High-accuracy Positioning Method for RTK Base Stations using PPP

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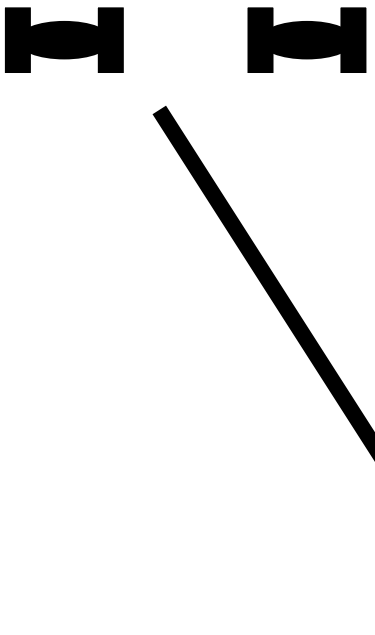
Why do we have to determine the position of base stations ?

- When we carry out RTK (Real Time Kinematic), positioning it is necessary to survey the true position of each base station.
- For base stations, this true position must be known with very high accuracy.
- Currently, RTK (carrier-phase DGNSS provides the highest level of positioning accuracy.
- However, if pre-surveyed base stations do not already exist, it is impossible to carry out RTK.

- **We focus on PPP (Precise Point Positioning) that does not depend on nearby base stations.**

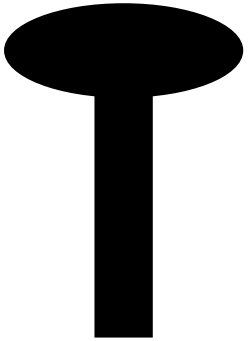
What is PPP ?

Satellites (GPS, GLONASS, BeiDou, Galileo and QZSS …)



Observation Values necessary for Positioning
(ex. Pseudo-range (code), Carrier-phase)

Precise Orbits and Clock Corrections
(Necessary for high-accuracy positioning.)



How do we use PPP ?

- When we determine true position using PPP, it is necessary to consider the frequency of the receiver being used.
- Currently, GPS receivers can be divided into **single frequency (only L1)** and **dual frequency (L1 and L2)** classes.
- Comparison of single frequency and dual frequency receivers:

