



Capacity Building for GNSS in Academia, Industry and Research Institutes in India

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Indian Space Research Organization (ISRO)

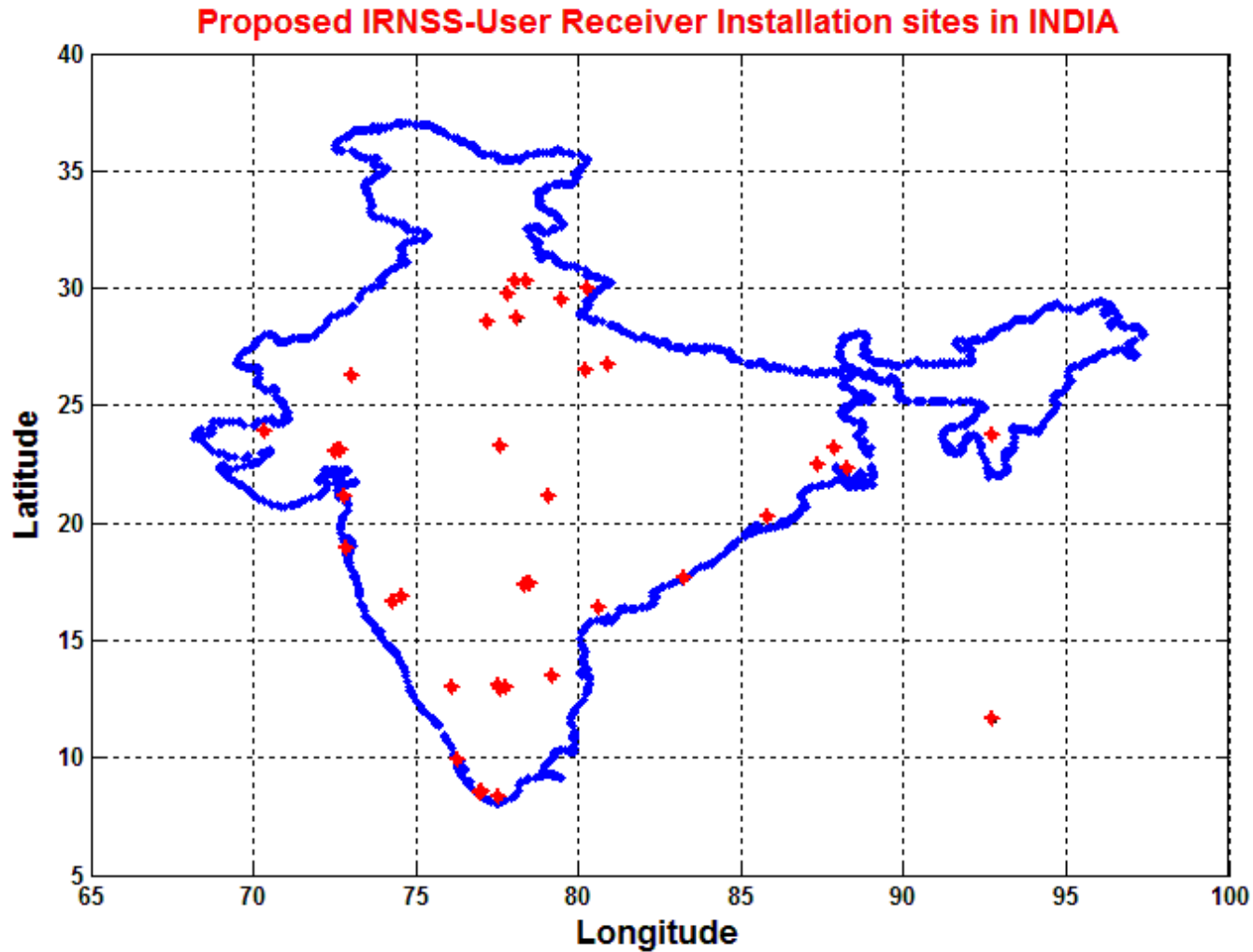
10/12/2019

ICG-14, Bengaluru

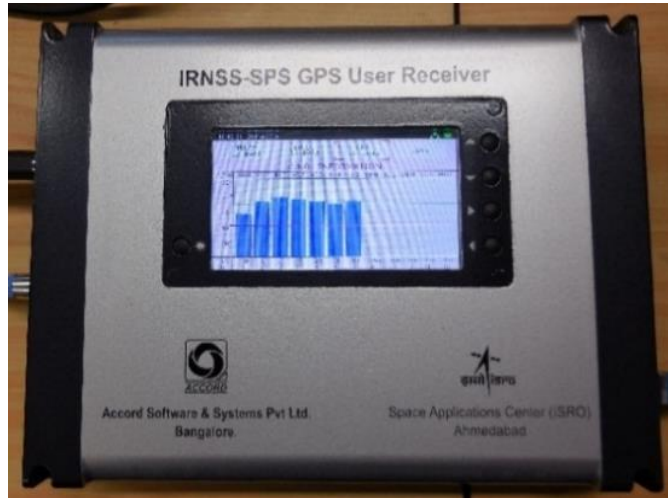
GNSS Capacity Building

- CSSTEAP GNSS Courses : Short Term(1 Month) & Long Term (9 Month)
- GNSS Receivers for Academia for field Trials during Constellation Evolution & beyond
- NavIC-GAGAN Utilization Programme : For Academia, Industry, Research Organizations
- Other : Demonstration cum training to user Agencies, Hackathon Events, Exhibitions (Static and Moving on the Wheels), GNSS – Centre of Excellence, Netru/Osmania Uni. Activities

- Interest Exploration Notes were circulated among Engg. Colleges/Universities
