

**A STUDY OF EFFECTS OF WEATHER CONDITIONS ON SATELLITE
TELEVISION CABLE NETWORK RECEPTION QUALITY IN WARRI
METROPOLIS, DELTA STATE, NIGERIA**

Abstract

In this study, we examined the effects of weather conditions on satellite television cable network reception quality in Warri Metropolis. The ex-post facto research design was used. Data was collected from both primary and secondary sources. The primary data were generated through personal observation/monitoring of Television sets that were connected to the three prominent networks (MYTV, DSTV, and HITV) in Warri. Also rainfall stations were established in each of the sample areas and were used to collect rainfall amount and duration for three months. The Secondary data used were wind speed, humidity, temperature and rainfall and were collected from the archives of the Nigerian Meteorological Agencies office in Warri for 20 years. A total of fifteen (15) TV sets and fifteen modem of MYTV, DSTV and HITV satellite-cable network were utilized for this study; three for each of the representative sampling area in the five (5) zones. Results showed that there is variation in the trends of climate parameters in Warri. There is variability in the rainfall, relative humidity as well as the wind speed trends in Warri from 1991-2011. The variations in these climate attributes have effects on the durability and functionalities of satellite cable network in the area. The reception quality for MYTV reduced from 69.8% on days without rainfall to 15.4% on rainy days during the study period, while DSTV signal quality reception was also reduced by rainfall and weather effect to 20.4% on rainy days from 85.6% mean on days without rainfall. HITV signal quality reception of 33.4% on days without rainfall was reduced to 7.2% by the effect of rainfall. Rainfall impairs signal quality. Further, the result revealed that there is a significant variation in cable network reception qualities of MYTV, DSTV and HITV. This is evident from the calculated F-value of 1028.136 which is greater than the critical table-value of 19.49 at 0.05 significant level. The r value shows a correlation of 0.989 between weather elements, especially rainfall and MYTV reception quality. However, R^2 value of 0.977 shows that 97.7% variation in the quality of signal reception from MYTV is explained by weather parameters. Also the r value shows a correlation of 0.994 between weather elements especially wind speed and DSTV reception quality. However, R^2 value of 0.988 shows that the quality of the signal reception from DSTV is explained by 98.8% dependency on weather parameters. Similarly, the r value shows a correlation of 0.970 between weather elements especially rainfall and HITV reception quality. However, R^2 value of 0.942 shows that the quality of the signal reception from MYTV is explained by 94.2% dependency on weather parameters. The policy implications of the findings of this study is that adequate and well implemented weather monitoring with remote sensing/satellite based platforms should be captured in the national laws of Nigeria. Based on these, it is recommended that rainfall monitoring through satellite and ground stations should be

intensified with a view of daily prediction and communication to users of cable satellite television products in order to know what signal quality to expect at the event of anomaly in climate elements especially in the face of a changing climate. The development of rainfall sensitive signal is very important for a holistic study.

KEYWORDS: WEATHER CONDITIONS, MYTV, GOTV, DSTV, NETWORK RECEPTION, WARRI

Introduction

Weather refers to the state of the atmosphere at a given point in time at a given location. On the other hand, climate is the synthesis of weather at a given location over a period of 30-35 years. Climate therefore refers to the characteristics condition of the atmosphere deduced from repeated observations over a long period (Ayoade, 2004). Weather and climate affects day-to-day activities and lifestyles from the clothes we wear to the buildings we design, the food and energy we produce and consume. Climate-environment relationship and impacts on human activities are predicted to change dramatically if global warming accelerates at the rates currently proposed. One of such impact is on satellite TV signal distortions as well as video quality and clarity (Ikuomola, 2011).

Changes in the weather condition affect the quality of the satellite television signal reception though this occurs rarely, and lasts only a short period of time. For the majority of users, it is heavy rains that can attenuate signal enough to result in noticeable degradation of image quality. In extreme cases, the reception can be effectively disrupted. The level of concern about the possibility of signal degradation/loss in a particular area depends on: (1) regional yearly rainfall figure, (2) location in the satellite footprint and (3) height of the satellite above the horizon. Ezekoye and Obodo (2007) noted that radio waves which is the ultimate wave used in telecommunication suffer lots of disturbances as a result of the irregular behaviour of ionosphere which is caused by erratic solar radiation from the sun. During solar quiescent periods, ionospheric conditions can be assumed to be nearly constant with respect to time. However, ionospheric conditions changes rather rapidly during solar disturbances. According to Sklar (2001), different weather conditions affect a satellite television system in the following ways:

The rainy season of the year can be the worst environmental enemy of a satellite system. Very cold weather can slow down or even totally spoil the satellite motor. This will

73 obviously mean no picture. Piling up of ice and snow can throw the dish out of alignment and
74 can even warp the dish itself. The actuator arm of the satellite system could freeze up which
75 would mean that it will not swing around and will be stuck in one position only. This will
76 severely affect the picture and quality.

77 Storms from winds of high speeds can dis-align the satellite dish and disrupt Satellite
78 TV pictures. Very bad storms such as a hurricane could even cause the dish to fall over.
79 Lightning can also strike a satellite dish and cause it to malfunction. For example, satellite
80 dishes low noise block (LNB) are the most affected in this regard.

81 The sun, the earth, and the satellites over the equator, come into alignment two times
82 annually around July 22 and October 3 (Mobberly, 2007). At these times, solar outages occur
83 which can affect the satellite dish. But this condition lasts for only few minutes at a time,
84 over two weeks and is a problem only in the daytime and not during night.

85 The Rainfall pattern experienced in a place has much effect on a satellite television
86 system. Heavy rainfall experienced in Warri and many other places in the Niger Delta area of
87 Nigeria affects signal reception of a properly aimed and wired satellite home system. The
88 effects normally last for the period or time of the rainfall. In some cases, it last longer after
89 the rainfall period especially when there is heavy downpour and likely to occur more often in
90 regions with significant annual rainfall. This puts Nigeria's Southern States where Warri is
91 located in a disadvantaged and unfavourable position. What causes signal attenuation is
92 mainly wave absorption by the rain drops. There are also some signal scattering, due to
93 refraction and diffraction of electromagnetic waves in and around rain drops (Peebles, 1998).

94 Changes in signal reception from factors such as degrading antenna connections as a
95 result of changing weather conditions may gradually reduce the quality of a Television signal.
96 The nature of digital TV results in a perfectly decodable video initially, until the receiving
97 equipment starts picking up interference that overpowers the desired signal or if the signal is
98 too weak to decode. Some equipment will show a garbled picture with significant damage,
99 while other devices may go directly from perfectly decodable video to no video at all or lock
100 up. This phenomenon is known as the digital cliff effect (Peebles, 1998).

