

MODERNIZATION OF THE WORLD DATA CENTER FOR ATMOSPHERIC ELECTRICITY

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ABSTRACT: WDC/AE has 25 years experience of collecting and distributing data in booklets of printed tables. Labouriousness of the manipulation restricts the usage of the available data. Today WDC/AE is beginning to collect and distribute data on computer media. The problems and solutions are discussed.

1. WDC/AE until 1988

In 1963 the Hydrometeorological Service of the USSR has entrusted the A.I. Voëikov Main Geophysical Observatory (MGO) in St.Petersburg with the functions of the Special Data Center on atmospheric electricity to serve the programs of the International Year of Quiet Sun (1964 - 1965). Later in 1965 it was transformed into the World Data Center on atmospheric electricity (WDC/AE). The responsibility of the WDC/AE has been the collection of the data from the world network and widespreading them among consumers. The first publication has been made in 1966 with data for January 1964 and since then the WDC/AE acts till present. The last publication was made in 1991 with materials for December 1990.

All publications for this period have been performed in the form of printed booklets. Each booklet contains the tables of atmospheric electricity data, the tables of the corresponding meteorological data in reduced form, the alphabetic list of the stations with information on their index, country, geographical coordinates, the methods of measuring and explanations to the tables. The meteorological data are given in special code to indicate periods of disturbed/undisturbed weather conditions which are needed for data selection. The elements generally measured at the stations are the potential gradient and the air polar conductivities, some stations record the vertical air- earth current. The list of stations that provide data to the WDC/AE till present is shown in Table 1. The information on the recorded parameters and period for which data are available in digital archive is given in the table too.

So today quite big database in printed tables has been formed in the WDC/AE representing long series of the data for some stations in the countries of the former USSR and in the world. The data are of particular value for many investigators in the region of atmospheric electricity and many scientific works have been performed on the basis of these data.

2. AIMS AND STAGES OF MODERNIZATION

The amount of the data collected in WDC/AE is increasing every year and processing the data in scientific analysis becomes more labourious. The aim of the modernization is to reduce the labour and costs in every stage of the data flow:

- collecting and preprocessing in stations,
- processing in WDC/AE,
- processing by users.

The main stages of the modernization are:

- creating a data archive on computer media;
- computerized data acquisition in stations and transfer to the center,

- distribution of the current data from the center to users on a computer medium (diskettes),
- creating a system of selection and transfer of data samples according to the request of users. Several stages could be developed simultaneously.

Table 1. List of the acting stations

Station	Country	EF	AC	CD	Archive
Dusheti	Georgia	RC	Gerd	no	* 1958-1983
Helsinki	Finland	RC	Gerd	yes	pr. tab
Irkutsk	Russia	RC	Gerd	no	* 1988-1991
Lisbon	Portugal	RC	no	no	pr. tab
Macerata	Italy	RC	Gerd	yes	pr. tab
Odessa	Ukraine	FM	Gerd	no	* 1988-1991
Sakusima	Japan	RC	no	no	pr. tab
South-Sakhalinsk	Russia	FM	Gerd	no	* 1988-1991
St.Petersburg (Voeikovo)	Russia	FM	Gerd	no	* 1966-1991
Swider	Poland	RC	Gerd	yes	pr. tab
Tashkent	Uzbekhistan	RC	no	no	* 1968-1991
Verkhnee Dubrovo	Russia	FM	Gerd	no	* 1969-1991

Remarks: EF - electric field, AC - air conductivity, CD - air - earth current density, RC - radioactive collector, FM - field-mill, pr. tab - printed tables, * - digitized data

3. PRIMARY ARCHIVE ON A MAINFRAME COMPUTER

The first stage of modernization was started in 1988 when the WDC/AE began to store the data on half-inch magnetic tape of an IBM-370 compatible computer. A database system specially designed for the meteorological and geophysical archives is used as a basis of atmospheric electricity system. Files of the database have extremely sophisticated format and they are not easy to use outside the special program block. All the atmospheric electricity data traditionally presented in the printed booklets of the WDC/AE, are completely included into the archive database. Besides, to enable a selection and correct handling of the data, some meteorological parameters are written into the files: codes of clouds' forms and quantity, wind direction and speed, information on atmospheric phenomena in reduced form.

