International Civil Aviation Organization

THE FOURTH MEETING OF IONOSPHERIC STUDIES TASK FORCE (ISTF/4)

New Delhi, India, 05 – 07 February, 2014

Agenda Item 4: Review of progress of tasks and related action items
(b) Task2- Iono Analysis

CHARACTERISTICS OF TEC OVER INDIAN REGION

(Presented by AAI, India)

SUMMARY

This paper presents the characteristics of GPS-TEC based on the iono analysis procedure defined by the paper IP/07 in the Third Meeting of Ionospheric Studies Task Force. The TEC data from GAGAN network at three different regions- Magnetic equator, Anomaly Crest region and Mid-latitude have been used for this analysis.

1. INTRODUCTION

1.1 The information paper IP/07 by Task-2 Lead in the Third Meeting of Ionospheric Studies Task Force (ISTF/3) provided the guidelines on categorization of data for GPS TEC analysis.

1.2 The objective of Task-2 (IONO ANALYSIS) of ISTF is to analyze the characteristics of ionosphere and provide the quantized information for the 'Iono Model' task (Task-5).

1.3 Based on these guidelines, the analysis of GPS TEC has been carried out over Indian region to characterize the ionosphere.

2. DISCUSSION

2.1 Due to the availability of data, the period of analysis is restricted from the year 2004 to July 2013 (~ 10 years data).

2.2 The analysis is carried out for three different regions:

a) Agatti (Magnetic equatorial station- MLAT 2.6°N)

b) Raipur (Anomaly Crest region- MLAT 12.03°N)

c) Shimla (Mid latitude- MLAT 22.21°N)

2.3 According to IP/07, if period of analysis is less than or almost equal to 11 years then solar activity can be categorized as Low Solar Active (LSA) period if solar flux F10.7 <150 and High Solar Active (HSA) if F10.7 >=150.

2.4 However, the analysis period of 2004 to 2013 comprises of mostly low and moderate solar activity due to extended solar minima in solar cycle 23. Hence the number of days with F10.7 >= 150 (HSA) was limited to just ~80 days, which are insufficient for TEC characterization.

2.5 The geomagnetic activity has been categorized as quiet and disturbed magnetic activity if Kp < 3 and Kp >= 3 respectively.

2.6 Thus only following two cases of analysis are possible with the available data set:

a) Low solar active and geomagnetic quiet days; and
b) Low solar active and geomagnetic disturbed days.

2.7 The maximum TEC in afternoon hours (7 - 9 UT; IST=UT+5:30 hrs) for each day during analysis period is computed. The TEC is further divided into four seasons- **Winter** (November, December, January), **Vernal Equinox** (February, March, April), **Summer** (May, June, July) and **Autumnal Equinox** (August, September, October).

2.8 The correlation of TEC with Solar Flux is obtained using quadratic fitting, in the form of following equation:

$$\mathbf{Y_{TEC} = ax^2_{F10.7} + bx_{F10.7} + c}$$

2.9 Figure 1 shows the correlation of TEC with solar flux F10.7 at magnetic equatorial station- **Agatti (MLAT-2.6°N)** during (a) Geomagnetic Quiet and (b) Geomagnetic Disturbed days. The quadratic correlation equation is provided in the panels for each season.

