

Water chemistry and hydrological processes in a small forested watershed at Yesan, South Korea

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This study was performed to examine the chemical and isotopic compositions of precipitation, throughfall, soil water and stream water in a small forested catchment, and to understand hydrological processes controlled by natural factors. The concentrations of cation in precipitation and throughfall are Ca>Na>K>Mg and K>Ca>Na>Mg, respectively. The chemical compositions of precipitation and throughfall are mainly controlled by dry deposition. The chemical compositions of throughfall are also influenced by vegetation. The concentrations of cation in soil water are Ca>Mg>Na>K. The concentrations of Ca and Mg are highly increased compared with those in precipitation and throughfall. These components are mainly released by dissolution of carbonate. The concentrations of cation in stream water are Na>Ca>Mg>K. The concentrations of these components in stream water are higher than those in precipitation and throughfall, but lower than those in soil water. This means that chemical compositions of stream water are controlled by precipitation and water-rock interaction.

The oxygen and hydrogen isotopic compositions of precipitation, throughfall and soil water show very wide range of variation, but those of stream water show the narrow range within 1 ‰. Soil water and stream water samples are plotted around the local meteoric water line of rainy season. This indicates that soil water and stream water are mainly supplied from rainy season precipitation.

The average value of the ⁸⁷Sr/⁸⁶Sr ratio of stream water is very similar with that of groundwater, indicating that stream water mainly originates from groundwater. Consequently, the stream water in the catchment is supplied by groundwater recharged during rainy season, and the stream water chemistry is controlled by precipitation and water-rock interaction.

Comparison of chemical and stable isotopic compositions between polluted and pristine stream water in Chuncheon, Korea

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Chuncheon is the capital city of Kangwon Province, located near the center of the Korean peninsula. Three man-made lakes surround the city and one major river runs through it. The chemical and isotopic compositions of the precipitation in the area were reported by Park *et al.* [1]. This study examines the chemical and isotopic compositions of three selected streams in the area to reveal the compositional differences anthropogenic pollution may result.

Methods

The stream water samples had been monthly collected at 20 different locations from July, 2002 to April, 2004. The collected samples were measured for pH, temperature and conductivity in the field and analyzed for Si, Al, Fe, Al, Ca, Mg, Na, and K with ICP-AES, F, Cl, NO₃, NH₄, and SO₄ with IC and hydrogen and oxygen isotopic compositions of water with SIR-MS. Multivariate statistical analyses were performed on the chemical compositions.

Results and Discussion

Comparison of the chemical compositions indicates that Na, K, Cl, NO₃ and SO₄ are the major components of the pollutants. The factor analysis indicates that water-rock interactions are the main controller of the water quality of the pristine streams. The pollutants might be provided mostly by dry deposition and domestic effluents.

The isotopic compositions of oxygen and hydrogen of the non-polluted stream water are similar to those of the local meteoric water, while the polluted stream water is tending to have more enriched isotopic compositions. The heavier isotopic compositions of the polluted water might be attributed to the prolonged evaporation during the water usage by the local residents. The estimated evaporation loss of the unpolluted and polluted stream were about 1.2 and 5.2 %, respectively.

[1] Park *et al.* (2006) *J. Geol. Soc. Korea* **42**, 283-292.