APPLICATION OF METEOINFORMATICS FOR THE ANALYSIS OF WEATHER FORECAST DATA

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Abstract: *In the context of the sustainable development, with strict observation of the environment protection required, the meteorological information are used in the spectrum for a modern agriculture, forestry, environment protection and engineering activities, urban climatology, planning in the activity of transportation and creating optimum conditions of loading-delivery, depositing and in the everyday life [1].*

Science 2007 at North University of Baia Mare is running an Oregon Scientific WMR 100 type weather station [2] which follows continuously the climatic parameters from urban area and microclimate.

The main aim of this paper is to survey the importance of meteo-informatics application for environment projects and for ecological research as an environmental project. As prospects for the future, would be to create a computerized network through which to connect personal weather stations, obtaining valuable information from several regions of the country and can, thus clearly distinguish details of the microclimate of each region. Future weather stations are tools that help everyday life of man, as a modern tool, easily accessible and useful.

Keywords: *meteorological information, meteo-informatics, environmental project*

1. INTRODUCTION

Environmental Information and Environmental Information Systems play a major role in environmental decision making. The management and use of Environmental Information Systems (EISs), especially the meteorological information system is very useful in different kind of economical activities.

Knowledge of weather prediction and atmospheric parameters has been concerns since the beginning of human history. If at first the weather was seen as a divine element, then we started tracking atmospheric factors, description of weather phenomena and tried to understand weather as a complete phenomenon.

Weather forecasting is a complex process that binds many parameters which can provide current information on weather for the following days. Weather influences human activity and its prediction allow greater freedom in scheduling of human activities.

2. BRIEF HISTORY

Human interest has manifested since ancient times when scientists began to observe and describe the weather and have also tried to give explanations for most of the weather phenomena. But for the first time weather observations have been made by Aristotle, and the data has been organized in a treaty called the Meteorological Complex. Aristotle studied weather phenomena such as wind, water cycle and condensation.

In the middle Ages, with the development of the first instruments Galileo built the first rudimentary thermometer, Torricelli – barometer and Robert Hooke - anemometer for measuring wind speed, these inventions started the development of meteorology. French scientist Laurent Lavoisier said they could forecast the weather for a day or two by measuring air pressure, humidity and wind speed.

In Romania there is information about the weather since ancient times, but only in 1884 we can really talk about meteorology, when the Romanian Meteorological Service was established under the leadership of Stefan Hepites, becoming one of the oldest scientific institutions in Romania. At the initiative of Stefan Hepites, Romania is among the founding countries of the International Meteorological Organization.

In the modern era, Romania had to adopt information system for meteorological data processing, so in 2004 to join the OPERA system, which is a project for operational use of weather radars in Europe. Nowadays weather information is accessible in different forms, through personal weather stations, internet sites, equipment and measurement instruments that provide information on atmospheric parameters in real time.

3. RESEARCH

The discussion starts with a description of the system, that have been called meteorological station Oregon Scientific WMR-type 100, which operates in the North University of Baia Mare from April 2008, in order to identify and pinpoint the shared attributes of this system and other specific aspects.

The weather station is used for continuous monitoring of weather condition and weather data in order to create a database. The purpose of this monitoring is to continue to issue monthly and annual reports on weather and monthly and annual reports, which are useful in environmental projects, or to describe and understand the urban microclimate.

Regarding the positioning of the weather station, this station was placed on the roof of the North University of Baia Mare. The meteorological station is located at an altitude of 250 m. The main console is located in an office on the 7th floor of the building and placed in the same proceeding with a PC connection.

Oregon Scientific Weather Station WMR 100 is a professional weather station equipped with a rotating central control system which facilitates access to information on the console. This unique console includes a sensor that registers the temperature and humidity. The weather station measures a broad spectrum of meteorological variables and allows wireless connection of 10 different types of sensors along the sensors included in the console. Weather station equipment includes a full outdoor sensor consisting of a thermo-hygrometer, an anemometer with vane, a rain gauge and a barometer. Console base is provided with an atomic clock that adjusts itself automatically.

Fig.1. Oregon Scientific WMR weather station

Recorded weather data are displayed on the main console; it has the possibility to connect to a computer and through a program allows unlimited recording of the data. Recorded weather variables are: temperature

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indoor / outdoor, humidity indoor / outdoor, wind speed and direction, average monthly rainfall, daily, annual, atmospheric pressure, dew point temperature, the cooling produced by wind, temperature index and more.