In Warri metropolis, different users of satellite TV products such as HITV, MYTV and DSTV have observe poor image quality on TV screens, poor videos and ceasing audio quality copiously on the weather. Even the LNB of these satellite TV dishes could be blown by thunderous storms that characterize the onset of the rainy season in these areas. Despite this problem, the producers of these satellite Cable TV product seems to have adopted only little measures to abate this situation. As such the poor reception of digital satellite signals persist unabated in the area. With the aforementioned problems steering glaringly at the face of almost all satellite-based TV network subscribers, it is of necessity to probe into the effect of weather characteristics on satellite TV broadcasting service quality. Thus, this study is set out to examine and determine how weather conditions affect reception of different satellite cable networks, HITV, MYTV and DSTV in Warri metropolis in Delta State of Nigeria. In order to achieve this aim, the following objectives have been outlined:

- i. To examine the general nature of the Weather characteristics in Warri.
- ii. To Identify the network signal quality on rainy days and days without rains and compare the reception quality of MYTV, DSTV and HITV in Warri
- iii. To assess the effects of weather elements such as rainfall, temperature, relative humidity and wind speed on MYTV, DSTV and HITV satellite Television network in Warri by determining the extent of attenuation.
- iv. To suggest solutions on identified problems of Satellite TV network (MYTV, DSTV and HITV) that are linked to climate.

2 Materials and Methods

2.1 Study Area

Warri metropolis lies between latitudes $5^{\circ}30'$ and $5^{\circ}35'$ N and Longitudes $5^{\circ}29'E$ and $5^{\circ}48'E$. The study area is situated within the Niger Delta region of Nigeria. It is bounded on the North by Okpe and Sapele Local Government areas, on the South by Warri South West and Ughelli South L.G.A, on the East by Ughelli South and Ughelli North L.G.A and to the West by Warri South West Local Government Area (see Fig 1.1). Warri Metropolis is made up of Warri South, Udu and Uwie Local Government areas. The areal expansion of Warri

during the past two decades has been remarkable. From a small river settlement, Warri has grown to cover the surrounding towns of Effurun, Ekpan, Enerhen, Edjeba, Ogunu, Jakpa, Ovwian-Aladja, Udu Road, etc. with the results that Warri is now about 31,668km² (Efe, 2002).

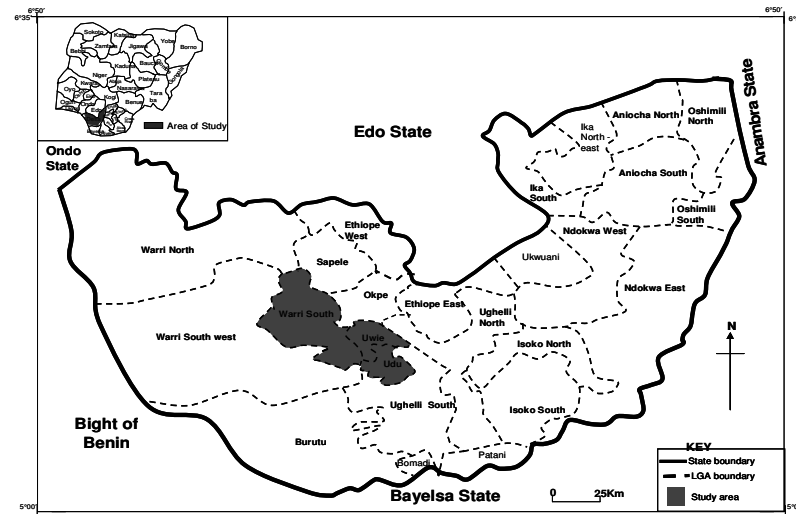


Fig. 1.1 : Map of Delta State Showing Study Area
Source: Modified after Ministry of Lands, Survey and Urban Development Asaba, 2008

Climate

The area is characterized by tropical equatorial climate with mean annual temperature of 32.8°C and annual rainfall amount of about 3000mm (Efe, 2002). Rainfall period is between January–December, with the minimum value of 8.2mm in January and over 536.6mm in September. The predominant wind system in Warri metropolis is the tropical Maritime Air Mass (mT) which is humid and moist, and brings rainfall into this environment. The influence of the Tropical Continent (cT) air mass is minimal; it brings in slight harmattan in the area between December and February.

There is no marked dry season in the area as rainfall in all the months is above 2.5mm (Efe, 2002b). There are high temperatures of 36°C and 37°C in the heavily built up and traffic congested areas of Enerhen junction, Enerhen road area, Estate, Okere road areas, Jakpa junction, Jakpa roads areas, Hausa quarters and Igbudu market areas respectively (see Efe, 2002a).

The rainfall patterns in Warri metropolis show that Warri have been experiencing heavy amount of torrential rainfall that spans a period of 12 months annually over the years. This is expected to have significant effects on television signals received in the area especially in the face of a changing climate. This climatic mix accounts for the general attenuation of satellite TV signals characteristic of the area. The annual mean rainfall, relative humidity, temperature and wind speed for twenty one years (1991-2011) in Warri was 238.39 mm, 83.5%, 32.8°C and 3.35 m/s respectively.

Vegetation

The natural vegetation is of rainforest with swamp forest in some areas. The forest is rich in timber tree species (*Ocotea bullata* [Burch.]), palm trees (*Elaeis guineensis*), as well as fruit trees. Unfortunately, much of the rain forest has been destroyed as a result of farming, commercial lumbering and urbanization. However, there is still a fairly large area of swamp forest vegetation. Thus, the climate and vegetation influences to a large extent the nature of attenuation in the area because rainfall, windstorm/thunderstorm, solar outages and the vegetation can be a good source of signal breakages, blurred picture clarity and total loss of signals from satellite dish antennas. Trees can have an effect on TV reception (Ramachandran and Kuma, 2007). Interference with signal tends to be attenuated in bad, windy and rainy weather. Satellite and digital reception are more sensitive to interference than analogue television reception (Ramachandran and Kuma, 2007).

Geology, Soil and Drainage

Warri metropolis is situated within the Niger Delta region of Nigeria, which has the Agbada, Akata and Benin geologic Formation. The rocks found in the area are of sedimentary origin. The soils are classified according to the U.S. soil Taxonomy System as alfisols, oxisols, ultisols, and spodosols (Soil Survey Staff, 1994). The alfisols are moderately fertile soil; oxisols/ultisols are infertile, while the spodosols and psamments are mainly sandy soils. Warri has a flat terrain of about 6m above sea level and located at the Shore of Warri River.

The area is characterized by hydromorphic soils which is a mixture of course alluvial and colluvial deposits (Okoye *et al.*, 1987; Efe, 2002). Near the Atlantic coast, its flat and low relief feature results in water stagnating on the ground surface. The Warri River and two creeks that lead to Rivers Forcados and Escravos drain the area too. Thus, reflects the rate of percolation and infiltration of water into the soil. This attribute makes Warri a preferred

choice for human habitation thereby increasing the population through urbanization which means more pressure on social infrastructure and more life challenges. These attributes of geology and drainage contribute to the problem under discussion because the nature of the terrain affects the stability of standing satellite dish antenna(s) especially the soil component.

Population

There have been a tremendous growth in the population; it has grown from being a rural area to an urban area. Warri metropolis is one of the rapidly growing cities in Nigeria, with its population rising rapidly from 280,000 in 1980, 500,000 in 1991 to 638,250 in 2006 (NPC, 2006) and estimated at 730, 000 in 2010 (Ojeh, 2011).

