

Ionospheric Models: IRI, NeQuick, Ionolab, IRI-Plas and Neural Network

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Introduction

- **Total Electron Content as an important descriptive parameter of the ionosphere.**
- **TEC is very important for ionospheric studies.**
- **A key parameter in propagation**
- **TEC is the major observable parameter in Space Weather, TEC Mapping (Spatial Interpolation), Ionospheric Characterization and Computerized Ionospheric Tomography (CIT).**

Introduction

- **TEC from different sources:**
 - **GPS-TEC (Gopi and Ionolab Techniques)**
 - **IRI-TEC**
 - **NeQuick-TEC**
 - **IRI-Plas-TEC**
 - **CAR NN Ionospheric model (Dr D.I. Okoh will help us on this)**

IRI Model

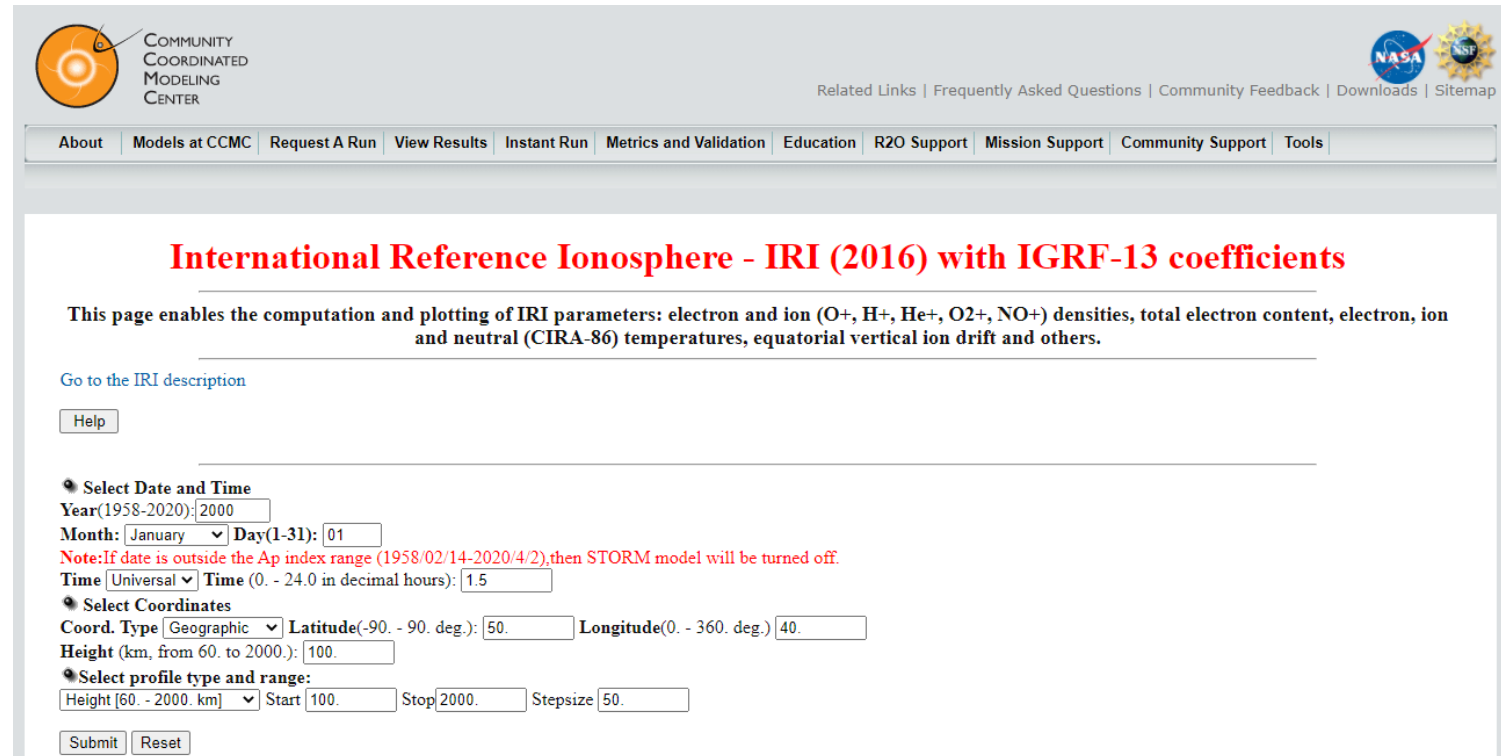
- The International Reference Ionosphere (IRI) is the most commonly used model.
- The IRI project is a joint programme of COSPAR and URSI
- Initiated in the late sixties with the aim of launching an international standard for the specification of ionospheric parameters.
- IRI is an empirical ionospheric model based on experimental observations of the ionospheric plasma.
- altitude range of 50 – 2000 km.
- The IRI model provides three options for the prediction of TEC, namely: IRI-2001, IRI01-Corr and NeQuick.

IRI-TEC

Visit

https://ccmc.gsfc.nasa.gov/modelweb/models/iri2016_vitmo.php

Play the video



The screenshot shows the IRI-TEC web application interface. At the top left is the logo for the Community Coordinated Modeling Center (CCMC), featuring a stylized orange sun. To the right of the logo is the text "COMMUNITY COORDINATED MODELING CENTER". In the top right corner, there are logos for NASA and NSF, along with a navigation menu containing links for "Related Links", "Frequently Asked Questions", "Community Feedback", "Downloads", and "Sitemap". Below the header is a horizontal navigation bar with buttons for "About", "Models at CCMC", "Request A Run", "View Results", "Instant Run", "Metrics and Validation", "Education", "R2O Support", "Mission Support", "Community Support", and "Tools". The main content area has a red heading: "International Reference Ionosphere - IRI (2016) with IGRF-13 coefficients". Below the heading is a paragraph: "This page enables the computation and plotting of IRI parameters: electron and ion (O+, H+, He+, O2+, NO+) densities, total electron content, electron, ion and neutral (CIRA-86) temperatures, equatorial vertical ion drift and others." There is a link "Go to the IRI description" and a "Help" button. The form includes sections for "Select Date and Time" with fields for Year (2000), Month (January), and Day (01); "Select Coordinates" with fields for Latitude (50) and Longitude (40); and "Select profile type and range" with fields for Start (100), Stop (2000), and Stepsize (50). A "Note" in red text states: "Note: If date is outside the Ap index range (1958/02/14-2020/4/2), then STORM model will be turned off." At the bottom are "Submit" and "Reset" buttons.

