Modeling is an important aspect of ionospheric research. The model of the ionosphere is usually used in setting up of communication link and also for correction purposes in satellite communication. This led the Committee on Space Research (COSPAR) and the International Union of Radio Science (URSI) to set up a working group to produce the International Reference Ionosphere (IRI).

The solar activity dependence of the ionosphere gives to saturation/amplication effects, which is observable at high solar flux levels. Hence the need to study saturation effect, which is stated to have seasonal and latitudinal variations (Ma et al., 2009) with dominance in the equatorial ionization anomaly (EIA) region (Sethi et al., 2002; Lui et al., 2003; Ma et al., 2009). This work is the first of such investigating the seasonal variation of the saturation effect in the African equatorial ionosphere. However, this work is limited to the tropics of the EIA.

For this work, we use:

Monthly averages of hourly foF2 for Ouagadougou (Geog. 12°N, 1°W, dip = 3°N) [1985 - 1995] and

Monthly averages of F10.7 (sF).

This is because Ma et al. (2009) had shown that F10.7 and F10.7P are better than Rz, and are identical in their relationship with monthly mean of foF2 values obtained from stations around the magnetic equator. Although, solar EUV is the best solar activity indicator, but not available for the period of study.

RESULTS

The goodness of fit r²-value and the t-ratio for each season

<table>
<thead>
<tr>
<th>Season</th>
<th>r²-value</th>
<th>t-value</th>
<th>F10.7 (sF) (sF)</th>
<th>F10.7 (sF) (sF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring</td>
<td>0.9872</td>
<td>14.26</td>
<td>16.07</td>
<td>16.07</td>
</tr>
<tr>
<td>Summer</td>
<td>0.9872</td>
<td>14.26</td>
<td>16.07</td>
<td>16.07</td>
</tr>
<tr>
<td>Autumn</td>
<td>0.9872</td>
<td>14.26</td>
<td>16.07</td>
<td>16.07</td>
</tr>
<tr>
<td>Winter</td>
<td>0.9872</td>
<td>14.26</td>
<td>16.07</td>
<td>16.07</td>
</tr>
</tbody>
</table>

Figure 1: Variations of the standard deviation of F10.7 with the slope, m, of the first segment of the two-segment fit. (a)March equinox, (b)June solstice, (c)September solstice, (d)December solstice.

CONCLUSION

- Saturation effect across all seasons in low-latitude at midday (Sethi et al., 2002; Xu et al., 2008).
- Saturation higher at noon than pre-noon and post-noon periods around the EIA crest (Lui et al., 2003).
- It is significant/important at the PRE peak period in the EIA crest (Lui et al., 2003).
- Saturation effect at midday is higher in winter and equinoxes than summer (Sethi et al., 2002).
- Midnight saturation effect in summer at the outer edge of the northern EIA crest (Xu et al., 2008).
- Saturation at mid-latitude, except winter (Sethi et al., 2002), amplification effect at high and mid latitudes in winter (Ma et al., 2009).
- Weaker in the trough and crest of the EIA. Seasonal variation less pronounced in the EIA compared with the high and mid-latitude regions (Ma et al., 2009).
- Saturation features deviates greatly from IRI representation at low-latitude but agreed well at mid-latitude.

FUTURE WORKS

- Validating the observation for the African EIA trough with larger volume of data (with say data covering two or more sunspot cycles)
- Investigate the exact contribution of the several ionospheric electrodynamics in the observed saturation effect in the African equatorial region

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REFERENCES


Long-term changes in solar activity dependence of foF2 (Source: Liu et al., 2003), but modified.

*Black line: 3.5°N [Manila]. Blue line: 13.8°N (Chung-Li). Red line: 15.3°S (Tahiti)