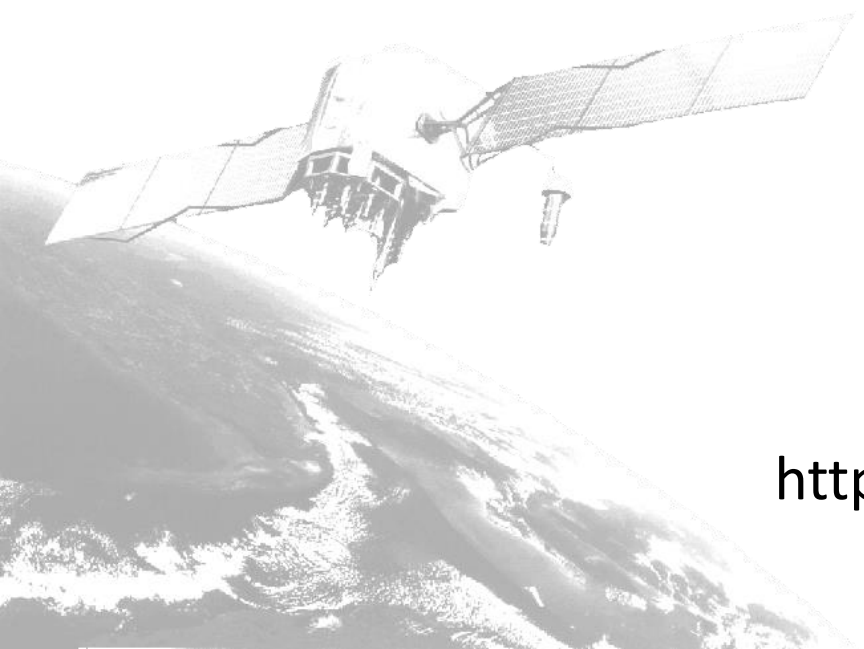# Low-cost RTK-GNSS for Agriculture
Procedure to set up the RTK-GNSS and its application for agriculture

Yoshihiro Iwaki, TUMSAT

http://store.shopping.yahoo.co.jp/agrii/

Objective

× Losing sight of work trace for tractor and agricultural machine degrease both the accuracy and efficiency of work

✓ Using GNSS for agricultural machine to guide the trace of machine in real-time

   × The accuracy of normal positioning results by consumer-grade GPS receiver is not enough

   ✓ **Set up the low-cost RTK-GNSS** (cm-level positioning) **environment**

✓ In the future, cause of agricultural and its machine will be more large-scale cm-level GNSS will be more required.

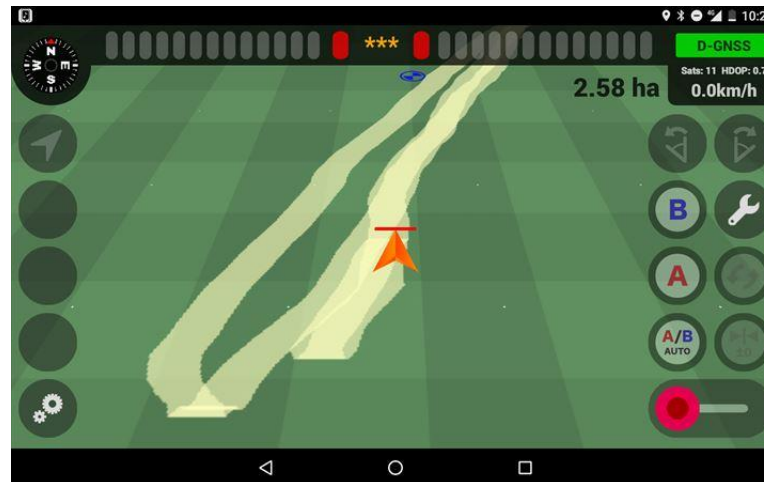# Normal positioning results by consumer-grade GPS receiver

