly within research institutes and universities.



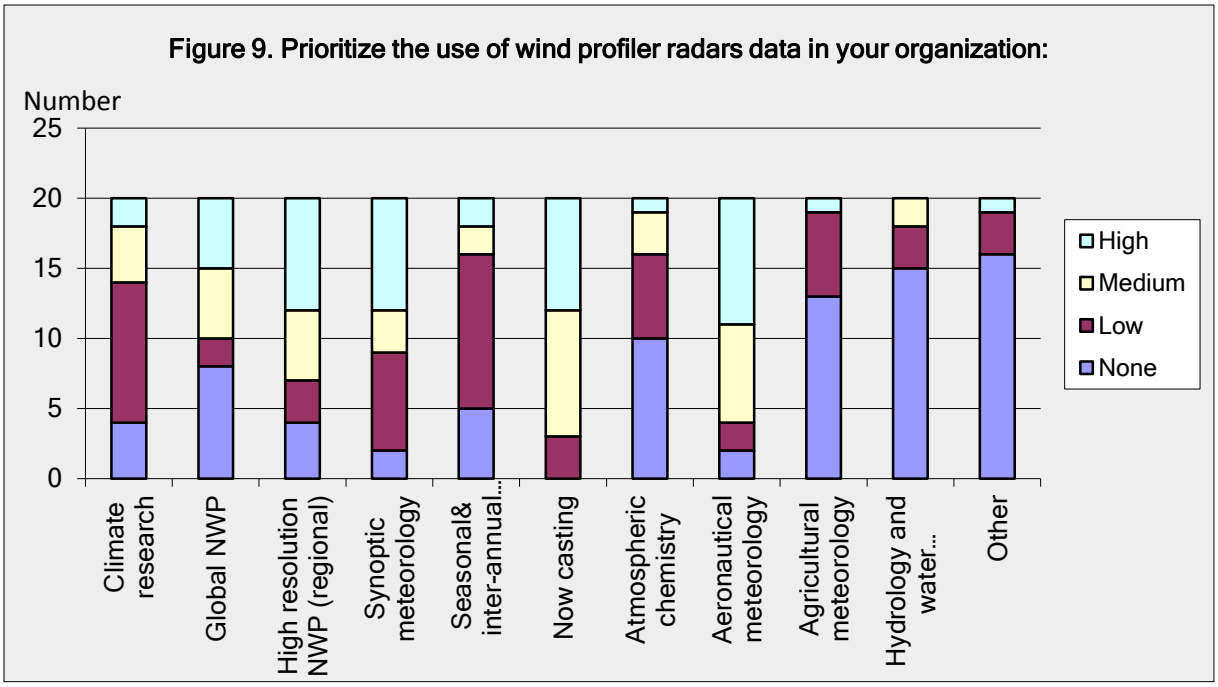
The use of WPR data by data users was prioritized for several meteorological and climatological applications (Figure 9). The applications areas indicating the highest usage were:

- NWP modelling,
- synoptic meteorology,
- now-casting, and
- aeronautical meteorology.

In contrast, the interest was least among the following application areas:

- atmospheric chemistry,
- agricultural meteorology, and
- hydrology/water resources.

The WPR data are used in combination with other information (like satellite, weather radar, ..) 60% of the time.



The main uses of WPR's data with other instruments and data:

- NWP assimilation and verification,
- combination with satellite information,
- combination with ground-based remote sensing systems (radar, microwave radiometers, ceilometers, weather radars) for various applications like weather forecast, PBL determination,.. and
- combination with in-situ systems (radiosondes, surface stations).

3.2.4. Focal point and comments

Fifteen Members (36%) provided the contact details for a person to act as a focal point with a further 52% of respondents willing to nominate a focal point on WPR's at a later time subject to approval.

Finally, the answers to the question on providing additional information relating to this survey that they think might provide clarification or be useful are shown in Table 3.

Canada	We have occasionally used WPR for time-limited research projects. We have no operational systems at this time. However, we will be considering cost-effective technologies over the next 5 to 10 years.
Kenya	We have serious challenges with low level wind shear at our busiest International Airport (Jomo Kenyatta Int. Airport) but we do not have any observational tool. Wind Profiler would be a good observational tool but we are funded from National Treasury which makes it difficult to acquire this system from the national budget.
Indonesia	We had three sites of WPR systems located at Makassar (South Sulawesi), Manodo (North Sulawesi), and one will installed in 2014 in Pekambaru Riau, Sumatra. Two of installed WPR systems are not in operation due to technical problem.
Benin	It would be helpful to participate in different seminars to get a clear idea on the use of radar. Also we need to have in our country a radar in the future to correct irrégularities level forecasts.
Iran	We would appreciate to have a feedback about the results of the survey.
Republica Dominica	De nuestra parte vemos saludables el intères puesto con esta iniciativa, ya que estamos falta de mas conocimiento y entrenamientos y experiencia con relatión experiencia con relation at tema. Agradecamos sobre maneras el tomarnos en cuenta como país para este tipo de encuesta. Y confirmamos que estaremos en la major disposición de seguir colaborando en lo que esteanuestro alcance.
United Kingdom	Aberystwyth MST radar is operated by NERC and the University of Aberystwyth, with the Met Office as a contracted customer.
West Africa	As my country doesn't have any WPR system, I would like for WMO to make sure to provide us some WPR system. And also organized the training for WPR metadatabase system like how to use data from WPR system and how to maintain the Equipment itself.
The Netherlands	The KNMI windprofiler has been purchased 20 years ago. It is unclear what the decision on continuation will be if replacement of broken parts will involve substancial costs.
Cook Islands	Can a cost/benefit analysis be made on the WP and the Upper Air Sounding to see if it is worth to support those that does Upper Air Sounding.

Table 3. Additional information relating to this survey provided by Members.

4. Summary

The answers of the survey included 122 WPR's operated mainly by NMH's. These systems are mainly concentrated in Europe, Far-East (Japan, China, South Korea), North America (Canada), and Australia. Note that several countries (USA, Germany, ..) operating WPR's did not answer the questionnaire.

In general, WPR's operators are running their systems in an operational modus, the first user being the NWP community, but also the synoptic meteorological, the now-casting as well as the aeronautical communities.

Several Members are willing to go into this technology, but this wish is often limited by financial constraints.

Finally, the analysis of the metadata questionnaire will be undertaken if a sufficient number of answers will be returned. Then it will constitute the basis of a metadata database for WPR's.

Appendix 1: Survey specimen
Appendix 2: Survey Metadata specimen
Appendix 3: Systematic analysis of the questionnaire

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Introduction

This survey has been compiled by the WMO CBS Expert Team on Surface-Based Observations (ET-SBO).

Please note the following about the survey:

1) Only one survey for each WMO Member should be completed.
2) The survey can be done once only on one computer.
3) Entered responses are automatically saved but can be changed by using the "back" button as long as the survey has not been fully completed.
4) As long as the survey has not been fully completed, returning to the survey on the same computer will return to the point at which the survey was left, with all completed responses intact.
4) Once completed, the survey cannot be revised or edited.
5) You response will not be submitted and received by WMO until you have answered all questions and proceeded to the end of the survey.

The purpose of the survey is to determine the current status of WMO Member use of wind profiler radar systems and also any plans for future use. The survey also requests information on the use of wind profiler radar data within your organization.

Please note that wind profiler system refers to both stationary and mobile surface-based measurement systems that measure horizontal and vertical wind speeds utilising an upward-pointing, pulsed radar transmitter and receiver. This survey does not include horizontal-scanning weather radar or LIDAR systems.

In addition to the questionnaire, ET-SBO is also seeking to develop a metadata database for wind profiler radars, which will be utilised as part of the WMO Observing Systems Capability Analysis and Review (OSCAR) Tool to assist Members in network planning and design. With this in mind, Members are requested to nominate a WMO Focal Point on Wind Profiler Radar Systems, who can provide this metadata.

If you have any questions or require clarification please contact:

Dean Lockett
Email: dlockett@wmo.int
Phone: 41 (0) 227308323

WMO thanks you for completing this survey on behalf of your organization.

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WMO Member Information

***1. Country:**

***2. Which organization within the Country / Territory is this response from?**

- ◯ National Meteorological or Hydrological Service
- ◯ Other

***3. Institute/organization:**

***4. Details of contact person providing the response:**

Name:	
Address 1:	
Address 2:	
City/Town:	
State/Province:	
ZIP/Postal Code:	
Country:	
Email Address:	
Phone Number:	

***5. Position of contact person in organization**

***6. Date of response:**

	DD	MM	YYYY
Date:		/ /	

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Wind Profiler Radar Systems Status

***7. Does your organization or, another organization on your behalf, operate wind profiler radar (WPR) systems?**

- ◯ Yes
- ◯ No

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Non-operation of WPR Reasons

***8. What is the reason for not operating WPR's (check all that apply)?**

- [ ] There is no requirement identified
- [ ] Insufficient knowledge about these systems
- [ ] Funding limitations
- [ ] In planning stages only
- [ ] The cost/benefit ratio does not justify such investment
- [ ] Other (please specify)

***9. Do you plan to operate wind profiler radars (WPR's) in the future?**

- ◯ Yes
- ◯ No

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Wind Profiler Radar Future

***10. In what time frame do you anticipate utilizing WPR's ?**

- ◯ This year
- ◯ Next 5 years
- ◯ Next 2 years
- ◯ Next 10 years

***11. For what purpose will your organization develop a WPR network?**

- ☐ To improve the density of the upper air observing networks
- ☐ Application of new technology
- ☐ Research studies (e.g. to better understand atmospheric science)
- ☐ To contribute to the safety of aircraft navigation
- ☐ Substitution for wind-find and/or radiosonde (e.g. to reduce operational costs)
- ☐ Other (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Status

*12. What is the current status of your WPR network:

- ◯ Systems installed for research or trial only
- ◯ Systems installed but not yet operational
- ◯ Stable and being maintained
- ◯ Operational and still developing and expanding
- ◯ Operational but undergoing modernisation or significant change
- ◯ Operational but being reduced
- ◯ Operational but being phased out
- ◯ Other (please specify)

*13. For what purpose(s) does(do) your organization operate WPR's?

- ☐ To improve the density of the upper air observing networks
- ☐ Application of new technology
- ☐ Research studies (e.g. to better understand atmospheric science)
- ☐ To contribute to the safety of aircraft navigation
- ☐ Substitution for wind-find and/or radiosonde (e.g. to reduce operational costs)
- ☐ Other (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Development

***14. To support the introduction of wind profiler radars your organization obtained support from:**

	Contract	Memorandum of Understanding	Partnership	Agreement	Other	None
Manufacturers	◯	◯	◯	◯	◯	◯
Consulting companies	◯	◯	◯	◯	◯	◯
Research institutes	◯	◯	◯	◯	◯	◯
Other NMHSs	◯	◯	◯	◯	◯	◯
Other	◯	◯	◯	◯	◯	◯

Other (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Sites

*15. How many WPR's have been installed in your network?

Number Fixed	
Number Mobile	

Please provide the following information for each major type of wind profiler in your organization's WPR network [note that this(these) WPR network(s) should be only those operated by your organization or by another organization on your organization's behalf¨]:

*16. WPR Network 1

Organization Operator	
Profiler Manufacturer	
Profiler Type	
Operating Frequency	
Wind Measurement Method	
Number Installed	

17. WPR Network 2

Organization Operator	
Profiler Manufacturer	
Profiler Type	
Operating Frequency	
Wind Measurement Method	
Number Installed	

18. WPR Network 3

Organization Operator	
Profiler Manufacturer	
Profiler Type	
Operating Frequency	
Wind Measurement Method	
Number Installed	

19. WPR Network 4

Organization Operator	
Profiler Manufacturer	
Profiler Type	
Operating Frequency	
Wind Measurement Method	
Number Installed	

20. WPR Network 5

Organization Operator	
Profiler Manufacturer	
Profiler Type	
Operating Frequency	
Wind Measurement Method	
Number Installed	

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Sites

***21. What were your main criteria for the site selection of WPR's?**

- [ ] Infrastructure
- [ ] Critical weather for events
- [ ] Gap in upper air network
- [ ] Use on mobile platforms (WPR mobile)
- [ ] Customer specific requirement
- [ ] Frequency allocation constraints
- [ ] Other (please specify)

***22. Does your organization have any plan to install additional WPR systems?**

- ◯ Yes
- ◯ No

Other (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Purpose of Additional Installations

*23. For what purpose?

- [ ] To improve the density of the upper air observing networks
- [ ] Application of new technology
- [ ] Research studies (e.g. to better understand atmospheric science)
- [ ] To contribute to the safety of aircraft navigation
- [ ] Substitution for wind-find and/or radiosonde (e.g. to reduce operational costs)
- [ ] Others (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network

***24. Are your WPR's part of a larger national or regional network?**

- ◯ No
- ◯ Yes

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Parent Network

*25. Name of the network and how many WPR's?

Name of the wider network:

Total number of WPRs in the wider network:

*26. Does online information exist for the wider WPR network?

- ◯ No
- ◯ Yes

If Yes, please specify the URL

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Online Site

***27. Does online information exist for your WPR network?**

- ◯ No
- ◯ Yes

If Yes, please specify the URL

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR System & Network Configuration

***28. Does one or more of the WPR systems measure temperature through RASS?**

- ◯ No
- ◯ Yes

If yes, how many?

***29. Are there any components of the WPR operating systems which are not provided by the manufacturer?**

- ◯ No
- ◯ Yes

If Yes, what are the components and what is their function? (1 component on each line)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Connectivity

***30. Does your organization have real time (permanent network connection) access to wind profiler radar outputs?**

- ◯ No
- ◯ Yes

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Connectivity Details

***31. The communication type for real time data transmission between wind profiler radars and operating centres are:**

- [ ] Satellite
- [ ] Terrestrial line (Leased line/Dial-up)
- [ ] Mobile phone (GSM, CDMA)
- [ ] Radio link
- [ ] Other (please specify)

***32. Are there any back-up communication methods in operation?**

- ◯ No
- ◯ Yes

If Yes, what method?

Network Operation & Maintenance

***33. Does your organization make changes in the WPR measurement configuration for a specific purpose?**

- ◯ No
- ◯ Yes

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Network Reconfiguration Details

***34. For what purpose are changes to configuration made?**

- [ ] Depending on weather conditions
- [ ] For extreme weather conditions
- [ ] For research studies
- [ ] Other (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Network Operation & Maintenance

***35. How are the WPR's maintained?**

- ◯ Not maintained
- ◯ Equipment manufacturer
- ◯ Maintained by the operating organization
- ◯ Maintenance contract (local company)
- ◯ Other (please specify)

***36. What is the frequency of Preventive Maintenance for the main components of the wind profiler radar systems?**

- ◯ Twice annually
- ◯ Annual
- ◯ 2 years
- ◯ More than 2 years
- ◯ Variable
- ◯ Other (please specify)

37. What are the main problems faced by your WPR engineers during operations and what are the respective methods employed in solving those problems? (e.g. vandalism, lightning, mechanical or electronics issues, communication, etc.)

Most frequent problem

2nd most frequent problem

3rd most frequent problem

***38. Do you have an estimation of the annual maintenance cost (amount spent on preventive and corrective maintenance)?**

- ◯ No
- ◯ Yes

If Yes, please provide an estimate of annual costs per WPR system.

***39. Do you collaborate with other countries or manufacturers for training?**

- ◯ No
- ◯ Yes

If Yes, with whom?

40. What types of training have been carried out for operating wind profiler radars?

Type of training 1	
Type of training 2	
Type of training 3	

41. Do you have any recommendations about operation of wind profiler radar or about training?

Recommendation 1	
Recommendation 2	
Recommendation 3	

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Data Quality

***42. Do you carry out any verification on your wind profiler radar data?**

- ◯ No
- ◯ Yes

If Yes, please specify how the verification is carried out and how frequently it is carried out

***43. Do you have any estimate of the quality of your WPR data?**

- ◯ No
- ◯ Yes

WPR Data Quality Estimation

44. The estimates are based on:

- [ ] Theoretical estimation based on the wind data themselves
- [ ] Statistics based on independent verification data
- [ ] Direct comparison with other equipment
- [ ] Feedback from forecasters and the network operators
- [ ] NWP monitoring statistics
- [ ] Manufacturer estimation
- [ ] Other (please specify)

Data Quality

***45. Would you agree to provide the WMO with any results (or references) of studies related to WPR performance?**

- ◯ None available
- ◯ No
- ◯ Yes

Exchange of WPR Data

***46. Does your organization exchange/disseminate WPR data with other organizations?**

- ◯ No
- ◯ Occasionally (ad hoc)
- ◯ Routinely (continuous exchange)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Data Exchange Details

*47. Data exchange format

- [ ] BUFR
- [ ] NetCDF
- [ ] HDF
- [ ] Ascii text
- [ ] Other (please specify)

*48. Is data provided via?

- [ ] Cooperative/collaborative agreement
- [ ] Commercial agreement
- [ ] Free service with no restriction
- [ ] Conditional free service
- [ ] Other (please specify)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

WPR Parameters

***49. Which parameters generated by your wind profiler radars interest users most?**

- [ ] Horizontal winds
- [ ] Vertical winds
- [ ] Temperatures
- [ ] Secondary products (please specify bellow)

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Submission of WPR Metadata

*50. Can metadata be submitted for your WPR stations?

- ◯ Yes
- ◯ Yes - but later by a designated Focal Point or someone else
- ◯ No

If later, please provide expected date of submission; If No, please provide a reason for non-submission

Note:

Submitted metadata will be retained by WMO and entered into the WMO Observing Systems Capability Analysis and Review Tool (OSCAR) database for use in the WMO Rolling Review of Requirements process. At a later time, WMO Focal Points for WPR (requested later in this survey) will be requested to routinely maintain these WPR metdata on behalf of their country and organization.

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Instructions for Submission of WPR Metadata

Thank you for agreeing to submit the metadata for your WPR sites.

This metadata will be retained by WMO and entered into the WMO Observing Systems Capability Analysis and Review Tool (OSCAR) database for use in the WMO Rolling Review of Requirements process. At a later time, WMO Focal Points for WPR (requested later in this survey) will be requested to routinely maintain these WPR metdata on behalf of their country and organization.

To submit the metadata, please download and save the Excel spreadsheet at the following location:

ftp://ftp.wmo.int/Documents/www/OPAG-IOS/WPR/WPR_Metadata_Submission.xls

If prompted with a login request by the FTP server, submit:
Username: anonymous
Password: anonymous

Enter the metadata into the worksheet entitled "WPR Metadata" according to the descriptions of required fields provided in the worksheet entitled "Instructions".

Please provide the details of the person providing the metadata within the worksheet entitled "Contact Details".

Please send the completed metadata spreadsheet to Mr Dean Lockett at the WMO Secretariat by email to: dlockett@wmo.int

If you have any issues or questions regarding this process please contact Mr Dean Lockett via the above email address.

It is recommended that you copy and save or write down these Instructions now before proceeding with the survey.

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Other Wind Profiler Radar Operators in your Country

***51. Are you aware of other organizations in your country that operate WPR systems?**

- ◯ No
- ◯ Yes

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Other Wind Profiler Radar Operators in your Country

52. Other WPR Operator Organization 1

Company:

Address 1:

Address 2:

City/Town:

State/Province:

ZIP/Postal Code:

Country:

Email Address:

Phone Number:

53. Number of WPR systems Organization 1

54. Other WPR Operator Organization 2

Company:

Address 1:

Address 2:

City/Town:

State/Province:

ZIP/Postal Code:

Country:

Email Address:

Phone Number:

55. Number of WPR systems Organization 2

56. Other WPR Operator Organization 3

Company:

Address 1:

Address 2:

City/Town:

State/Province:

ZIP/Postal Code:

Country:

Email Address:

Phone Number:

57. Number of WPR systems Organization 3

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Use of Wind Profiler Data

***58. Does your organization make use of WPR data?**

- ◯ No, not at all
- ◯ No, but would like to obtain for use from other sources
- ◯ Yes, from other sources only
- ◯ Yes, from own sources only
- ◯ Yes, from both own and other sources

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

How WPR Data is Provided to Your Organization

***59. Is data provided by?**

- ◯ Public organization
- ◯ Private organization
- ◯ Both

How WPR Data is Used

***60. Prioritize the use of wind profiler radars data in your organization:**

	High	Medium	Low	None
Climate research	◯	◯	◯	◯
Global NWP	◯	◯	◯	◯
High resolution NWP (regional)	◯	◯	◯	◯
Synoptic meteorology	◯	◯	◯	◯
Seasonal& inter-annual monitoring	◯	◯	◯	◯
Now casting	◯	◯	◯	◯
Atmospheric chemistry	◯	◯	◯	◯
Aeronautical meteorology	◯	◯	◯	◯
Agricultural meteorology	◯	◯	◯	◯
Hydrology and water resources	◯	◯	◯	◯
Other	◯	◯	◯	◯

Other use

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

How WPR Data is Used

***61. Do you use WPR data together with other instruments or data sources (satellite, weather radar etc.)?**

- ◯ No
- ◯ Yes

How WPR Data is Used

62. Please describe your use of WPR data with other instruments and data sources:

Use 1	
Use 2	
Use 3	

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Nomination of WMO WPR Focal Point

***63. Are you able to nominate a person that can act as a WMO Focal Point on wind profiler radars for your ororganization?**

- ◯ No
- ◯ Yes
- ◯ At a later time subject to approval

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind

Nomination of WMO WPR Focal Point

***64. Please provide the contact details for the WMO Focal Point on WPR for your organization:**

Name:	
Organization:	
Address 1:	
Address 2:	
City/Town:	
State/Province:	
ZIP/Postal Code:	
Country:	
Email Address:	
Phone Number:	

Any Additional Information

65. Please provide any additional information relating to this survey that you think might provide clarification or be useful.

Thank you.

