

Processing of raw GNSS data

Automated Survey Systems

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CONTENT

- Get raw data of permanent GNSS stations
- Post-process with different scenarios
- Open-source software RTKLIB (install both of them)
 - www.rtklib.com,
 - <https://rtklibexplorer.wordpress.com/>
- Use GUI
- Use CLI

RAW DATA OF PERMANENT STATIONS

- Free data for scientific and educational purposes
- IGS: <https://igs.org/>
- EUREF: <https://epncb.oma.be/>
- ...
- Task to do: find raw data of BUTE, BME1 and other stations in your country

BUTE PERMANENT STATION

- Download from web
 - http://www.epncb.oma.be/_networkdata/siteinfo4onestation.php?station=BUTE00HUN
 - *One-day session, in RINEX 3 format*
- Download directly from command prompt
 - https://igs.bkg.bund.de/root_ftp/EUREF/obs/2022/033/BUTE00HUN_R_20220330000_01D_30S_MO.crx.gz
 - *ftp client*
 - *wget*

NAVIGATION DATA

- Download directly from command prompt:
ftp://igs.bkg.bund.de/EUREF/BRDC/2022/033/BRDC00WRD_R_20220330000_01D_MN.rnx.gz
- M = mixed (G = GPS, E = GAL, R = GLO, C = BDS)

UNCOMPRESSING

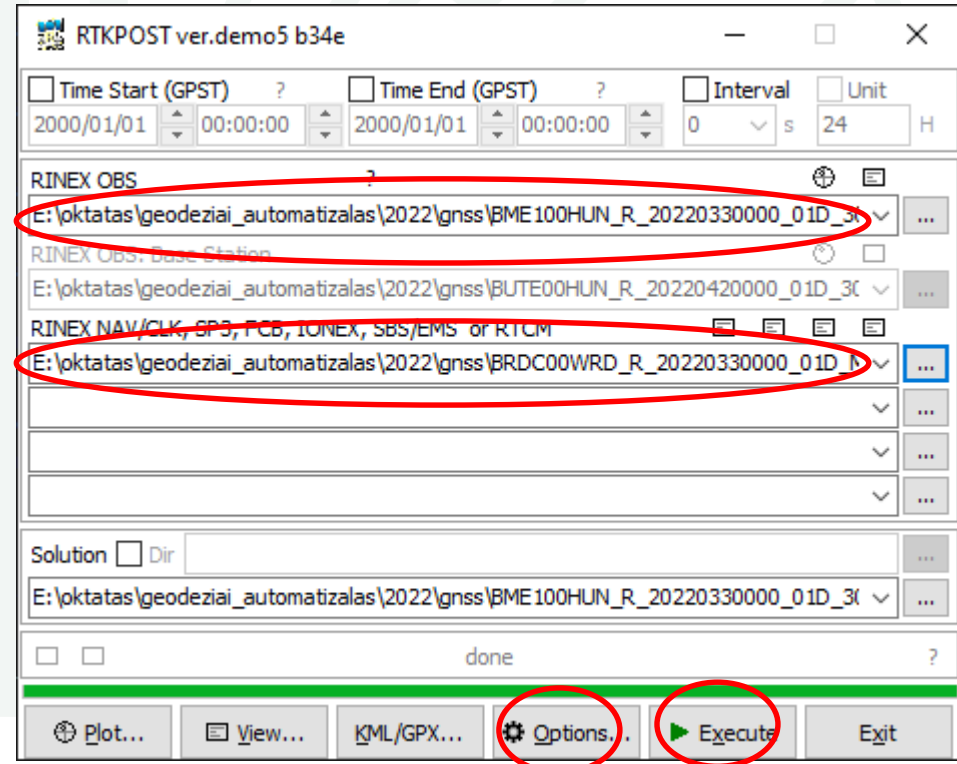
- Gzip (e.g. `c:\rtklib\bin\gzip -d`)
- Hatanaka decompression (e.g. in `c:\rtklib\bin\crx2rnx`)
- Use recent version of `crx2rnx`

Task to do (in command prompt if there is any way):

- download raw data from BUTE and BME1 for a specific day (e.g. yesterday)
- download navigational data for the same day
- develop a python script to do it (see the jupyter notebook in the moodle)

