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INTERNATIONAL CONFERENCE of SCIENTIFIC PAPER
AFASES 2012
Brasov, 24-26 May 2012

CONSIDERATIONS REGARDING BAIA MARE URBAN AREA WEATHER EVOLUTION

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Abstract: *Human interest in meteorological domain has been manifested since ancient times, when scientists began to observe and describe the weather and have tried to explain most of the weather phenomena.*

Science in 2007 at North University of Baia Mare is continuously registered meteorological data with Oregon Scientific WMR 100 weather station type. It can follow the climatic parameters continuously from the urban area and microclimates. 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 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.

The main aim of this paper is to survey the environment for application meteoinformatics importance of projects and for ecological research. As we know, it is necessary to extend the perspectives in studying of Environment Information Systems (EISs) integrated in the urban ambient problematic. Meteoinformatic systems became usable in terms of research recently, but their efficiency and ease of use has led to an increasing rate of their use.

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 mezoclimate of each region.

Keywords: *meteorology, weather station, climatic parameters, meteoinformatics, EISs*

1. INTRODUCTION

The beginnings of meteorology can be traced back to ancient times [1] and contain serious discussion about the processes of cloud formation and rain and the seasonal cycles caused by the movement of earth around the sun [2]. The Greeks were the first meteorologists (7th century B.C.).

Thales of Miletus associated weather with movement of the stars and planets and considered water to be the basic element of all matter. Anaximander thought that wind was moving air, idea which was later rejected by Aristotle. His ideas included the four elements (earth, wind, fire and water) in a world in which people must be seen a vital part.

He said that they were arranged in separate layers, but they could mingle.

Aristotle also believed that heat could cause water to evaporate. He deduced many things about weather, both wrong and right, but was the first to explain it. Thus, Aristotle is considered the founder of meteorology.

One of the first weather instruments was designed by a German-Nicholas deCusa. In the 15th century, he hung out some wool and noticed that it was heavier when moisture condensed on it.

Around 1593, Galileo was the first to realize that gases and liquids expand when heated, and he invented the first thermometer. Also, in 1643, Evangelista Torricelli invented the barometer. Very close to this time, wind and calibrated rain gauges were invented.

In 1686, Edmund Halley proposed that air is heated by the sunrises and winds are caused by air flowing in to replace air that has risen.

In the 1740's, Ben Franklin proposed that storms move from place to place. In 1768, John Heinrich Lambert developed the hygrometer.

In 1830, William Redfield discovered the circular path of a hurricane. He noticed that after a hurricane, trees in eastern Connecticut fell in one direction, while those in the western part of the state fell in the other direction.

In 1918, Vilhelm Bjerknes and his son Jacob discovered that many weather phenomena result from the meeting and interaction of warm and cold air masses. Also, Carl Gustaf Rossby discovered the jet stream and that it governs the easterly movement of most weather.

One of the most impressive achievements described in the *Meteorology* is the description of what is now known as the hydrologic cycle.

Meteorology, as we perceive it now, may be said to have had its firm scientific foundation in the 17th century after the invention of the thermometer and the barometer and the formulation of laws governing the behavior of atmospheric gases.

It was in 1636 that Halley, a British scientist, published his treatise on the Indian summer monsoon, which he attributed to a seasonal reversal of winds due to the differential heating of the Asian land mass and the Indian Ocean [3].

2. THE SPECIFIC IMPLICATIONS OF WEATHER EVOLUTION

2.1 The modern meteorology concept

The current weather and forecast is constantly repeated by the media as the weather channel provides meteorological information 24 hours a day.

Regular programming on television is interrupted for severe weather updates, because the meteorologists are constantly considered and called upon as key witnesses in trials where weather may have effected the events in question [4,5].

Forecasting is the real challenge of meteorology and as can be seen in the section on history, it has come a long way.