It has a high population density that is concentrated in the core areas of the city. These areas include; Warri-Sapele road, Agbassa, Okere, Okumagba Avenue, Egbudu, Iyara, Jakpa, Airport road, P.T.I. road, Udu and Ekpan. Thus, the increase in population of the area has led to increase in the demand of satellite TV products patronage. Presently, one does not even need to subscribe directly to major distributors/dealers like Poyen Nomovo but with as little as ₦500.00 some smaller dealers can get every household in the proximity neighbourhood connected. As such satellite dish antennas are found on virtually every roof top in the metropolis as a result of both legal and illegal connections from youths who have perfected the act.

Socio-Economic Activities

Warri is an administrative centre, health centre, commercial centre and educational centre. The socio-economic activities in Warri are classified into: the primary activities which are agricultural activities such as farming, livestock farming, etc. The people of Warri grow crops such as Corn, Cassava, Okro etc. for consumption i.e. they are mainly subsistence farmers or agriculturist. The secondary activities are basically the processing activities such as Carpentry, Tailoring, Carving, etc. which is the conversion of raw materials into finished goods. Small-scale industries are prevalent especially in agro-allied and metal work.

Warri is an oil city with many multinational oil companies such as Shell Petroleum Development company (SPDC), Chevron, and home based oil and gas companies such as Warri Refinery and Petrochemical Company (WRPC), Nigeria National Petroleum Corporation (NNPC), exploiting oil and flaring of gas (Tamuno, 2009). Service companies in Warri are varied and numerous among which are Banks such as Oceanic Bank Plc, Zenith

Bank Plc, Intercontinental Bank Plc among others, which provide banking service and Insurance companies in the area. The Insurance companies include IGI Insurance, Equity life Assurance, Intercontinental-Wapic Insurance, Investment and Allied Assurance to mention but a few.

Warri metropolis boasts of many Satellite TV connections to homes in the different parts of the metropolis. There are also ones provided by the Delta State Government for the public. In Warri metropolis, almost every big registered and unregistered establishment are users of one or more of these satellite TV company products. All banks, Hotels, oil Companies found in Warri are connected to DSTV or HI TV or MY TV or all in most cases because of specific programs/channels provided by these stations. For football lovers, HI TV is the favourite; for home movies, it is MY TV and for major international news channels, DSTV is most preferred though they all share some programs/channels in common. Monthly subscription for MYTV is N1900.00 and this makes available 20 channels to the subscriber. For HITV, it is N3500.00 for 31 channels while DSTV premium comes with 70 channels with a monthly subscription of N9800.00. About 4 audio services and 5-14 international radio channels are available to all subscribers.

Methods

This study adopted an Ex-post facto (Causal Comparative) design. In the process of carrying out the study “*A Study of Climate Effects on satellite television cable network Receptions*” the research design was based on field survey which involves personal observation/monitoring of reception problems associated with MYTV, DSTV and HITV occasioned by rainfall, temperature, wind and relative humidity. Rainfall, temperature, Relative humidity and wind speed data were obtained from Nigerian Meteorological Agency, Warri for 20 years and complimented by field data generated through personal observation/monitoring of Television sets that were connected to the three networks (MYTV, DSTV, and HITV) and another set of rainfall data that was generated from rainfall stations established in each of the sample areas.

The stratified sampling technique was adopted for the collection of primary data which involves personal observation of screens of three television sets with the different networks. The stratified sampling method was used to divide the area into five zones based on major economic activities (land use) shown in table 1. A total of fifteen (15) TV sets and fifteen modem of MYTV, DSTV and HITV satellite-cable network were utilized for this study, three for the representative sampling area in each of the five (5) zones. The data were

collected from Independent Satellite Television service provider's offices located in the five zones. The choice of the independent satellite cable service providers was borne out of the fact that they already have MYTV, DSTV and HITV networks installed for about three (3) years and has been providing services to their clients (subscribers) in Warri. This was done to ensure that the three TV cable networks (MYTV, DSTV and HITV) have equivalent signal reception.

Table 1: Sample Areas

Zones	Areas	Sampling Sites
A	Effurun, PTI, NNPC, GRA	PTI
B	Osubi, Shell, NPA, Aladja	NPA
C	Edjeba, Ugborikoko, Estate	Edjeba
D	Enerhen, Udu, Eket	Enerhen Road
E	Okere, Okumagba Avenue	Okere

The procedure adopted for collection of the signal quality and strength data was a full range of concurrent observations. The researcher and four (4) trained research assistants collected the primary data needed for this study. The four (4) research assistants including the researcher had three television sets each having the three digital cable TV networks (MYTV, DSTV and HITV) that the study is set to examine. A total of fifteen TV sets were deployed for this study and were positioned at 2m above the ground on a flat table at the offices of the satellite network providers used as platform for this study. Observations took place between 6.00am and 9.00pm daily with observations recorded at intervals of every one hour for four months (May, June, July and August in 2012). Each of the observers was located in one of the five zones (A-E) in Warri where they monitored and collected data in that area.

For purpose of clarity, the reception (signal) quality displayed on the "Information Central" screen of the cable TV networks was used to adjudge reception quality. viz:

0-30% - No Signal

30-60%- Poor reception

61-90%- Good reception

91% & above-Very good reception

Also a total of five (5) rainfall stations were established, one for each sample area. These were manned by the researcher and four (4) research assistants who were trained in such act to collect daily records of rainfall amount and intensities for the period of four (4) months. Records were made once every day. The data were presented in statistical diagrams and analysed with the aid of multiple regressions and Analysis of variance. The result for

quality of reception and the effects of weather characteristics was tested using the multiple regression using the SPSS (version 17), while the results from the reception according to satellite TV system in use was tested using the analysis of variance (ANOVA statistics).

3 Result and Discussions

3.1 Climate characteristics in Warri

Table 2: Mean Annual Rainfall, Relative Humidity, Wind Speed and Temperature trend in Warri from 1991 to 2011

Years	Rainfall (cm)	RH (%)	Wind Speed (m/s)	Temperature (°C)
1991	254.20	85.2	4.12	33.2
1992	266.74	82.5	4.18	33.1
1993	274.68	83.1	3.93	33.7
1994	233.13	81.5	3.97	32.8
1995	286.40	84.8	3.08	32.7
1996	226.39	85.2	2.88	32.4
1997	220.48	83.0	2.88	32.3
1998	207.73	81.3	3.34	33.5
1999	249.63	83.8	3.18	31.8
2000	224.07	83.8	3.61	33.3
2001	199.22	83.9	3.55	32.6
2002	246.95	83.8	3.52	33.4
2003	232.80	83.7	3.10	32.5
2004	293.51	84.0	3.13	33.3
2005	197.38	84.0	3.23	32.4
2006	201.89	85.1	3.20	32.2
2007	239.22	86.3	2.94	31.5
2008	269.93	85.4	2.98	33.2
2009	203.79	83.9	2.99	32.7
2010	223.13	84.3	2.99	33.4
2011	254.95	74.4	3.45	34.2
Mean	238.39	83.5	3.35	32.8

Source: Nigeria Meteorological Station (NIMET) Lagos

From Table 2 and figures 2 and 3, there is variation in the trends of instrumental climate parameters in Warri. There is variability in the rainfall, relative humidity as well as the wind speed trends in Warri from 1991-2011. The variations in these climate attributes have effects on the durability and functionalities of satellite cable network in the area.

