Bioclimatic Classification of Locations in South-East Nigeria for Indoor Thermal Comfort

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INTRODUCTION

Buildings ought to adapt to the prevailing climates and provide comfortable and conducive internal environments for occupants [1]. Due to constant exposure to high solar radiation in tropical locations, buildings in such locations are designed to minimize indoor heat gain and maximize evaporative cooling, to ensure the thermal comfort of occupants [2]. Nigeria is located in the tropical climate belt and different parts of the country experience wide climatic variations all year round.

The climates in Nigeria have been studied to produce classifications that are focused on agricultural and weather prediction purposes with little or no application for building design [3]. The Givoni psychrometric chart (GPC) [4], shown in Fig. 1, provides 14 zones for characterizing a location's bioclimatic condition.

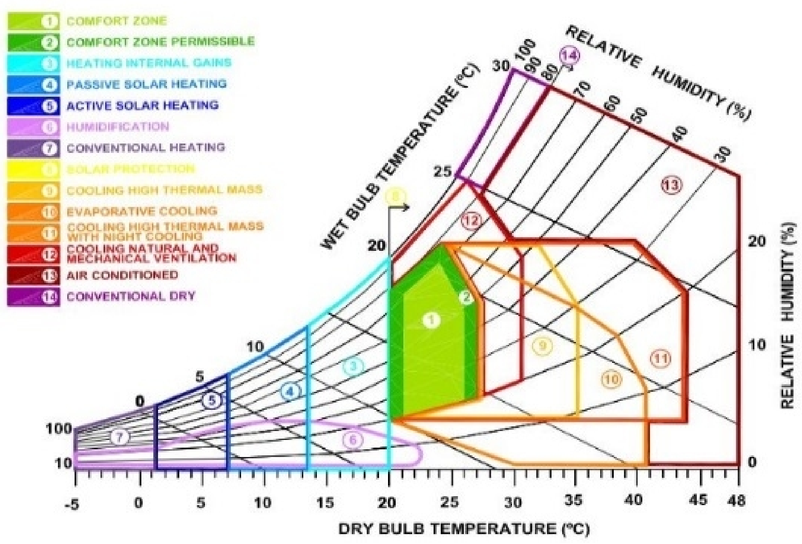

Fig. 1: Psychrometric chart adopted from Givoni [4].

METHODOLOGY

The study sites are located within the South Eastern (SE) region of Nigeria. This region falls within the latitude 6°N and 8°N and longitude 4.5°E and 7.5°E (Fig. 2). Daily annual average of relative humidities, dew point temperatures, dry bulb temperatures and the wet bulb temperatures of five locations (Abakaliki, Ebonyi State; Awka, Anambra State; Enugu, Enugu State; Owerri, Imo State and Umuahia, Abia State; Aba, Abia State and Onitsha, Anambra State) were obtained.

These climate data were plotted on the GPC for each location, the positions of the location's characteristic climatic conditions on the GPC were used to determine their annual thermal comfort classification.

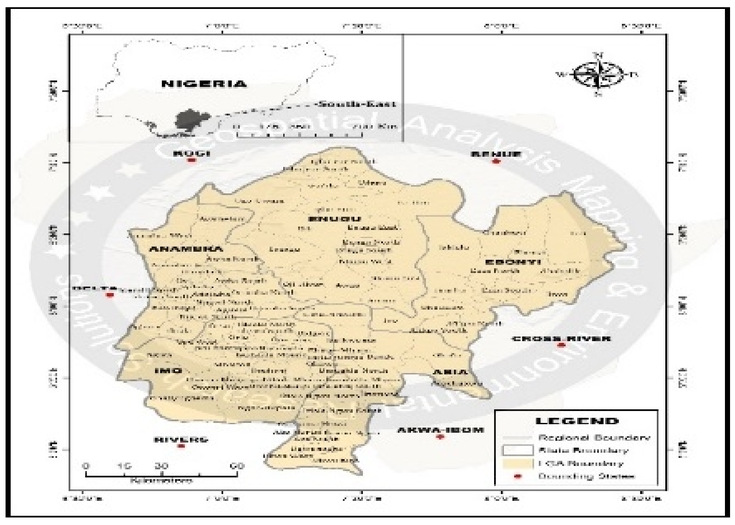

Fig. 2: Map of South Eastern Nigeria with LGAs [5]

