

# A COMPREHENSIVE WORLDWIDE WEB-BASED WEATHER RADAR DATABASE

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## Abstract

The fourteenth session of the Commission for Instruments and Methods of Observation (CIMO) requested the Expert Team on Remote-Sensing Upper-Air Technology and Techniques to establish a fully comprehensive web based database of the global use of weather radars. In this context a survey has been carried out and a worldwide weather radar database web page is being established.

## 1. Introduction

It has been already proven that, Doppler Weather Radar is an essential precipitation observing system in meteorology for very large scale areas. They have been and will continue to be a very important meteorological tool in severe weather warnings, precipitation estimation and its spatial distribution, air traffic management, disaster management, numerical weather prediction (verification and data assimilation), agriculture, hydrological, weather modification and climate applications. Radar networks have developed in many countries and often have competing requirements resulting in multiple networks created by different internal agencies and not just NHMS's.

## 2. Weather Radar Survey

Several reasons for establishing this database:

- Presenting a comprehensive web-based database for radar network planning information and resource allocation for all members
- Assessing the global state of weather radars
- Assisting a wide spread international exchange of radar data
- Presenting common issues/problems and potential solutions gathered by questionnaire

Weather radars have traditionally been used for local or regional applications but with long term climate studies, use of radar for validation of high resolution Numerical Weather Prediction, use in assimilation into NWP models and distributed hydrological models, cross-border data exchange, their use and the quality of the radar data is now a global resource. The purpose of the survey is to begin to assess the availability, the uses and the quality of the radar data and the practices of radar maintenance and support.

The survey will also help in the global protection of radio-frequencies used by weather radar. The information requested in the spread sheet will help demonstrate the widespread use of weather radar and the technical specification. Even partial information would be useful for protecting radio-frequency spectrum allocation.

To establish database a questionnaire has been prepared which has following main sections and have been distributed all WMO members: Radar site(s) information, Radar hardware characteristics, Owner information and Data, products and applications. Gathering replies from members have been carried out and will be continued to keep the web site up-to-date.

### 2.1. Overview of the survey

The survey has four main sections on the following themes:

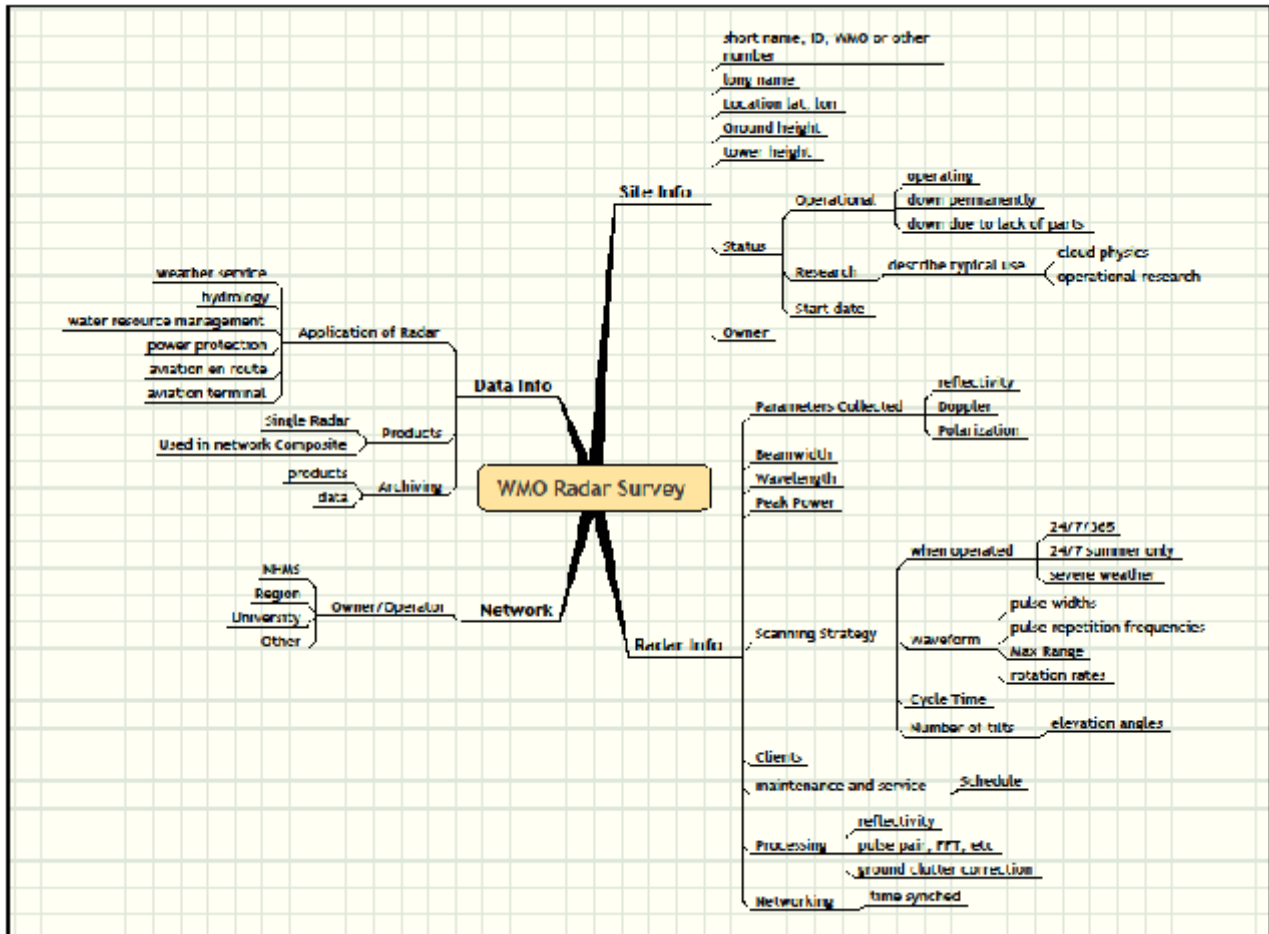
- a. Radar site(s) information
- b. Radar hardware characteristics
- c. Owner information
- d. Data, products and applications