Appendix 2. Survey Metadata specimen

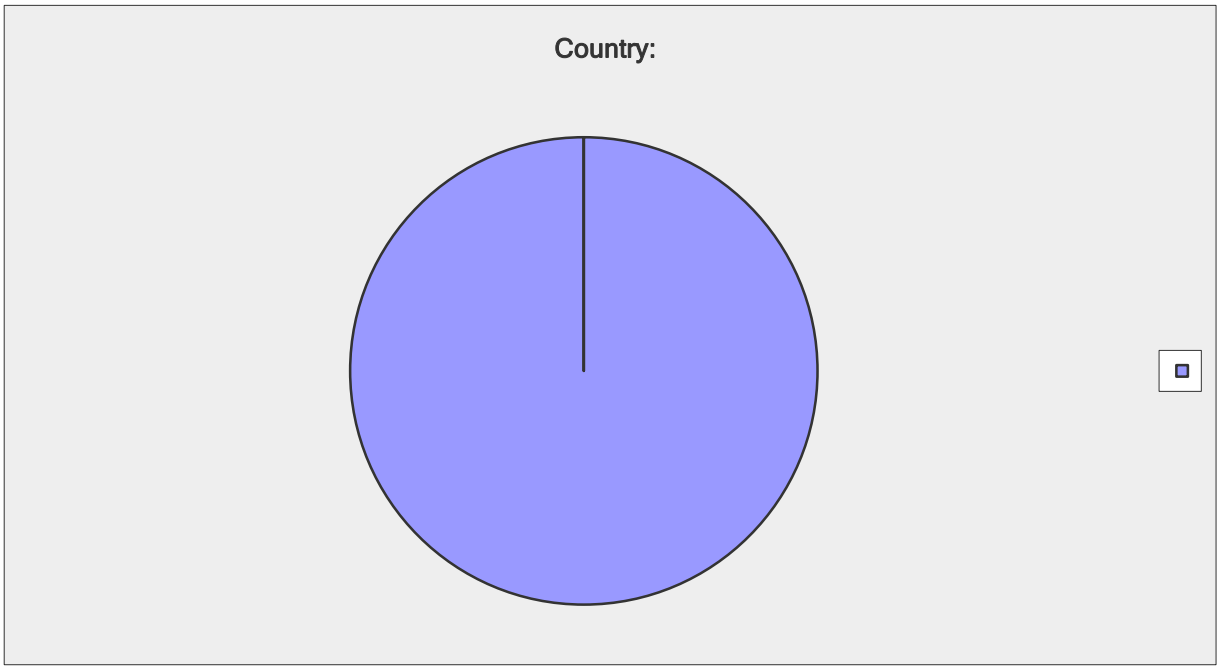
No. or Field	Instructions
1	Enter metadata for one site per speadsheet row
2	Enter the information in each column as per the instructions below
3	Leave entries blank if metadata is not available for fields
4	If required, the spreadsheet contains a conversion from Degrees Minutes Seconds to decimal degrees in columns AW to BD, otherwise, overwrite the formulae in columns F and G with the correct decimal coordinates
Location Name	Name of the site or location of the WPR
Country	The country in which the WPR is located
Organization Owner	The organization that owns the WPR
Organization Station ID	The station number or identifier as designated by the organization owner
WMO Station No.	The WMO number for the site if one has been allocated
Latitude	Decimal latitude (preferred precision of 1 second), -90.0000 to +90.0000, negative indicates southern hemisphere latitude
Longitude	Decimal longitude (preferred precision of 1 second), -180.0000 to 180.0000, negative indicates western hemisphere longitude
Commenced Operation	Date at which the WPR became operational the site - format: d-MMM-YYYY
Site Altitude	Altitude of the WPR site ground above Mean Sea Level (metres)
WPR Altitude	Altitude of zero altitude reference for the WPR above Mean Sea Level (metres)
Manufacturer	Manufacturer of the majority componentry of the WPR
Model	Manufacturer or organization identification name of the Model and/or type of WPR system
Operating Frequency	Radio frequency at which the WPR is operated (MHz)
Transmission Power	WPR transmitting power (in kW)
Receiver Type	Analogue or Digital (select from list)
Antenna Type	Antenna type deployed: CO-CO array, yagi, other (select from list)
Gain	Antenna gain (dB)
Beam Width	Attenna beam width (-3 dB angle)
Elevation Angle	Elevation angle of oblique beams (in degrees from horizontal)
Wind Measurement Method	Operational wind derivation method of the WPR (select from drop-down list)
Integration Time Interval	Operational temporal resolution of the WPR (in minutes)
Number Operating Modes	The number of different pulse modes that are operated in a single vertical wind profile derivation (select from drop down, 1 or 2)
Mode 1 Pulse Length	The pulse width of the WPR for Operating Mode 1 (in nano seconds)
Mode 1 Height Range Minimum	The midpoint of the lowest height range bin attained in Operating Mode 1 (in metres)

Mode 1 Height Range Maximum	The midpoint of the highest height range bin attained in Operating Mode 1 (in metres)
Mode 1 Vertical Resolution	The lowest vertical resolution (bin size) attained in Operating Mode 1 (in metres)
Mode 2 Pulse Length	The pulse width of the WPR for Operating Mode 2 (in nano seconds)
Mode 2 Height Range Minimum	The midpoint of the lowest height range bin attained in Operating Mode 2 (in metres)
Mode 2 Height Range Maximum	The midpoint of the highest height range bin attained in Operating Mode 2 (in metres)
Mode 2 Vertical Resolution	The lowest vertical resolution (bin size) attained in Operating Mode 2 (in metres)
Observation Mode	Mode of operation of the WPR, either continuous or sporadic (select from drop-down list)
RASS Available	Does the system have RASS capability (Y, N)
RASS Active	If the system does have RASS capability, is it routinely activated for operational use (Y, N) - N if use is sporadic
Clutter Fence Deployed	Does the system have a clutter fence deployed (Y, N)
Data on GTS	Is WPR data routinely transmitted on the GTS (Y, N)
GTS Format	If data for the system is routinely transmitted on the GTS, indicate the format that it is transmitted in - BUFR WMO Standard, BUFR Other, Other)
Wind Components	Is this data parameter routinely transmitted on the GTS (Y, N)
Wind Direction	Is this data parameter routinely transmitted on the GTS (Y, N)
Wind Speed	Is this data parameter routinely transmitted on the GTS (Y, N)
Vertical Wind Speed	Is this data parameter routinely transmitted on the GTS (Y, N)
Air Temperature	Is this data parameter routinely transmitted on the GTS (Y, N)
SNR	Is this data parameter routinely transmitted on the GTS (Y, N)
Entry Date	The date on which this metadata record is entered - format: d-MMM-YYYY
Comment	Additional information relevant to the above metadata or the WPR system - separate additional comments by a ';'

Appendix 3. Systematic analysis of the questionnaire

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

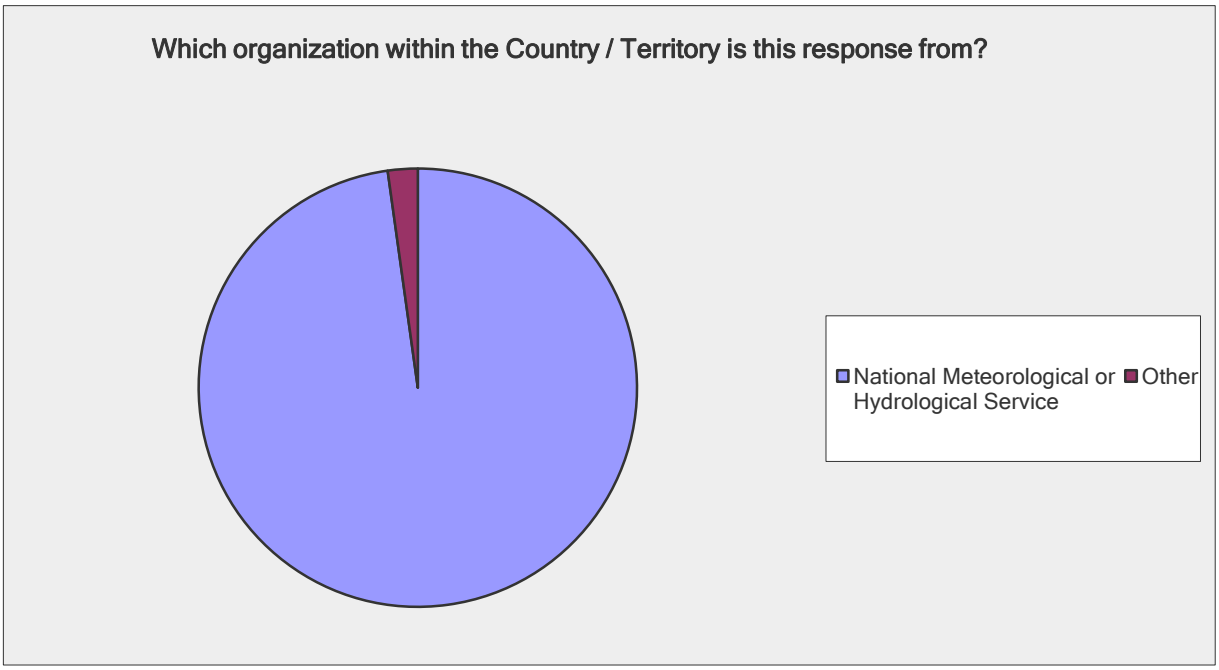
Country:		
Answer Options	Response Percent	Response Count
	100.0%	46
answered question		46
skipped question		0



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Which organization within the Country / Territory is this response from?

Answer Options	Response Percent	Response Count
National Meteorological or Hydrological Service	97.8%	45
Other	2.2%	1
answered question		46
skipped question		0



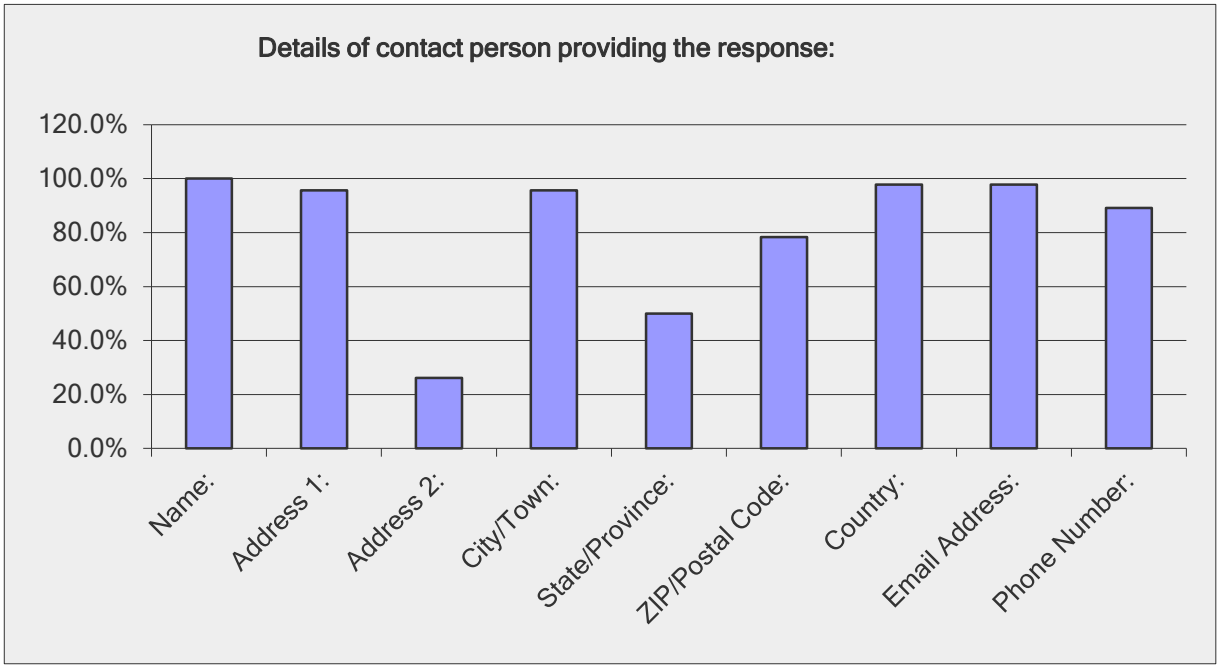
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Institute/organization:	
Answer Options	Response Count
	46
answered question	46
skipped question	0

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Details of contact person providing the response:

Answer Options	Response Percent	Response Count
Name:	100.0%	46
Address 1:	95.7%	44
Address 2:	26.1%	12
City/Town:	95.7%	44
State/Province:	50.0%	23
ZIP/Postal Code:	78.3%	36
Country:	97.8%	45
Email Address:	97.8%	45
Phone Number:	89.1%	41
	answered question	46
	skipped question	0

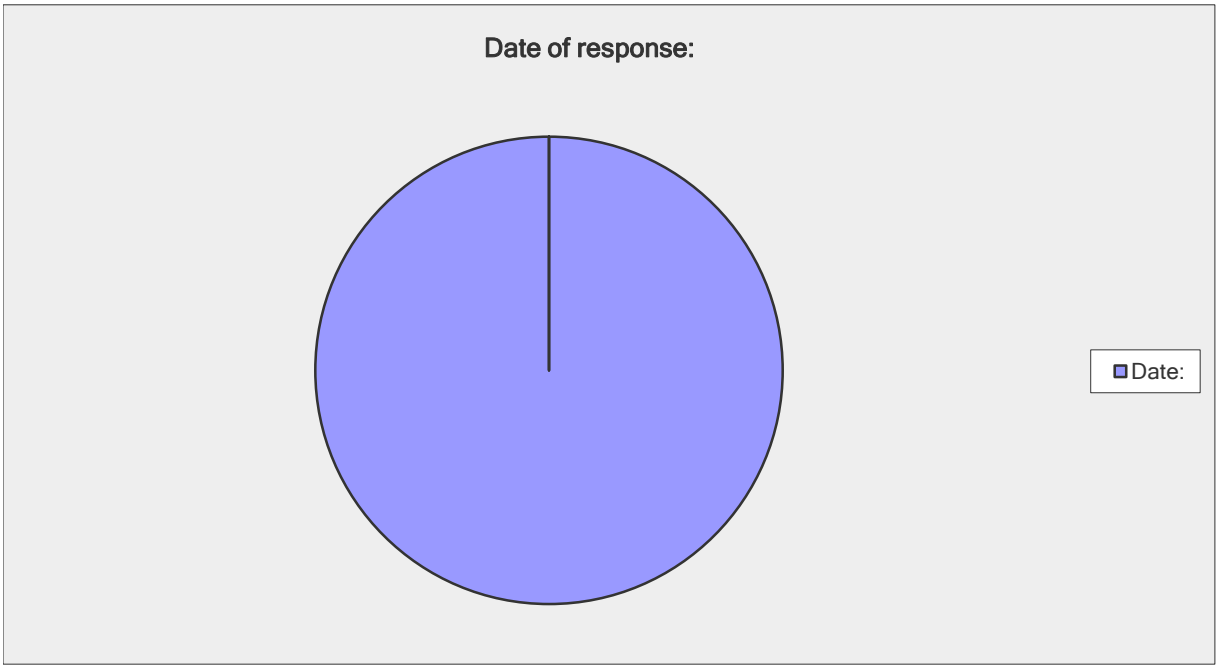


CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Position of contact person in organization	
Answer Options	Response Count
	46
answered question	46
skipped question	0

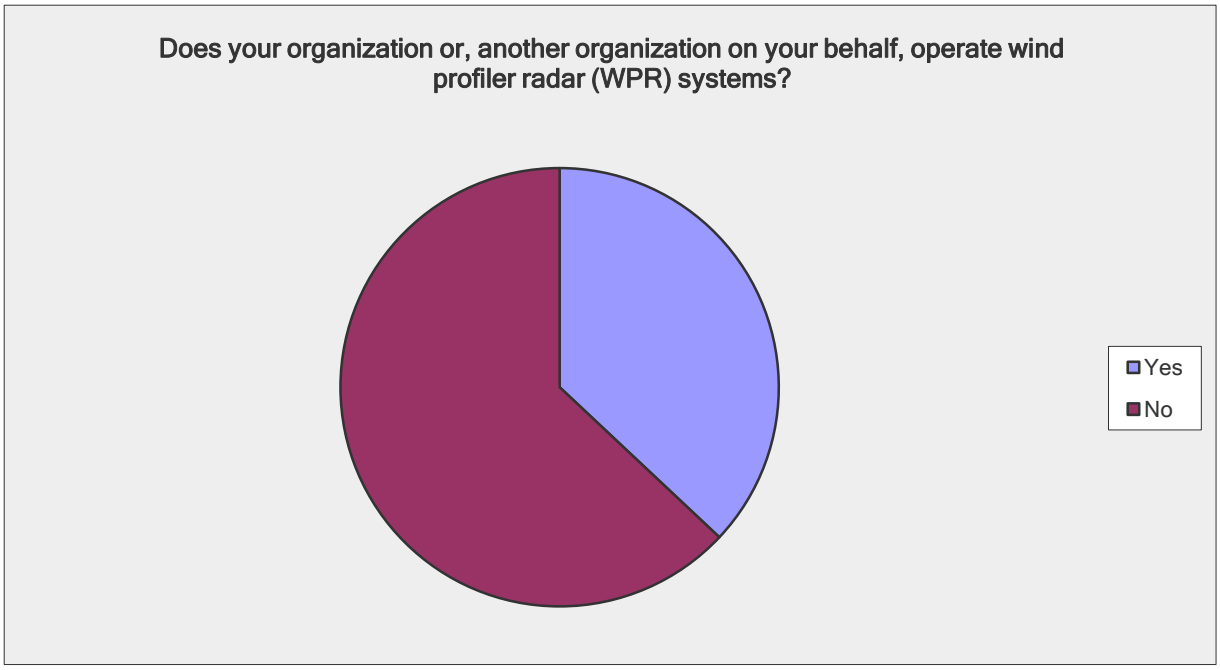
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Date of response:		
Answer Options	**Response Percent**	**Response Count**
Date:	100.0%	46
	answered question	**46**
	skipped question	**0**



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

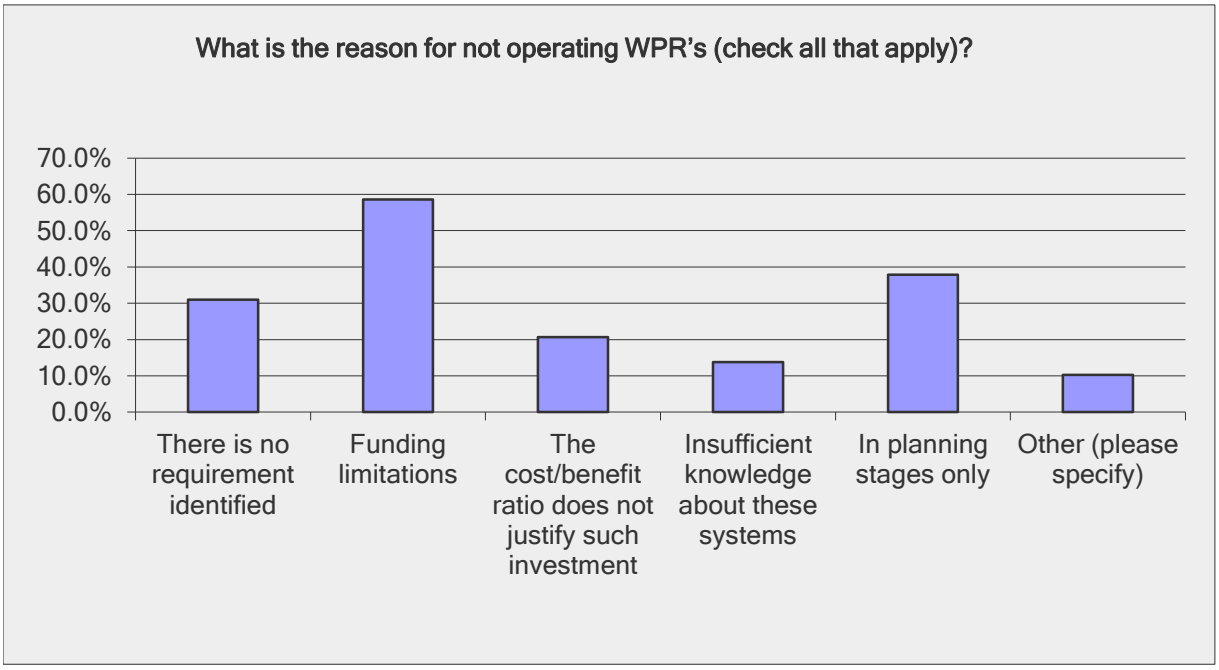
Does your organization or, another organization on your behalf, operate wind profiler radar (WPR) systems?		
Answer Options	**Response Percent**	**Response Count**
Yes	37.0%	17
No	63.0%	29
answered question		46
skipped question		0



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

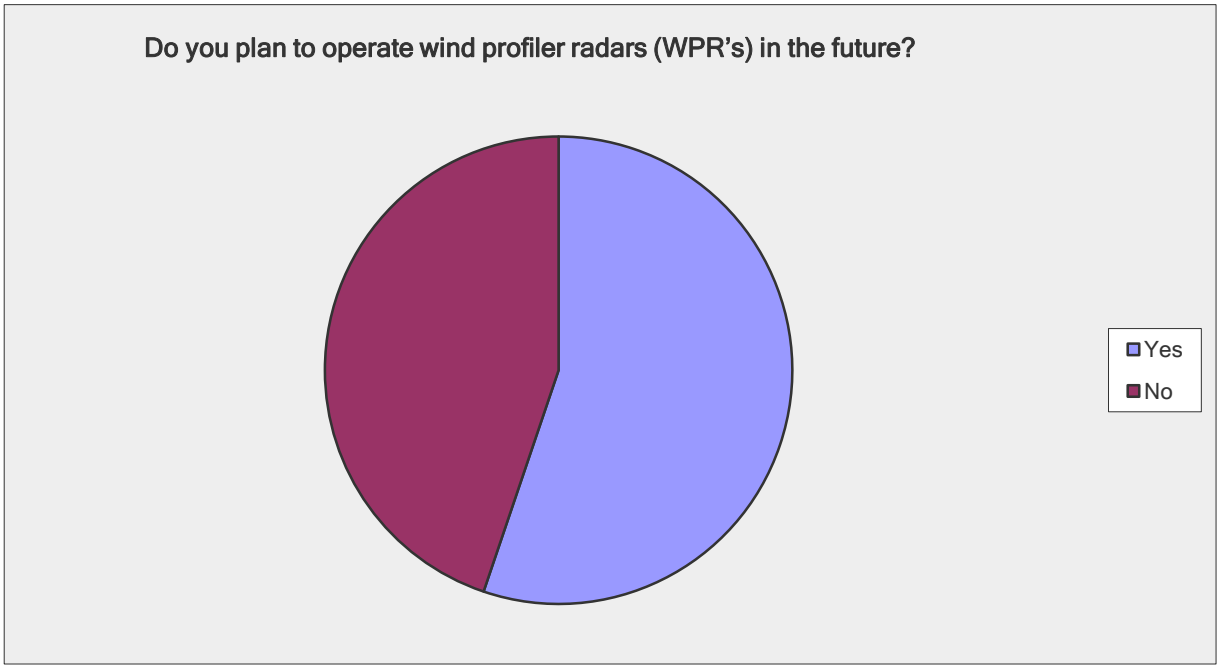
What is the reason for not operating WPR's (check all that apply)?

Answer Options	Response Percent	Response Count
There is no requirement identified	31.0%	9
Funding limitations	58.6%	17
The cost/benefit ratio does not justify such investment	20.7%	6
Insufficient knowledge about these systems	13.8%	4
In planning stages only	37.9%	11
Other (please specify)	10.3%	3
answered question		29
skipped question		17



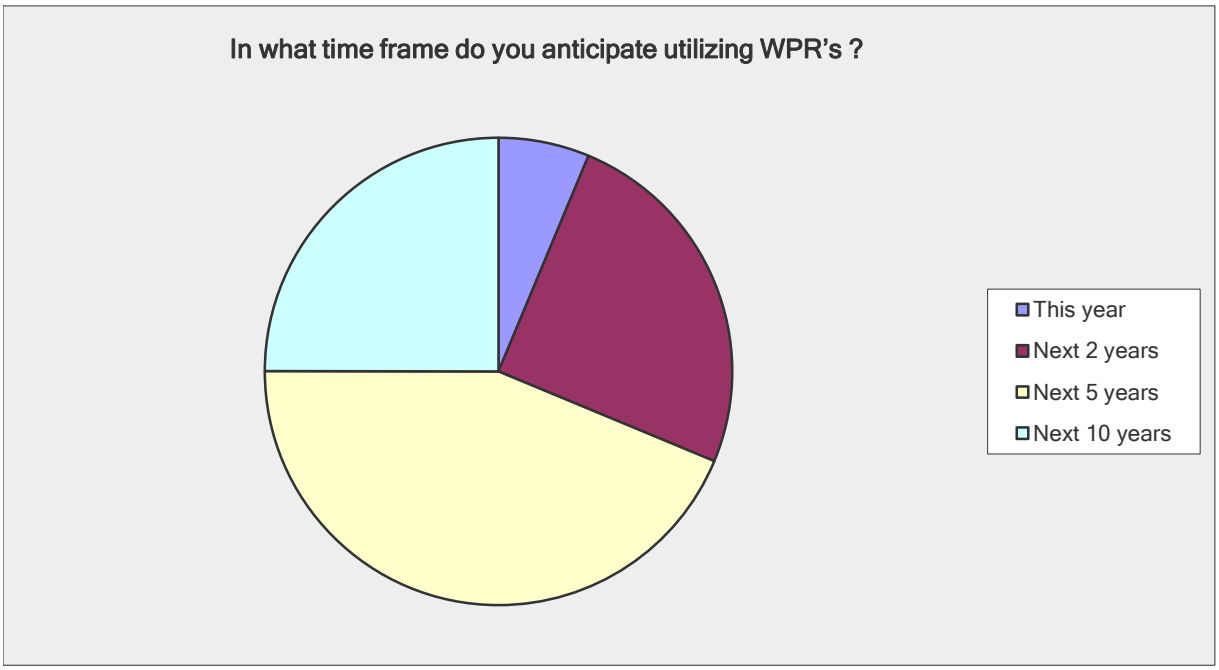
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Do you plan to operate wind profiler radars (WPR's) in the future?		
Answer Options	**Response Percent**	**Response Count**
Yes	55.2%	16
No	44.8%	13
answered question		**29**
skipped question		**17**



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

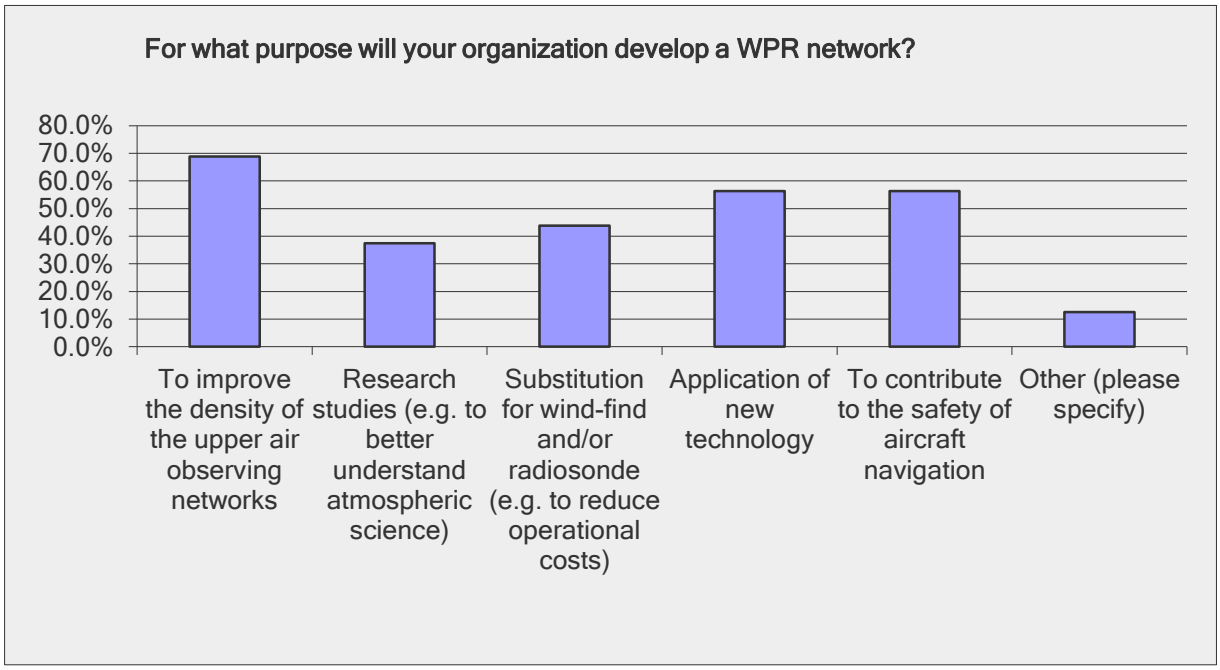
In what time frame do you anticipate utilizing WPR's ?		
Answer Options	**Response Percent**	**Response Count**
This year	6.3%	1
Next 2 years	25.0%	4
Next 5 years	43.8%	7
Next 10 years	25.0%	4
	answered question	16
	skipped question	30



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

For what purpose will your organization develop a WPR network?

