A Review of Currently Available IGS Network Summaries

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1 Summary

Various metrics, reports, and summaries of the IGS network have been devised over the years. Based on feedback received at the Central Bureau, IGS users, analysts, and station personnel make use of these in different ways based on the information content, method of distribution, and personal preference. Users evidently have different needs in terms of the level of information required, depending on their goals. It is appropriate to review what is currently available in the context of assuring that the community has ready access to information that enables both assessment and improvement of network performance.

2 Summaries based on site logs

The site logs on file at the IGS Central Bureau (`ftp://igscb.jpl.nasa.gov/pub/station/log/`) comprise the definitive source for IGS site information. As such, several network summaries are generated from the site logs.

2.1 The SINEX template

A file known as the SINEX template is located at `ftp://igscb.jpl.nasa.gov/pub/station/general/igs.snx`. The SINEX format is fully documented at `ftp://igscb.jpl.nasa.gov/pub/data/format/sinex.txt` but an excerpt is shown here:

```
+SITE/RECEIVER
 albh  A ---- P 92:125:00000 92:128:85800 ROGUE SNR-8C          312   Meenix
 albh  A ---- P 92:128:85800 92:351:72300 ROGUE SNR-8C          312   Meenix Upgr
 albh  A ---- P 92:351:72300 93:113:57600 ROGUE SNR-8C          312   Meenix 7.3
 albh  A ---- P 93:113:57600 93:131:69180 ROGUE SNR-8C          312   Meenix 7.3
 albh  A ---- P 93:131:69180 93:298:79200 ROGUE SNR-8C          312   Meenix 7.3
 albh  A ---- P 93:298:79200 93:327:70260 ROGUE SNR-8100        119   SFG2 0.0 L
```

This section shows receiver characteristics, starting alphabetically with station ALBH. Each line denotes the range of time by start and ending day and time of day that a particular receiver was installed at the site. Similar sections detail the time history of other characteristics such as antenna installations. The SINEX template is intended mainly as an input to analysis software to allow homogeneous processing of the IGS network with agreed-upon site parameters. The template is thought to be generally meeting this goal, but improvements may certainly be considered. One request the CB has received is to provide SINEX template data for former IGS stations, to allow for homogeneous processing of historic sites as well. This may certainly be realized; the primary difficulty is the well-known questionable state of format compliance with logs predating late 1999.

2.2 SINEX/RINEX header error file

Each day when the SINEX template is generated from current site logs, the CB compares the most current available RINEX header with the parameters available in the site log (compliance to site log format is also checked, but there

have been no such errors since late 1999 and new logs are checked thoroughly before being installed in the official area). The entire file `ftp://igscb.jpl.nasa.gov/pub/station/general/igs.snx.err` for 7 July 2000 is shown here:

```
ammn: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00185
ankr: Antenna height 0.0574 in RINEX day 00188 does not match height   0.0600 in site log
barb: Antenna ASH700936E_C         in RINEX day 00188 does not match antenna
      ASH700936E_C    SNOW in site log
ineg: IERS DOMES INEG in RINEX day 00169 does not match 40507M001 in site log
karr: Antenna AOAD/M_T        DOM in RINEX day 00188 does not match antenna
      AOAD/M_T        DOME in site log
karr: Unknown antenna AOAD/M_T        DOM in RINEX day 00188
kodk: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00188
mac1: Antenna height 0.0000 in RINEX day 00188 does not match height   0.0280 in site log
mas1: Receiver ROGUE SNR-12 RM in RINEX day 00188 does not match receiver
      AOA SNR-12 ACT        in site log
monp: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00184
pin1: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00188
pvep: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00188
sio3: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00186
vndp: IERS DOMES (MARKER NUMBER) field not found in RINEX day 00188
wuhn: Receiver ASHTECH Z-XII3 in RINEX day 00188 does not match receiver
      ROGUE SNR-8000         in site log
wuhn: Antenna ASH700936E      SNOW in RINEX day 00188 does not match antenna
      AOAD/M_T              in site log
```

This assortment of errors is fairly typical for recent months: several sites do not list a DOMES number in their RINEX headers, a few (MAS1, WUHN) show temporary apparent discrepancies related to very recent equipment changes, KARR has a spacing error in its RINEX header, etc.

2.3 SINEX/RINEX header error emails

The errors placed in `igs.snx.err` are also emailed twice weekly to the site operator, hopefully for a quick correction. A record of these emails is available in `ftp://igscb.jpl.nasa.gov/pub/station/general/igs.snx.emails`. The purpose of this file is not for public humiliation but rather so that analysts and users may check that the CB is aware of an error and an operator has been notified.

2.4 loghist.txt

This file (`ftp://igscb.jpl.nasa.gov/pub/station/general/loghist.txt`) is quite similar to the SINEX template in that it is generated from current site logs and indicates a hardware history of IGS sites. The beginnings of the first few lines demonstrate the similarity to the first few lines of the RECEIVER block of the SINEX template.

```
Logfile   Site Name             Code DOMES #   Latitude  Longitude Elev Receiver Type       Receiver Number
albh0003 Albert Head            ALBH 40129M003   48.3898  236.5126    0 ROGUE SNR-8C         312
                                ALBH 40129M003   48.3898  236.5126    0 ROGUE SNR-8C         312
```

The loghist.txt file continues horizontally to present similar antenna and frequency standard information.

2.5 logsum.txt

This file, located in the same download directory as loghist.txt, provides the same information, but only the currently installed hardware, rather than complete site histories.