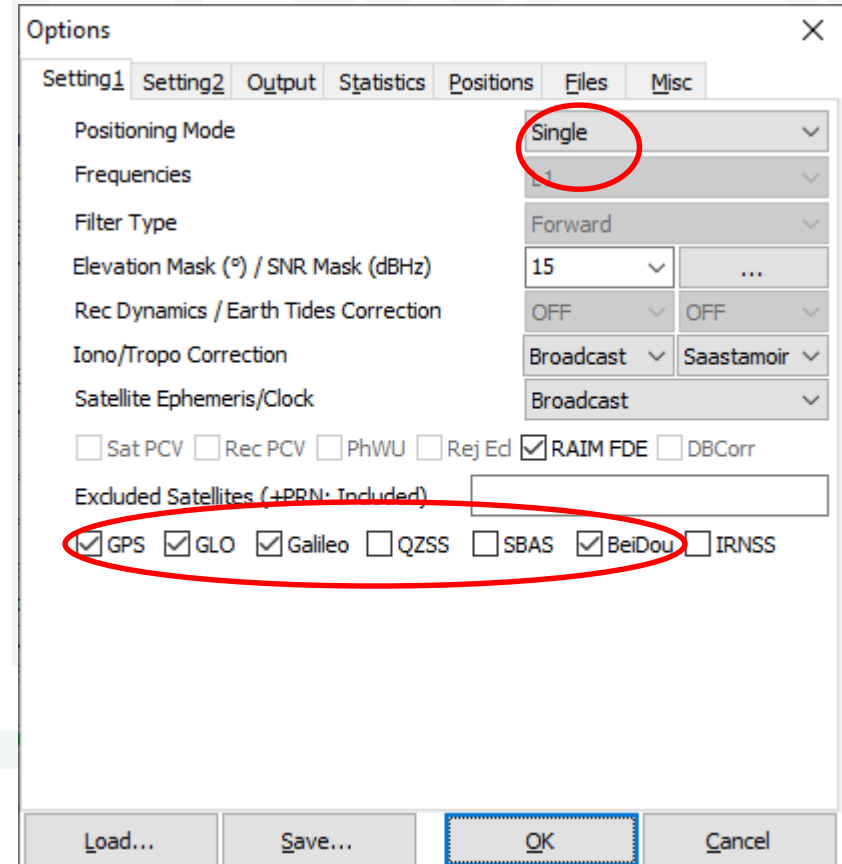
POST-PROCESS - SPP

- Launch RTKPOST
- BME1 as rover



SPP - SETTINGS

- Single
- GPS+GLO+GAL+BDS



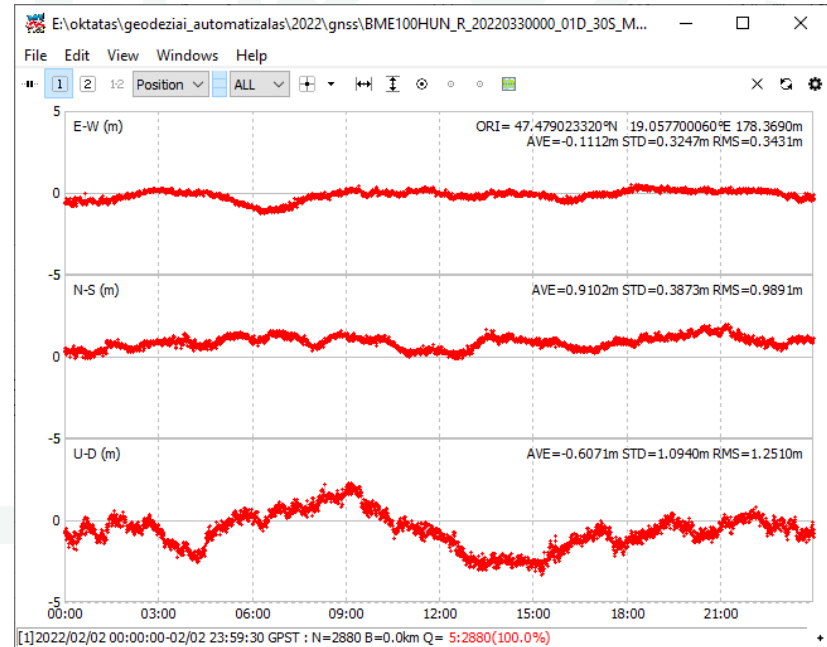
PLOT THE RESULTS

True position: 47.47902332 , 19.05770006 , 178.369
(IGb14, epocha 363/2021)