- MoUs were signed with short listed and selected Academic institutes
- NavIC+GPS+GAGAN Receivers were provided to these institutes well before the constellation was fully deployed.
- They were active partners in field trials of NavIC System Evolution stage.
- Continuous collection of data in various User Receiver's operational modes under guidance of SAC/ISRO. The data analysis tool was also developed.
- The SIS performance evaluation also benefits from these user community.
- Institutes have successfully carried out many BE/B.TECH/M.Tech/PhD projects using NavIC/GNSS technology.



Receiver : IDU



ODU



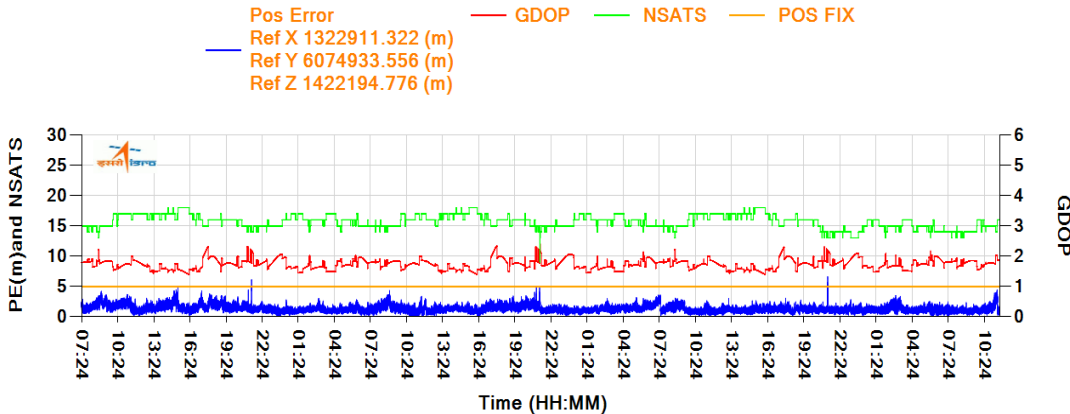
Main Features :

- 36 Channels
- 11 NavIC (L5), 11 NavIC (S), 12 GPS (L1), 2 GAGAN
- NavIC and Hybrid Mode of PVT
- NMEA output
- FPGA based Receiver
- Continuous Data logging as per operational mode