3 Site performance

The venerable `igsnet` report, originally developed by J. Zumberge, is emailed weekly to a large distribution and archived at the CB in `ftp://igscb.jpl.nasa.gov/mail/igsnet/`. This report attempts to summarize each site's behavior over a week's period, rather than the station configuration as the summaries of the previous section. A few lines of this report for 2000-06-18 are shown below:

```
Other IGS Global Sites
site    overall     quantity  quality  latency    agency        location
--------------------------------------------------------------------------
albh       10          10        10       10       NRCan/GSC     Canada
ankr       10          10        10       10       IfAG          Turkey
aoml       10          10        10       10       NOAA          USA
artu       10          10        10       10       RDAAC-IRIS    Russian Federation
asc1       10          10         9       10       NASA/JPL      Ascension Island
auck       10          10        10       10       IGNS-JPL      New Zealand
bahr       10          10        10        9       DMA           Bahrain
```

The Latency score is determined by the number of hours that a daily RINEX file took to reach the first Global Data Center, Quantity is determined by the average number of valid clock solutions, and the Quality score is digested from a number of measures:

  – valid clocks > 250

  – < 100 phase bias resets

  – 3D formal location error < 1cm

  – rms pseudorange residuals < 86cm

  – pseudorange measurements > 0.9× phase measurements

  – rms phase residuals < 13nm

The statistics for these figures (except for Latency) are obtained from the engineering data available at the JPL Analysis Center. While there have been no major problems with the data kindly provided by the JPL AC, we may wish to consider supplementing these figures with similar data from other ACs, or from the combinations performed by the Analysis Center Coordinator.

Comments received at the CB about the `igsnet` report are varied. Some like to have the performance of a site boiled down into a single score; others feel that particularly the single Quality score does not "tell the whole story" like a complete set of data.

4   CBIS station list

The CB Tracking Network list at `http://igscb.jpl.nasa.gov/network/list.html` may be thought of as a sort of network summary. It presents a complete list of the locations of currently installed sites, and indicates which stations are Global (analyzed by at least 3 DCs, one of which is not on the same continent) based on recent IGSReports. Further, the clickable 4-character site id's lead to the current site log, plots of the historic `igsnet` scores, and IGSMails relating to that site.

One recent suggestion related to this list received by the CB is to indicate new (perhaps 6 months or less) sites with a symbol, to aid in identification of new IGS stations. This will be implemented shortly.

5   Non-CB summaries

IGS network summaries are also available outside the CB from Data Centers and Analysis Centers. This is not intended to be an exhaustive list but to highlight a representative few which have been particularly useful to the CB.

5.1   CDDIS yyddd.status

Daily summary files such as `ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsstatus/2000/00172.status` contain simple quality checks as provided by the `teqc` software. A small portion of this file is provided here.

```
       Dly  No.   No.   Pts.      Avg. Avg. Pos.  No.
Site   (H)  Exp.  Obs.  Del.   %  MP1  MP2  Diff  Slps V   Receiver Type        Antenna Type
----   ---  ----- ----- ----- --- ---- ---- ----  ---- -  -------------------- --------------------
albh    1   20948 20774     0  99 0.27 0.21 0.03     3 1  AOA BENCHMARK ACT     AOAD/M_T      EMRA
algo    2   20910 20441     0  97 0.24 0.25 0.03     2 1  AOA SNR-12 ACT        AOAD/M_T
alic    3   23013 22957     3  99 0.30 0.31 0.04    38 1  AOA ICS-4000Z ACT     AOAD/M_T      DOME
amc2    1   10722 10687     0  99 0.24 0.25 0.03    26 1  AOA SNR-12 ACT        AOAD/M_T
```

5.2   CDDIS import check

The file `ftp://cddisa.gsfc.nasa.gov/pub/reports/gpsdata/check_import.cddis` provides a summary of daily
file latency at the CDDIS GDC:

```
*****  A A A A A A A A A A A A B B B B B B B B B B B C C C C C C C C C C C
CDDIS  L L L M M M N O O R R S U A A A A I I J O R R R A A E H H H H I O O R
*****  B G I C M U K A M E T C C H K R R L S F R A M U S S D A U U W C C R O
       H O C 2 N N R 1 L Q U 1 K R O B H I H S 1 Z U S 1 A U T M R K 1 0 D 1
******************** Last Update :   7-JUL-00 21:00 (Day 189) ***************
00-188 1 1 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 . . 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1
00-187 1 1 1 1 2 2 2 1 1 1 2 . 1 1 . . 1 . . 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1
00-186 1 1 1 1 3 2 . 1 1 1 1 1 1 1 1 1 . . 1 1 . 1 1 1 1 1 1 1 1 1 1 1 1 1 1
```

This excerpt shows latency scores in days for the past 3 days of the current year.

5.3   JPL AC engineering data

The statistics used in the `igsnet` Quality score are available from the JPL AC at `http://milhouse.jpl.nasa.gov/eng/`.

```
Station ID      epochs  clock   p-code      Phase        phase   Days        Days Since Last
                                Residual    Residual     breaks  Processed   Day Processed
AGMT            242.85  55.53   29.33       5.58         54.92   78          2
ALBH            286.16  6038.63 45.08       5.98         56.79   1885        3
```

6   Conclusions

Many different IGS network summaries are available to meet various needs. The CB is always interested in improving
or combining them to best serve the community without having a confusing assortment of summaries which largely
duplicate one another. Input from analysts and the user community is invaluable in identifying which summaries
are most useful and where improvements can be made.