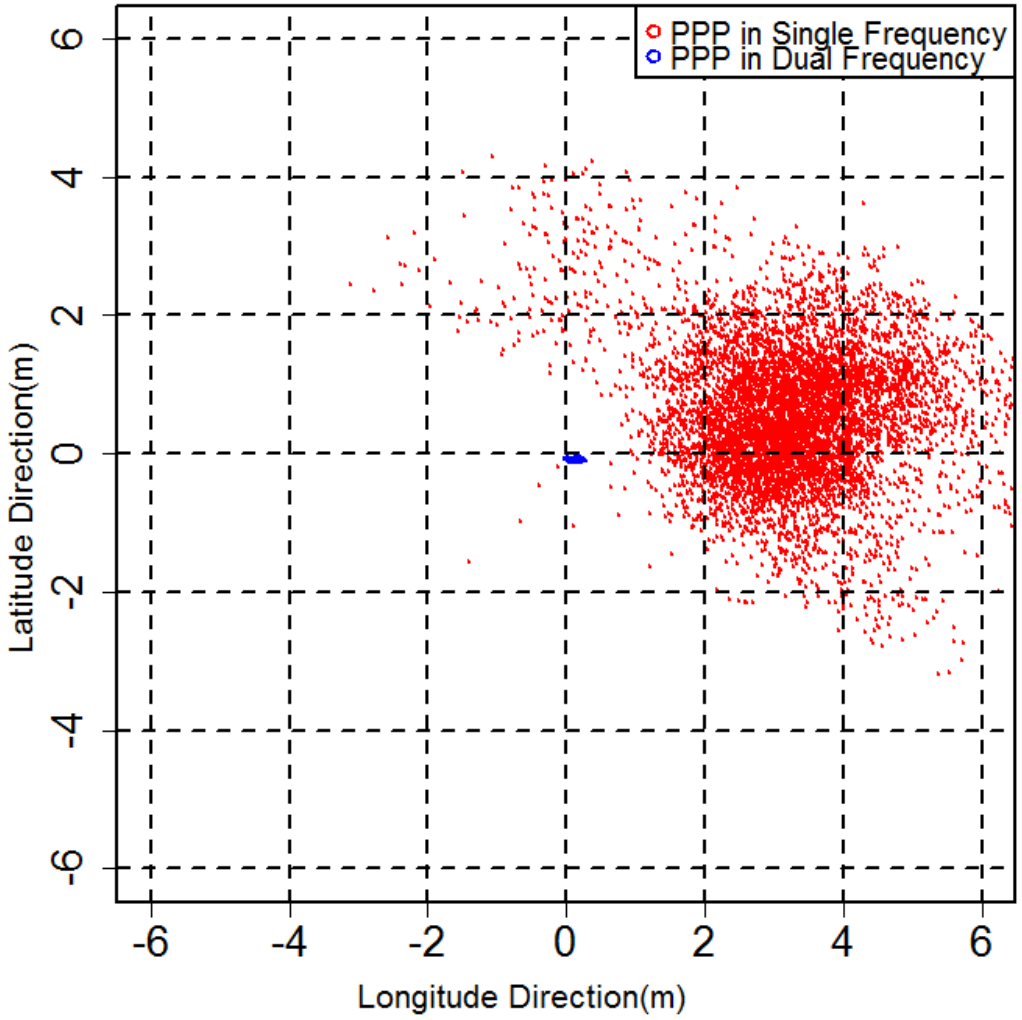
	Single Frequency	Dual Frequency
Price	**Low Cost**	**High Cost**
PPP Positioning Accuracy	**50-100 cm**	**1-10 cm**

- **If we estimate position using dual frequency, we will achieve higher accuracy than if we use single frequency.**