Options

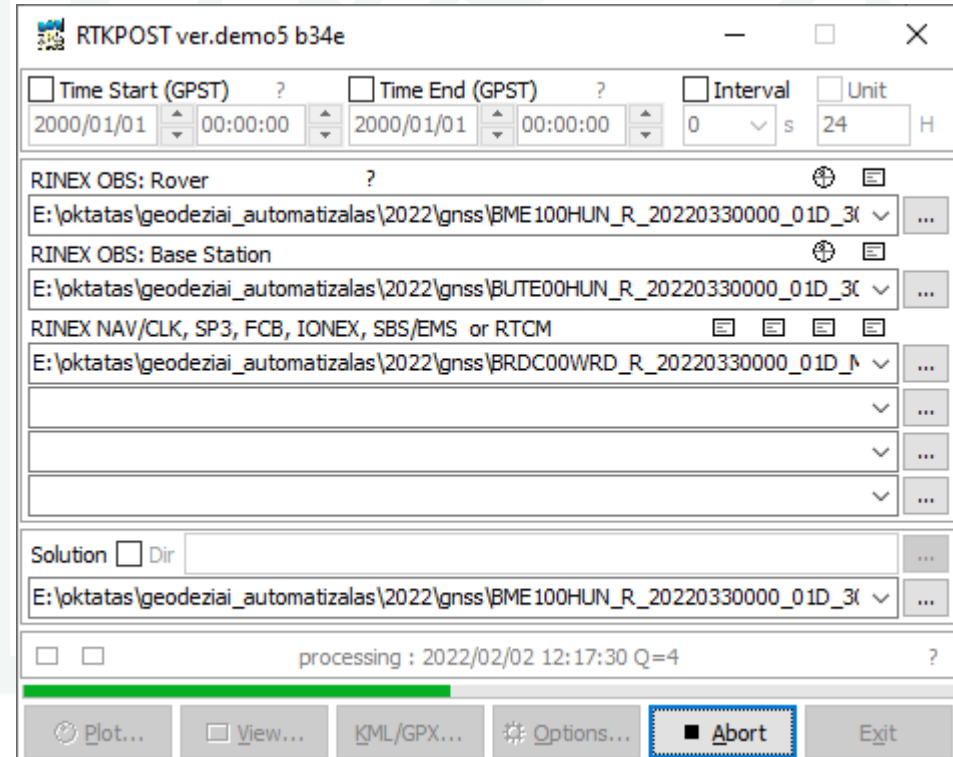
Time Format	h:m:s GPST	Error Bar/Circle	OFF	Mark Color 1 (1-6)	
Lat/Lon Format	ddd.ddddd	Direction Arrow	OFF	Mark Color 2 (1-6)	
Show Statistics	ON	Graph Label	ON	Line Color	
Cycle-Slip	LLI Flag	Grid/Grid Label	Grid/Label	Text Color	
Parity Unknown	ON	Compass	OFF	Grid Color	
Ephemeris	OFF	Scale	ON	Background Color	
Elevation Mask (°)	0	Auto Fit	ON	Plot Style	Mark/Line
Elev Mask Pattern	OFF	Y-Range (±)	5m	Mark Size	2
Hide Low Satellite	OFF	RT Buffer Size	10800	Font	Tahoma 8pt
Max NSAT/DOP	50	<input type="checkbox"/> Time Sync Port	10071	Animation Interval	10
Max Multipath	10	Coordinate Origin	Lat/Lon/Hg	Update Cycle (ms)	100
Receiver Position	Lat/Lon/Hg	Lat/Lon/Hgt	47.479023320 19.057700060 178.3690		
Satellite System	<input checked="" type="checkbox"/> GPS <input checked="" type="checkbox"/> GLO <input checked="" type="checkbox"/> GAL <input checked="" type="checkbox"/> QZS	RINEX Opts			
	<input checked="" type="checkbox"/> BDS <input checked="" type="checkbox"/> NavIC <input checked="" type="checkbox"/> SBS	Shape File			
Excluded Sats (+Sn: Included)		TLE Data			
		TLE Sat No			

OK Cancel



POST-PROCESS - DGPS

- Base: BUTE, rover: BME1
- Base station coordinates:
47.48094884, 19.05653907,
180.798
(IGb14, epocha 363/2021)



POST-PROCESS - DGPS

Options

Setting₁ Setting₂ Output Statistics Positions Files Misc

Rover

Lat/Lon/Height (deg/m) ...

90.000000000 0.000000000 -6335367.6285

Antenna Type (*: Auto) Delta-E/N/U (m)

0.0000 0.0000 0.0000

Base Station

Lat/Lon/Height (deg/m) ...

