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IRNSS RINEX DATA PROCESSING

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ABSTRACT
Indian regional satellite system (IRNSS) by ISRO is satellite system of India. IRNSS is used for a variety of applications. It provides navigation and timing services to all the users. For using it for navigation purposes the data extracted from the receiver is to be pre-processed before using it for position estimation or for applying any algorithms. Initially the raw data is taken from the receiver and converted into RINEX format using the receiver converter software. In this paper, the processing of RINEX data extracted from the receiver is explained which results in extraction of all the ephemeris parameters from navigation file of RINEX data and pseudoranges from the observation file. The parameters thus extracted can be used with development of various algorithms or can be used for any application. The results indicate extraction of the parameters corresponding to RINEX 3.03 version navigation and observation files of 24 hour data.

1. INTRODUCTION

For using GNSS for various applications, it is indeed required to extract various parameters to estimate the atmospheric correction parameters and to calculate the position of the satellite. Earlier GPS was the only GNSS system that is used for navigation purposes and the ambiguity regarding the observable parameters is less. Later many GNSS systems of various countries were launched such as BeiDou, GLONASS (Globalnaya Navigazionnaya Sputnikovaya Sistema), Galileo, QZSS(Quasi-Zenith Satellite System), Navigation with Indian Constellation (NavIC) /IRNSS with each GNSS system following its own system time and other parameters, are widely used for better accuracy. The RINEX format was developed and enhanced to allow different receivers to exchange and use each other's data in a common format. This allows researchers, engineers, and others to easily compare and combine GNSS data from different sources.

2. RINEX:

RINEX stands for Receiver Independent Exchange Format. RINEX was initially developed for the easy exchange of the GPS and other navigation systems such as IRNSS, GLONASS data to be collected and analysed.

RINEX files contain information about GPS signals received by a GPS receiver, such as the time of the observation, the satellite transmitting the signal, and the signal strength. The data is stored in a standard format that can be easily accessed and analysed by different software

programmes. It is a standard ASCII format (as the name suggests, it is independent of the receiver). Three major RINEX versions have been developed so far.

- **RINEX VERSION 1** : This is the first RINEX version that has been presented. It was developed in 1989.
- **RINEX VERSION 2**: RINEX Version 2 was presented and accepted in 1990 to mainly include tracking of other satellite systems such as GLONASS and SBAS.

Later, subversions of version 2 had been developed to include other improvements, such as

- Version 2.10: Among other minor changes, it allows for sampling rates other than integer seconds and introduces raw signal strengths as new observables.
- Version 2.11: This is the last official version of RINEX 2, which includes the definition of a two-character observation code for L2C pseudoranges and some changes in the Navigation Message Files.
- **RINEX VERSION 3:** This is the latest RINEX version that has been developed since the early 2000s.

At that time, new constellations such as QZSS, IRNSS, and BeiDou were added, and they started transmitting new signals, which made it clear that RINEX 2 is not capable of handling tracking modes and satellites efficiently. This has paved the way for a more efficient and standardised version of RINEX.

Other subversions of RINEX 3 are:

- RINEX 3.00: launched in 2007, which fully supports multi-GNSS systems.
- RINEX 3.01 was introduced in 2009. In this version improvements to generate consistent phase observations across various tracking modes and channels.
- RINEX 3.02: Introduced in 2013 to extend its support for the Japanese Navigation System,

  QZSS (Quasi-Zenith Satellite System) and additional information regarding BeiDou

- RINEX 3.03: Introduced in 2015 to extend its support for the Indian Navigation System, NavIC/IRNSS
- RINEX 3.04 was introduced in 2018 to add clarifications for signal tables.
- RINEX 3.05: Last version of '3' Format In this major revision, reconstructions have been made for easy reading and understanding.

RINEX files are mainly used for data analysis, post processing, Quality control, Data sharing.

2.1 RINEX file formats:

RINEX version 3.03 files were considered for our analysis. RINEX mainly consists of two file formats namely Observation file and Navigation File.