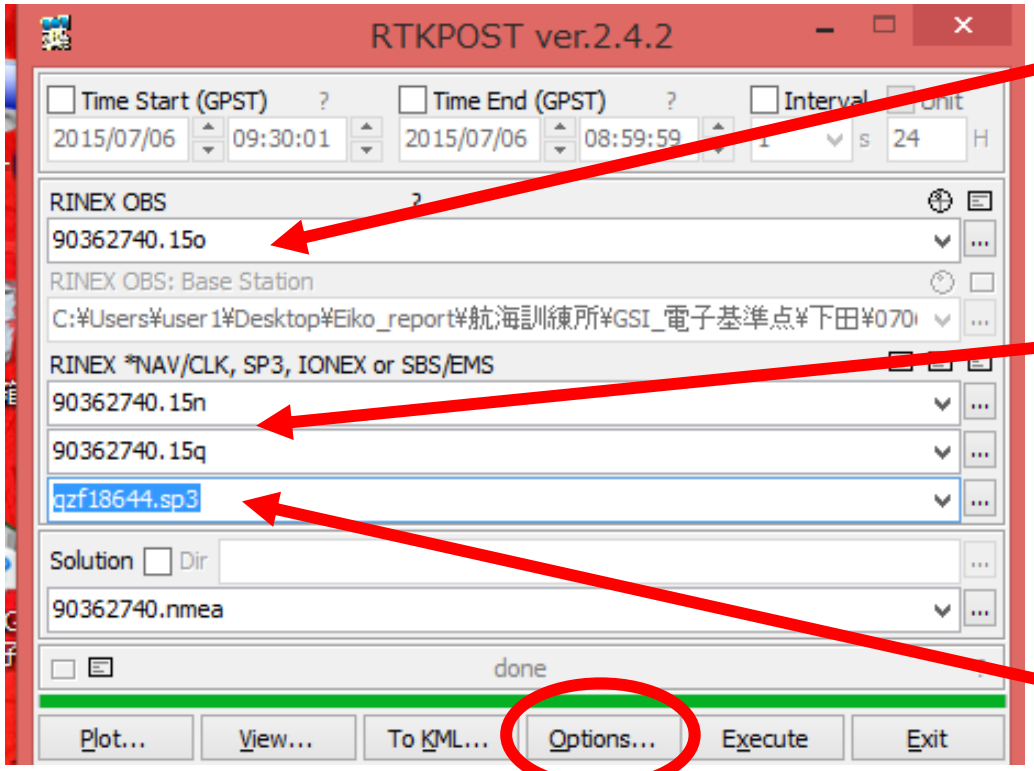
PPP Positioning Accuracy

Static Receiver Locations (in Thailand): Phangan Island (Single Frequency), Chula Univ. (Dual Frequency)

When we estimate the position using single frequency, there is a limit to the improvement of positioning accuracy using PPP.



PPP Positioning using RTKLIB



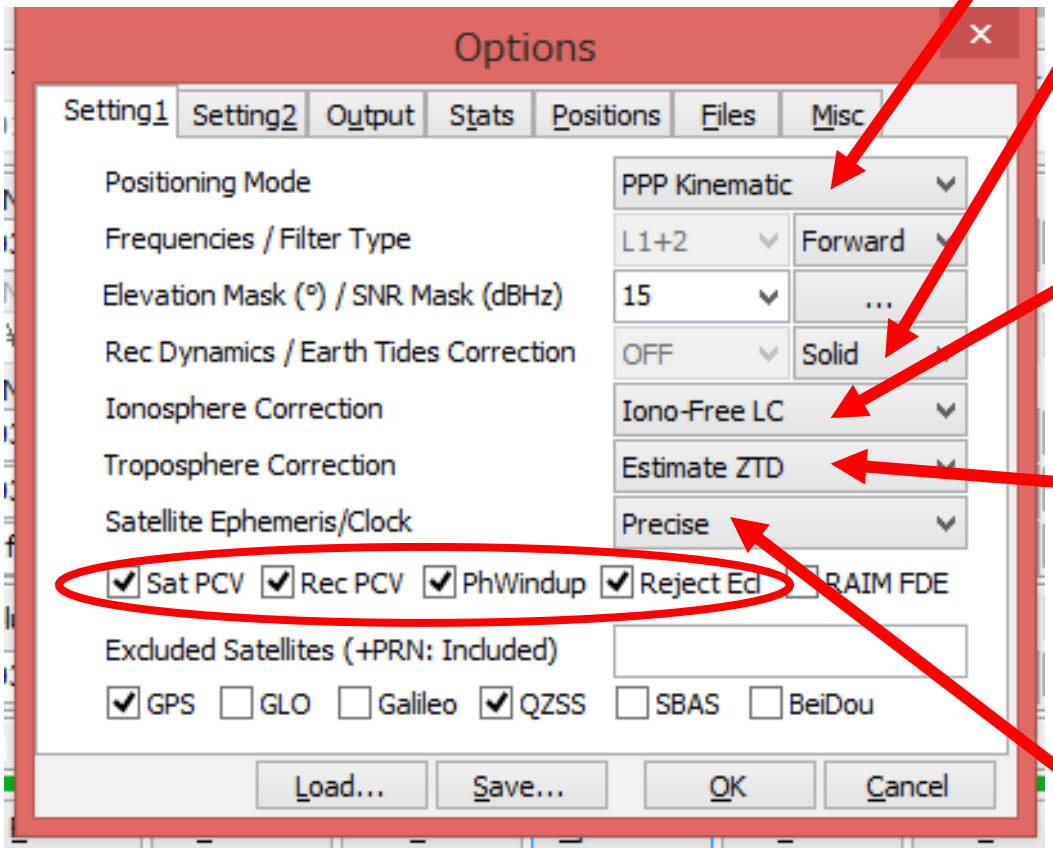
Select the observation data file.
(ex. File name is “90362740.15o”.)

