International Civil Aviation Organization

THE THIRD MEETING OF IONOSPHERIC STUDIES TASK FORCE (ISTF/2)

15 – 17 October 2013, Seoul, Republic of Korea

Agenda Item 5:   Review of progress of tasks and related action items

(a) Task 1 – Data Collection

**CURRENT STATUS OF DATA CONVERSION TOOL AND
DATABASE OF GTEX**

(Presented by Japan)

SUMMARY

This paper reports the current status of data conversion tool and database of GTEX. Software to convert RINEX data to GTEX data (ver. 0.1) is available from a NICT website. Software for GTEX (ver. 1.0), which is agreed in the second ISTF meeting, will be available by the end of 2013. Database of GTEX (ver. 0.1) data has been developed and available via NICT Science Cloud.

1.   INTRODUCTION

1.1   In the second meeting of the Ionospheric Studies Task Force held in Bangkok, Thailand from 15 to 17 October 2013, GNSS-TEC Exchange (GTEX) format (ver. 1.0, see Table 1) was agreed to be a data sharing format for ionospheric delay.

1.2   This working paper introduces software "RNX2GTEX" to convert RINEX data to GTEX data (ver 0.1, see Table 2) developed by NICT, Japan. The current status of database of GTEX data in NICT Science Cloud is also introduced.

2.   DISCUSSION

2.1   Unfortunately, RNX2GTEX ver. 1.0 which can provide GTEX ver. 1.0 is still under development. We hope it will be available by the end of 2013. The major difference between GTEX ver. 0.1 and ver. 1.0 is that the GTEX ver. 0.1 provides only slant TEC and TEC flag for each satellite at each epoch, and does not include GNSS satellite zenith and azimuth angle.

2.2   RNX2GTEX (ver. 0.1) for Linux/Unix consists in a set of programs written in fortran 77 and a shell script. The RNX2GTEX for Linux/Unix is available from the website:
http://seg-web.nict.go.jp/GPS/DRAWING-TEC/software/RNX2GTEX.tgz

The tar file includes RNX2GTEX directory, in which there are README, a shell script (RNX2GTEX.sh), Makefile and fortran source codes. Please use the Makefile to compile the fortran source codes. The shell script, RNX2GTEX.sh execute executable file in RNX2GTEX. It is needed to edit directory names (e.g., RINEX_DIR, TEC_DIR, work_dir etc.) in the shell script. Then, execute RNX2GTEX.sh with arguments of year and day-of-year as follows:

```
[machine]$ ./RNX2GTEX.sh 2013 180
```
Please refer to README for details of installation and usage.

2.3   RNX2GTEX for Windows XP/Vista/7 is available from the website:
http://seg-web.nict.go.jp/GPS/DRAWING-TEC/software/ RNX2GTEX_WIN.zip
RNX2GTEX for Windows is an application for creating GTEX data files from RINEX data using explorer-like GUI. Please refer to "RNX2GTEX_manual_en.pdf" included in the zip for details of installation and usage.

2.4   NICT has developed the database of GTEX (ver. 0.1) derived from all the available online GNSS receiver data from 2000 to the current. This database is available via NICT Science Cloud (http://sc-web.nict.go.jp/ in Japanese only) . Although registration is needed to use the Cloud and access to the database, English page is not available now. Please contact to Takuya Tsugawa (tsugawa@nict.go.jp) to get the account of the Science Cloud. Regional and global TEC maps have also been developed using GTEX database. These maps are browsable via DRAWING-TEC website: http://seg-web.nict.go.jp/GPS/DRAWING-TEC .

3.   ACTION REQUIRED BY THE MEETING

3.1   The meeting is invited to do the following:

a) note the information presented in this paper; and

b) discuss any relevant matters as appropriate.

