IRI MODEL REPRESENTATION OF TOTAL ELECTRON CONTENT AT 0UTC AND 6UTC OVER GHANA

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STUDY OBJECTIVE

To show how the iri model describes the relationship between the electron density and temperature at various heights for 0UTC and 6UTC over Ghana

DATA SOURCE AND INPUT PARAMETERS

The data is from Model Web Browser Results
iri model listing

year= 1997., month= 01, day= 10, hour=0,

- URSI maps are used for the F2 peak density (NmF2)
- CCIR maps are used for the F2 peak height (hmF2)
- B0-Table option is used for the bottom side thickness parameter B0

DATA SOURCE AND INPUT PARAMETERS

- Danilov- option is used for the ion composition
- The foF2 STORM model is turned on
- IRI-95 option is used for the electron temperature
- IRI-95 option is used for the D-region Ne
- Scotto-97 no L option is used for the F1 occurrence probability

DATA SOURCE AND INPUT PARAMETERS

- Peak Densities/cm-3: NmF2= 1000.0 NmF1= 0.0 NmE= 1713.9
- Peak Heights/km: hmF2= 100.00 hmF1= 0.00 hmE= 110.00
- Solar Zenith Angle/degree 154.6
- Dip (Magnetic Inclination)/degree -11.39
- Modip (Modified Dip)/degree -11.26
- Solar Sunspot Number (12-months running mean) Rz12 10.5
- Ionospheric-Effective Solar Index IG12 2.3
- F2 peak electron density (NmF2/cm-3= 1000.0) provided by user
- F2 peak height (hmF2/km=100.0) provided by user

OUTLINE

- Total electron content overview
- Objective of the study
- IMPORTANCE OF TEC
- Results
- Conclusion

TOTAL ELECTRON CONTENT OVERVIEW

- TEC is the number of electrons in a volume of one square meter in cross-section, extending along a ray path from a satellite to a ground receiver

$$TEC = \int_{p} N(s)\,ds$$

N(s) is the electron density

- TEC has a unit of electrons per square meter, where 10^{16} electrons/m^2 = 1 TEC unit (TECU).

IMPORTANCE OF TEC

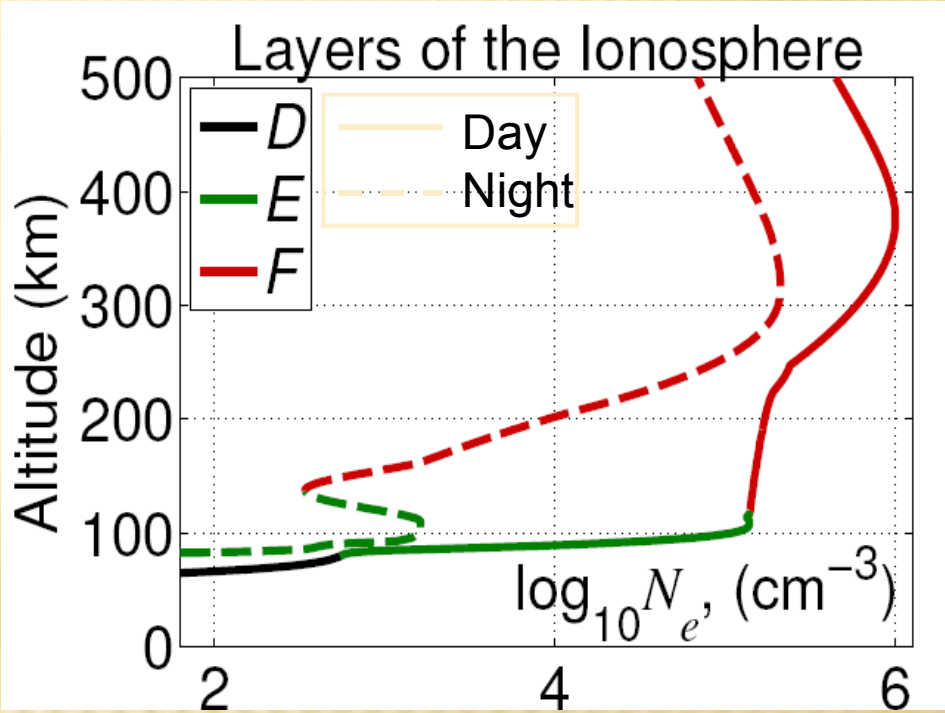
TEC is an important descriptive quantity for the ionosphere of the Earth

TEC is also significant in determining the scintillation and group delay of a radio wave through a medium.