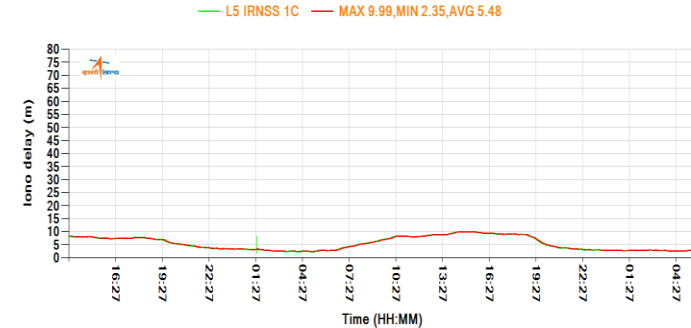


Sample results : Weekly Bulletin Report

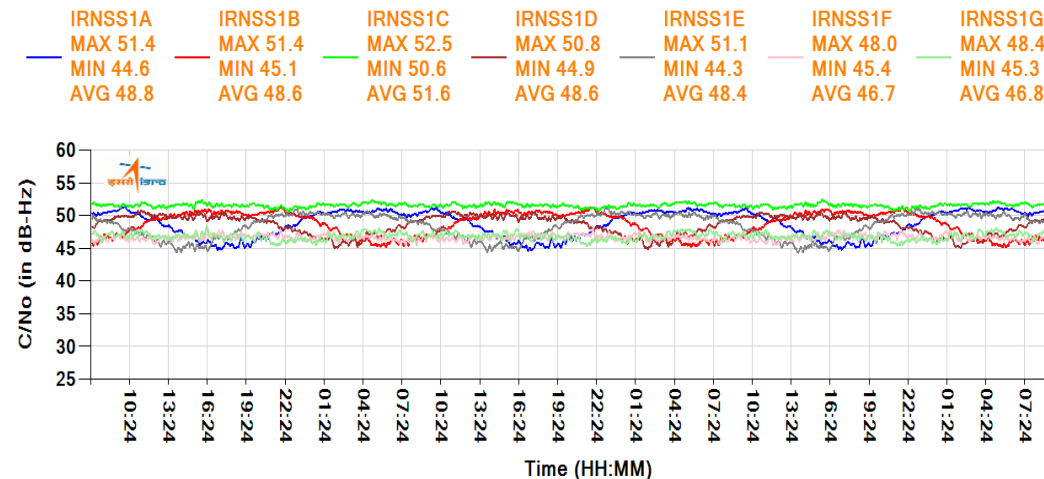
A047 GAGAN-BLR GPS(L1)+IRNSS(L5+S) 3DRMS Position Error: 1.4(m), Duration : 04/02/2018 , 07:24:34 to 07/02/2018 , 11:40:43 (IST)



A047 GAGAN-BLR :IRNSS L5 IONO Duration : 09/02/2018 , 13:27:32 to 11/02/2018 , 05:29:41 (IST)



A047 GAGAN-BLR :IRNSS L5 C/No(dBHz) Duration : 04/02/2018 , 07:24:34 to 07/02/2018 , 11:40:43 (IST)

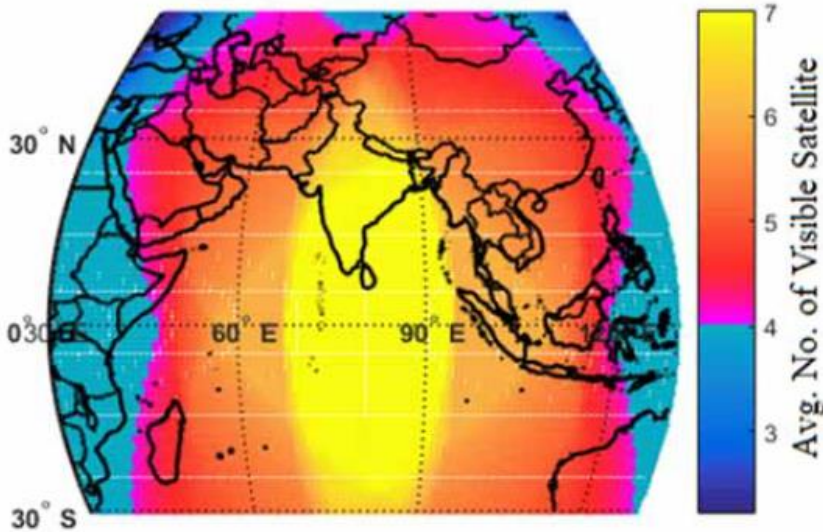


- Position Error
- Iono Delay in L5
- Signal Strength C/No Plot
- Generated using IRNSS Data Analysis Software (IRDAS)