Select the navigation data file.
(ex. File name is “90362740.15n”.)

Select the precise orbit and clock (PPP) data file.
(ex. File name is “qzf18644.sp3”(QZSS Final).)

Once you have finished this setup, please click “Options…”.

PPP Positioning using RTKLIB



Select “PPP Kinematic”.

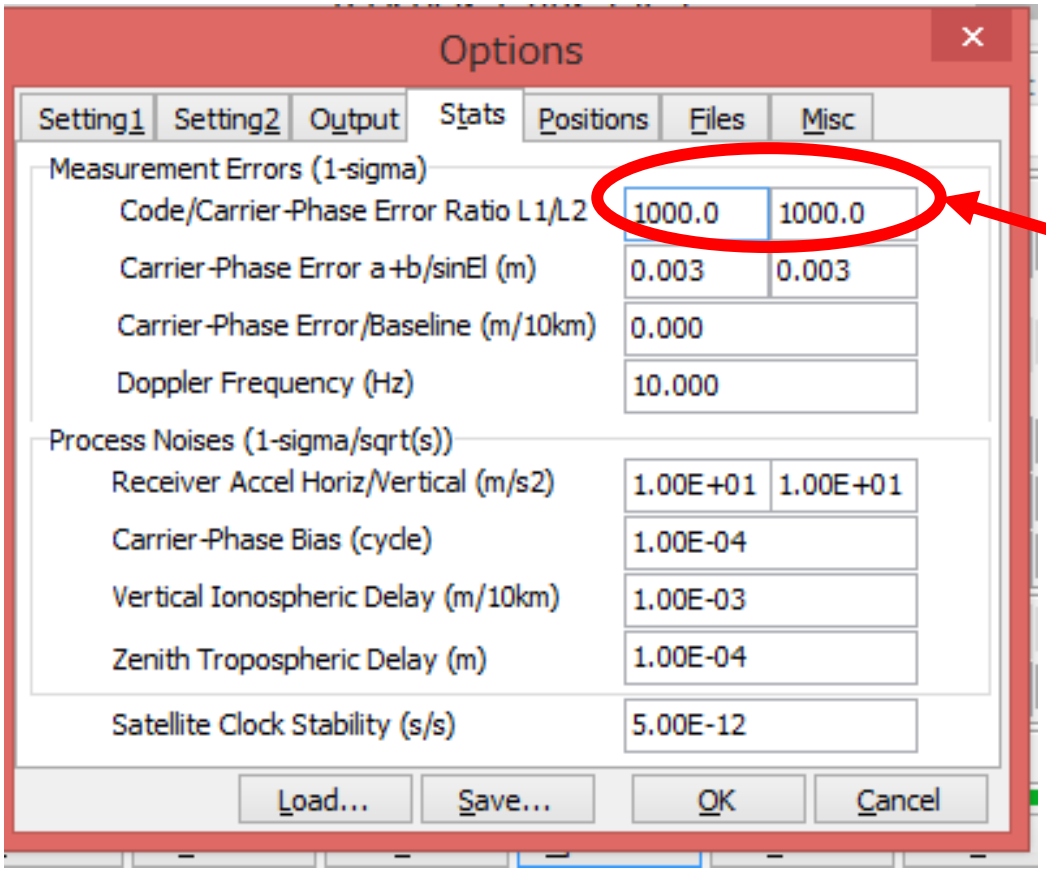
Earth Tides Correction is “Solid”.

Ionosphere Correction is “Iono-Free LC”.

Troposphere Correction is “Estimate ZTD”.

If you use precise orbit and clock information provided in sp3 format, please check “Precise”.