The radar survey is composed of a questionnaire (word document) and a spread sheet (excel document) and available from:

<http://www.wmo.int/pages/prog/www/Questionnaires.html>

“Questionnaire on Weather Radars” is placed in Annex I and “Spreadsheet” is placed in Annex II of this document.

**Questionnaire content diagram:**



**2.2. Replies and initial results of the survey**

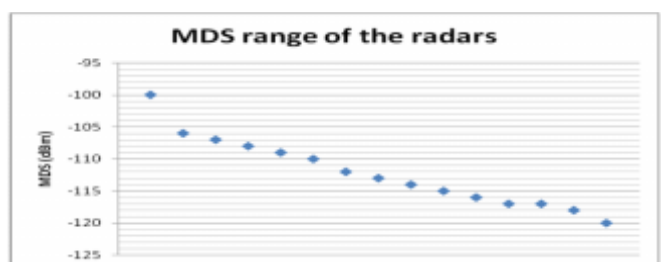
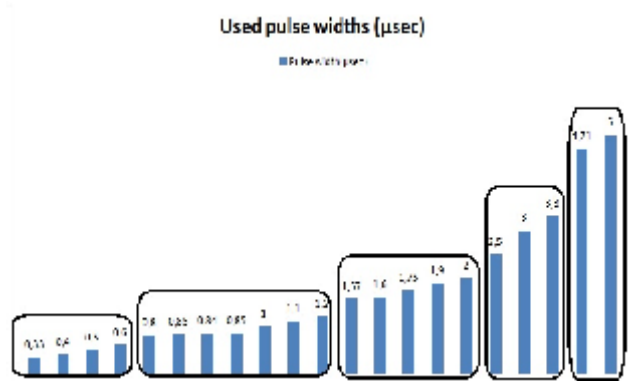
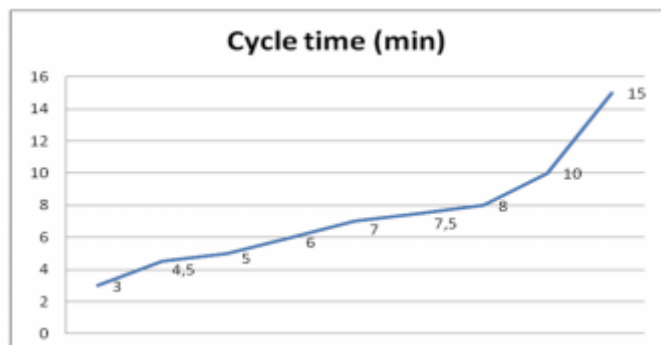
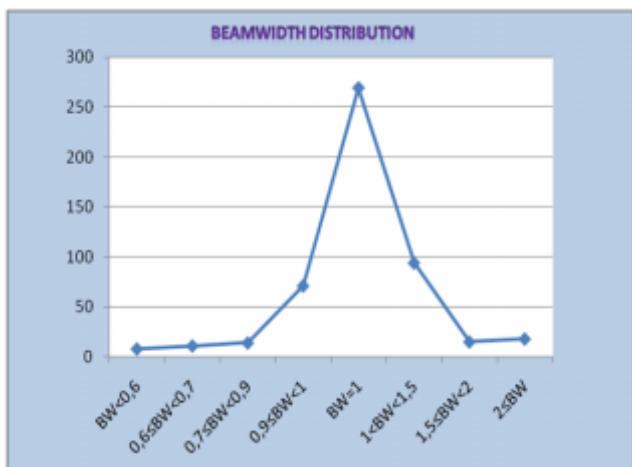
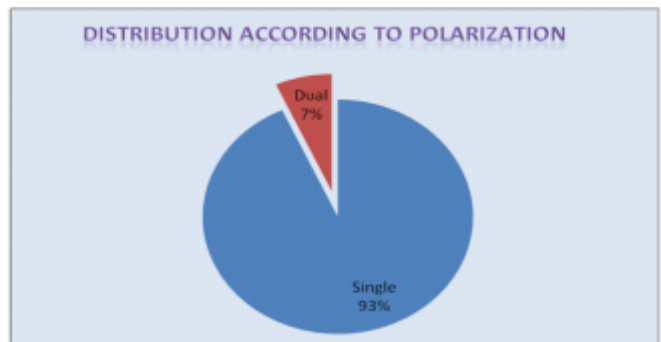
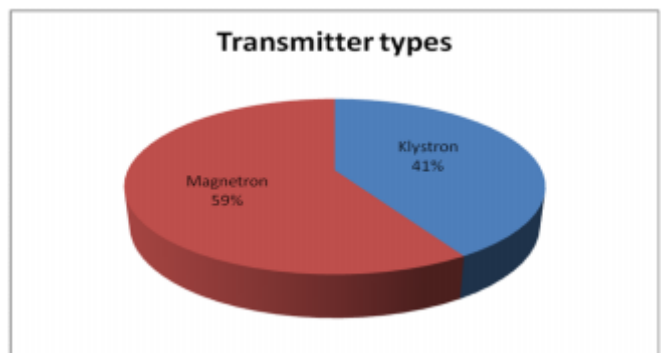
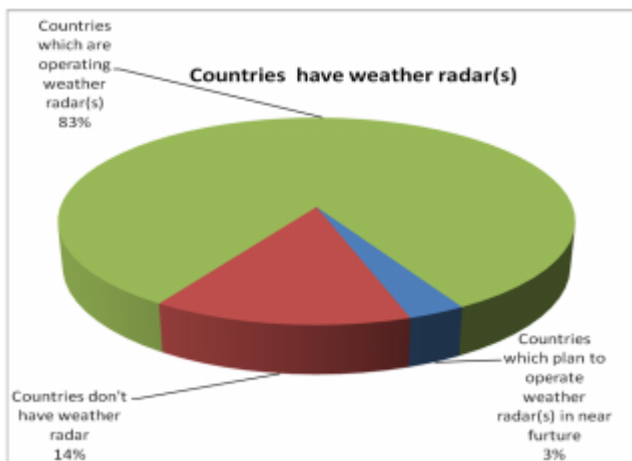
Totally 66 countries have been replied the questionnaire. 11 countries including Bosnia Herzegovina, Chile, Egypt, Kazakhstan, Kyrgyzstan, Mauritius, Monaco, Seychelles, Sudan, Uruguay, and Zambia informed that they are not operating weather radar. 7 countries including Algeria, Argentina, Botswana, China, Korea, Malaysia and Russia replied questionnaire due to they are operating weather radars, but their filled spread sheet haven't reached. There is no information regarding with the number and type of the radars operated by this countries for this reason. Totally 517 weather radar information have been sent by remaining 48 countries. The following table contains the list of these countries.

