CHANGES IN WET BULB GLOBE TEMPERATURE AND HEALTH RISK TO HEAT-RELATED HAZARDS: AN OVERVIEW OF BANGLADESH

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1. INTRODUCTION

Increasing temperatures and changes in other meteorological variables have put millions of people at risk in a highly populated, hot and humid country like Bangladesh. The wet bulb globe temperature (WBGT), an indication of human heat stress, allows for a better evaluation of the dangers posed by climate change to human health [1]. The present study employed high-resolution reanalysis data to assess spatiotemporal changes in outdoor WBGT over Bangladesh over the period 1979-2021. The objectives were to demonstrate changes in heat stress conditions, their areal coverages, temporal extents, and trends at annual and seasonal scales and propose possible adaptation measures.

2. DATA AND METHODS

The present study used reanalysis of meteorological variables, including air temperature, wind speed, dew point temperature, solar radiation, and surface pressure, of the fifth generation European Centre for Medium-Range Weather Forecasts (ERA5) having a spatial resolution of 0.25° for the period 1979-2021. Liljegren's model [2] was used to estimate outdoor WBGT based on the following equation:

$$WBGT = 0.7\,T_{nwb} \times 0.1T_a \times 0.2T_g \quad (1)$$

Where T_{nwb} is the weighted sum of natural wet bulb temperature, T_a is dry bulb/ambient temperature, and T_g is the globe temperature. T_{nwb} and T_g were estimated using separate models proposed by [2].

3. RESULTS

The findings revealed a rise in annual average WBGT by 0.0.8-0.5°C/decade over the country, with a higher increase in the southeast and northeast. The number of days with WBGT related to high and extreme risk of heat-related illness has increased by 2-4 days/decade in monsoon (June and September) and 1-3 days/decade in pre-monsoon (March-May) during 1979–2021. Figure 1 shows the changes in the area affected and the number of affected days by different categories of heat stress during monsoon from 1979 to 2021, as an example. The results showed that the increase in WBGT led to a five-fold increase in the afflicted areas and a three-fold increase in high and extreme heat stress days in monsoon in recent years compared to the early period. Trend analysis of different meteorological variables indicates an increase in air temperature and solar net radiations are the major cause of rising WBGT and related health risks in Bangladesh.

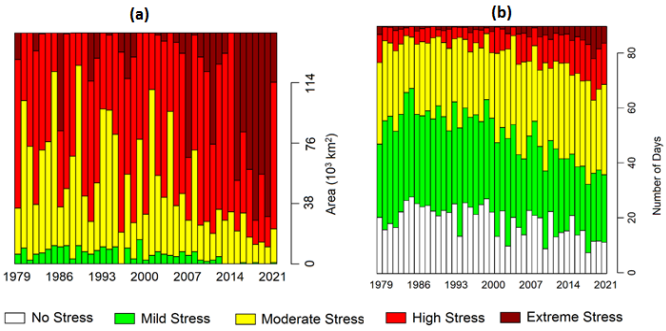

Figure 1 (a) The area affected, and (b) the number of affected days by different categories of average heat stress during monsoon from 1979 to 2021 in Bangladesh.

4. DISCUSSION AND CONCLUSION

The study revealed that increased temperature and solar radiation caused an increase in the affected area and number of days with WBGT related to high and extreme risk of heat-related illness while a decrease in WBGT related to no health risk. Nearly 37.75% of Bangladesh's total 160 million population is employed in monsoon agriculture with prolonged exposure to heat stress. In addition, 5.3 million urban residents rely on outside labor for a living. The increasing WBGT has put a vast population at heat risk, particularly occupational injuries, heat-related illness and death. To lessen the escalating effects, the country requires region-specific rules for activity adjustment, such as work-rest ratio, activity length and time, hydration, and appropriate attire.

References

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