Statistical analysis of atmospheric parameters, noise temperature and digital terrestrial television signal strength over Jos metropolis, Plateau state, Nigeria

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ABSTRACT

The study of the relationship between the Received Signal Strengths (RSS) from Unity TV (786 MHz) located at Rayfield (9.84 ° North 8.89 ° East), Jos, Plateau State and some atmospheric parameters with noise temperature has been done using two years half-hourly data. The measurement was carried from 5 am and 9 pm daily. The analysis was carried out using the regression, co-integration and Granger causality models. The results show that the RSS is higher in the morning hours (5.00 am–9.00 am) late in the evening (6.30 pm–9.00 pm) but lower between 9.00 am and 6.30 pm. This might be due to the “dusty” atmosphere and low reflection of ionosphere in the day time which causes signal attenuation within the day time. The correlation coefficients from the coefficient of determination (R squared) of 0.88, 0.004, 0.838, 0.25, 0.867, and 0.112, are −0.94, −0.07, 0.92, −0.50, −0.93, −0.334 for atmospheric temperature, pressure, relative humidity, wind speed, noise temperature and rainfall respectively. It means all the independent variables except relative humidity are inversely proportional with the RSS. Also, the higher R² values for atmospheric temperature, relative humidity and noise temperature respectively, indicates higher correlation between RSS and these parameters. It can be inferred that the models are suitable for predicting Unity TV (UTV) signal strength and that of other TV stations in Jos and environs, using T, RH and NT as inputs. The results also showed that there is a co-integration and Granger Causal relationship between the parameters and RSS.

The result will find applications to the Nigeria Broadcasting Commission in the assigning of frequencies taking atmospheric parameters into considerations, Radio Engineers and Scientists, Satellite link designers, and mobile communication experts for the link budget design and appropriate equipment deployment based on the atmospheric condition on the geographical areas.

1. Introduction

Digital terrestrial television is the type of television service in which the decoder or similar equipment receives the television signal from a transceiver which in turn receives the signal from the satellite in space. The effects of rain on the signal strength depends on the frequency, rain droplet size, shape and the rain rate (Adami et al., 2000), hence not every signal strength transmitted suffers same effect from rainfall. Also, since the quality of radio signal is affected by noise in different forms (Haykin, 2004), and atmospheric parameters as the condition of the atmosphere can lead to loss of signal (Amajama, 2016), there is need for regular investigation on the impacts of these atmospheric components on signal strength especially as the quality of terrestrial television signal received by viewers is of great interest to stakeholders in the broadcasting world (Ajewole et al., 2014).

Although some components of the atmosphere have their influence on the Received Signal Strength (RSS), the conditions of the atmosphere depend on the geographical location, altitude, as well as the variation in time of the day and the season of the year (Ayantuji et al., 2011; Ukhurebor, 2018, Chima et al., 2020).

In the work by Omolaye et al. (2014), the signal strength of Ondo State Radiovision Corporation was investigated within the radius of 25 km. The measurement was carried out at every 1 km taking five major routes within from the station. The pathloss was later determined using the signal strength. But in this our work, the instrumentation for the measurement is fixed in a particular location, and the readings taking at

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an interval of 30 min from 5.30 am to 9.00 pm daily from April 2019 to December 2020.

Akinbolati et al. (2017), did a work on the influences of temperature, atmospheric pressure, humidity, precipitation and surface radio refractivity on the Received Signal Strength (RSS) of a Digital Terrestrial Broadcast Station (DTTBS) in Akure metropolis, South West Nigeria. Although their work is related with ours especially the atmospheric parameters, the study area is not yet operating on full digital terrestrial television as seen in Plateau and Abuja, the two locations or cities in Nigeria which have their terrestrial television broadcasting fully digitized. In addition, the measured of the signal strength and the atmospheric parameters was not done in fixed location to assess the change at the same point with time but along some routes from the station, and at the interval of 1 km.

Chima et al. (2020) investigated the effects of atmospheric temper-ature and wind speed on UHF signal strength in Enugu State University of Technology and environs, Enugu State, but the independent variables here are two compared to ours which also studied the effect of atmospheric pressure, noise temperature, relative humidity, rainfall in addition to atmospheric temperature and wind speed. Also, Enugu State is not operating on full digital terrestrial television broadcasting, thus making the environment different from our study area. Therefore, the aim of this work is to investigate the effect of atmospheric parameters and noise temperature on digital terrestrial television signal strength over Jos metropolis, Plateau state, Nigeria, which is one of two cities (the other being Abuja) in Nigeria that is currently operating on fully digitised terrestrial television broadcasting.

