

Evaluation of submarine groundwater discharge in Japanese Islands by multiple linear regression analysis of river flow and geology

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Submarine Groundwater Discharge (SGD) is one of the essential themes of hydrological research. This discharge has been used as a sustainable and available water resource throughout the world, as well as a means of transporting pollutants to the sea. Numerical analysis is more efficient than a field survey for the evaluation of the volume of SGD in a wide area such as the Japanese Islands. In previous calculations, however, because of the lack of river flow data from the lowest flow gauge to the river mouth in coastal areas, accuracy of the calculated runoff has been questionable. In this study, the distribution of SGD in the Japanese Islands has been determined for the first time. The Japanese Islands have been divided into 204 areas, including 109 class A river basins. The volume of SGD in 182 basins and areas has been calculated by the perennial water balance method under constant conditions. In basins that have multiple flow gauges, the increase in river flow in coastal areas has been predicted by multiple linear regression analysis (MLRA) of the river flow, excess rainfall and geologic distribution in an upper stream. Insufficient data of basins and their areas have been grouped with others by cluster analysis, based on the composition ratios of geology. The SGD in each group regarded as one river basin has been predicted by performing MLRA using the river data belonging to that group. The case study indicates that the accuracy of an SGD evaluation using the water balance method with multiple linear regression is as high as that of a groundwater simulation.