COMMUNITY COORDINATED MODELING CENTER

Related Links | Frequently Asked Questions | Community Feedback | Downloads | Sitemap

About | Models at CCMC | Request A Run | View Results | Instant Run | Metrics and Validation | Education | R2O Support | Mission Support | Community Support | Tools

International Reference Ionosphere - IRI (2016) with IGRF-13 coefficients

This page enables the computation and plotting of IRI parameters: electron and ion (O+, H+, He+, O2+, NO+) densities, total electron content, electron, ion and neutral (CIRA-86) temperatures, equatorial vertical ion drift and others.

[Go to the IRI description](#)

Select Date and Time
Year(1958-2020):
Month: Day(1-31):
Note: If date is outside the Ap index range (1958/02/14-2020/4/2), then STORM model will be turned off.
Time Time (0. - 24.0 in decimal hours):

Select Coordinates
Coord. Type Latitude(-90. - 90. deg.): Longitude(0. - 360. deg.)

Select profile type and range:
Height [60. - 2000. km] Start Stop Stepsize



Instant Model Run

International Reference Ionosphere - IRI (2016) with IGRF-13 coefficients

This page enables the computation and plotting of IRI parameters: electron and ion (O+, H+, He+, O2+, NO+) densities, total electron content, electron, ion and neutral (CIRA-86) temperatures, equatorial vertical ion drift and others.

[Go to the IRI description](#)

Help

Select Date and Time

Year(1958-2020): 2000

Month: January Day(1-31): 01

Note: If date is outside the Ap index range (1958/02/14-2020/4/2), then STORM model will be turned off.

Time: Universal Time (0. - 24.0 in decimal hours): 1.5

Select Coordinates

Coord. Type: Geographic Latitude(-90. - 90. deg.): 50. Longitude(0. - 360. deg.): 40.

Height (km, from 60. to 2000.): 100.

Select profile type and range:

Height [60. - 2000. km] Start: 100. Stop: 2000. Step size: 50.

Submit

Reset

IRI-TEC

- Visit https://ccmc.gsfc.nasa.gov/modelweb/models/iri2016_vitmo.php
- Play the video

Optional Input:

Sunspot number, R12 (0. - 400.) Ionospheric index, IG12 (-50. - 400.)
F10.7 radio flux, daily (0. - 400.) F10.7 radio flux, 81-day (0. - 400.)

Electron content: Upper boundary (50. - 2000. km)

Ne Topside Ne F-peak F-peak storm model F-peak height

Bottomside Thickness F1 occurrence probability:

Auroral boundaries E-peak auroral storm model D-region model

Te Topside Ion Composition

Note: User may specify the following 5 parameters only for Profile type 'Height':

F2 peak density (NmF2) ($10^9 - 10^{14} \text{m}^{-3}$) or F2 plasma frequency (foF2) (2.-14. MHz):

F2 peak height (hmF2) (100. - 1000. km) or Propagation factor M(3000)F2 (1.5 - 4.):

E peak density (NmE) ($10^6 - 10^{14} \text{m}^{-3}$) or E plasma frequency (foE) (0.1-14. MHz):

E peak height (hmE) (70.-200. km): Bottomside thickness (B0) (50.-500. km):

IRI-TEC

- **Visit**
https://ccmc.gsfc.nasa.gov/modelweb/models/iri2016_vitmo.php
- **Play the video**

Select output form:

- List model data
- Create model data file in ASCII format for downloading
- Plot model data

Note 1: The first selected parameter below always will be along the X-axis, the other selections will be along Y-axis. (e.g. if you want a Height profile, you may specify Height as the first parameter in the listing below.)

Note 2: User may get scatter plot if he specifies any two parameters below and changes the "connect type" in the "Advanced plot selections" to "show points only"

Submit Reset

Select desired output parameters

Independent Variables

- | | |
|---|---|
| <input type="checkbox"/> Year | <input type="checkbox"/> CGM Latitude, deg. |
| <input type="checkbox"/> Month | <input type="checkbox"/> CGM Longitude, deg. |
| <input type="checkbox"/> Day of month | <input type="checkbox"/> Magnetic inclination (DIP), degree |
| <input type="checkbox"/> Day of year | <input type="checkbox"/> Modified dip latitude, degree |
| <input type="checkbox"/> Hour of day, UT/LT
(depending on user's choice above) | <input type="checkbox"/> Declination, degree |
| <input type="checkbox"/> Solar zenith angle, degree | <input type="checkbox"/> InvDip, degree |
| <input checked="" type="checkbox"/> Height, km | <input type="checkbox"/> Dip latitude, degree |
| <input type="checkbox"/> Geographic/Geomagnetic Latitude, deg.
(depending on user's choice above) | <input type="checkbox"/> MLT, hour |
| <input type="checkbox"/> Geographic/Geomagnetic Longitude, deg.
(depending on user's choice above) | |

IRI-TEC

- **Visit**
https://ccmc.gsfc.nasa.gov/modelweb/models/iri2016_vitmo.php
- **Play the video**

IRI Model Parameters

- Electron_density (Ne), m^{-3}
- Ratio of Ne and F2 peak density(Ne/NmF2)>
- Neutral Temperature Tn, K
- Ion Temperature Ti, K
- Electron Temperature, Te, K
- Atomic Oxygen ions (O^+), percentage
- Atomic Hydrogen (H^+),ions, percentage
- Height of F2 peak (hmF2), km
- Height of F1 peak (hmF1), km
- Height of E peak (hmE), km
- Height of D peak (hmD), km
- Density of F2 peak (NmF2), m^{-3}
- Density of F1 peak (NmF1), m^{-3}
- Density of E peak (NmE), m^{-3}
- Density of D peak (NmD), m^{-3}
- Equatorial vertical ion drift, m/s
- Ratio of foF2 storm to foF2 quiet
- F1 probability
- Atomic Helium (He^+), ions, percentage
- Molecular Oxygen (O_2^+) ions, percentage
- Nitric Oxide ions (NO^+), percentage
- Cluster ions, percentage
- Atomic Nitrogen (N^+) ions, percentage
- Total Electron Content (TEC), $10^{16} m^{-2}$
- TEC top, percentage
- Propagation factor M(3000)F2
- Bottomside thickness (B0), km
- Bottomside shape (B1)
- E-valley width, km
- E-valley depth (Nmin/NmE)
- F2 plasma frequency (foF2), MHz
- F1 plasma frequency (foF1), MHz
- E plasma frequency (foE), MHz
- D plasma frequency (foD), MHz
- CGM lat of auroral oval boundary
- Ratio foE storm to foE quiet
- Spread-F probability

