

Investigating the Relationship between Nigerian Rainfall Climatology and Lightning Stroke Distribution

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Abstract: A detailed lightning spatio-temporal study employing lightning detection networks has never been made for Nigeria. This type of research is critical for developing national plans because Nigeria has a land area of 923,769 square kilometers, a population of 206 million (2020), a population density of 223 persons per square km, and is one of the countries with the most lightning strikes in the world, with a lightning strike density of up to 147 strokes/square km/year as determined in this paper. This study gives a comprehensive national assessment of the spatio-temporal distribution of lightning across Nigeria annually from 2015 to 2021. The study also identifies the lightning hotspot in the country's 36 states and Federal Capital Territory, which are divided into six regions. A 7-year lightning dataset was compiled from the Global Lightning Dataset GLD360 network for Nigeria from 2015 to 2021. Vaisala owns the GLD360, which can detect the majority of lightning discharges worldwide. The lightning dataset was analyzed using the Python programming language and ArcGIS. The dataset contains over 123 million lightning strokes that occurred in Nigeria. Between 9 and 25 million lightning strokes occur each year, with the lowest (9.1 million) and highest (24.9 million) strokes in 2015 and 2018, respectively. The South-South region has the highest average lightning stroke density of 38 strokes/km²/year. Cross River State in the South-South region is identified as the lightning hotspot with the highest lightning strokes density of 79 strokes/km²/year in 2021 and average stroke density of 53 strokes/km²/year. Further, we investigate the relationship between rainfall and lightning distribution in Nigeria with yearly spatio-temporal plots from 2015 to 2021. The results

reveal a positive correlation between rainfall intensity and lightning stroke density across Nigeria. The South-South has highest average rainfall intensity and average lightning stroke density of 3678 mm/year and 38 strokes/km²/year, respectively. Knowledge of lightning distributions in Nigeria will aid understanding of the weather conditions responsible for lightning occurrence; influence of lightning on power system reliability; occurrence of severe weather; and when to safely hold outdoor activities. [View less](#)

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