



# GNSS Data Processing for High-Accuracy Single, DPGS and Kinematic

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# Objectives

- Learn how to post-process GNSS data using RTKLIB software
  - Data Conversion Methods
  - Data Check and Data Plots
  - Data Post-Processing Methods: Single, DGPS and Kinematic
- Learn data processing methods
  - Single Method
    - Standard GNSS Accuracy: Few meters to 10m
  - DGPS Method
    - Differential Correction, Code-phase Observation
    - Meter level accuracy
  - Kinematic method
    - Differential Correction with Code and Carrier phase observation
    - Centimeter level accuracy
- Compare accuracy levels
  - Compare accuracy between Single, DPGS and Kinematic methods





#### Data Files

- Two data sets "STATIC" and "DYNAMIC" are provided.
- "STATIC" contains data for a fixed point, no antenna movement.
- "DYNAMIC" contains data logged by mounting GPS antenna on a vehicle.
- Unzip the files to STATIC and DYNAMIC folders.

Data ID	Purpose	Туре	File Name	File Type	Receiver Model	Receiver Type	Frequency and Satellites	Observation Mode	Purpose
KDB 001	PurposeTypeStatic ObservationBas Static ObservationRov ObservationDynamic ObservationRov Rov	Base- Station	NetR9_181215_static.binex	BINEX	Trimble NetR9	High-End Survey Grade	Multi- Frequency Multi-System	Static	Use as Base- Station
KDR 001		Rover	F9P_181215_static.ubx	UBX	U-blox F9P	Low-Cost	Dual- Frequency Multi-System	Static	Static Data Analysis
KDB 002	Dynamic	Base- Station	ECJ02_base	UBX	U-blox F9P			Static	Use as Base- Station or Static Rover
KDR002	Observation	Rover	F9P_dynamic_rover_RTKsample	UBX	U-blox F9P			Dynamic	Dynamic Data Analysis





## **Base-Station Position Data**

• For DPGS, KINEMATIC or other data processing methods where a Base-station data are used, it is necessary to provide Base-Station's coordinates.

Data ID	LAT	LON	НТ	Location	Receiver Model	Antenna Type	Remarks
KDB 001	35.66634207	139.79221086	59.771	Tokyo	Trimble NetR9		High-End Survey Grade Receiver
KDB 002	35.66633434	139.79220132	59.746	Tokyo	U-blox F9P		Low-Cost Receiver





# Data Processing Flow





# Launch RTKLIB Menu

- ➢ Go to RTKLIB Folder
- ➢ Go to BIN Folder
- Double Click RTKLAUNCH.exe file
- Or create a shortcut to RTKLAUNCH.exe file and copy this shortcut to Desktop for easy access



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📌 Quick access	Name	Date modified	lype	Size									
Desktop 🔹	📊 image	2020/12/29 7:28 PM	File folder										
Downloads	eaflet	2020/12/29 7:28 PM	File folder										
	🐵 convbin	2020/12/29 7:28 PM	Application	1,171 KB									
🛅 Documents 🛛 🖈	crx2rnx	2020/12/29 7:28 PM	Application	79 KB									
E Pictures 🖈	🔳 gzip	2020/12/29 7:28 PM	Application	90 KB									
אלעב+ז' 🖌	💵 pos2kml	2020/12/29 7:28 PM	Application	878 KB									
COURSE B 🖈	😅 rnx2rtkp	2020/12/29 7:28 PM	Application	1,334 KB									
DynamicData	📅 rtkconv	2020/12/29 7:28 PM	Application	9,760 KB									
PrecentationMaterials	对 rtkget	2020/12/29 7:28 PM	Application	9,135 KB									
	🔣 rtklaunch	2020/12/29 7:28 PM	Application	9,950 KB									
StaticData	🐺 rtknavi	2020/12/29 7:28 PM	Application	11,914 KB									
TrainingMaterials	🎇 rtkplot	2020/12/29 7:28 PM	Application	11,153 KB									
OneDrive - Personal	🎇 rtkpost	2020/12/29 7:28 PM	Application	10,597 KB									
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Documents	libiconv-2.dll	2020/12/29 7:28 PM	Application exten	905 KB 📉 🗸									
36 items													



# Convert GNSS Data File to RINEX Format for Post-Processing







Centimeter level accuracy

# **GNSS** Data Post-Processing

Select RTKPOST	Input Base-station Coordinates or select
	Coordinate File
	Options (8) ×
KIKLIB V.2.4.3 D34	Setting1 Setting2 Output Statistics Positions Files Misc Options
	Integer Ambiguity Res (GPS/GLO/BDS)
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	Min Rado to Pix Ambiguity 3 90.00000000 0.00000000 -6335367.6285
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RTKPOST ver 2.4.3 b34 Soloct POVER File - X	Outage to Reset Amb/Slip Thres (m) 5 0.050 35.666341998 139.792210860 59.7710
Select NOVEN THE	Max Age of Diff (s) / Sync Solution 30.0 ON V Antenna Type (*: Auto) Delta-E/N/U (m)
Time Start (GPST) ? Time End (GPST) ? Interval Unit	Reject Threshold of GDOP/Innov (m) 30.0 30.0 Station Position File
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RINEX OBS: Rover ? Select BASE File	Baseline Length Constraint (m)         0.000         0.000         Load         Save         QK         Cancel
D:¥GNSS Presentation Materials¥Lectures¥UT_CSIS¥DATA¥StaticData¥F9P_181215_static.obs	Save OK Cancel Select Processing Mode
RINEX OBS: Base Station	Try with different modes
D:¥GNSS_Presentation_Materials¥Lectures¥LIT_CSIS¥DATA¥StaticData¥NetR9_181215_static.obs	Kinematic
	Setting2 Output Statistics Positions Files Misc DGPS/DGNSS
	Positioning Mode Kinematic Kinematic
Select BASE Navigation File.	Frequencies / Filter Type ? L1+2 V Forward V Static
This is RINEX ".NAV" file	Elevation Mask (°) / SNR Mask (dBHz) 15 Fixed
Modify Output File name	Rec Dynamics / Earth Tides Correction OFF V OFF V PPP Kinematic
	Ionosphere Correction Broadcast V PPP Static
Solution Dir	Troposphere Correction Saastamoinen V PPP Fixed
	Satellite Ephemeris/Clock Broadcast   Single: Standard Position Computation
	Sat PCV Rec PCV PhWU Rej Ed RAIM FDE DBCorr     (Only Rover Data is necessary)
	Few IVIETERS accuracy: 3- 30m     Excluded Satellites (+PRN: Induded)
	GPS // GRANASS // Galileo // OZSS // BDS // Navic // SBAS // (Base and Pover Data necessary)
Plot     EView     KML/GPX     Contions     Evidence Evidence	• Meter level accuracy 1 – 3m
	Load Save OK Cancel • Kinematic: RTK





# Base-Station: Satellite Visibility Plot









# **Base-Station: Skyplot**







# Rover: Satellite Visibility Plot

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#### Rover: Skyplot







# **GNSS Data Processing: Single**





# GNSS Data Processing: DGPS

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# **CNSS** Data Processing: Kinematic







#### GNSS Data Processing: Single, DGPS, Kinematic