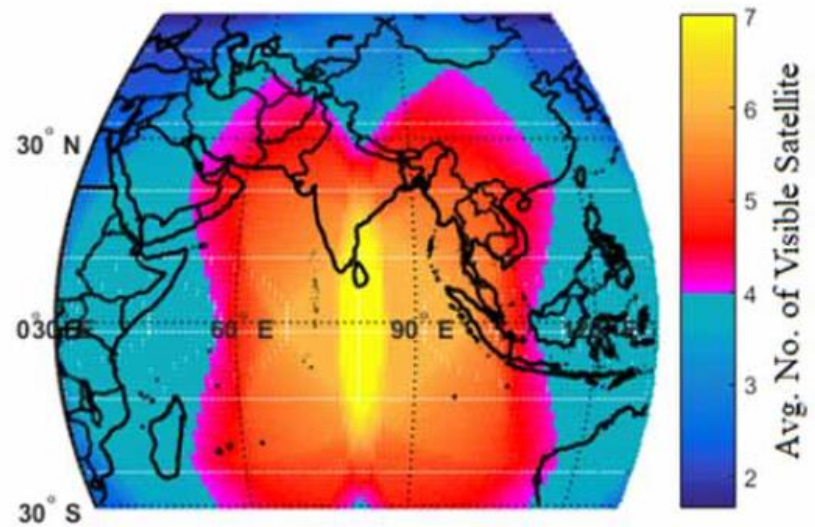
- Announcement of Opportunity on SAC/ISRO website
- Participation open for Academia, R&D Institutes, Industries
- 28 proposals selected for funding
- Typical Project duration 3 years
- Principal Investigator (PI) & Co-PI from Academic Institute and One ISRO Focal person for each project
- Broad Areas covered under these Projects are :
 - Differential NavIC
 - Ionosphere
 - Science Applications
 - Navigation Applications
 - Navigation Algorithm
- Annual Review of the projects @ SAC/ISRO

- 36 Channel IRNSS_GPS_GAGAN SPS receivers were provided by ISRO as per project requirements
- These Receivers were installed at identified sites a resources and training was provided to Users.
- Users were also encouraged to make use of GNSS receiver at their disposal
- Archived GAGAN data from 26 different sites

Some sample Results



20° elevation mask



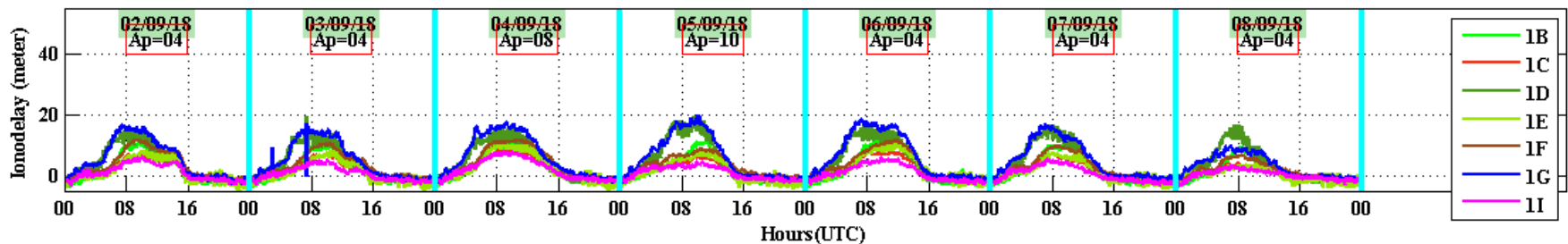
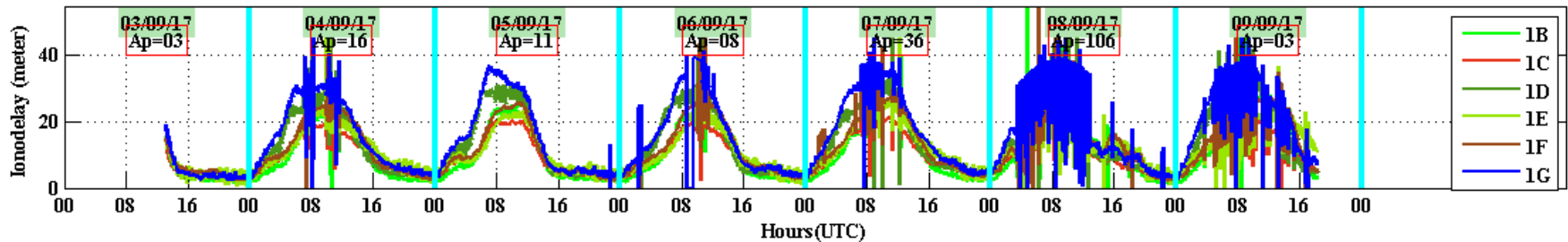
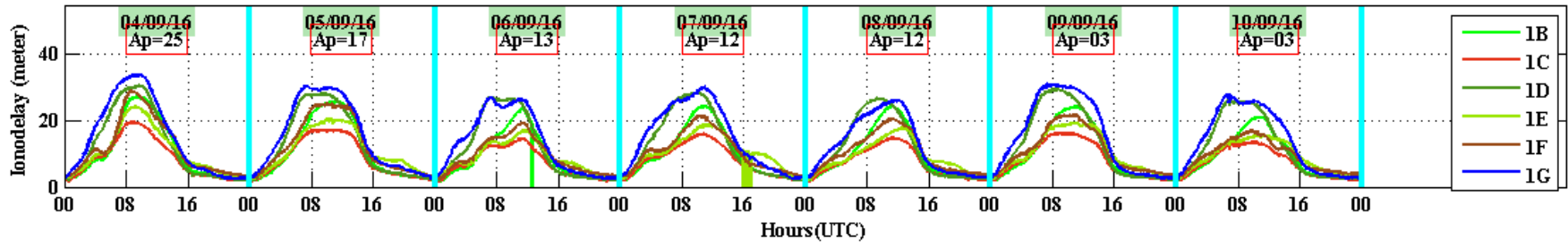
30° elevation mask