2. Materials and method

Jos is the capital city of Plateau State in the North-central zone of Nigeria. Located in Guinea Savanna vegetation, Jos is situated between latitude 8.30°N and 10.40°N, and longitude 8.48°E and 10.70°E and on the altitude of about 1,400 m, with the rainy season from April to September, and dry season from October to March. It has the average annual rainfall of 1,324 mm, and an average daily temperature of 22.8 °C (Wuyeb and Daloeng, 2020).

The measurement instrumentation which were bought from the market for the work was setup in a location (Rayfield) in Jos on Latitude 9.84° North and Longitude 8.89° East which is about 10 km from the Transmitter of Startimes TV. The instrumentation is made up of CATV signal strength meter used for Unity TV (786.00 MHz) signal strength measurement, automatic weather station used for measuring atmospheric temperature, pressure, rainfall, relative humidity and wind speed, while the noise temperature was measured with non-contact infra thermometer. The availability of the equipment was 98% as 2% of the time was downtime when the routine maintenance of the instrumentation (changing of batteries, cleaning) at every three months interval was carried out.

The data was taken every 30 min from 5.00 am to 9.00 pm daily, beginning from April, 2019 to December, 2020, and the results were averaged, and analysed using regression analysis, co-integration and Granger Causality models to assess their relationships and the causality effects between the parameters and the RSS. Models for predicting the signal strength in Jos and environs have been developed using the atmospheric parameters and noise temperature as inputs variables. The statistical analysis was carried out using microsoft excel worksheet, matlab software and E-Views application.

The long run Granger Causal relationship is determined using the Vector Error Correction Model (VECM) given as 1, 2 and 3 (Hamdi andShia, 2012):

\[ \Delta \text{UTV} = \beta_0 + \sum_{i=1}^{6} \beta_i \Delta \text{UTV}_{t-1} + \sum_{i=1}^{6} \beta_i \Delta \text{WS}_{t-1} + \sum_{i=1}^{6} \beta_i \Delta T_{t-1} + \sum_{i=1}^{6} \beta_i \Delta RH_{t-1} + \sum_{i=1}^{6} \beta_i \Delta RF_{t-1} + \sum_{i=1}^{6} \beta_i \Delta P_{t-1} + \sum_{i=1}^{6} \beta_i \Delta NT_{t-1} + \lambda \text{ECT}_{t-1} \text{(1)} \]

where \( UTV \) is the Unity TV Received Signal Strength, \( WS \) is the wind speed, \( T \) is the temperature, \( RH \) is the relative humidity, \( RF \) is the rainfall, \( P \) is the atmospheric pressure, and \( NT \) is the noise temperature. \( \lambda, \beta \) and \( C \) are constant terms, are short-run elasticities (coefficients of the first-differenced variables), \( \beta_1 \) and \( \beta_2 \) are long-run elasticities (coefficients of the variables of interest), \( \text{ECT}_{t-1} \) is Error correction terms lagged for one period, \( \Delta \) is First difference operator, \( k \) is the lag length.

\[ \text{ECT}_{t-1} = (w_1 \Delta \text{UTV}_{t-1} + w_2 \Delta \text{WS}_{t-1} + w_3 \Delta T_{t-1} + w_4 \Delta RH_{t-1} + w_5 \Delta RF_{t-1} + w_6 \Delta P_{t-1} + w_7 \Delta NT_{t-1} + C) \text{(2)} \]

Substituting (2) into (1), it gives;

\[ \Delta \text{UTV} = \beta_0 + \sum_{i=1}^{6} \beta_i \Delta \text{UTV}_{t-1} + \sum_{i=1}^{6} \beta_i \Delta \text{WS}_{t-1} + \sum_{i=1}^{6} \beta_i \Delta T_{t-1} + \sum_{i=1}^{6} \beta_i \Delta RH_{t-1} + \sum_{i=1}^{6} \beta_i \Delta RF_{t-1} + \sum_{i=1}^{6} \beta_i \Delta P_{t-1} + \sum_{i=1}^{6} \beta_i \Delta NT_{t-1} + i (w_1 \Delta \text{UTV}_{t-1} + w_2 \Delta \text{WS}_{t-1} + w_3 \Delta T_{t-1} + w_4 \Delta RH_{t-1} + w_5 \Delta RF_{t-1} + w_6 \Delta P_{t-1} + w_7 \Delta NT_{t-1} + C) \text{(3)} \]