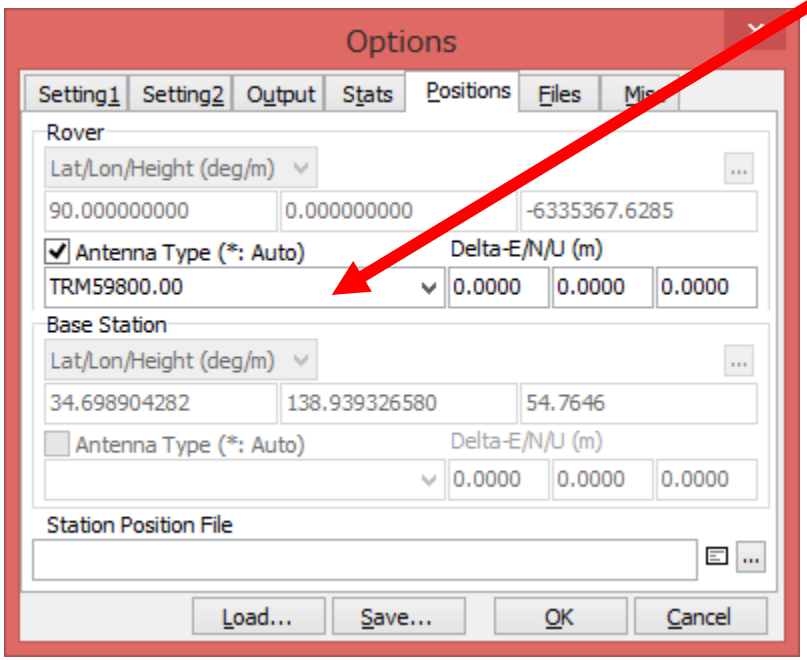
PPP Positioning using RTKLIB



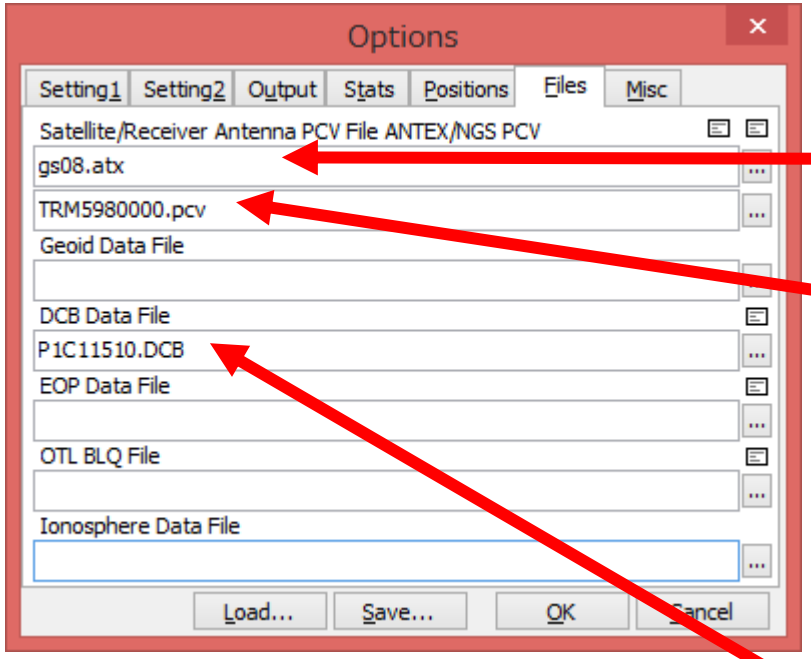
Code/Carrier-Phase Error Ratio L1/L2 has to be set as “1000.0”.

PPP Positioning using RTKLIB

Select the antenna type.