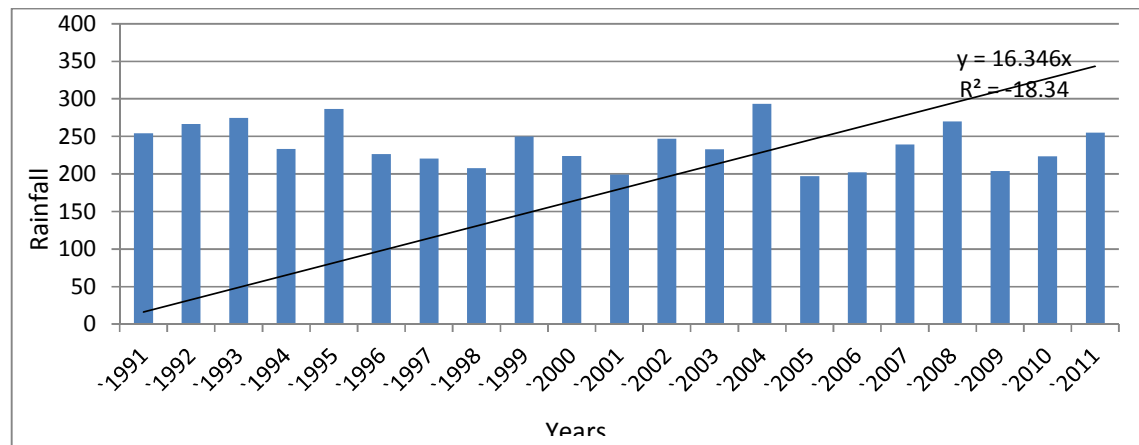


Fig 2 Rainfall variation in Warri from 1991-2011

From Fig 2, the highest amount of rainfall were in the year 1995 and 2004 while there was a decline in 2009 and 2010 but gradually increased in 2011.

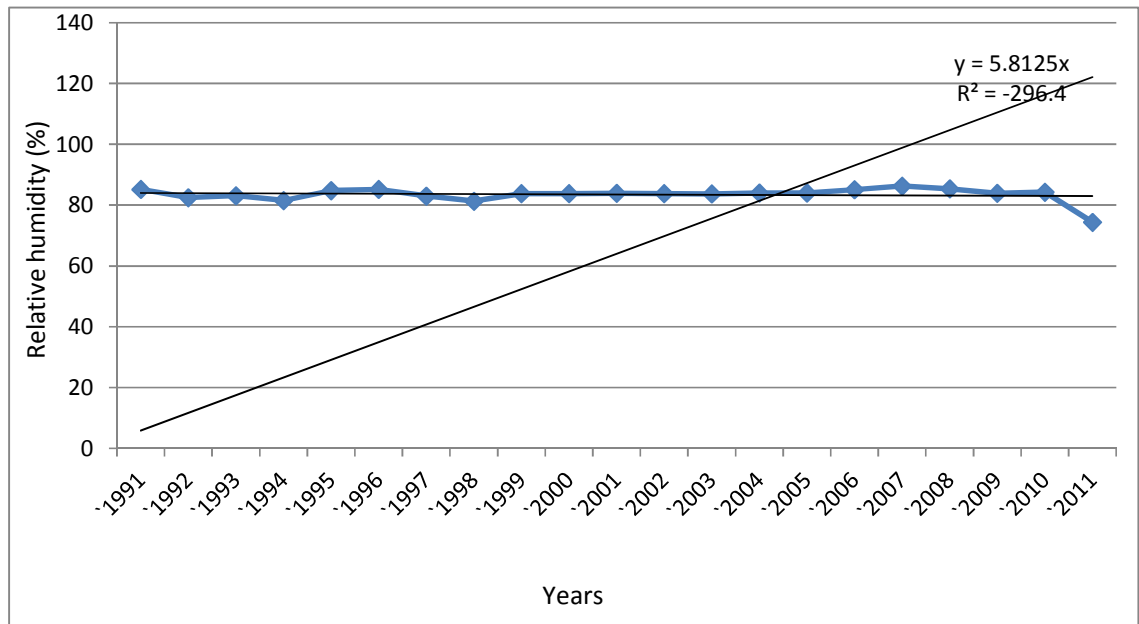


Fig 3 Relative Humidity Trend in Warri from 1991-2011

From fig 3, there was also a variation in the RH pattern between 1991 to 2011. However, the decline in RH started from 2010 to 2011. The implication of that is that the amount of water vapour in the atmosphere of the study area is changing.

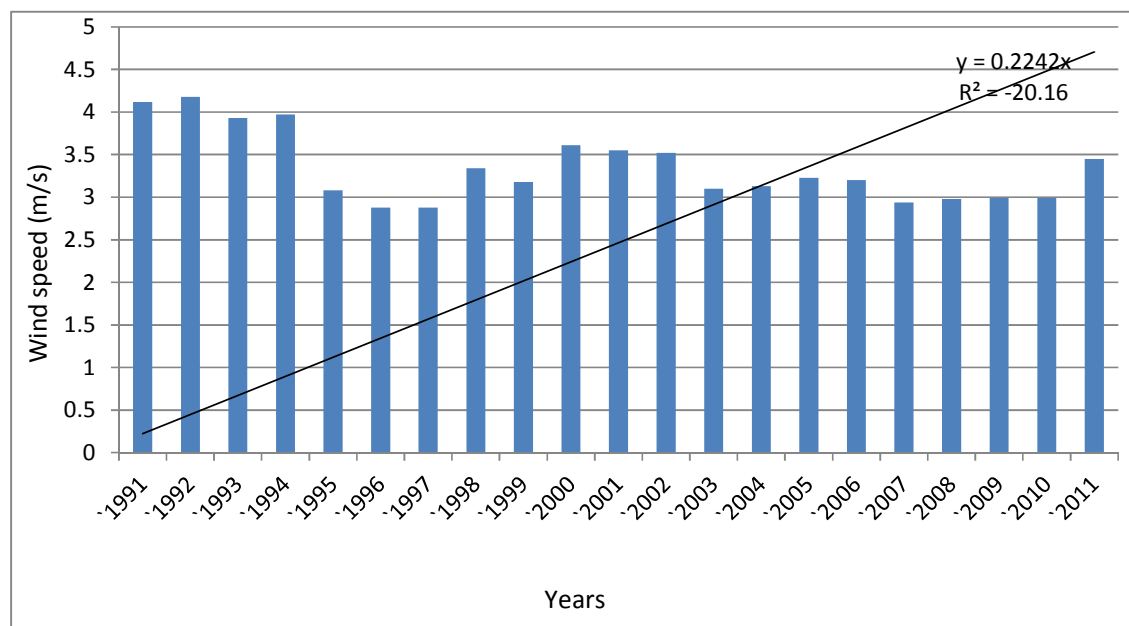


Fig 4: Wind Speed Trend in Warri from 1991-2011

From Fig 4, the wind pattern shows that the beginning of the 1990's had more wind and a 3-year decline was observed before the wind became steady for almost four years and there was an increase in 2011.