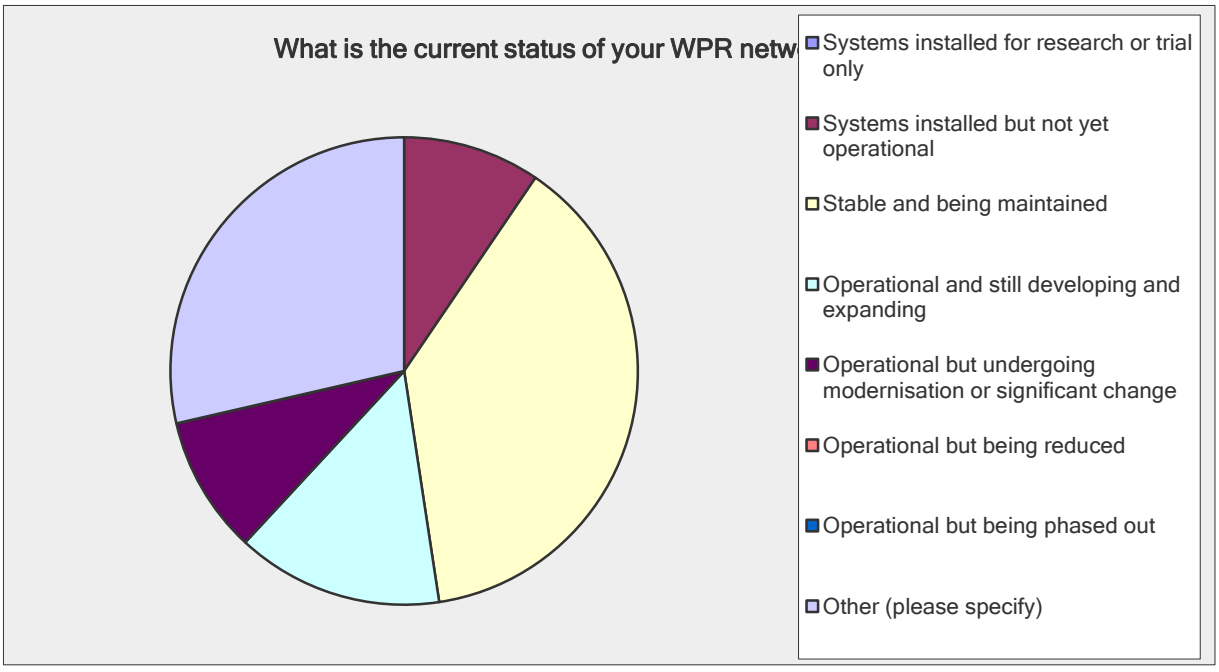
Answer Options	Response Percent	Response Count
To improve the density of the upper air observing	68.8%	11
Research studies (e.g. to better understand atmospheric	37.5%	6
Substitution for wind-find and/or radiosonde (e.g. to	43.8%	7
Application of new technology	56.3%	9
To contribute to the safety of aircraft navigation	56.3%	9
Other (please specify)	12.5%	2
answered question		16
skipped question		30



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

What is the current status of your WPR network:

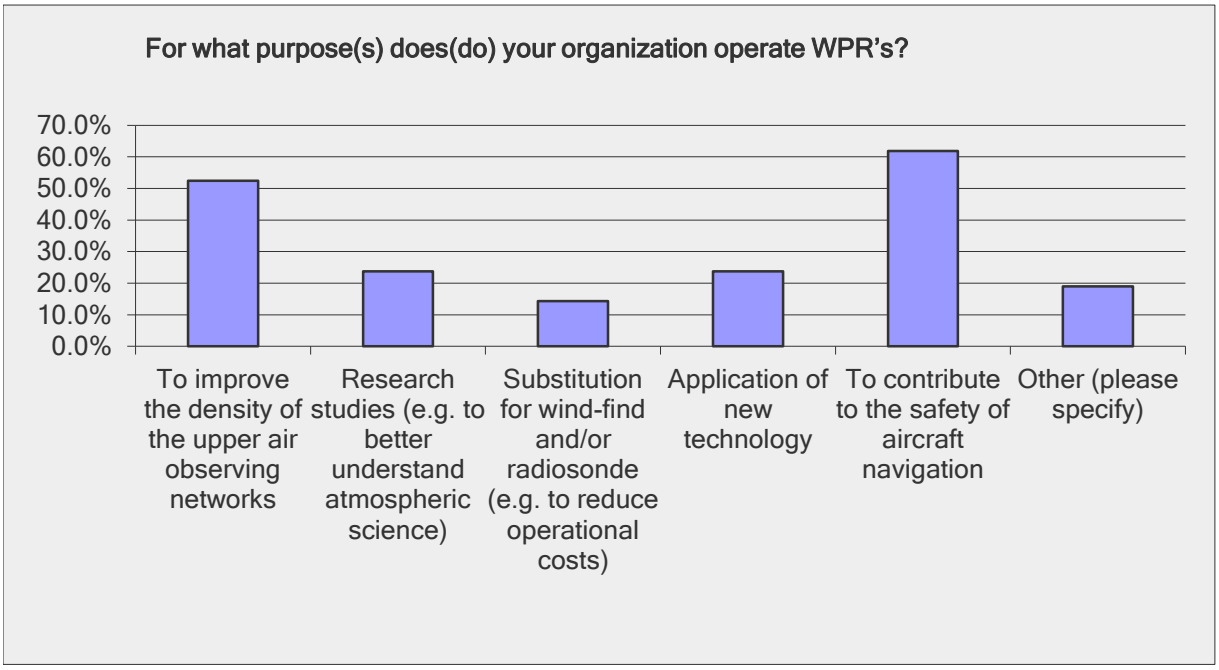
Answer Options	Response Percent	Response Count
Systems installed for research or trial only	0.0%	0
Systems installed but not yet operational	9.5%	2
Stable and being maintained	38.1%	8
Operational and still developing and expanding	14.3%	3
Operational but undergoing modernisation or significant	9.5%	2
Operational but being reduced	0.0%	0
Operational but being phased out	0.0%	0
Other (please specify)	28.6%	6
answered question		21
skipped question		25



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

For what purpose(s) does(do) your organization operate WPR's?

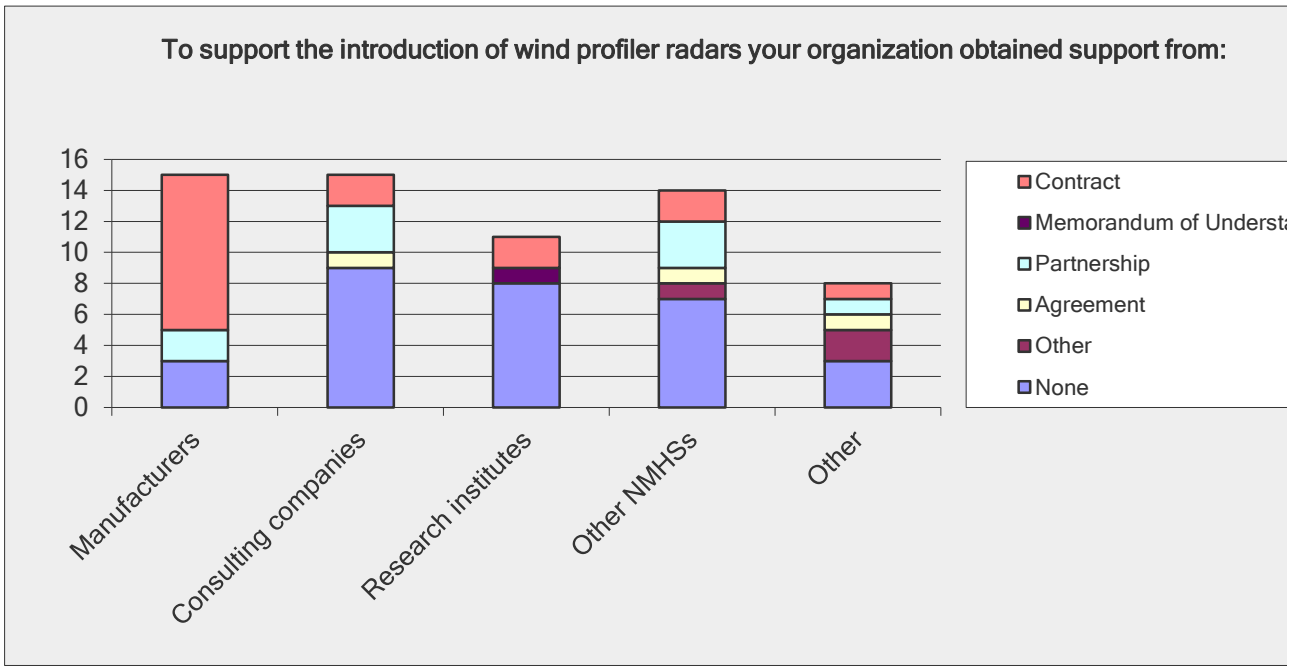
Answer Options	Response Percent	Response Count
To improve the density of the upper air observing	52.4%	11
Research studies (e.g. to better understand atmospheric	23.8%	5
Substitution for wind-find and/or radiosonde (e.g. to	14.3%	3
Application of new technology	23.8%	5
To contribute to the safety of aircraft navigation	61.9%	13
Other (please specify)	19.0%	4
answered question		21
skipped question		25



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

To support the introduction of wind profiler radars your organization obtained support from:

Answer Options	Contract	Memorandum of Understanding	Partnership
Manufacturers	10	0	2
Consulting companies	2	0	3
Research institutes	2	1	0
Other NMHSs	2	0	3
Other	1	0	1
Other (please specify)			

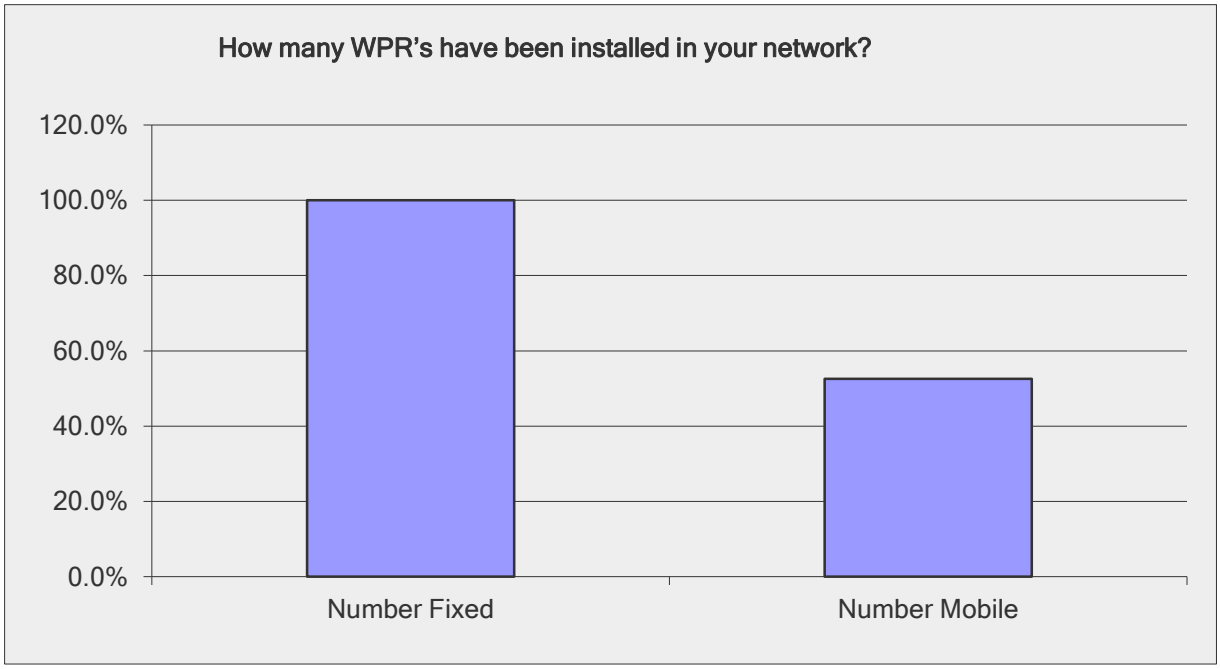


Agreement	Other	None	Response Count
0	0	3	15
1	0	9	15
0	0	8	11
1	1	7	14
1	2	3	8
			5
		answered question	21
		skipped question	25

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

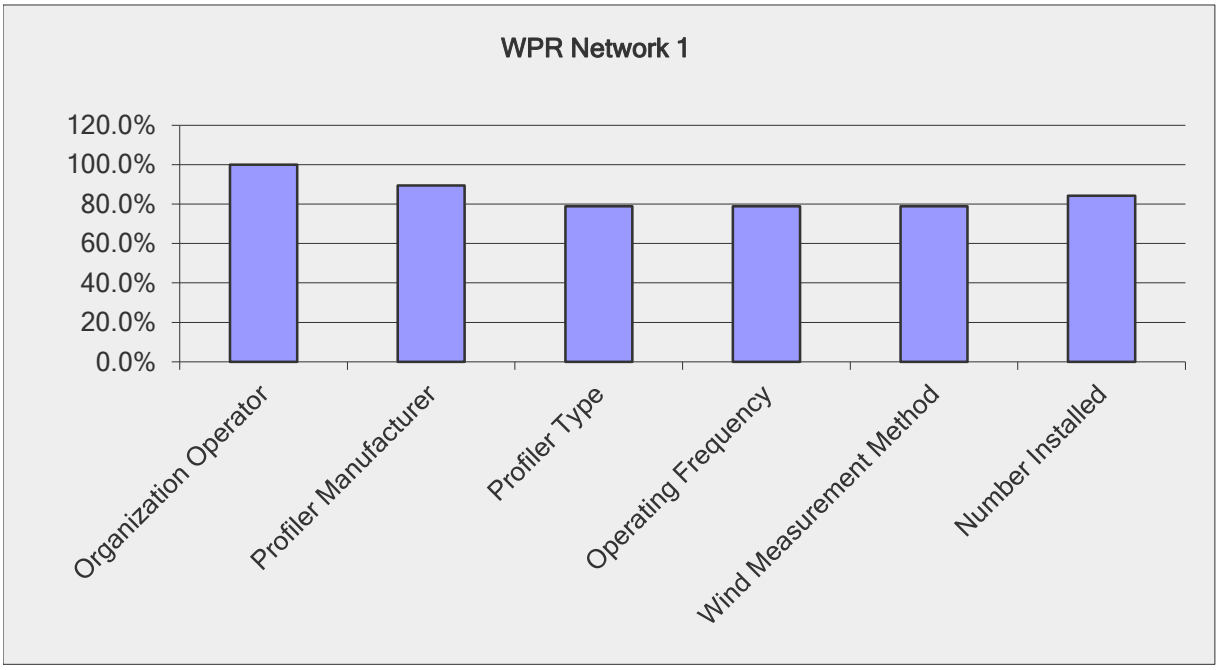
How many WPR's have been installed in your network?

Answer Options	Response Percent	Response Count
Number Fixed	100.0%	19
Number Mobile	52.6%	10
answered question		19
skipped question		27



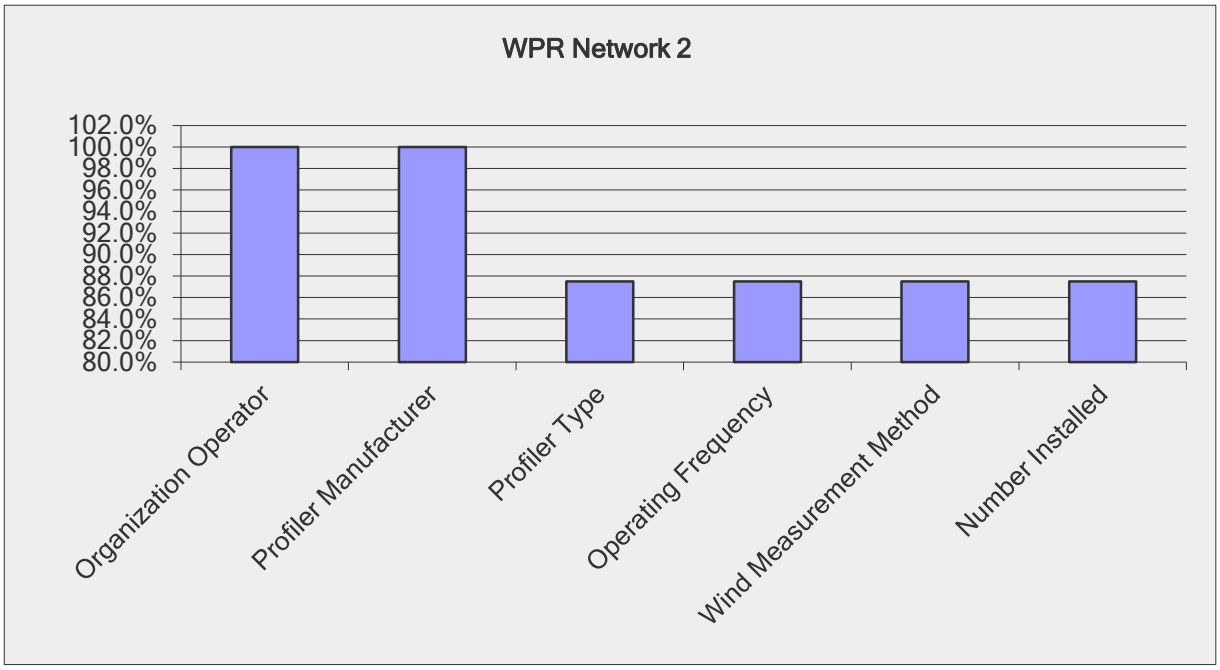
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

WPR Network 1		
Answer Options	**Response Percent**	**Response Count**
Organization Operator	100.0%	19
Profiler Manufacturer	89.5%	17
Profiler Type	78.9%	15
Operating Frequency	78.9%	15
Wind Measurement Method	78.9%	15
Number Installed	84.2%	16
	answered question	**19**
	skipped question	**27**



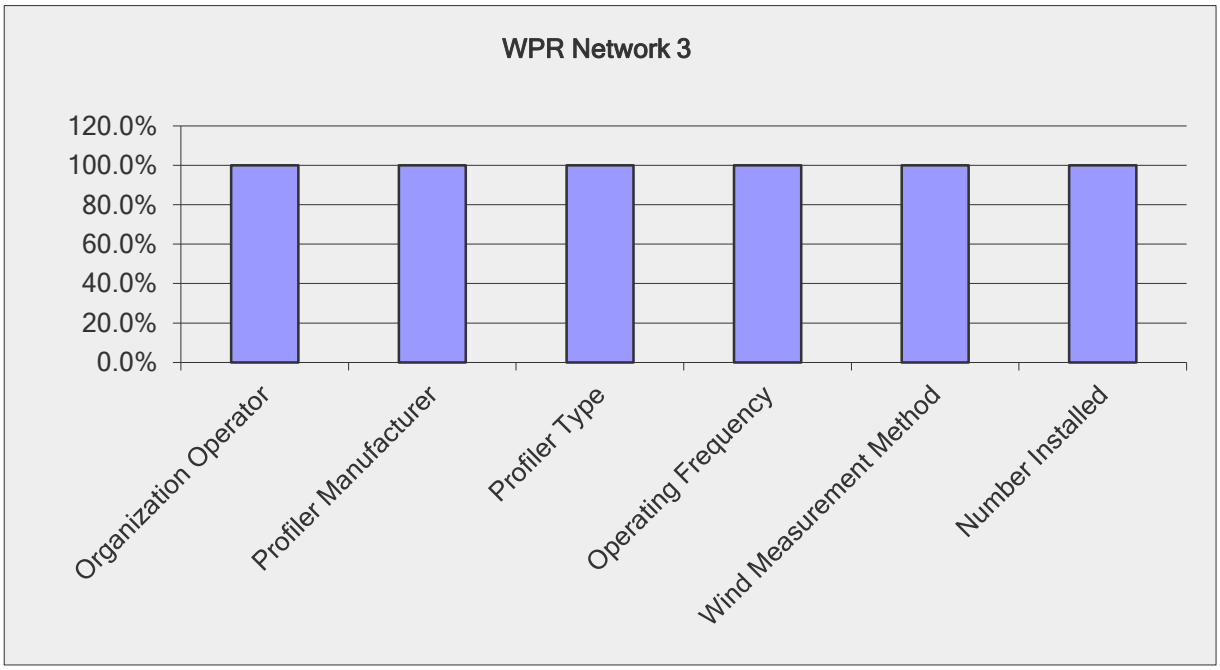
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

WPR Network 2		
Answer Options	**Response Percent**	**Response Count**
Organization Operator	100.0%	8
Profiler Manufacturer	100.0%	8
Profiler Type	87.5%	7
Operating Frequency	87.5%	7
Wind Measurement Method	87.5%	7
Number Installed	87.5%	7
	answered question	8
	skipped question	38



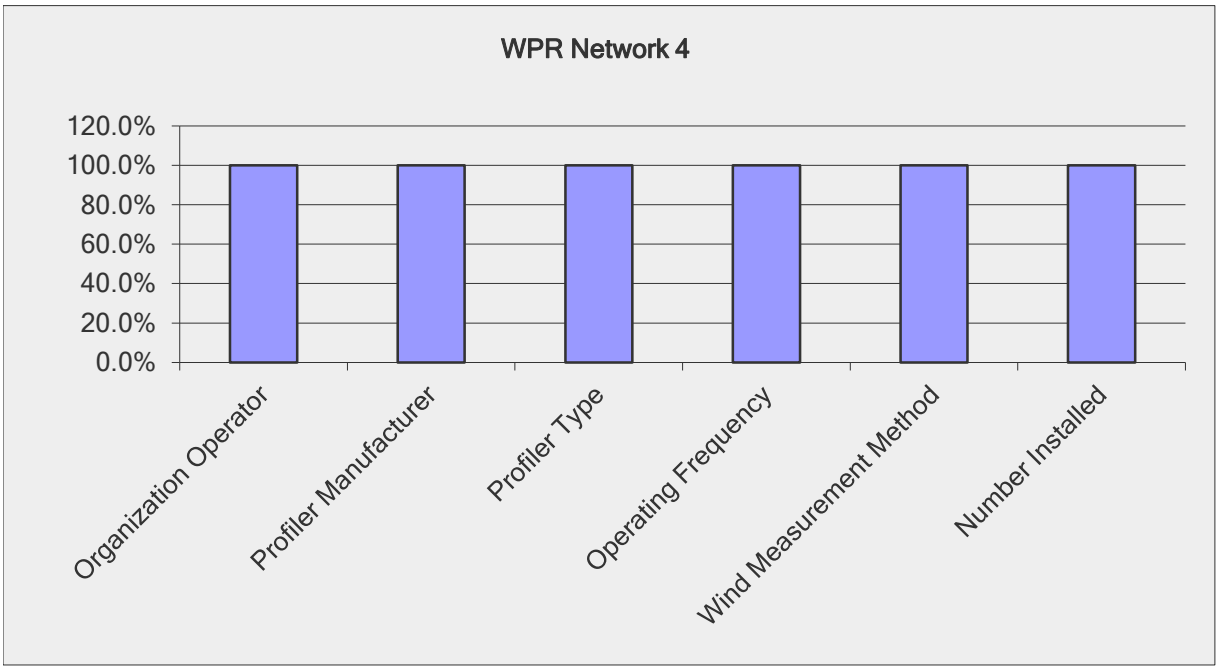
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