PPP Positioning using RTKLIB



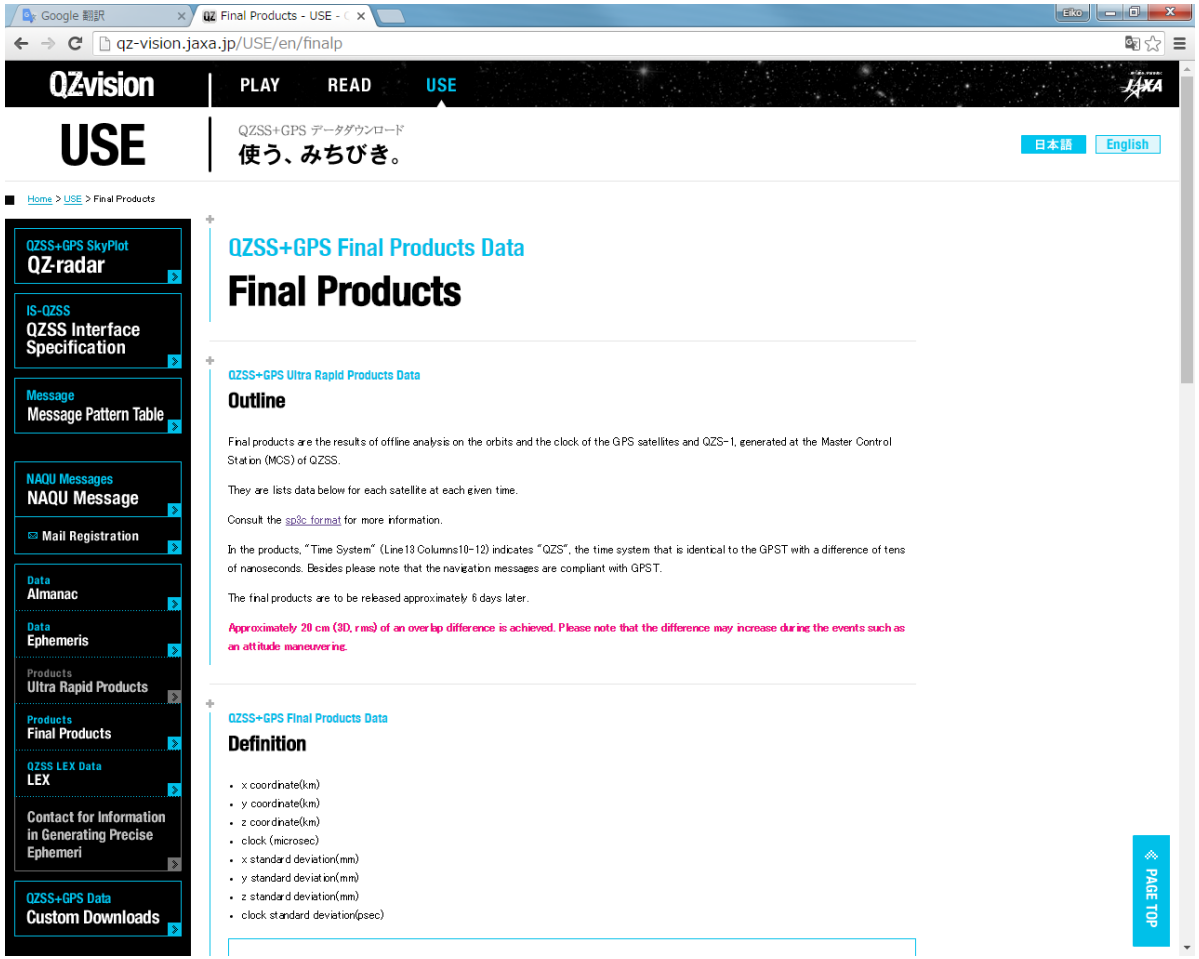
Select Satellite Antenna PCV File ANTEX/NGS PCV.
ANTEX file is provided by ".atx".

Select Receiver Antenna PCV File ANTEX/NGS PCV.
Receiver antenna pcv file is provided by ".pcv".