47.48094884 19.05653907 180.798

Antenna Type (*: Auto) Delta-E/N/U (m)

0.0000 0.0000 0.0000

Station Position File

Load... Save... OK Cancel

Options

Setting₁ Setting₂ Output Statistics Positions Files Misc

Positioning Mode DGPS/DGSS

Frequencies 1.1

Filter Type Forward

Elevation Mask (°) / SNR Mask (dBHz) 15 ...

Rec Dynamics / Earth Tides Correction OFF OFF

Iono/Tropo Correction Broadcast Saastamoir

Satellite Ephemeris/Clock Broadcast

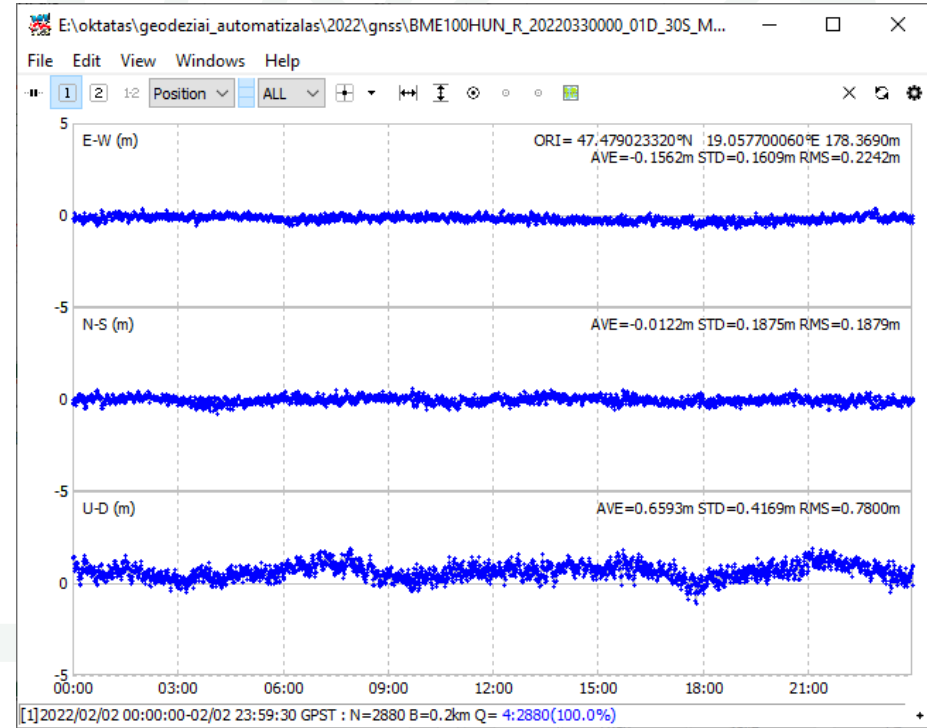
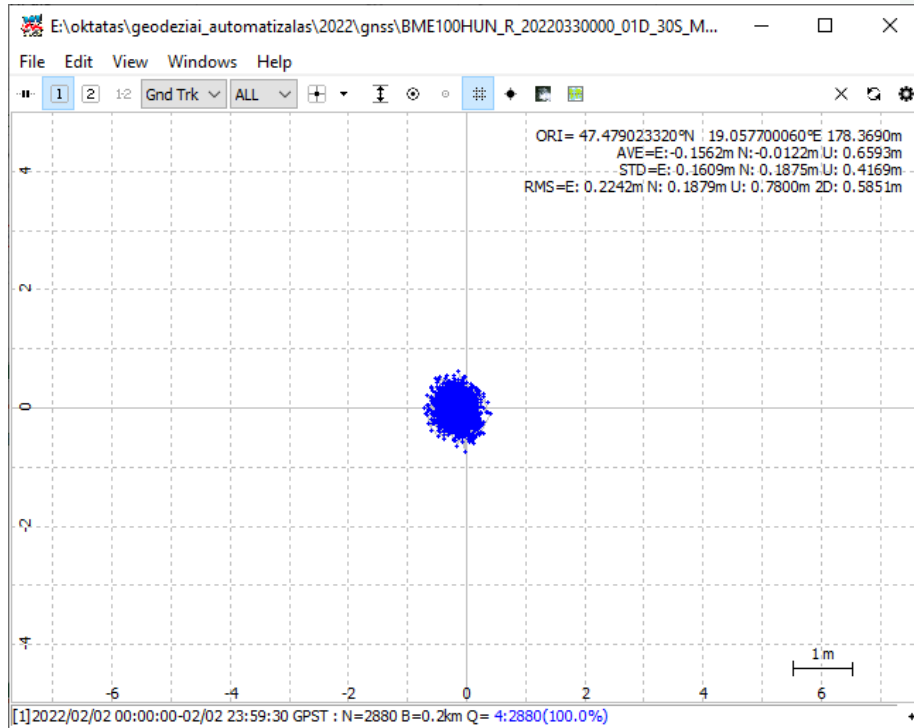
Sat PCV Rec PCV PhWU Rej Ed RAIM FDE DBCorr