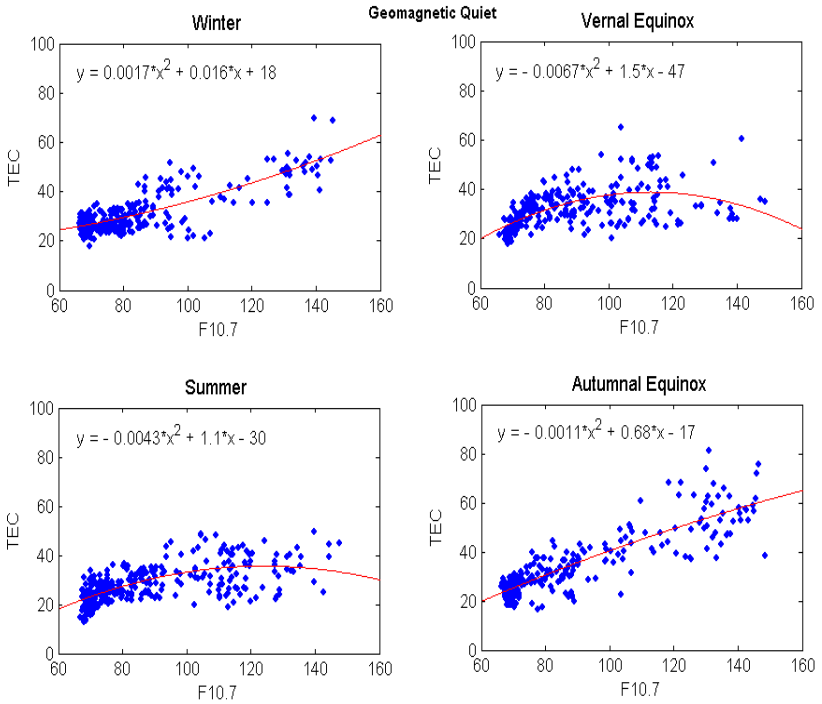

Figure 1 (a): Correlation of TEC with solar flux F10.7 at magnetic equatorial station- **Agatti (MLAT-2.6°N)** during Geomagnetic **Quiet** days. The quadratic correlation equation is provided in the panels for each season.

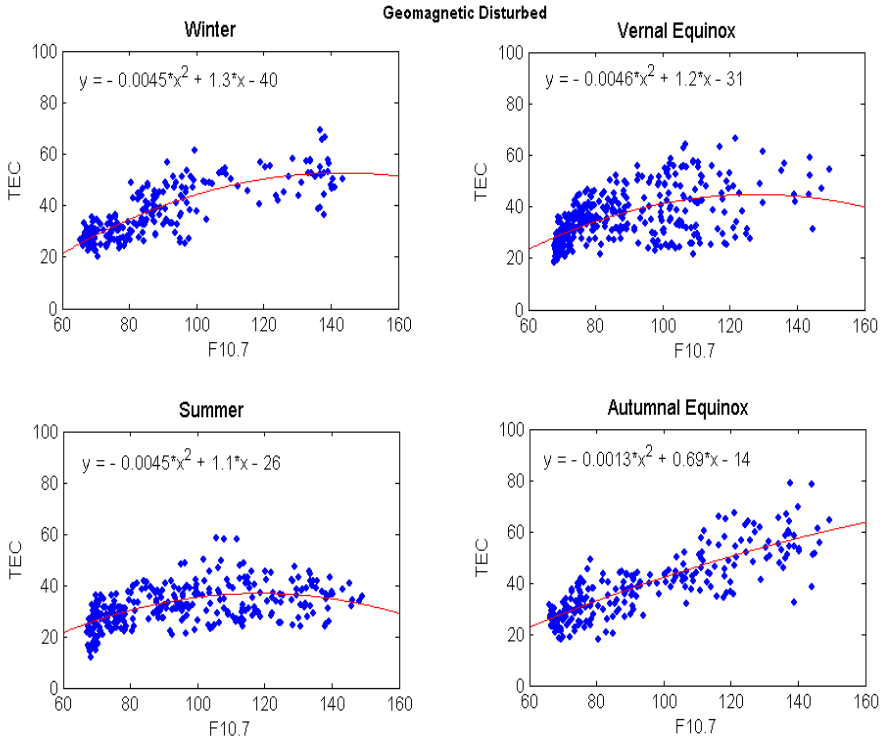

Figure 1 (b): Same as Figure 1 (a) but for Geomagnetic **Disturbed** days.

2.10 Figure 2 shows the correlation of TEC with solar flux F10.7 at low latitude station (EIA crest region) - **Raipur (MLAT-12.03°N)** during (a) Geomagnetic Quiet and (b) Geomagnetic Disturbed days. The quadratic correlation equation is provided in the panels for each season.

