Atmospheric Dynamics Using Station Experiential Techniques in Ado Ekiti, Southwestern Nigeria

[1]Alao Olumuyiwa Ademola, [2]Ajayi Isaac Rotimi, [3]Ilevbare Martins, [4]Oluwatoki Tolani Grace

[1]Department of Mathematical and Physical Sciences, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria

[2]Department of Physics and Electronics, Adekunle Ajasin University, Akungba Akoko, Ondo State, Nigeria

[3]Department of Geology, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria

[4]Department of Computer Science, Afe Babalola University, Ado Ekiti, Ekiti State, Nigeria

DOI: https://doi.org/10.51244/IJRSI.2025.12110071

Received: 21 November 2025; Accepted: 27 November 2025; Published: 09 December 2025

ABSTRACT

Imetos paranometer was used to measure rainfall precipitation, atmospheric temperature, wind speed, relative humidity, maximum and minimum dew points in the study area with geographical compass of Lat. 7.67^0N, Long. 5.31^0E. Data were recorded at every one hour from year 2013 to 2016. In addition, a Thermo-hygrometer was used to record air temperatures and relative humidity to validate the measurements of the paranometer. By involving statistical and time series techniques, the data obtained from the study were fitted into mathematical models of wind chill temperature index, the humidity controlled air temperature index and the heat index to determine the internal body temperature required to better understand the consequences of changing atmospheric temperature on human health.

The study has established that long term good health of humans depends on continued climate stability and that empirical knowledge of health consequences associated with changing atmospheric temperature in tropical climate can be used to predict possible corresponding health implication of people living in the area. The study therefore recommends further research into the subject and continuous enlightenment of the society about climate change dynamics in their locations.

Keywords: Surface heat flux, Atmospheric temperature, Ambient temperature, Time Series Data, Atmospheric dynamics

INTRODUCTION

Global climate changes have been found to affect human health through trails of varying complexity, scale and directness and with different timing. Also, impacts would vary geographically as a function both of environment and topography and of the vulnerability of the local population (Kilbourne E.M, 1989). The weather variables which include the temperature, wind speed, relative humidity and dew points have both positive and negative impacts although experts review anticipate predominantly negative. This condition is true since climatic change would interrupt or otherwise alter a large range of natural ecological and physical systems that are integral part of earth's life- support system.

Through climate change humans are contributing to a change in the conditions of life on earth. The more direct impacts on health include those due to changes in exposure to weather extremes, heat waves, cold spells and increases in other extreme weather events with may include floods, storms, and droughts; and increased production of certain air pollutants. Understanding and interpretation of climate variables may compensate for

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

possible increases from high frequency of heat waves and cold spell in a particular changing climate.

The extent of change in the frequency, intensity and location of extreme weather events due to climate change remains uncertain in an earth region or location. In the earth regions with a high level of excess cold, the beneficial impact may outweigh the detrimental, there are still time or periodic adaptation that are required.(Langford, I.H. and Bentham, G. 1995; Rooney, C. et al, 1998).Climate change, acting via less direct mechanisms, would affect the transmission of many infectious diseases especially water, food and vector-borne diseases and regional food productivity especially cereal grains. In the longer term and with considerable variation between populations as a function of geography and vulnerability, these indirect impacts are likely to have greater magnitude than the more direct (McMichael, A.J. and Githeko, 2001; Epstein, P.R. 1999). For vector-borne infections, the distribution and abundance of vector organisms and intermediate hosts are affected by various physical factors; temperature, precipitation, humidity, surface water and wind and biotic factors; vegetation, host species, predators, competitors, parasites and human interventions. The rate of increase caused by changing climate has given an image which has been referred to as the global-change also referred to as "the image of the millennium" and provides a summary about human impacts on earth. The consequence of this effect is that future rates of global warming are expected to be greater than previously estimated because earlier analyses overestimated historical contributions from climate changing effects. This is major contribution to climate change which depends on extrapolation of expected trends and do not consider possible triggers that may be set off as the earth's atmosphere warms. One phenomenon that could have overwhelming effects is a failure of the circulation of warm water around the atmospheric current which forms part of a global atmosphere just below the stratosphere. The current is driven by cold cloud water. Climate change caused by mechanism of the atmospheric circulation especially resulting from increasing rainfall affects the atmospheric temperature gradients. The consensus is that most tropical areas, particularly over oceans, receive more rainfall or precipitations with decreases in most of the subtropics and relatively smaller increases in high latitudes. However, the uncertainties about precipitations are increased by the potential for geographical and seasonal shifts in rainfall patterns.

