

Evaluation of measurement accuracy in GPS observation - Relationship between temperature and analytical value -

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GPS is actively used to research crustal movement and earthquake prediction. The accuracy improvement of GPS is necessary and indispensable for these researches. Possible cause, which might drop accuracy, is the following three.

1. Influence of stream to reaching from satellite to antenna.
2. Cyclic variation of ground.
3. Convenience of observation equipment of GPS.

The accuracy improvement by the history of having been developed as a military purpose of the United States cannot hope for item 3. But, the influence of item 1 and item 2 and the relations of the GPS measurement accuracy are clarified. Moreover, it tries for the improvement of the measurement accuracy. This time, I want to clarify the relation of the GPS accuracy to the temperature especially.

Comparing measurement accuracy among larger difference in temperature in the morning and daytime, good analytical results were usually obtained with a condition of low temperature in the morning. However, vertical component does not calculate good standard deviation so that annual fluctuation became large.

I could harmonize such badly fluctuated curve including annual change with an averaged curve of the hour temperature very much. Taking the correlation in to account, it was clarified that a rise of temperature by 1 would rise of ground by 0.82mm. Based on the result, one could remove annual variation in GPS observation data; the standard deviation ranges from 19.08mm to 20.44mm. However, accuracy of vertical component is still bad compared with the horizontal component.

Moreover, daily fluctuations in temperature are also evident. This environmental effect means a selectivity of vertical ground motion due to daily temperature variation.

The following things have been understood as a result.

1. A periodic annual change of vertical component demonstrates a good correlation with the atmosphere temperature.
2. Since the cause of a periodic annual change can be removed by considering the above relation, the decision accuracy of the trend (location and geodesy) can be improved.
3. GPS observation data contain a daily variation as well as an annual periodicity, it is necessary to consider it in the analysis.