2.1.1 RINEX NAVIGATION FILE:

A RINEX (Receiver Independent Exchange Format) navigation file is a standardized file format used in GNSS applications. It is a text file that contains the broadcast ephemeris data for GNSS satellites, which is used by receivers to calculate satellite positions and other information needed for navigation.

A typical RINEX navigation file contains a header section and a data section. The header section includes information such as the satellite system (e.g., GPS, GLONASS, Galileo), the start and end time of the data collection, and the type of data (ephemeris, clock corrections, etc.). The data section includes the ephemeris data for each satellite, which includes information such as the satellite's position and velocity, clock bias, and other parameters.

The following figure shows the RINEX navigation file:

```
     3.03           N:IRNSS NAV DATA    I: IRNSS            RINEX VERSION / TYPE
IRNSS NAV GEN       ACCORD              09-NOV-17 11:28     PGM / RUN BY / DATE
Version Number of DataExtraction_IRNSSUR : 1.19             COMMENT
IRNA   2.7008D-08  5.8860D-07 -7.5102D-06  7.5102D-06       IONOSPHERIC CORR
IRNB   1.3722D+05 -1.6384D+04 -8.3231D+06  8.3231D+06       IONOSPHERIC CORR
IRUT  3.6379788071D-09-1.376676551D-14  86688  950          TIME SYSTEM CORR
    18                                                       LEAP SECONDS
                                                             END OF HEADER
I07 2017 11 06 08 47 12 7.630991749465D-04-2.721662895055D-10 0.000000000000D+00
     1.950000000000D+02 4.213750000000D+02 3.885876148053D-10-2.728840328273D+00
     1.414492726326D-05 3.406950272620D-04 2.171471714973D-05 6.493284172058D+03
     1.173600000000D+05-1.490116119385D-08-2.467686442348D+00 1.862645149231D-07
     6.918955466267D-02-6.589375000000D+02-2.834875666213D+00 7.471739799382D-10
    -5.871673150184D-10                    9.500000000000D+02
     2.000000000000D+00 0.000000000000D+00-1.396983861923D-09
     1.101600000000D+05
I02 2017 11 06 08 47 12 2.145846374333D-04 4.126832209295D-11 0.000000000000D+00
     4.000000000000D+00 8.603125000000D+02 2.837261040454D-09 1.697657849898D+00
     2.817809581757D-05 2.045601839200D-03-6.433576345444D-06 6.493354862213D+03
     1.152000000000D+05-2.980232238770D-08-1.950419760389D+00 1.862645149231D-08
     5.031047411090D-01 2.784375000000D+02-2.951755245757D+00-2.792973481413D-09
     8.428922527028D-11                    9.500000000000D+02
     2.000000000000D+00 0.000000000000D+00-1.862645149231D-09
     1.080000000000D+05
I03 2017 11 06 08 47 12-7.344270125031D-05-3.205968823750D-11 0.000000000000D+00
     1.950000000000D+02 6.856250000000D+01 3.790157875289D-09 4.682314351473D-02
     2.142041921616D-06 2.306882292032D-03 2.412125468254D-05 6.493483839035D+03
     1.173600000000D+05-9.685754776001D-08-2.794732638209D+00 6.705522537231D-08
     4.860322369650D-02-7.276875000000D+02 1.885161806842D-01-2.954408777270D-09
    -6.625275969337D-10                    9.500000000000D+02
     2.000000000000D+00 0.000000000000D+00-1.396983861923D-09
     1.101600000000D+05
```

Figure 1: RINEX navigation file of IRNSS data version 3.03

2.1.1 a)NAVIGATION HEADER:

The following are the important parameters of Navigation file:

a) **RINEX VERSION / TYPE**: It comprises of − Format version: 3.03; - File type ('N' denotes Navigation Data); − Satellite System: G: GPS, R: GLONASS E: Galileo; J: QZSS; C: BDS; I: **NavIC/IRNSS; S: SBAS M: Mixed**

b) **PGM / RUN BY / DATE:** It includes name of the program creating current file, agency name creating file, date and time of file creation.