Excluded Satellites (+PRN: Included)

GPS GLO Galileo QZSS SBAS BeiDou IRNSS

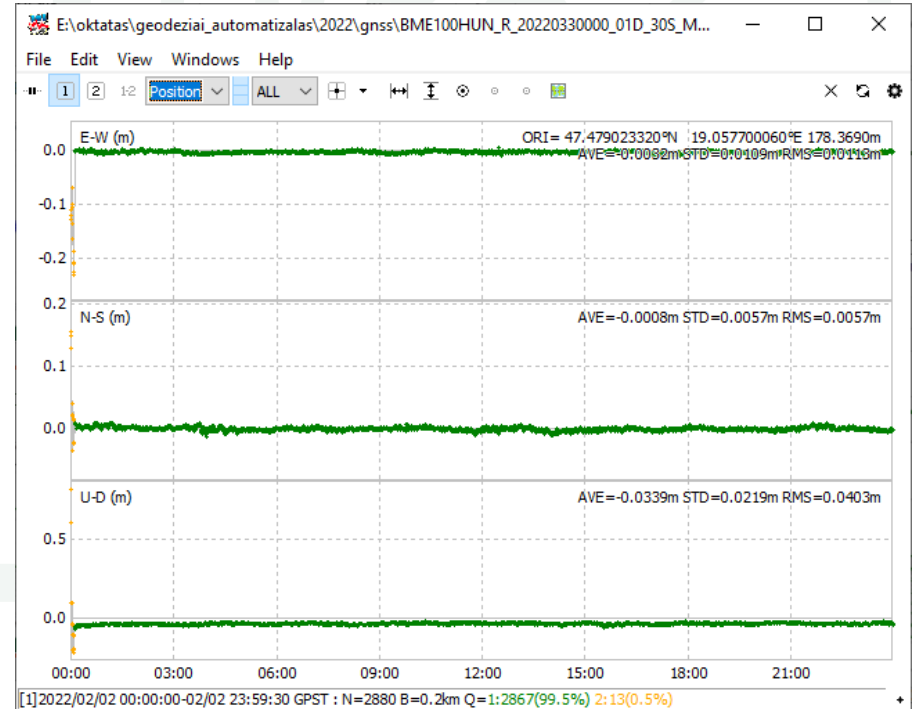
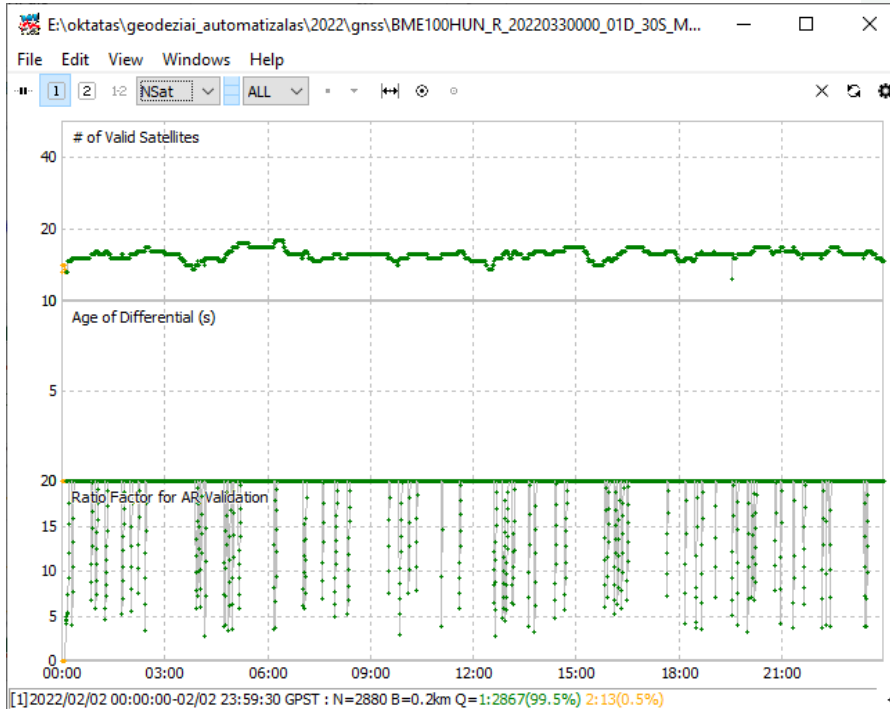
Load... Save... OK Cancel

