Positioning Method of Determining Base Stations using PPP

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

• When we carry out RTK (Real Time Kinematic), it is necessary to survey the true position of base stations.
• The true position must be achieved by high-precision positioning.
• Currently, the most high-precision positioning is said to RTK.
• However, if base stations do not exist in near place, it is impossible to carry out RTK.

• We focus on PPP (Precise Point Positioning) that does not depend on base stations.
What is PPP?

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

- Observation Values necessary for Positioning (ex. Pseudo-range (code), Carrier-phase)
- Precise Orbit and Clock Correction (It is necessary for high-precision positioning.)
How do we use PPP?

- When we determine the true position using PPP, it is necessary to focus on the frequency of the receiver for use.
- Currently, the frequency of the receiver to be used can be divided into **single frequency (only L1)** and **dual frequency (L1 and L2)**.
- Comparison of single frequency and dual frequency

<table>
<thead>
<tr>
<th></th>
<th>Single Frequency</th>
<th>Dual Frequency</th>
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</thead>
<tbody>
<tr>
<td><strong>Price</strong></td>
<td>Low Cost</td>
<td>High Cost</td>
</tr>
<tr>
<td><strong>Positioning Accuracy of PPP</strong></td>
<td>50-100cm</td>
<td>1-10cm</td>
</tr>
</tbody>
</table>

- If we estimate the position in dual frequency, it will be able to achieve higher accuracy positioning than single frequency.
Positioning Accuracy of PPP

Land Fixed Point: Phangan Island (Single Frequency), Chula Univ. (Dual Frequency)

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

Please set the observation data. (ex. File name is “90362740.15o”.)

Please set the navigation data. (ex. File name is “90362740.15n”.)

Please set the data of precise orbit and clock. (ex. File name is “qzf18644.sp3” (QZSS Final).)

If you finished these set up, please click “Options...”.
PPP Positioning using RTKLIB

Please check “PPP Kinematic”.

Earth Tides Correction is “Solid”.

Ionosphere Correction is “Iono-Free LC”.

Troposphere Correction is “Estimate ZTD”.

If you use the precise orbit and clock provided by sp3 format, please check “Precise”.
PPP Positioning using RTKLIB

Code/Carrier-Phase Error Ratio L1/L2 has to be provided by “1000.0″.
Please set your antenna type.

### Options

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<th>Setting2</th>
<th>Output</th>
<th>Stats</th>
<th>Positions</th>
<th>Files</th>
<th>Note</th>
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</thead>
<tbody>
<tr>
<td><strong>Rover</strong></td>
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</table>
PPP Positioning using RTKLIB

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

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

Please set DCB(Differential Code Bias) File.
WEB Site to Download Precise Orbit and Clock

• QZ-vision (http://qz-vision.jaxa.jp/USE/en/finalp)
WEB Site to Download Precise Orbit and Clock

Please click “Custom Download”.

OZ-vision
WEB Site to Download Precise Orbit and Clock

Please check “QZSS+GPS” and “Final Products”. 