IRI-TEC

- **Visit**
https://ccmc.gsfc.nasa.gov/modelweb/models/iri2016_vitmo.php
- **Play the video**

Indices used by the model

- 12-month running mean of sunspot number (Rz12)
- Ionospheric Index IG12
- Daily Solar Radio Flux F107D
- 81-day Solar Radio Flux F107_81D
- 3-h_ap
- daily_ap
- 3-h_kp

Advanced plot selections (optional)

Connect Type: Character size(0.5-2.0)

Plot Symbol: Symbol Size(0.1-4.0):

Y-axis Scale: X-axis Scale:

Image size (pixels): X: Y:

Ionolab-TEC

- Visit ionolab.org
- Register
- Services include
 - IONOLAB-TEC online
 - IRI-Plas Online
 - IRI-PLAS-MAP Service
 - IRI-Plas STEC
 - IONOLAB-TEC Software

The screenshot shows the homepage of the IONOLAB website. The browser address bar displays www.ionolab.org. The page features the IONOLAB logo in large red letters, with the full name 'IONOSPHERIC RESEARCH LABORATORY' below it. Navigation flags for Turkey and the UK are visible. The site is affiliated with Hacettepe University, Harita Genel Komutanlığı, and Bilkent University. A left sidebar contains a menu with items like 'Main Page', 'About IONOLAB', 'About Ionosphere', 'Activities', 'Publications', 'Contact Us', 'Related Links', 'News', 'FAQ', 'Videos', 'Member Operations', and 'IONOLAB-TEC Online'. The main content area includes a 'Welcome to IONOLAB Web Site' message, a 'Dear Users' section with a disclaimer, and a 'Space Weather Services' section listing links for IONOLAB-TEC Online, IONOLAB-TEC/STEC Software, IRI-Plas Online, IRI-Plas HmF2/FoF2/TEC/W-Index Maps, and IRI-Plas STEC Service. An 'IONOLAB Research' section lists 'IONOLAB-TEC Estimation' and 'HF Channel Characterization'.

Ionolab-TEC Online - 1

IONOLAB-TEC Online (v1.28)

Please use the [REFERENCES](#) list to cite IONOLAB-TEC Online.

[Türkçe](#) | [Single Station](#) | [Multiple Station](#) | [Single Station - Day Comparison](#)

TEC for Single Station

Station Code

EUREF stations are also supported by their 4-character code names.

Observation Start Date

Observation End Date

Show IONEX data


Output Type


- Graphics
 Excel


Calculate

Ionolab-TEC Online - 2

TEC for Single Station

Station Code 

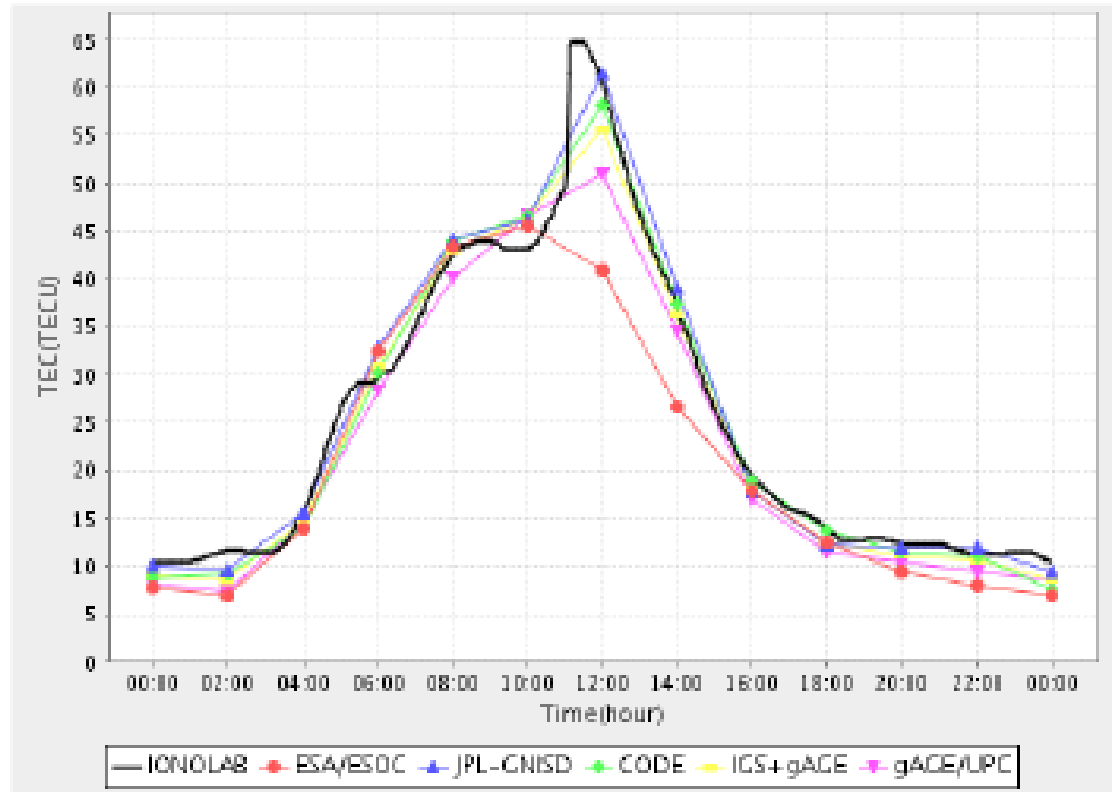
Observation Start Date 

Observation End Date 

Show IONEX data

Output Type Graphics Excel

TEC Estimation for Zelenchukskaya (Russia) station on 28 October 2003
Receiver bias is calculated by IONOLAB.