Positioning results

consumer-grade GPS receiver
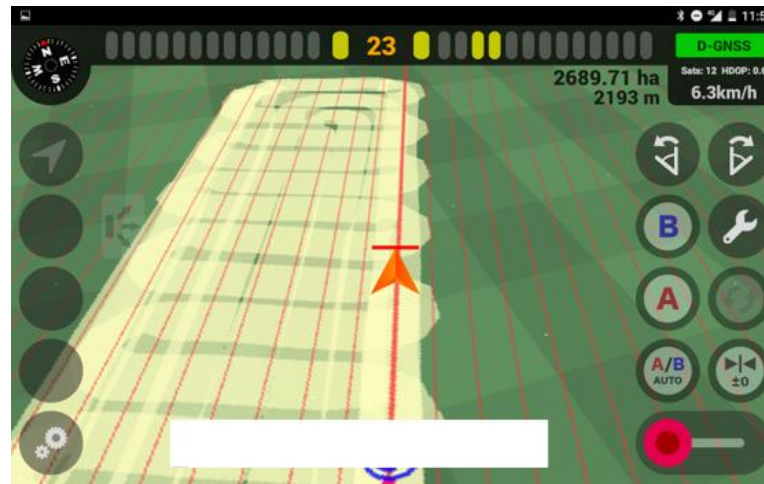
Accurate results

Relatively not accurate results

The accuracy is not enough

Example case of farming required cm-level positioning

Puddling for rice-planting		• Before the rice-planting, puddling the soil • Difficult to confirm the trace of tractor cause of muddy ground • Over one month for 12ha • **Under 30cm precision is required**
Spraying agrochemical with machine		• Arm of machine is 16m • Difficult to confirm the spread trace cause of wide arm and trace of machine • 7 times for a year and its takes 2-3days for each. For rice, wheat and soy beans • **Under 50cm precision is required**

→low-cost RTK-GNSS (cm-level positioning)