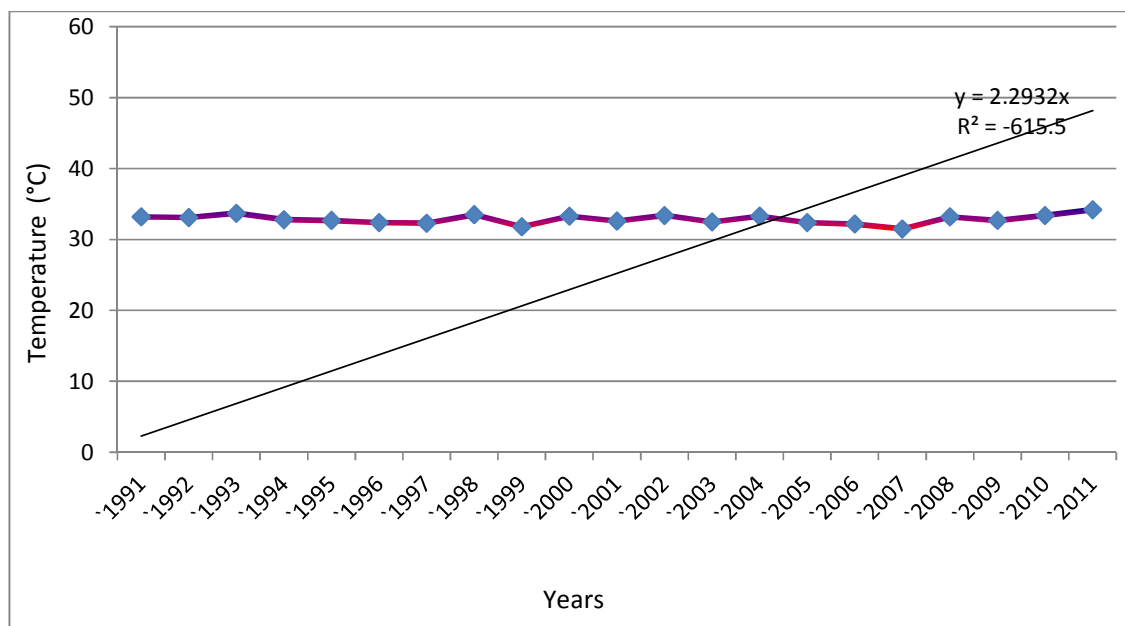


Fig 5: Temperature Trend in Warri from 1991-2011

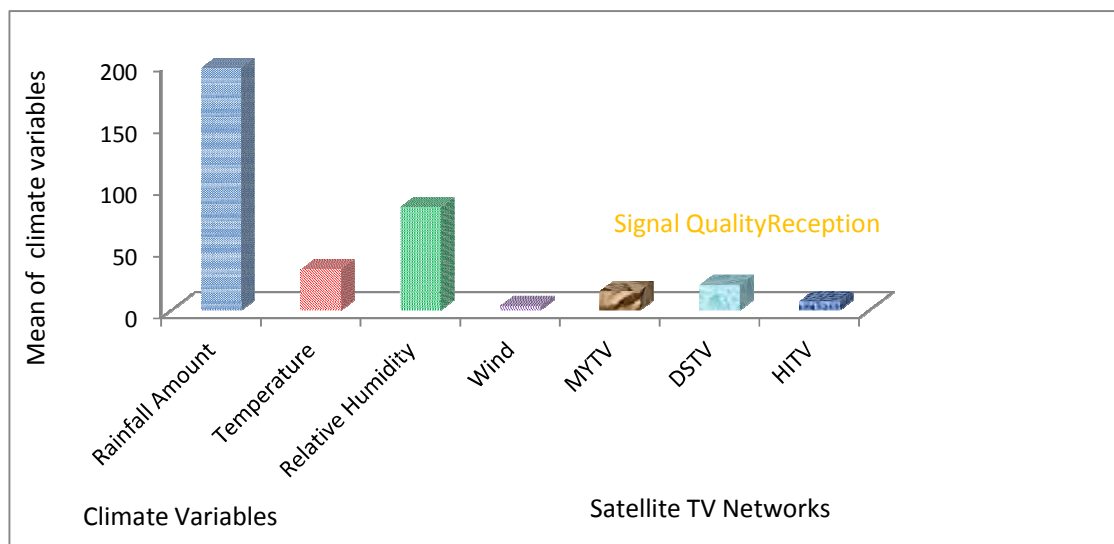
From Fig 5, the trend in temperature shows it is rising from 33.2 °C in 1991 and 31.5 °C in 2007 to 34.2 °C in 2011.

321

322 **3.2 Prominent climatic Elements causing Network Distortions and Effects on**
 323 **MYTV, DSTV and HITV.**

324 **Table 3: Mean Rainfall, Temperature, Relative Humidity, Wind and Network Signal**
 325 **Quality (May-August-2012)**

Months	Rainfall amount (mm)	Temperature (°C)	RH (%)	Wind (Knots)	Reception Quality on Rainy Days			Reception Quality on Days Without Rainfall		
					MYTV	DSTV	HITV	MYTV	DSTV	HITV
May	135.5	33.4	82.2	3.1	17.8	22.3	9.3	69.6	84.3	32.4
June	219.4	34.2	84.5	3.4	14.2	19.8	6.8	66.9	87.2	33.8
July	259.4	32.6	84.8	3.4	13.4	19.5	5.3	68.9	85.9	32.9
August	170.8	31.4	82.5	3.3	16.2	20.4	7.4	73.8	85.0	34.5
Mean for the 4 Months	196.2	32.9	83.5	3.3	15.4	20.4	7.2	69.8	85.6	33.4



326

327 **Fig 6: Satellite TV network quality reception signal on Rainy Days (May-August, 2012)**

328 From table 3 and figure 6, the reception quality for MYTV reduced from 69.8% when there
329 was no rainfall to 15.4% on rainy days during the study period. DSTV signal quality
330 reception was also down to 20.4% on rainy days from 85.6% mean on days without rainfall.
331 More so, HITV signal quality reception of 33.4% on days without rainfall was brought down
332 to 7.2% by the effect of rainfall. This implies that climatic elements have attenuating effect
333 on network quality in Warri and rainfall has been implicated for the signal quality reduction.

