

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

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## Schedule

- GNSS data processing and accuracy comparison using RTKLIB
  - Use Sample Data
- Learn how to use RTKLIB/RTKNAVI for real-time data processing
- Learn other tools of RTKLIB
- Log GNSS Data outside for RTK and PPP
- Other

# 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.

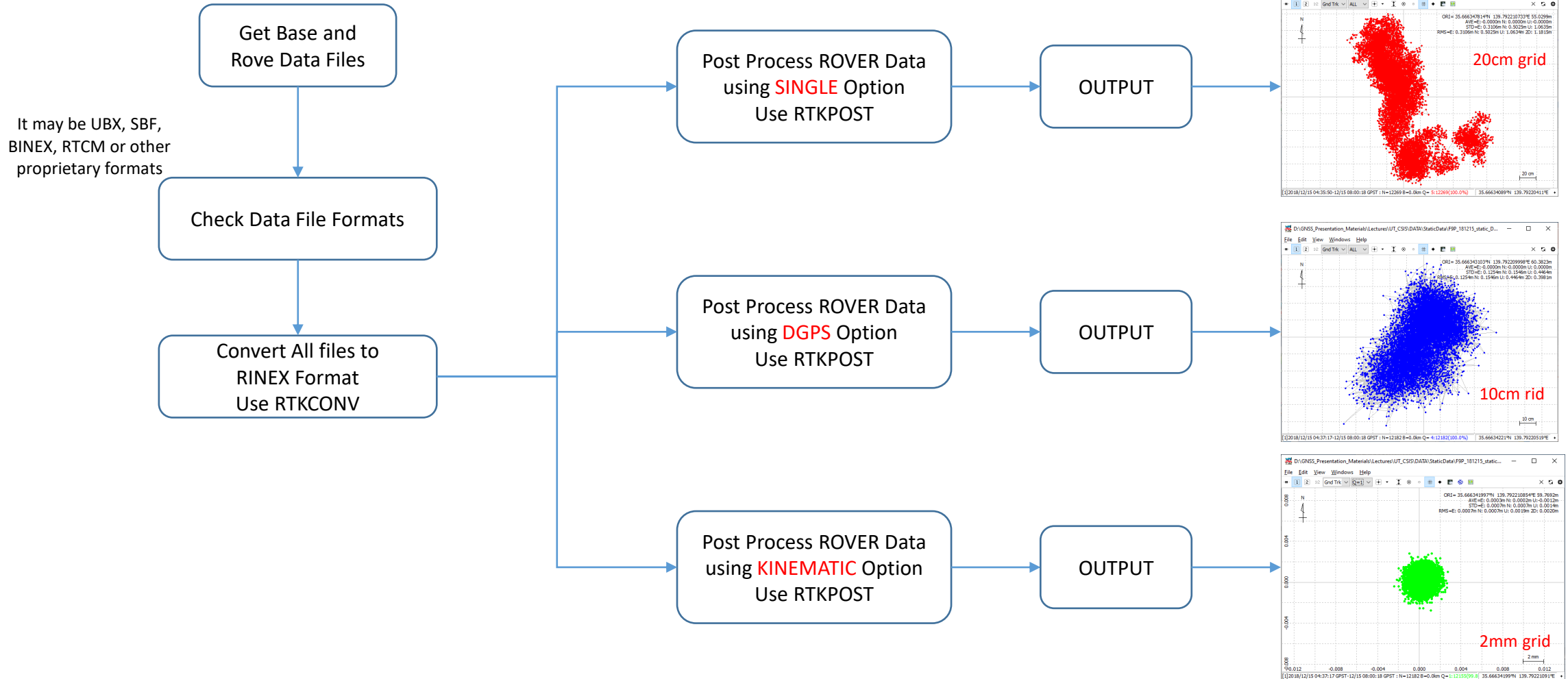
Data ID	Purpose	Type	File Name	File Type	Receiver Model	Receiver Type	Frequency and Satellites	Observation Mode	Purpose
KDB01	Static Observation	Base-Station	NetR9_181215.binex	BINEX	Trimble NetR9	High-End Survey Grade	Multi-Frequency Multi-System	Static	Use as Base-Station
		Rover	F9P_181215_static.ubx	UBX	U-blox F9P	Low-Cost	Dual-Frequency Multi-System	Static	Static Data Analysis
KDB02	Dynamic Observation	Base-Station	ECJ02_base	UBX	U-blox F9P	Low-Cost	Dual-Frequency Multi-System	Static	Use as Base-Station or Static Rover
		Rover	F9P_dynamic_rover_RTKsample	UBX	U-blox F9P	Low-Cost	Dual-Frequency Multi-System	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.