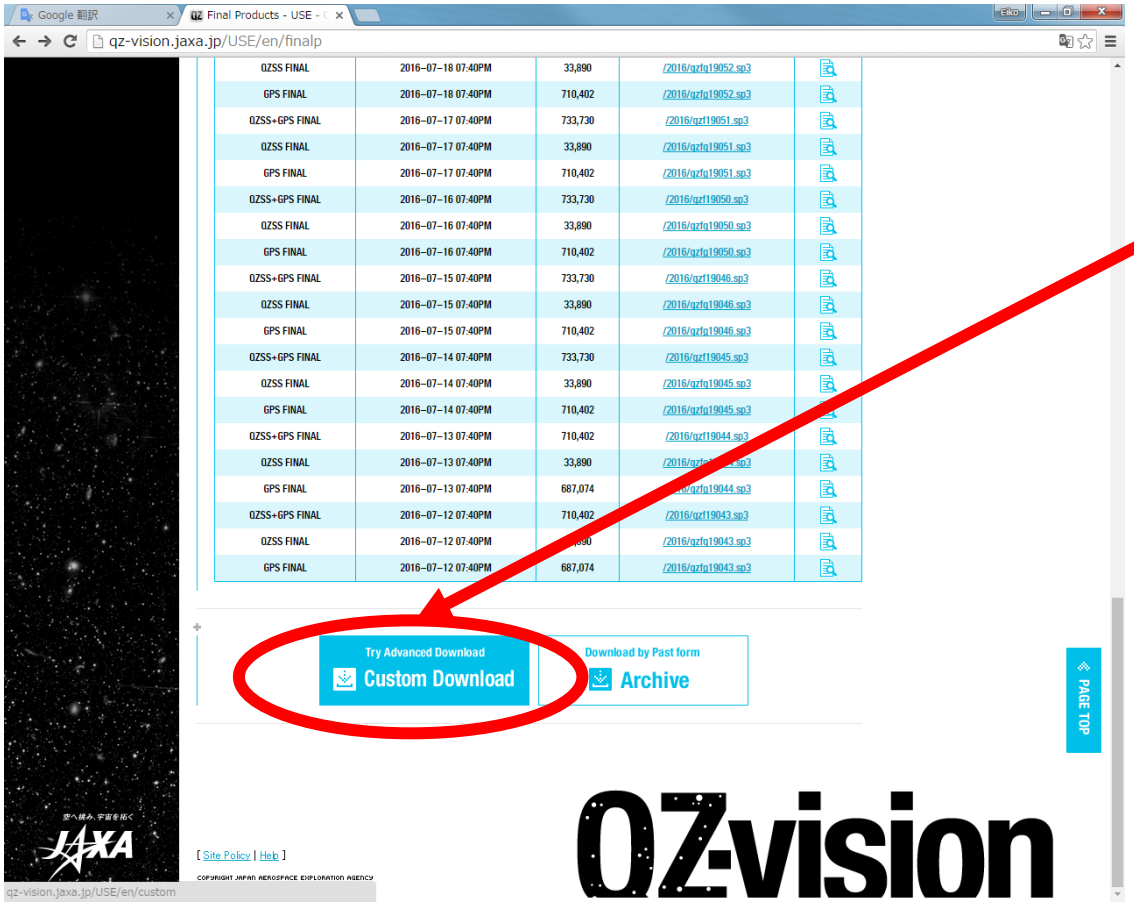
Select DCB(Differential Code Bias) File.