Set up the low-cost RTK-GNSS environment

Equipment

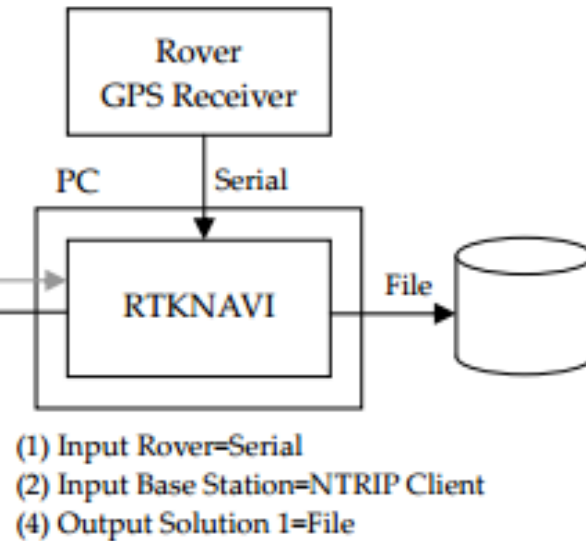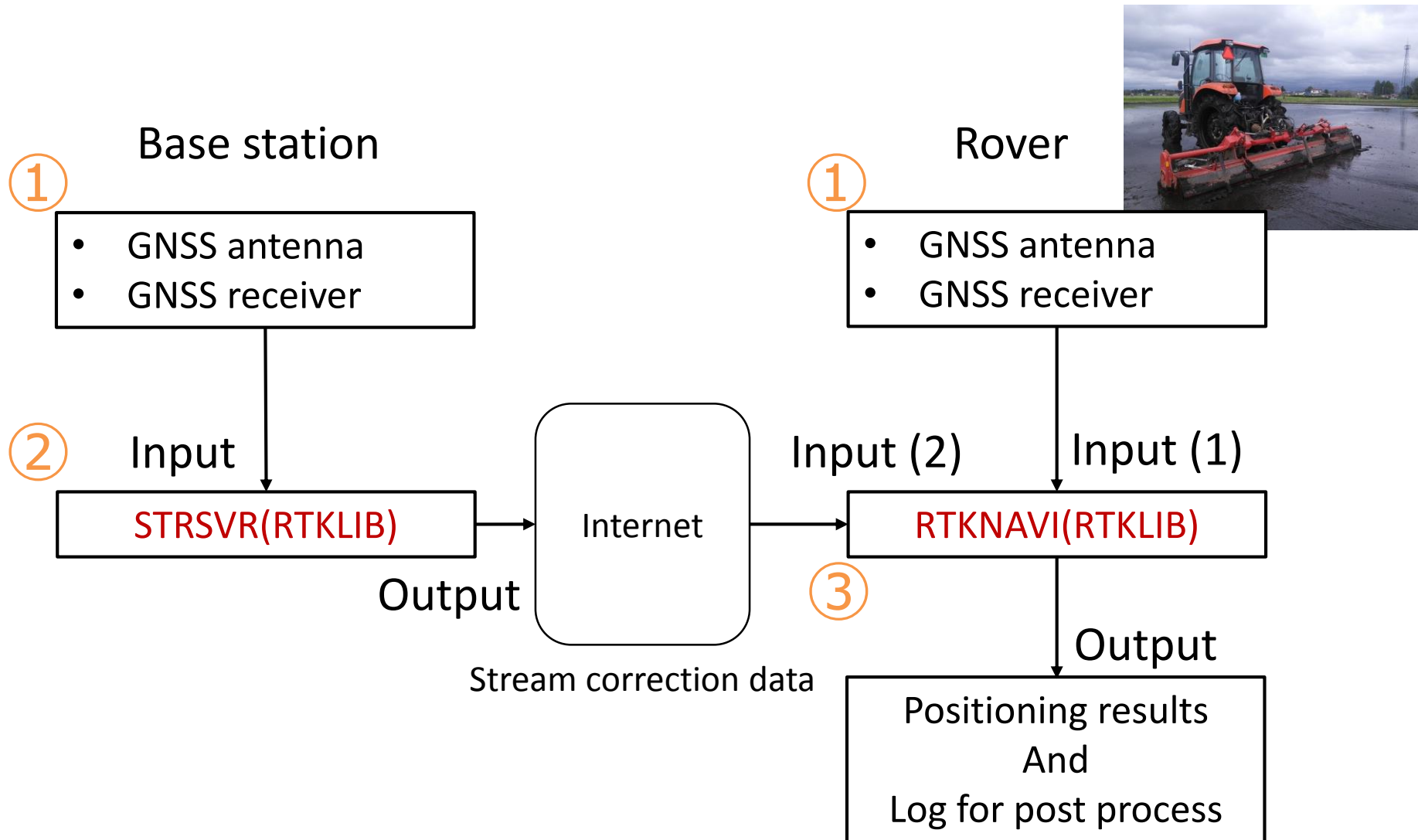|	Base station	Rover	From
PC	Windows VISTA	Windows10	
GNSS receiver	U-blox M8T	U-blox M8T	TUMSAT
Antenna	Tallysman	Tallysman	TUMSAT
Software	RTKLIB ver. 2.4.2 p12	RTKLIB ver. 2.4.2 p12	DL by website http://www.rtklib.com
	u-center_v8.21	u-center_v8.20	
Connection	Wi-Fi	Wi-Fi	

Set up the low-cost RTK-GNSS environment

- NTRIP caster

Base station   Rover

Reference Station

NTRIP Caster

NRTK provider

Internet

Rover GPS Receiver

PC   Serial

RTKNAVI

File

(1) Input Rover=Serial
(2) Input Base Station=NTRIP Client
(4) Output Solution 1=File

Set up the low-cost RTK-GNSS environment

Base station

①
- GNSS antenna
- GNSS receiver

Rover

①
- GNSS antenna
- GNSS receiver

② Input

STRSVR(RTKLIB)

Output

Internet

Stream correction data

Input (2)

Input (1)

③

RTKNAVI(RTKLIB)

Output

Positioning results
And
Log for post process
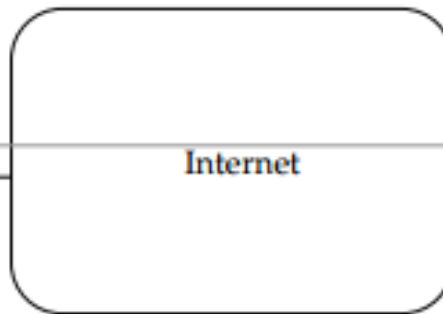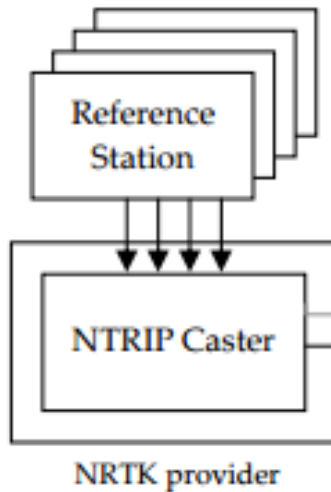
① Set up GNSS receiver