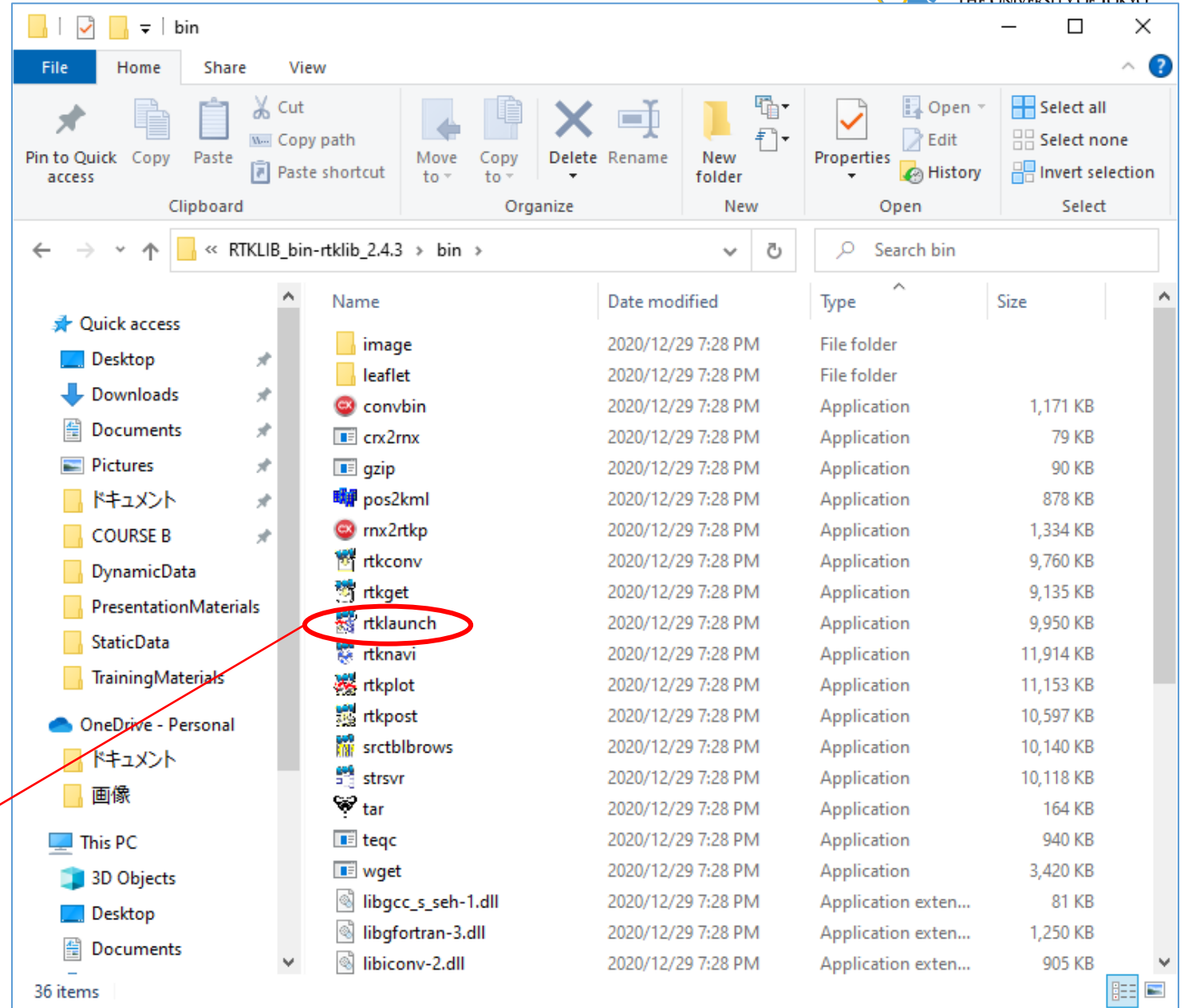
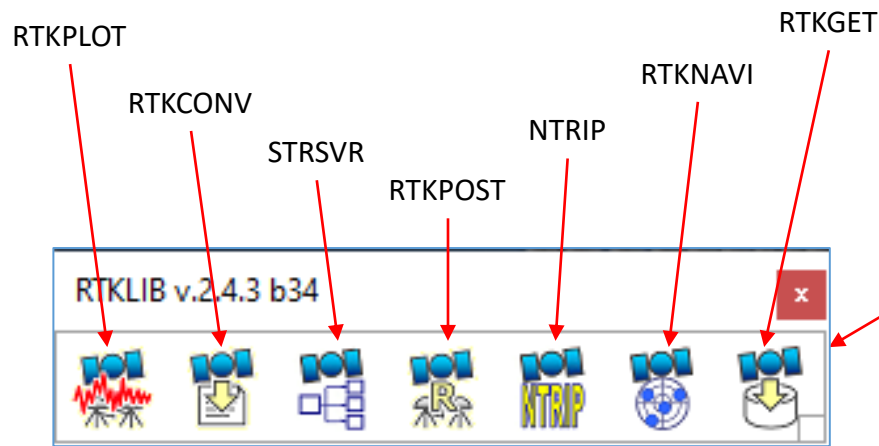
Data ID	LAT	LON	HT	Location	Receiver Model	Antenna Type	Remarks
KDB 001	35.66634207	139.79221086	59.771	Tokyo	Trimble NetR9		High-End Survey Grade Receiver
KDB 002	35.66633434	139.79220132	59.746	Tokyo	U-blox F9P		Low-Cost Receiver

# 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



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

**Select RTKCONV** →

**1** (RTKLIB v.2.4.3 b34)

**2** Select File to be converted  
Repeat this process for both BASE and ROVER files

**3** Select File Type or use AUTO

**4** Select OPTIONS

**5** Select RINEX Version, 3.02 is OK  
Select higher version if NAVIC data is available

**6** Use Default selections  
You may change if necessary

**7** Convert

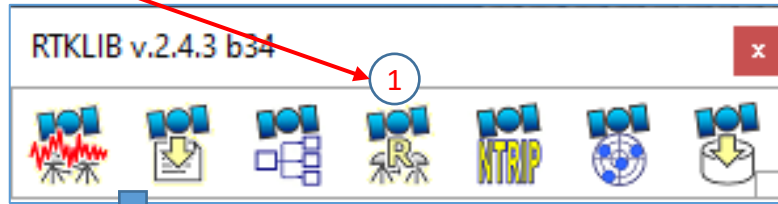
**Options**

- RINEX Ver: 3.02
- Sep NAV:  Station ID: 0000
- RINEX2 Name:
- RunBy/Obsrv/Agency: [ ] [ ] [ ]
- Comment: [ ]
- Maker Name/#/Type: [ ] [ ] [ ]
- Rec #/Type/Vers: [ ] [ ] [ ]
- Ant #/Type: [ ] [ ] [ ]
- Approx Pos XYZ:  0.0000 0.0000 0.0000
- Antenna Delta H/E/N: 0.0000 0.0000 0.0000
- Phase Shift  Half Cyc Corr  Iono Corr  Time Corr  Leap Sec
- Satellite Systems:  GPS  GLO  GAL  QZS  BDS  NavIC  SBAS
- Excluded Satellites: [ ]
- Observation Types:  C  L  D  S
- GNSS Signals?:  L1  L2  L3  L4  L5
- Mask... FCN...
- Receiver Options: [ ]
- Time Tolerance (s): 0.005 Debug: OFF
- Buttons: OK, Cancel