WPR Network 3		
Answer Options	**Response Percent**	**Response Count**
Organization Operator	100.0%	2
Profiler Manufacturer	100.0%	2
Profiler Type	100.0%	2
Operating Frequency	100.0%	2
Wind Measurement Method	100.0%	2
Number Installed	100.0%	2
	answered question	**2**
	skipped question	**44**



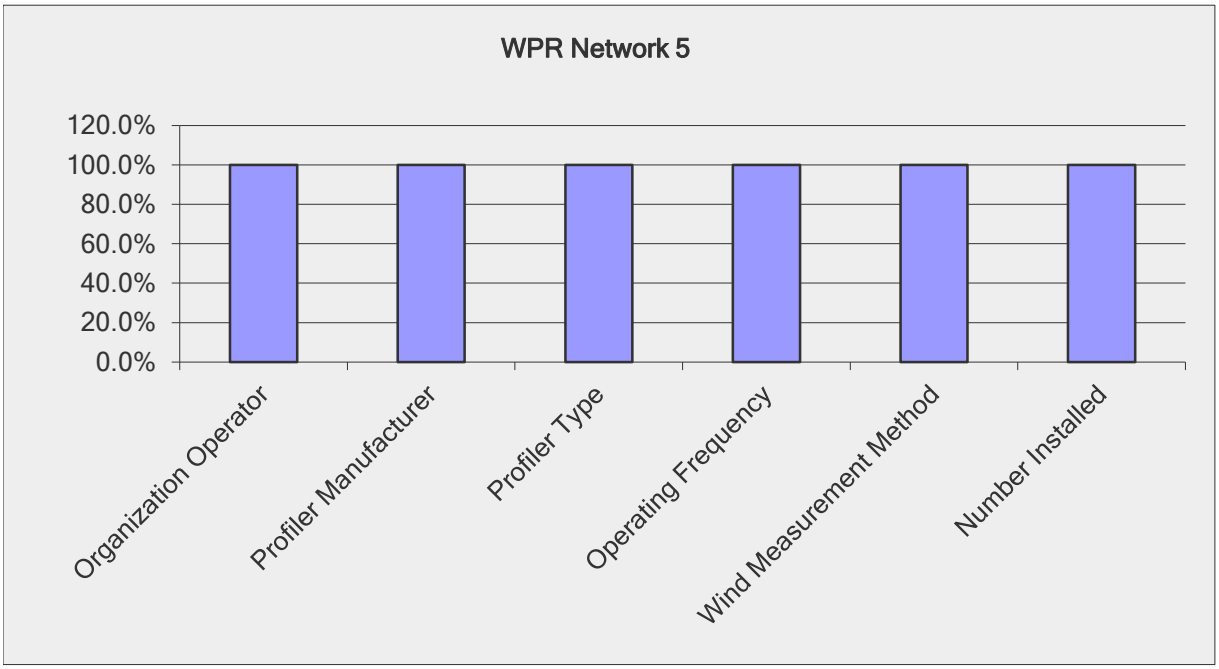
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

WPR Network 4		
Answer Options	**Response Percent**	**Response Count**
Organization Operator	100.0%	1
Profiler Manufacturer	100.0%	1
Profiler Type	100.0%	1
Operating Frequency	100.0%	1
Wind Measurement Method	100.0%	1
Number Installed	100.0%	1
	answered question	1
	skipped question	45



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

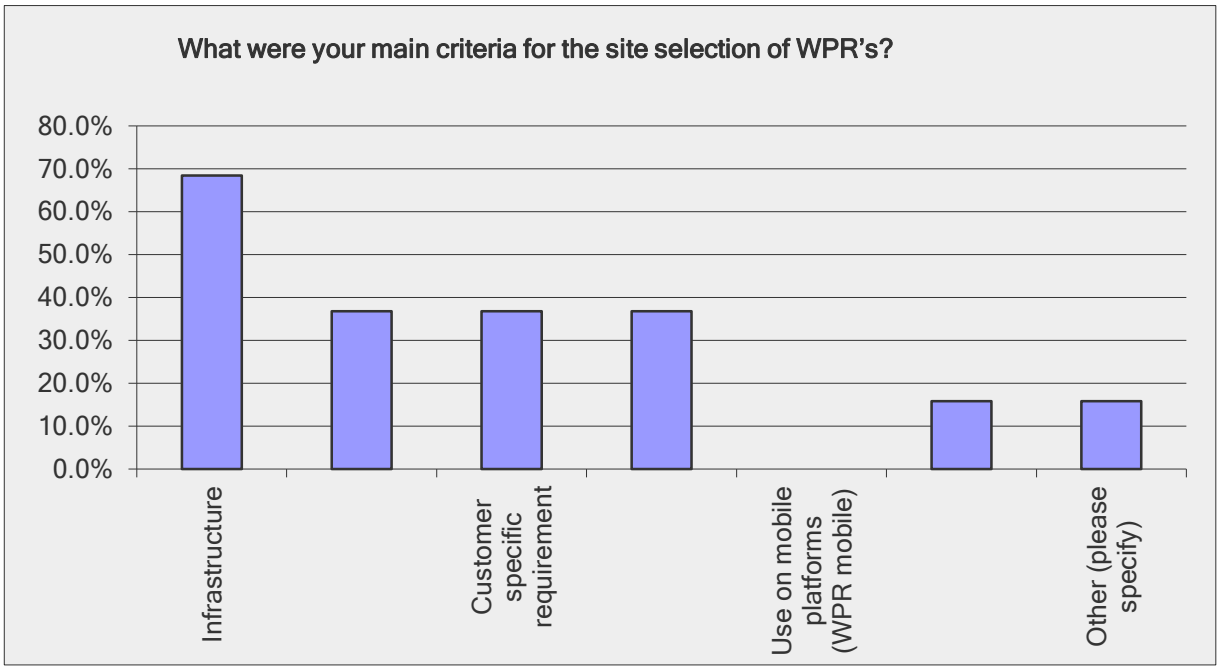
WPR Network 5		
Answer Options	**Response Percent**	**Response Count**
Organization Operator	100.0%	1
Profiler Manufacturer	100.0%	1
Profiler Type	100.0%	1
Operating Frequency	100.0%	1
Wind Measurement Method	100.0%	1
Number Installed	100.0%	1
	answered question	1
	skipped question	45



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

What were your main criteria for the site selection of WPR's?

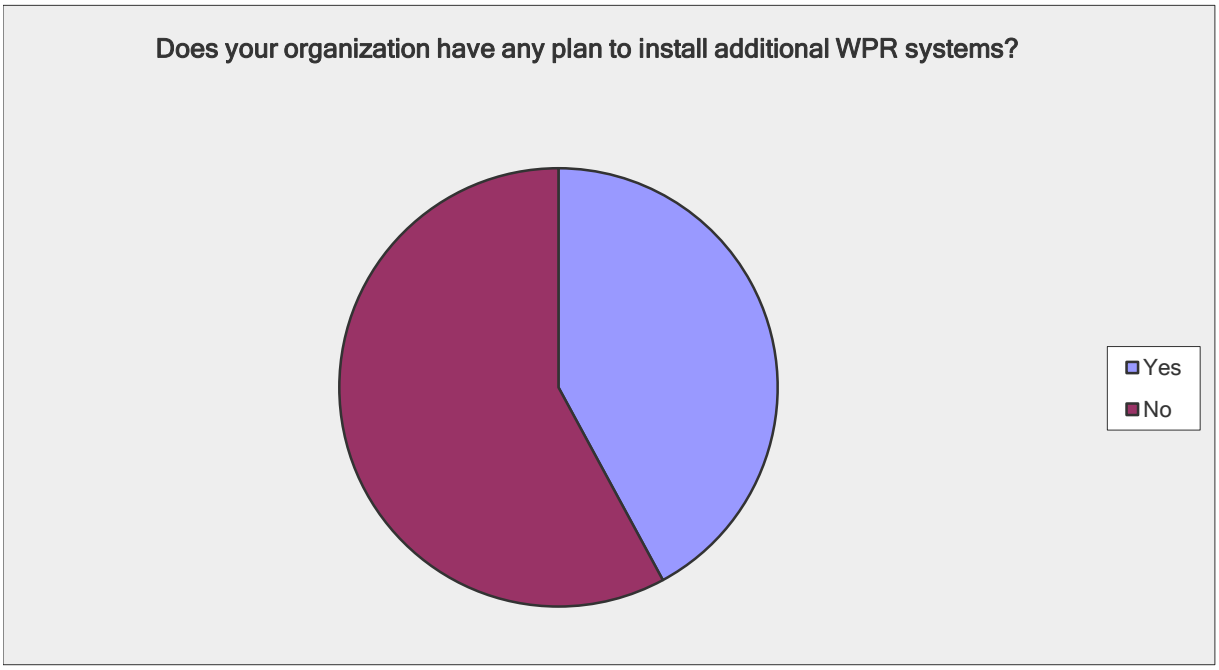
Answer Options	Response Percent	Response Count
Infrastructure	68.4%	13
Gap in upper air network	36.8%	7
Customer specific requirement	36.8%	7
Critical weather for events	36.8%	7
Use on mobile platforms (WPR mobile)	0.0%	0
Frequency allocation constraints	15.8%	3
Other (please specify)	15.8%	3
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Does your organization have any plan to install additional WPR systems?

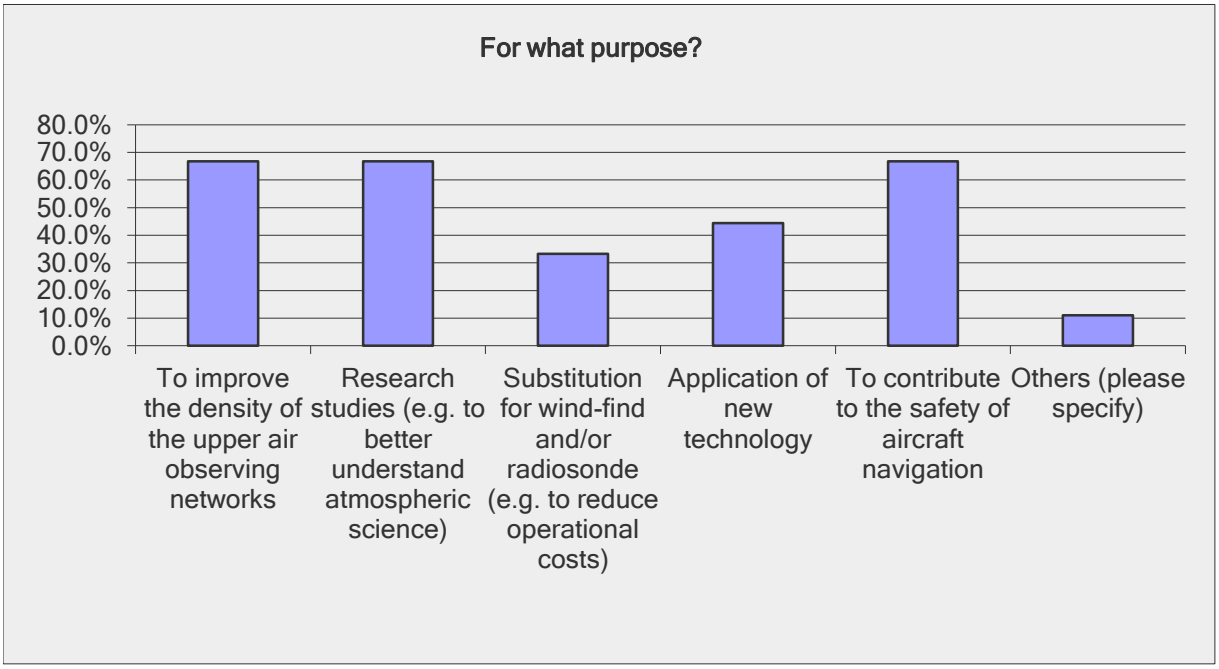
Answer Options	Response Percent	Response Count
Yes	42.1%	8
No	57.9%	11
Other (please specify)		1
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

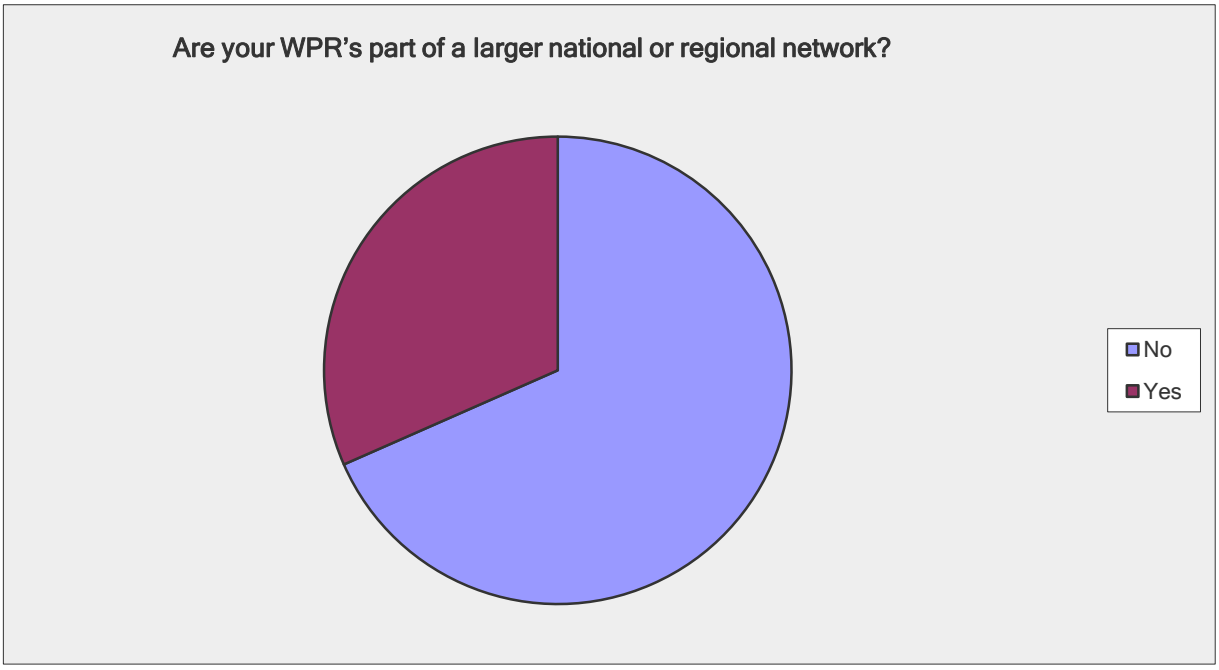
For what purpose?

Answer Options	Response Percent	Response Count
To improve the density of the upper air observing	66.7%	6
Research studies (e.g. to better understand atmospheric	66.7%	6
Substitution for wind-find and/or radiosonde (e.g. to	33.3%	3
Application of new technology	44.4%	4
To contribute to the safety of aircraft navigation	66.7%	6
Others (please specify)	11.1%	1
answered question		9
skipped question		37



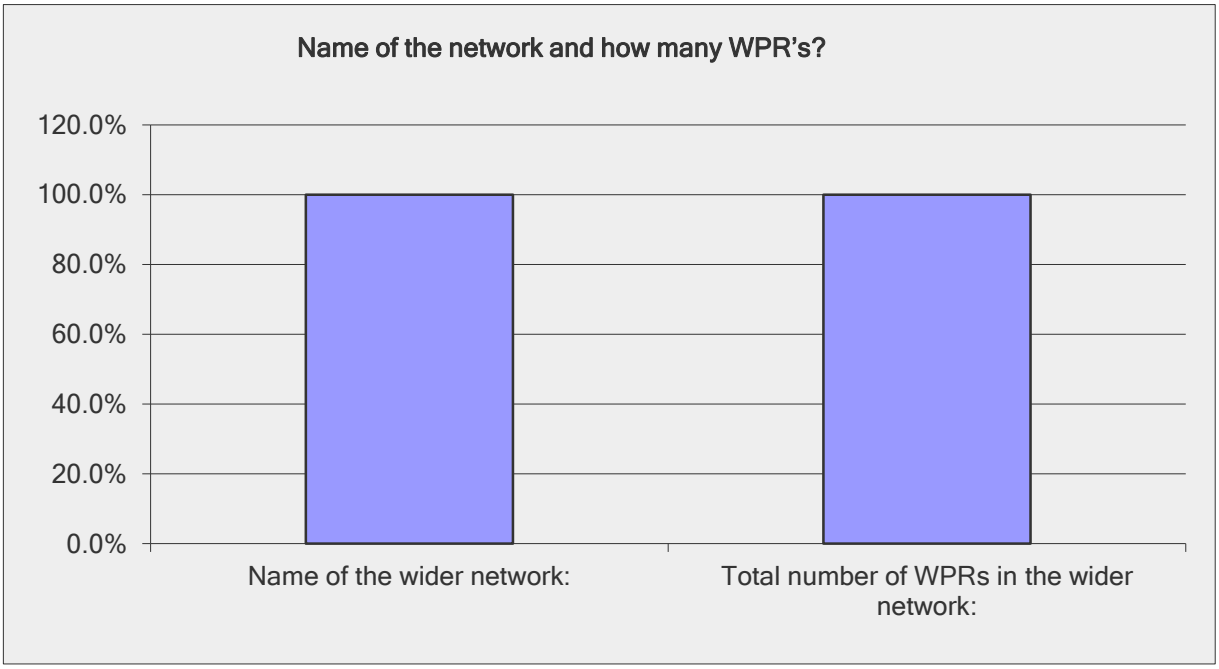
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Are your WPR's part of a larger national or regional network?		
Answer Options	**Response Percent**	**Response Count**
No	68.4%	13
Yes	31.6%	6
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

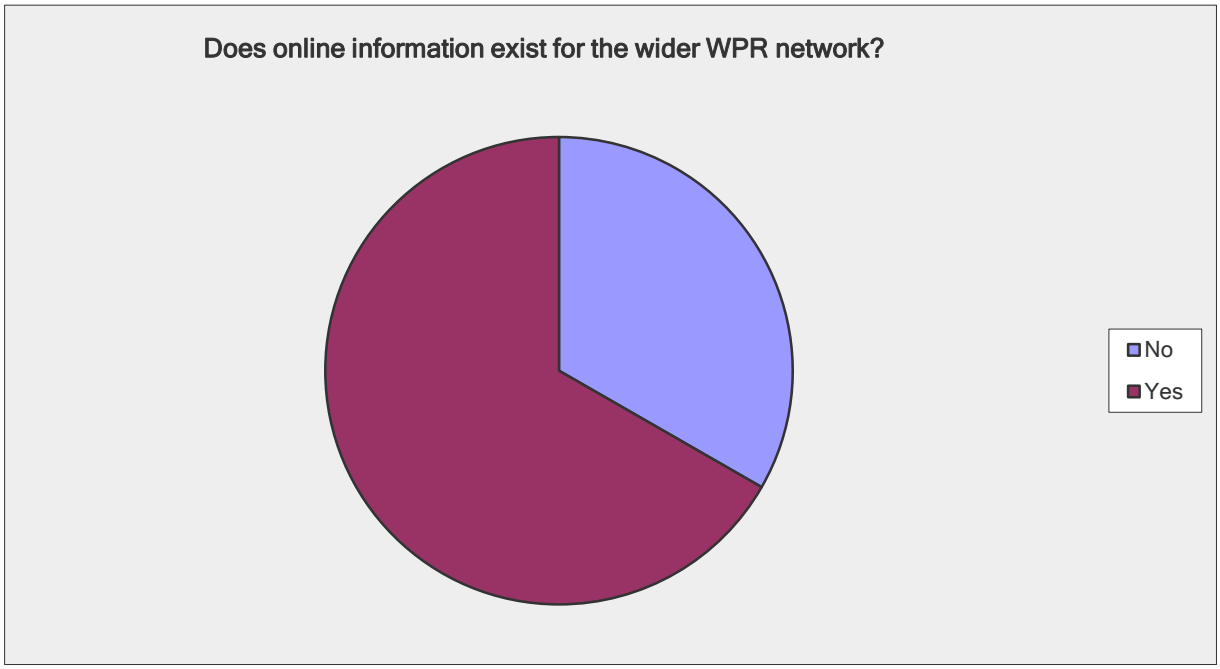
Name of the network and how many WPR's?		
Answer Options	**Response Percent**	**Response Count**
Name of the wider network:	100.0%	9
Total number of WPRs in the wider network:	100.0%	9
	answered question	9
	skipped question	37



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

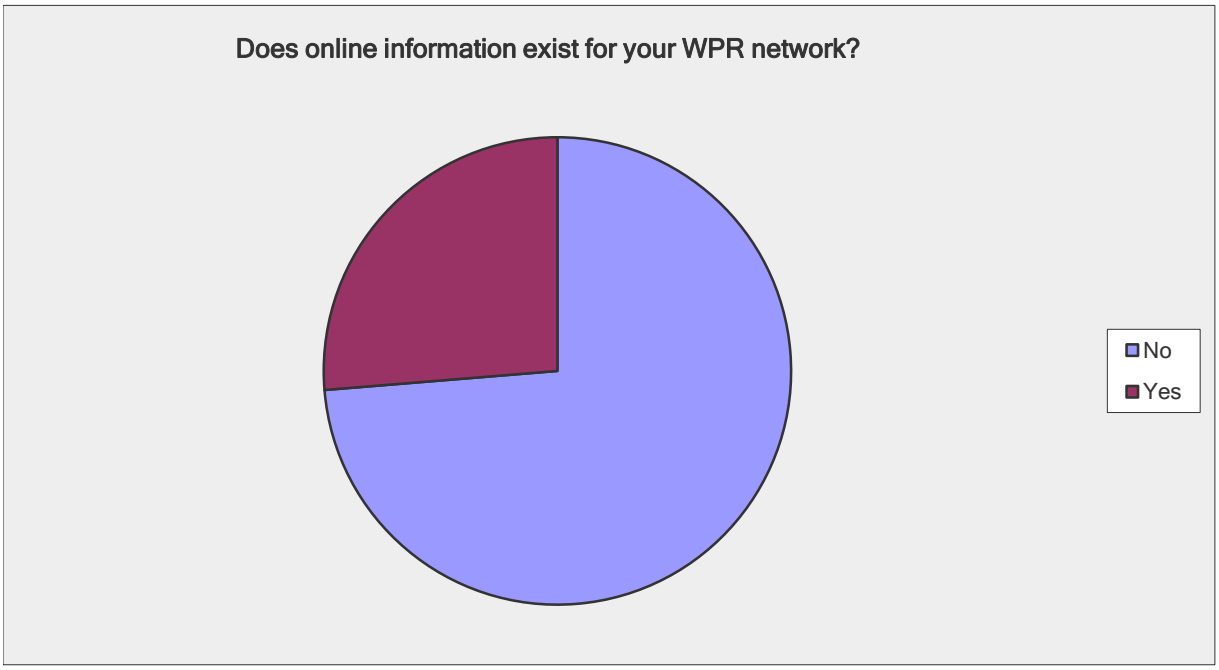
Does online information exist for the wider WPR network?