	Base station	Rover
PC	Windows VISTA	Windows10
Receiver	U-blox M8T	U-blox M8T
Software	u-center_v8.21	u-center_v8.20
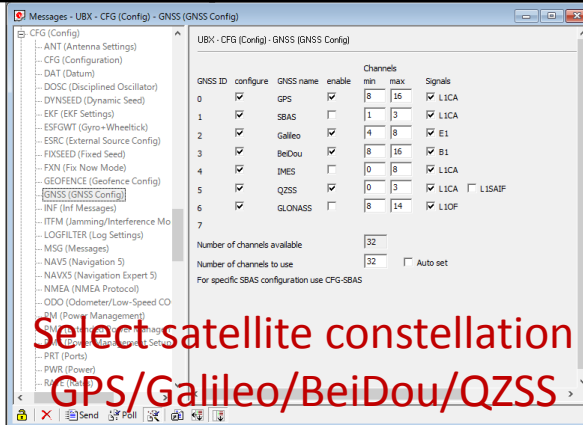
Select satellite constellation
GPS/Galileo/BeiDou/QZSS
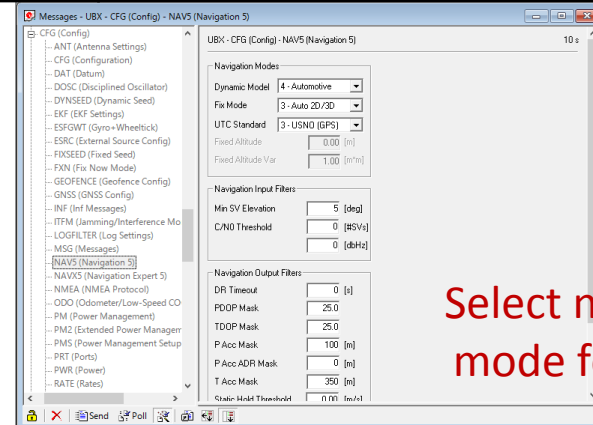
Select navigation mode for NMEA
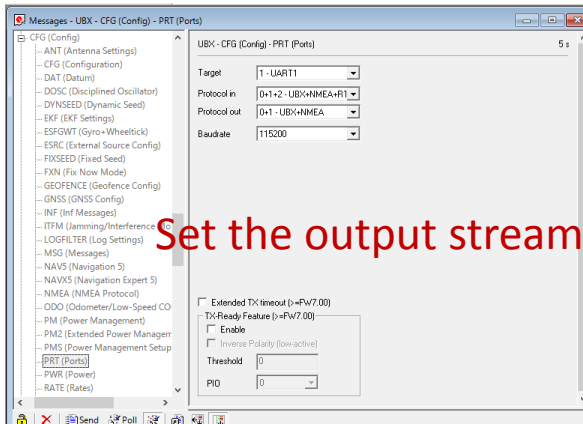
Set the output stream
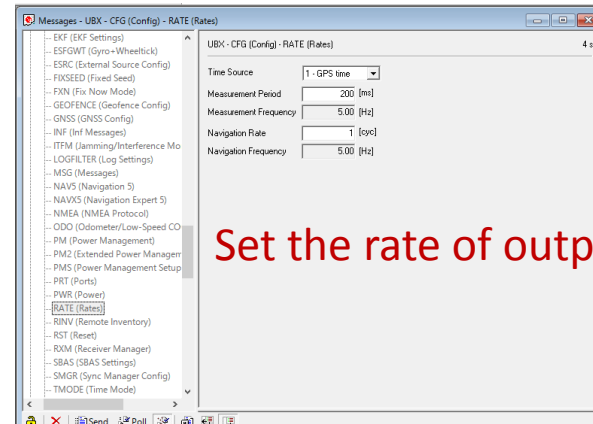
Set the rate of output