# GNSS Data Post-Processing

Select RTKPOST



**Select ROVER File**

**Select BASE File**

**Select BASE Navigation File.**  
This is RINEX ".NAV" file

**Modify Output File name**  
as necessary

**6**

**8**

Integer Ambiguity Res (GPS/GLO/BDS) **Fix and** ON OFF

Min Ratio to Fix Ambiguity: 3

Min Confidence / Max FCB to Fix Amb: 0.9999 / 0.25

Min Lock / Elevation (°) to Fix Amb: 0 / 0

Min Fix / Elevation (°) to Hold Amb: 10 / 0

Outage to Reset Amb/Slip Thres (m): 5 / 0.050

Max Age of Diff (s) / Sync Solution: 30.0 / ON

Reject Threshold of GDOP/Innov (m): 30.0 / 30.0

Max # of AR Iter / # of Filter Iter: 1 / 1

Baseline Length Constraint (m): 0.000 / 0.000

Input Base-station Coordinates or select Coordinate File

**9**

**Base Station**

Lat/Lon/Height (deg/m) Datum ITRF2014

35.666341998 139.792210860 59.7710

Antenna Type (\*: Auto) Delta-E/N/J (m): 0.0000 0.0000 0.0000

Select Processing Mode  
Try with different modes

**7**

**7**

Positioning Mode: Kinematic

Frequencies / Filter Type: L1+2 Forward

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

Rec Dynamics / Earth Tides Correction: OFF OFF

Ionosphere Correction: Broadcast

Troposphere Correction: Saastamoinen

Satellite Ephemeris/Clock: Broadcast

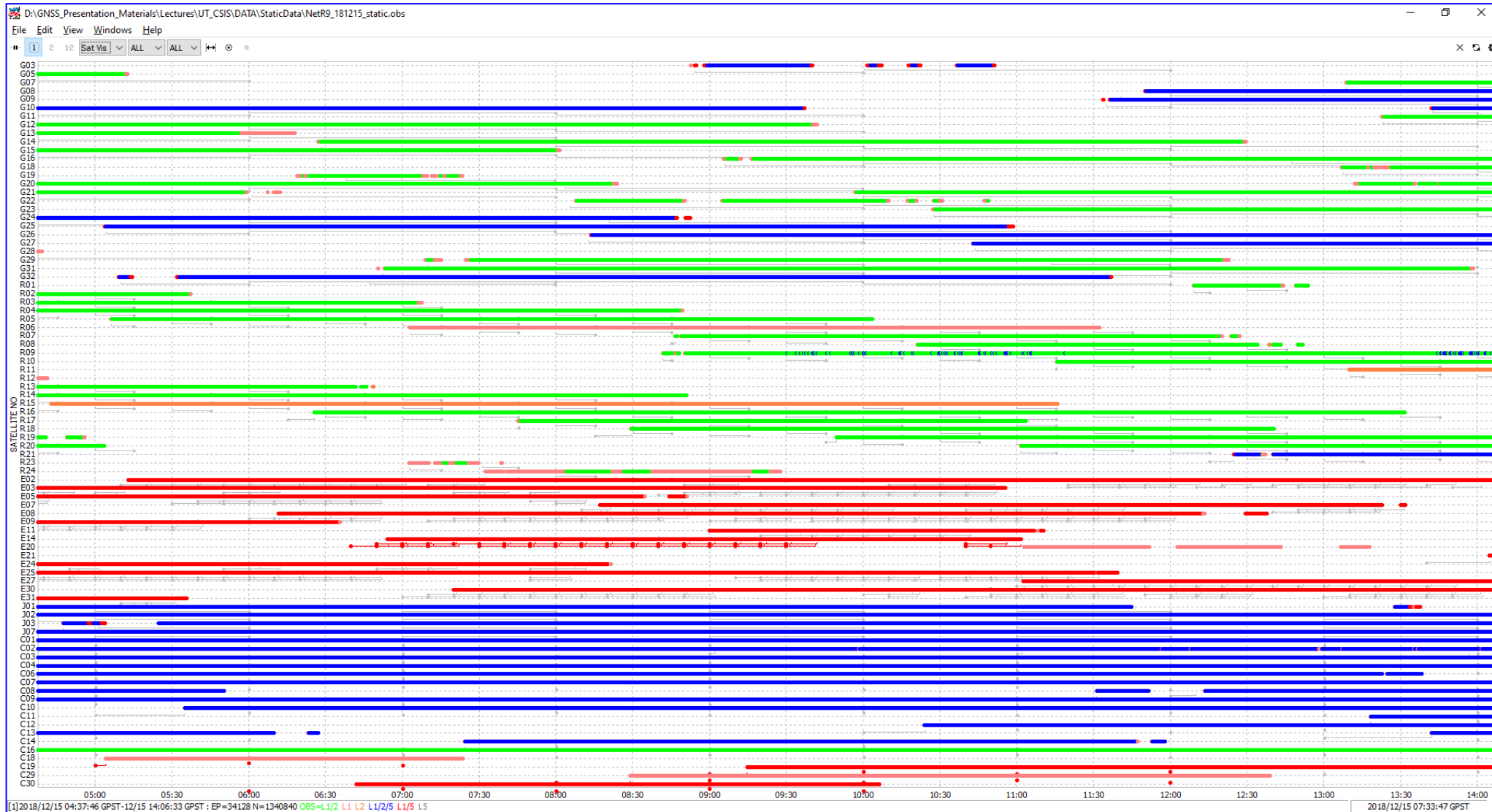
Sat PCV  Rec PCV  PhWU  Rej Ed  RAIM FDE  DBCorr

Excluded Satellites (+PRN: Included):  GPS  GLONASS  Galileo  QZSS  BDS  NavIC  SBAS

- Single: Standard Position Computation
  - (only Rover Data is necessary)
  - Few Meters accuracy: 3- 30m
- DGPS: DGPS Correction (code-Phase)
  - (Base and Rover Data necessary)
  - Meter level accuracy, 1 – 3m
- Kinematic: RTK
  - (Base and Rover Data necessary)
  - Centimeter level accuracy