c) **IONOSPHERIC CORR:** It contains the Ionospheric correction parameters− Correction type: GAL = Galileo ai0 - ai2, GPSA= GPS alpha0 - alpha3, GPSB= GPS beta0 - beta3, QZSA = QZS alpha0 - alpha3, QZSB = QZS beta0 - beta3, BDSA = BDS alpha0 - alpha3,

BDSB = BDS beta0 - beta3, IRNA = NavIC/IRNSS alpha0 - alpha3, IRNB = NavIC/IRNSS beta0 - beta3.

d) **TIME SYSTEM CORR**: It includes the difference between GNSS system time and other time systems.

e) **END OF HEADER:** It has the Final record in the header section

2.1.1 b) NAVIGATION FILE DATA RECORD DESCRIPTION

Data records contain all the parameters of an ephemeris file. It has one SV/epoch/SV clk row and seven broadcasting orbits for each epoch time. The similar style is observed for subsequent epoch times of various Satellites.

The following parameters are observed in Ephemeris data records:

SV / EPOCH / SV CLK : The satellite PRN number is a unique identifier assigned to each IRNSS satellite.

Epoch: The epoch time is the time at which the ephemeris data was calculated. It is usually given in GPS time, which is the time kept by the GPS satellites. Toc (Time of Clock) is generally year , month, day, hour, minute, second.

SV clock bias (seconds): A correction factor that accounts for the difference between the satellite's clock time and GPS time.

SV clock drift (sec/sec): A correction factor that accounts for the rate at which the clock bias is changing.

SV clock drift rate (sec/sec2) A correction factor that accounts for the rate at which the clock drift is changing.

Table 1: Broadcast orbit 0 of navigation file

Col No	Parameter
Orbit 0	
2-3	SVPRN
5-9	Year
10-11	Month
13-14	Day
16-17	Hour
22-23	Second
24-42	af0
43-62	af1
63-80	af2

Table 2: Broadcast orbit 1 and 2 of navigation file

Col No	Parameter
Orbit 1	
5-23	IODE(Issue of data ephemeries)
24-4	CRS(sine harmonic correction (m))
43-61	Delta n(Mean motion difference(semicircles/sec))
62-80	Mo(i)(Mean anamoly(semicircles))
Orbit 2	
5-23	Cuc(cosine harmonic correction (rad))
24-42	Ecc
43-61	Cus(radians)
62-80	Root a(m)(sqrt of semi major axis)

Table 3: Broadcast orbit 3 and 4 of navigation file

Col No	Parameter
Orbit 3	
5-23	Toe(ref time of ephemeries(s))
24-4	Cic(cosine harmonic correction(radians))
43-61	Omega0(longitude of ascending node(semicircles))
62-80	Cis
Orbit 4	
5-23	I0(inclination angle)
24-42	Crc (m)
43-61	Omega(argument of perigree)(semicircles)
62-80	Omegadot(rate of right ascension)(semicircles/sec)

Table 4: Broadcast orbit 5, 6 and 7 of navigation file

Col No	Parameter
Orbit 5	
5-23	IDOT(rate of inclination angle)
24-42	codes
43-61	Week no
62-80	L2flag
Orbit 6	
5-23	Sv accuracy
24-42	Sv health
43-61	Tgd
62-80	Iodc(issue of data clock)
Orbit7	
5-23	Tom(transmission time of message)

The tables 1, 2, 3 and 4 details the information carried by various broadcast orbits of the navigation file.