② Set up STRSVR(RTKLIB) for Base station

Input : GNSS receiver
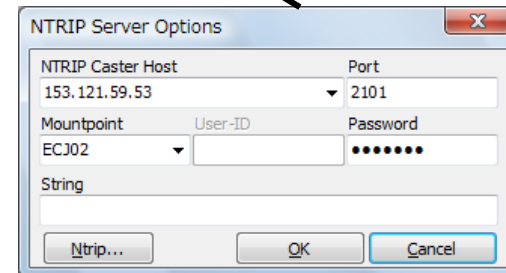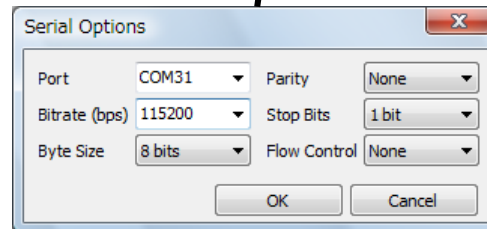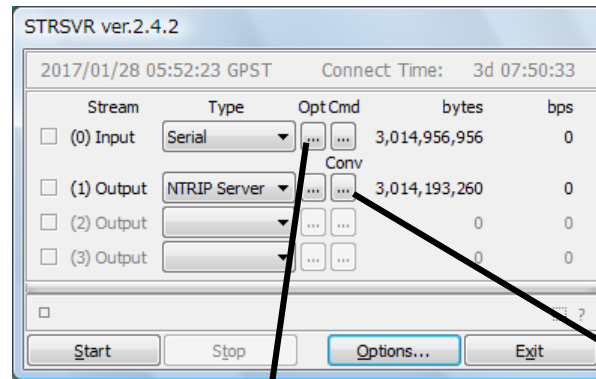
To NTRIP caster setting

③ Set up RTKNAVI (RTKLIB) for Rover

Input stream setting

Output stream setting
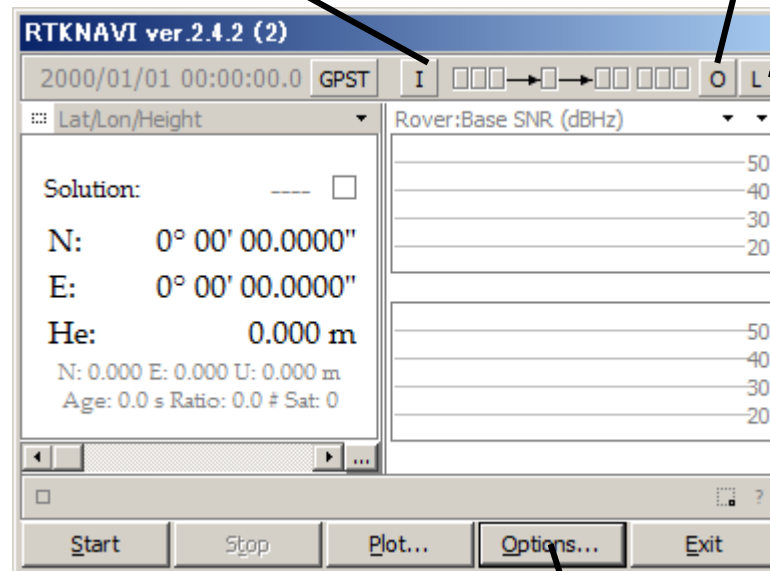
Log stream setting

