Altitude effect of stable isotopes in precipitation at south slope of Mt. Tsukuba

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In mountain area, stable isotopes of oxygen and hydrogen in precipitation are relatively low at high altitude than at low altitude, which is called altitude effect. It may be possible to estimate the recharge area of groundwater, spring water and river water at Mt. Tsukuba by using the stable isotopes in precipitation.

Monthly precipitation water was sampled at 6 points (30, 60, 275, 450, 640 and 878 m above sea level) from December 2005 to June 2007 at south slope of Mt. Tsukuba. The stable isotopes of oxygen and hydrogen were analyzed for all samples. The local meteoric water line from January to December 2006 is $dD=7.68d^{18}O+11.55$ ($R^2=0.938$). Temporal variation of precipitation amount and stable isotopes in each points show the similar tendency. On July and October in 2006, the stable isotopes are relatively low cause of large precipitation amount. The stable isotopes are also relatively low in January and February in 2006 cause of low air temperature and snowfall. The precipitation amount is most large at the point of 640 m above sea level. No positive correlation is recognized between precipitation amount and altitude. Thus the stable isotopes of oxygen and hydrogen of precipitation decrease with increase the altitude, the existence of altitude effect was confirmed ($d^{18}O$ is -0.1 permill/100 m and dD is -0.6 permill/100 m). The d-excess values have seasonal variation that the values are relatively high in winter period and relatively low in summer period.