2.1.2 RINEX OBSERVATION FILE

A RINEX (Receiver Independent Exchange Format) observation file is a standardized file format used in GPS/GNSS (Global Navigation Satellite System) applications. It is a text file that contains raw GNSS measurement data collected by a receiver, such as code and carrier phase measurements, satellite ephemeris and clock corrections, and other related information. Each RINEX file contains a header and data section. The header part consists of global information and usually placed on top of the file and succeeded by data section. As the above given observation file is a mixed type, it has recorded the observations of 4 GPS satellites and 7 IRNSS satellites for every second for 24 hour duration. Data part of the Observation File mainly consists of two records. They are Epoch record and Observations record.

```
     3.03           OBSERVATION DATA     M:MIXED           RINEX VERSION / TYPE
OBS GEN             ACCORD               09-NOV-17 11:28   PGM / RUN BY / DATE
Version Number of DataExtraction_IRNSSUR : 1.19            COMMENT
Unknown                                                    MARKER NAME
0                                                          MARKER NUMBER
HUMAN                                                      MARKER TYPE
Unknown             Unknown                                OBSERVER / AGENCY
100883              18700                17171460          REC # / TYPE / VERS
18730               L5L1S1                                 ANT # / TYPE
  0.0000D+00  0.0000D+00  0.0000D+00                       APPROX POSITION XYZ
  0.0000D+00  0.0000D+00  0.0000D+00                       ANTENNA: DELTA H/E/N
G    4 C1C L1C D1C S1C                                     SYS / # / OBS TYPES
I    8 C5C L5C D5C S5C C9C L9C D9C S9C                     SYS / # / OBS TYPES
DBHZ                                                       SIGNAL STRENGTH UNIT
SNR is mapped to RINEX snr flag value [1-9]                COMMENT
>= 25dBHz -> 1; 26-27dBHz -> 2; 28-31dBHz -> 3             COMMENT
32-35dBHz -> 4; 36-38dBHz -> 5; 39-41dBHz -> 6             COMMENT
42-44dBHz -> 7; 45-48dBHz -> 8; >= 49dBHz -> 9             COMMENT
     1.000                                                 INTERVAL
  2017    11     6     8    47   10.0000000     GPS        TIME OF FIRST OBS
  2017    11     8    10    37    1.0000000     GPS        TIME OF LAST OBS
G L1C                                                      SYS / PHASE SHIFT
I L5A                                                      SYS / PHASE SHIFT
I L9A                                                      SYS / PHASE SHIFT
                                                           END OF HEADER

> 2017 11 06  8 47 10.0000000  0 17      -0.000000016594
G04  23234533.998 6 122098293.084 6     -1089.073 6        39.953
G24  23321208.093 6 122553748.871 6     -2394.219 6        40.760
G21  20922654.882 8 109949285.139 8     -1115.285 8        47.523
G18  21912959.191 8 115153363.812 8       127.432 8        45.770
G10  21875042.841 8 114954120.794 8       788.857 8        45.366
G08  24957000.938 7 131149901.014 7      1279.206 7        42.334
G14  21635372.484 7 113694651.843 7      1036.597 7        44.836
G20  25026416.636 4 131514731.608 4     -1735.459 4        35.551
G27  22962539.140 7 120668952.008 7      -303.178 7        42.392
G32  21122495.182 9 110999456.684 9       211.510 9        49.779
I01        4.975 9        19.52309     -1906.340 9        50.785          4.975 8        41.35408     -4037.643 8        45.112
I02  38002723.507 8 149130847.19208       360.589 8        46.611   38002705.002 7 315897888.58407       764.188 7        43.999
I03  36047185.820 9 141456893.61709        25.486 9        51.779   36047168.992 8 299642474.03808        54.199 8        47.030
```

Figure 2: RINEX observation file of IRNSS data version 3.03

2.1.2 a) OBSERVATION FILE HEADER:

The IRNSS Observation data header section consists of

- **RINEX version /Type:**
  It represents the format version (Ex:3.04,3.03, 3.02, 2.11, etc.), type of file for IRNSS Navigation file (O-IRNSS OBSERVATION DATA), satellite system (I-IRNSS).

- **Program/Run by/Date:**
  It represents the name of the program (IRNSS NAV GEN) creating a file, the name of an agency or equipment creating file, Date and time of file creation.

- **Marker name:**
  It represents the name of the antenna marker.
- **Marker number:**
  It represents the antenna marker number.
  Ex: 0, 13101M010.
- **Marker type:**
  There is a different type of markers
  a. HUMAN.
  b. GEODETIC.
  c. NON-GEODETIC.
  d. ANIMAL.
  e. AIR BORBE.

f. SPACEBORNE. etc.

