

The altitude effect of the river water in the Sakawa watershed

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The calculation technique of a recharge altitude using the altitude effect of the stable isotopes of meteoric water is the effective technique of solving flow mechanisms, such as river water, groundwater and spring.

In the many cases of stream water, the altitude effects are calculated using the small streams and small springs of an altitude difference of watershed. However, a river and spring with a small catchment area are thought that there is also a valley unsuitable for calculation of an altitude effect, since it is easy to be influenced of the seasonal change of rain water and a local flow mechanism.

The purpose of this study is to estimate the altitude effect of stream water using the areal average elevation of watershed. In order to obtain a relationship between the topography of the watershed and the oxygen isotopes of stream water, the areal average elevation and areal average direction of watersheds were calculated at 23 sub-basin within the Sakawa watershed, spanning from the eastern part of Shizuoka prefecture to western part of Kanagawa prefecture. In this study, the topography of the watershed were calculated using the Digital Elevation Models data of the Geographical Survey Institute, and the average value of the oxygen isotopes of stream water measured twice per year.

The sampling of river water was performed at 23 points in August 1998 and March 1999.

The result of the geographical feature analysis using digital elevation models data at the 23 sub-basins, the elevations of sampling points were distributed from 14 to 671m, the areas of sub-basins were distributed from 0.5 to 477.8km² and the altitude difference in each sub-basin were distributed from 213 to 3713m. Moreover, the areal average elevations of 23 sub-basins were distributed from 300 to 1410m, but the elevations of 18 in 23 sub-basin were distributed from 600 to 1000m. From a result of the geographical feature analysis in the lowest sub-basin of Sakawa watershed, it was clear that the areal average elevation of Sakawa watershed is 586m, the area is 590.5km², and the direction of an average slope is southeast.

The oxygen isotopic ratios of stream water were from -9.3 to -8.0 per mil in August, from -9.2 to -7.9 per mil in March, and average value was -8.46 per mil and -8.36 per mil, respectively. Although the maximum seasonal variation for every sampling point was 0.4 per mil, there were less than 0.2 per mil at 18 in 23 sampling points.

The correlation is small between the altitude of the sampling points and the oxygen isotopic ratios at the stream water, the altitude effect was -0.07 per mil per 100m calculated from the altitude of the sampling points.

On the other hand, the result of the altitude effect was -0.15 per mil per 100m using areal average elevation of watershed at 21 in 23 sampling point. In order to verify this altitude effect, the number of sub-basins used for analysis was changed from the small altitude difference of watershed to the large one.

Consequently, it became clear that a correlation coefficient falls rapidly from near 700m of altitude differences. Moreover, the altitude effect computed by 5 smallest sub-basins to 711m of altitude differences became -0.17 per mil per 100m.