



King Mongkut's Institute of Technology Ladkrabang
School of Engineering
– Introduction to Total Electron Content (TEC)
and GPS-TEC analysis (GPS Gopi) –

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Objectives

- Understand the basics of Total Electron Content (TEC).
- Utilize GPS-TEC analysis (GPS Gopi version 3) to compute TEC.

H/W and S/W requirements

- PC or Laptop
- GPS-TEC analysis (GPS Gopi) version 3.

<https://seemala.blogspot.com/2020/12/gps-tec-program-version-3-for-rinex-3.html>

Preparation of data for the GPS Gopi software

1. The GPS Gopi software necessitates the following three file types for the analysis of 1-day TEC data:
 - Observation file (From the GNSS receiver).
 - Navigation file (From the GNSS receiver or download from internet).
 - Differential (P1-C1) and (P1-P2) code biases for satellites (IGS Website).
2. For example, if you want to process the GNSS file from Chiangmai station on Day of year (DOY) 22 in 2024, the following files must be prepared.
 - CHMA0220.24o
 - CHMA0220.24n
 - P1C12401.DCB (GPS-Gopi will download automatically)
 - P1P22401.DCB (GPS-Gopi will download automatically)
3. The example of all RINEX files including analysis software can be downloaded from the following link: <https://cssrg-pc.telecom.kmitl.ac.th/s/DxpwD7M5jqgnBGA?path=%2F>

The GPS Gopi utilization and testing

4. Launch the **GPS_TEC.exe** file after downloading the GPS Gopi software to your computer from the following link: <https://seemala.blogspot.com/2020/12/gps-tec-program-version-3-for-rinex-3.html> and open the **GPS_TEC.exe** as shown below.

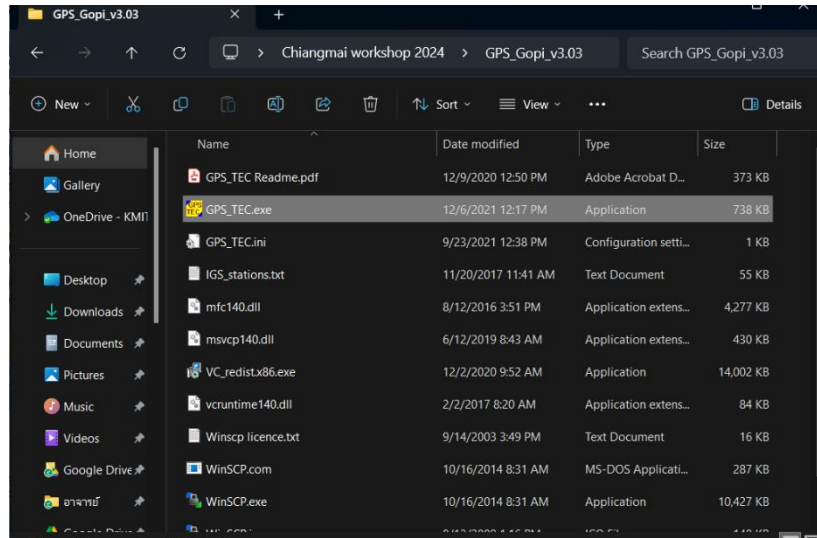


Fig. 1 Launch the "GPS_TEC.exe" program.