3.3 Comparison of MYTV, DSTV and HITV Reception Quality in Warri

Table 4: Mean Network Signal Quality in Warri Metropolis on Days without Rainfall and Rainy Days

Months	Time	Zones Sample Area	Network Reception Quality on days without rainfall (%)			Network Reception Quality on rainy days (%)		
			MYTV	DSTV	HITV	MYTV	DSTV	HITV
May	6am-12noon 0500-1100hrsGMT	PTI	69	85	36	11	18	5
		NPA	67	90	30	32	41	8
		Edjeba	70	89	25	7	13	3
		Enerhen Rd	61	83	39	12	17	8
		Okere	67	87	35	8	18	6
	12noon-6pm 1100-1700hrsGMT	PTI	81	85	32	20	28	14
		NPA	73	89	31	18	21	7
		Edjeba	72	61	39	24	36	12
		Enerhen Rd	74	86	41	17	19	15
		Okere	68	81	29	42	56	18
	6pm-12midnight 1700-2300hrsGMT	PTI	70	90	37	31	38	15
		NPA	56	67	29	19	22	12
		Edjeba	69	87	29	3	14	3
		Enerhen Rd	91	94	33	19	21	4

		Okere	69	74	31	8	13	9
June	6am-12noon 0500-1100hrsGMT	PTI	67	96	38	11	18	5
		NPA	70	85	30	32	41	8
		Edjeba	61	91	25	7	13	3
		Enerhen Rd	67	90	39	12	17	8
		Okere	71	89	35	8	18	6
	12noon-6pm 1100-1700hrsGMT	PTI	73	83	32	18	24	6
		NPA	79	90	33	5	13	2
		Edjeba	69	89	39	3	12	0
		Enerhen Rd	67	83	43	6	12	3
		Okere	70	87	29	13	18	8
	6pm-12midnight 1700-2300hrsGMT	PTI	61	85	37	16	19	6
		NPA	67	89	31	21	24	7
		Edjeba	81	90	30	11	13	4
		Enerhen Rd	73	89	25	24	29	11
		Okere	69	90	31	16	19	9
	6am-12noon	PTI	70	89	30	36	41	19

July	0500-100hrsGMT	NPA	61	83	25	15	21	8
		Edjeba	67	85	39	21	26	13
		Enerhen Rd	71	85	35	13	17	7
		Okere	70	89	32	4	8	4
	12noon-6pm 1100- 1700hrsGMT	PTI	61	90	31	32	39	11
		NPA	69	89	39	13	17	8
		Edjeba	67	83	41	22	25	13
		Enerhen Rd	70	87	29	32	46	14
		Okere	61	85	37	7	9	3
	6pm-12midnight 1700- 2300hrsGMT	PTI	70	90	31	12	14	5
		NPA	61	89	30	17	21	8
		Edjeba	67	83	25	3	7	3
		Enerhen Rd	81	87	39	7	7	4
		Okere	69	85	35	12	16	7
	6am-12noon 0500-	PTI	83	89	32	21	27	9
		NPA	73	90	31	3	8	7

August	1100hrsGMT	Edjeba	71	89	39	4	7	3
		Enerhen Rd	69	83	41	9	11	6
		Okere	72	87	29	28	34	17
	12noon-6pm 1100- 1700hrsGMT	PTI	73	85	37	39	58	21
		NPA	72	89	31	11	15	6
		Edjeba	73	90	32	9	12	3
		Enerhen Rd	69	81	31	8	9	3
		Okere	67	78	39	0	0	0
	6pm-12midnight 1700- 2300hrsGMT	PTI	70	81	41	3	8	2
		NPA	61	67	29	0	0	0
		Edjeba	61	81	37	7	11	5
		Enerhen Rd	80	90	31	3	3	3
		Okere	75	81	30	0	0	0
		Mean	69.8	85.6	33.4	15	20	7.2

336

Source: Field Work

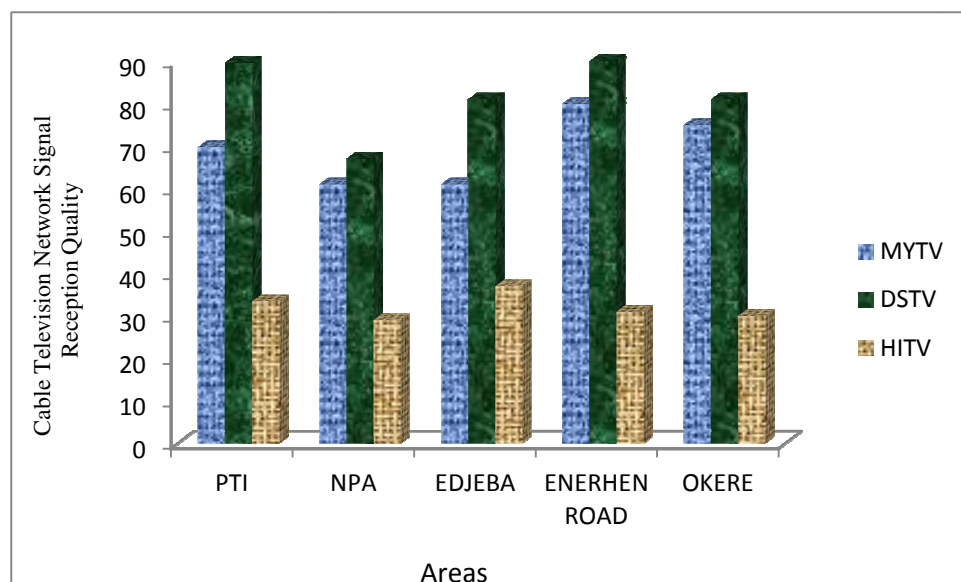


Fig 7: Satellite TV network quality reception without rainfall event

From table 4 and Fig 7, network signal quality in the different areas of Warri exhibited divergent characteristics on normal days without rainfall. The signal quality of DSTV shows a very good reception in all the zones and within each of the time frame where the network quality monitoring was done during the four month study period. The signal quality of MYTV on the other hand shows good reception quality but not as high as DSTV while that of HITV showed low signal reception quality.

It is also observed from the table 4 that the mean signal reception quality show that it was 69.8% for MYTV, 85.6% for DSTV and 33.4% for HITV on normal days without rainfall.

3.4 Effects of Rainfall, Temperature, Relative Humidity, and Wind on MYTV, DSTV and HITV Signal Reception

3.4.1 Hypothesis I

H0: There is no significant variation in the reception quality output of MYTV, DSTV and HITV in Warri.

Table 5: Multiple Comparisons

Multiple Comparisons

Reception Quality

Tukey HSD

(I) Satellit e TV recepti on quality Signal	(J) Satellit e TV recepti on quality Signal	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
MYTV	DSTV	32.500 [*]	1.545	.000	28.85	36.15
	HITV	70.000 [*]	1.545	.000	66.35	73.65
DSTV	MYTV	-32.500 [*]	1.545	.000	-36.15	-28.85
	HITV	37.500 [*]	1.545	.000	33.85	41.15
HITV	MYTV	-70.000 [*]	1.545	.000	-73.65	-66.35
	DSTV	-37.500 [*]	1.545	.000	-41.15	-33.85

*. The mean difference is significant at the 0.05 level.