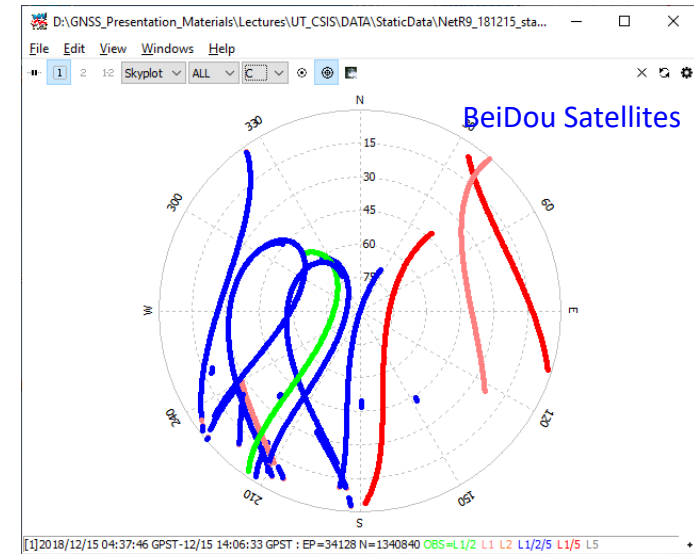
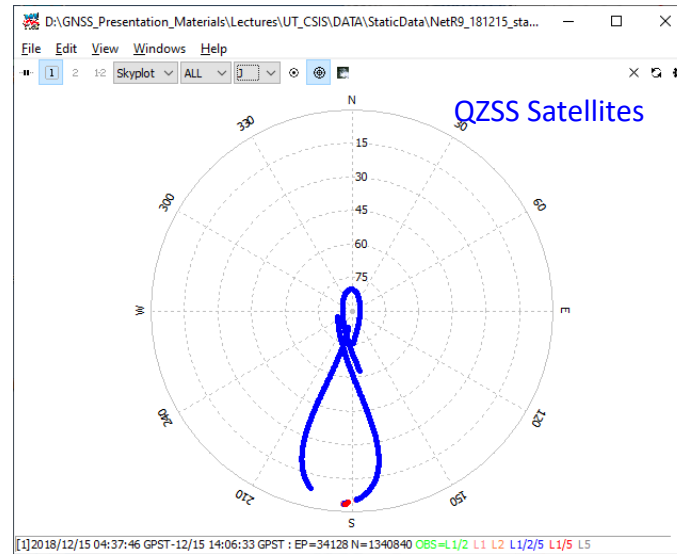
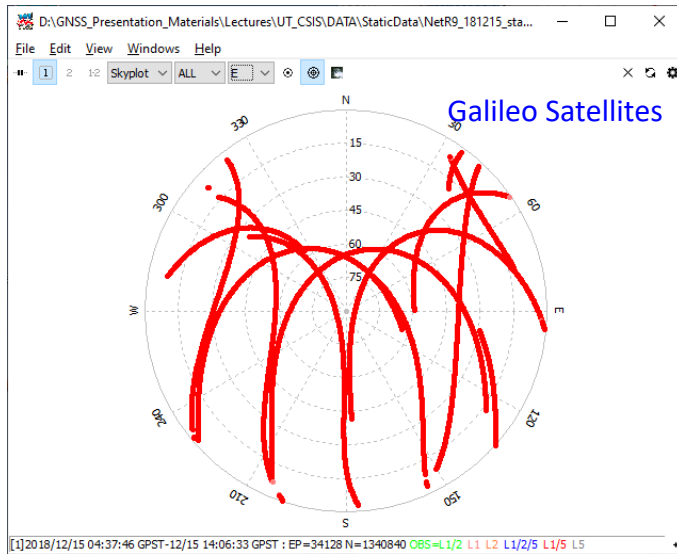
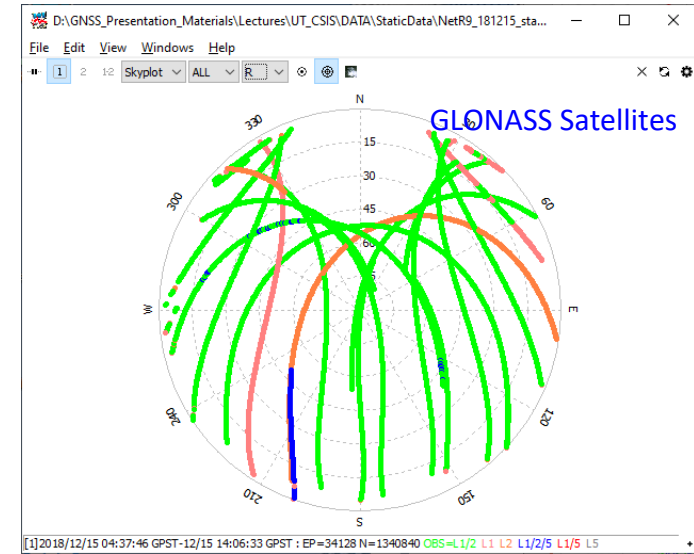
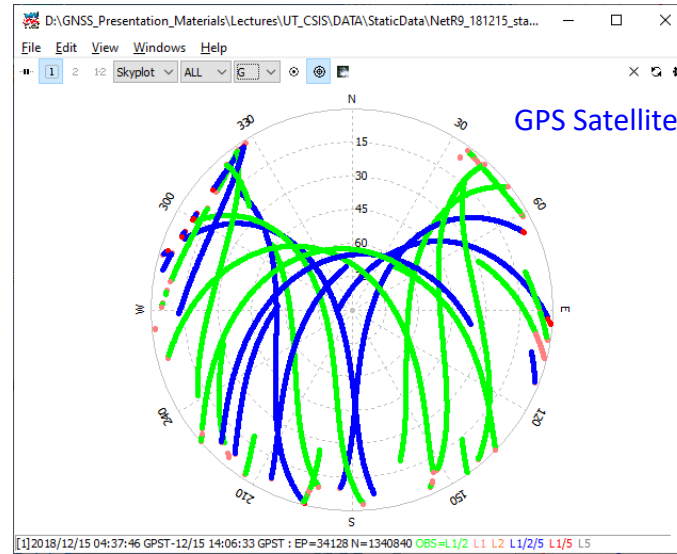
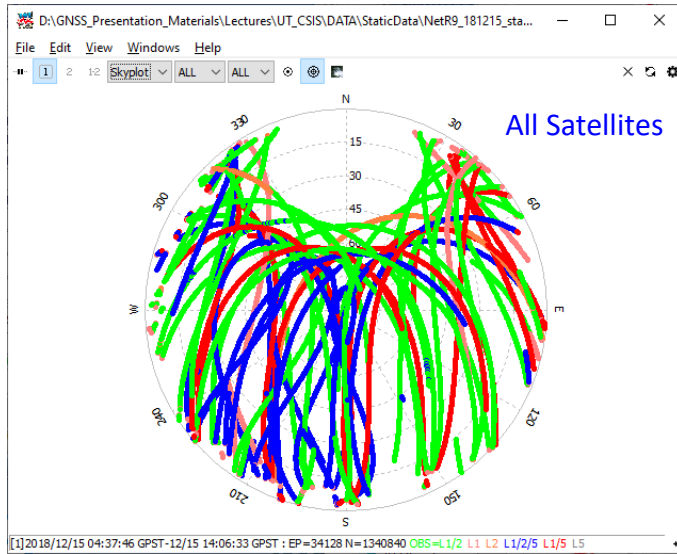
# Base-Station: Satellite Visibility Plot