Ionolab-TEC Online - 3

TEC Comparison for Different Stations

Station Codes

Observation Start Date

Observation End Date

Show IONEX data

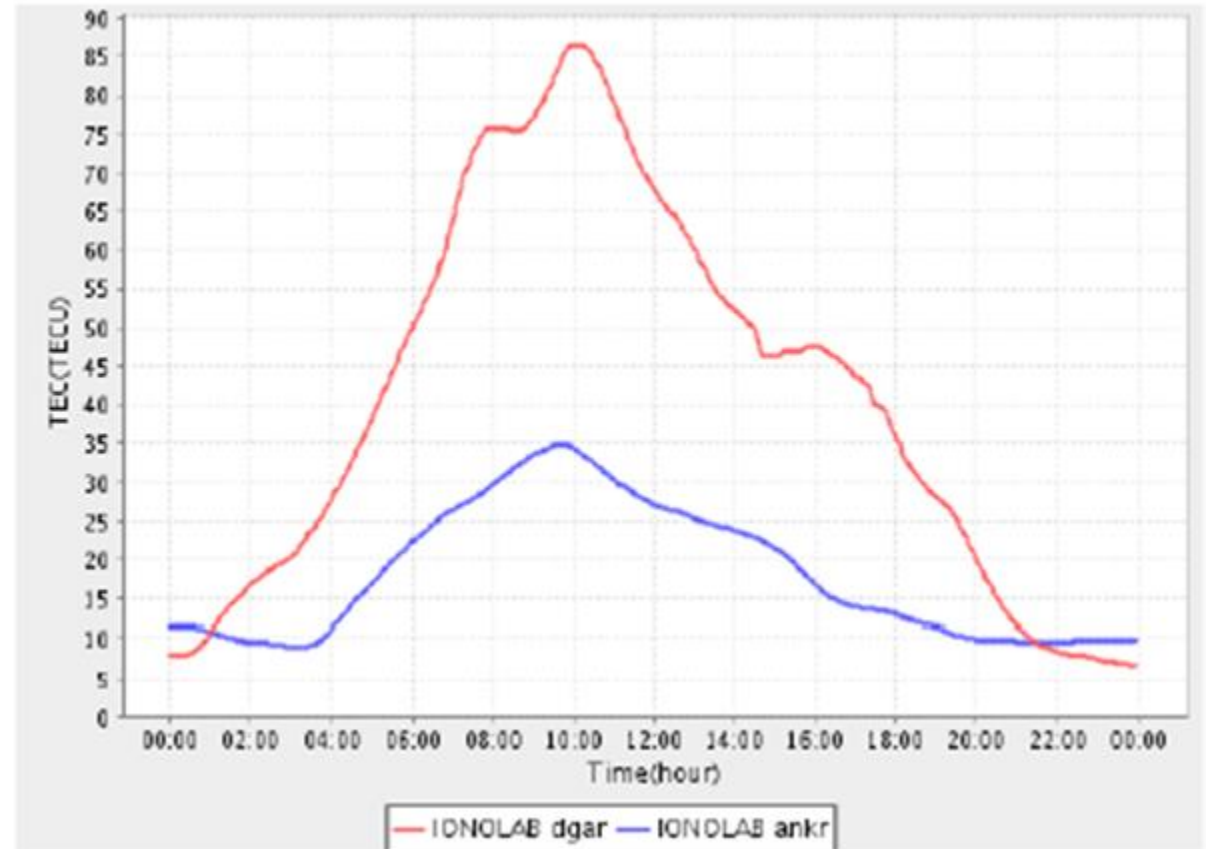
Output Type

- Graphics
 Excel

Calculate

TEC Estimation Comparison for selected stations on 10 October 2003

Receiver bias is calculated by IONOLAB.



Ionolab-TEC Online - 4

The output can be given in the form of an Excel file into a user defined directory with 2.5 min time resolution

	A	B	C	D	E	F	G
1	TEC Esimation for Zelenchukskaya(Russia) station on 10/28/03 12:00 AM						
2	Date	Time	TEC(TECU)				
3	28.10.2003	00:00:00	10,54843281				
4	28.10.2003	00:02:30	10,54843281				
5	28.10.2003	00:05:00	10,54843281				
6	28.10.2003	00:07:30	10,54843281				
7	28.10.2003	00:10:00	10,54843281				
8	28.10.2003	00:12:30	10,54843281				
9	28.10.2003	00:15:00	10,54843281				
10	28.10.2003	00:17:30	10,54843281				
11	28.10.2003	00:20:00	10,54843281				
12	28.10.2003	00:22:30	10,51602579				
13	28.10.2003	00:25:00	10,46986127				
14	28.10.2003	00:27:30	10,43218492				
15	28.10.2003	00:30:00	10,40602088				

Reference

U. Sezen, F. Arikan, O. Arikan, O. Ugurlu, and A. Sadeghimorad, Online, automatic, near-real time estimation of GPS-TEC: IONOLAB-TEC, *Space Weather*, (11),1–9, doi:10.1002/swe.20054, 2013.

Practical Session (If time permits)

- Visit www.ionolab.org

Ionolab-TEC Software - 1

- **Copyright (c) 2016 IONOLAB Group, Hacettepe University, Ankara.**
- **IONOLABTEC executable is provided for non-commercial purposes only.**
- **ionolabtec.exe is a command line tool to calculate GPS TEC for a given GPS receiver and date**
- **by downloading and processing the necessary RINEX, SP3, DCB and IONEX files.**
- **IONOLABTEC executable uses the wget executable located in the apps folder to perform the necessary downloads.**

Ionolab-TEC Software - 2

- **Follow the steps below.**
- **1. Verify the MATLAB Compiler Runtime (MCR) is installed and ensure you have installed version 8.1 (R2013a).**
- **You can download the necessary 'MCRInstaller.exe' from the IONOLAB-TEC Executable page on the IONOLAB website (www.ionolab.org).**
- **You can also download the Windows 32-bit version of the MCR for R2013a from the MathWorks Web site by navigating to <http://www.mathworks.com/products/compiler/mcr/index.html>**
- **NOTE: You will need administrator rights to run MCRInstaller.**
- **You need to do this step only once.**

Ionolab-TEC Software - 3

- **2. Extract the ZIP file "ionolabtecv1.25.zip" to an appropriate place**
- **3. In Windows Explorer select the folder which holds extracted contents**
- **4. Press the Shift key on the keyboard and right-click on the folder while pressing the Shift key**
- **5. Then select "Open command window here" option from the right-click menu.**