- **Observer / Agency:**
  It represents the agency name of the observer /agency.
- **Receiver/ Type/ Version:**
  It represents the receiver number, it's type, internal version(software).
- **Antenna / Type:**
  It represents type of an antenna number, type of antenna.
- **Approx. position XYZ:**
  It represents the geocentric approximation position in terms of the X, Y, Z coordinate system.
- **Antenna: Delta H/E/N:**
  It represents the height of the antenna, horizontal eccentricity in East /North.
- **Observation types:**
  It shows how many different observation kinds and bands there are for a certain satellite system.
  Ex: C5C, L5C, D5C, S5C (Pseudo Range, Carrier Phase, Doppler, Signal Strength).
- **Signal strength unit:**
  It represents the strength of the signal in terms of dbHz.
- **Interval:**
  It represents observation file interval in seconds.
- **Time of first observation:**
  It represents the first observation time record. The interval may be in terms of a year, month, day, hour, minute, second.
- **Time of last observation:**
  It represents the last observation time record. The interval may be in terms of year, month, day, hour, minute, second.
- **System / Phase shift:**
  It represents the system phase shift corrections used that can used to generate phase shifts in cycle shifts in satellite systems, type. band etc.

2.1.2 b) NAVIGATION FILE DATA RECORD

The body of RINEX Observation data consists of pseudo ranges, lines data divided into the sections those parameters are

- Visible satellites.
- Year.
- Day.
- Hour.
- Minute.
- Pseudo ranges.

3. RESULTS

The RINEX navigation and observation files discussed in section 2 are taken as the inputs and the programs are written in in MATLAB to extract all the parameters of both the files. Figures 3 and 4 indicate the results thus obtained of the extracted parameters. Figure depicts the extracted parameters of IRNSS navigation file considering a duration of 24 hour data. Figure 4 illustrates the extracted pseudoranges, signal strengths of IRNSS from mixed observation file considering the RINEX data file of 24 hour duration.