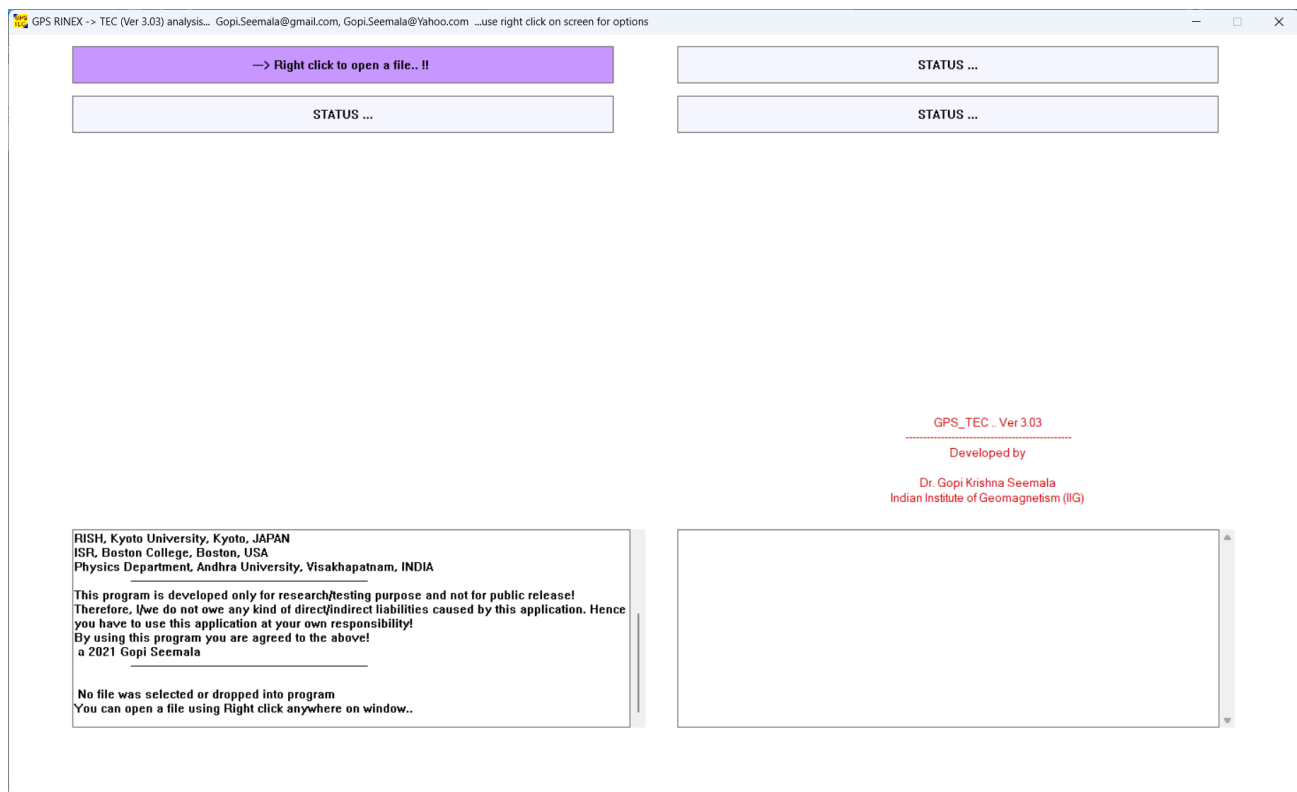
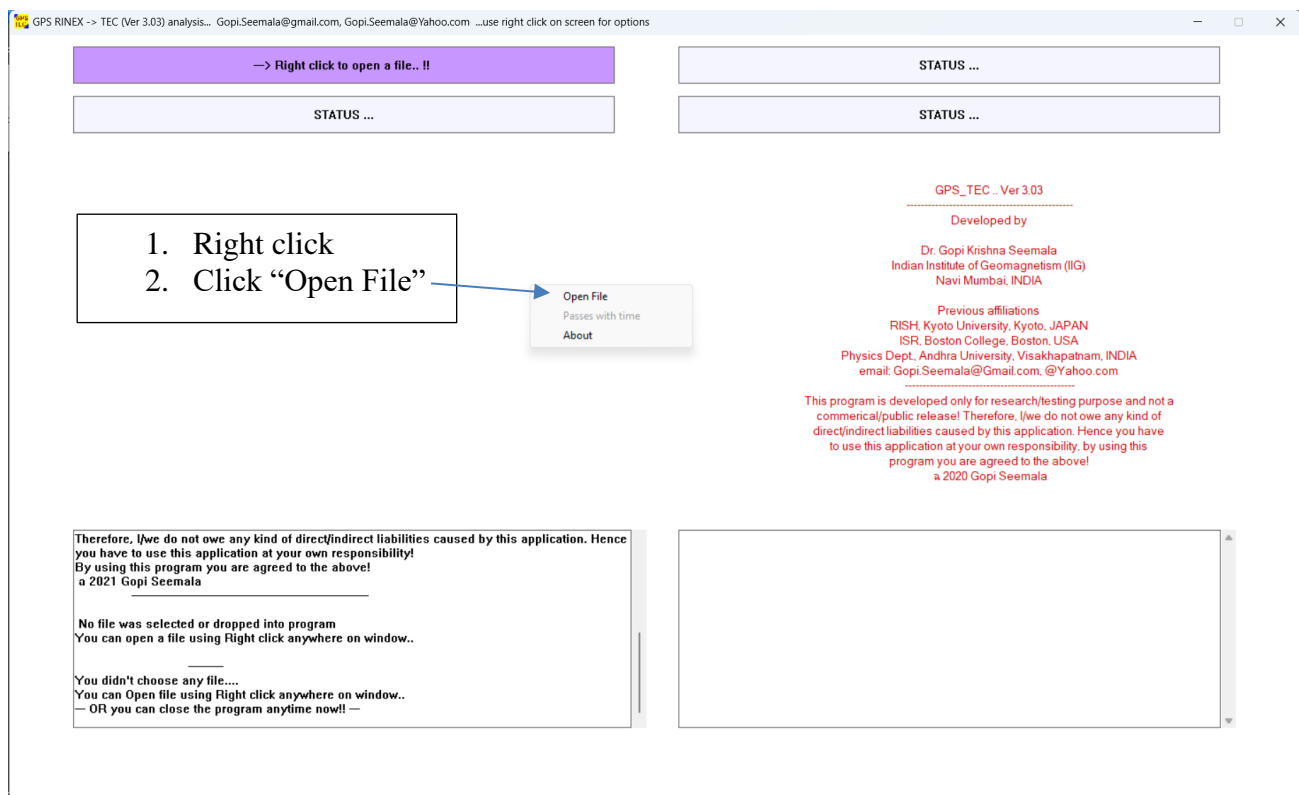