**Courtesy : The University of Burdwan, Golapbag, Burdwan Uni.
West Bengal**

Three Years Iono Delay Comparison

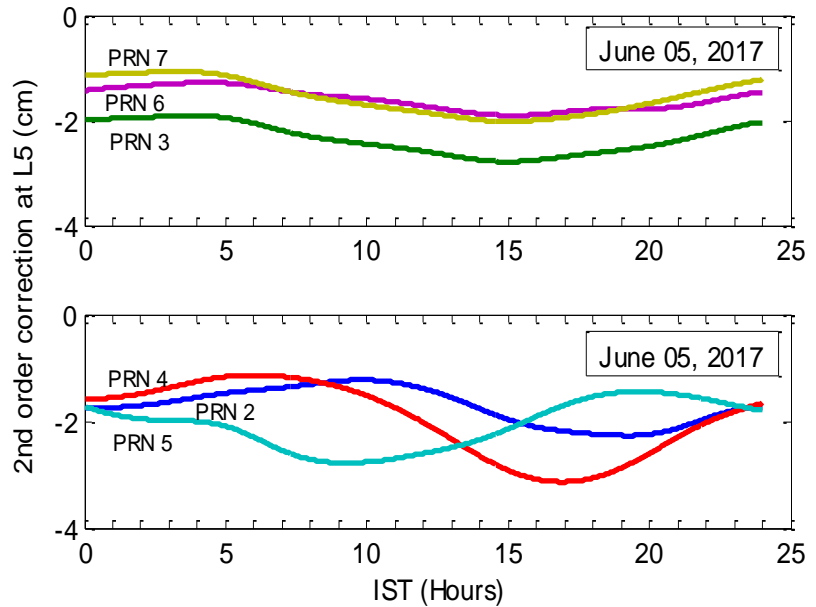
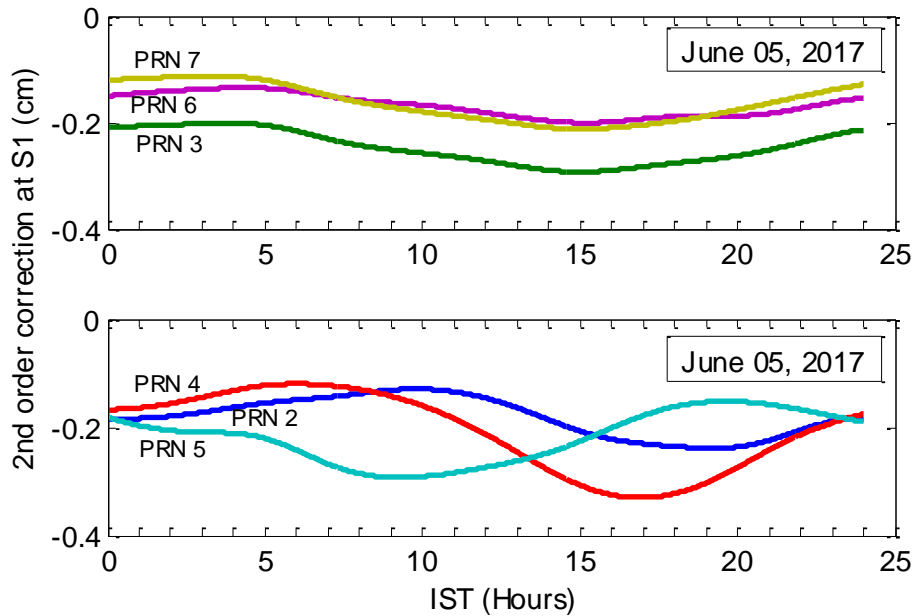
Courtesy : SVNIT, Surat