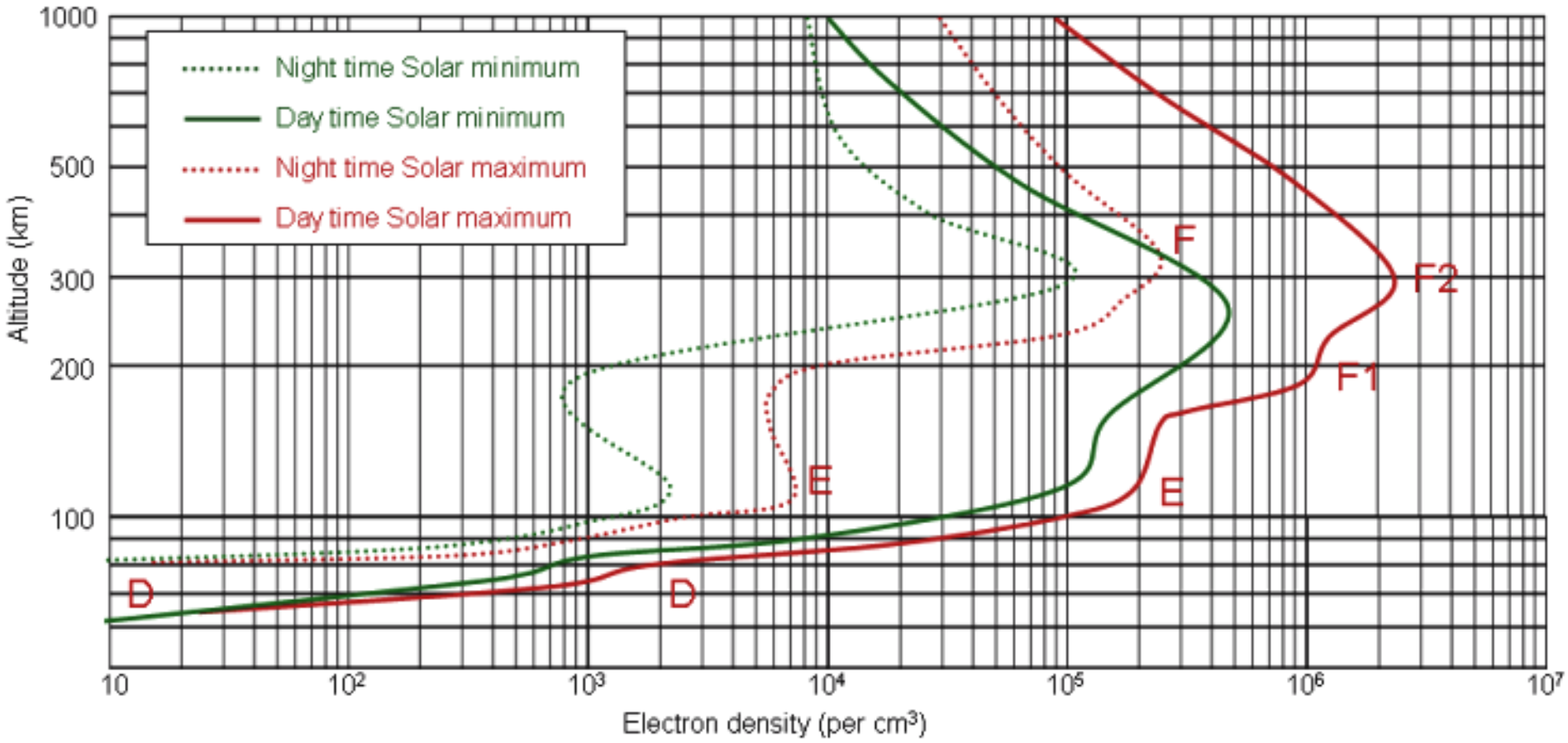
TEC is a key parameter to navigation and communication