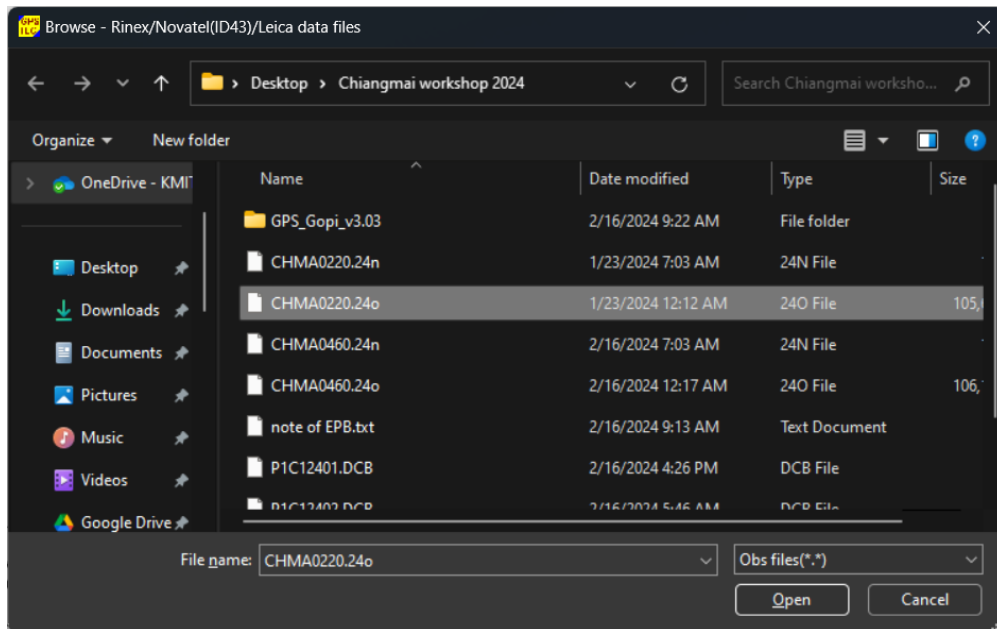