L5 Band Performance Comparison for SVNIT Surat(27.16 N Latitude, 72.78 E Longitude)



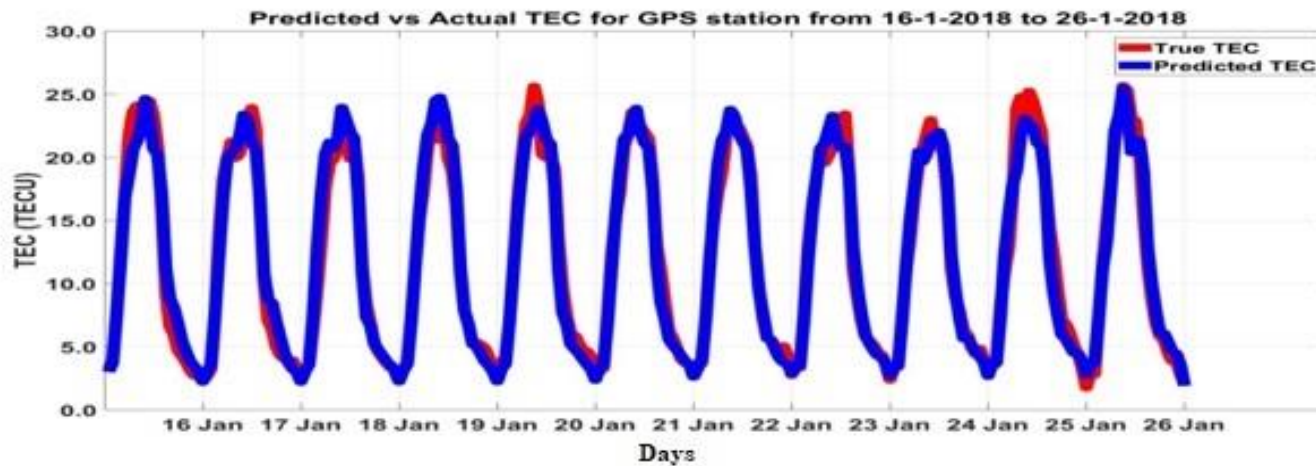
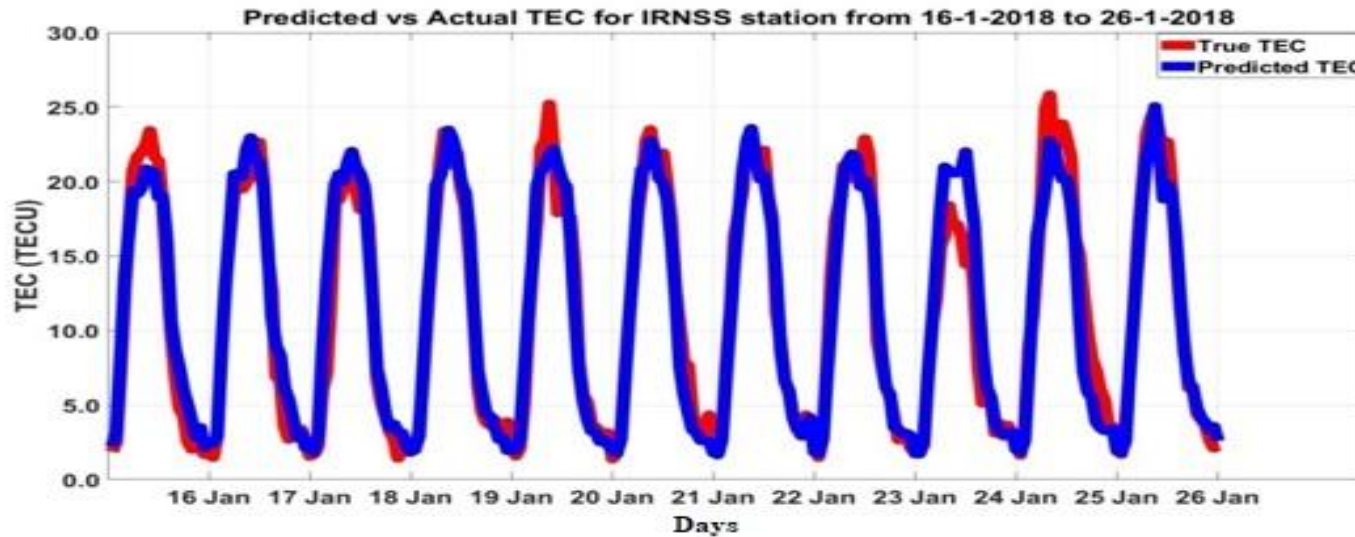
Observation: . It has been deduced that during the intense geomagnetic storm week of September 2017, more Ionodelay noted compared to year 2016 and 2018 respectively. 1G NavIC satellite suffer more Ionodelay compared to all other observed satellites.