OVERVIEW OF THE IONOSPHERE

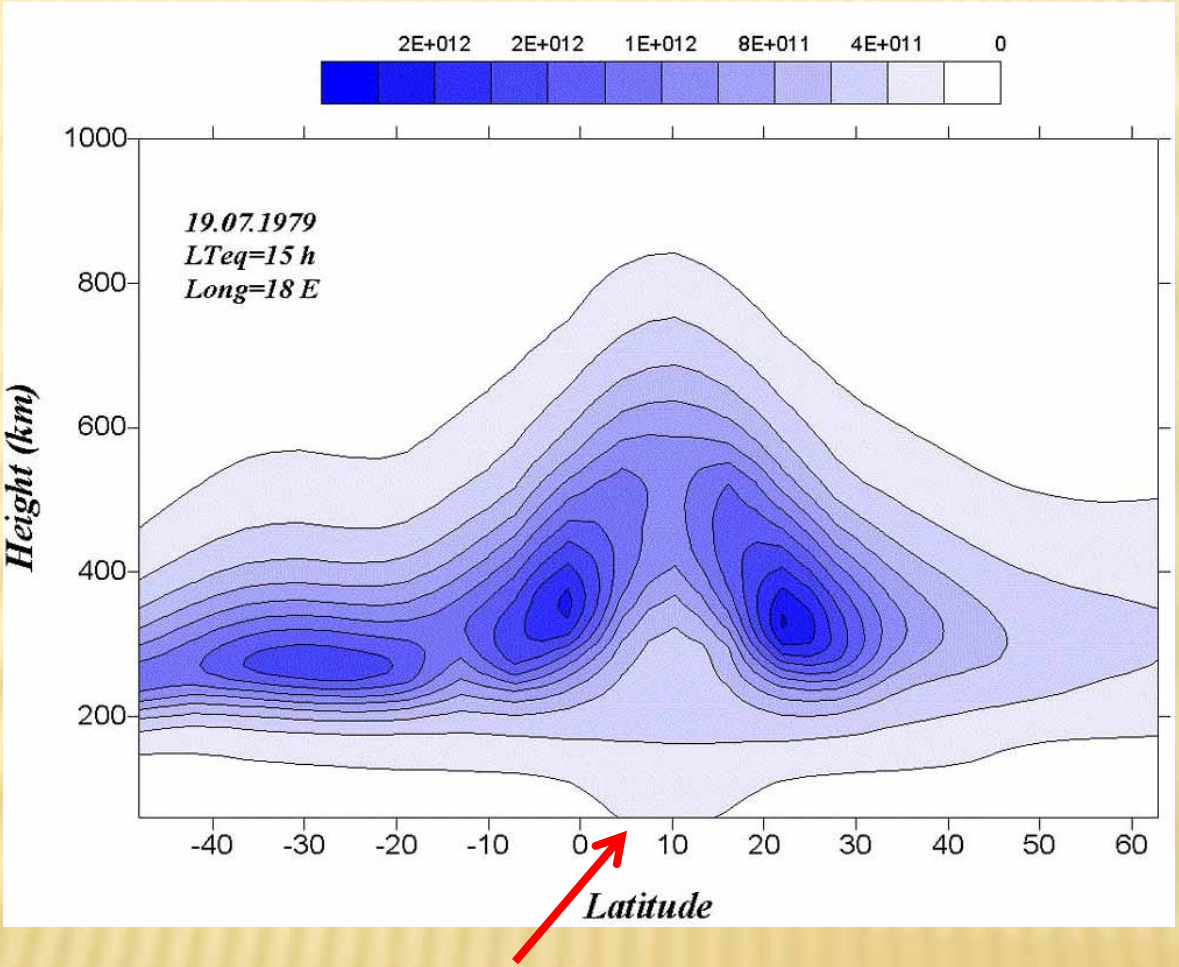
- Structure of ionosphere continuously changing
  - Varies with day/night, seasons, latitude and solar activity
- Essential features are usually identifiable
- Ionosphere divided into layers, according to electron density and altitude
  - D Layer (or D Region)
  - E Layer
  - F Layer
- Several reasons for distinct layers
  - Solar spectrum energy deposited at various altitudes depending on absorption of atmosphere
  - Physics of recombination depends on density of atmosphere (which changes with altitude)
  - Composition of atmosphere changes with altitude