2.2 The dynamism of meteorology

Dynamic meteorology generally focuses on the fluid dynamics of the atmosphere. The idea of air parcel or area is used to define the smallest element of the atmosphere, while ignoring the discrete molecular and chemical nature of the considered atmosphere [3].

An air parcel is defined as a point in the fluid continuum of the atmosphere, in which the fundamental laws of fluid dynamics, thermodynamics and atmospherically motion are used to study the atmosphere. The physical quantities that characterize the state of the atmosphere are temperature, density, pressure, and much more, all these variables having unique values in the continuum [5].

Weather forecasting is perceived as the application of science and technology to predict the state of the atmosphere for a future time and a given location. Human beings have attempted to predict the weather informally for millennia, and formally since at least the 19th century. In this sense weather forecasts are made by collecting quantitative data about the current state of the atmosphere and using scientific understanding of atmospheric processes to project how the atmosphere will evolve in a considered time and space.

Once an all-human endeavor based mainly upon changes in barometric pressure, current weather conditions and sky condition, forecast

models are now used to determine future conditions [3,4].

Human input is still required to pick the best possible informatics forecast model to base the forecast upon, which involves pattern recognition skills, teleconnections, knowledge of model performance and knowledge of model biases.

The chaotic and complex nature of the atmosphere, the massive computational power required to solve the equations that describe the dynamism of atmosphere, error involved in measuring the initial conditions and an incomplete understanding of atmospheric processes mean that forecasts become less accurate as the difference in current time and the time for which the forecast is being made increases. The use of ensembles and model consensus help narrow the error and pick the most likely outcome.

There are a variety of end uses to weather forecasts. Weather warnings are important forecasts because they are used to protect life and property, in the sense of environmental protection and people health security.

Forecasts based on temperature and precipitation are important to agriculture, and therefore to commodity traders within stock markets. Temperature forecasts are used by utility companies, for example, to estimate demand over coming days. On an everyday basis, people use weather forecasts to determine what to wear on a given day. Since outdoor activities are severely curtailed by heavy rain, snow and the wind chill, forecasts can be used to plan activities around these events, and to plan ahead and survive them.

There are different kind of meteorology as it follows:

- *aviation meteorology* - deals with the impact of weather on air traffic management and it is important for air crews to understand the implications of weather on their flight plan as well as their aircraft;
- *agricultural meteorology* – is the science concerned with studying the effects of weather and climate on plant distribution, crop yield, water-use efficiency, phenology of plant and animal development, and the energy balance of managed and natural ecosystems;
- *hydrometeorology* - is the branch of meteorology that deals with the hydrologic cycle, the water budget, and the rainfall statistics of storms;
- *nuclear meteorology* - investigates the distribution of radioactive, aerosols and gases in the atmosphere;
- *maritime meteorology* - deals with air and wave forecasts for ships operating;
- *military meteorology* - is the research and application of meteorology for military purposes.

Creating forecasts is a complex process which is constantly being updated and always associated with the Environmental Information Systems (EISs). It involves the application of information technology and detailed meteorological knowledge of how the atmosphere, the Earth's surface and the oceans work. Like many others fields related to environmental protection modern weather forecasting applies scientific knowledge to predict future atmospheric conditions across the globe or the considerate area of a community, for example, from observations of the current state, made from land; at sea; in the air and from space.

2.3 A brief history of meteorology

Meteorology, branch of science that deals with the atmosphere of a planet, particularly that of the earth, the most important

application of which is the analysis and prediction of weather [3].

Individual studies within meteorology include aeronomy, the study of the physics of the upper atmosphere; aerology, the study of free air not adjacent to the earth's surface; applied meteorology, the application of weather data for specific practical problems; dynamic meteorology, the study of atmospheric motions (which also includes the meteorology of other planets and satellites in the solar system); and physical meteorology, which focuses on the physical properties of the atmosphere.