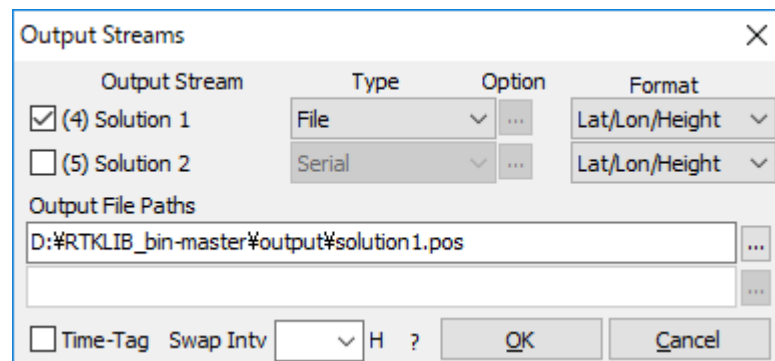RTKNAVI options
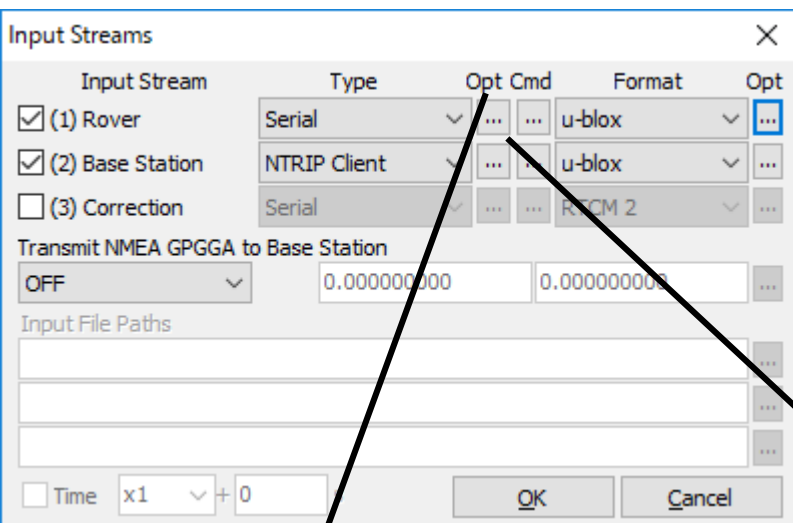
③ Set up RTKNAVI (RTKLIB) for Rover

RTKNAVI options

③ Set up RTKNAVI (RTKLIB) for Rover

Stream setting

Output

Input

Log
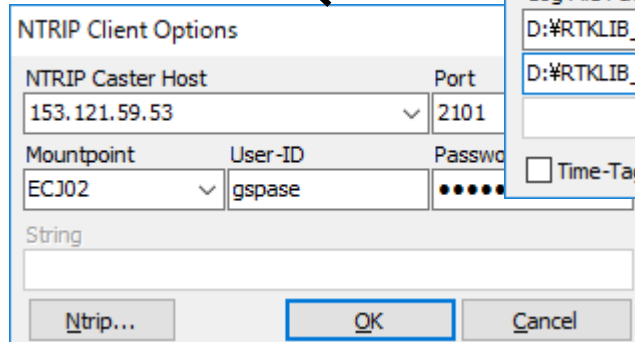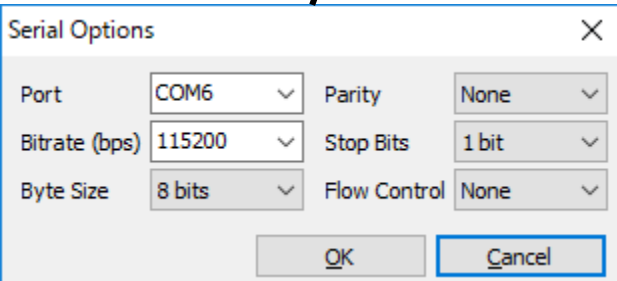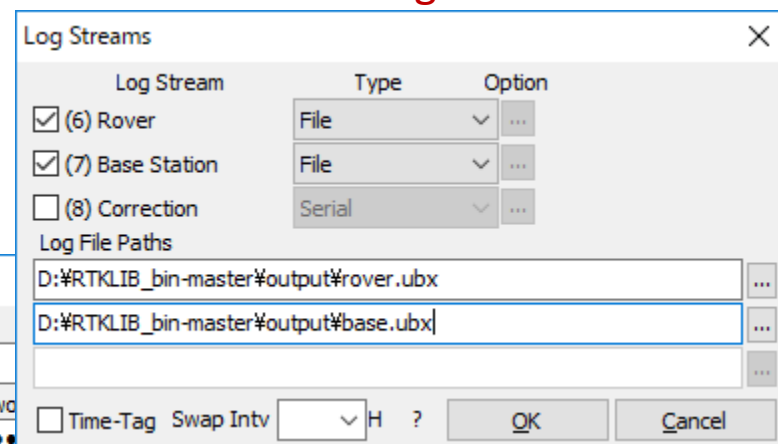
Setting up antenna for experiments