Data Source and Experimentation

The primary instrument used in this study is an imetos paranometer, a weather radar station in an African tropic on the geographical compass of (Lat. 7.67^0N, Long. 5.31^0E) at Afe Babalola University, Ado Ekiti, South West, Nigeria. The weather data recorded by the instrument were assessed in a computer model. The instrument been a sturdy, easy to mount and perfectly designed for a variety of different task in climate zones. It measures extreme weather conditions, the precipitation, soil moisture, wind speed and wind direction, atmospheric pressure, relative humidity. However, it is termed a field climate thermo-hygrometer instrument used to provide necessary data needed for climate activities and also to cater for most exotic micro-meteorological challenges which may have implications on health.

The digital thermo–hygrometer is the secondary climate instrument used in this study which measures both humidity of the air and temperature of the air. The thermo hygrometer measures different ranges of humidity and temperature depending on the model. The thermo hygrometer takes the measurements, store them to memory and transfer the data to the computer for further detailed analysis. The thermo hygrometer offers contactless working which enables non-destructive measurements advantageous to this work.

The experiential analysis of the records taken from the instruments involve the threshold ambient temperature of the day on the data model recorded with synchronizing expected maximum and minimum atmospheric temperatures and hence the average atmospheric temperatures were considered true atmospheric temperature values. Alongside on the model read the date, and the expected average precipitation, and the geographical rain spot. For harmonic reasons the atmospheric temperature and the felt (ambient) temperature were compared at different relative speeds in (m/s). The time series involved, enabled us to compare the precedence and expedience implications of terrestrial radiations, solar noon and solar radiations. Our variations however enable plot-grams for different spots climate induced conditions.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Fig.2.1: Imetos paranometer (pessl) instrument used for climate data collection remotely recorded by the computer model

Fig. 2.2: Digital thermo-hygrometer used to record humidity of the air and temperature of the air

RESULTS AND DISCUSSION

The time series of description of earth radiation budget on air felt temperature for zero precipitation possibilities day, April 24, 2013 in Ado Ekiti had been compared with the time series description of earth radiation budget on operational temperature for a conditional precipitation possibilities day May 6, 2013 in Ado Ekiti. These temperature variations has been observed for the day, when solar radiation usually exceeds terrestrial radiation and the surface becomes warmer, through the night when solar radiation ceases, but terrestrial radiation continue and cool the surface, these circle is completed for a day when cooling continued after sunrise until solar radiation again exceeds terrestrial radiation.

The atmospheric radiation changes had been temperature dependent for which the patterns for zero precipitation are different from precipitation events. (see figure 3.1 and figure 3.2). From figure 3.1, it is observed that solar radiation is maximum during the solar noon and thus the clouds are considered warm or clear air. It is unlike this on precipitation days, see figure 3.2, Though the temperature gradient maintain a sharp fall during the solar noon most constantly for about 4^0C of the humidity controlled air temperature, during which the solar radiation invariably maintains an equality with the terrestrial radiation and yet the solar

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

radiation are bound to exceed though at minimum temperature. The temperature variations are greatest very near the earth's surface which was temporal aided characteristics in this region of study.

The observatory study critically considered some environmental factors such as large bodies of water and wind drifts, these are considered some fluctuation phenomena of the asymmetrical properties as may be observed from the plots (see figure 3.1 and figure 3.2). However, sunny days are found to typically have the greatest daily temperature variations.