1	svprn	7	2	3	4	5	6	3	5	7	7	3	5	7	3	5	3	5	7	3
2	af2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	M0	-2.72884	1.697658	0.046823	2.788362	0.014757	1.974977	0.109866	0.077838	-2.65273	-2.61959	0.176498	0.144509	-2.53989	0.24314	0.211109	0.309945	0.277885	-2.44856	0.373306
4	roota	6493.284	6493.355	6493.484	6493.544	6493.403	6493.43	6493.482	6493.395	6493.322	6493.245	6493.477	6493.391	6493.274	6493.476	6493.391	6493.47	6493.387	6493.317	6493.465
5	deltan	3.89E-10	2.84E-09	3.79E-09	2.86E-09	4.17E-09	-5.33E-10	4.32E-09	4.19E-09	3.40E-10	2.80E-10	5.02E-09	4.21E-09	2.06E-10	5.75E-09	4.23E-09	6.44E-09	4.26E-09	1.17E-10	6.97E-09
6	ecc	0.000341	0.002046	0.002307	0.001928	0.001958	0.001701	0.002306	0.001955	0.00033	0.000351	0.002304	0.001953	0.000343	0.002304	0.001953	0.002301	0.001951	0.000333	0.0023
7	omega	-2.83488	-2.95176	0.188516	-3.05655	3.027512	-3.08133	0.18848	3.027438	-2.84797	-2.81462	0.188357	3.027276	-2.82781	0.188225	3.027183	0.187932	3.026916	-2.85262	0.187581
8	cuc	1.41E-05	2.82E-05	2.14E-06	2.82E-05	1.63E-05	2.04E-05	2.00E-06	1.64E-05	1.38E-05	1.36E-05	1.74E-06	1.63E-05	1.36E-05	1.37E-06	1.62E-05	8.90E-07	1.60E-05	1.36E-05	3.58E-07
9	cus	2.17E-05	-6.43E-06	2.41E-05	-5.30E-06	6.62E-06	2.01E-05	2.43E-05	7.06E-06	2.17E-05	2.16E-05	2.46E-05	7.54E-06	2.15E-05	2.49E-05	8.04E-06	2.51E-05	8.52E-06	2.15E-05	2.53E-05
10	crc	-658.938	278.4375	-727.688	247	-115.25	-605	-734.813	-130.125	-656.875	-654.438	-744.063	-147	-652.688	-753.563	-164.125	-762.125	-180.313	-652.938	-768.313
11	crs	421.375	860.3125	68.5625	847.5625	499.8125	632.9375	63.375	500.5625	411.875	406.9375	54.1875	498.5	405.5	41.1875	494.0625	24.6875	487	408	6.4375
12	i0	0.06919	0.503105	0.048603	0.502785	0.505702	0.067953	0.048602	0.505703	0.069188	0.069189	0.048601	0.505704	0.069188	0.0486	0.505705	0.0486	0.505706	0.069187	0.048599
13	idot	-5.87E-10	8.43E-11	-6.63E-10	1.42E-10	8.94E-10	-5.54E-10	-6.53E-10	8.95E-10	-5.93E-10	-5.99E-10	-6.36E-10	8.94E-10	-6.06E-10	-6.14E-10	8.94E-10	-5.87E-10	8.95E-10	-6.15E-10	-5.60E-10
14	cic	-1.49E-08	-2.98E-08	-9.69E-08	-7.45E-08	-1.08E-07	-1.60E-07	-1.30E-07	-9.31E-08	-3.35E-08	-5.22E-08	-1.45E-07	-8.57E-08	-7.45E-08	-1.30E-07	-7.82E-08	-7.45E-08	-7.08E-08	-1.01E-07	1.49E-08
15	cis	1.86E-07	1.86E-08	6.71E-08	-1.86E-08	-1.56E-07	-7.45E-09	3.73E-09	-1.60E-07	1.94E-07	2.01E-07	-9.31E-08	-1.64E-07	2.09E-07	-2.09E-07	-1.64E-07	-3.17E-07	-1.68E-07	2.12E-07	-3.99E-07
16	Omega0	-2.46769	-1.95042	-2.79473	-1.94829	1.184121	-2.49314	-2.79474	1.184118	-2.4677	-2.46767	-2.79474	1.184114	-2.46768	-2.79475	1.184111	-2.79476	1.184107	-2.46769	-2.79477
17	Omegadot	7.47E-10	-2.79E-09	-2.95E-09	-2.85E-09	-3.84E-09	1.67E-09	-3.47E-09	-3.83E-09	8.07E-10	8.70E-10	-4.14E-09	-3.82E-09	9.43E-10	-4.86E-09	-3.81E-09	-5.51E-09	-3.81E-09	1.02E-09	-6.01E-09
18	toe	117360	115200	117360	115200	117360	115200	118224	118224	118224	119136	119136	119136	120048	120048	120048	120960	120960	120960	121824
19	af0	0.000763	0.000215	-7.34E-05	0.000511	-2.47E-05	-0.00052	-7.35E-05	-2.48E-05	0.000763	0.000763	-7.35E-05	-2.48E-05	0.000762	-7.35E-05	-2.49E-05	-7.36E-05	-2.50E-05	0.000762	-7.36E-05
20	af1	-2.72E-10	4.13E-11	-3.21E-11	2.54E-11	-8.47E-11	-1.15E-11	-3.22E-11	-8.50E-11	-2.76E-10	-2.73E-10	-3.21E-11	-8.40E-11	-2.71E-10	-3.21E-11	-8.42E-11	-3.24E-11	-8.47E-11	-2.77E-10	-3.23E-11
21	toc	117360	115200	117360	115200	117360	115200	118224	118224	118224	119136	119136	119136	120048	120048	120048	120960	120960	120960	121824
22	IRNSSWeek	950	950	950	950	950	950	950	950	950	950	950	950	950	950	950	950	950	950	950