PLOT THE RESULTS



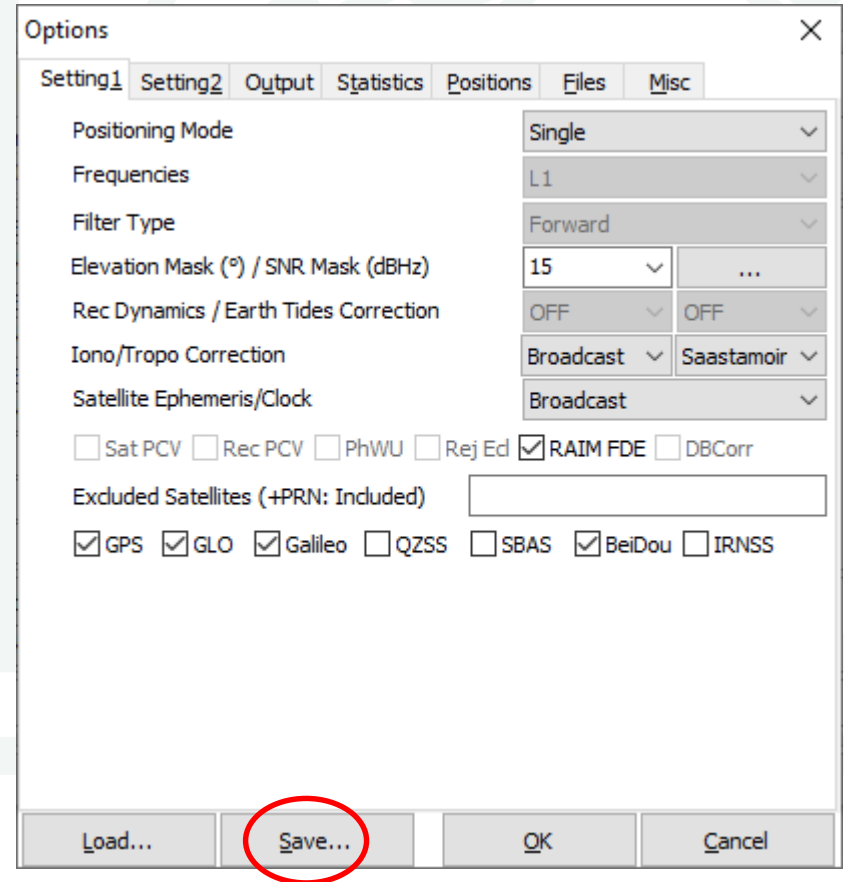
POST-PROCESS – KINEMATIC (RTK?)

Turn off BDS



POST-PROCESS IN CLI

- In GUI save the settings into a config file (e.g. spp.conf)



POST-PROCESS IN CLI - SPP

- Open a command prompt
- Type: `c:\rtklib\rnx2rtkp.exe -k spp.conf -o BME100HUN_R_20220330000_01D_30S_MO.pos BME100HUN_R_20220330000_01D_30S_MO.rnx BRDC00WRD_R_20220330000_01D_MN.rnx`
- All the settings are in the conf file, all you need to give are the output file name, RINEX observation and navigation file names
- You can give the full path if the files are in different directories which is highly recommended
- Some parameters can be given in the command prompt, see the help

POSS-PROCESS IN CLI - DGPS

- `c:\rtklib\rnx2rtkp -k dgps.conf -r 4081881.745 1410011.666
4678199.766 -o
BME100HUN_R_20220330000_01D_30S_MO.pos
BME100HUN_R_20220330000_01D_30S_MO.rnx
BRDC00WRD_R_20220330000_01D_MN.rnx
BUTE00HUN_R_20220330000_01D_30S_MO.rnx`
- Give the rover observation file at first

TASKS TO DO

- plot the results (pos files) using rtkplot
- develop your own script to make the plots in python
- run rnx2rtkp in kinematic mode
- develop python scripts to run rnx2rtkp (see the handout in the moodle)