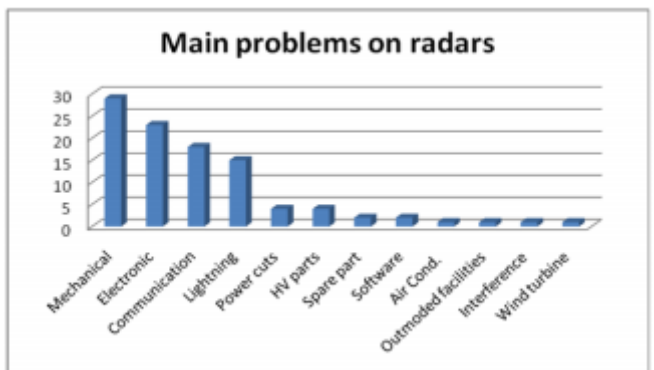
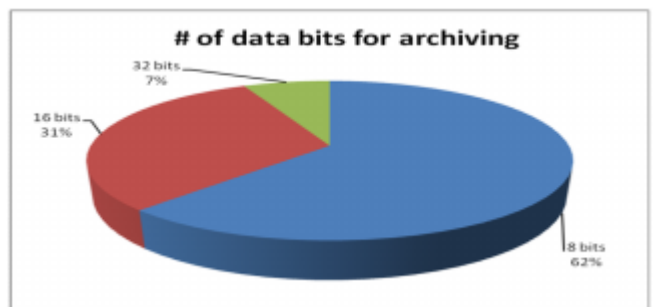
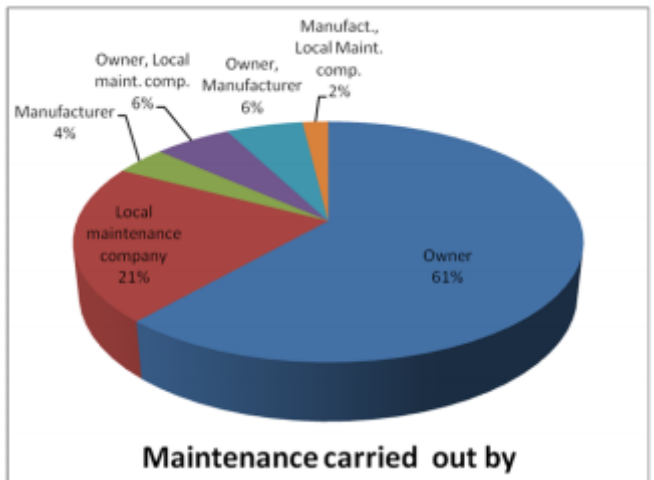
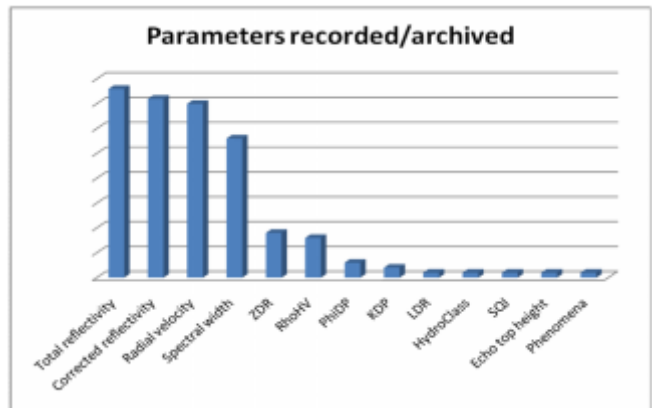
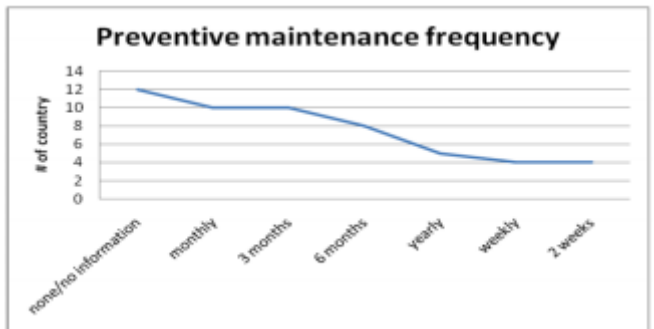
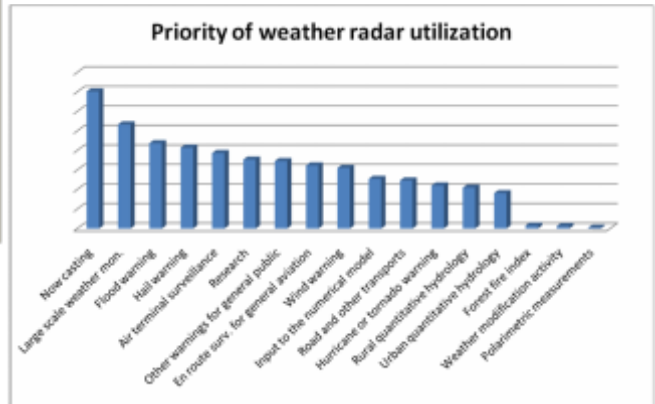
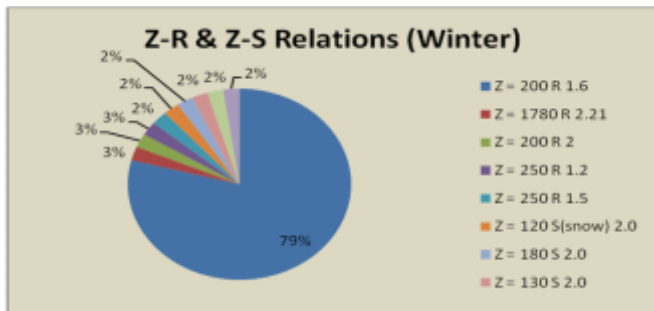
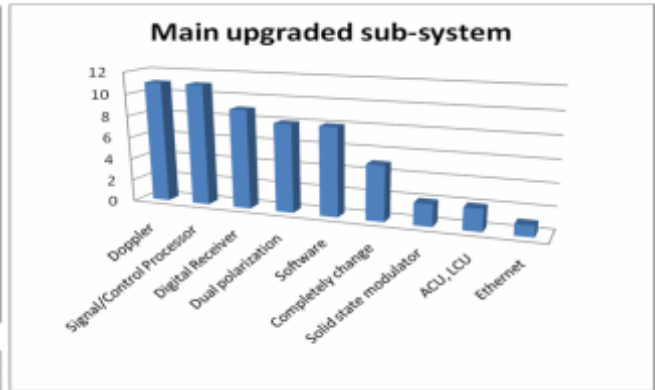
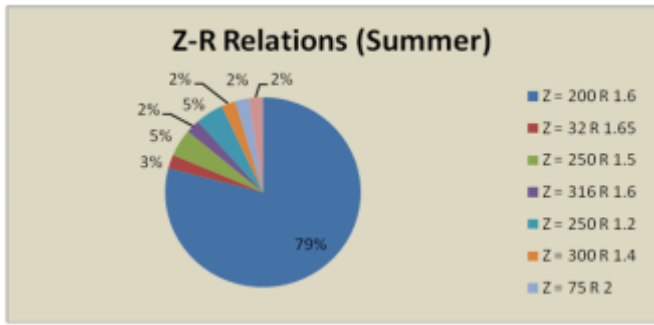
Country	Radar #	Country	Radar #	Country	Radar #
Austria	5	Hungary	3	Serbia	14
Azerbaijan	2	Iceland	1	Singapore	1
Bangladesh	5	Indonesia	19	Slovakia	2
Belarus	3	Iran	5	Slovenia	1
Belgium	2	Israel	1	South Africa	24
Belize	1	Italy	22	Spain	15
Brazil	2	Japan	29	Sweden	12
Bulgaria	3	Jordan	1	Thailand	26
Canada	31	Latvia	1	Trinidad & Tobago	1
Croatia	2	Myanmar	1	Tunisia	1

