# Correlation between ENSO and Radio Refractive Index over West Africa

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El Niño–Southern Oscillation (ENSO), a phenomenon in the eastern and central equatorial Pacific has been found to have significant global effects. The occurrence of El Nino spread warm water across the tropical Pacific leading to the release of heat energy into the atmosphere from the oceans. Due to the spread of the heat energy, global fluctuation of temperature patterns has been established to have a climatic linkage between El Nino and La Nina. The intense year of El Nino episode (1982 – 1983) had impact on the weather worldwide. In the era of technology, information from a transmitter get to the receiver inform of electromagnetic wave through different channels in which the atmosphere is one of it. The variations in atmospheric parameters result in variation in refractivity [1]. Refractivity (N) can be expressed as [2]

$$N = 77.6\frac{P}{T} + 3.75 \times 10^5 \frac{e}{T^2} = N_{dry} + N_{wet} \quad (1)$$

The hydrostatic component ($N_{dry}$) depends on the atmospheric pressure and temperature while the non-hydrostatic ($N_{wet}$) is a function of the atmospheric temperature and humidity [3]. The mathematical tool that only indicates the presence or absence of a relationship between ENSO and Radio refractivity is known as Correlation. The correlation coefficient (r) is given [4]

$$r = \frac{1}{n-1}\sum\left(\frac{x-\bar{x}}{S_x}\right)\left(\frac{y-\bar{y}}{S_y}\right) \quad (2)$$

This study examines the correlation between ENSO and Radio refractive index over West Africa. Sea Surface Temperature (SST) and daily reanalysis atmospheric parameter (temperature, pressure, and relative humidity) on the grid of 0.25 x 0.25 were used to determine ENSO and radio refractivity respectively. The years of strong ENSO (1982/83) has been considered. The Wet and Dry components of the refractivity index ranges from -10 to 5 N unit and 225 to 270 N unit respectively. Latitudinal correlation between ENSO and the wet component shows a weak correlation along the coastal region. This study offers the opportunity to predict radio refractivity through ENSO in other to plan for better communication system.

## Reference

[1] T. Adediji, M. O. Ajewole, J. S. Ojo, A. G. Ashidi, M. Ismail, and J. S. Mandeep, "Influence of some meteorological factors on tropospheric radio refractivity over a tropical location in Nigeria". *Mausam*, **66,** 1, 2015, pp. 123-128.

[2] S. T. Ogunjo, I. A. Fuwape, S. S. Oluyamo, A. Rabiu, and J. B. Dada, "Dynamics of vertical profile of radio refractivity," *In: Annual Conference of African Geophysical Society, Abidjan, Cote d'Ivoire*. 2017.

[3] H. Sizun, "Radio wave propagation for telecommunication application", Springer Berlin Heidelberg New York, *Springer Berlin Heidelberg* New York, 2005.

[4] C, Samprit, and A. S. Hadi, "Simple linear regression," *John Wiley & Sons. Inc*, 2006, pp. 21–45.