Estimation of spatial distribution of ungauged submarine groundwater discharges to the Osaka Bay, western Japan

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Recently, Submarine Groundwater Discharge (SGD) has recognized as carrier of freshwater and of nutrients to the sea (Taniguchi, et al., 2002; Tappin, 2002; Burnett et al., 2006). The Land-Ocean Interactions in the Coastal Zone (LOICZ) project has tried to estimate SGD on a global scale by classifying coastal zones according to climate, geology or landform (LOICZ, 1996; LOICZ, 1997; Bokuniewicz, 2001). Typological approach is one of most effective method to estimate for SGD for extensive area with includes ungauged basin. Because, estimation of SGD on the extensive area has often have need of river discharge record. However, these methods can not estimate quantitatively, because they have not applied thickness of aquifer or permeability to estimation model. It is difficult to put these parameters to estimation model for extensive area. The objective of this study is to estimate of spatial distribution of ungauged submarine groundwater discharges to the Osaka bay western Japan as a trial to estimate SGD quantitatively. This study has used 'slope' as a parameter which calculated from 50m DEM dataset. This estimation is based on Darcy's law. To calculate hydraulic gradient and cross section area, we have calculated slope from 50m DEM. The relationship between slope and hydraulic gradient, slope and cross section area are based on Onodera et al. (preparation). The value of hydraulic conductivity is $0.001 m^s$ on the assumption that the aquifer filled with well sorted sand in the whole area. The result of estimation indicates north and south part of coast around Osaka bay has high SGD and middle part has low SGD in relatively. There are some mountains behind coast in the north and the south part. In contrast, reclamation land has distributed in the middle part. We analyzed dissolved SiO_2-Si (DSi) concentrations of coastal seawater for the proof of estimation. Because of almost all the groundwater has high DSi concentration. As a result of chemical analysis, DSi concentrations of seawater which sampled at the central of the bay show $0.021 mgL^{-1}$. In the north part of the bay, the concentrations show $0.034 mgL^{-1}$ on average and the maximum shows $0.091 mgL^{-1}$. In the south part of the bay, the concentrations show $0.043 mgL^{-1}$ on average and the maximum shows $0.084 mgL^{-1}$. This result indicates that high SGD area has high DSi concentration. In other words, this estimation which using only DEM shows a good performance.