Ionolab-TEC Software - 4

- **6. Once the Command Window is open now you can run the ionolabtec executable**
 - **a. Type "ionolabtec ankr 2015-05-19" in the command window**
 - **b. The program will start downloading the necessary RINEX, SP3, DCB and IONEX files from the HTTP/FTP sites specified in the config file "ionolabtec.cfg" to the local folders specified in the config file "ionolabtec.cfg"**
- **and calculate GPS TEC value from the RINEX file downloaded.**

Ionolab-TEC Software - 5

- **GPS TEC results will be saved to a text file named with the receiver name and the date given**
- **(e.g., ankr_20150519.txt).**
- **c. If files already present in the local directories, then those files are not downloaded again.**
- **Try running the same command (ionolabtec ankr 2015-05-19) again, you will notice that program will not download the downloaded files again.**

Practical Session (If time permits)

- **Press the Shift key on the keyboard and right-click on the folder while pressing the Shift key**
- **Then select "Open command window here" option from the right-click menu.**

IRI-Plas 2017 (Online) - 1

IRI-Plas 2017 Online

T. Gulyaeva, F. Arikan, L. Poustovalova and U. Sezen, "TEC proxy index of solar activity for the International Reference Ionosphere IRI and its extension to plasmasphere IRI-PLAS model," Int. J. Sci. Eng. Applied Sci., 3(5), pp. 144-150, May. 2017.
Available at <http://ijseas.com/volume3/v3i5/ijseas20170519.pdf>

IRI-Plas (by T.L. Gulyaeva) source and executables are available at <ftp://ftp.izmiran.ru/pub/izmiran/SPIM/>. This website uses the 2017-05-27 release.

Please use the [REFERENCES](#) list to cite IRI-Plas Online.



Hacettepe University
Dep. of Electrical & Electronic Engineering



Türkçe Multiple Input

Required Inputs

- Date (YYYY-MM-DD) Kp
- Hour (HH:MM) UTC Local Time
- Coordinate (Lat, Lon) °N °E Geocentric Geomagnetic

Optional Inputs

- F2-peak Plasma Frequency (foF2) MHz [2 MHz - 15 MHz]
- Propagation Information F2-peak Height (hmF2) km [100 km - 999 km]
 Propagation Factor (M3000F2) [1.5 - 4.0]
- Total Electron Content (TEC) TECU [0 - 300 TECU] **GIM TEC** (since 1998-06-01)
- Solar Activity Sunspot Number (Rz12) [0 - 400]
 F10.7 Radio Flux (F10.7D) sfu [0 - 400 sfu]
- F-peak Model CCIR URSI
- foF2 Storm Model On Off
- Solar Proxy Index SSN1 SSN2 F107 GEC TEC IG MGII Lyman-α GEC_RZ

IRI-Plas 2017 (Online)– 2

Optional Outputs

Generate Ne(h) & fN(h) profiles On Off

Currently, list is empty.

Description of Outputs

```
IRI-PLAS 2017 (27 May 2017)
PC Date: Year,Month,Day = 20170911   Time = 1548
*** ISO_IRI parameters are being calculated ***
Ne, B0: Bottomside thickness is obtained with Gulyaeva-1987 model.
  hmF2: CCIR model is used.
Ne, foF2: CCIR model is used.
Ne, foF2: STORM model included.
hmF2(foF2) STORM2 model included.
YEAR MMDD UThr LThr XHI  SSN  COV  Kpm   L  Glati Glong Mlati Mlong MoDip  hmF2  foF2
2017  901  1.0  1.2 157.  22.  79.  3.3  1.02  6.5  3.4  8.7  77.3 -12.1 277.3  5.61
  NmF2  Nes    QF    MLT  ECbot  ECTop  ECpl  TEC   TAU  h05b  h05t  Hsc  SP
 390471. 16717.  1.180  1.400  1.80  10.76  1.62 14.17 363.0 233.1 432.0 245.0 ssn1+f107
  H      NE      FN      Te      Ti      Tn
20200.  1.1511E+08  0.096 3744.89 3738.80 784.32
20000.  1.1800E+08  0.098 3744.23 3738.09 783.98
18000.  1.5116E+08  0.110 3720.74 3714.01 780.37
16000.  1.9354E+08  0.125 3659.62 3652.26 776.30
14000.  2.4711E+08  0.141 3551.03 3542.99 771.70
12000.  3.1232E+08  0.159 3386.37 3377.62 766.43
10000.  3.8625E+08  0.176 3160.26 3150.76 760.33
 9000.  4.2500E+08  0.185 3023.80 3013.89 756.91
 8000.  4.6448E+08  0.194 2872.30 2861.94 753.21
 7000.  5.0499E+08  0.202 2706.68 2695.83 749.19
 6000.  5.4858E+08  0.210 2528.27 2516.82 744.83
 5000.  6.5024E+08  0.229 2338.55 2326.35 740.12
 4000.  9.2091E+08  0.273 2138.32 2125.04 735.07
 3000.  1.7368E+09  0.374 1924.10 1909.13 729.81
 2500.  2.8030E+09  0.475 1806.58 1790.32 727.21
 2000.  5.2633E+09  0.651 1673.66 1655.56 724.78
 1800.  7.1379E+09  0.759 1612.97 1593.85 723.90
```

Output Sample

IRI-Plas 2017 (MATLAB) – 1

- Be sure you have MATLAB installed
- Open the folder – IRI Plas
- Open the MATLAB file – inputCreator.m (to generate the input data set)
- Input the name of the stations, Year, Lat and long of the station (in 1dp).
- Run
- This will generate input file saved as note pad - Input.FILE.

```
fid=fopen('Input.inp', 'wt');  
%statns={'ILOR', 'TETN', 'RABT', 'SHEB', 'DASM', 'DAMY', 'ROBE', 'YKRO', 'EBBE', '  
%lats=[8.5 35.6 34.0 15.9 11.8 9.6 7.8 6.9 0.1 0.4 -8.6 -9.3 -20.9 -28.8 -32.4];  
%longs=[4.5 5.4 6.9 39.1 41.0 41.9 40.0 5.2 32.5 34.0 39.3 33.7 57.5 32.1 20.7];  
statns={'AZU1', 'BAY3'};  
lats=[34.13 55.2];  
longs=[242.1 197.3];
```