Answer Options	Response Percent	Response Count
No	33.3%	3
Yes	66.7%	6
If Yes, please specify the URL		6
answered question		9
skipped question		37



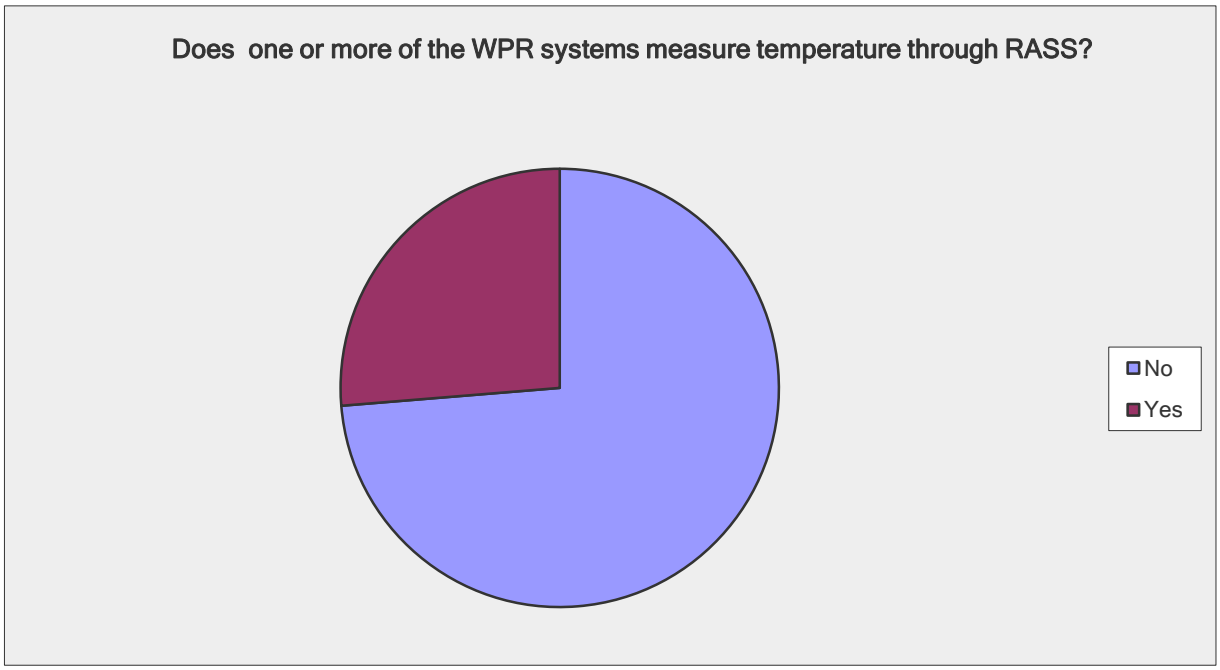
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Does online information exist for your WPR network?		
Answer Options	**Response Percent**	**Response Count**
No	73.7%	14
Yes	26.3%	5
If Yes, please specify the URL		5
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

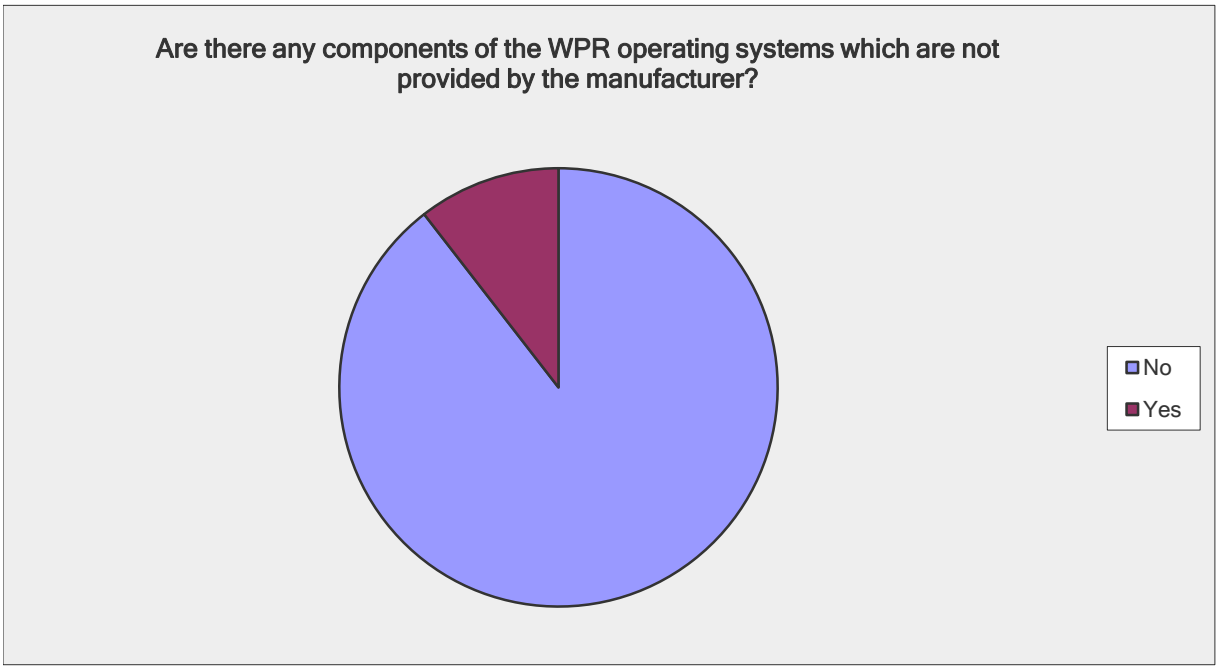
Does one or more of the WPR systems measure temperature through RASS?		
Answer Options	**Response Percent**	**Response Count**
No	73.7%	14
Yes	26.3%	5
If yes, how many?		5
	answered question	19
	skipped question	27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Are there any components of the WPR operating systems which are not provided by the manufacturer?

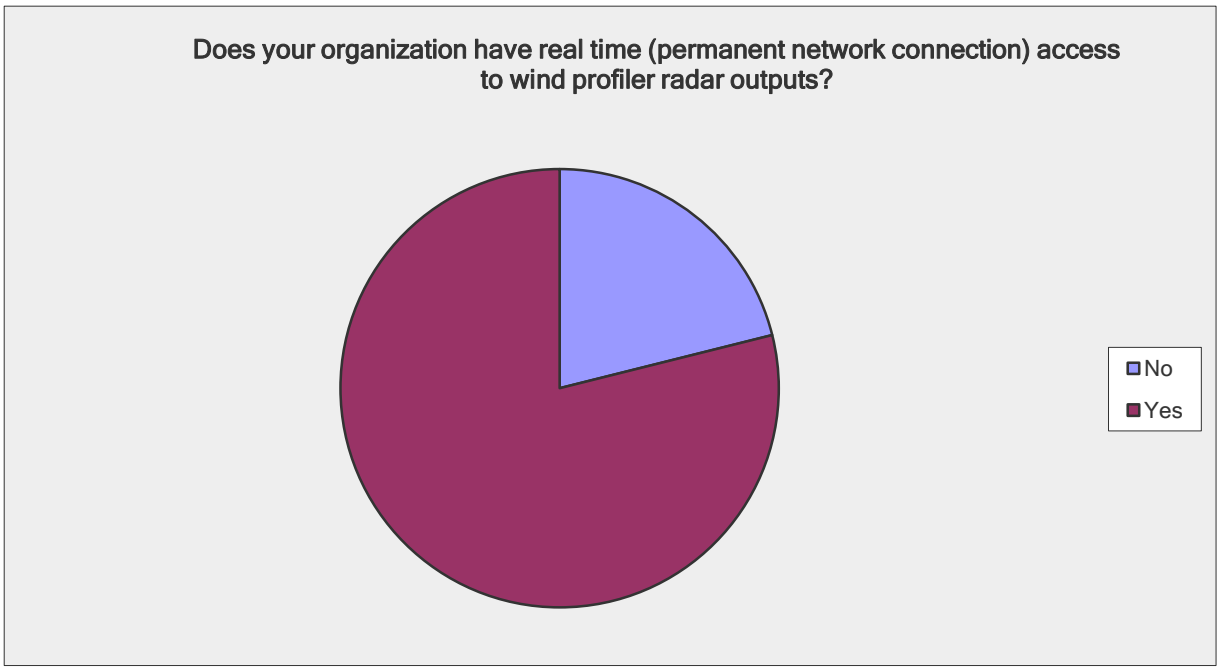
Answer Options	Response Percent	Response Count
No	89.5%	17
Yes	10.5%	2
If Yes, what are the components and what is their function? (1 component		2
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Does your organization have real time (permanent network connection) access to wind profiler radar outputs?

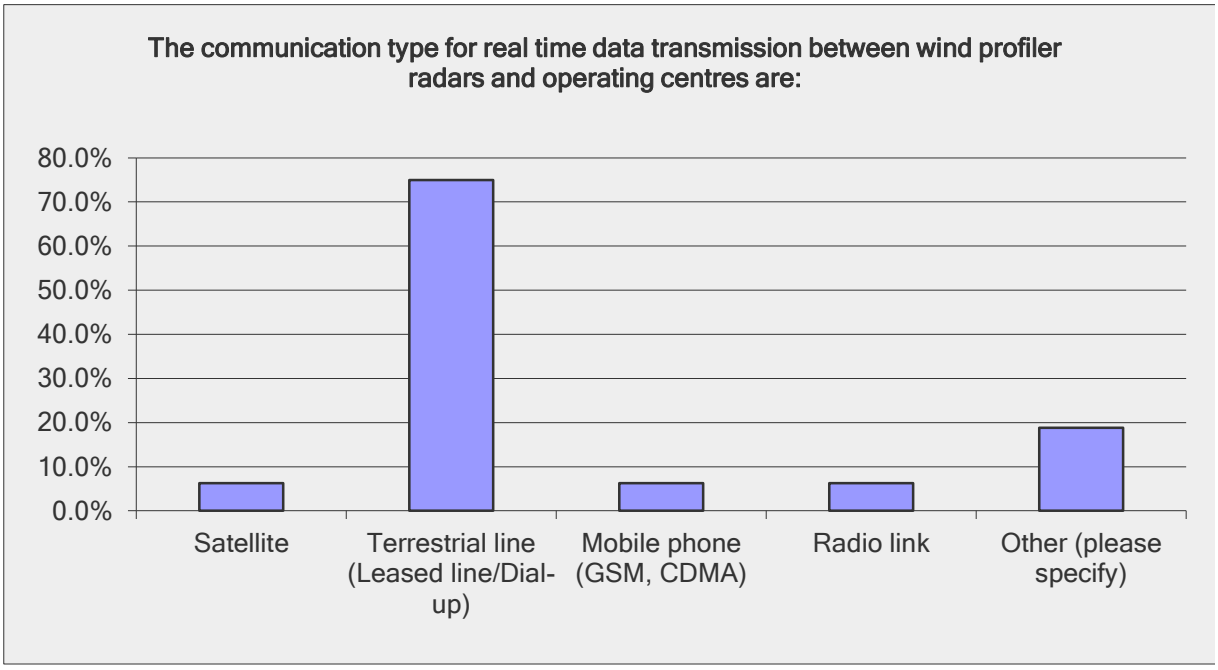
Answer Options	Response Percent	Response Count
No	21.1%	4
Yes	78.9%	15
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

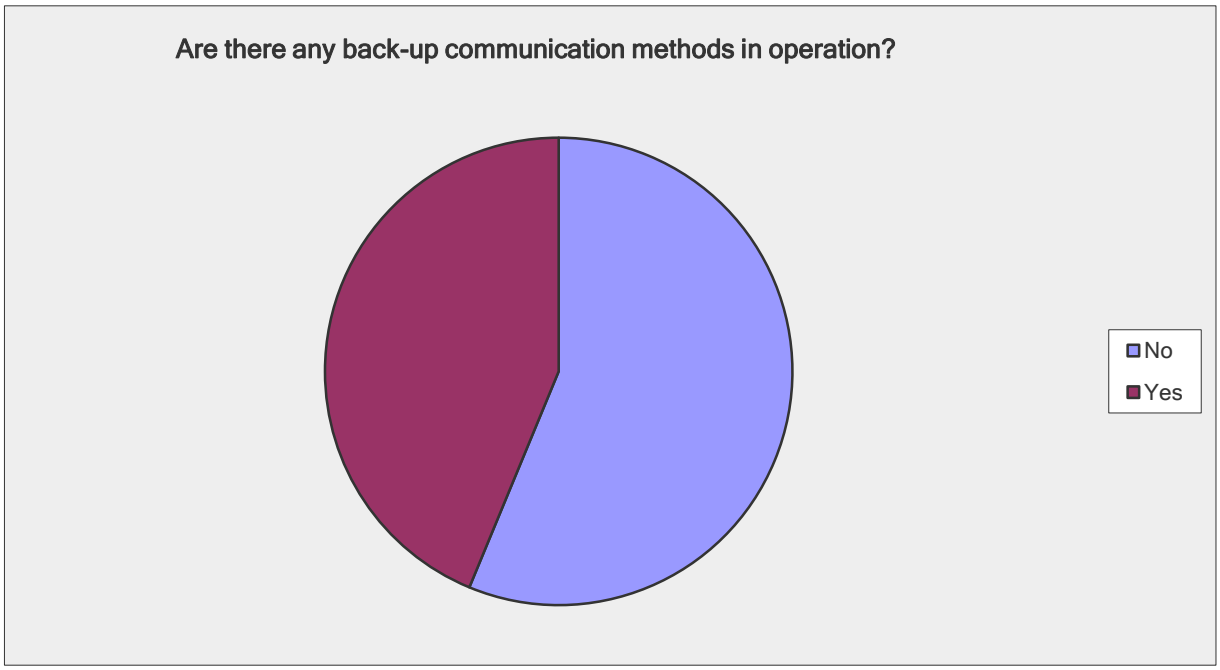
The communication type for real time data transmission between wind profiler radars and operating centres are:

Answer Options	Response Percent	Response Count
Satellite	6.3%	1
Terrestrial line (Leased line/Dial-up)	75.0%	12
Mobile phone (GSM, CDMA)	6.3%	1
Radio link	6.3%	1
Other (please specify)	18.8%	3
answered question		16
skipped question		30



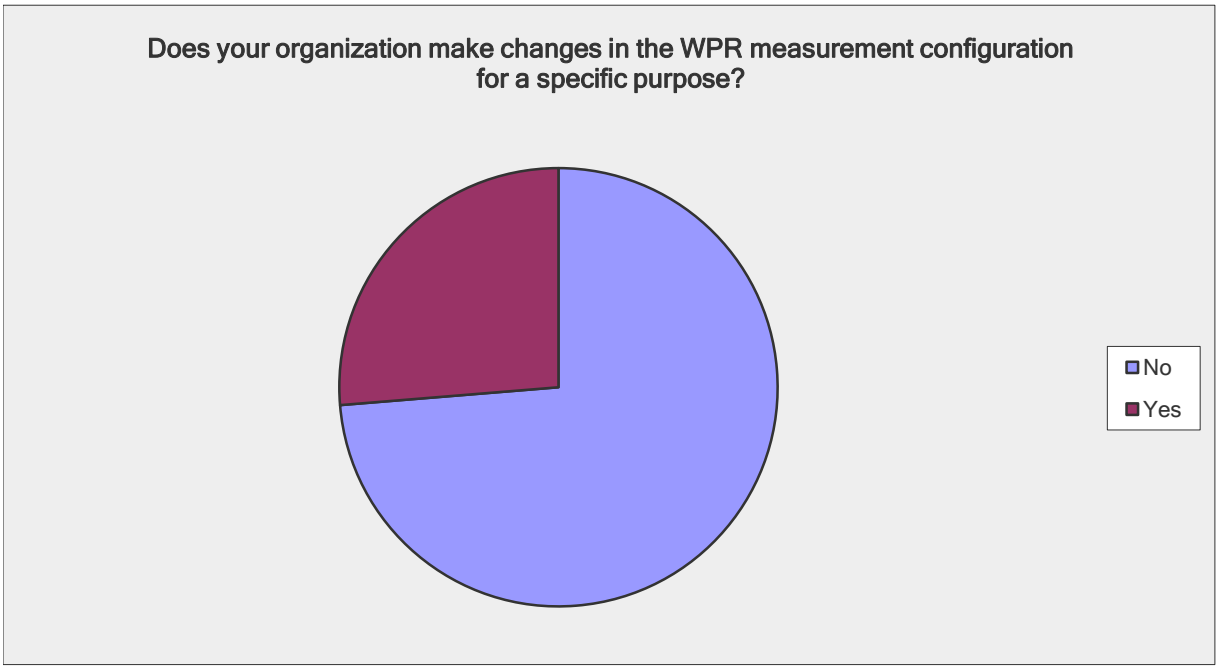
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Are there any back-up communication methods in operation?		
Answer Options	**Response Percent**	**Response Count**
No	56.3%	9
Yes	43.8%	7
If Yes, what method?		7
answered question		16
skipped question		30



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

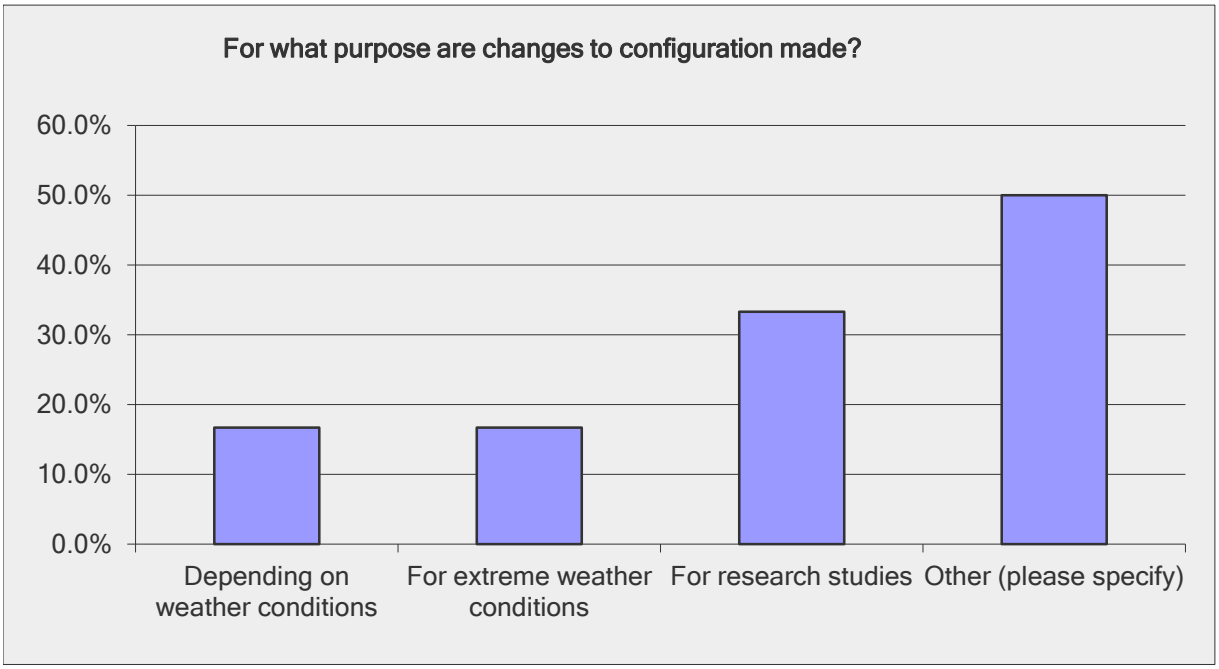
Does your organization make changes in the WPR measurement configuration for a specific purpose?		
Answer Options	**Response Percent**	**Response Count**
No	73.7%	14
Yes	26.3%	5
answered question		**19**
skipped question		**27**



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

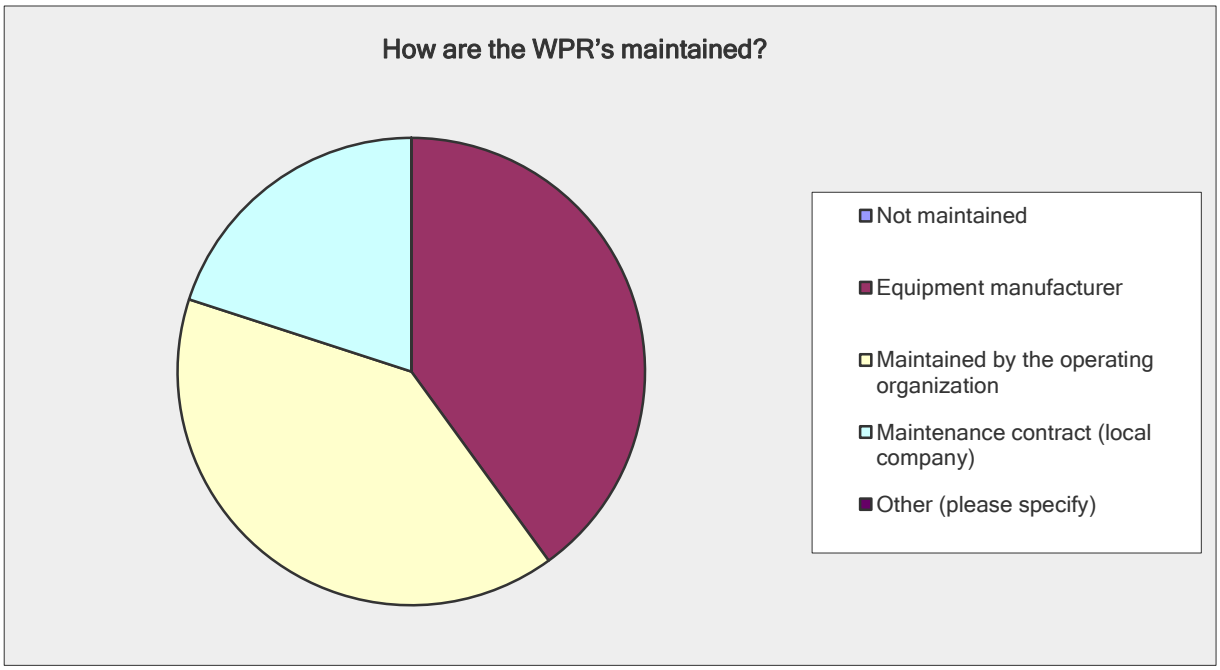
For what purpose are changes to configuration made?

Answer Options	Response Percent	Response Count
Depending on weather conditions	16.7%	1
For extreme weather conditions	16.7%	1
For research studies	33.3%	2
Other (please specify)	50.0%	3
answered question		6
skipped question		40



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

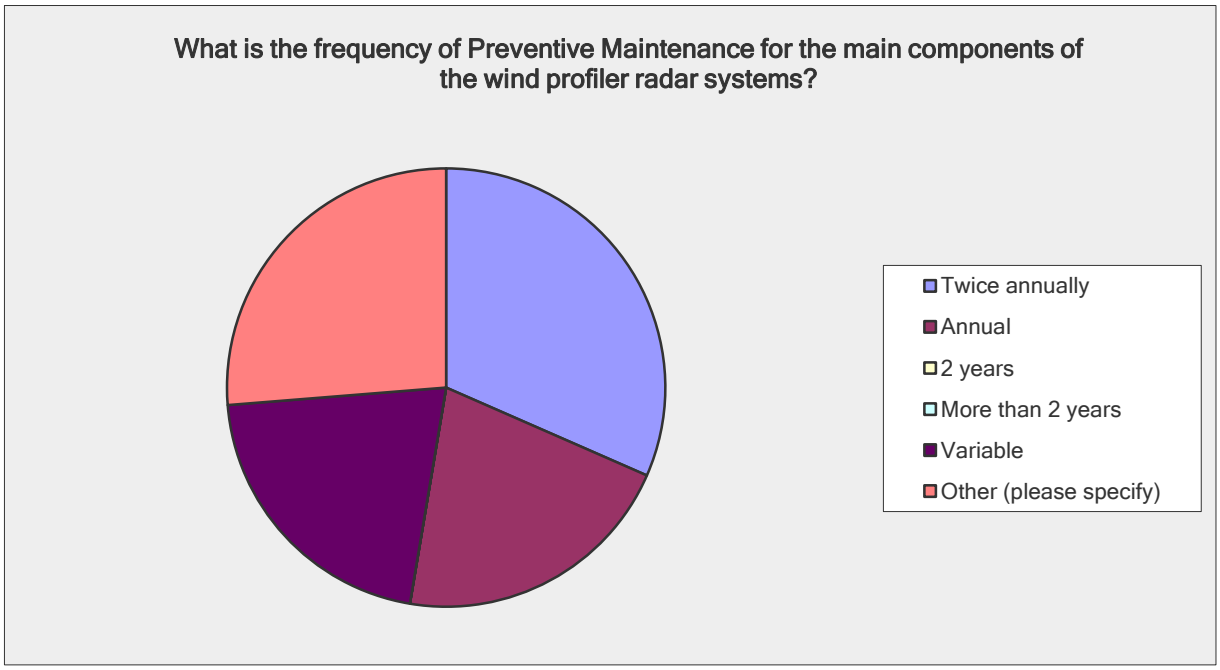
How are the WPR's maintained?		
Answer Options	**Response Percent**	**Response Count**
Not maintained	0.0%	0
Equipment manufacturer	40.0%	2
Maintained by the operating organization	40.0%	2
Maintenance contract (local company)	20.0%	1
Other (please specify)	0.0%	0
	answered question	5
	skipped question	41



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

What is the frequency of Preventive Maintenance for the main components of the wind profiler radar systems?