Aristotle's *Meteorologica* (340 B.C.) is the oldest comprehensive treatise on meteorological subjects. Although most of the discussion is inaccurate in the light of modern understanding, Aristotle's work was respected as the authority in meteorology for some 2,000 years. In addition to further commentary on the *Meteorologica,* this period also saw attempts to forecast the weather according to astrological events [4], using techniques introduced by Ptolemy.

As speculation gave way to experimentation following the scientific revolution, advances in the physical sciences made contributions to meteorology, most notably through the invention of instruments for measuring atmospheric conditions, Leonardo da Vinci's wind vane (1500), Galileo's thermometer (1593), and Torricelli's mercury barometer (1643) [4].

Further developments included Halley's account of the trade winds and monsoons (1686) and Ferrel's theory of the general circulation of the atmosphere (1856).

The invention of the telegraph made possible the rapid collection of nearly simultaneous weather observations for large continental and marine regions, thus providing a view of the large-scale pressure and circulation patterns that determine the weather.

3. THE WEATHER EVOLUTION IN BAIA MARE URBAN AREA

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 [1].

As we presented in a previous article ,the weather station of University of Baia Mare is used for continuous monitoring of weather condition and weather data in order to create a database [1]. 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.

Fig. no. 1. Oregon Scientific WMR weather station

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 [1].

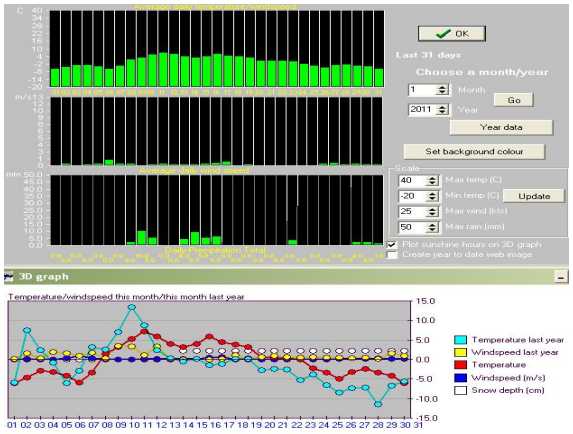

Fig. no. 2. Example of recorded weather variables

Recorded weather variables are: temperature 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 [1].

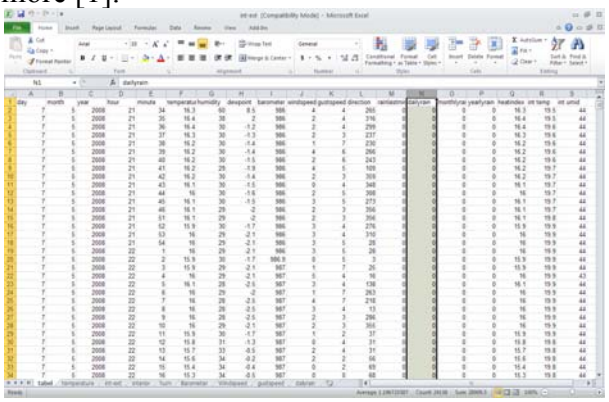

Fig. no. 3. Data registered by Oregon Scientific WMR 100 Weather Station

The main aim of this paper is to survey the environment for application meteoinformatics Importance of Projects and for ecological research. As we know, it is necessary to extend the perspectives in studying of Environment Information Systems integrated in the urban ambient problematic to give a new approach in meteorological information representation by diagrams, graphics or other figures.