Fig. 2 The graphical user interface of the GPS Gopi TEC analysis software.

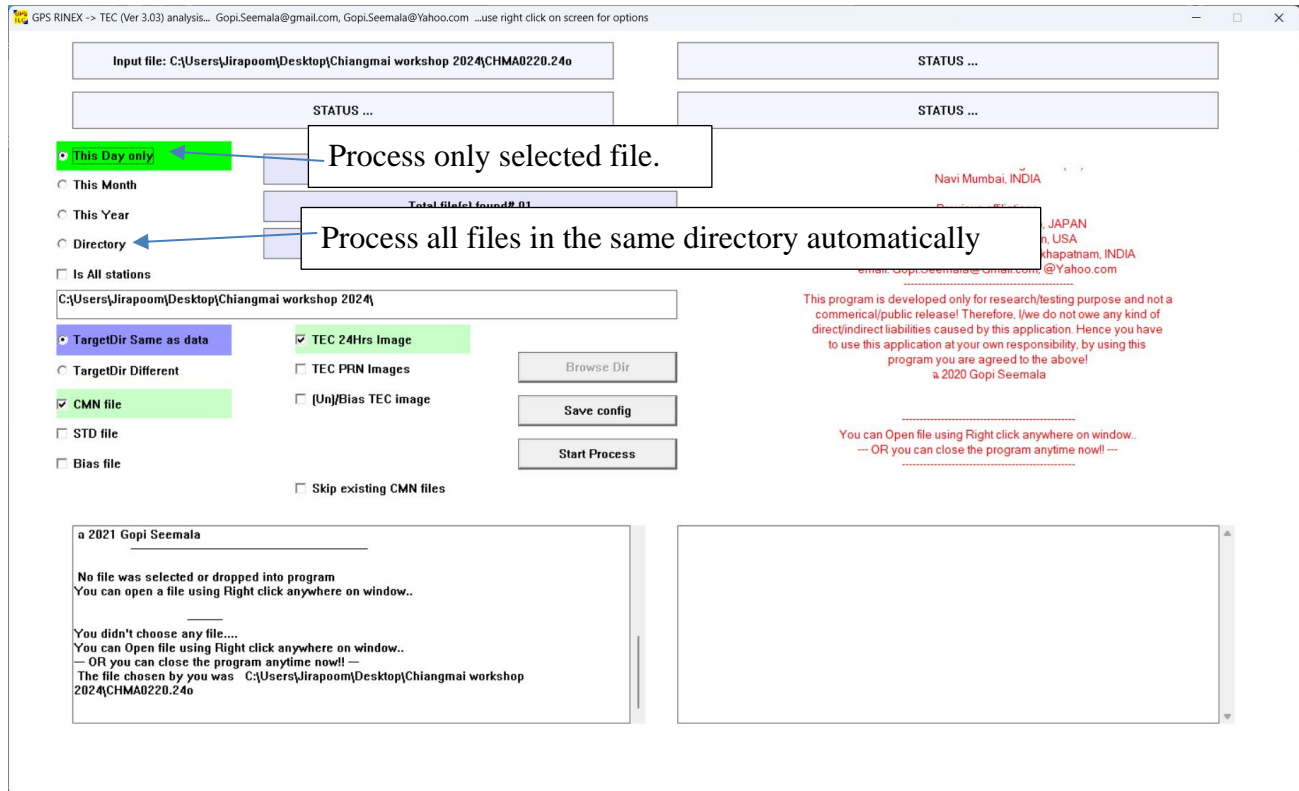
5. Right clicking the GUI will launch the file selection windows.