Table 6 ANOVA STATISTICS – Explaining the variation in Reception quality

	Sum Squares	of Df	Mean Square	F	Table value	Sig.	Remark
Between Groups	147250.000	2	73625.000	1028.136	19.49	.000	Significant variation exist
Within Groups	12675.000	177	71.610				
Total	159925.000	179					

From Table 5 and 6, the calculated F-value is 1028.136 with 177 denominator under 2 numerator degree of freedom is greater than the critical table-value of 19.49 at 0.05 significant level. Thus the posited null hypothesis that there is no significant variation in the reception quality of MYTV, DSTV and HITV in Warri is rejected, and it can now be inferred that there is significant variation in the reception quality output of MYTV, DSTV and HITV in Warri. This can be seen

from the multiple comparisons in table 6 that there was significant variation in means of MYTV and that of DSTV and HITV. This result corroborates Sklar (2001), Peebles (1998) and Ezekoye and Obodo (2007).

3.4.2 Hypothesis II

H0: MYTV, DSTV and HITV reception Quality is not significantly dependent on weather characteristics in Warri metropolis.

This hypothesis was tested using the stepwise method of multiple regression analysis (table 7)

Table 7: Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.989 ^a	.977	.966	.36596	.977	86.408	1	2	.011	3.363

a. Predictors: (Constant), RAINFALL

b. Dependent Variable: MYTV RECEPTION

From table 7, the R value shows a correlation of 0.989 between weather elements (rainfall as predicted by stepwise regression) and MYTV reception quality. However, R² value of 0.977 shows that the quality of the signal reception from MYTV is explained by 97.7% dependency on weather characteristics (especially rainfall). The contributions of wind, relative humidity and temperature were excluded. The Durbin-Watson value of 3.36, imply a negative first-order autocorrelation. Negative first-order autocorrelation occurs when consecutive residuals differ widely. This result corroborated earlier study by the Commonwealth of Australia (2010)

Table 8 ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Table Value	Sig.
1	Regression	11.572	1	11.572	86.408	5.23	.011 ^a
	Residual	.268	2	.134			
	Total	11.840	3				

a. Predictors: (Constant), RAINFALL

b. Dependent Variable: MYTV
RECEPTION

383 In table 8, the calculated value, F, is 86.408 which is greater than the table value of 5.23 at
384 $P > 0.05$. This means the null hypothesis is rejected and the alternate hypothesis that MYTV
385 reception quality is significantly dependent on weather characteristics (rainfall) in Warri.

386

Table 9 Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	22.493	.785		28.666	.001			
	RAINFALL	-.036	.004	-.989	-9.296	.011	-.989	-.989	-.989

a. Dependent Variable: MYTV
RECEPTION

387

388 From table 9, the standardized beta value of 0.989 shows that MYTV signal reception quality
389 correlated strongly with rainfall. The other weather parameters, temperature, RH and wind which
390 were excluded by stepwise regression are presented in table 10.

391

Table 10 Excluded Variables^b

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	WIND	-.310 ^a	-1.989	.297	-.893	.188
	RH	-.230 ^a	-.473	.719	-.428	.078
	TEMPERATURE	-.039 ^a	-.267	.834	-.258	.991

a. Predictors in the Model: (Constant), RAINFALL

b. Dependent Variable: MYTV RECEPTION

392 The beta values of wind, RH and temperature in table 10 shows a weak correlation of these
 393 weather parameters with MYTV reception quality in Warri.

394

395

Table 11 DSTV Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. Change	
1	.994 ^a	.988	.982	.17078	.988	160.514	1	2	.006	1.933

a. Predictors: (Constant), WIND

b. Dependent Variable: DSTV reception

397 From Table 11, the R value shows a correlation of 0.994 between weather elements (wind as predicted
 398 stepwise regression) and DSTV reception quality. However, R² value of 0.988 shows that the
 399 quality of the signal reception from DSTV is explained by 98.8% dependency on weather
 400 characteristics (especially wind). The contributions of rainfall, relative humidity and temperature were
 401

402 cluded. The Durbin-Watson value of 1.933, imply a positive first-order autocorrelation. Positive
403 autocorrelation occurs when consecutive residuals tend to be similar.

404

Table 12 ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Table value	Sig.
1	Regression	4.682	1	4.682	160.514	14.66	.006 ^a
	Residual	.058	2	.029			
	Total	4.740	3				

a. Predictors: (Constant), WIND

b. Dependent Variable: DSTV reception

405

406 In table 12, the calculated value, F, is 160.514 which is greater than the table value of 14.66 at
407 $P > 0.05$. This means the null hypothesis is rejected and the alternate hypothesis that DSTV
408 reception quality is significantly dependent on weather characteristics (wind) in Warri.

409

Table 13 Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
1 (Constant)	49.650	2.302		21.564	.002			
WIND	-8.833	.697	-.994	-12.669	.006	-.994	-.994	-.994

a. Dependent Variable: DSTV reception

410

411 From table 13, the standardized beta value of 0.994 shows that DSTV signal reception quality
 412 correlated strongly with wind. The other weather parameters, temperature, RH and rainfall which
 413 were excluded by stepwise regression are presented in table 14.

414

Table 14: Excluded Variables^b

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
1 RH	.068 ^a	.328	.798	.312	.256
RAINFALL	-.068 ^a	-.274	.830	-.264	.188
TEMPERATURE	.098 ^a	1.858	.314	.881	1.000

a. Predictors in the Model: (Constant),
WIND

b. Dependent Variable: DSTV reception

415
 416 The beta values of rainfall, RH and temperature in table 14 showed a weak correlation of these
 417 weather parameters with DSTV reception quality in Warri.

418

Table 15: HITV Model Summary^b

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.970 ^a	.942	.912	.48966	.942	32.283	1	2	.030	.772

a. Predictors: (Constant),
RAINFALL

b. Dependent Variable: HITV
reception

419
 420 From Table 15, the R value shows a correlation of 0.970 between weather elements (rainfall as
 421 predicted by stepwise regression) and HITV reception quality. However, R² value of 0.942

shows that the quality of the signal reception from MYTV is explained by 94.2% dependency on weather characteristics (especially rainfall). The contributions of wind, relative humidity and temperature were excluded. The Durbin-Watson value of 0.772, imply a positive first-order autocorrelation. This result corroborated earlier study by the Commonwealth of Australia (2010)

Table 16 ANOVA^b

Model		Sum of Squares	df	Mean Square	F	Table value	Sig.
1	Regression	7.740	1	7.740	32.283	2.79	.030 ^a
	Residual	.480	2	.240			
	Total	8.220	3				

a. Predictors: (Constant), RAINFALL

b. Dependent Variable: HITV reception

In table 16, the calculated value, F, is 32.283 which is greater than the table value of 2.79 at $P > 0.05$. This means the null hypothesis is rejected and the alternate hypothesis that HITV reception quality is significantly dependent on weather characteristics (rainfall) in Warri.