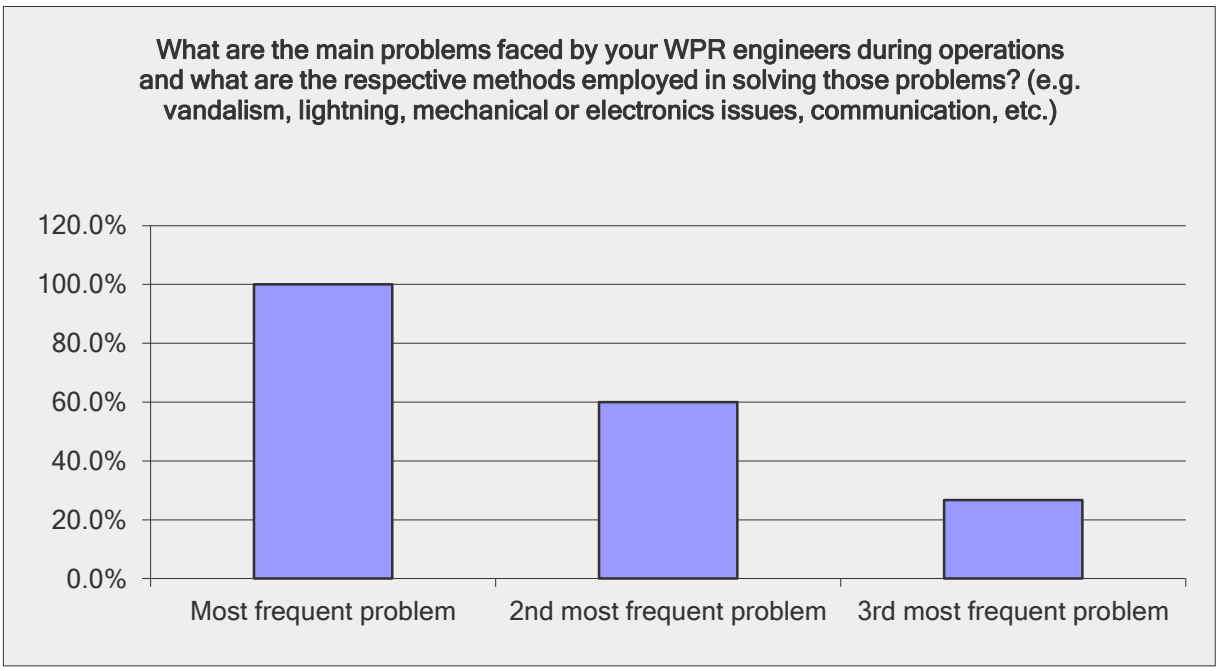
Answer Options	Response Percent	Response Count
Twice annually	31.6%	6
Annual	21.1%	4
2 years	0.0%	0
More than 2 years	0.0%	0
Variable	21.1%	4
Other (please specify)	26.3%	5
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

What are the main problems faced by your WPR engineers during operations and what are the respective methods employed in solving those problems? (e.g. vandalism,

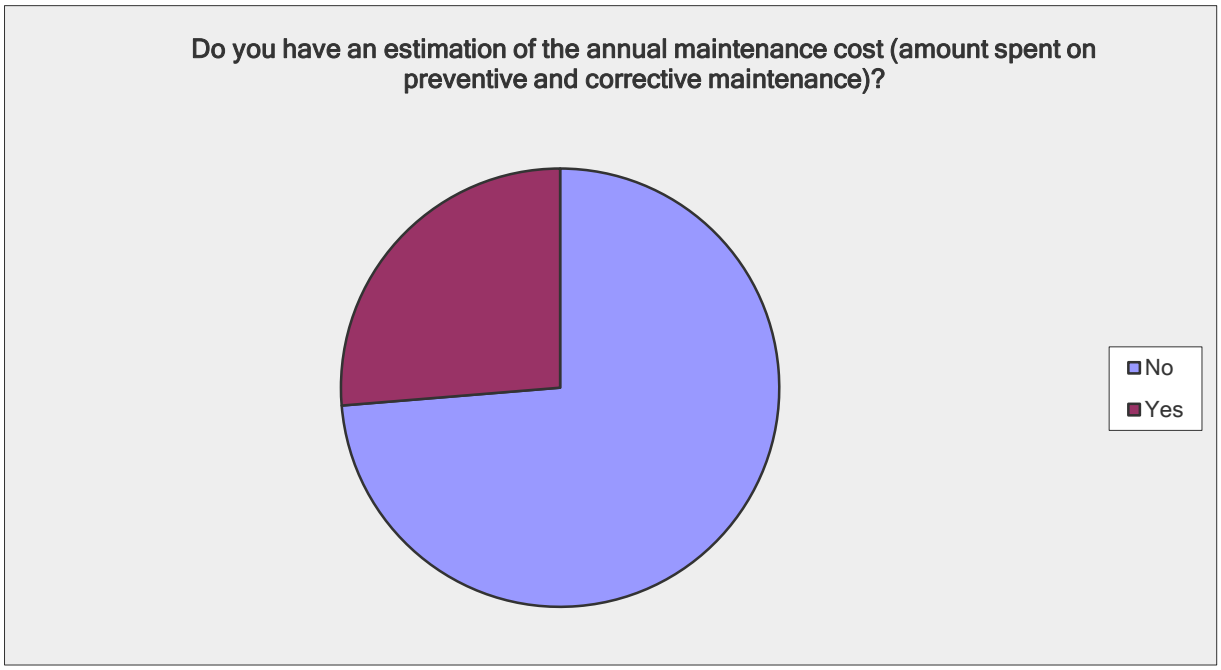
Answer Options	Response Percent	Response Count
Most frequent problem	100.0%	15
2nd most frequent problem	60.0%	9
3rd most frequent problem	26.7%	4
answered question		15
skipped question		31



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

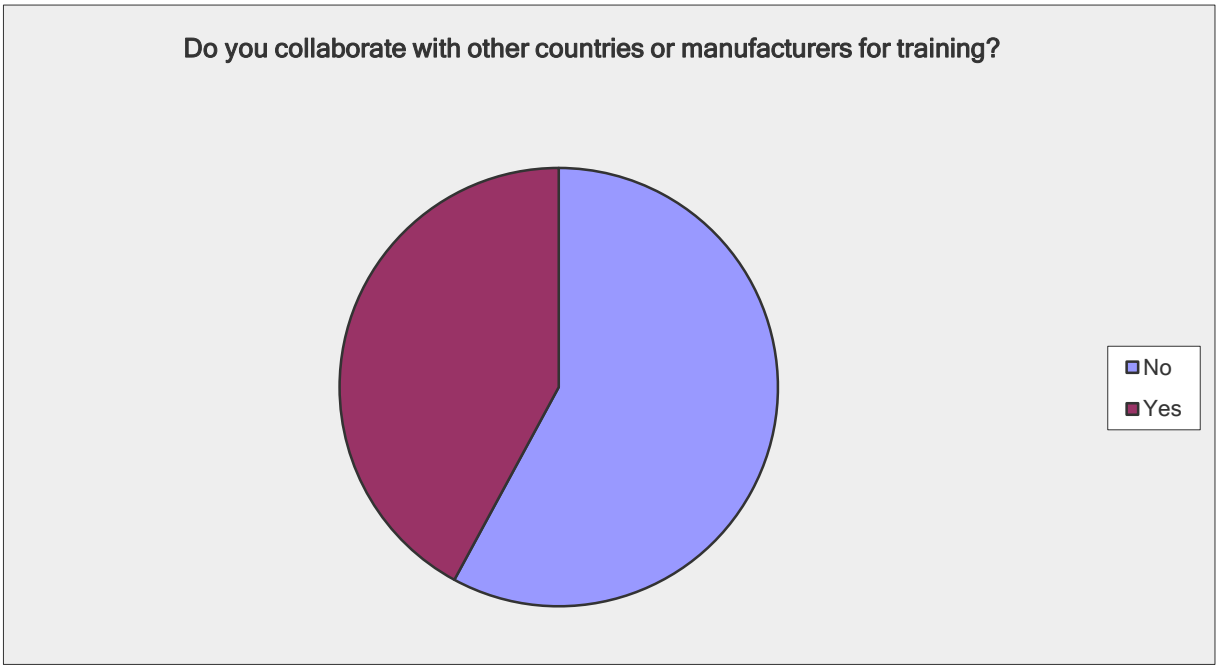
Do you have an estimation of the annual maintenance cost (amount spent on preventive and corrective maintenance)?

Answer Options	Response Percent	Response Count
No	73.7%	14
Yes	26.3%	5
If Yes, please provide an estimate of annual costs per WPR system.		5
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

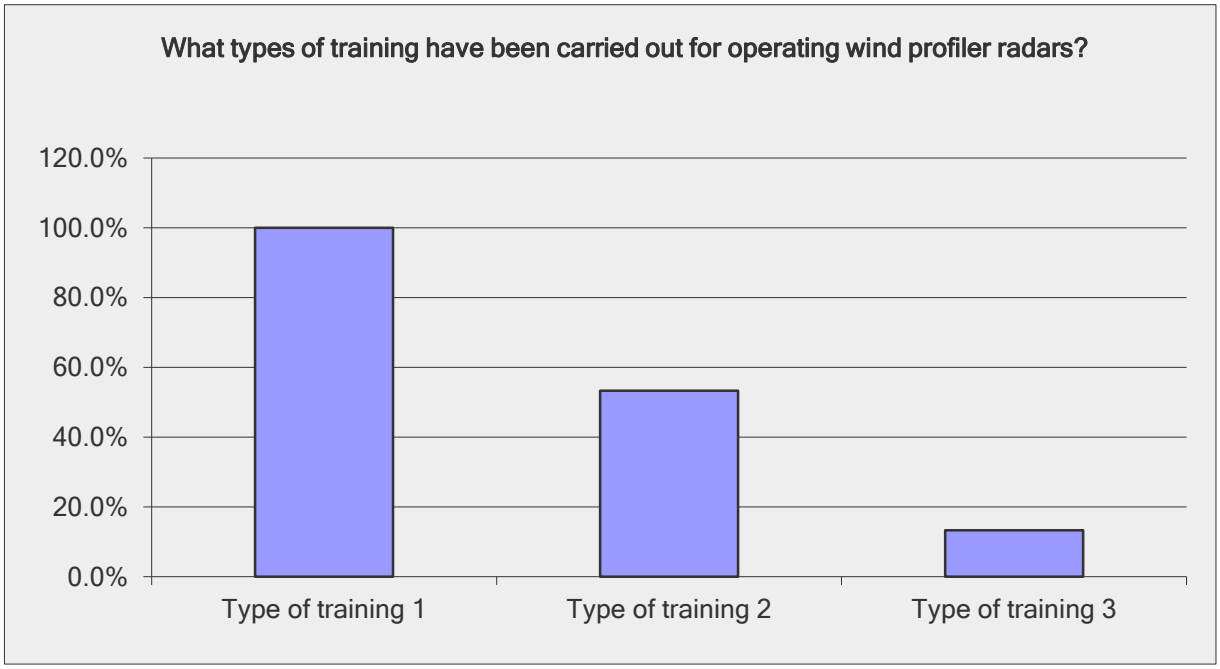
Do you collaborate with other countries or manufacturers for training?		
Answer Options	**Response Percent**	**Response Count**
No	57.9%	11
Yes	42.1%	8
If Yes, with whom?		8
answered question		19
skipped question		27



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

What types of training have been carried out for operating wind profiler radars?

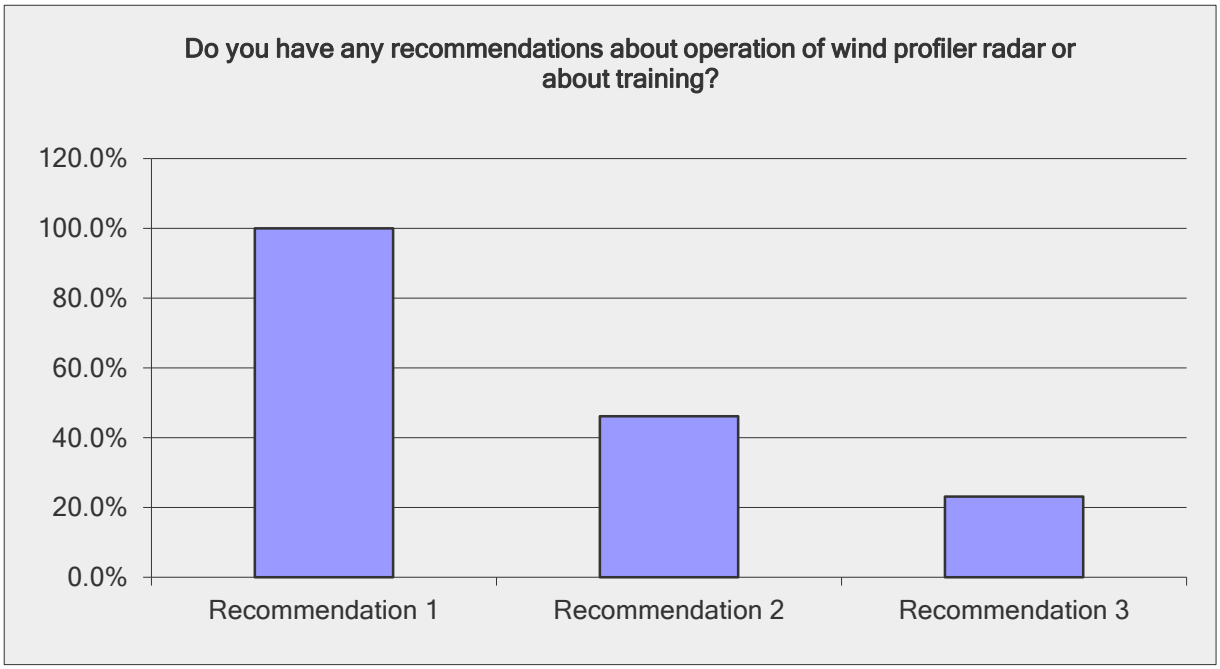
Answer Options	Response Percent	Response Count
Type of training 1	100.0%	15
Type of training 2	53.3%	8
Type of training 3	13.3%	2
	answered question	15
	skipped question	31



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Do you have any recommendations about operation of wind profiler radar or about training?

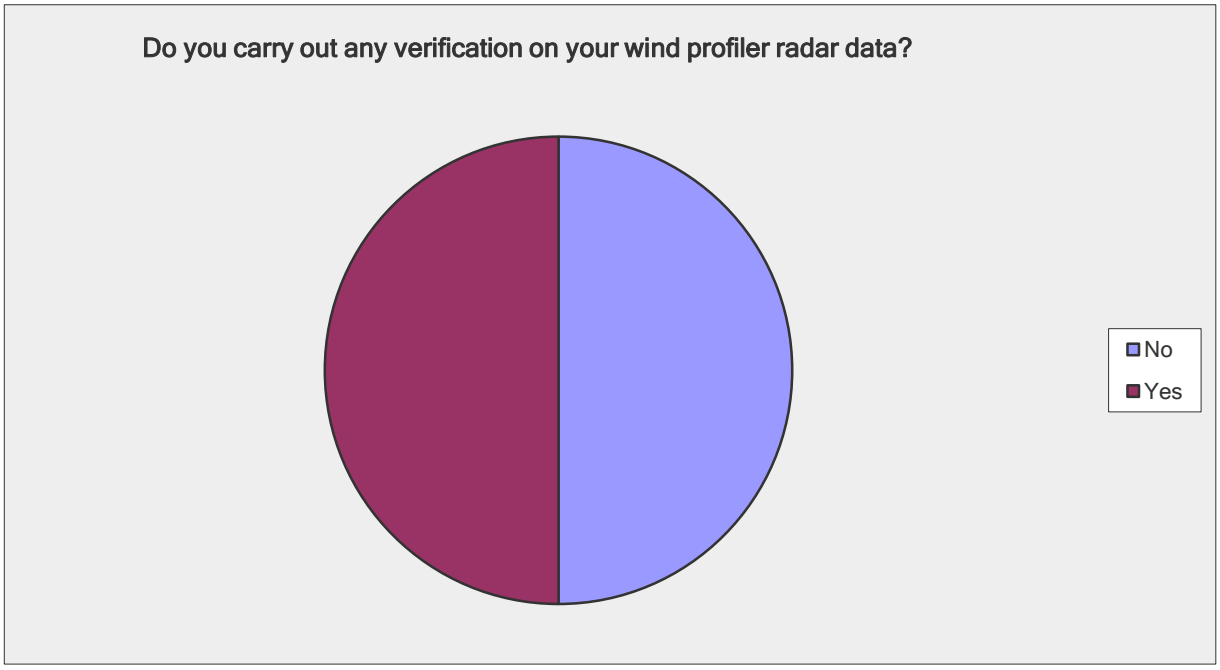
Answer Options	Response Percent	Response Count
Recommendation 1	100.0%	13
Recommendation 2	46.2%	6
Recommendation 3	23.1%	3
	answered question	13
	skipped question	33



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

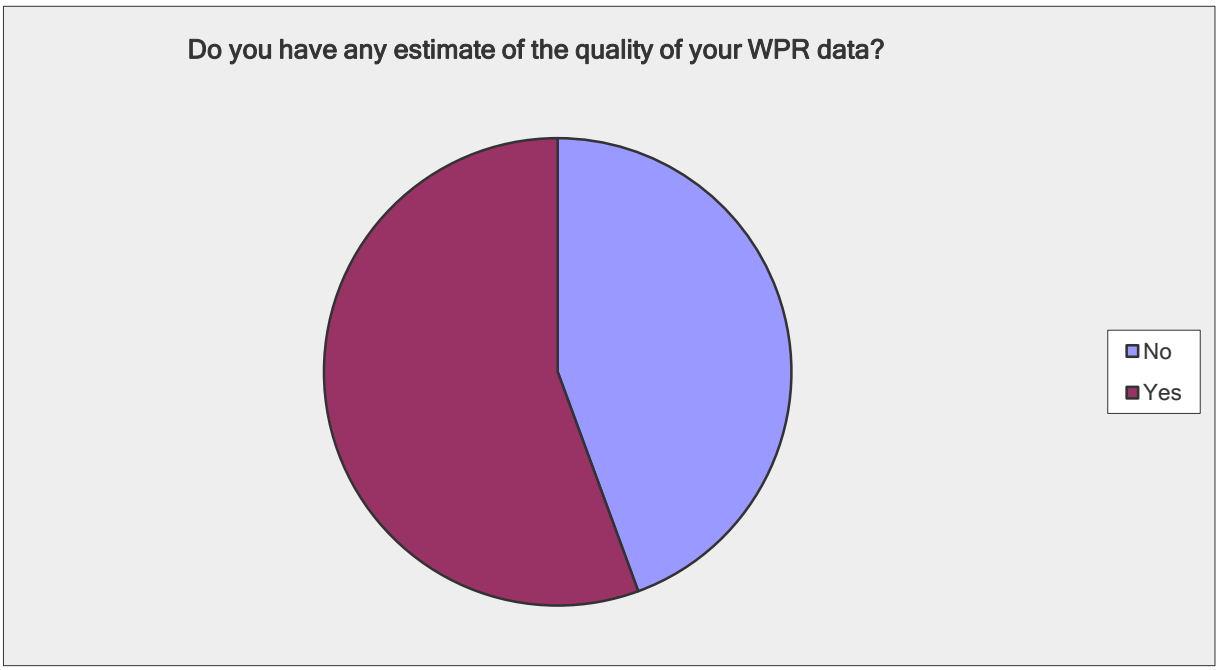
Do you carry out any verification on your wind profiler radar data?

Answer Options	Response Percent	Response Count
No	50.0%	9
Yes	50.0%	9
If Yes, please specify how the verification is carried out and how		9
answered question		18
skipped question		28



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

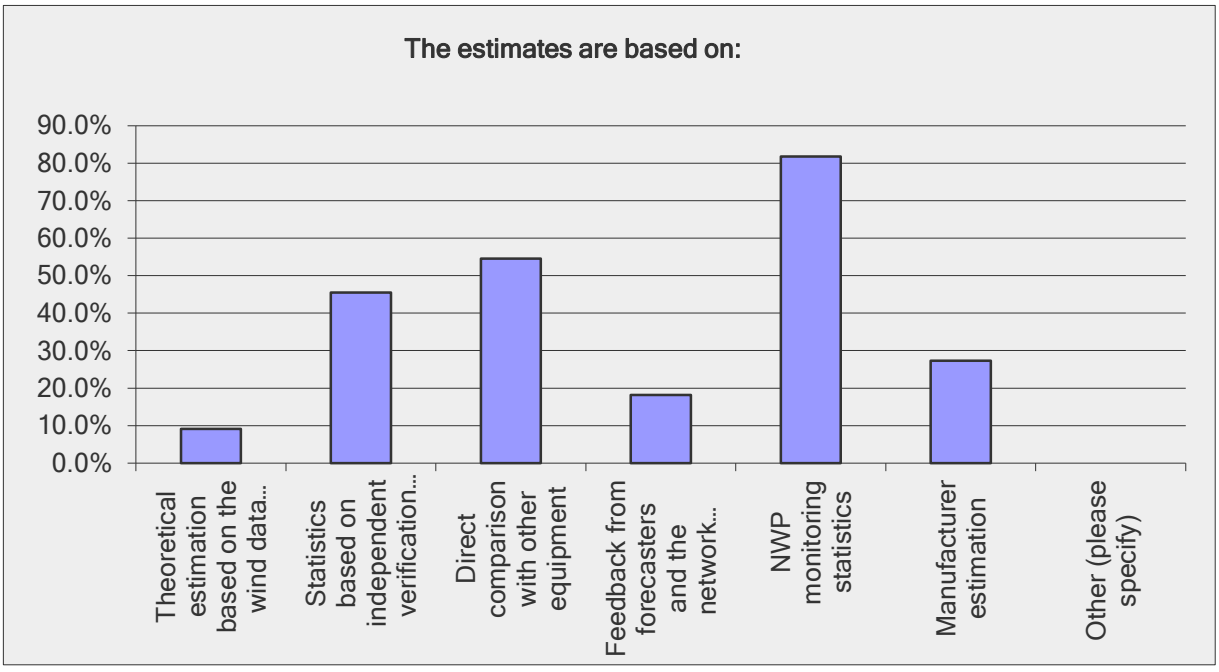
Do you have any estimate of the quality of your WPR data?		
Answer Options	**Response Percent**	**Response Count**
No	44.4%	8
Yes	55.6%	10
answered question		18
skipped question		28



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

The estimates are based on:

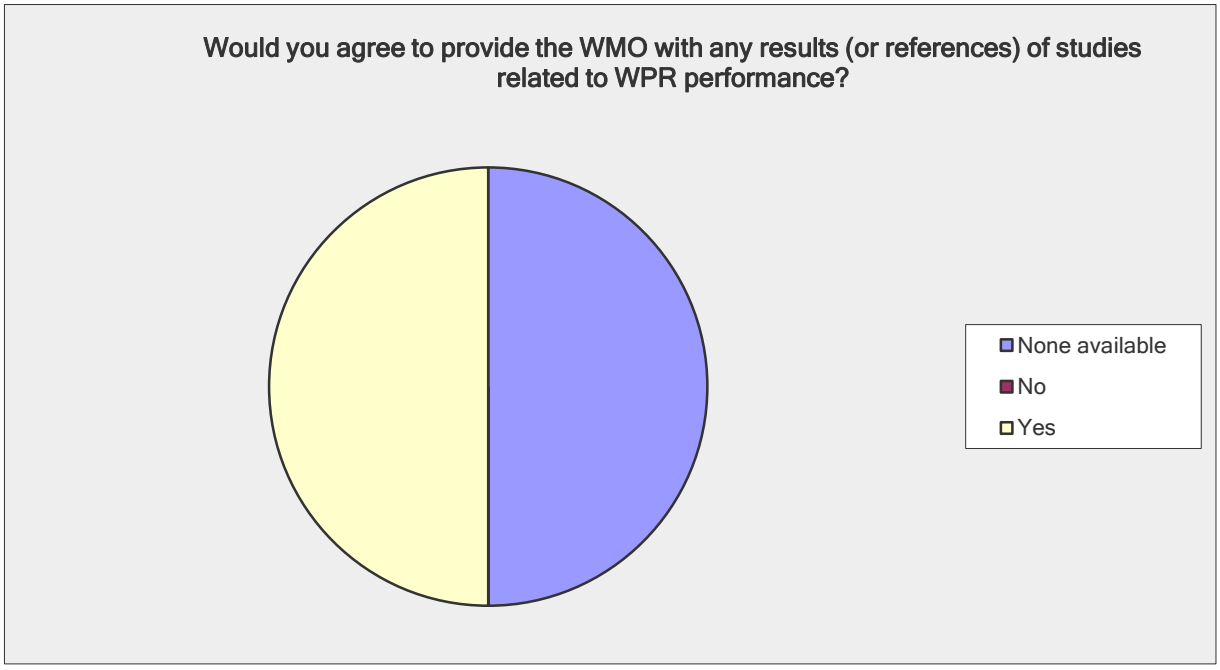
Answer Options	Response Percent	Response Count
Theoretical estimation based on the wind data	9.1%	1
Statistics based on independent verification data	45.5%	5
Direct comparison with other equipment	54.5%	6
Feedback from forecasters and the network operators	18.2%	2
NWP monitoring statistics	81.8%	9
Manufacturer estimation	27.3%	3
Other (please specify)	0.0%	0
	answered question	11
	skipped question	35



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Would you agree to provide the WMO with any results (or references) of studies related to WPR performance?

