

On the error source of the vertical component of GPS measurements in mountain areas

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It is thought that the accuracy of GPS measurement in the mountain areas is poorer than that in the flat areas, especially in the vertical component. In order to clarify the cause of the accuracy decrease, and also to improve the accuracy, we have repeatedly performed GPS observations at Yamainudan near the top of Mt. Sobatsubu in the southern part of the South Japan Alps from September 1997. We also get the GEONET GPS data by the Geographical Survey Institute near Mt. Sobatubu, and processed GPS data at Mt. Sobatsubu with the GEONET data. We obtained height differences and Zenith Tropospheric Delay (ZTD) separately. We found that there is a negative correlation between the obtained height difference and the difference of ZTD. This negative correlation does not change when we processed the data with different fixed stations. The existence of the negative correlation shows that the larger ZTD change than the real one is estimated when the data are processed to obtain the height difference. When we change the mapping function using in the process, the results seldom change.

The ZTD data using in this investigation are obtained from the GPS data. We observed the wet zenith delay by using Water Vapor Radiometer and radiosonde for some duration. We compared ZTD with that from Water Vapor Radiometer or radiosonde, and we confirmed that the ZTD change obtained from GPS is reliable.

We also processed the GEONET GPS data in the area of the Central Japan Alps and the North Japan Alps. The obtained height differences and ZTD difference have not clear correlation in the Central Japan Alps area, and positive correlation is found between them in the North Japan Alps area.

We can assume that the load of snow may produce the different correlation. The load may change the height of the mountain in the North Japan Alps because of heavy snow. We compared the height difference data between January and March when there is heavy snow in the mountain area of the North Japan Alps with those in November when there is little snow. The ZTD difference is almost the same between this two periods, and the obtained height difference is almost the same. This fact may show that the effect of the load of snow is so small that the obtained height difference seldom changes by the load.

Next, we compared the shape of valley. We found that the correlation between the height difference and the ZTD difference is usually negative when the valley is narrow and steep, and it is positive when the valley is wide and gentle.

We do not take the shape of the valley into consideration when we process GPS data. However, the water vapor condition will change according to the shape of valley. The results of the present investigation may show that it is necessary to take the valley shape into consideration when we process GPS data in the mountain areas.