WEB Site to Download Precise Orbit and Clock (PPP) Information

- QZ-vision (http://qz-vision.jaxa.jp/USE/en/finalp)

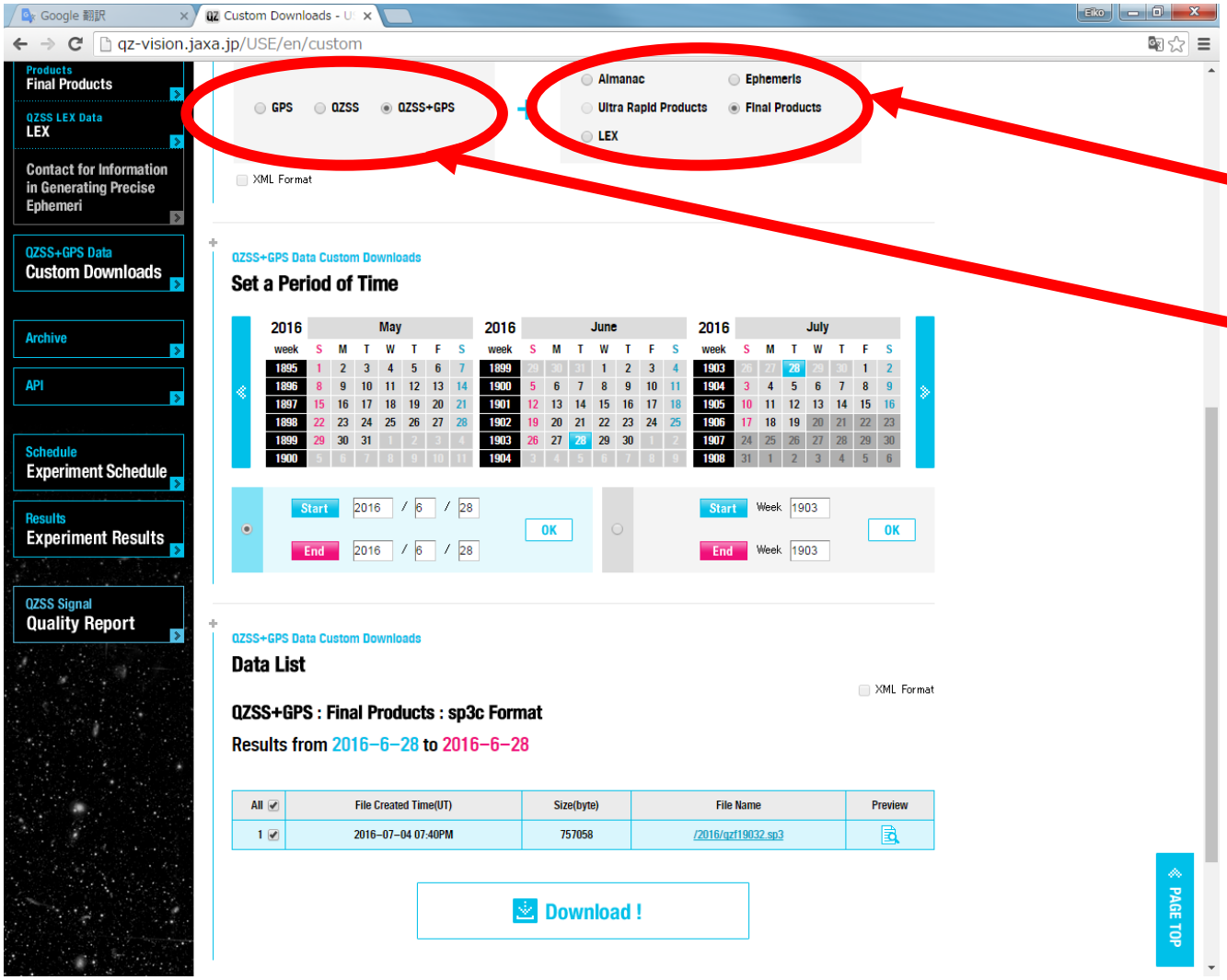


WEB Site to Download Precise Orbit and Clock (PPP) Information



Click
“Custom Download”.

WEB Site to Download Precise Orbit and Clock (PPP) Information



Select "QZSS+GPS" and "Final Products".