Table 17: Coefficients^a

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
		B	Std. Error	Beta			Zero-order	Partial	Part
1	(Constant)	13.001	1.050		12.383	.006			
	RAINFALL	-.030	.005	-.970	-5.682	.030	-.970	-.970	-.970

a. Dependent Variable: HITV reception

From table 17, the standardized beta value of 0.970 shows that HITV signal reception quality correlated strongly with rainfall. The other weather parameters, temperature, RH and wind which were excluded by stepwise regression are presented in table 18.

Table 18: Excluded Variables^b

Model	Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
					Tolerance
1 WIND	-.272 ^a	-.559	.676	-.488	.188
RH	.765 ^a	1.894	.309	.884	.078
TEMPERATURE	.231 ^a	3.177	.194	.954	.991

a. Predictors in the Model: (Constant), RAINFALL

b. Dependent Variable: HITV reception

The beta values of wind, RH and temperature in table 18 showed a weak correlation of these weather parameters with HITV reception quality in Warri.

The implication of the result of this study is that rainfall significantly affects the signal reception of MYTV and HITV more than DSTV which is more affected by wind. Also the effects exerted by temperature, relative humidity on MYTV, DSTV and HITV had negative correlation indicating that as rainfall amount and intensity increases, the reception signals of MYTV and HITV decreases while it combines these effects with wind in the case of DSTV.

3.5 Level of Signal Strength at which total loss of Signal is experienced in MYTV, DSTV and HITV Networks.

452 **Table 19: Signal Levels at which total Loss of signal is experienced in certain**
 453 **Channels**

MYTV Channel name	Signal Strengt h	DSTV Channel name	Signal Strength	HITV Channel name	Signal Strength
BBC World	38	Africa Magic	50*	Sky News	25
BET	38	Africa Movies	50*	BBC World	28
MYTV More	39	CCTV	52	HI Sport	21
Trace	37	Action	50	HI Soccer	24
1 Music	38	CCTV 9	53	HI Nolly	26
MYTV Series	40	CCTV N	55	Trace	22
MYTV Africa	36	Channel O	50	Kidsco	25
MYTV Promo	38	MTV Base	50	Ajazeera	32
Dove Vision	40	B4U	53	Zee Cinema	29
Nollywood	37	Universal Ch	55	TVC	24
Nollywood Plus	38	Silver Bird	51	E!	26
Channel 44	39	AIT	58	HI Mix	22
MYTV Yoruba	38	NTA	52	History	29
Elshaddai	37	ESPN	55	National Geo	28
Soul Life	39	TV 3	55	Hits	26
Inspiration	38	TV 5	57	HI Sport2	26
CTL	37	Food Channel	54	God	24
Praise TV	39	LTV	53	HI Life	29
KBC World	40	Channels TV	53	Fox news	31
ATV	39	Eurosport News	56	Sony Entr TV	29
MFM TV	41	Blitz	52	HI Movies	28
Cpice TV	38	CNN	50*	HI Kids	25
Evangel TV	37	Cartoon	50*	Amuludum Y	29
EWTN	39	Network	54	Discovery W	31
W.R.S	38	BBC World	51	Eurosport	28
Muvi TV		Travel	56	HI mix2	29
Africa Unit	35*	Channels	55	Channels	30
IQRAA	37	Magic World	52	NTA5	29
Love World	37	Animal Planets	55	HITV 9ja	29
True Movies 1	39	Nat Geographic	53	Bollywood	28
Muvi TV	38	Trace TV	50		
Dunamis	39	E!	55		
Setanta Africa	37	ETVA	53		
FX	37	MNET	51		
ITVN	39	Super Sports 10	53		
Chosen TV	37	NaGeo Wide	50*		
Eurosport News	38	Super Sports 1	53		
Omega	36	Super Sports 2	50*		

K.L.N	37	Super Sports 3	52		
Hossanna	37	Super Sports 4	52		
Messiah	39	Super Sports 5	50*		
Press TV	35*	SuperSports 5N	53		
R.T.M	38	Super Sports 6	51		
Novo Tempo	37	Super Sports 7	56		
Overcomer TV	39	SuperSports 3N	55		
Miracle TV	41	Super Sports 9	53		
Spirit World	38	SuperSport HD	54		
Prophetic Ch	39	Zee Cinema	53		
CTV	37	BET	51		
AIT	38	Kidsco	51		
NTA Plus	35	FLN	55		
Emmanuel TV	35*	FX	53		
Olive TV	39	Ajazerra	53		
ACBN	38	Mnet Series	53		
Jim Jam	39	BBC L	55		
F.L.N	42	BBC Prime	52		
KICC	38	SuperSp Select	55		
ABN	38	ESPNC	53		
Fox	37	Swahi	53		
E!	37	B4U Music	55		
Kidsco	39	Sky News Int	52		
Zee Cinema	39	ETWN	54		
E.T.V	38	DISH	51		
Ahlulbayt TV	39	CCTV 4	53		
Ben TV	38	Learn	55		
		Africa Movie II	52		
		LC2	55		
		Islamic Chann	50*		
		Metro	50*		
		Africa Magic H	54		
		Africa Magic Y	52		
		Mira	58		
		Sun City	53		
		MMI	55		
		GTV			
		LC1			

454 ➤ * these channels will still be on at this level of signal (Author monitored, 2012)

455 Table 19 shows that at these levels of signal quality (37%-41%), most of the channels go off air
456 on MYTV completely but few channels still retains signal such as Emmanuel TV, Press TV,
457 Muvi TV (African Unit) while on DSTV, most of the stations also goes off air at 51%-58% with
458 the exception of Channels like Super Sports 4, Super Sports 5N, Super Sport 7, Africa Magic

Hausa, Africa Magic (Yoruba), Mira, Cartoon network, BBC World, Africa Magic and Africa Movies which goes off at 50% signal strength level.

This is the reason behind level of differences experienced by subscribers to these networks. Most of the channels that continue to receive reception at these low level of signal quality in either MYTV or HITV are actually DSTV-fed channels in which additional satellite Dish and LNB are deployed to tap into DSTV channels by positioning the dish to face DSTV signal reception axis in the EMS. Thus, DSTV therefore has more resistance ability to the vagaries of climate. However, this study has been able to show that climate parameters especially rainfall has a great role to play when it comes to signal reception strength and quality. Though the study has proved that there are some other stations that can withstand rainfall effect to a certain level as a result of its high signal strength and can be watched at the presence of this weather anomaly, except when the rainfall becomes more intense. It has also been observed that the higher the signal strength the lower the effects of rainfall on the above satellite cable modems (MYTV, DSTV and HITV).

Conclusion

This research was undertaken to examine the effects of weather conditions on satellite cable television cable network (MYTV, DSTV and HITV) reception quality in Warri metropolis in order to examine the general nature of weather characteristics, its effects on cable networks as well as signal quality patterns on rainy and non-rainy days.

We conclude from the study that climate elements especially rainfall significantly influenced reception quality of MYTV, DSTV and HITV in Warri metropolis due to its attenuation, thus serious concern for rainfall monitoring through state-of-the-art technology platforms is indispensable.

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