where \( \Delta \) is the Unity TV Received Signal Strength, \( \Delta \) is the wind speed, \( \Delta T \) is the temperature, \( \Delta RH \) is the relative humidity, \( \Delta RF \) is the rainfall, \( \Delta P \) is the atmospheric pressure, and \( \Delta NT \) is the noise temperature. \( \beta_i \) and \( C \) are constant terms, are short-run elasticities (coefficients of the first-differenced variables), \( \beta_1 \) and \( \beta_2 \) are long-run elasticities (coefficients of the variables of interest), \( \text{ECT}_{t-1} \) is Error correction terms lagged for one period, \( \Delta \) is First difference operator, \( k \) is the lag length.

3. Results and discussion

Figure 1 represents the averaged half hourly signal strength of the TV station from April to December 2019 and January to December, 2020. It can be observed that higher signal strength was received between 5.00 am to 9.00 am and between 6.30 pm to 9.00 pm which is morning and evening, but low between 9.00 am to 6.30 pm. This is because the ionosphere reflects better when there is little or no radiation from the sun which in this case is in the morning and evening. It may also be as a result of the clear sky in the morning and evening compared to afternoon when dust particles are much in the atmosphere. In the afternoon hours, particles move at a faster speed due to the higher kinetic energy acquired as a result, the higher amount of heat energy gotten from the sun resulting in rise in temperature.

3.1. Correlation of RSS with Noise temperature and Atmospheric parameters

Figures 2(a – f) present the regression relationship between the RSS and the atmospheric parameters, the analysis which was performed in
Based on the coefficients of determination (R squared) of 0.88, 0.004, 0.838, 0.25, 0.867, and 0.112, for atmospheric temperature, pressure, relative humidity, wind speed, noise temperature and rainfall respectively, the corresponding correlation coefficients are −0.94, −0.07, 0.92, −0.50, −0.93, −0.33, respectively. This implies that atmospheric temperature, pressure, wind speed, noise temperature and rainfall are inversely proportional with the RSS, while relative humidity is directly proportional with the RSS. It also implies that an increase in atmospheric temperature, pressure, wind speed, noise temperature and rainfall will lead to a decrease in RSS, and vice versa, while an increase in relative humidity will lead to an increase in RSS, and vice versa. Relative humidity favours
higher signal strength because it will in a way reduce the atmospheric and noise temperatures which cause signal strength to decrease probably due to higher kinetic energy gained by particles in the atmosphere at higher temperature, resulting in attenuation of RSS.

Also, the higher R squared values of 0.88, 0.838 and 0.867 for atmospheric temperature, relative humidity and noise temperature respectively, indicates higher correlation between RSS and these parameters, while the lower R squared values of 0.004, 0.25 and 0.112 for atmospheric pressure, wind speed and rainfall, shows that there is a little correlation between the RSS of Unity TV and these parameters.

This implies that the models generated from the atmospheric temperature, relative humidity and noise temperature can suitably predicts the signal received from the Unity TV as well as other TV stations in Jos and environs, using atmospheric temperature (T), relative humidity (RH) and noise temperature (NT) as inputs. The findings is in conformity with the works of Ukhurebor (2018), Ojo et al. (2020), and Chima et al. (2020) in which the signal strength recorded was found to be inversely related to temperature, wind speed and atmospheric pressure in their separate works carried out in Benin city-Edo State, Abuja and Enugu State.

### 3.2. Co-integration

For preliminary test of the co-integration, and considering the probability or P value of 0.05, the Trace Test (Table 1) shows that there are co-integrations as indicated by the asterisk (*), hence the null hypothesis of no co-integration is rejected.

In the first row Table 1, the null hypothesis implies that there is no co-integration between UTV RSS and no variable, and this has the probability value of 0.9389, which is less than 0.05 significant or critical level. Hence the null hypothesis is rejected. In the second row, the null hypothesis was that there was no co-integration between UTV RSS and at most one variable, and this has the probability value of 0.0031, which is also less than 0.05 critical level. Hence the null hypothesis is rejected as there is co-integration between them. In the third row, the null hypothesis was that there was no co-integration between UTV RSS and at most two variables, and this has the probability value of 0.0155, which is less than 0.05 critical level. Hence the null hypothesis is rejected as there is co-integration between them. In the fourth row, the null hypothesis was that there was no co-integration between UTV RSS and at most three variables, and this has the probability value of 0.0481, which is less than 0.05 critical level. Hence the null hypothesis is rejected as there is co-integration between them. In the fifth row, the null hypothesis was that there is one co-integration equation between the variables, there is a long run relationship, and the null hypothesis of no co-integration will be rejected.