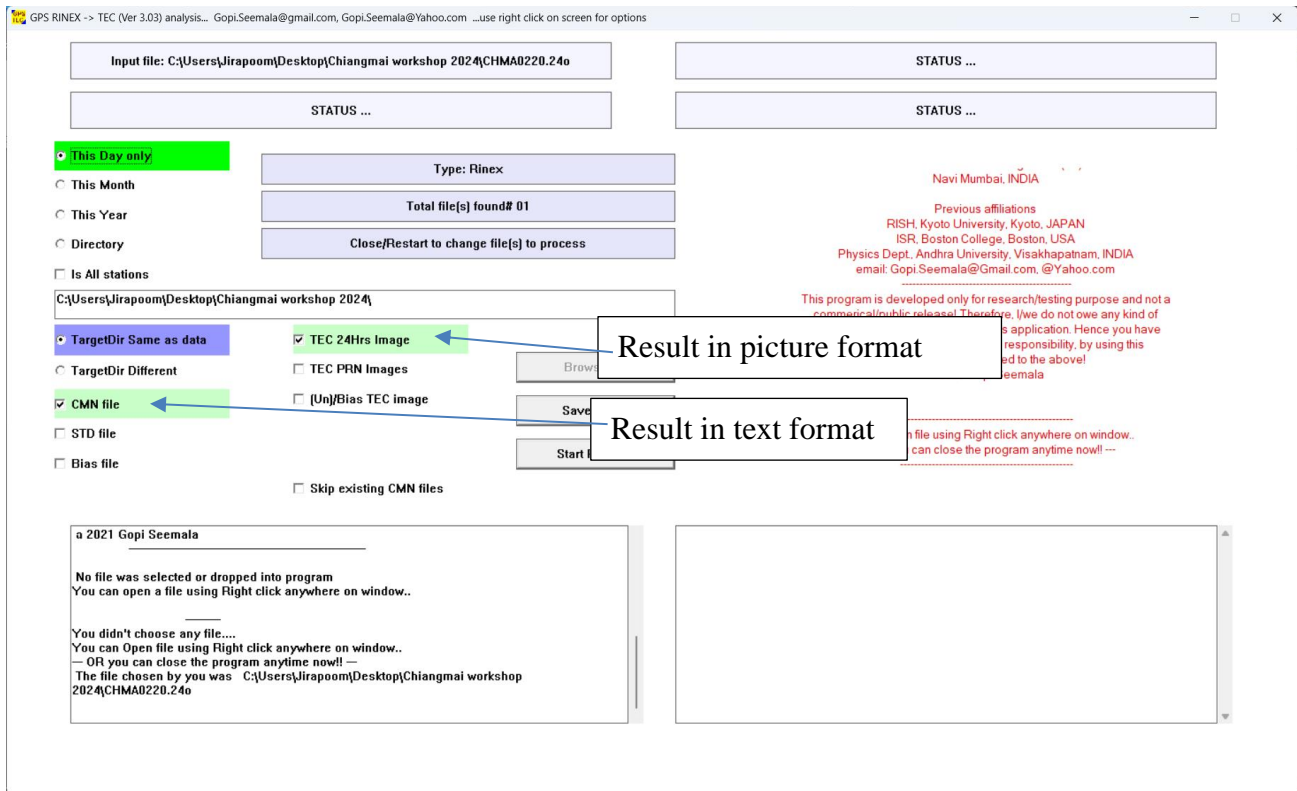
6. Navigate to the folder containing the RINEX files. Then, choose the RINEX file for observation (XXXXDDDO.YYy).



- In order to initiate the processing of the TEC file from the chosen RINEX file, check the "This day only" box. Selecting "Directory" will cause all RINEX files in the same directory to be processed automatically.



- The output of the software may consist of textual documents as well as images. Select "the CMN file" to obtain text-based results; select "TEC 24hrs image" to obtain image-based results.



9. Click “Start Process” to start analysis. The software will compute TEC from the selected file/files.
10. The result of the TEC calculation will be saved in the same directory as the RINEX file, once the software has finished. The "Cmn file" represents the textual output of TEC, while the "PNG file" represents the image output.

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C:\Users\Jirapoom\Desktop\Chiangmai workshop 2024\CHMA022-2024-01-22.Cmn - Notepad++
File Edit Search View Encoding Language Settings Tools Macro Run Plugins Window ?
pass-new.txt test.py P1C12401.DCB CHMA022-2024-01-22.Cmn
1 Unknown_station, "C:\Users\Jirapoom\Desktop\Chiangmai workshop 2024\CHMA0220.24o"
2
3 18.83528 98.96996 294.94091
4
5 MJdatet Time PRN Az Ele Lat Lon Stec Vtec S4
6 60331.048519 1.164444 2 276.20 12.65 19.599 88.742 35.75 17.56 -99.000
7 60331.048623 1.166944 2 276.13 12.64 19.588 88.737 35.75 17.56 -99.000
8 60331.048634 1.167222 2 276.13 12.64 19.587 88.737 35.75 17.56 -99.000
9 60331.048924 1.174167 2 275.94 12.61 19.557 88.722 35.75 17.55 -99.000
10 60331.049560 1.189444 2 275.53 12.55 19.489 88.690 35.75 17.53 -99.000
11 60331.049676 1.192222 2 275.46 12.54 19.477 88.684 35.75 17.53 -99.000
12 60331.049769 1.194444 2 275.40 12.53 19.467 88.679 35.75 17.52 -99.000
13 60331.049780 1.194722 2 275.39 12.53 19.466 88.678 35.88 17.57 -99.000
14 60331.049792 1.195000 2 275.39 12.53 19.465 88.678 35.97 17.60 -99.000
15 60331.049803 1.195278 2 275.38 12.53 19.464 88.677 35.83 17.55 -99.000
16 60331.049815 1.195556 2 275.37 12.53 19.462 88.677 35.83 17.55 -99.000
17 60331.049826 1.195833 2 275.37 12.53 19.461 88.676 35.87 17.57 -99.000
18 60331.049838 1.196111 2 275.36 12.52 19.460 88.675 35.85 17.56 -99.000
19 60331.049850 1.196389 2 275.35 12.52 19.459 88.675 35.93 17.59 -99.000
20 60331.049861 1.196667 2 275.34 12.52 19.457 88.674 35.98 17.61 -99.000
21 60331.049873 1.196944 2 275.34 12.52 19.456 88.674 35.96 17.60 -99.000
22 60331.049884 1.197222 2 275.33 12.52 19.455 88.673 35.96 17.60 -99.000
23 60331.049896 1.197500 2 275.32 12.52 19.454 88.673 36.01 17.62 -99.000
24 60331.049907 1.197778 2 275.31 12.52 19.453 88.672 36.04 17.63 -99.000
25 60331.049919 1.198056 2 275.31 12.52 19.451 88.671 36.06 17.64 -99.000
26 60331.049931 1.198333 2 275.30 12.52 19.450 88.671 36.09 17.65 -99.000
27 60331.049942 1.198611 2 275.29 12.51 19.449 88.670 36.09 17.65 -99.000
Normal text file length : 51,635,590 lines : 704,229 Ln : 1 Col : 1 Pos : 1 Macintosh (CR) UTF-8 INS