SOLAR ACTIVITY VARIATIONS

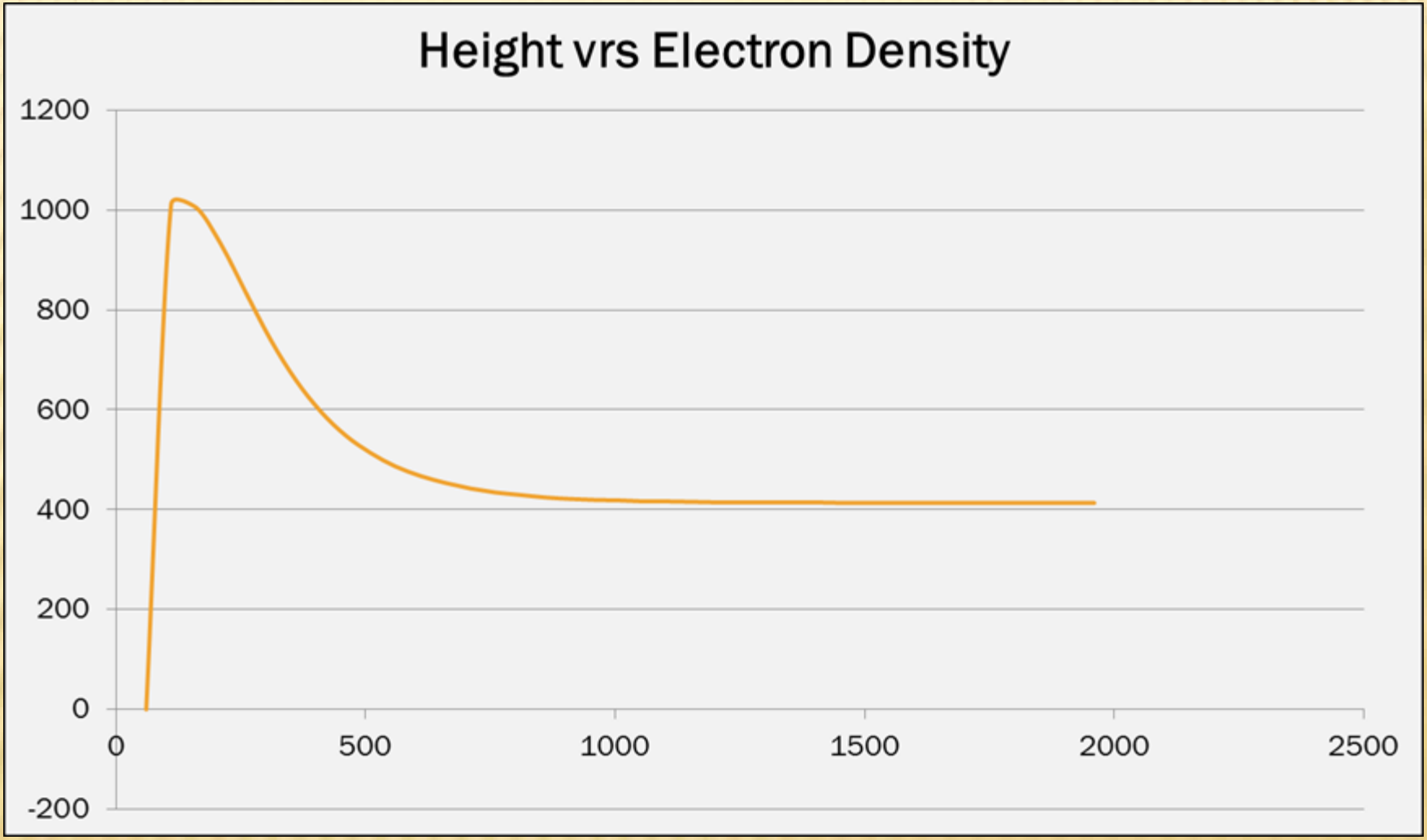