In the sixth row, the probability value is 0.1105. This is also greater than 0.05 critical level, hence, the null hypothesis of no co-integration with “at most 6” variables cannot be rejected. In the seventh row, when the null hypothesis is “at most 6”, the probability value is 0.1105. This is also greater than 0.05 critical level, hence, the null hypothesis of no co-integration with “at most 6” variables cannot be rejected. In the 5th, 6th, and 7th rows, the Trace statistics are greater than the respective Critical values, and so, the null hypothesis of no co-integration cannot be rejected.

Therefore, there is co-integration between three variables out of the six variables according to trace statistic method.

In addition, the Maximum Eigenvalue test (Table 2) is another result for the determination of co-integration. According to the rule, once there is one co-integration equation between the variables, there is a long run relationship, and the null hypothesis of no co-integration will be rejected.

In the first row of Table 2, at the Eigen value of 0.9389, Max-Eigen Statistic of 81.0662, and Critical Value of 46.2314, the probability is 0.0000, and this is less than 0.05, hence there is a co-integration. Also, the value of the Max-Eigen Statistic of 81.0662 is greater than Critical Value of 46.2314, and this is another condition for a co-integration, thus, there is a long-run relationship between RSS and the variables, and the null hypothesis will be rejected.

#### 3.3. Vector error correction estimates

The results presented in Table 3 shows that in every 1% change in wind speed, there will be about 5.1% decrease in UTV RSS; in every 1% change in temperature, there will be a 14.6% decrease in UTV RSS; in every 1% change in relative humidity, there will be a 0.94% increase in UTV RSS; in every 1% change in rainfall, there will be 0.54% decrease in UTV RSS; in every 1% change in pressure, there will be 0.54% decrease in UTV RSS; and in every 1% change in noise temperature, there will be a 7.9% decrease in the UTV RSS.

### Table 1. Co-integration using Trace Test method.

| Hypothesized Co-integration Rank Test (Maximum Eigenvalue) | Unrestricted Co-integration Rank Test (Maximum Eigenvalue) |
|-----------------------------------------------------------|----------------------------------------------------------|
| Hypothesized No. of CE(s) | Eigenvalue | Trace Statistic | 0.05 Critical Value | Prob. ** |
| None *         | 0.9389 | 191.9318 | 125.6154 | 0.0000 |
| At most 1 *    | 0.7018 | 110.8656 | 95.7537 | 0.0031 |
| At most 2 *    | 0.6158 | 75.7738 | 69.8189 | 0.0155 |
| At most 3 *    | 0.5761 | 48.0320 | 47.8561 | 0.0481 |
| At most 4      | 0.3946 | 23.1430 | 29.7971 | 0.2391 |
| At most 5      | 0.1880 | 8.5866 | 15.4947 | 0.4050 |
| At most 6      | 0.0841 | 2.5472 | 3.8415 | 0.1105 |

Trace test indicates 4 co-integrating eqn(s) at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level.

### Table 2. Co-integration using Maximum Eigenvalue method.

| Hypothesized Co-integration Rank Test (Maximum Eigenvalue) | Unrestricted Co-integration Rank Test (Maximum Eigenvalue) |
|-----------------------------------------------------------|----------------------------------------------------------|
| Hypothesized No. of CE(s) | Eigenvalue | Max-Eigen Statistic | 0.05 Critical Value | Prob. ** |
| None *         | 0.9389 | 81.0662 | 46.2314 | 0.0000 |
| At most 1      | 0.7018 | 35.9017 | 40.0776 | 0.1639 |
| At most 2      | 0.6158 | 27.7419 | 33.8769 | 0.2257 |
| At most 3      | 0.5761 | 24.8890 | 27.5843 | 0.1065 |
| At most 4      | 0.3946 | 14.5563 | 21.1316 | 0.3212 |
| At most 5      | 0.1880 | 6.0394 | 14.2646 | 0.6081 |
| At most 6      | 0.0841 | 2.5472 | 3.8415 | 0.1105 |

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level. * denotes rejection of the hypothesis at the 0.05 level.
Table 3. Vector error correction estimates.

