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Evaluation of Seasonal High Resolution Automated Weather Station (AWS) Data and its Impact on Society and Sustainability – A Case Study at Jahangirnagar University Campus

Md Shafiqul Islam Sany[1*], Mahmuda Khatun[1], A.T.M. Shakhawat Hossain[1] and Toru Terao[2]

[1]Department of Geological Sciences, Jahangirnagar University, Savar, Dhaka, Bangladesh
[2] Kagawa University, Saiwai Cho, Takamatsu City, Kagawa, Japan

(*Corresponding E-mail: sanyislam0000@gmail.com)

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Abstract: The research focuses on location-specific monitoring and evaluation of high-resolution Automated Weather Station (AWS) data at Jahangirnagar University to interpret local climate conditions and assess the microdynamic impacts of climate variability. The study analyzes seasonal patterns in key weather parameters using AWS observations, emphasizing their microclimatic implications and relevance for climate resilience planning. High-resolution weather parameters, including temperature, relative humidity, precipitation, wind speed, air pressure, and solar radiation, were analyzed using AWS data. To validate the findings, the AWS data were compared with historical climate records from the Bangladesh Meteorological Department (BMD). The results reveal clear seasonal variations in climatic parameters. Temperatures reached up to 36°C during the pre-monsoon and monsoon seasons and dropped to about 13°C in winter. Relative humidity was highest during the monsoon season and lowest in winter. Precipitation followed typical monsoon patterns, while wind speed and solar radiation showed seasonal variability influenced by atmospheric pressure systems and cloud cover. Medical survey data from Jahangirnagar University also indicated that during the pre-monsoon period, students experienced significant heat-related health issues, including vomiting, severe headaches, unconsciousness, high fever, and other heat-induced illnesses due to extreme temperatures. These findings contribute to a better understanding of local climate dynamics and support decision-making in agriculture, water resource management, disaster preparedness, and urban planning. The study highlights the importance of granular, location-based weather monitoring. It also demonstrates that high-resolution AWS data provide more reliable and detailed climate information than conventional records from BMD. Such data can significantly support climate monitoring, sustainable development, community resilience, and climate-adaptive policymaking in Bangladesh.

Keywords: ***AWS, Automatic weather station, Weather, Climate, Solar radiation, Sustainable development.***

Introduction

Climate variability has significantly impacted Bangladesh, particularly through seasonal changes in temperature, precipitation, and other weather parameters, which affect agriculture, water resources, and disaster management. The tropical monsoon climate of Bangladesh, combined with urban heat island effects, makes it essential to understand these variations at a microclimatic level. Jahangirnagar University (JU), located in Savar, Dhaka, serves as an ideal site to study these microclimatic variations, as it is affected by both natural climatic factors and urbanization. This study aims to utilize high-resolution data from Automatic Weather Stations (AWS) to assess seasonal variations in critical climate parameters such as temperature, humidity, precipitation, wind speed, and solar radiation. By comparing this data with historical weather data from the Bangladesh Meteorological Department (BMD), the study aims to enhance the understanding of local climate dynamics, which is crucial for climate adaptation and resilience planning (Rashid et al., 2024).

The study analyzes the health hazard vulnerability among JU students impacted by the seasonal change. The research also highlights the importance of localized climate data for supporting sustainable development, particularly in agriculture and water management sectors (Rashid et al., 2024; Baten et al., 2023).

Methods

This study utilizes high-resolution data from AWS at Jahangirnagar University, Savar, to analyze seasonal variations in temperature, humidity, precipitation, wind speed, and solar radiation from September 2023 to July 2024. The data was supplemented with historical climate data from the Bangladesh Meteorological Department (BMD) (Rashid et al., 2024). The AWS data was recorded at minute intervals, while the BMD data was aggregated into daily averages for comparison. Seasonal classification was based on the four climatic periods: winter, pre-monsoon, monsoon, and post-monsoon. Statistical methods such as graphical representation and trend analysis were applied to evaluate the seasonal changes and validate the AWS data against BMD's historical data (Ahasan et al., 2010).

A survey was conducted among students, and the health hazard data were collected and digitized for statistical analysis.

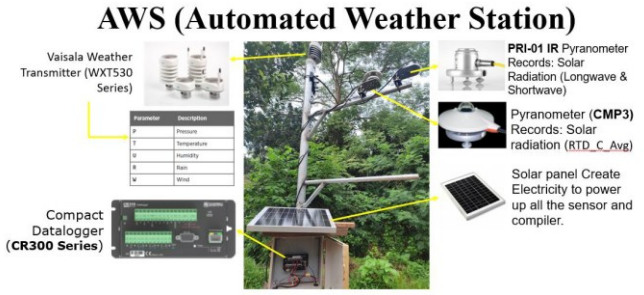

Figure1, Automatic Weather Station (AWS) JU established in August 2023.

Results and discussion

Temperature reached 36 °C in pre-monsoon and monsoon, falling to 13 °C in winter, consistent with national trends. Relative humidity peaked during monsoon and dropped in winter, following regional patterns (Murata et al., 2011). Extreme heat caused health risks, including vomiting, severe headache, unconsciousness, high fever, and other heat-related illnesses.

Precipitation reached maximum between June and September, with minimal winter rainfall, reflecting long-term trends in Bangladesh (Ahasan et al., 2010; Baten et al., 2023). Wind speeds were highest in pre-monsoon and monsoon due to pressure gradient changes, while solar radiation varied seasonally, with shortwave radiation attaining maximum pre-monsoon and longwave radiation declining during monsoon (Kambezidis et al., 2012).

Figure 2, September 2023- July 2024 average temperature data (AWS) indicating heat waves and cold outbreaks.

In addition to atmospheric analysis, the study revealed social implications: medical data from Jahangirnagar University showed increased heat-related illnesses, including exhaustion, dehydration, and fainting during pre-monsoon heat, highlighting human vulnerability. These results confirm high-resolution AWS data reliability and emphasize its role in climate monitoring, disaster preparedness, and resilience planning (Masson-Delmotte et al., 2021).

Conclusion

This study shows that high-resolution AWS data effectively captures seasonal climatic variations at Jahangirnagar University. Temperature, humidity, rainfall, and radiation patterns closely match BMD records, confirming AWS accuracy. The findings underscore the value of AWS technology for precise local climate monitoring and for supporting climate-resilient planning, public health awareness, and sustainable development in Bangladesh.

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