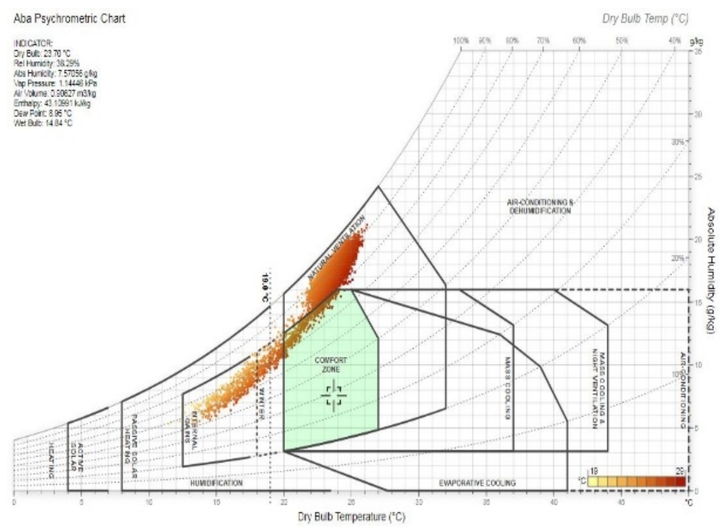

Fig. 3: Annual climatic properties of Aba

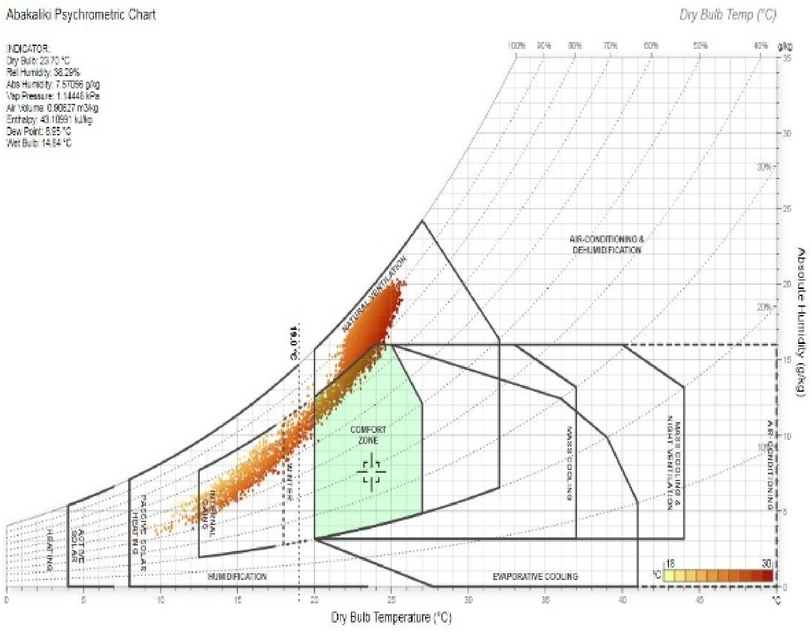

Fig. 4: Annual climatic properties of Abakaliki

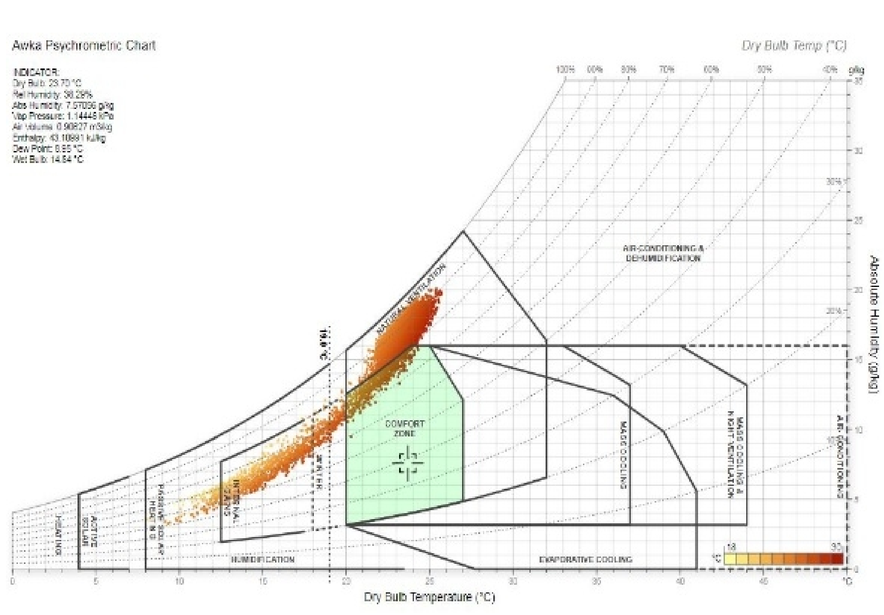

Fig. 5: Annual climatic properties of Awka

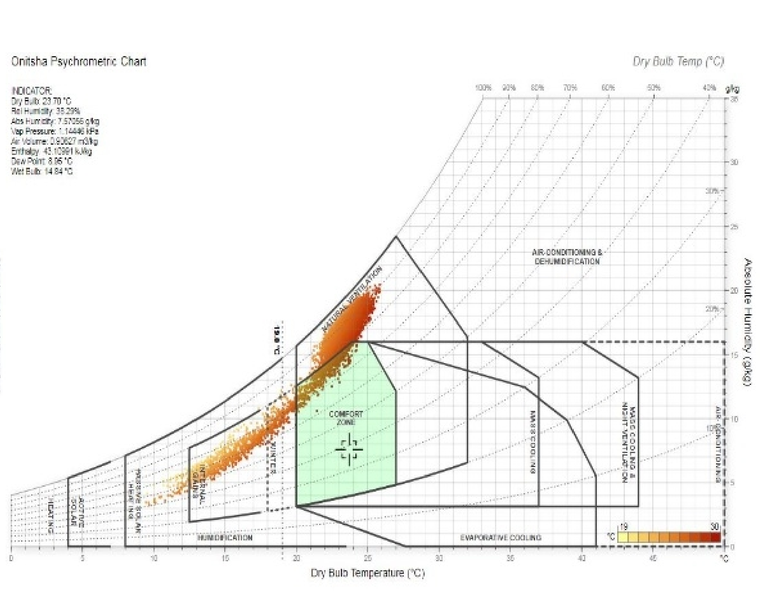

Fig. 6: Annual climatic properties of Onitsha.

RESULTS AND DISCUSSION

Figs 3 – 4 show on the GPC, the dry bulb temperatures for Aba, Abakiliki, Awka and Onitsha, respectively. Conditions in these cities are quasi-identical, and fall mostly within the *natural ventilation* zone and slightly into the *comfort permissible* zone. Thus in addition to conventional mechanical ventilation, buildings in this part of Nigeria can be cooled into comfort zone by natural methods. These could be by the inducement of cross ventilation as natural ventilation strategy with vertical spaces within building.

Subsequent studies will characterize the seasonal trends in bioclimatic conditions in these locations and develope methodologies for determining energy use levels required for acheiving indoor thermal comfort in these locations.

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