| Sample (adjusted): 31 |
|-----------------------|
| Included observations: 29 after adjustments |
| Standard errors in the brackets "()" & t-statistics in bracket "[ ]" |

Cointegrating Eq: CointEq1

| Variable | Coef | Std. Error | t-Statistic | Prob. |
|----------|------|------------|-------------|-------|
| UTV(-1)  | 1.000 | [1.9538] | [2.6413] | 0.1986 |
| WS(-1)   | -5.1605 | [9.1895] | 35.1309 | 0.0054 |
| T(-1)    | 14.6168 | [1.5906] | 7.9278  | 0.0012 |
| RH(-1)   | 0.9461 | [0.3011] | 3.1425  | 0.1658 |
| RF(-1)   | -0.5462 | [0.2282] | 2.3939  | 0.7434 |
| P(-1)    | -35.1309 | [4.0516] | 8.6710  | 0.0022 |
| NT(-1)   | -7.9278 | [0.7590] | 10.4458 | 0.1639 |
| C        | 31633.1800 | [3.1425] | 9.1895  | 0.1680 |

3.4. Short run causal effect

Table 4 shows the result of the short run Granger Causality. Granger causality relationship exists between UTV RSS where the probability of Chi square is less or equal to 0.05. As presented in Table 4, taken unity TV as the dependent variable, it is observed that only pressure and rainfall have a short run Granger causal effect on RSS from Unity TV because it has the probability of 0.001 for rainfall and 0.0047 for pressure, these values are less than 0.05; hence the null hypothesis is rejected. In the case of wind speed, atmospheric temperature, relative humidity, and noise temperature, they have no short run causal effect on RSS. Generally, all the independent variables have short run causal effect on the RSS with the relative humidity being the dependent variable.

3.5. Long run causal effect

The following relations were deduced based on the long-run causal relationship as formulated using the Least Square Causality equations, (the probability of 0.05 levels shows the long run causal relationship among the variables). The speed of adjustment, Lambda (λ), which is the same as C (x)“Highlighted RED” in the equations is the coefficients of Error Correction Terms (ECT) in each equation, and is used to express long-run relationship at 0.1 level. The equations formulated are:

\[
\begin{align*}
D(UTV) &= C(1) - 5.16^*WS(-1) + 14.62^*T(-1) + 0.55^*RH(-1) - 9.18^*NT(-1) + 31633.1800 \\
D(RF) &= 1.2687 + 0.3807^*C(2) - 0.3087 \\
D(P) &= 3.6261 \\
D(RH) &= 15.0317 \\
D(T) &= 0.7434 \\
D(WS) &= 0.9461 \\
\end{align*}
\]

Table 5. Long-run causal relationship.

| Coefficient | Std. Error | t-Statistic | Prob. |
|-------------|------------|-------------|-------|
| C(1)        | -0.0477    | 0.1049      | -0.4547 | 0.6501 |
| C(2)        | -0.1681    | 0.1593      | -1.0555 | 0.2930 |
| C(3)        | -0.1639    | 2.1106      | -0.7777 | 0.9382 |
| C(4)        | 0.7203     | 3.6261      | 0.1986  | 0.8428 |
| C(5)        | 0.6054     | 0.4368      | 1.3859  | 0.1680 |
| C(6)        | 0.5553     | 0.1432      | -3.8771 | 0.0002 |
| C(7)        | -9.8943    | 3.5040      | -2.8237 | 0.0054 |
| C(8)        | 0.2687     | 1.0380      | 0.2589  | 0.7961 |
| C(9)        | -0.3087    | 0.4153      | -0.7434 | 0.4585 |

For the long-run Granger Causality relationship, and the Granger causality is gotten from ECT which have the coefficient of C(1), hence the probability at the coefficient, C(1), will be studied if P ≤ 0.05, as the probability of 0.05 levels shows the long run causal relationship among the variables. For the short-run Granger Causality relationship, the probability (P values) of all the independent or exogenous variables will be studied based on their coefficients. The results of the Long-run causal relationship is shown in Table 5.

In Eq. (4), C(1) is the coefficients of ECT which is the long-run part of the equation, C(2) is the coefficient Unity TV RSS term on the short-run, C(3), C(4), C(5), C(6), C(7), and C(8) are the coefficients of wind speed, atmospheric temperature, relative humidity, rainfall, pressure, and noise temperature respectively in the short-run part of the UTV model.