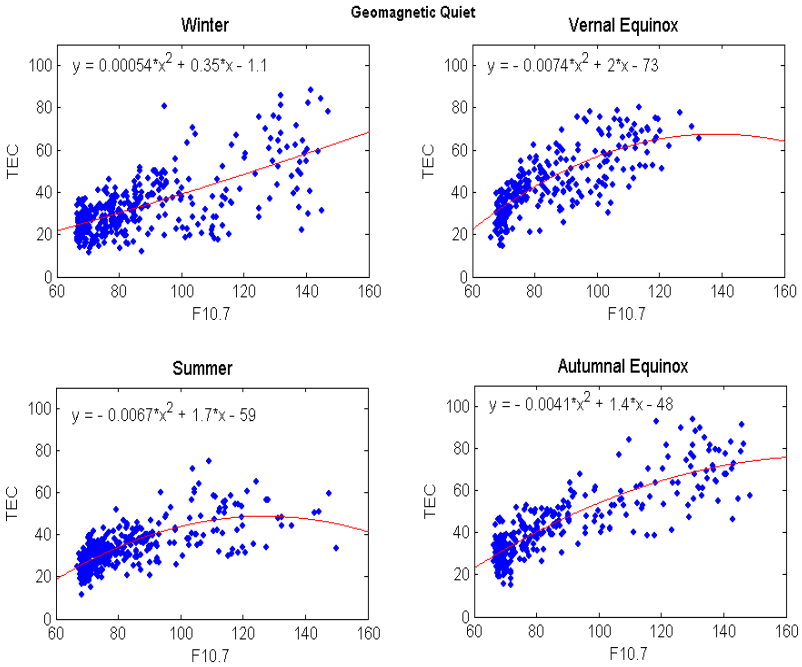

Figure 2 (a): Same as Figure 1 (a) but for **anomaly crest station- Raipur (MLAT-12.03°N)** during Geomagnetic **Quiet** days.

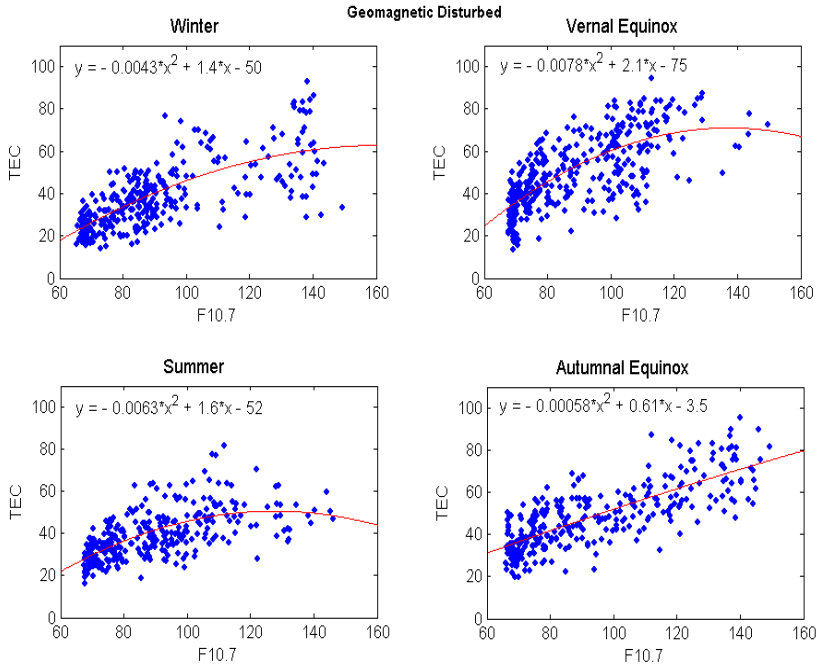

Figure 2 (b): Same as Figure 2 (a) but for Geomagnetic **Disturbed** days.

2.11 Figure 3 shows the correlation of TEC with solar flux F10.7 at mid latitude station - **Shimla (MLAT-22.21°N)** during (a) Geomagnetic Quiet and (b) Geomagnetic Disturbed days. The quadratic correlation equation is provided in the panels for each season.