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Fig. 3 Result in text-based format.

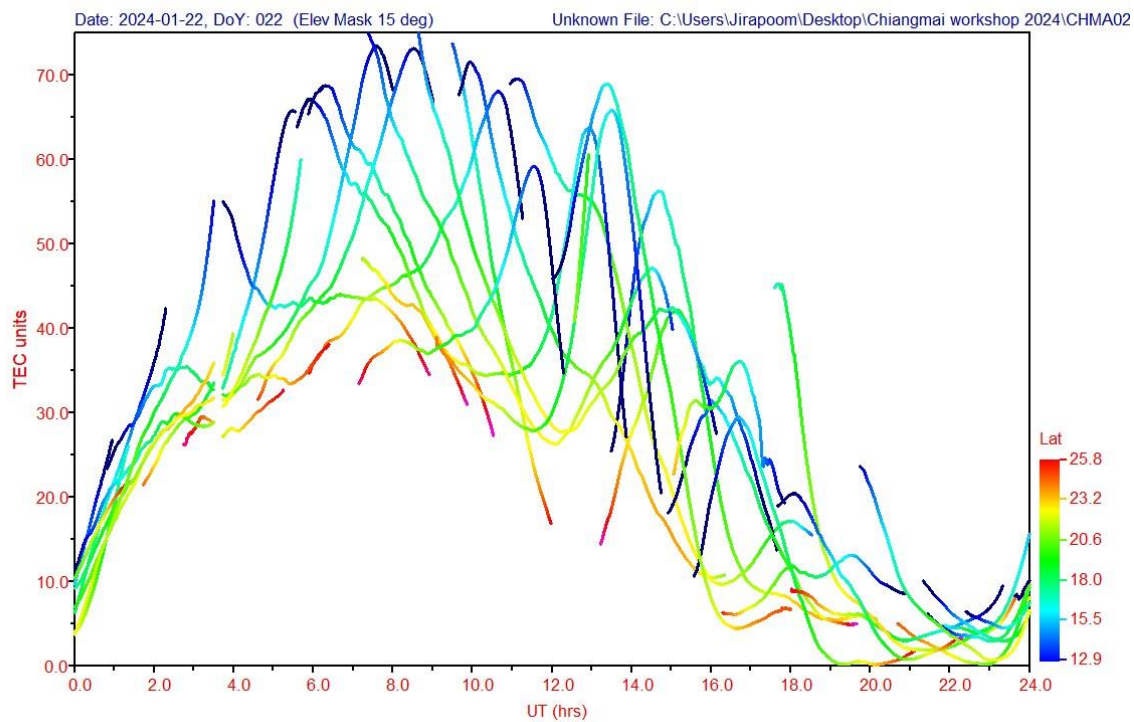


Fig. 4 Result in picture format.