Second Order Iono Corrections



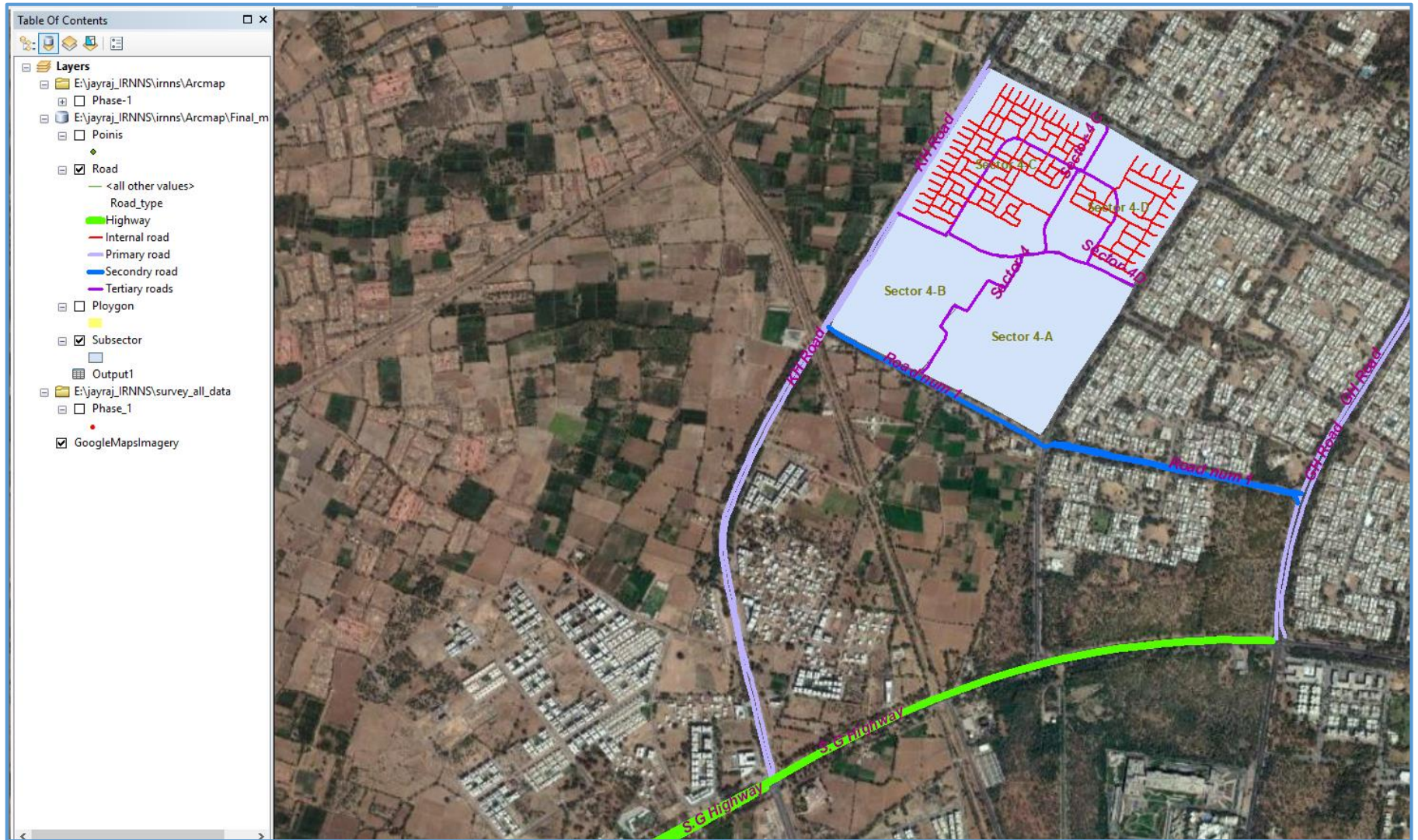
Courtesy : Graphic Era University, Dehradun