Visible Satellites



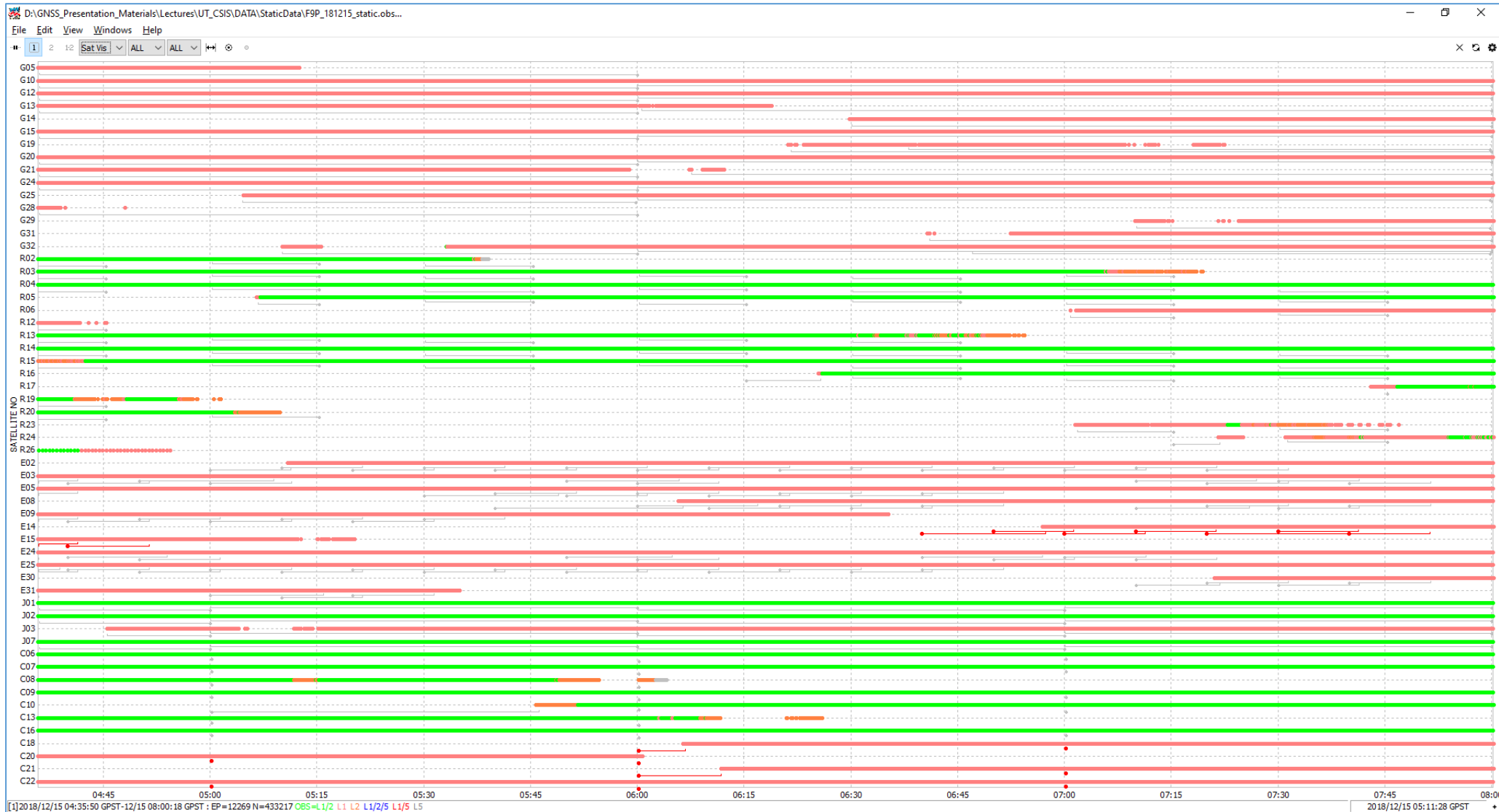
TIME, UTC

# Base-Station: Skyplot



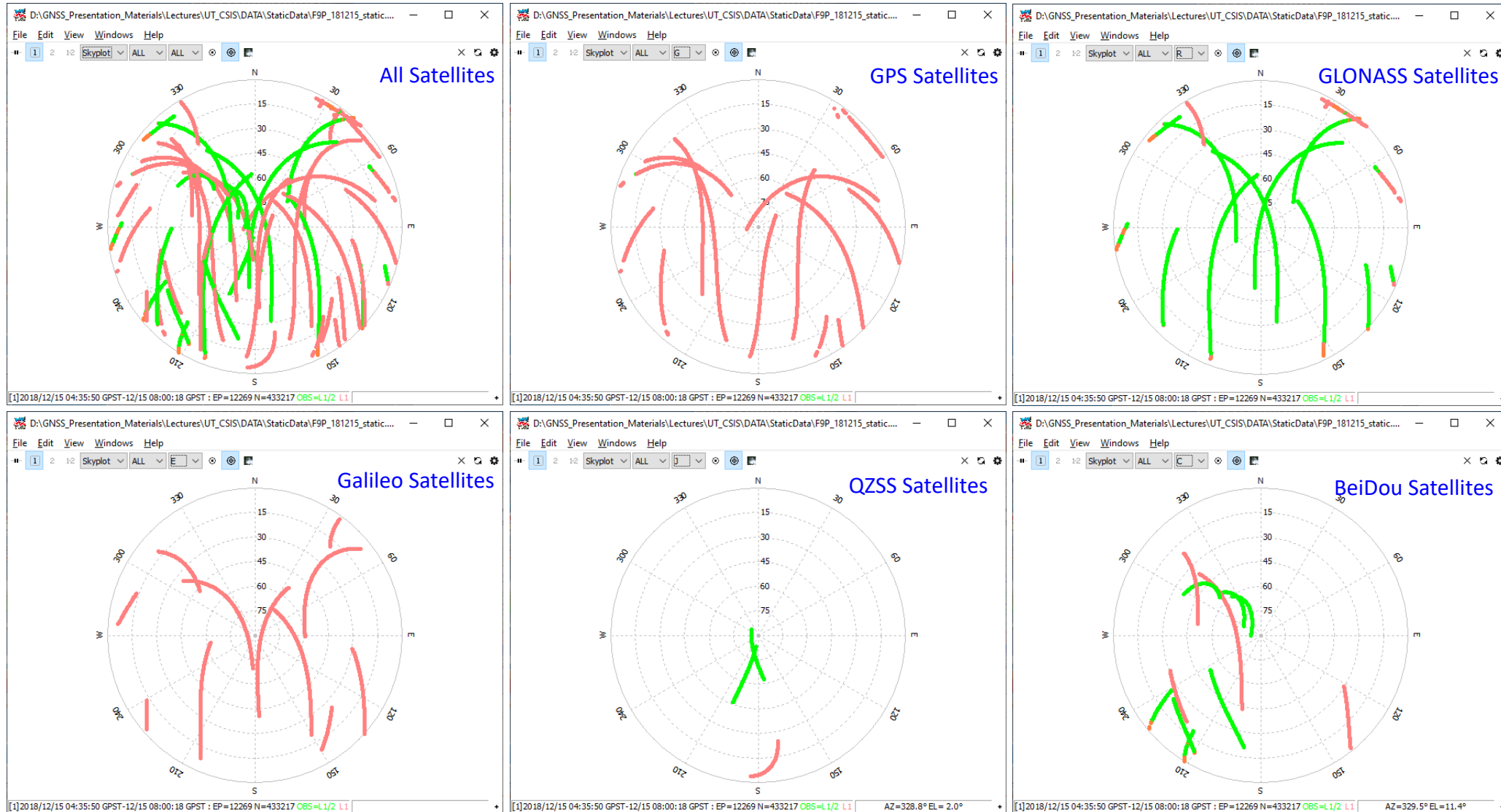