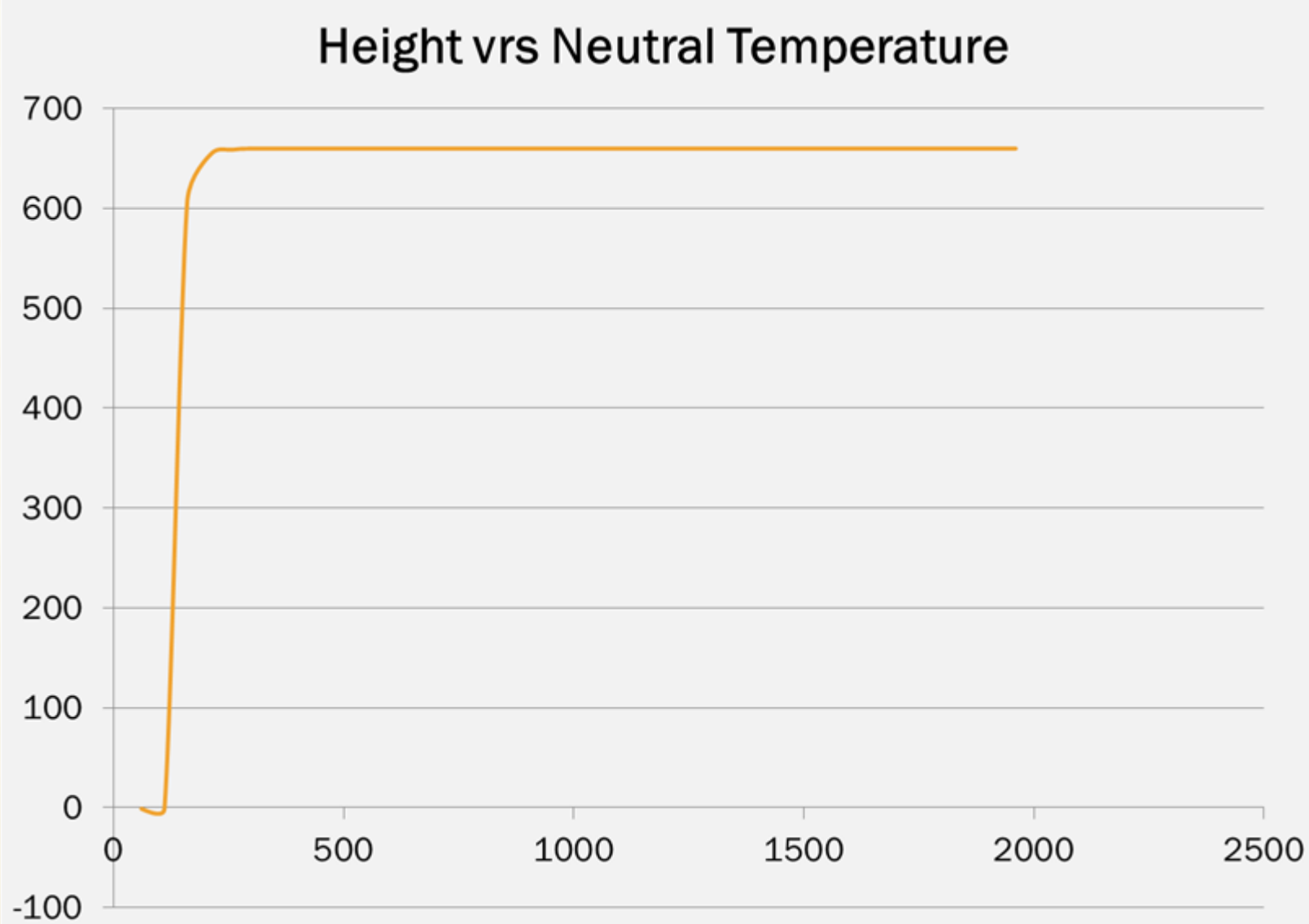
LATITUDINAL CROSS SECTION OF THE IONOSPHERIC ELECTRON DENSITY