Figure 3.1: Fitted Three- Quartered Diurnal Cycle Time sequenced Parallel Surface Heat Flux (Temperature) Observations on zero precipitation specified days March-April in 2014 and 2015

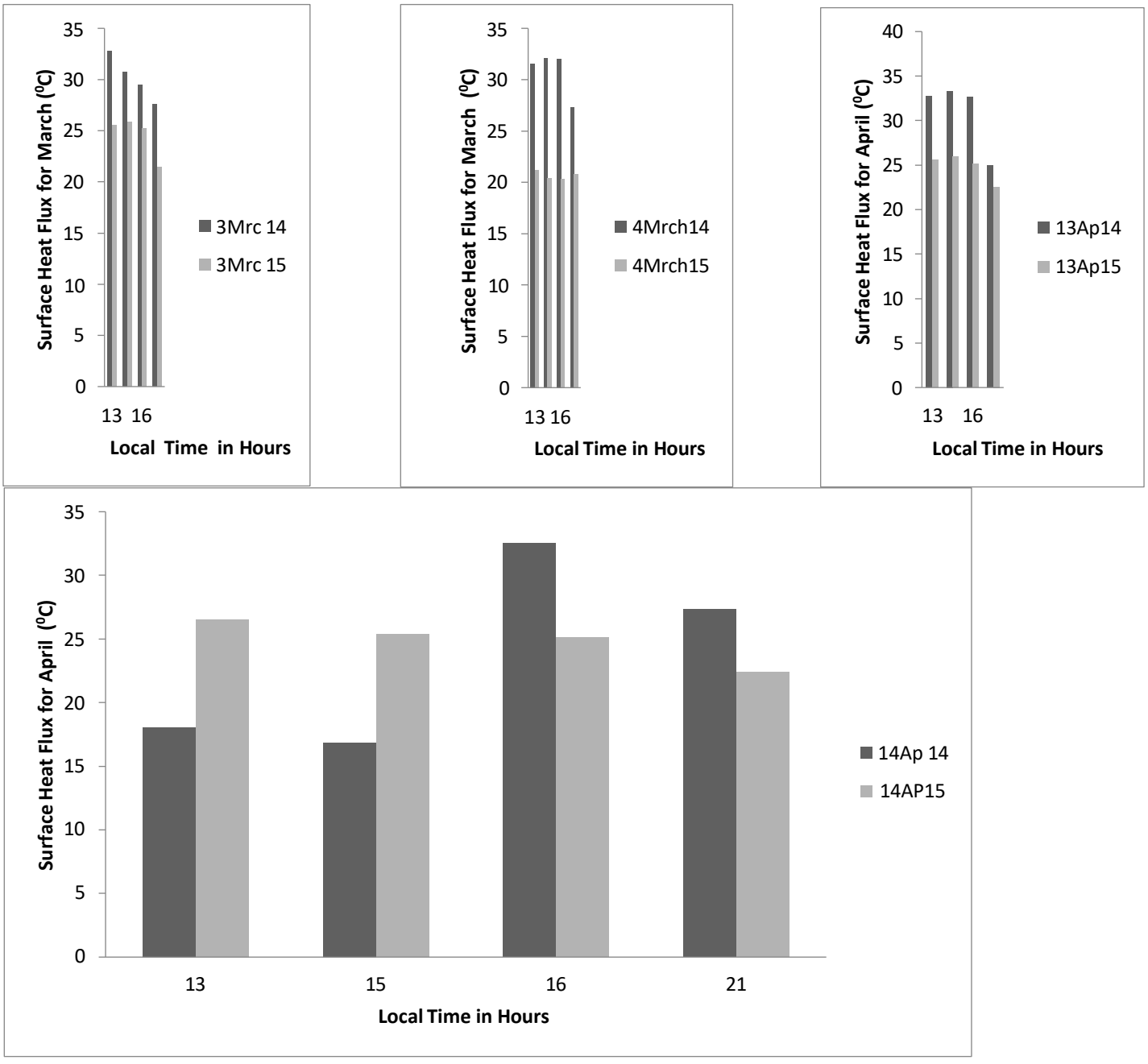
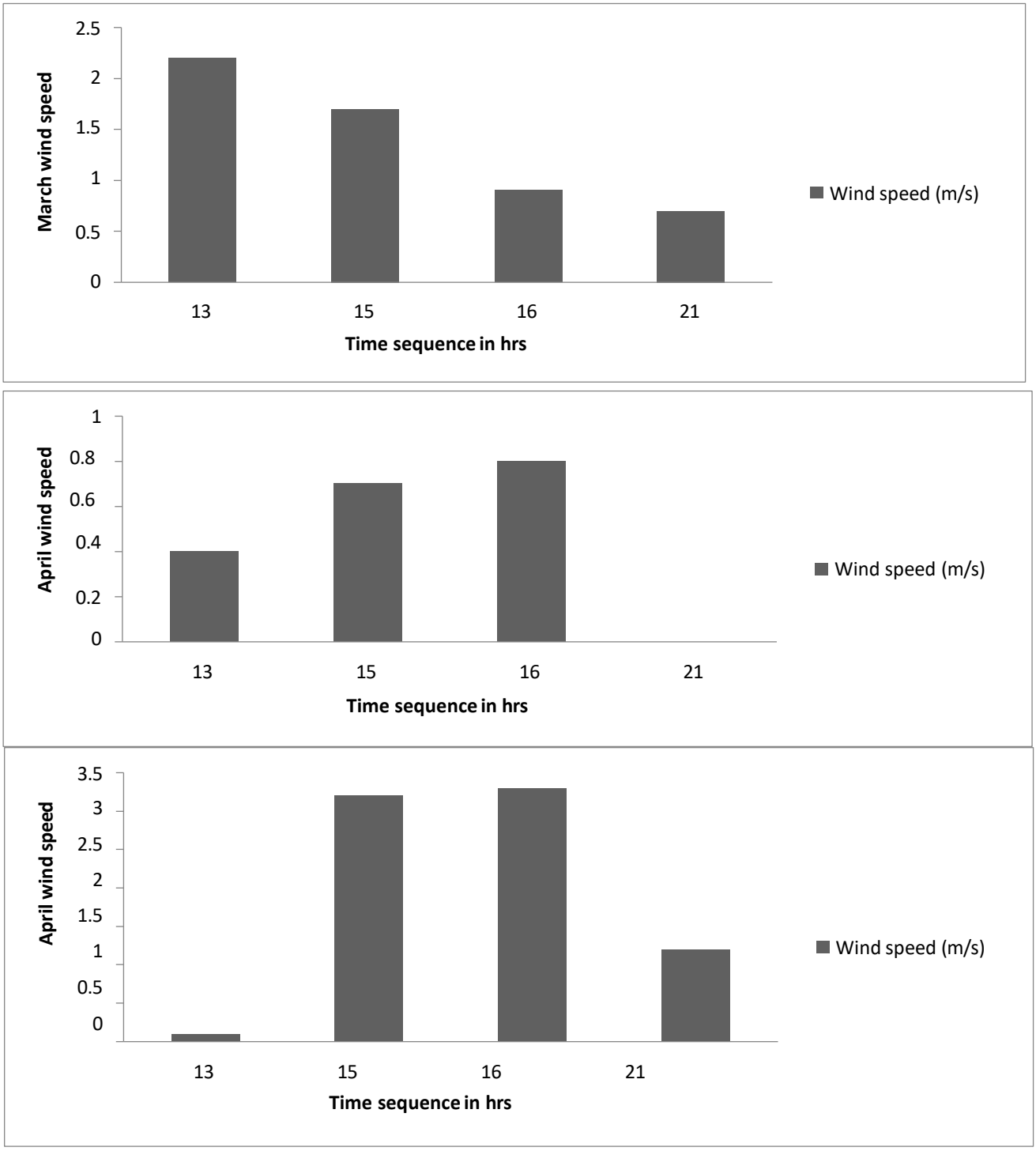