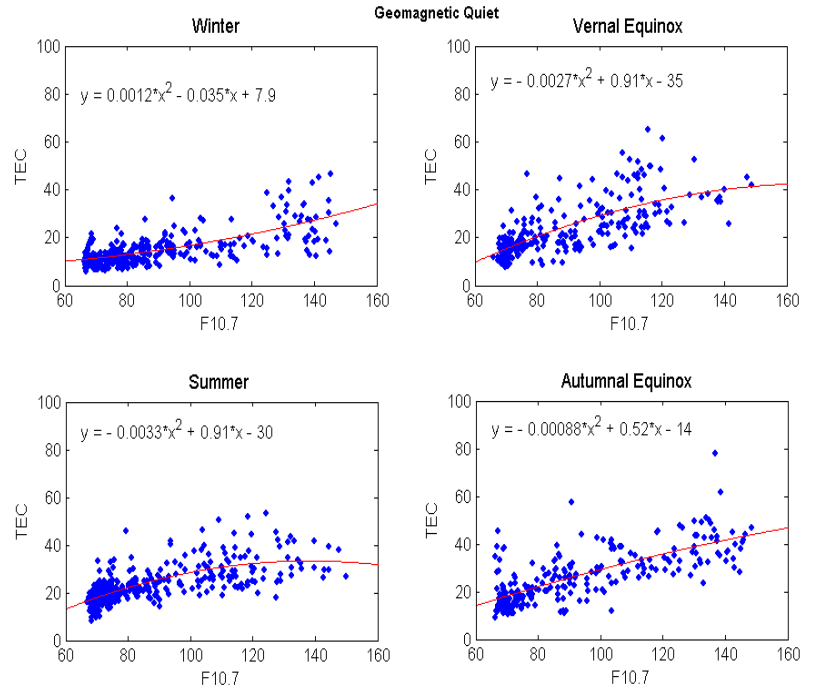

Figure 3 (a): Same as Figure 1 (a) but for **Mid-latitude station- Shimla (MLAT-22.21°N)** during Geomagnetic **Quiet** days.

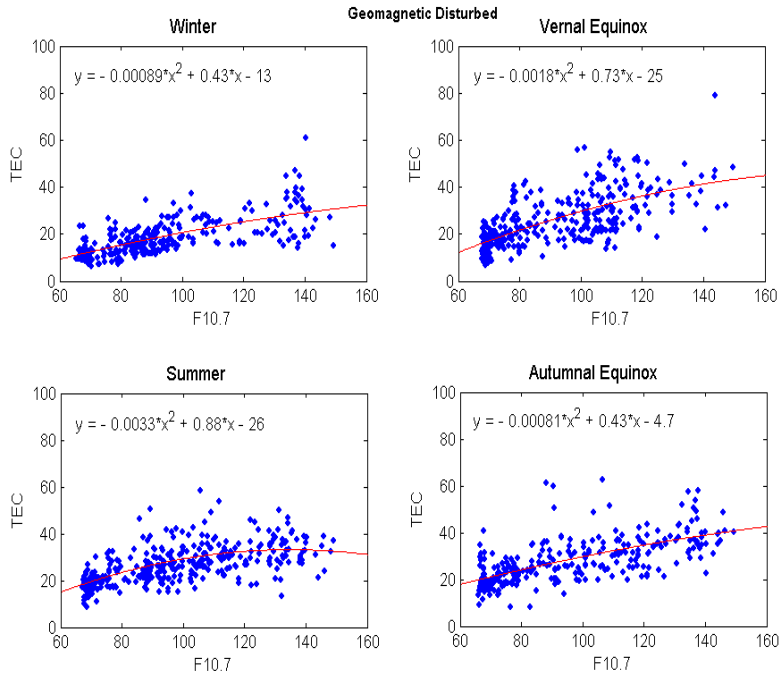

Figure 3 (b): Same as Figure 3 (a) but for Geomagnetic **Disturbed** days.

3. ACTION REQUIRED BY THE MEETING

3.1 The meeting is invited to:

a) recognize India's continued support in the ISTF activities and its tasks.

b) note the results presented in the paper and discuss their relevance for Task-2 & 5.

c) discuss any relevant matters as appropriate.

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