



Diurnal and Seasonal Surface Refractivity in Lagos, Nigeria

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Abstract

Estimation of radio refractivity in the lower troposphere is very important in the planning and design of terrestrial microwave radio links for optimal performance. The objective of this work is to estimate statistical variation of the diurnal and seasonal surface radio refractivity in Nigeria's coastal city of Lagos (6° 35' N, 3° 45' E). Data used for this work were obtained from National Space Research and Development Agency (NASRDA) Centre for Lower Atmospheric Research, Anyigba, based on Campbell's weather instrument that logged data at every 5 minutes. The surface values of water vapour pressure, air pressure and air temperature for the years 2006-2010 were analysed to obtain the diurnal and seasonal refractivity profiles. The results obtained reveal that average surface refractivity in Lagos is 388 N-units. The most prevalent refractivity condition in this region is super-refraction and the mean refractivity gradient in the first kilometre of the troposphere is -48 N-units/km. The diurnal trend shows that surface refractivity is more pronounced in the night in the rainy season, but during the dry season it is highest in the evening time. The result also shows that refractivity is generally higher in the wet season than in the dry season. Optimal planning of Nigeria's terrestrial radio network cannot be achieved without long-term surface refractivity data for Nigerian stations. Thus, more efforts should be made in this respect, and to possibly match the derived refractivity profiles with actual propagation data.

Keywords: Surface refractivity, refractivity gradient, diurnal and seasonal variations, k-factor.

1. Introduction

Radio ray propagated through the Earth's atmosphere is influenced by variations in the atmospheric refractive index along its trajectory, which causes the ray path to curve.