TIME SERIES MODELLING OF RAINFALL DATA IN DIFFERENT LOCATIONS IN NIGERIA

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Abstract

This paper is motivated by the need to fit time series models to rainfall data in six different locations in Nigeria. The locations are North East, North West, North Central, South East, South West and South South. The aim is to find out whether amount of rainfall is a contributory factor to the choice of seasonal model required to analyse rainfall data in each of the locations. One state is selected to represent each location, given the fact that amounts of rainfall in the states that make up a particular location are on the average approximately equal, as recorded, from their respective capital cities (Statistical Bulletin, CBN 2014). 408 (four hundred and eight) monthly rainfall data (January 1981-December 2014) were analysed using SARIMA models. The rainfall data used in this paper are recorded amounts of rainfall from the capital cities of the states in their respective zones or locations. The results have shown that $SARIMA(1, 1, 1)_{12}$ model was the best model for rainfall data in Borno (North East), Benue (Middle Belt) and Lagos (South West), $SARIMA(1, 0, 1)(1, 1, 1)_{12}$ model for rainfall data in Zamfara (North West) and Enugu (South East), while $SARIMA(0, 1, 1)(2, 1, 2)_{12}$ model for rainfall data in Rivers (South South). The findings have it that rainfall data from three locations were fitted with $SARIMA(1, 1, 1)_{12}$ model, irrespective of the variations in the average amounts of rainfall in the affected locations. It was revealed that amount of rainfall is not a determining factor to adequate seasonal models needed for further analysis and forecast of rainfall data in the locations. Based on these findings, it is quite true that rainfall data in the locations fitted with the same model have similar natural characteristics that are only observed in the patterns of ACF and PACF. These similarity in the patterns of rainfall in the locations negates the pre-assumption that amount of rainfall is a determining factor to the choice of a model.

References

[1] Issahaku Abdul-Rahaman, Campion Benjamin Betey and Edziyie Regina, Rainfall and temperature changes and variability in the upper east region of Ghana, Earth and Space Science 3(8) (2016).

[2] M. A. Abdulrahim, I. P. Fabiyi and A. Ismaila, Time series analysis of mean monthly rainfall for drought management in Sokoto, Nigeria, Ethiopian J. Environ. Stud. Managem. 6(5) (2013), 461-470.

[3] Joseph O. Adejuwon, Rainfall seasonality in Niger delta belt, Nigeria, J. Geograp. Regional Plann. 5(2) (2012), 51-60.

[4] M. O. Adenomon, V. E. T. Ojehomon and B. A. Oyejola, Modelling the dynamic relationship between rainfall and temperature time series data in Niger state, Nigeria, Math. Theo. Modell. 3(4) (2013).

[5] O. J. Asemota, O. J. Bamanga and O. J. Alaribe, Modelling seasonal behaviour of rainfall in North East Nigeria; A state space approach, Internat. J. Statist. Appl. 6(4) (2016), 203-222.

[6] John Chisimkwuo, George Uchechukwu and Chukwuemeka Okezie Sampson, Time series analysis and forecasting of monthly maximum temperature in South Eastern Nigeria, Internat. J. Innovative Res. Develop. 3(1) (2014).

[7] P. P. Dabral, T. Saring and D. Jhajharia, Time series models of monthly rainfall and temperature to detect climate change for Jorhat (ASSAM), India, Global NEST J. 18(3) (2016), 494-507.

[8] Caroline M. Dunning, Emily C. L. Black and Richard P. Allan, The onset and cessation of seasonal rainfall over Africa, J. Geophys. Res. Atmosph. 12(19) (2016).

[9] Michael Chibuike Ekwe, Johnah Kunda Joshua, Johnson Eze Igwe and Aekunle Ayodotun Osinowo, Mathematical study of monthly and annual rainfall trends in Nasarawa State, Nigeria, IOSR J. Math. 10(1) (2014), 56-62.

[10] Dare Ogunrinde Emmanuel, Time Series Analysis of Rainfall, South-Western Part of Nigeria, Using ARIMA Model (A case study of Lagos). Undergraduate & Postgraduate Thesis, Department of Statistics, Federal University of Agriculture, Abeokuta, Ogun State, 2012.

[11] Sambo Uba Emmanuel and H. R. Bakari, An application of time series analysis in modelling monthly rainfall data for Maiduguri, North East Nigeria, Math. Theo. Modell. 5(11), (2015).

[12] Harison Etuk Ette, Udo Moffat Imo and Ele Chims Benjamin, Modelling monthly rainfall data of Port Harcourt, Nigeria by Seasinal Box- Jenkins Methods, Internat. J. Sci. 2 (2013).

[13] I. O. Ewona, J. E. Osang and S. O. Udo, Trend analyses of rainfall patterns in Nigeria using regression parameters, Internat. J. Techno. Enhancem. Emerg. Engining. Res. 2 (2014).

[14] Anand Tularam Gurudeo and Ilahee Mahbub, Time series analysis of rainfall and temperature interaction in coastal catchments, J. Math. Statist. 6(3) (2010), 372-380.

[15] Chinelo O. Igwenagu, Analysis of rainfall pattern in Enugu state, Nigeria, Europ. J. Statist. Probab. 3(3) (2015), 12-18.

[16] Meher Janhabi and Jha Ramakar, Time series analysis of monthly rainfall data for the Mahanadi river Basin, India, Sci. Cold Arid Reg. 5(1) (2013), 0073-0084.

[17] Cong Rong-Gang and Brady Mark, The interdependence between rainfall and temperature: Copula analyses, Scientif. World J. 2012 (2012), Article ID 405675.

[18] S. E. Uba and H. R. Bakari, An application of time series analysis in modeling rainfall data for Maiduguri, North Eastern Nigeria, Math. Theo. Model. 5(11), (2015).

[19] M. Bibi Umar, Jorg Kaduk and Balzter Heiko, Spatial-temporal variation and prediction of rainfall in north-eastern, Nigeria, Climate 2 (2014), 206-222.

[20] Anthony Effiong Usoro, Seasonal autoregressive moving average models and their application to quarterly rainfall series, J. Statist. Econom. Methods 3(4) (2014), 47-56.

[21] Anthony Effiong Usoro, Comparative study of seasonal autoregressive integrated moving average and Fourier series models in modelling rainfall data, A case of Akwa Ibom state, J. Statist.; Adv. Theo. Appl. 15(2) (2016), 85-102.

[22] Olaoluwa S. Yaya, A. Gil-Alana Luis and A. Akomolafe Abayomi, Long memory, seasonality and time trends in the average monthly rainfall in Major cities of Nigeria, CBN J. Appl. Statist. 6(2) (2015), 39-58.