Cyprus	1	Netherlands	2	Turkey	6
Estonia	2	New Zealand	6	Ukraine	7
Finland	8	Norway	8	United Arab Emirates	6
France	24	Pakistan	7	United Kingdom	16
Germany	16	Panama	1	USA	159
Hong Kong	3	Poland	8	Uzbekistan	1

A considerable amount of countries except of these 66 countries have not replied the questionnaire yet. These countries include Australia, Denmark, India, Greece, Portugal, Saudi Arabia and so on. It is expected that after completing missing information, this number will be doubled. Especially, impact of the data which will be gathered from China, Australia, Russia, India, Korea and airports of USA can be expected to increase the numbers fairly and change the graphs in the report given below. Full report can be reached from WMO web page and weather radar database web page which is being developed.

**2.3. Sample graphs from the "Weather Radar Survey Report" which are planning to be published together with whole graphs and key findings in "weather radar database web page".**





**Samples for archived amount of data:**

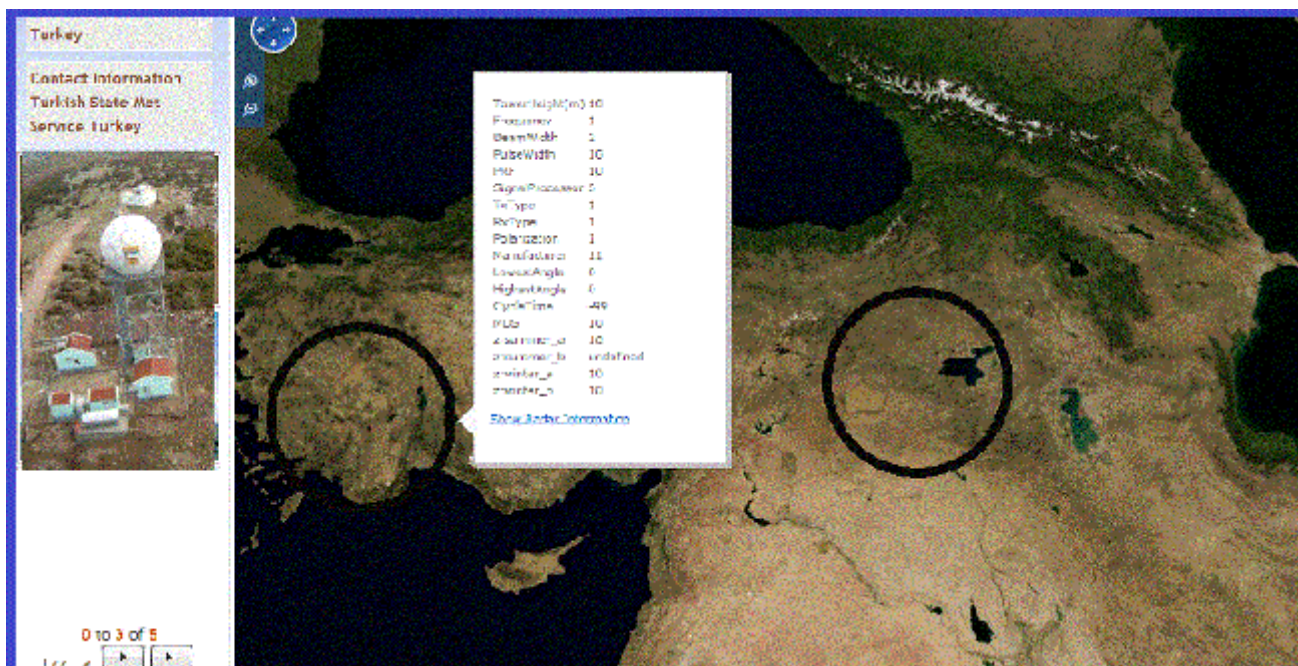
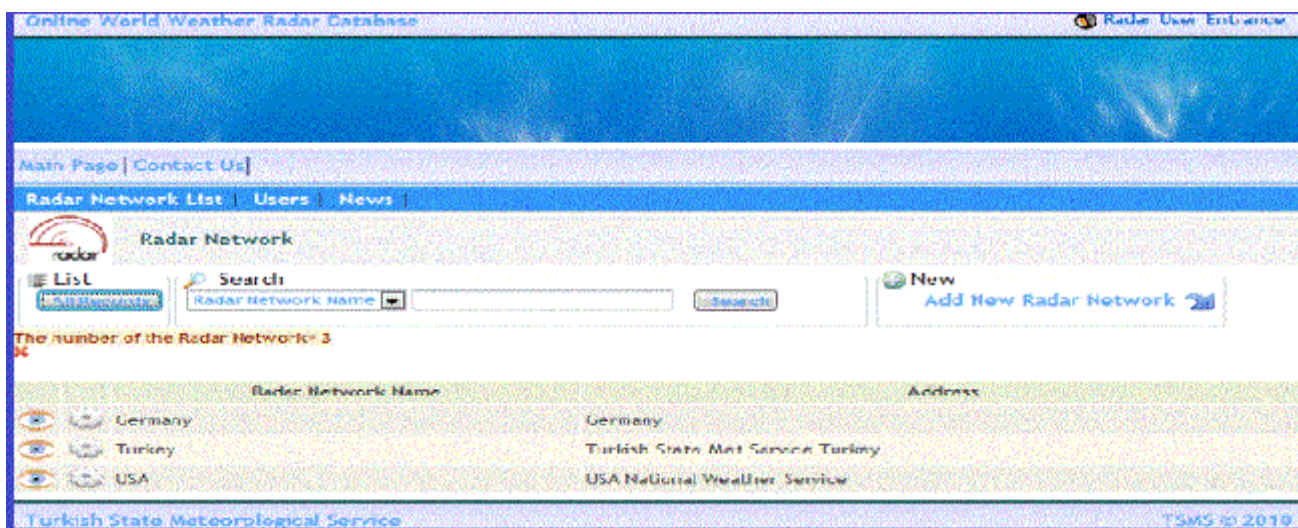
USA (159 radars)	>500 TB/year
Canada (31 radars)	2.5 TB/year
New Zealand (6 radars)	1.5 TB/year
Netherlands (2 radars)	365 GB/year
Argentina (2 radars)	51.6 GB/year
Slovenia (1 radar)	30 GB/year