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TABLE 1

Example of GTEX (version 1.0) derived from daily data of "0132" GNSS station of GEONET.

```
----|---1|0---|---2|0---|---3|0---|---4|0---|---5|0---|---6|0---|---7|0---|---8|
     1.0                GTEX DATA            GNSS                GTEX VERSION / TYPE
RNX2GTEX V1.0      NICT, JAPAN                              PGM / RUN BY
     0                                                     EXPONENT OF TECU
     TEC values in 10^16 el/m^2 (1 TEC Unit)               COMMENT
     TEC Status Flag = 0 : Normal data                     COMMENT
                     = 1 : Lack of observables (TEC=999.)  COMMENT
                     = 2 : Too large TEC (TEC=999.)        COMMENT
                     = 4 : Cycle slip (TEC discontinuity)   COMMENT
                     = 5 : Cycle slip (LLI)                COMMENT
                     = 6 : Beginning of arc               COMMENT
     TYPES OF DATA   = R1 : Raw slant TEC including bias    COMMENT
                       A1 : Absolute slant TEC            COMMENT
                          R1 or A1 is necessary            COMMENT
                       1F : TEC status flag                COMMENT
                       1O : Observation data used for TEC  COMMENT
                       ZN : Satellite zenith angle         COMMENT
                       AZ : Satellite azimuth angle        COMMENT
                                                           BIAS ESTIMATION PGM
01321310.12o  01321320.12o  01321330.12o                  RINEX FILE NAME
0132                                                       MARKER NAME
00000           TPS NETG3          3.4 EG3 Jul,02,2010 REC # / TYPE / VERS
                TRM29659.00     GSI                        ANT # / TYPE
 -3690821.3891  2897721.3097  4305504.4426               APPROX POSITION XYZ
     42.7294       141.8640        0.0486                POSITION LAT LON ALT
    6    L1    C1    L2    P2    S1    S2                  # / TYPES OF OBSERV
    5    R1    1F    1O    ZN    AZ                        # / TYPES OF DATA
   30.000                                                 INTERVAL
 2012    5    11    0    0    0.0000000     GPS            TIME OF FIRST OBS
                                                          END OF HEADER
 12  5 11  0  0  0.0000000  0  9G21G 9G18G15G28G 5G27G 8G26
 -61.7242  0  L1L2C1P2  32.45  194.42
 -33.4733  0  L1L2C1P2   9.32   14.04
 -49.7988  0  L1L2C1P2  20.39    9.03
 -55.8391  0  L1L2C1P2  83.27   39.34
 -43.6837  0  L1L2C1P2  32.21   44.21
 -38.7060  0  L1L2C1P2   8.31    3.34
 -44.8228  0  L1L2C1P2  74.42  265.99
 -31.3004  0  L1L2C1P2  23.01  343.20
 -48.7904  0  L1L2C1P2  50.12  115.79
 12  5 11  0  0 30.0000000  0  9G21G 9G18G15G28G 5G27G 8G26
```

TABLE 2

Example of GTEX (version 0.1) derived from daily data of "0132" GNSS station of GEONET.

```
----|---1|0---|---2|0---|---3|0---|---4|0---|---5|0---|---6|0---|---7|0---|---8|
    0.1             GTEX DATA           GNSS              GTEX VERSION / TYPE
RNX2GTEX V0.1     NICT, JAPAN                             PGM / RUN BY
    0                                                     EXPONENT OF TECU
    TEC values in 10^16 el/m^2 (1 TEC Unit)              COMMENT
    TEC Status Flag = 0 : Normal data                    COMMENT
                    = 1 : Lack of observables (TEC=999.) COMMENT
                    = 2 : Too large TEC (TEC=999.)       COMMENT
                    = 4 : Cycle slip (TEC discontinuity)  COMMENT
                    = 5 : Cycle slip (LLI)               COMMENT
                    = 6 : Beginning of arc              COMMENT
01321310.12o  01321320.12o  01321330.12o                 RINEX FILE NAME
0132                                                     MARKER NAME
00000             TPS NETG3          3.4 EG3 Jul,02,2010 REC # / TYPE / VERS
                  TRM29659.00    GSI                     ANT # / TYPE
 -3690821.3891  2897721.3097  4305504.4426               APPROX POSITION XYZ
      42.7294     141.8640        0.0486                 POSITION LAT LON ALT
    6    L1    C1    L2    P2    S1    S2                 # / TYPES OF OBSERV
   30.000                                                INTERVAL
  2012    5    11    0    0    0.0000000     GPS          TIME OF FIRST OBS
                                                         END OF HEADER
 12  5 11  0  0  0.0000000  0  9G21G 9G18G15G28G 5G27G 8G26
-61.7242  0
-33.4733  0
-49.7988  0
-55.8391  0
-43.6837  0
-38.7060  0
-44.8228  0
-31.3004  0
-48.7904  0
 12  5 11  0  0 30.0000000  0  9G21G 9G18G15G28G 5G27G 8G26
```