Figure 3.1 shows the temperature observations on zero precipitation specified days in March and April in 2014 and 2015 respectively. The variation taken for 2014 and 2015 give a clear variations with its temperature dependent on the characteristics of the spectral distribution of solar radiations which are about 12^0C in 2014 higher than temperature temporally characterized for 2015 mostly during the solar noon. This work investigates the time sequenced parallel temperature observations on zero precipitation specified days March and April in 2014 and 2015, of how daily temperature variation will vary only when clouds are clear and there are no saturation for precipitation events. This however gives an indication that temperature variations became an important factor of the solar energy and earth radiation budget. Nonetheless, heat generated by conduction

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

and heat exchange between the layers of warm air may not be sufficient enough for cloud formation resulting in precipitations. On regular days when the clouds are clear, incoming solar radiation exceed outgoing heat energy for many hours after noon and equilibrium is usually reached at relatively an atmospheric temperature observed as unusually very high. The temperature variations observed to be very high when are nearer the earth's surface which was represented by time aided as can be observed for the rainfall upland area being the region of our study. However, sunny days are found to typically have high records of atmospheric temperature variations. Nonetheless, low lying moist area in the vicinity of study have the least of variations. These factors explains why the tropics used in this study have high temperatures during the solar noon on bright sunny days and of temperatures of about $\pm 4^0C$ below the room temperature under raining s

Figure 3.2: Variation of Wind speed transect 'Y Y' on zero precipitation specified days in 2014



ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

Figure 3.3: Variation of Wind speed transect 'Y Y' on zero precipitation specified days in 2015

