WORK EXAMPLE: ONLINE GNSS PROCESSING SERVICES

1. AIM:

The work example aims to introduce the various online (free) GNSS processing services, which could be used to derive accurate estimates of positions/coordinates on a global reference frame.

2. DESCRIPTION:

You will be introduced to five (5) free online GNSS processing services to obtain International Terrestrial Reference Frame (ITRF) 2014 coordinates in Cartesian format, X, Y, and Z.

The online GNSS processing services are:

1. CSRS-PPP: Canadian Spatial Reference System, Natural Resources Canada (https://webapp.geod.nrcan.gc.ca/geod/tools-outils/ppp.php)
2. MagicGNSS: GMV (https://magicgnss.gmv.com/)
3. CenterPoint RTX: Trimble Navigation (http://trimblertx.com)
4. GAPS: The University of New Brunswick (http://gaps.gge.unb.ca/submitbasic.php)
5. AUSPOS: Geoscience Australia (http://www.ga.gov.au/bin/gps.pl)

Follow the guidelines instructions provided online by the GNSS processing service providers. Note that these services are free but some require registration, e.g., name, password etc.

Once all the details have been entered correctly, you could then submit the data for processing. The results will be sent back to you via email.

3. DATA:

A sample GNSS RINEX data collected at Chulalongkorn University GNSS station in Bangkok Thailand will be provided. The GNSS RINEX data was collected on 1 December 2017 over a one-day period (24 hours). The data was downloaded from the International GNSS Service (IGS) ftp archive.

The IGS operates and maintains a large permanent network of GNSS CORS receivers which can be used in geodetic surveys and processing.

RINEX stands for Receiver Independent Exchange Format and is the standard format which all allows different types of GNSS receivers to be used together and also their data to be

processed together, in all GNSS software. The RINEX format is particularly useful for GNSS research and testing and contains important information required to calculate the GNSS receivers' position is included, with the exception of the satellite ephemeris.

Figure 1 shows an example of a RINEX (version 2.11) header for an IGS station, i.e., Melbourne Observatory. Each GNSS station has a unique 4-char ID. In the case of Melbourne Observatory, the 4-char ID is MOBS. In the case of Chulalongkorn University GNSS station, the 4-char ID is CUSV.

Understanding the file naming conventions in GNSS is important. The IGS recommend using the following naming convention for RINEX files:

```
ssssdddf.yyt
|   |  | | |
|   |  | | +--  t:  file type:
|   |  | |          O: Observation file
|   |  | |          N: GPS Navigation file
|   |  | |          M: Meteorological data file
|   |  | |          G: GLONASS Navigation file
|   |  | |          L: Future Galileo Navigation file
|   |  | |          H: Geostationary GPS payload nav mess file
|   |  | |          B: Geo SBAS broadcast data file
|   |  | |                       (separate documentation)
|   |  | |          C: Clock file (separate documentation)
|   |  | |          S: Summary file (used e.g., by IGS, not a standard!)
|   |  | |
|   |  | +---  yy:  two-digit year
|   |  |
|   |  +-----   f:  file sequence number/character within day
|   |               daily file: f = 0
|   |               hourly files:
|   |               f = a:  1st hour 00h-01h; f = b: 2nd hour 01h-02h;
...
|   |               f = x: 24th hour 23h-24h
|   |
|   +-------  ddd:  day of the year of first record
|
+----------- ssss:  4-character station name designator
```

As examples, the RINEX file for:

▪ Melbourne Observatory GNSS station on 17 February 2011 will be named as MOBS0480.11O.

▪ Chulalongkorn GNSS station on 1 December 2017 will be named as CUSV3350.17O.

You could use interactive GNSS calendars, which are available online, e.g., http://www.gnsscalendar.com/, to convert dates in different formats.
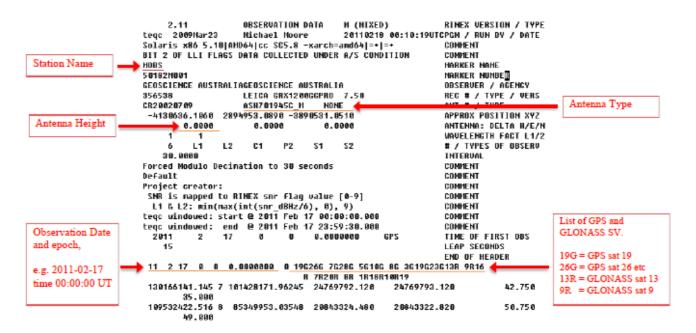
Example:

Friday, December 1, 2017 (UTC)

Julian Day Number: *2458088.5*
Day of Year: *335*
GPS Week: *1977*
GPS Week Number: *19775*

Header Information included in RINEX file

In Summary, the important information from this file that is required in the online processing for MOBS0480.110 is as follows:

Antenna Type = ASH701945C_M   NONE

Antenna Height= 0.000m

Figure 1: Example of a RINEX Version 2.11 file.

It is worth noting that most, if not all, of the online GNSS processing services accept RINEX Version 2.11 files. However, the GNSS community is now moving towards RINEX Version 3 to accommodate multi-GNSS data. For more information on the file formats currently used by the GNSS community, refer to https://igscb.jpl.nasa.gov/components/formats.html