# Rover: Satellite Visibility Plot

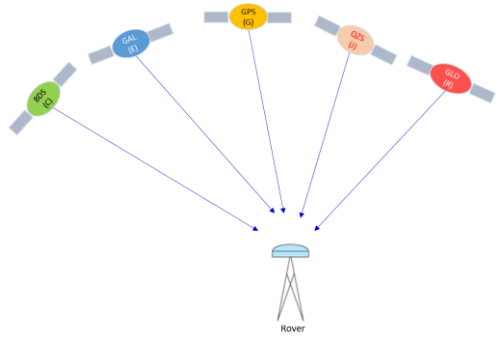
Visible Satellites



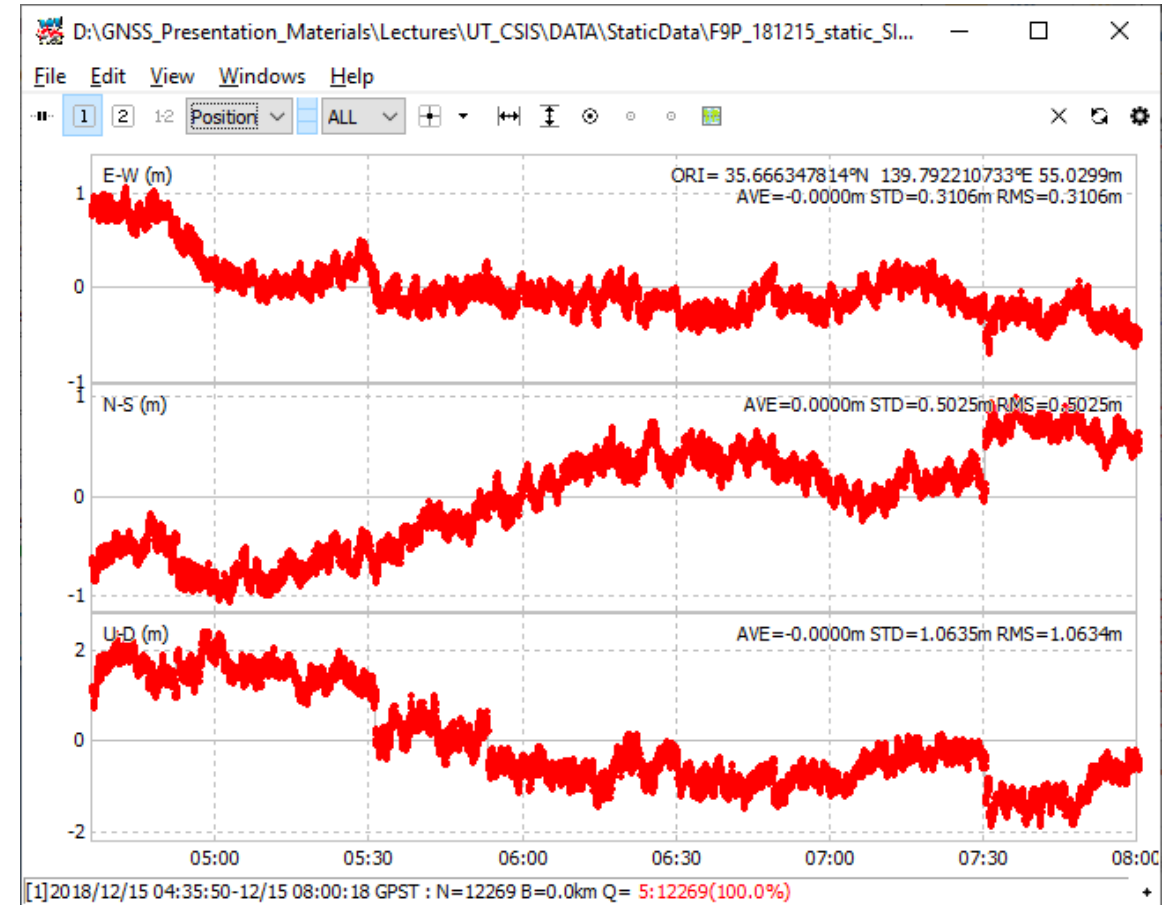
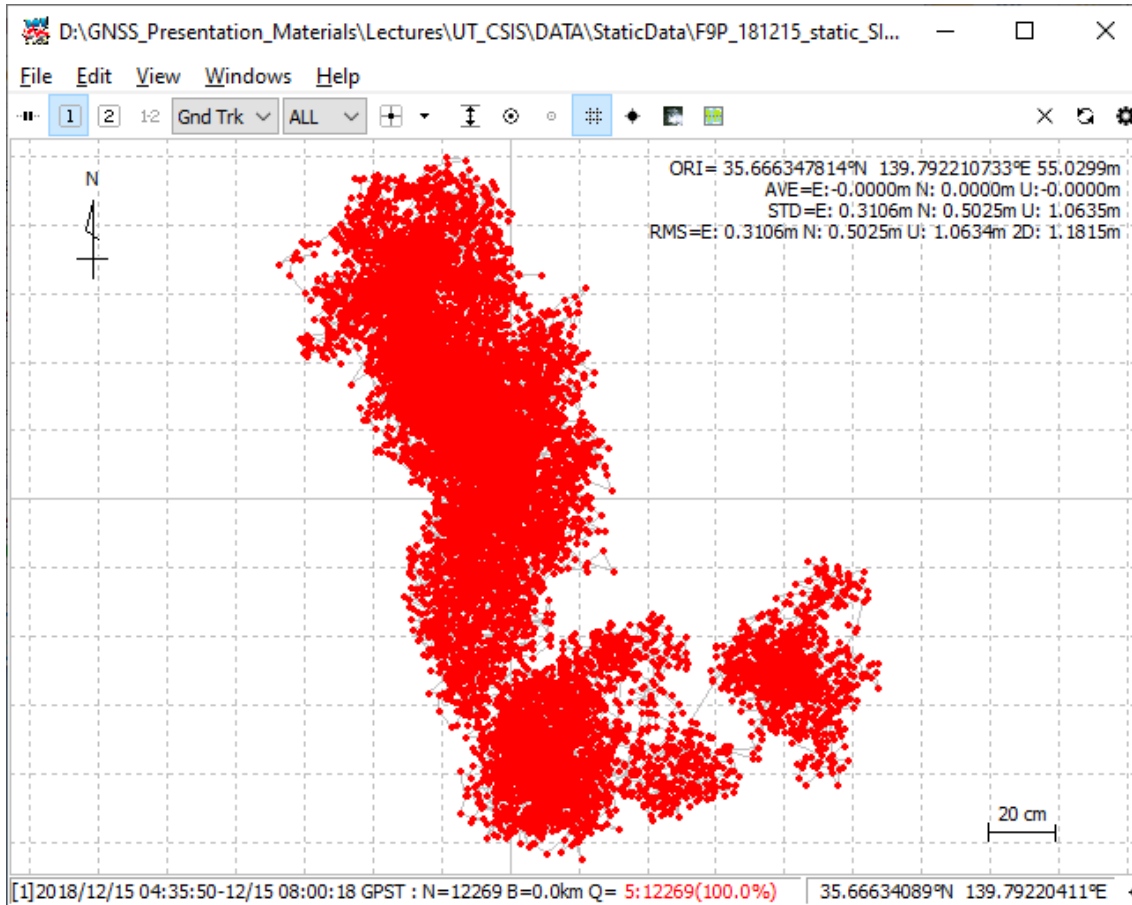
TIME, UTC