Base station			
Rover 3 case for experiment	Hood（front）	Rotary（back）	Cabin (mid）

Experiments field

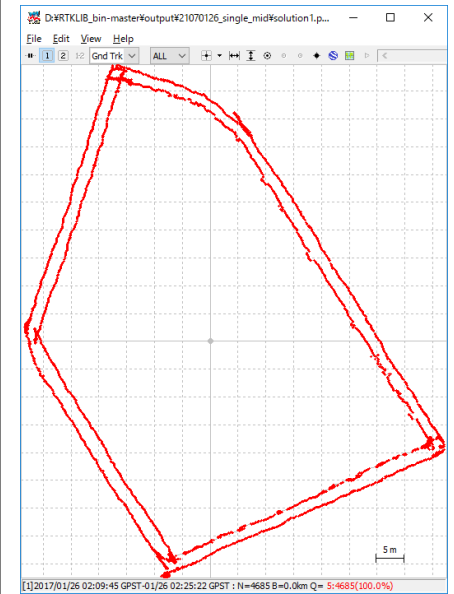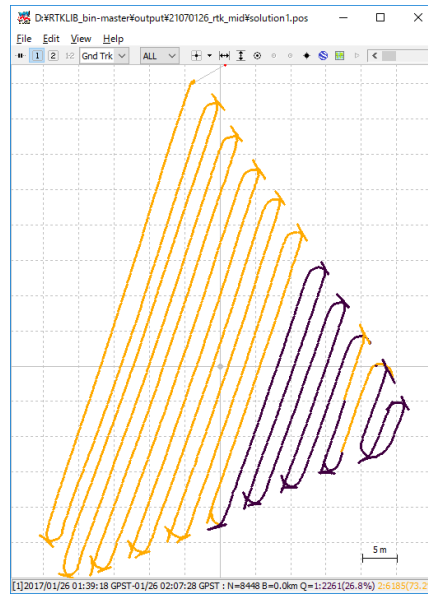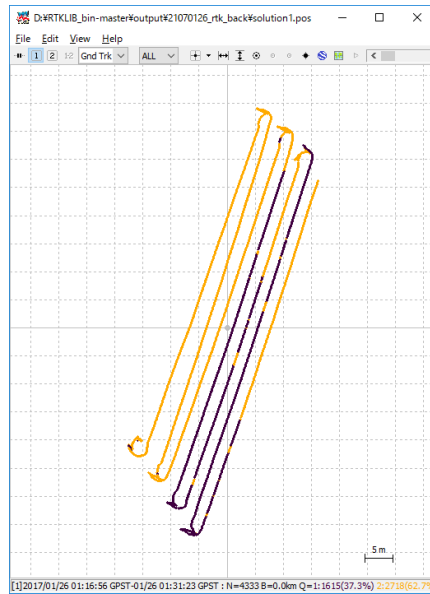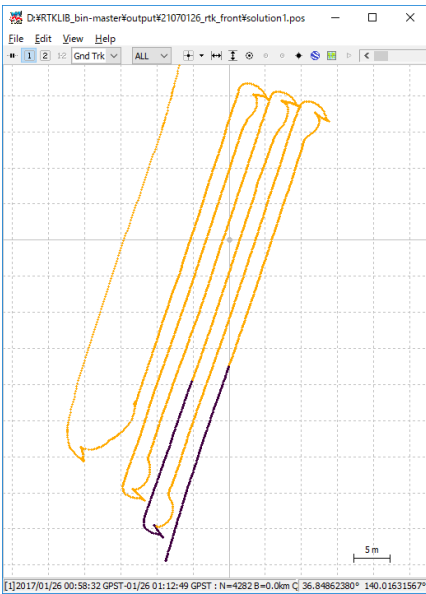

Tochigi pref. Ohtawara
2017/1/26 AM

Experiments results

Hood（front）	Rotary（back）	**Cabin（mid）**
RTK-GNSS		Single

- Results seems to accurate enough for farming
- Roof top of cabin is most suitable

Suggestions by Iwaki-san

- Were to buy receivers?
- How to connect Ntrip caster by their own?
- Suitable version of RTKLIB?
- Manuals for tuning options to RTKLIB
- Making applications to navigate tractor easily
- Recommendation for suitable equipment (ex. tablet PC)