### 3. Worldwide weather radar database web page

The process of gathering replies from countries which have not responded the questionnaire and the countries replied the questionnaire but not completed spread sheet will be continued. Methods for collecting the required data from operators of weather radars except of NHMSs (like universities, airports, TV stations) should be searched and applied. Methods for collecting the required data from these users and keeping the database up-to-date should be developed. In this context spreading/gathering the questionnaire could be continued during courses and other activities organized by WMO and in web page desing, every authorized member can update the information about their country's radar network.

Gathered data will be presented by a webpage which will be hosted by Turkish State Meteorological Service (TSMS) and can be accessible through a link placed in the web page of WMO. Weather radar networks will be able to be searched according to the parameters and all parameters of radar can be observed via this web page. There will be authorized persons who can update their network by approval of web page responsible people.

#### Sample views from the web page under development:



The screenshot displays a web interface for radar data. At the top, there are navigation links: 'Main Page | Contact Us | Radar Network List | Users | News'. Below this, the page is titled 'Turkey' and has sub-links: 'Radar Network | Radars | Specification | Specification All | User List | User Note | Picture | File'. A 'Responsible People' table lists 'Serkan Emiruglu' with a 'Smml' checkbox checked. The 'Records' section shows a table for Radar No: 1 with the following data:

Radar No	1	Reg. Date	28.05.2010
Frequency	S Band (2000-4000 MHz/15-7.5 m)	Latitude (":':")	39230000
Height	10	Tower Height	10
Lowest Angle	2.00	Highest Angle	2.00
Manufacturer	MTS - Mitsubishi Electric Corporation, Japan	Polarization	Single
PRF	10	TX Type	Magnetron
ZR Summer a	10	ZR Summer b	10
Açıklama	detaylı	ZR Winter a	10
		ZR Winter b	10
		Reg. Date	28.05.2010
		Establish Date	29.05.2010
		Beam Width	1.00
		Pulse Width (µSec)	10
		Cycle Time (minute)	10
		MDS (dBm)	10
		Signal Processor	RYPE
		RX Type	

The footer of the page includes 'Turkish State Meteorological Service' and 'TSMS © 2010'.

#### 4. Evaluation

Replies to the questionnaire which is prepared for establishing a comprehensive web-based weather radar database are very encouraging. Even though there are some missing data in returned questionnaires, there is a positive tendency for collaboration on weather radars for several reasons.

Firstly, countries need to exchange radar data like other meteorological data with other countries for improving the capabilities for the services provided. Main areas of utilities from radars in developing countries are Nowcasting, warning and surveillance. But some advanced usages like input into Numerical Weather Prediction (NWP) models may be one of the main usages in developed countries in future.

Secondly, weather radars are quite sophisticated and expensive observing systems. They are subject to continuous improvement with new technologies and planning radar network is a crucial issue. However, resources of countries for such expensive operations are limited. This kind of surveys and establishing a database can be helpful for user for planning, lead to establish some standards on some issues like data exchange and calibration, steer manufacturers to some goals and new improvements.

Another important point based on the gathered data from the replies to questionnaire is training. It can be seen that there is a huge gap between countries in this area.

Improving data quality of operational radars should be taken into consideration also. This can be achieved by wide spreading applications of correction algorithms like beam blockage correction, attenuation correction, Z-R relation studies, calibration methods and maintenance studies by trainings or encouraging collaboration between countries .

Establishing weather radar database web page presently has been performed and design of web page is being carried out in collaboration with WMO. OPERA supports database by opening its database to the study and sharing experiences.