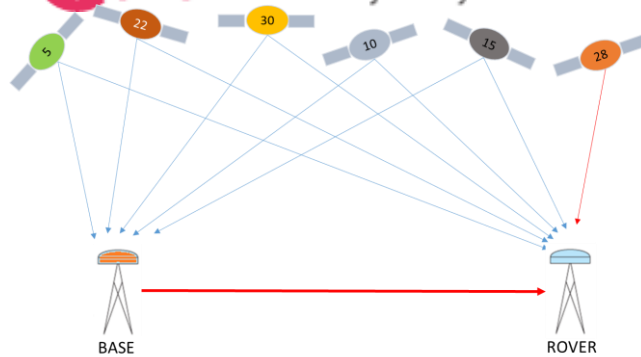
# Rover: Skyplot



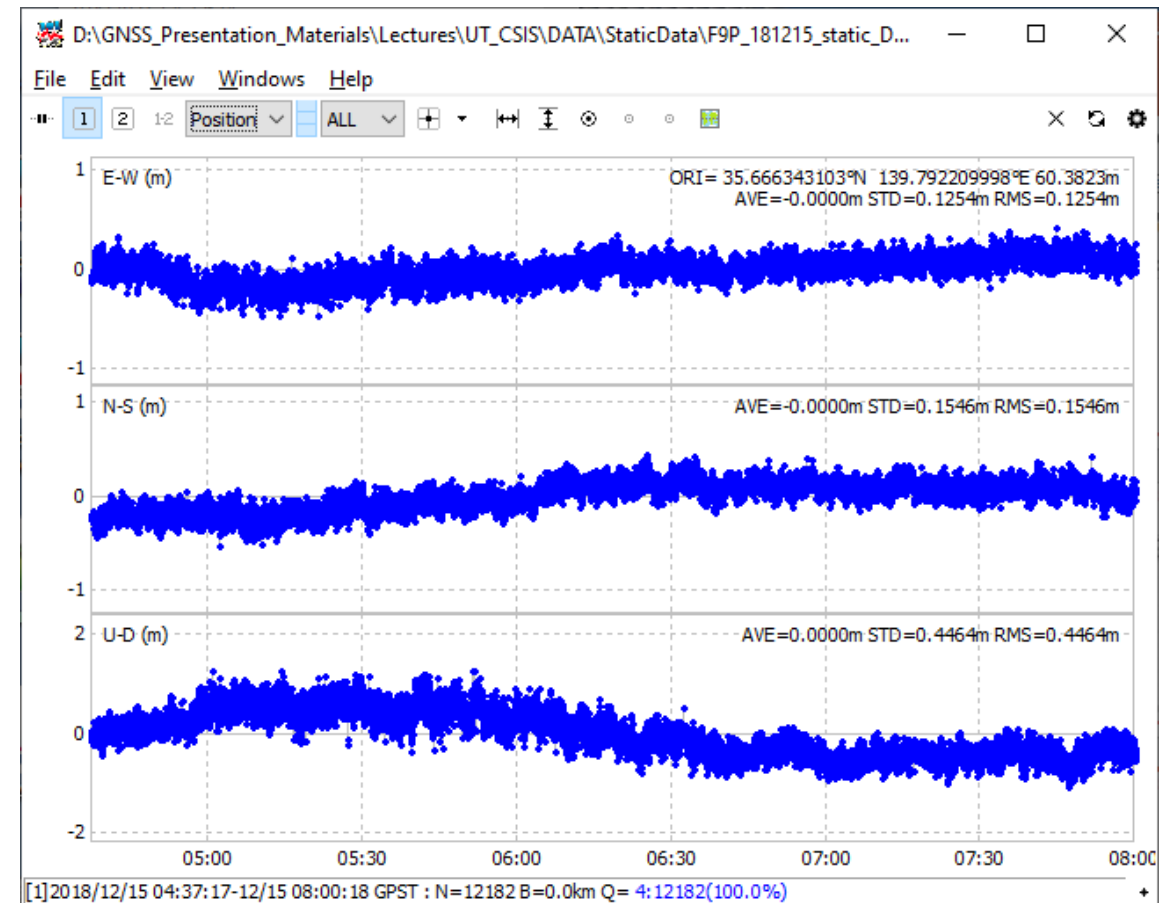
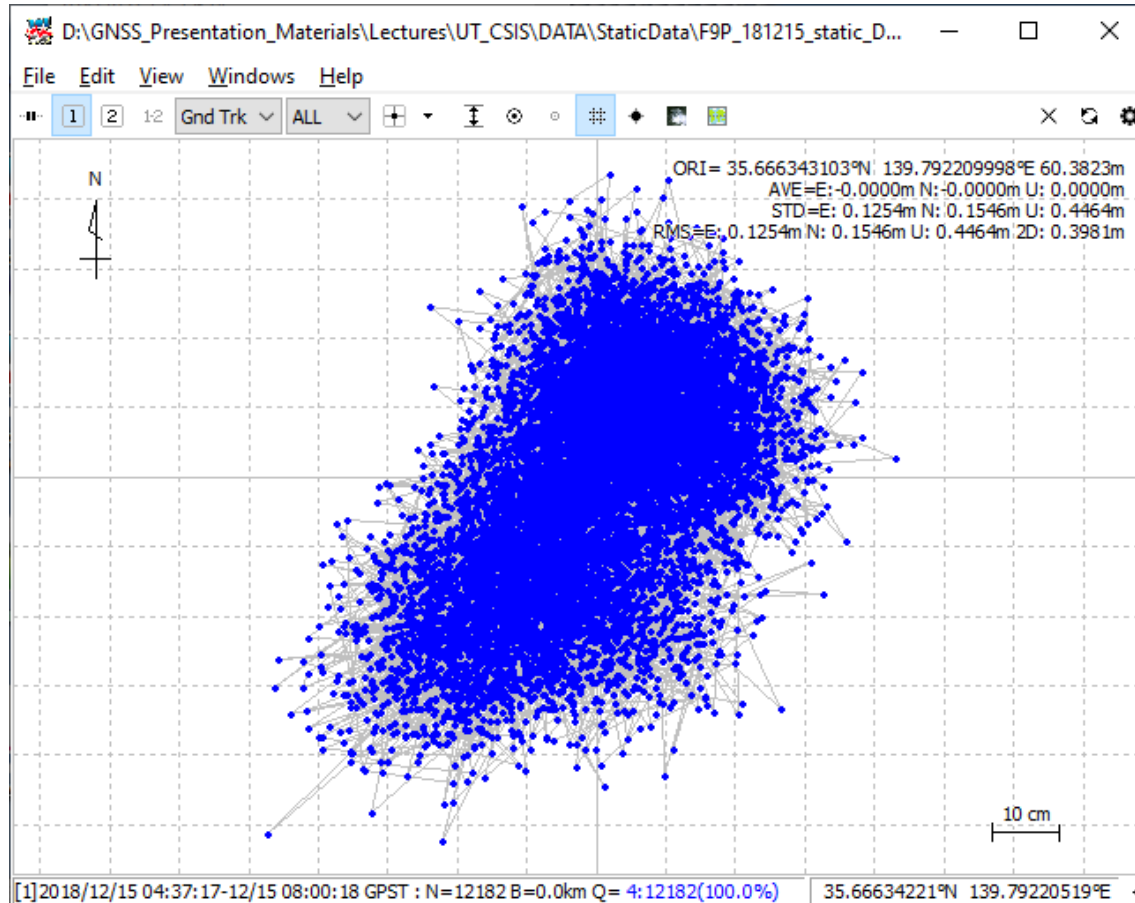