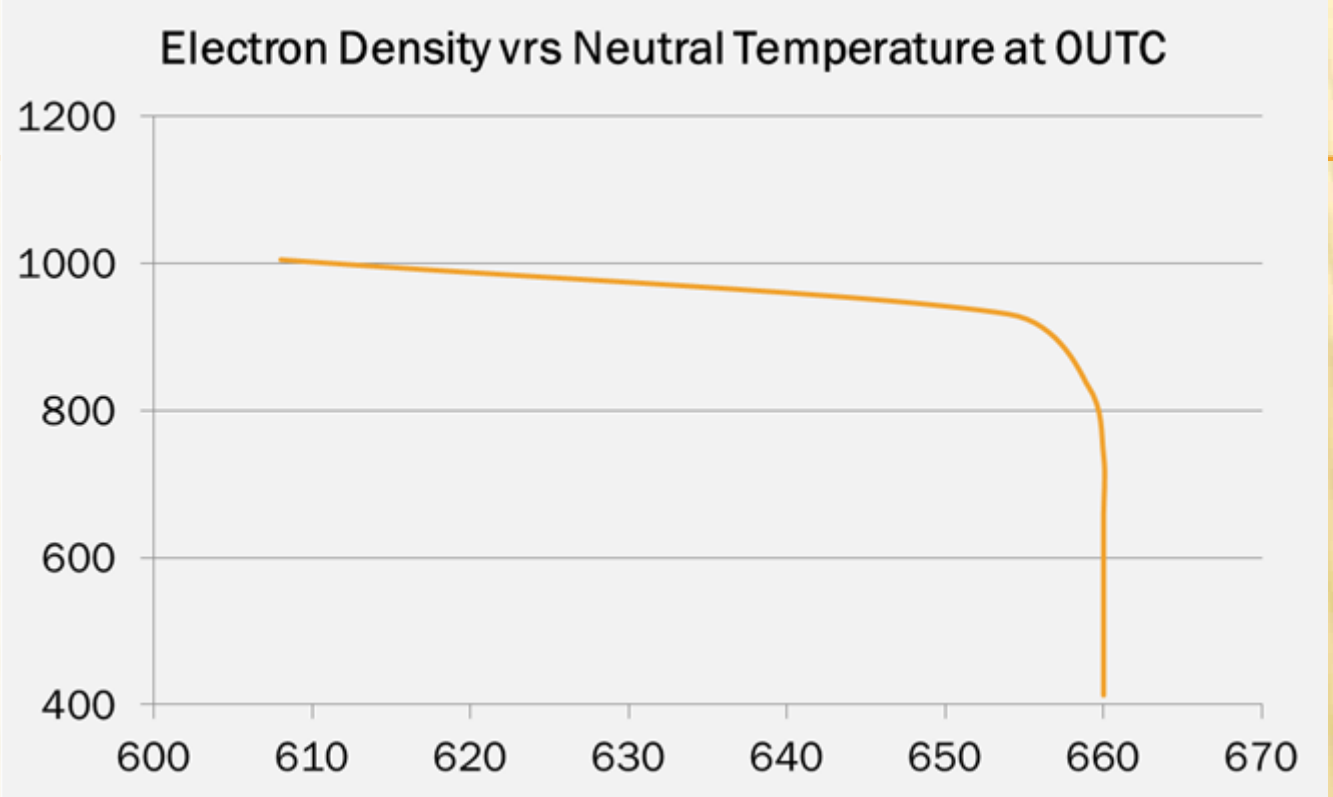


Ghana lies (5N -11N)