IRI-Plas 2017 (MATLAB) – 1

- **Open the isomain (It is an Application).**
- **Type Input.inp**
- **This produces the output which contains TEC data as Input.out in note pad**

```
PC Date: Year,Month,Day = 20170911 Time = 1529  
ENTER THE PATH & NAME OF INPUT FILE=  
Input.inp
```

IRI-Plas 2017 (MATLAB) – 1


- Next, Open the MATLAB file – separator
- Input the name of the stations, Year, Lat and long of the station (in 1dp). (Just as you have it in inputCreator.m)
- Run.
- The final data is stored in the folder - Output

```
header_line_remove_iono.m × inputCreator.m × separator.m × IRI2001.m × IRI01cor.m × IRInequick.m × TEC
1 - fid=fopen('Input.out');
2   %stats={'ILOR', 'TETN', 'RABT', 'SHEB', 'DASM', 'DAMY', 'ROBE', 'YKRO', 'EBBE', 'I
3 - stats={'AZU1', 'BAY3'};
4   %lats=[8.5 35.6 34.0 15.9 11.8 9.6 7.8 6.9 0.1 0.4 -8.6 -9.3 -20.9 -28.8 -32.4];
5   %longs=[4.5 5.4 6.9 39.1 41.0 41.9 40.0 5.2 32.5 34.0 39.3 33.7 57.5 32.1 20.7];
6 - lats=[34.13 55.2];
7 - longs=[242.1 197.3];
03-Sep-20 5:14:46 PM
```

NeQuick - 2

https://t-ict4d.ictp.it/nequick2

Home | About T/ICT4D | Models | People | News | Projects | Bibliography Search

 The Abdus Salam
International Centre
for Theoretical Physics

T/ICT4D

log in

site map | accessibility | contact

You Are Here: Home / NeQuick 2

only in current section

Search Site

NeQuick 2 Web Model

Terms of Use

References

Source Code

GNSS TEC Calibration

NeQuick model

Brief Description of NeQuick model

NeQuick 2 is the latest version of the NeQuick ionosphere electron density model developed at the **Aeronomy and Radiopropagation Laboratory (now T/ICT4D Laboratory) of the Abdus Salam International Centre for Theoretical Physics (ICTP)** - Trieste, Italy with the collaboration of the **Institute for Geophysics, Astrophysics and Meteorology of the University of Graz**, Austria.

The NeQuick is a *quick-run* ionospheric electron density model particularly designed for trans-ionospheric propagation applications. To describe the electron density of the ionosphere up to the peak of the F2 layer, the NeQuick uses a profile formulation which includes five semi-Epstein layers with modelled thickness parameters. Three profile anchor points are used: the E layer peak, the F1 peak and the F2 peak, that are modelled in terms of the ionosonde parameters **foE**, **foF1**, **foF2** and **M(3000)F2**. These values can be modelled (e.g. ITU- R coefficients for foF2, M3000) or experimentally derived. A semi-Epstein layer represents the model topside with a height- dependent thickness parameter empirically determined.


NeQuick – 2 (Source Code)

<https://t-ict4d.ictp.it/nequick2/source-code>

The screenshot shows a web browser displaying the source code page for NeQuick 2. The page has a navigation menu at the top with links for Home, About T/ICT4D, Models, People, News, Projects, and Bibliography Search. The main header features the ICTP logo and the text 'The Abdus Salam International Centre for Theoretical Physics' and 'T/ICT4D'. A 'log in' link is visible in the top right. On the left side, there is a vertical menu with links for 'NeQuick 2 Web Model', 'Terms of Use', 'References', 'Source Code', and 'GNSS TEC Calibration'. The main content area includes links for 'site map', 'accessibility', and 'contact', and a breadcrumb trail: 'You Are Here: Home / NeQuick 2 / Source Code'. The title 'Source Code' is prominently displayed. The text explains that the source code is updated and distributed by the Ionosphere Radiopropagation Unit of the T/ICT4D Laboratory. It mentions that the package contains FORTRAN functions and subroutines, model coefficients (ITU), solar activity, and modip. A current version is available for the scientific community, and interested parties are directed to write to bnava@ictp.it or yenca@ictp.it. On the right side, there is a search box with the text 'Search Site' and a search button, and a 'News' section with several articles: 'Dr. Christine Amory award' (Nov 26, 2015), 'Visits of first quarter of 2013' (Mar 12, 2013), 'T/ICT4D paper selected for 'Editor's Choice' column' (Nov 22, 2011), 'Guglielmo Marconi Laboratory inaugurated' (Nov 23, 2010), and 'International Collaboration' (Oct 12, 2009). A 'More news...' link is at the bottom of the news section. The footer contains the text: 'The Abdus Salam International Centre for Theoretical Physics (ICTP) | © 2012 | Strada Costiera, 11 - 34151 Trieste Italy (+39) 040 2240 111'. The timestamp '03-Sep-20 5:14:46 PM' is visible in the bottom left corner.

NeQuick – 2 (Online Model)

Home About T/ICT4D Models People News Projects Bibliography Search

 The Abdus Salam
International Centre
for Theoretical Physics
T/ICT4D

log in

site map | accessibility | contact

only in current section

Search Site →

You Are Here: Home / NeQuick 2 / NeQuick 2 Web Model

NeQuick 2 Web Model

Computation and plotting of slant electron density profile and total electron content

Endpoints Coordinates

Lower endpoint: Latitude °N Longitude °E Height km

Higher endpoint: Latitude °N Longitude °E Height km

Satellite data: Azimuth °N Elevation ° Height km

Date and Time

Year(YYYY) Month Day(DD) Time

Solar Activity

R12 (source: NOAA-NGDC)

Daily Solar Radio Flux (source: NOAA-NGDC)

Use Input Solar Index type Value *

NeQuick – 2 (Online Model)

Solar Activity

R12 (source: NOAA-NGDC)

Daily Solar Radio Flux (source: NOAA-NGDC)

User Input Solar index type **Value ***

ITU-R compliant *

*For R12: [0 to 150]; for F10.7: [63 to 193] F.U.

Warning! Not respecting the limits could lead to undefined electron density values! (ITU-R P.1239 recommendation)

Run NeQuick

Calculating...