Figure 3: Extracted parameters of RINEX navigation file

1	week'	epoch'	flag'	prn'	C5C '	L5C '	D5C '	S5C '	C9C '	L9C '	D9C '	S9C '
2	1974	118030	0	1	4.975	19.523	-1906.34	50.785	4.975	41.354	-4037.64	45.112
3	1974	118030	0	2	38002724	1.49E+08	360.589	46.611	38002705	3.16E+08	764.188	43.999
4	1974	118030	0	3	36047186	1.41E+08	25.486	51.779	36047169	3E+08	54.199	47.03
5	1974	118030	0	4	37287590	1.46E+08	452.047	49.256	37287570	3.1E+08	957.929	44.248
6	1974	118030	0	5	37169520	1.46E+08	-150.113	47.146	37169502	3.09E+08	-317.991	45.737
7	1974	118030	0	6	38548580	1.51E+08	10.579	46.601	38548558	3.2E+08	22.76	39.167
8	1974	118030	0	7	38340705	1.5E+08	29.379	44.36	38340683	3.19E+08	62.228	42.488
9	1974	118031	0	1	0.415	1.629	-1906.251	50.722	0.415	3.451	-4037.67	44.794
10	1974	118031	0	2	38002632	1.49E+08	360.655	47.116	38002613	3.16E+08	764.292	43.384
11	1974	118031	0	3	36047179	1.41E+08	25.453	51.123	36047163	3E+08	54.085	46.923
12	1974	118031	0	4	37287475	1.46E+08	451.984	48.454	37287455	3.1E+08	957.444	44.636
13	1974	118031	0	5	37169558	1.46E+08	-150.319	47.469	37169540	3.09E+08	-318.219	45.178
14	1974	118031	0	6	38548577	1.51E+08	10.581	46.492	38548556	3.2E+08	22.701	39.129
15	1974	118031	0	7	38340698	1.5E+08	29.404	43.538	38340675	3.19E+08	62.242	42.258
16	1974	118032	0	1	1.04	4.081	-1906.691	51.124	1.04	8.645	-4039.16	45.044
17	1974	118032	0	2	38002540	1.49E+08	360.282	46.704	38002522	3.16E+08	763.261	44.216
18	1974	118032	0	3	36047173	1.41E+08	25.098	51.243	36047156	3E+08	53.464	47.084
19	1974	118032	0	4	37287360	1.46E+08	451.511	47.515	37287340	3.1E+08	956.725	44.226
20	1974	118032	0	5	37169597	1.46E+08	-150.866	47.014	37169578	3.09E+08	-319.256	45.813
21	1974	118032	0	6	38548575	1.51E+08	10.261	46.671	38548553	3.2E+08	21.949	38.963
22	1974	118032	0	7	38340690	1.5E+08	28.914	42.834	38340668	3.19E+08	61.336	42.595
23	1974	118033	0	1	1.641	6.441	-1906.463	50.641	1.641	13.644	-4038.33	44.695
24	1974	118033	0	2	38002448	1.49E+08	360.631	46.417	38002430	3.16E+08	763.703	43.568
25	1974	118033	0	3	36047167	1.41E+08	25.221	51.095	36047150	3E+08	53.712	47.406
26	1974	118033	0	4	37287245	1.46E+08	451.783	47.664	37287224	3.1E+08	957.186	44.574
27	1974	118033	0	5	37169635	1.46E+08	-150.655	47.154	37169617	3.09E+08	-318.623	45.574
28	1974	118033	0	6	38548572	1.51E+08	10.594	46.67	38548551	3.2E+08	22.196	38.912

Figure 3: Extracted parameters of RINEX observation file.

4. CONCLUSIONS

The IRNSS RINEX data are processed and all the parameters are extracted pertaining to both the navigation and observation files. The MATLAB is used for processing of RINEX observation data file and RINEX navigation data file. From observation data file, observed pseudoranges are extracted and stored in the variable. From RINEX navigation data file, the ephemeris data has been extracted and stored in the variable which can be further used for further processing like position estimation etc.

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14. Document RTCA DO 229, Appendix A