# GNSS Data Processing: Single

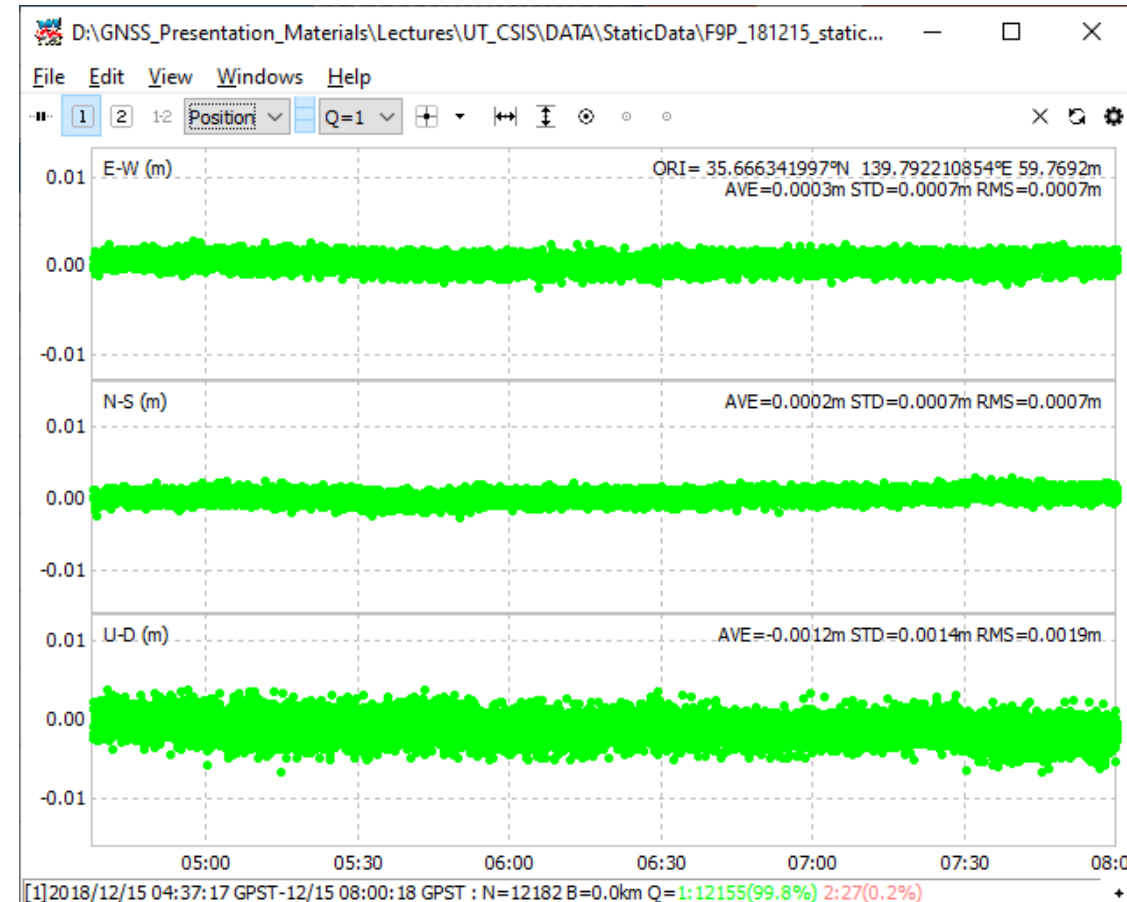
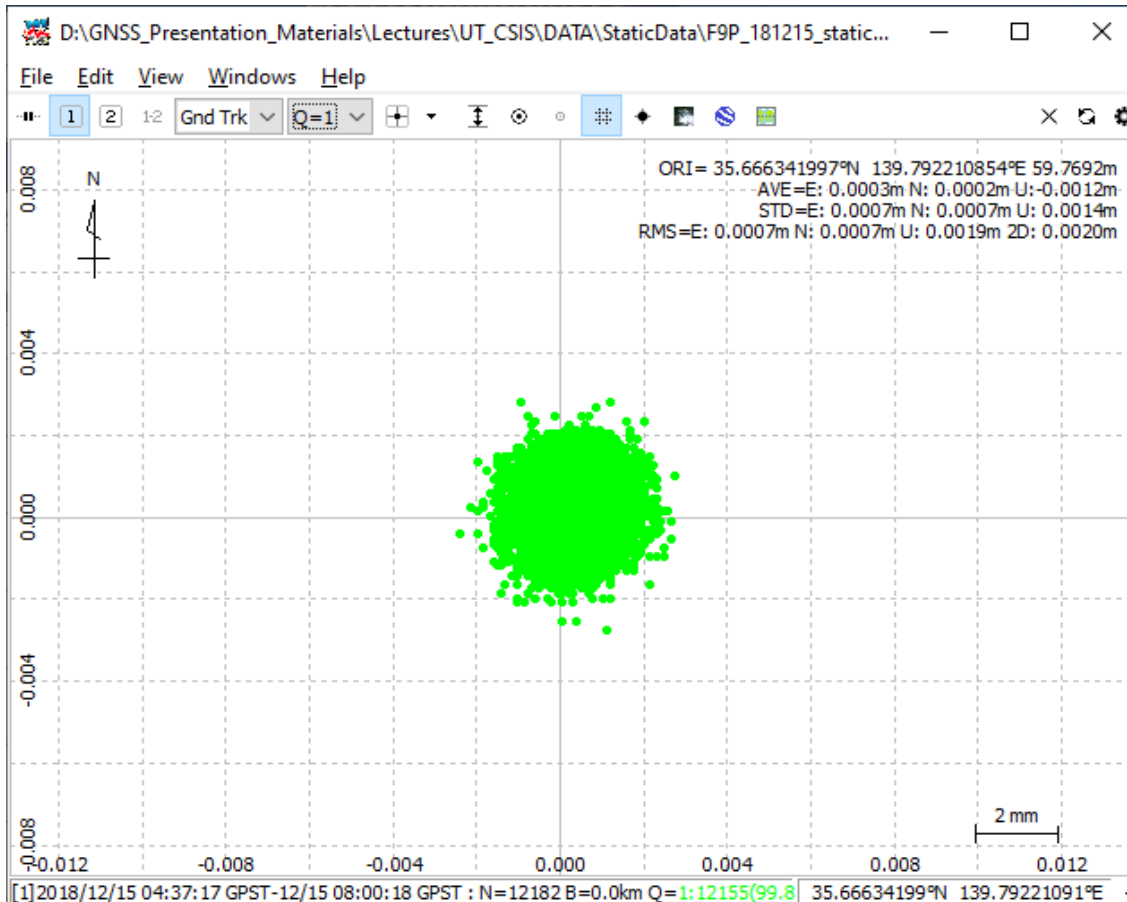
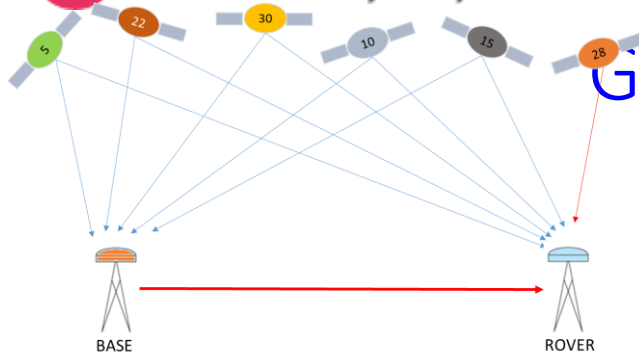




# GNSS Data Processing: DGPS



# GNSS Data Processing: Kinematic





# GNSS Data Processing: Single, DGPS, Kinematic