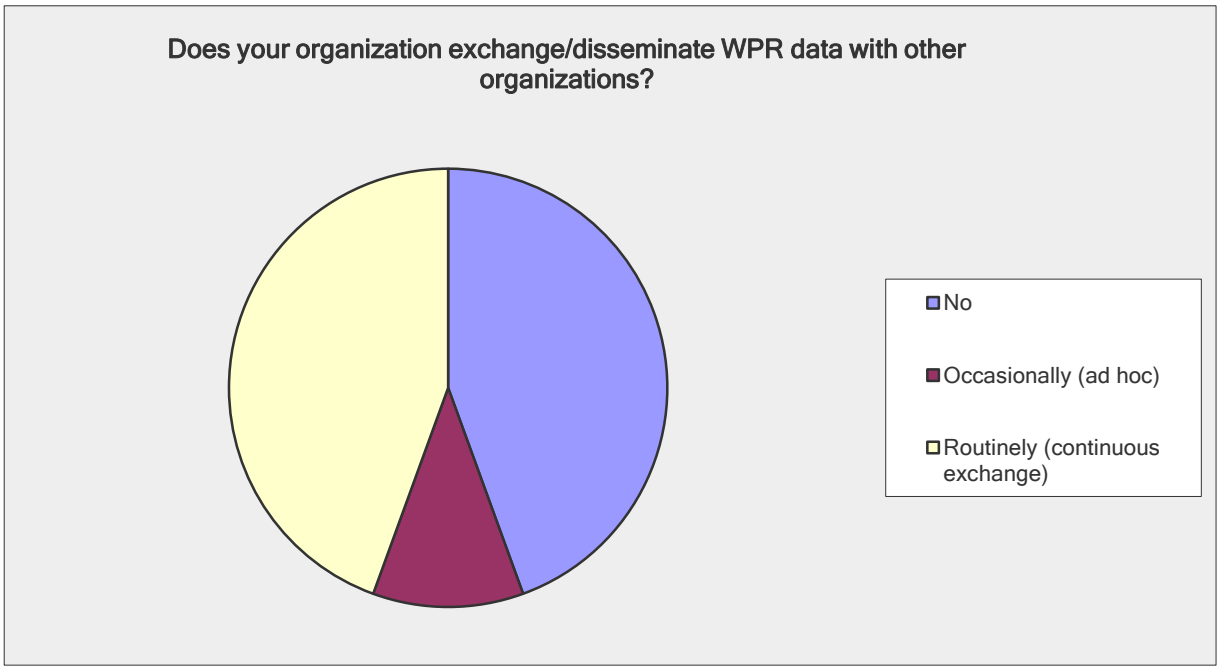
Answer Options	Response Percent	Response Count
None available	50.0%	9
No	0.0%	0
Yes	50.0%	9
answered question		18
skipped question		28



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

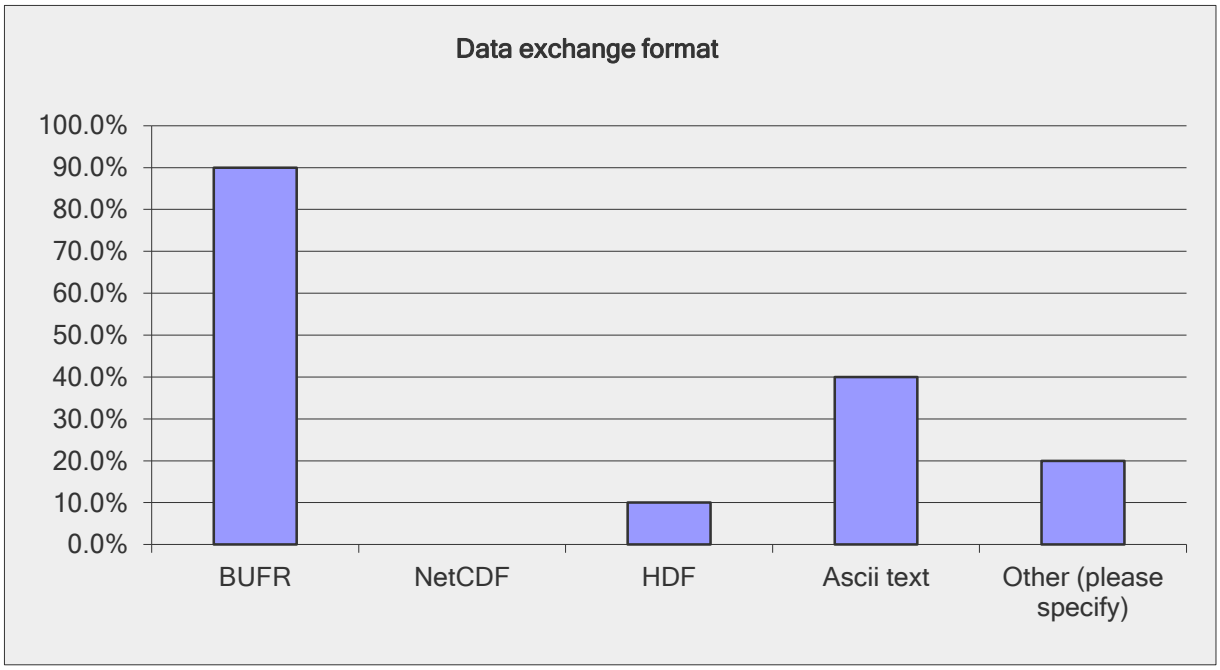
Does your organization exchange/disseminate WPR data with other organizations?

Answer Options	Response Percent	Response Count
No	44.4%	8
Occasionally (ad hoc)	11.1%	2
Routinely (continuous exchange)	44.4%	8
answered question		18
skipped question		28



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

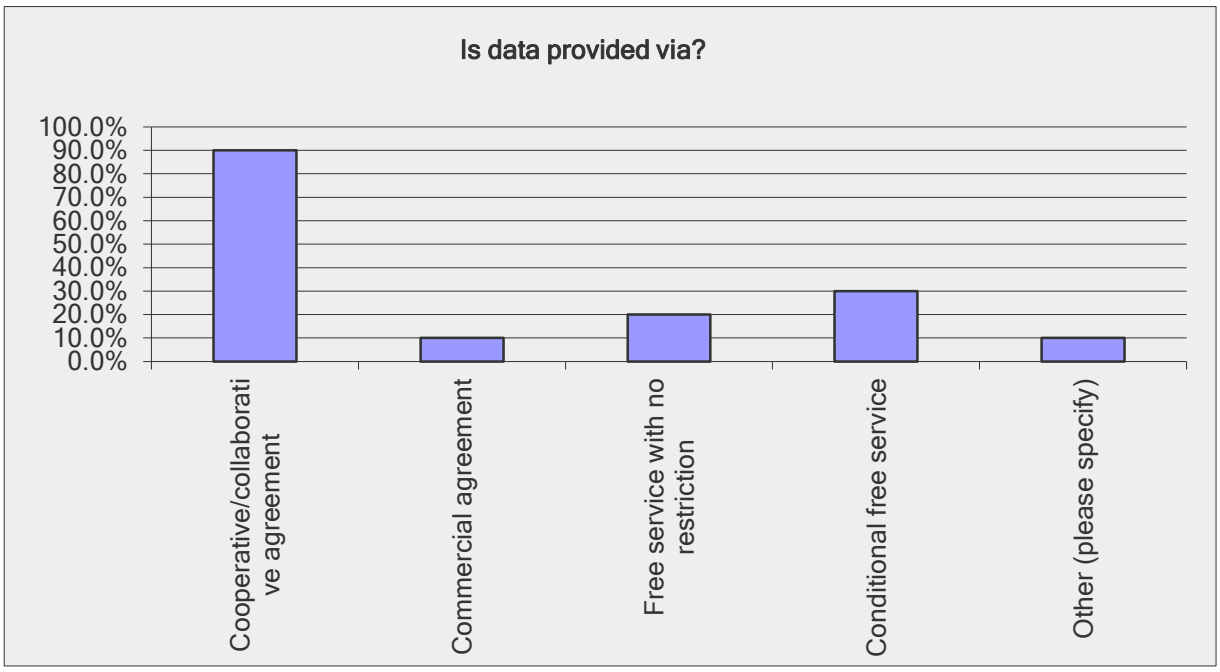
Data exchange format		
Answer Options	**Response Percent**	**Response Count**
BUFR	90.0%	9
NetCDF	0.0%	0
HDF	10.0%	1
Ascii text	40.0%	4
Other (please specify)	20.0%	2
	answered question	10
	skipped question	36



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Is data provided via?

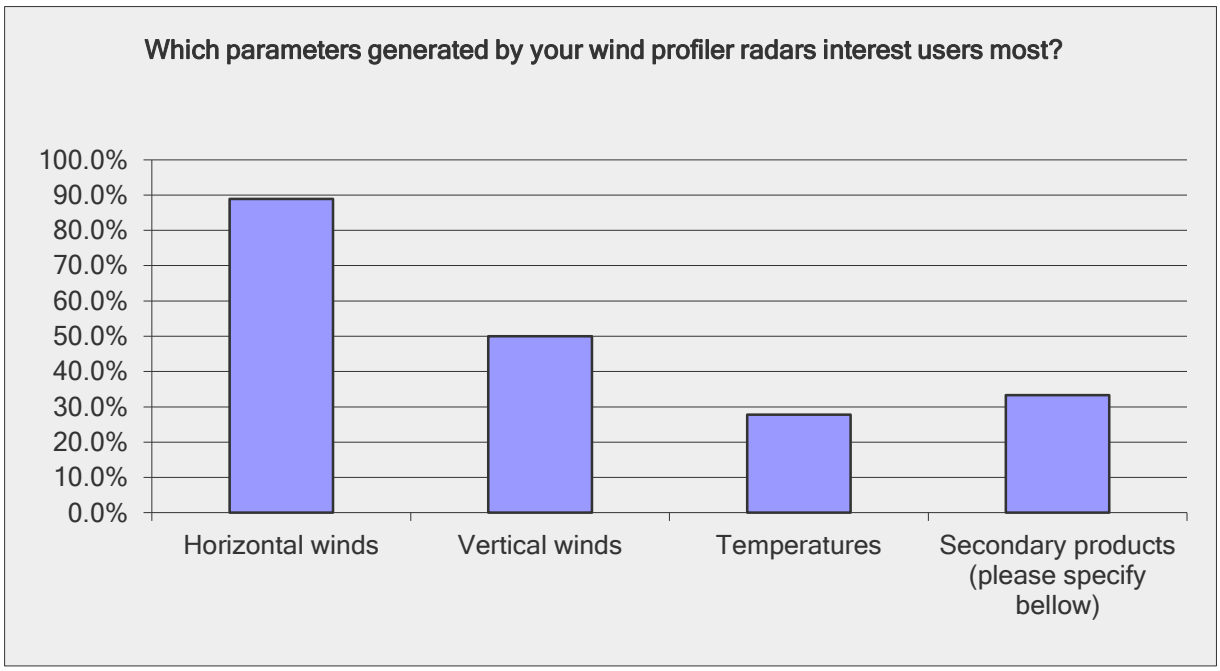
Answer Options	Response Percent	Response Count
Cooperative/collaborative agreement	90.0%	9
Commercial agreement	10.0%	1
Free service with no restriction	20.0%	2
Conditional free service	30.0%	3
Other (please specify)	10.0%	1
	answered question	10
	skipped question	36



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Which parameters generated by your wind profiler radars interest users most?

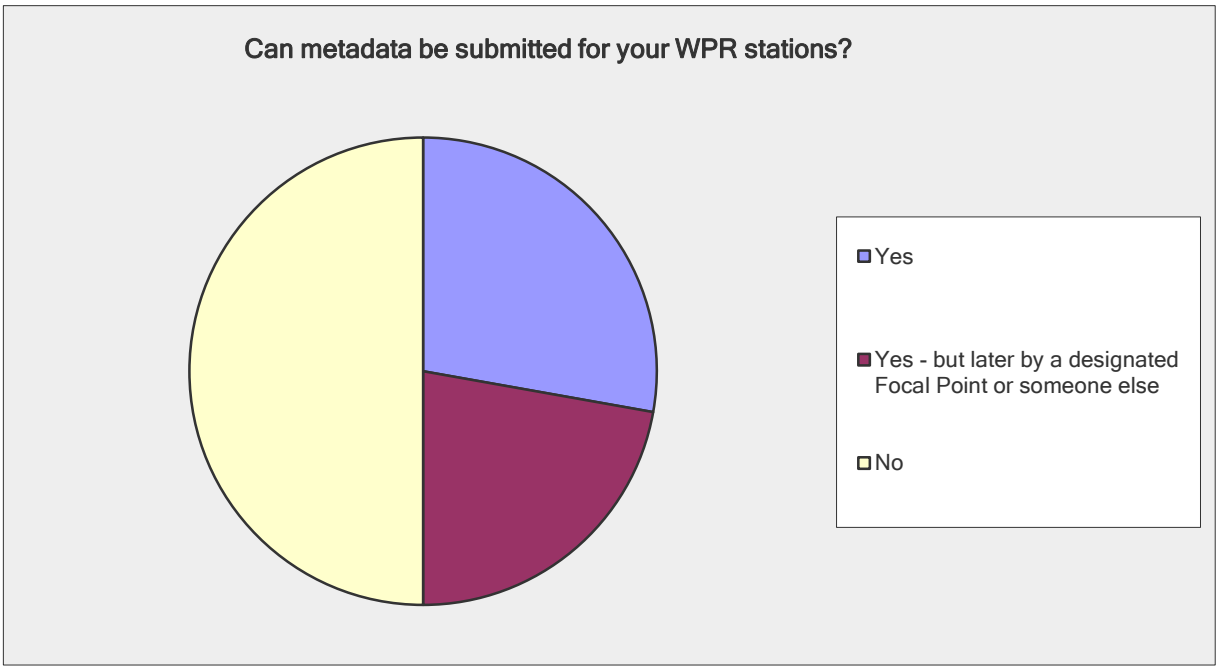
Answer Options	Response Percent	Response Count
Horizontal winds	88.9%	16
Vertical winds	50.0%	9
Temperatures	27.8%	5
Secondary products (please specify bellow)	33.3%	6
	answered question	18
	skipped question	28



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

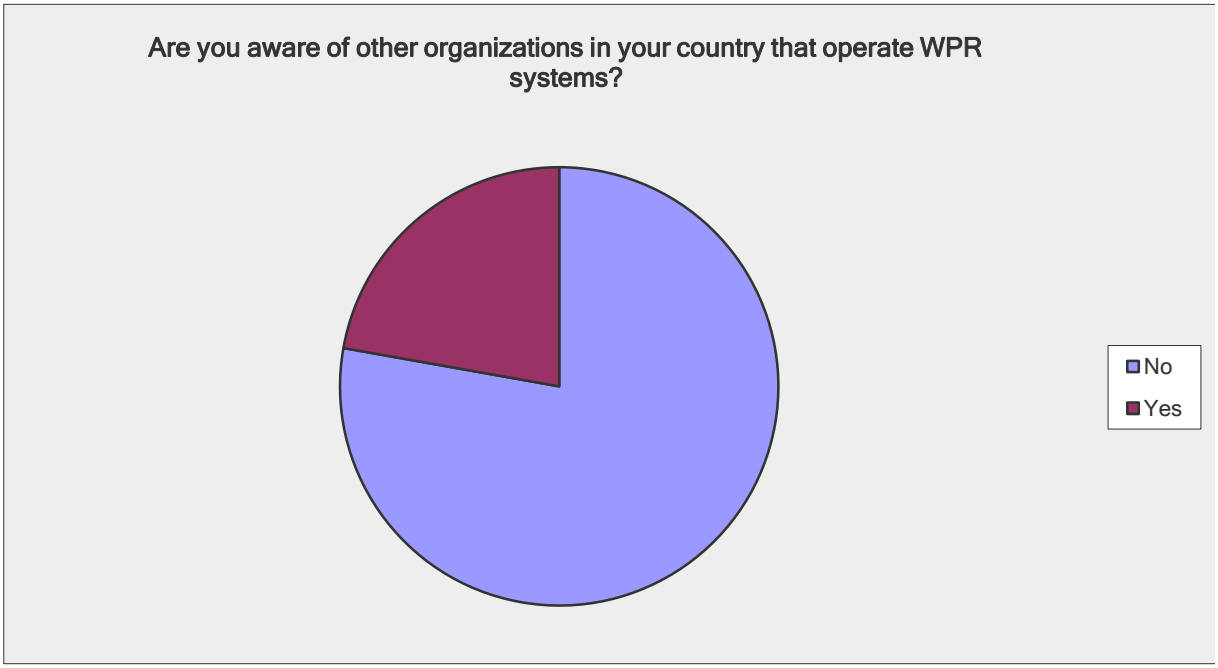
Can metadata be submitted for your WPR stations?

Answer Options	Response Percent	Response Count
Yes	27.8%	5
Yes - but later by a designated Focal Point or someone	22.2%	4
No	50.0%	9
If later, please provide expected date of submission; If No, please provide		5
answered question		18
skipped question		28



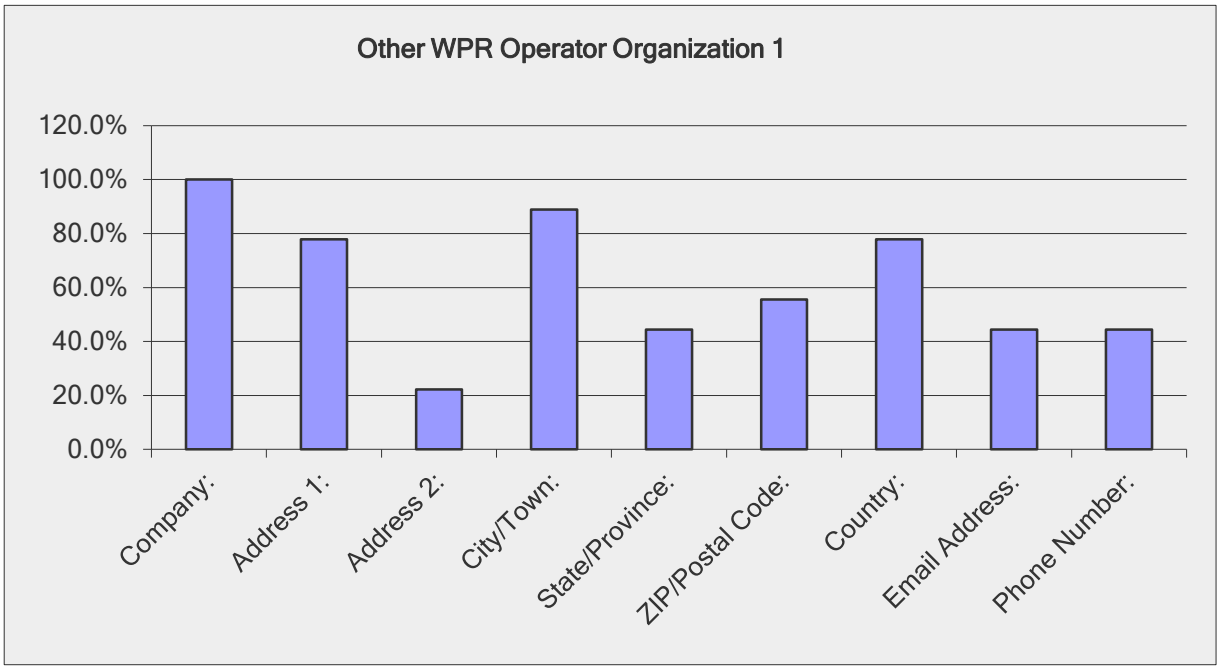
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Are you aware of other organizations in your country that operate WPR systems?		
Answer Options	**Response Percent**	**Response Count**
No	77.8%	35
Yes	22.2%	10
	answered question	45
	skipped question	1



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Other WPR Operator Organization 1		
Answer Options	**Response Percent**	**Response Count**
Company:	100.0%	9
Address 1:	77.8%	7
Address 2:	22.2%	2
City/Town:	88.9%	8
State/Province:	44.4%	4
ZIP/Postal Code:	55.6%	5
Country:	77.8%	7
Email Address:	44.4%	4
Phone Number:	44.4%	4
	answered question	**9**
	skipped question	**37**

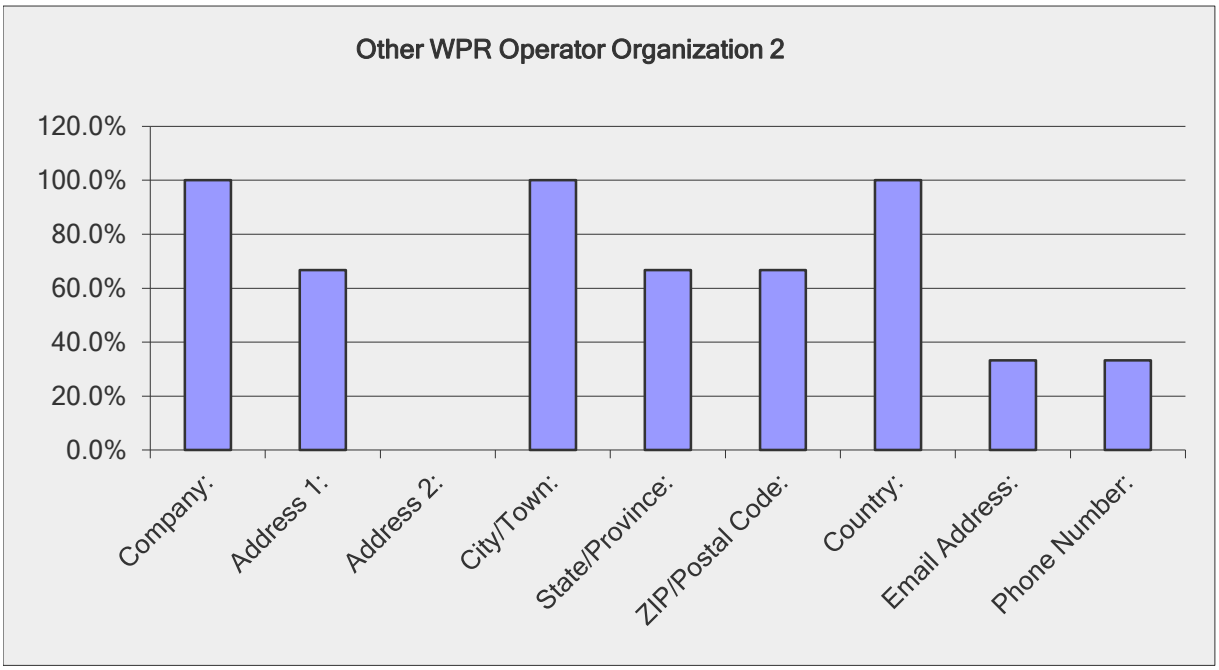


CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Number of WPR systems Organization 1	
Answer Options	Response Count
	8
answered question	8
skipped question	38