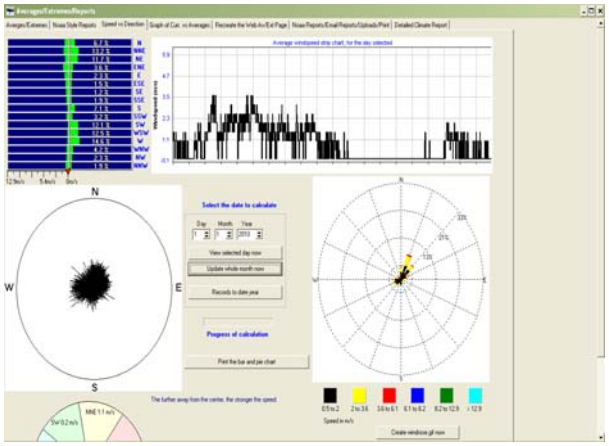

Fig. no. 4. Graphs registered by Oregon Scientific WMR 100 Weather Station

Meteoinformatic 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 such as Oregon Scientific WMR 100 Weather Station are used in most projects, thus making it easier to retrieve data about the weather. At 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 in urban climate – database;
- ✓ Research on soil-tailings from Bozanta tailing damp.

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 mezoclimate of each region.

Future weather stations are tools that help everyday life of man, as a modern tool, easily accessible and useful.

4. CONCLUSIONS

The word “meteorology” and the terms associated such as “meteoinformatics” or “hydrometeorology” were coined from a research book called “Meteorologica” which was written by Aristotle [2,6]. This early work described the science of earth like its geology, elements, hydrology, seas, wind and weather.

In the modern term, the term meteorology explains a complete and multidisciplinary science. It is essential for understanding the dynamics of atmosphere and for forecasting weather phenomena like hurricanes and thunderstorms and much more [7].

Weather forecasting was practiced since the beginning of time with more or less accuracy. Historical records show several examples of weather predicting methods based on observing surrounding elements.

Sky is undoubtedly the first indicator, and the main one, used in meteorology, its cover and nature of clouds provides clues of the upcoming temperature and weather. The wind factor is also important and is associated with temperature and often rains. Animals and birds are also known to give indications about the future weather. Scientists across the world since ancient times have tried to understand the meteorological phenomena like wind and rain. Many instruments for measuring wind power, humidity and rain were invented in the early 15th century.

During the 17th century, several discoveries tipped in favor of scientific meteorology. A device to measure temperature was invented by Galileo Galilei and the factor that atmospheric pressure was linked to altitude was discovered by Blaise Pascal. The invention of barometer by Evangelista Torricelli is significantly the most important discovery. It is still in use today which indicates atmospheric pressure changes that are linked with the future weather changes.

There are also other methods which have been evolved. Meteorology is a lot related with cycles and their analysis which was what Fernando II de Medici wanted to prove. He carried out a very determined program in 1654 for recording weather patterns in different European cities with a view to compile data and make their analysis.

Other breakthroughs were followed in the 18th century and science was taken to a new level. A modern mercury based thermometer was invented by Gabriel Fahrenheit. Theories about hydrodynamics were devised by Daniel Bernoulli and those theories had helped greatly in understanding the atmospheric changes.

When the theory of thermodynamics and atmospheric pressures were adapted, no real changes were important for understanding meteorology. In recent times, focus has been given on meteorological tools for its improvement and attaining better accuracy results. A tremendous boost was given to meteorology because of the technology in two ways. The first is the ability to communicate results and analysis with timing, it was made possible due to the invention of telegraph.

The second is the ability of probing skies with using balloons, satellites and radars.

Meteorology is a part of our everyday lives, reported to the weather evolution in the context of local society expansion.

People are kept updated about the changing weather with dedicated channels and mobile devices. The science is still progressing and is an important element of the economy with many industries like agriculture and civil aviation depending on it.

REFERENCES

1. Coman, M., Taro, G., Cioruța B., (2011) *Application of meteoinformatics for the analysis of wether forecast data*, International Conference of Scientific Paper AFASES 2011, www.afahc.ro
2. Taro, G., Coman, M., (2009) *Interurban Research Regarding the Evolution of Temperature in Baia Mare*, Scientific Bulletin of North University of Baia Mare, vol XXIII
3. http://en.wikipedia.org/wiki/Meteorology
4. www.imd.gov.in/doc/history/history.htm
5. www.imd.gov.in/doc/history/modern-meteorology.htm
6. www.shorstmeyer.com
7. www.meteoromania.ro

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