For Table 5 (which is an extract of the generated result of long-run Granger Causality analysis using E-Views application), for the long-run Granger Causal effect, at the coefficient of C(1), probability or P value is 0.6501, which is greater than 0.05 alpha or significant level. Therefore, the null hypothesis of no long-run Granger Causal relationship between UTV RSS and the atmospheric parameters cannot be rejected. This implies that noise temperature and atmospheric parameters do not have any type of causal effect on the UTV RSS in a long-run.

Also, for the short-run Granger Causal relationship, the coefficients; C(3), C(4), C(5), C(6), C(7), and C(8) which are the coefficients of wind speed, atmospheric temperature, relative humidity, rainfall, pressure, noise temperature are considered respectively.

Also, from Table 5, the probability values for C(3) is 0.9382, and this is greater than 0.05 significant level. This means that there is no short-run Granger Causality relationship between UTV RSS and wind speed whose coefficient is C(3) in Eq. (4). Also, for C(4) which is the coefficient of atmospheric temperature, the probability value at C(4) is 0.8428, and which is also greater than 0.05 significant level, hence, there is no short-run causal relationship between atmospheric temperature and UTV RSS. C(5) is the coefficient of relative humidity. The probability at C(5) is 0.168, and this is greater than 0.05 P-value or significant level. Hence, there is no short-run Granger Causal relationship between UTV RSS and relative humidity. C(6) is the coefficient of rainfall in the UTV model equation. At C(6), the probability value is 0.0002, and this is less than the 0.05 significant level. This implies that rainfall has a short run granger causal effect on UTV RSS. At the coefficient of C(7), which is for atmospheric pressure, the value of the probability is 0.0054, which is less than the significant level of 0.05. Hence, there is a short-run Granger causality relationship between atmospheric pressure and UTV RSS. As for C(8) which is the coefficient of noise temperature, the probability value at this point is 0.7961, and implies no short-run Granger Causality relationship between UTV RSS and noise temperature because 0.7961 probability value is greater than 0.05. In summary, it is only rainfall and atmospheric pressure that have short-run Granger Causal relationship with UTV RSS.
4. Conclusion

It can be inferred that the received signal strength is higher from 5.00 am–9.00 am and 6.30 pm–9.00 pm but lower in-between this period, 9.00 am–6.30 pm, mostly as a result of the presence of dust particles in the atmosphere and low reflection of ionosphere in the day time or when there is much radiation from the sun which causes signal attenuation. Also, the Johansson co-integration method shows that there are four co-integrating equations from the Maxmum-Eigen value (Tables 1 and 2), thus there is a co-integration between the variables and UTV RSS. This means that there is a long-run relationship between the Unity TV RSS and the atmospheric parameters in the study area. In addition, the result showed that there is no long run Granger Causality effect of the independent variable (atmospheric temperature, pressure, relative humidity, wind speed, noise temperature and rainfall) on UTV RSS because the probability value (0.6501) for error correction term or coefficient of the variables of interest is greater than 0.05. There is a short run Granger causality relationship between the variables as rainfall and atmospheric pressure had the probability values of 0.0001 and 0.0047, which are both less than the 0.05 significant level. Given that the probability value for joint Granger causality effect of all the exogenous or independent variables on the UTV RSS as 0.0001 (Table 4), it can be concluded that the parameters have joint Granger Causal relationship with UTV RSS. Furthermore, the higher R squared values of 0.88, 0.838 and 0.867 for atmospheric temperature, relative humidity and noise temperature respectively, indicates higher correlation between RSS and these parameters. It can be inferred that the models are suitable for predicting Unity TV signal strength and that of other TV stations in Jos and environs, using atmospheric temperature, relative humidity and noise temperature as inputs. Generally, information from the study will be a good tool for the Nigerian Broadcasting Commission in the assigning of channels to users as well as having the knowledge of radio or signal horizon of the same frequency is also determined by atmospheric condition especially atmospheric temperature; radio engineers and scientists, satellite link designers for appropriate link design and installation of appropriate equipment suitable in a particular geographical location based on its atmospheric condition, and mobile communication experts to have the knowledge of suitable equipment especially the type and size of antennas including the altitude of the location of the mast.

Declarations

Author contribution statement

Abdullahi Ayegba; Joseph Sunday Ojo; Adekunle Titus Adediji: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data will be made available on request.

Declaration of interest's statement

The authors declare no conflict of interest.

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