Processing Records of Wind Speed and Direction  
(September - November 2009) 

Carmen Otilia RUSANESCU 1), Marin RUSANESCU 2)

1) Faculty of Biotechnical Systems Engineering, “Politehnica” University of Bucharest 313 Splaiul Independentei, Bucharest, Romania  
2) Valplast Industrie Bucharest

Abstract. A direction for current high research is the wind monitoring and renewable energy. In this paper is monitored by the meteorological station wind direction and is calculated wind rose in September December 2009. The Siap GECO + MICROSOFT Version 2.3.2 automatically record the following parameters: air temperature, wind speed and direction, atmospheric humidity, solar radiation, rain.

Keywords: wind, wind rose.

INTRODUCTION

For weather data acquisition was used the weather station shown in Figure 1b installed at the Faculty of Biotechnical Systems Engineering Bucharest, type AWS/EV manufactured in Italy and that acquire data about: atmospheric temperature, the wind speed, wind direction, atmospheric pressure, rainfall, humidity, solar radiation.

Data acquisition is done using software GECO, an operating system that runs under Microsoft Windows 95, 98, ME, Win NT, Windows 2000, XP. Meteorological data are measured and recorded automatically transmitted in real time by specific systems and stored in databases on the computer. Primary meteorological data stored in databases, will be subject to evaluation processes, calculation and statistical analysis.

Wind speed and direction (from the wind) is determined with vane or anemometers equipped with a particular empennage and fitted to standard height of 10 m, or ground for the study of evaporation, vertical variation of wind speed can be determined with an empirical formula.

Wind speed and direction are determined at the height of the anemometer, which in standard measurement is considered to be at 10 meters. Dispersion models consist in the velocity of the atmospheric emission measured at the height of the installation stack. This is why a dependency relation between the two speeds is needed. This can be determined from the height variation with the wind speed.

Fig. 1a Wind sensor
Wind speed, expressed in m/s. Wind rose (Fig. 2). Graphic representation of the frequency of different wind directions. Wind direction, is the direction of the wind and is assessed (in the sense of movement clockwise from true north), horizontal after the 8 sectors. Prevailing wind direction is expressed in degrees of the rose wind (North = 0°, East = 90°, South = 180°). Wind direction and strength are two characteristics that describe a horizontal wind. In meteorology is always talking about the direction of the wind according to the cardinal points (North, East, South West) or the difference of angle with North (a wind in the South is 180 degrees, a west wind is in sector 270°).

Weather data processing
Meteorological data processing was done using the GECO software which is an operating system that runs on Microsoft Windows 95, 98, ME, Win NT, Windows 200, XP which generates the wind rose and statistics concerning the direction, intensity and the stability class for the weather data input. The program sorts data according to wind direction in 16 sectors, each having 22.5 degrees and depending on the intensity in 6 classes of speed. Analyzing the average values on the 8 directions of wind speed it can be seen that the maximum speed value of the wind is the same as its main direction, which is North North-East, the average of the targeted month being 1.7 m/s. The lowest recorded average wind speed is 0.2 m/s, registered form the Eastern direction. Regarding the distribution of speed ranges cardinal directions, it is noticed that in this case the dominant direction is north-east, followed by southeast direction. Wind speeds in other directions is missing. The predominant wind direction as the wind rose is: N, N-E.

Fig. 2 shows that the distribution of wind speeds rose to a dataset of 27 November 2009, note that wind blows with intensity from the N-NE-SE, weather data are purchased from the weather station at the Faculty I.S.B.
Fig. 2. Wind Rose 27/11/2009

Fig. 3 a-e representation of wind speed and wind direction September to November 2009

Station 1 Wind Speed (VD) m/s, September, 2009

Fig. 3 a
Based on statistical analysis to chart changes outlined minimum values, maximum during September-December 2008, it is noted that the minimum wind speed are analyzed within less than 0.1 m/s (23.11, 4 pm, 24/11/2009 at 5) and the maximum not exceeding 4.4 m/s (December 10, 2009, at 12).

To calculate wind speeds at other heights above the ground using the following formula: $u_R$ is the term that indicates the wind speed at a certain height on the ground $Z_R$, while $u$ is the speed that we want to estimate a height above ground $w$.

$$ u = u_R \cdot \left( \frac{z}{z_R} \right)^\rho $$  \hspace{1cm} (1)

Strength calculations of structures, for reasons of precaution, this formula is used to estimate wind speed at a certain height, because it tends to overestimate the speed.

Data were estimated using logarithmic law of wind profile for neutral atmospheric conditions:

$$ V_{90m} = V_{10m} \left[ \frac{\ln \left( \frac{z_{90m}}{z_0} \right)}{\ln \left( \frac{z_{10m}}{z_0} \right)} \right] $$  \hspace{1cm} (2)
With this equation it is possible to calculate the wind speed at a height determined \( z_{60m} \) ground, knowing the speed measured by an anemometer at a height \( I \) \( V10 \) 10 meters above ground 0.8 considered appropriate and imposing a value for the roughness coefficient of \( z_0 = 0.8 \) corresponding an area with houses and trees rare. I chose this class because of roughness, meteorological station is located in its vicinity, for which this length is 0.8 prevailing winds blowing from the north, north-east, and therefore the wind meets city construction, and its value is influenced by them, after passing the meteorological station.

The data estimated at 60 m above ground is a noticeable speed increase in value by approximately 1 m/s.

<table>
<thead>
<tr>
<th>Month</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monthly average at ten meter</td>
<td>1.05</td>
<td>1.65</td>
<td>1.6</td>
<td>2.1</td>
</tr>
<tr>
<td>Monthly average at sixty meter</td>
<td>1.95</td>
<td>3.0855</td>
<td>2.992</td>
<td>3.92</td>
</tr>
</tbody>
</table>

CONCLUSIONS

In this work was analyzed the direction and wind speed in warm months of the year in September – November 2009, by type weather station type AWS / EV. It is noted that the prevailing wind direction is N, NE. Weather station recorded data were processed by GECO program, achieving wind rose. There was statistical analysis on recorded data observing the minimum wind speed 0.1 m/s and a maximum of 4.4 m/s.

Wind direction is the N according to statistical analysis with a minimum of 1.5\(^{\circ}\)N and a measured maximum of 9.9\(^{\circ}\)N.

We calculated monthly average at ten meter and sixty meter. Frequency and speed of wind during the year reflect through positive and negative aspects of people's everyday work.

In the current context, characterized by the alarming increase of pollution caused by energy production from fossil fuels, is becoming increasingly important to reduce dependence on these fuels. Wind energy is a very good solution in the global energy problem. Using renewable resources is addressed not only to produce energy but by the pattern generation recasts and development model, by decentralizing resources. Especially wind energy is one renewable energy forms that are doing small-scale applications. The main advantage of wind energy is zero emissions of pollutants and greenhouse gases, because it is not burning.

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