©2012 | Questions to yenca@ictp.it | [Terms of Use](#)

Some Research Works - 1

TEC derived from some GPS stations in Nigeria and comparison with the IRI and NeQuick models

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**ADVANCES IN
SPACE
RESEARCH**
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Abstract

Total electron content (TEC) measured simultaneously using Global Positioning System (GPS) ionospheric monitors installed at some locations in Nigeria during the year 2011 ($Rz = 55.7$) was used to study the diurnal, seasonal, and annual TEC variations. The TEC exhibits daytime maximum, seasonal variation and semiannual variations. Measured TEC were compared with those predicted by the improved versions of the International Reference Ionosphere (IRI) and NeQuick models. The models followed the diurnal and seasonal variation patterns of the observed values of TEC. However, IRI model produced better estimates of TEC than NeQuick at all locations.

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Advances in Space Research 53 (2014) 1290–1303

Some Research Works - 1

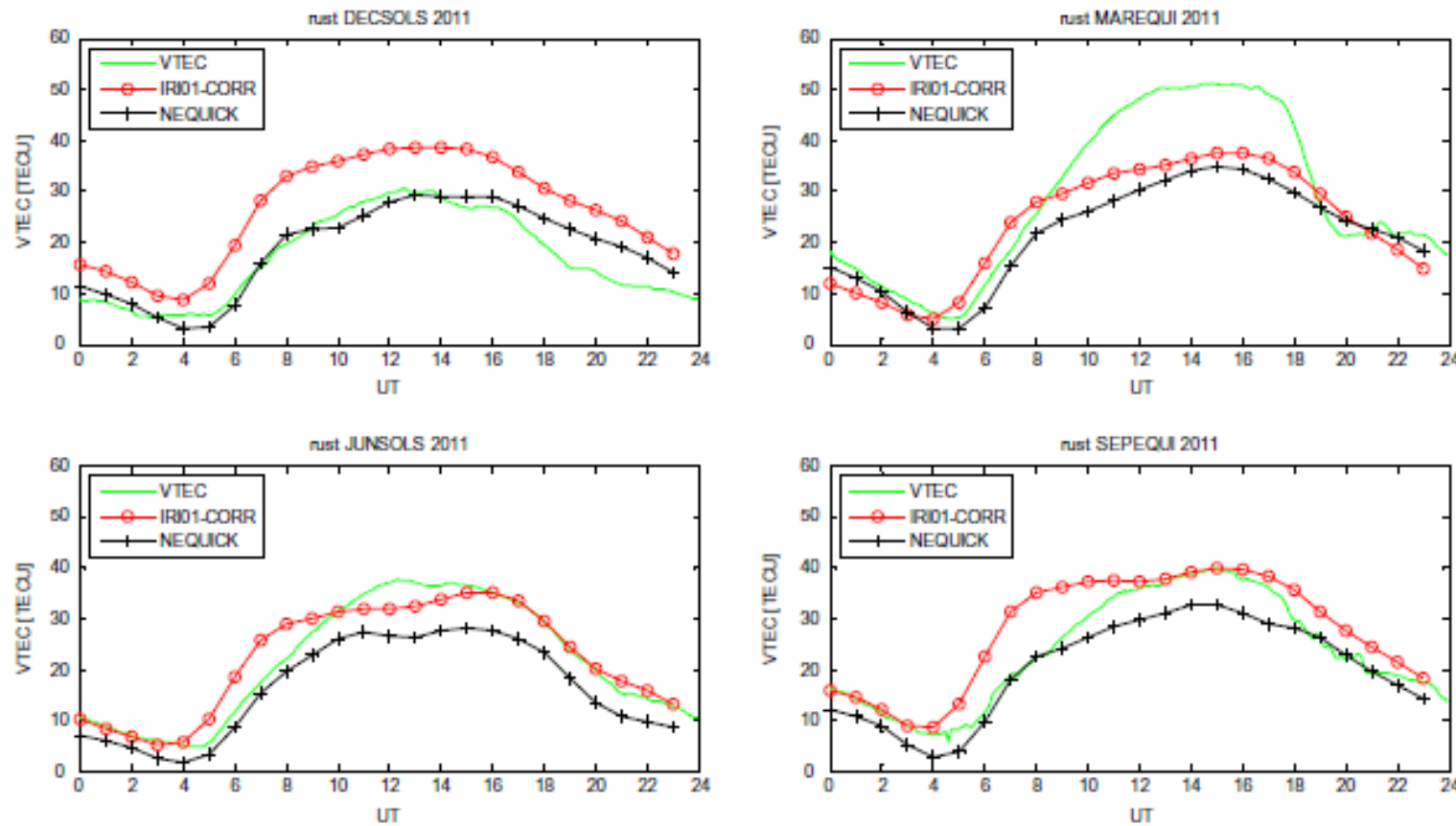


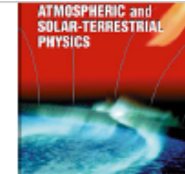
Fig. 8. Diurnal variations of observed mean values of TEC at RUST along with the IRI and NeQuick predicted values.

Some Research Works - 2



Journal of Atmospheric and Solar-Terrestrial Physics

journal homepage: www.elsevier.com/locate/jastp



Assessment of IRI-2012, NeQuick-2 and IRI-Plas 2015 models with observed equatorial ionization anomaly in Africa during 2009 sudden stratospheric warming event



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Journal of Atmospheric and Solar-Terrestrial Physics 164 (2017) 203–214

ARTICLE INFO

Keywords:

Sudden stratospheric warming
Equatorial ionization anomaly
Plasma transportation
Ionospheric empirical models

ABSTRACT

In Africa, we assessed the performance of all the three options of International Reference Ionosphere 2012, IRI-2012 (i.e. IRI-2001, IRI-2001COR and IRI-NeQuick), NeQuick-2 and IRI-Plas 2015 models prior to and during 2009 sudden stratospheric warming (SSW) event to predict equatorial ionization anomaly (EIA) crest locations and their magnitudes using total electron content (TEC) from experimental records of Global Positioning System (GPS). We confirmed that the IRI-Plas 2015 that appeared as the best compared to all of the models as regard

Some Research Works - 3



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Advances in Space Research 49 (2012) 316–326

**ADVANCES IN
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www.elsevier.com/locate/asr

Low solar activity variability and IRI 2007 predictability of equatorial Africa GPS TEC