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Other WPR Operator Organization 2		
Answer Options	**Response Percent**	**Response Count**
Company:	100.0%	3
Address 1:	66.7%	2
Address 2:	0.0%	0
City/Town:	100.0%	3
State/Province:	66.7%	2
ZIP/Postal Code:	66.7%	2
Country:	100.0%	3
Email Address:	33.3%	1
Phone Number:	33.3%	1
	answered question	**3**
	skipped question	**43**

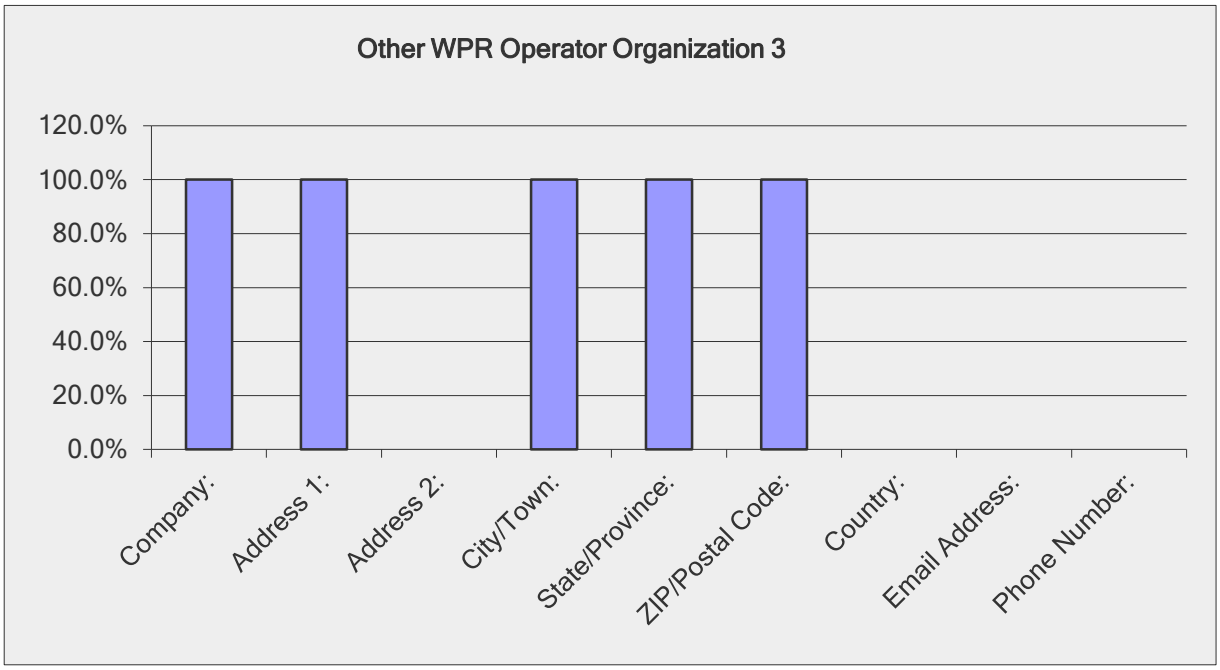


CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Number of WPR systems Organization 2	
Answer Options	Response Count
	3
answered question	3
skipped question	43

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Other WPR Operator Organization 3		
Answer Options	**Response Percent**	**Response Count**
Company:	100.0%	1
Address 1:	100.0%	1
Address 2:	0.0%	0
City/Town:	100.0%	1
State/Province:	100.0%	1
ZIP/Postal Code:	100.0%	1
Country:	0.0%	0
Email Address:	0.0%	0
Phone Number:	0.0%	0
	answered question	1
	skipped question	45



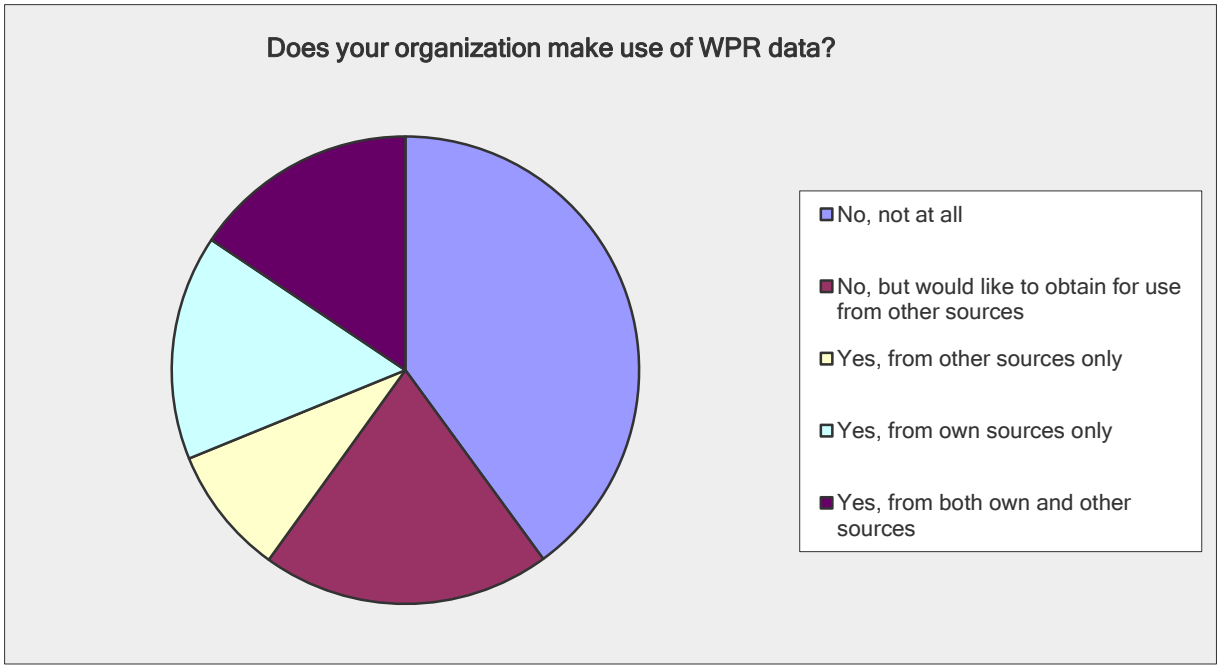
CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Number of WPR systems Organization 3	
Answer Options	Response Count
	2
answered question	2
skipped question	44

CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

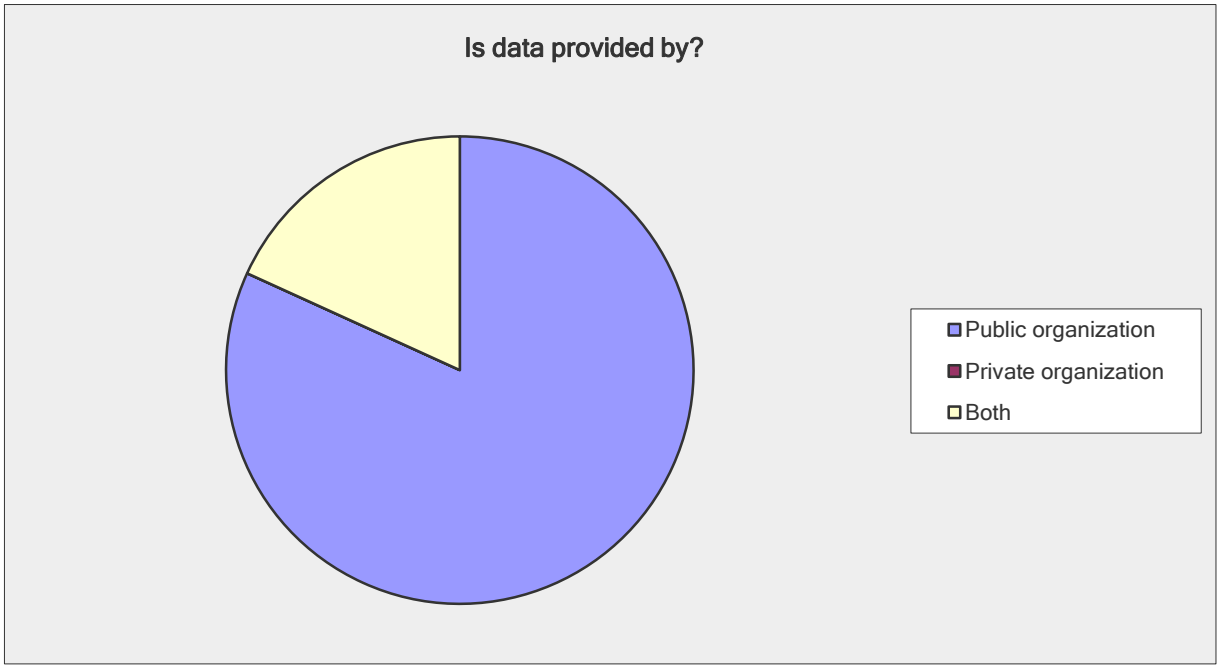
Does your organization make use of WPR data?

Answer Options	Response Percent	Response Count
No, not at all	40.0%	18
No, but would like to obtain for use from other sources	20.0%	9
Yes, from other sources only	8.9%	4
Yes, from own sources only	15.6%	7
Yes, from both own and other sources	15.6%	7
answered question		45
skipped question		1



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Is data provided by?		
Answer Options	**Response Percent**	**Response Count**
Public organization	81.8%	9
Private organization	0.0%	0
Both	18.2%	2
	answered question	11
	skipped question	35



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Prioritize the use of wind profiler radars data in your organization:

Answer Options	High	Medium	Low
Climate research	2	4	10
Global NWP	5	5	2
High resolution NWP (regional)	8	5	3
Synoptic meteorology	8	3	7
Seasonal& inter-annual monitoring	2	2	11
Now casting	8	9	3
Atmospheric chemistry	1	3	6
Aeronautical meteorology	9	7	2
Agricultural meteorology	1	0	6
Hydrology and water resources	0	2	3
Other	1	0	3
Other use			

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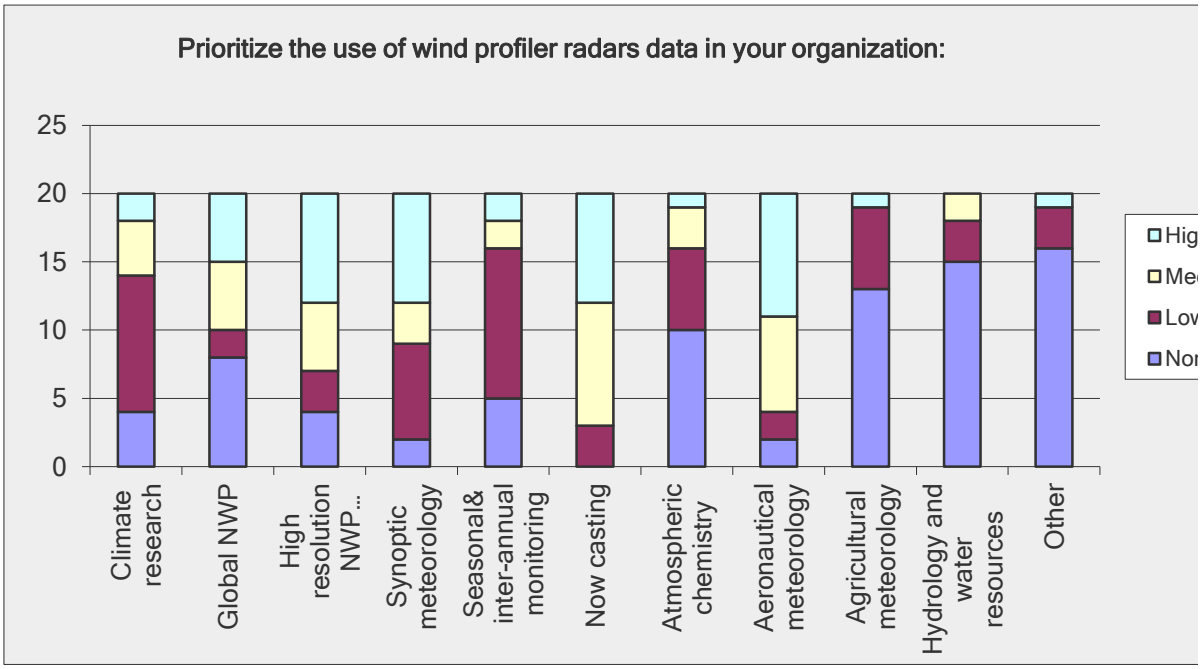
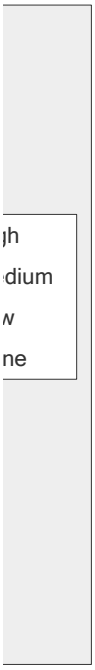


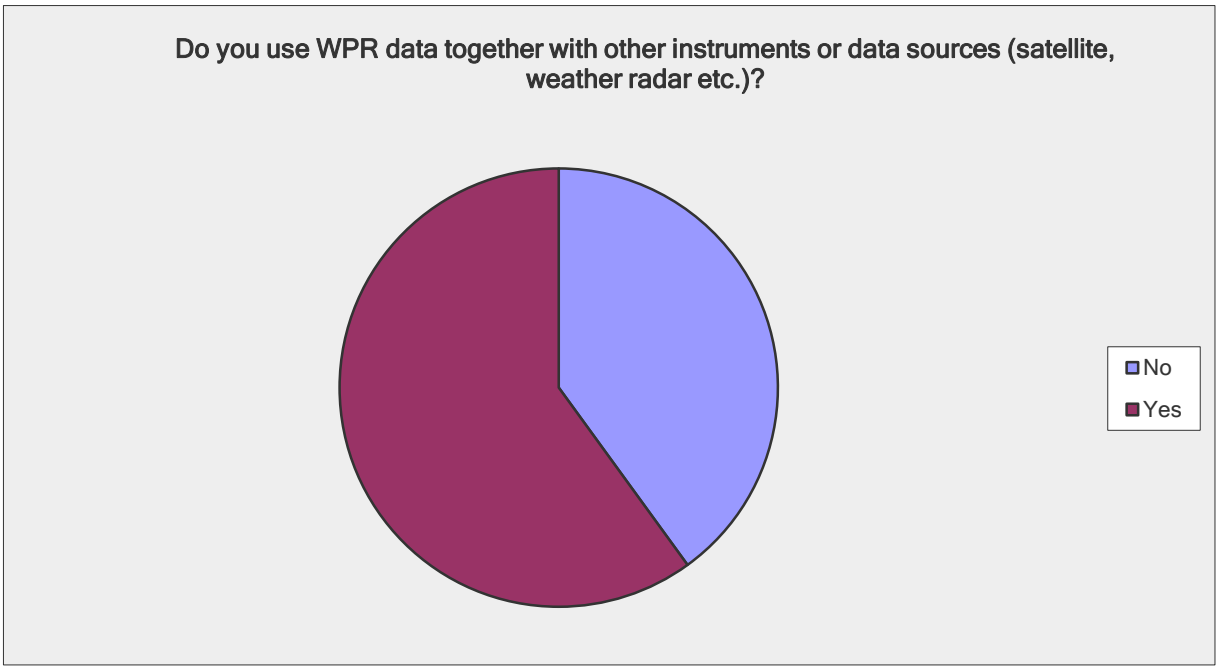
None	Response Count
4	20
8	20
4	20
2	20
5	20
0	20
10	20
2	20
13	20
15	20
16	20
	3
swered question	20
kipped question	26



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Do you use WPR data together with other instruments or data sources (satellite, weather radar etc.)?

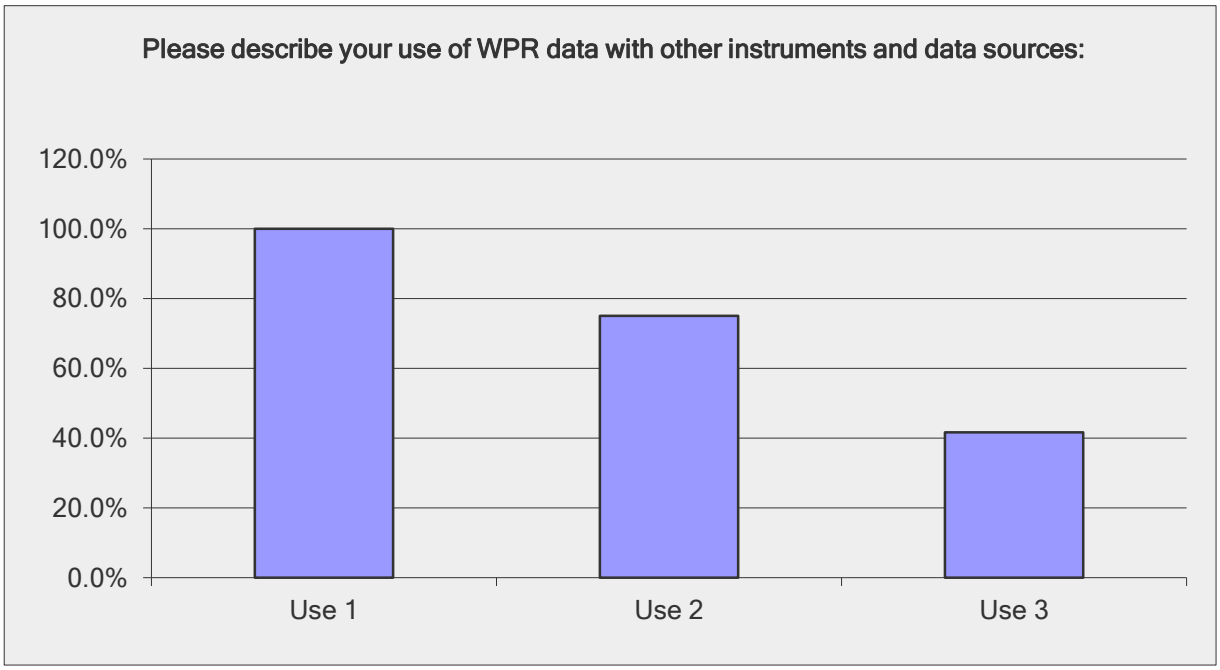
Answer Options	Response Percent	Response Count
No	40.0%	8
Yes	60.0%	12
answered question		20
skipped question		26



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Please describe your use of WPR data with other instruments and data sources:

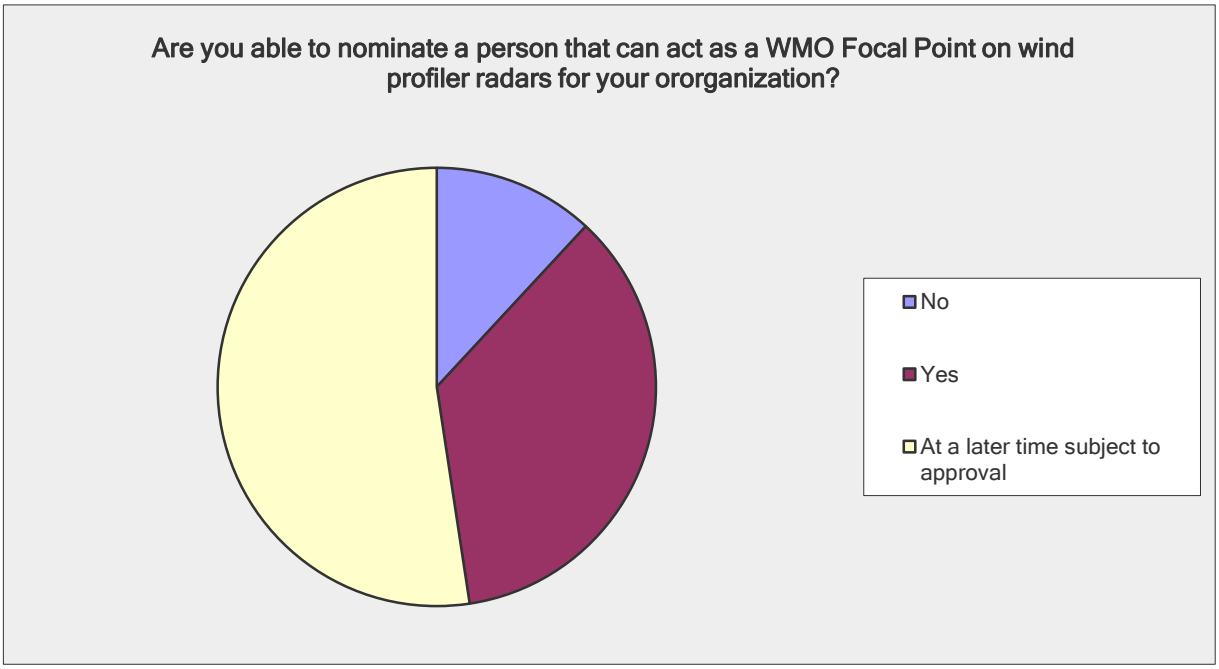
Answer Options	Response Percent	Response Count
Use 1	100.0%	12
Use 2	75.0%	9
Use 3	41.7%	5
	answered question	12
	skipped question	34



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Are you able to nominate a person that can act as a WMO Focal Point on wind profiler radars for your ororganization?

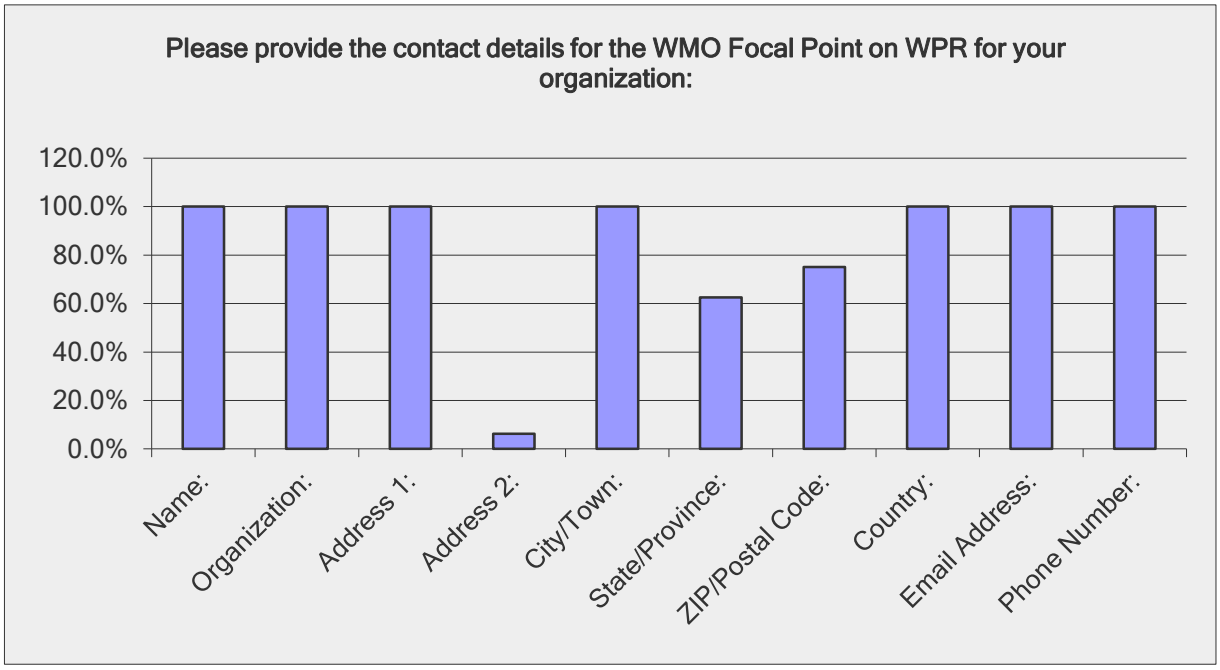
Answer Options	Response Percent	Response Count
No	11.9%	5
Yes	35.7%	15
At a later time subject to approval	52.4%	22
	answered question	42
	skipped question	4



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Please provide the contact details for the WMO Focal Point on WPR for your organization:

Answer Options	Response Percent	Response Count
Name:	100.0%	16
Organization:	100.0%	16
Address 1:	100.0%	16
Address 2:	6.3%	1
City/Town:	100.0%	16
State/Province:	62.5%	10
ZIP/Postal Code:	75.0%	12
Country:	100.0%	16
Email Address:	100.0%	16
Phone Number:	100.0%	16
	answered question	16
	skipped question	30



CBS ET-SBO Questionnaire on Member Utilisation of Radar Wind Profilers

Please provide any additional information relating to this survey that you think might provide clarification or be useful. Thank you.

Answer Options	Response Count
	14
answered question	14
skipped question	32