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Monitoring Future Climate Changes Pattern over Major Cities in Ghana Using Coupled Modeled Intercomparison Project Phase 5, Support Vector Machine, and Random Forest Modeling

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Abstract : Climate change is recently gaining the attention of many countries across the world. Climate change, which is also known as global warming, referring to the increasing in average surface temperature has been a concern to the Environmental Protection Agency of Ghana. Recently, Ghana has become vulnerable to the effect of the climate change as a result of the dependence of the majority of the population on agriculture. The clearing down of trees to grow crops and burning of charcoal in the country has been a contributing factor to the rise in temperature nowadays in the country as a result of releasing of carbon dioxide and greenhouse gases into the air. Recently, petroleum stations across the cities have been on fire due to this climate changes and which have position Ghana in a way not able to withstand this climate event. As a result, the significant of this research paper is to project how the rise in the average surface temperature will be like at the end of the mid-21st century when agriculture and deforestation are allowed to continue for some time in the country. This study uses the Coupled Modeled Intercomparison Project phase 5 (CMIP5) experiment RCP 8.5 model output data to monitor the future climate changes from 2041-2050, at the end of the mid-21st century over the ten (10) major cities (Accra, Bolgatanga, Cape Coast, Koforidua, Kumasi, Sekondi-Takoradi, Sunyani, Ho, Tamale, Wa) in Ghana. In the models, Support Vector Machine and Random forest, where the cities as a function of heat wave metrics (minimum temperature, maximum temperature, mean temperature, heat wave duration and number of heat waves) assisted to provide more than 50% accuracy to predict and monitor the pattern of the surface air temperature. The findings identified were that the near-surface air temperature will rise between 1°C-2°C (degrees Celsius) over the coastal cities (Accra, Cape Coast, Sekondi-Takoradi). The temperature over Kumasi, Ho and Sunyani by the end of 2050 will rise by 1°C. In Koforidua, it will rise between 1°C-2°C. The temperature will rise in Bolgatanga, Tamale and Wa by 0.5°C by 2050. This indicates how the coastal and the southern part of the country are becoming hotter compared with the north, even though the northern part is the hottest. During heat waves from 2041-2050, Bolgatanga, Tamale, and Wa will experience the highest mean daily air temperature between 34°C-36°C. Kumasi, Koforidua, and Sunyani will experience about 34°C. The coastal cities (Accra, Cape Coast, Sekondi-Takoradi) will experience below 32°C. Even though, the coastal cities will experience the lowest mean temperature, they will have the highest number of heat waves about 62. Majority of the heat waves will last between 2 to 10 days with the maximum 30 days. The surface temperature will continue to rise by the end of the mid-21st century (2041-2050) over the major cities in Ghana and so needs to be addressed to the Environmental Protection Agency in Ghana in order to mitigate this problem.

Keywords : climate changes, CMIP5, Ghana, heat waves, random forest, SVM
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