Abstract Details

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Title: Magnitudes, Mechanisms, and Environmental Consequences of Submarine Groundwater Discharge (SGD) in the Coastal Ocean

Abstract:
There has emerged a recognition that the submarine discharge of fresh, brackish, and marine groundwaters into coastal oceans is comparable to inputs via river discharge [1, 2]. We have measured magnitude and mechanisms of submarine groundwater discharge in many coastal areas of Korea. Based on direct seepage-rate measurements, we found that SGD from a volcanic island (Jeju Island, Korea) is higher by orders of magnitude relative to typical continental coasts. In order to determine the factors controlling the magnitude of SGD, we chose two coastal sites and monitored SGD tracers. Firstly, we measured the activities of naturally occurring radium isotopes (226Ra and 228Ra) in estuarine water downstream of the dam constructed in the Nakdong River, Korea, during three periods. The results showed that the excess Ra was highest when the river discharge was lowest (but the water level of the dam relative to the sea level was highest) due to the largest discharge of Ra from submarine groundwater. This suggests that even though there is no visible freshwater discharge into this estuary, the discharge of chemical species is significant through SGD. Secondly, we monitored the bi-hourly variations of the natural SGD tracers (222Rn and CH4) at a coastal seawater station over two seasons. The results showed sharp increases of SGD from neap to spring tide during the wet season. The observed increase was much greater than what would be expected from the rainfall and tidal-height changes. We conclude from this that the temporal variation of SGD is regulated predominantly by a semi-monthly fluctuation of a tidal oscillating pumping force in this environment. Such a large temporal variation of SGD and associated chemical substances appears to cause significant environmental and ecological changes in the coastal ocean. References [1] T. M. Church, Nature 380, 579 (1996). [2] W. S. Moore, Nature 380, 612 (1996).

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