RESULTS

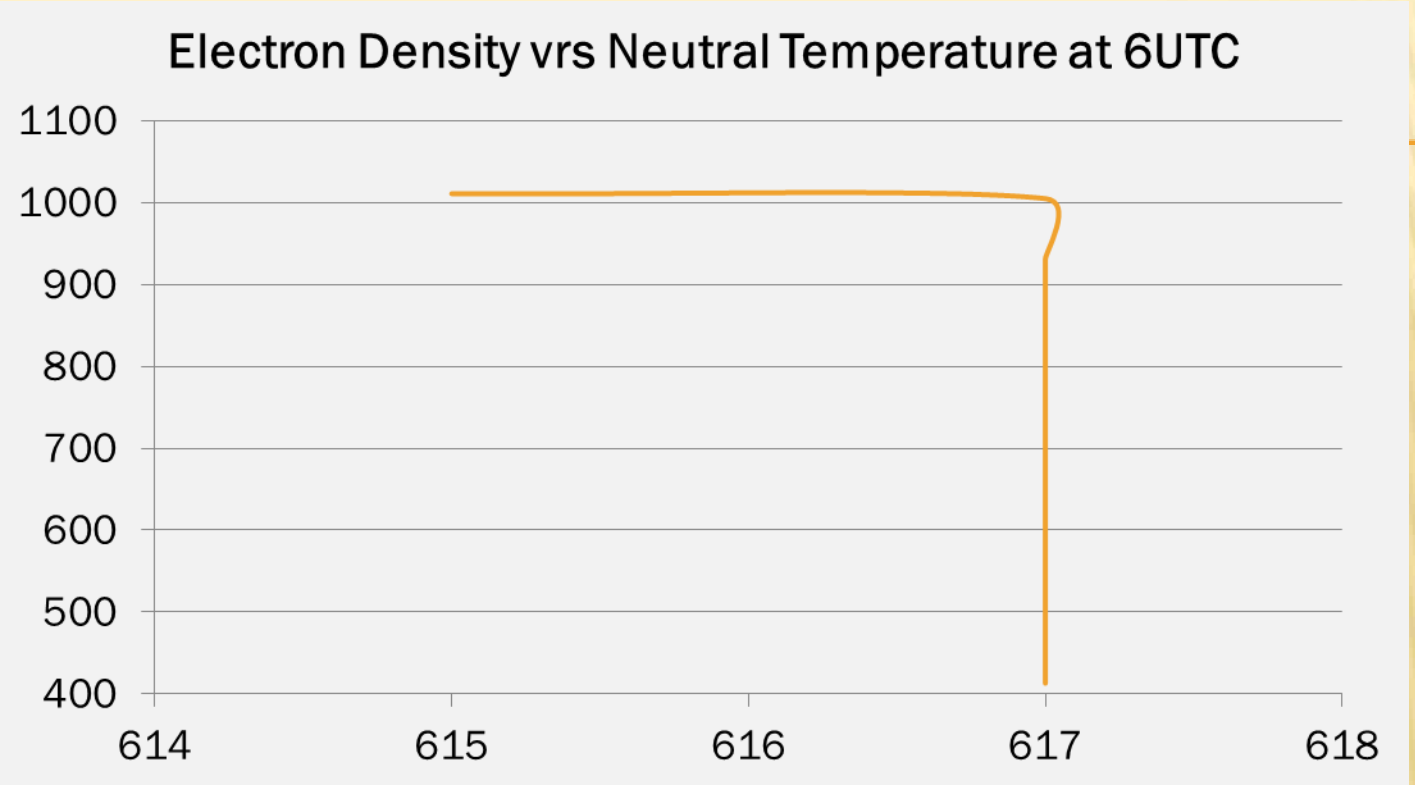

Height vrs Electron Density
1200
1000
800
600
400
200
0
-200
0
500
1000
1500
2000
2500


Height vrs Neutral Temperature
700
600
500
400
300
200
100
0
-100
0
500
1000
1500
2000
2500



Zero UTC shows that electron density decreases gradually from 1005 $Necm^{-3}$ to 834$Necm^{-3}$ with increase in temperature in a range of 608K to 654K.

At a constant temperature of 654K, electron density decreases sharply from 800$Necm^{-3}$, implying that at that particular temperature, electron density keep decreasing.



Similar characteristics is seen in the graph at 6 UTC but the sharp decreases at 800Necm^{-3} occur at an earlier temperature of 617K, which has been explained with the effect of solar activities.

CONCLUSION

Time of the day has significant effect on Electron Density.

Special thanks