

Seasonal Variations of Spring Water Quality in the Northwestern Part of Shimousa Upland

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The processes of changing water quality from rainwater to spring water are estimated to be divided into two processes. One is the natural process of sediment-groundwater interaction, and the other is the human-induced process of adding artificial loads directly and indirectly. It is predicted that the temporal variation of spring water quality is characterized to some extent by the load characteristics in both processes. This study examined the overall condition of seasonal variations in major inorganic concentrations of water springs at upland area, and investigated the relationships between the load characteristics of ions through two processes and the seasonal variations of spring water quality.

The study area is the northwestern part of Shimousa Upland located in the eastern part of Tokyo Metropolitan Area. The landform consists of upland surface dissected by small valleys and alluvial lowland. Water springs are located at various altitudes in the valleys, and the relative heights between upland surface and spring points vary accordingly. The land use of drainage basins also differs among springs.

A total of 60 springs were selected and surveyed in the study area, and 44 springs were sampled five times (Jun.-Aug.2002, Oct.-Nov.2003, Dec.2003, Feb.-Mar.2004 and Jul.-Sep.2004) so that seasonal timings could be covered. Water quality elements such as water temperature, electric conductivity, pH, alkalinity, silica concentration, and major inorganic ion concentrations of sodium, potassium, calcium, magnesium, chloride, nitrate and sulfated were measured by pH&EC meter, digital titrater, spectrometer and chromatography. For every spring, relative height between spring point and upland surface was surveyed on the 1/2,500 scale maps, and drainage basin land use in 1994 was analyzed on the basis of the detailed digital information of land use (with a cell of 10 m x 10 m square) published by Geographical Survey Institute of Japan.

With an increase in relative height between spring point and upland surface, coefficient of seasonal variation of electric conductivity, for example, basically decreases. Also at the same time, it is observed to be variable even at the same level of relative height. As for the major inorganic ions, the basic tendency to increase along the increase of relative height is observed regardless of sampling season while it is also rather variable in the middle and upper part of scatter plot. It seems to correspond to the characteristics of land use of drainage basin. Moreover, there is a correspondence of seasonal variation coefficient to spatial variation coefficient of each inorganic ion concentration, and from this result, it is seen the seasonal variation is much smaller than spatial one and it is characterized by load characteristics which differs among ion species.

The ratio to additional load is calculated by subtracting basic load from observed one, while the basic load is given by a linear function of relative height. The ratio to additional load shows good correspondence to the average value of seasonal variation coefficient, depending on the individual ions. At the same time, the spatial variation of seasonal variation coefficient differs among the ions. It indicates that the characteristic of seasonal variation could be changed, affected by that of additional load, i.e. human-induced process.