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Received 11 July 2011; received in revised form 28 September 2011; accepted 29 September 2011

Available online 7 October 2011

Abstract

Diurnal, seasonal and latitudinal variations of Vertical Total Electron Content (VTEC) over the equatorial region of the African continent and a comparison with IRI-2007 derived TEC (IRI-TEC), using all three options (namely; NeQuick, IRI01-corr and IRI-2001), are presented in this paper. The variability and comparison are presented for 2009, a year of low solar activity, using data from thirteen Global Positioning System (GPS) receivers. VTEC values were grouped into four seasons namely March Equinox (February, March,

Some Research Works - 3

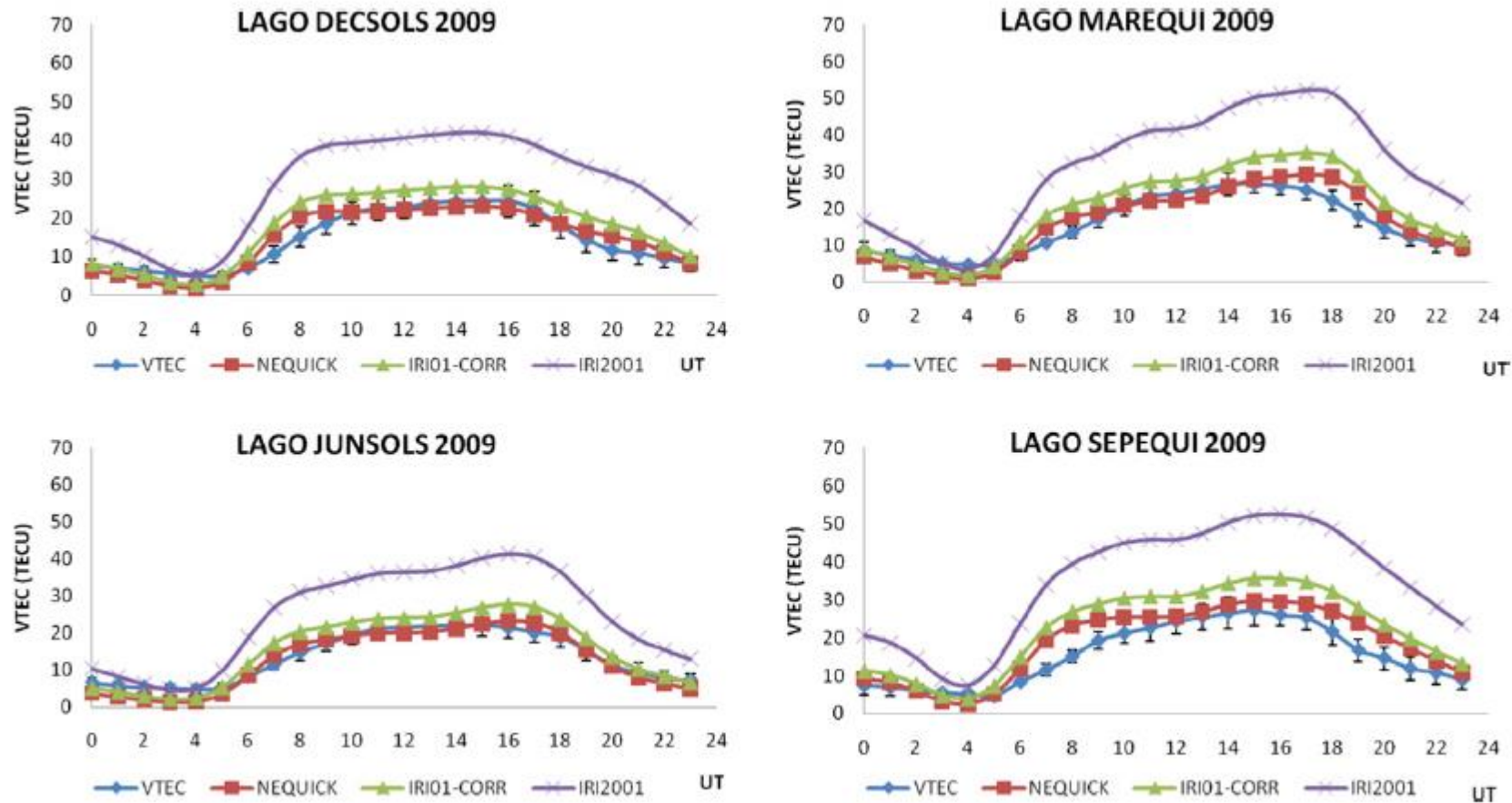


Fig. 5. Diurnal variations of observed mean values of TEC at Lagos along with the IRI-2007 modeled values using the three options.

Some Research Works



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Advances in Space Research 56 (2015) 1686–1698

**ADVANCES IN
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Comparison of GPS-TEC observations over Addis Ababa with IRI-2012 model predictions during 2010–2013

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Available online 1 August 2015

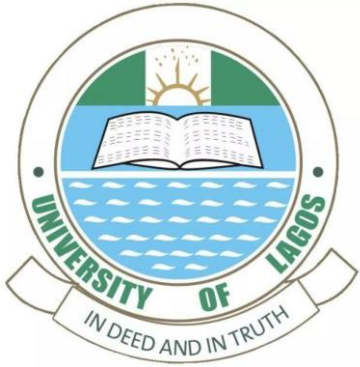
Abstract

This study presents Global Positioning System-Total Electron Content (GPS-TEC) observations over Addis Ababa (Lat: 9.03°N Lon: 38.77°E Mag. lat: 0.18°N) and an evaluation of the accuracy of International Reference Ionosphere-2012 (IRI-2012) model predictions during 2010–2013. Generally, on a diurnal scale, TEC recorded minimum values at 0400–0600 LT and maximum at 1400–1600 LT. Seasonally, TEC recorded maximum values during December solstice and September equinox, and minimum during June solstice. On a year-by-year basis, 2013 recorded the highest values of TEC for both the observed and the model measurements, while 2010 recorded the lowest, implying the solar activity dependence of TEC. Furthermore, we observed discrepancies in the comparison of

More Research Works

- **Comparing CAR NN Ionospheric TEC model with IRI-Plas, NeQuick etc**
- **Comparing experimental values of TEC from different techniques.**
- **Others...**

Acknowledgment



Thank you for listening

ありがとうございました