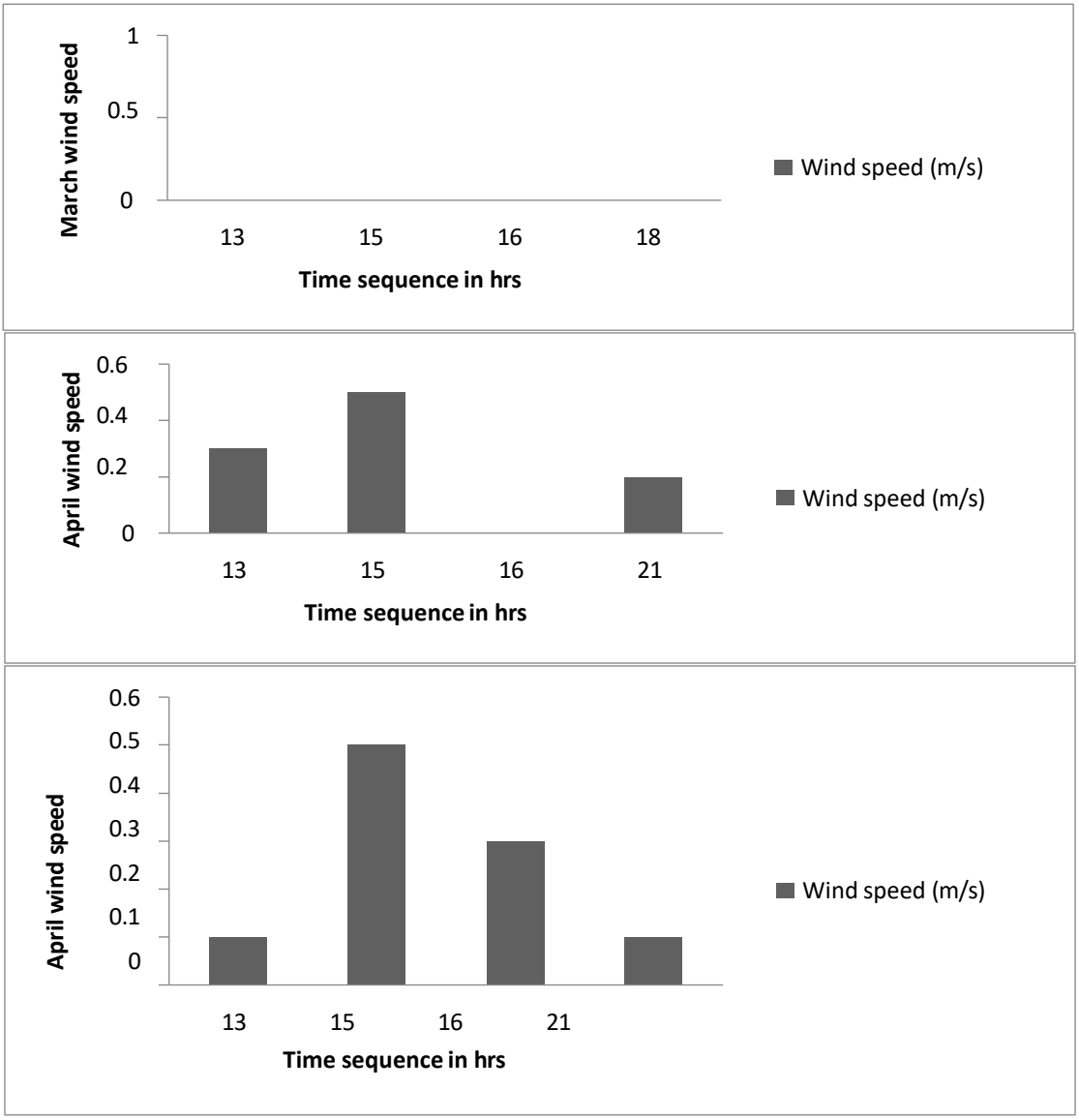


Figure 3.3 show the variations of the wind speeds behavior on clear air days in some days in 2014 and 2015. Our observation by histograms describes the aurora behavior of the wind in respective of the absence of temperature with unusually rising characteristics. The air temperature has however become invariably independent for some wind speeds relatively less than $0.5.\,m/s$ and become more obvious for wind speed $\leq$ $0.5.\ m/s$. The seasonal variations and incoming solar radiation are concluded however to be more heat energy driven than by the wind speed for rainfall upland area.

Other observations include that the wind though independent of air at a particular level in the atmosphere during which conduction of heat through the ambient medium, they still contribute to the cloud formations that results in warm air and cold cloud relatively to the range between$4^{o}C\ and\ 8^{0}C$ and are mostly resulting in precipitation. The descriptive nature of the time series wind velocity confirms that the precipitation period when the radiation budget is characterized be at exceeded limits of solar radiations over terrestrial radiations even when there are zero precipitations or precipitation activities or events. See figure 3.2 and figure 3.3 for the transects for specified day in 2014 and 2015.

The plot - grams of the zero precipitation specified days in 2014 and 2015 gave the indications that the comparisons of wind speed and wind gust with daily time interval for the specified days show that the variation of the season is asymmetrical in progression indicative of uneven characteristic of the wind speed as an element of the weather system .The wind velocity in air very near the earth's surface are termed to be symbolic of time aided characteristics of near $3.5.\ m/s$ for wind gust mostly resulting in rain or cold clouds as observed in this study.

ISSN No. 2321-2705 | DOI: 10.51244/IJRSI |Volume XII Issue XI November 2025

REFERENCES

1. Epstein, P.R. (1999) .Climate and health Science.Pp 347–348
2. Kilbourne, E.M. (1989) .Heat waves. In: The public health consequences of disasters".US Department of Health and Human Services, Centres for Disease Control: Pp 51–61.
3. Langford, I.H. and Bentham, G. (1995) .The potential effects of climate change on winter mortality in England and Wales". International Journal of Biometeorology Vol. 38: Pp 141–147.
4. McMichael, A.J and Githeko, A.(2001) . Human health.in: Climate Change
5. Rooney, C.(1998) .Excess mortality in England and Wales during the 1995 heat- wave.Journal of Epidemiology and Community Health, Pp 482–486.