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Comparison between Oxygen (dry) and Water Vapour (wet) Attenuation from an Airborne Platform to Satellite in Nigeria

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Abstract:

Aeronautical applications have become very important in supporting communications for in-flight entertainment and in-flight connectivity services. As the local aircraft is moving from one location to the other at higher altitudes between 6 – 8 km above the sea level, the link between airborne platform and satellite undergoes signal degradation which affects internet connection for the passenger. However, cloud and gases are major tropospheric effects that cause attenuation above rain height of 5 km for radio wave propagation most importantly microwave signals for an airborne platform to space communication in the Ku and above. Therefore, the analysis and prediction of the airborne-satellite path links of gas and cloud attenuation is essential, hence the importance of this research. An historical radiosonde data obtained from National Oceanic and Atmospheric Administration (NOAA) covering three locations in Nigeria; Abuja (2006-2018), Ikeja (1966-2019), and Kano (1972-2019) at an elevation angles of 48.5 °, 44.5 ° and 48.8 ° respectively were used for this research. The total attenuation at V-band, both uplink and downlink frequencies follow the same pattern; at Abuja station in 2007 the total attenuation is about 2.6053 dB at 50 GHz and 0.7487 dB at 40 GHz while at Ikeja station in 1961 the total attenuation is about 3.7882 dB at 50 GHz and 1.0575 dB at 40 GHz and finally at Kano station in 1990 the total attenuation is about 5.7119 dB at 50 GHz and 1.4881 dB at 40 GHz. Hence, the results can be useful for the Nigeria meteorological Agency (NIMET) and the Nigeria Civil Aviation Authority (NCAA) in planning for a more efficient airborne – space communication for aviation safety, in-flight connectivity (IFC) and in-Flight entertainment (IFE).

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I. Introduction

In-flight connectivity (IFC) has been made possible via satellite. This has been chiefly provided over L-band, which generally has a low throughput [1]. Ku/Ka-band satellite technologies have been introduced to passenger and airline services; airlines can increase in-flight connectivity options to their passengers to improve their in-flight entertainment services; the Ku/ Ka-band is used in playing a significant role in the provision of other safety-related services to complement other data linked systems such as VHF (very high frequency) VDL (datalink mode), or L-band sitcom [2].

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