4. DATA PROCESSING

Information obtained from the meteorological station is stored as strings of data. These strings of data containing information on atmospheric parameters, with a frequency of one digit per minute, allow their interpretation with high precision and getting a detailed picture of the weather conditions. Strings of data can be stored in the computer system of gross state indefinitely, given the small size of these files, or can be processed and interpreted.
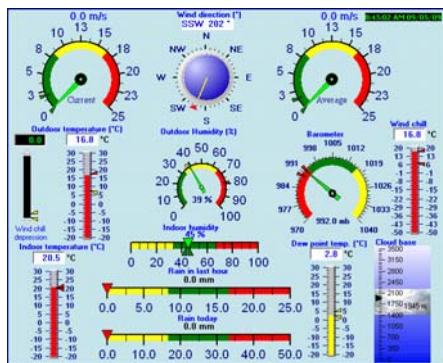

Fig.2. Weather Display® software interface

Data processing can be done in several ways, depending on the urgency and need for information. The fastest processing software offers a computer programme which is used for recording data arrays, namely Weather Display ®, besides providing information on current weather conditions and monthly and annual reports. Still using Weather Display Software ® files are created in a so-called "diary", containing all the data recorded by the meteorological station in the rough.

If a clearer picture of the meteorological parameters is needed, then the data can be processed by using Microsoft Excel. For a calendar month, a log files containing 43,000 rows of data with values for the following parameters:
- Temperature;
- Humidity;
- Pressure;
- Wind;
- Precipitation.

Manually processing of a large amount of information would take time and energy, but these values, by using the computer system, are processed quickly and efficiently, obtaining detailed graphics and easy to interpret. Also using programs in concordance with environmental informatics strategies, such as Surfer or GIS, we can obtain maps with real values, which have a special importance both for engineering and environmental protection activities and for communities.
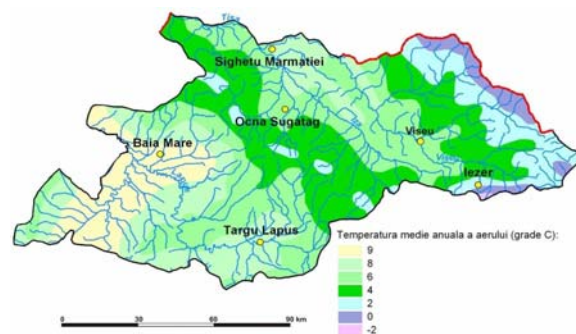

Fig.3. Characterization of the air temperature
(Source: www.cjmaramures.ro)

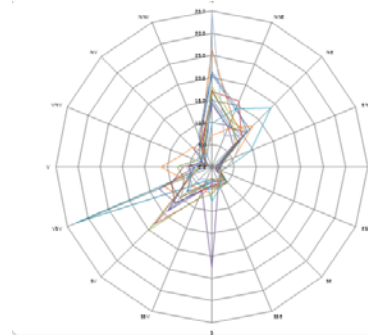Fig.4. Characterization of the air humidity
(Source: www.cjmaramures.ro)

Fig.5. Detailed histogram of wind directions

As integrated part of the "environmatics" or environmental informatics, the meteo-informatics seems to play a major role in environmental decision making, being one of the most important applications for the analysis of weather forecast data. Much more, the development of these systems is tightly connected to the environmental awareness of the last three decades.

5. RESULTS

To get a clearer picture on the computer processing of the data we present some results obtained. Parameters most difficult to interpret and predict are those tied to the wind and temperature, but spectacular results are being obtained with the help of the computer system.

Temperature is one parameter that influences most the human activities and life. Temperature forecasting is difficult because it depends mainly on other meteorological factors. For an accurate prediction of these values one had to interpret the temperature from several points of view, such as:
- The evolution of daily, monthly, seasonal and annual temperature;
- Maximum and minimum daily, monthly, seasonal and annual maximum and minimum temperatures and extreme temperatures;
- Comparisons between multi-annual values.

We get raw information that is processed and stored for interpretation and subsequent use.

Wind is an important parameter because it is responsible for transport and the dispersion of pollutants in nature. In practice, it is sometimes necessary to collect and process information about wind direction and intensity in real time and manual processing of such information in a timely manner is very difficult, if not impossible, but with a computer, we can get information quickly and save precious time and energy.

If the values are wrong, we can easily identify and remove them quickly, without having to repeat the calculation.

6. ADVANTAGES AND DISADVANTAGES

The main advantages of "meteo-informatic systems" are:
- Easy to use;
- Autonomous systems;
- Data is processed quickly and efficiently;
- Information can be stored on long term, without being compromised, and can be accessed easily at any time;
- Provides a clear picture of the phenomena due to high frequency data recorder.

Some disadvantages of: "meteo-informatic systems" are:
- Can interfere with data recording errors or misleading;
- Still are expensive;
- Require staff for operation and maintenance.

7. APPLICATIONS AND PERSPECTIVES

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"Meteo-informatic systems" became usable in terms of research recently, but their efficiency and ease of use has led to an increasing rate of their use. Weather stations are used in most projects, thus making it easier to retrieve data about the weather. North University of Baia Mare has been successfully applied on information obtained from weather station in a number of areas, such as:

- Microclimate research – projects;
- Research urban climate – database;
- Research on soil-tailings – project.

As prospects for the future would be to create a computerized network through which to connect personal weather stations, obtaining valuable information from several regions of the country and can, thus clearly distinguish details of the microclimate of each region. Future weather stations are tools that help everyday life of man, as a modern tool, easily accessible and useful.

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