All new data since 1988 are included into the digital archive database. The problem of digitizing the retrospective data presented in the printed booklets has not been solved finally. Compressed font of booklets is serious hindrance to use a scanner. However WDC/AE uses possibilities to digitize historical data (see Table 1) but it demands much manual labour.

4. TRANSFER OF DATA FROM STATIONS TO THE WDC/AE

The data are divided into two groups. The first one presents the data added into digital archive after 1988. These data are prepared in the form available for computers at the stations. The staff there puts the primary data on the magnetic or punched tape and send it to the processing center (WDC in the MGO). After some kinds of checking and processing data files are converted into binary format to store on magnetic tape. To provide the uniform and correct fulfillment of the data

treatment the WDC has issued the guide documents and sent them to each station. From the foreign stations WDC receives the data in the printed tables.

The second group of the data is the historical one. These data can be considered as lost for the computerized treatment. However the WDC concerned in transferring the data into digital archive and performs this work as far as possible, although it demands much manual labour.

Some stations are ready to send their data to the WDC using floppy diskettes 5.25". E.g., T. Toumi has sent the data of Kevo and Helsinki for 1989 (24 data files) in two 360 K diskettes in the form of ASCII files with explanations on the structure of the records. Each record of fixed length represents a set of data fields delimited with spaces and has a mark of data quality. The files can be readily imported by the data management programs. This is an example as data can be arranged on the diskettes to send to the WDC. There is information about another stations also able to send diskettes.

One of possible ways of data delivering has been fulfilled in Voeikovo where compact audio cassettes are used to store and transfer data from the station equipment to the PC.

5. COMPUTERIZED DATA ACQUISITION IN STATIONS

The technical solution of computerized data acquisition could be individual for every station. Standardization of the format of the data prepared for the WDC/AE is recommended but not required. Among the stations of the former USSR the computerized data acquisition and control unit UT-8908 and a cheap 8-bit computer ATARY 130XE are used. The special features of the data acquisition system hardware are the ability to survive the heavy voltage overloads on inputs typical for thunderstorm situation and long-time (up to several days) breaks of the AC power. Software of system is solving the problems of automatic zero control for various sensors and statistical processing of data during an hourly period (the inputs scanning period is a few seconds). The last full hour's statistical parameters are stored in RAM and displayed together with the current values. In few weeks the data should be saved in the outer memory or directly transferred to a PC via RS-232C interface. Data saved by the data acquisition system on the audio cassette or diskette are ready to send to WDC/AE.

6. DISTRIBUTION OF THE CURRENT DATA

A software has been developed to reformat and copy the data from the primary archive to the PC diskettes. The distributive data are written as ASCII - files that have sequential structure. Some features of distribution diskettes are:

1. one file presents the data of one station for one month;
2. a file consists of up to 744 records of fixed length, each of them represents an hourly set;
3. a file is identified with its filename that permit a program treatment;
4. records are identified with the station number and full time indication;
5. a record contains a set of data fields delimited with spaces or commas; it presents atmospheric electricity values and meteorological parameters if they are available;
6. each diskette is supplied with explanations and station descriptions.

The ASCII-files could be easily imported by all word processors and most data management systems and electronic spread sheets such as LOTUS-123, Framework, Base III Plus, etc.

Distributive 360 K diskettes can fully replace the printed booklet issued formerly. Practical introduction of the data distribution of data diskettes depends only on the financial situation of the WDC/AE.

7. DISTRIBUTION OF THE RETROSPECTIVE DATA

A complementary software is developed to provide the distribution of data in a special compressed format. This helps to write more data to one diskette that is useful when the samples of retrospective data should be given on the user's request. The manipulation of the compressed data is supported by a special data management program that is written on every distributive diskette. The program enables to:

1. look at contents of the diskette,
2. select the subset of data needed for analysis,
3. look at the selected data,
4. print the selected data,
5. write the selected data to an ASCII-file,
6. write the selected data to a binary integer file.

The data written by the management program into the ASCII or integer files are easy to import and use by standard data analysis systems or BASIC/PASCAL - programs.

8. CONCLUSION

The modernization of the WDC/AE is in progress. The goals are to reduce the costs of maintaining both for the stations and the center and give the clients of WDC/AE an easy way to the analysis of large amounts of data stored in the archive database. Main elements of the new technology are prepared for practical use.

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