Predicted Vs Actual IRNSS and GPS TEC ACSCE and IISC Stations:




Courtesy : ACS
College of
Engg., Bangalore

Digitisation, Classification and Attribution of data for Sector-4 Gandhinagar





Asset Tracking System



ATS

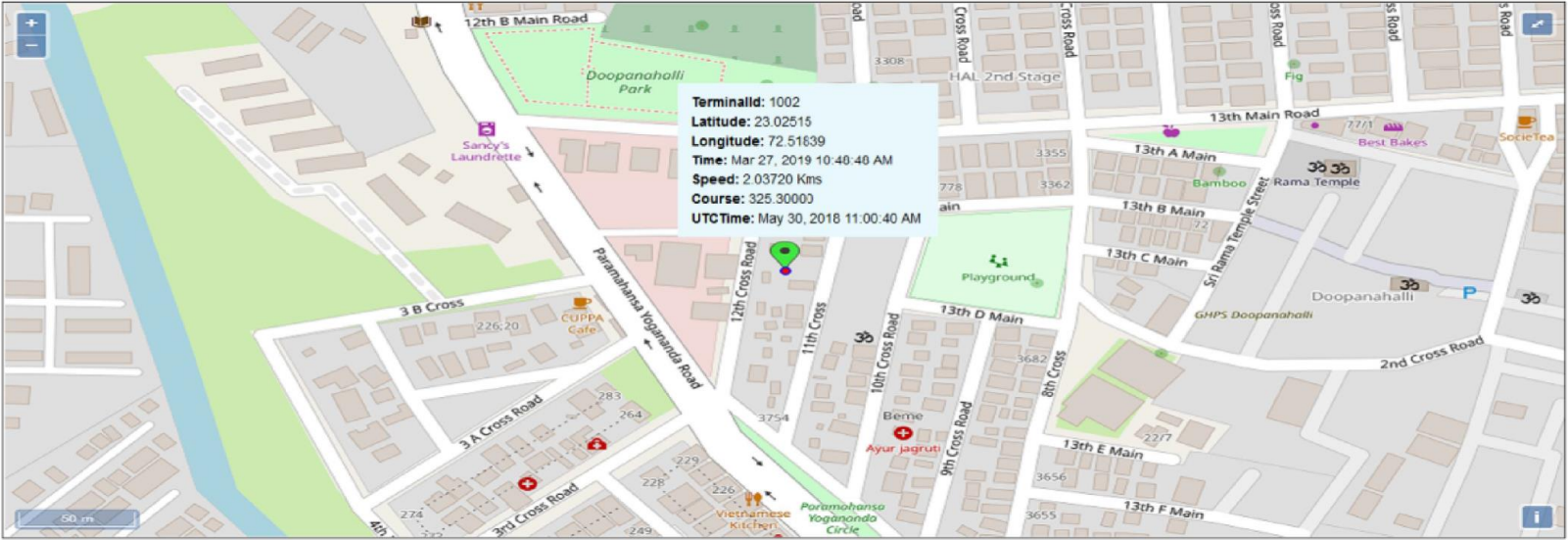
System Alarm Kapil Sharma

- Home
- Group
- User
- Channel
- Terminal
- Tracking
- Log

Home

* Indicates Mandatory

Group: Channel: Terminal:



TerminalId: 1002
Latitude: 23.02515
Longitude: 72.51639
Time: Mar 27, 2019 10:40:40 AM
Speed: 2.03720 Kms
Course: 325.30000
UTC Time: May 30, 2018 11:00:40 AM

- ~ 60 papers Published in Journals / Conferences
- 2 PhD Thesis
- 9 M.Tech Projects
- 15 B.Tech Projects



NavIC based VTS for AIS-140 testing (NavIC module by Telit)
Brandname: Autocop



NavIC based VTS for AIS-140 testing (NavIC module by Quectel)
Brandname: Securinex Digital fare meter





Development of NavIC/GNSS Modules through Industries : L5 Only Module, S band Module, L5+S band Module, L5+L1 Module, Differential NavIC Module

- GNSS Activities by Academic Institutes :
Osmania University (Research & training centre for Navigational Electronics-NETRU), Hyderabad, SVNIT- Surat, Burdwan University, CBIT etc
- GNSS User – Industry Meet

