Abstract

Groundwater discharge (SGD) from the coastal aquifers to the oceans takes place when the elevation of the water table of coastal aquifers is higher than the mean sea level, varying seasonally and tidally. SGD provides a route for escape of a large portion of the fresh groundwater, solutes and contaminants to sea. The present study is the first detailed documentation of SGD to the Bay of Bengal. The study site is at Chandipur (21^{o} 26' 11.6" N and 87^{o} 01' 3.1" E), a micro tidal coast of Balasore district of Odisha, India adjoining the Bay of Bengal. The specific objectives of the study are to made (1) delineation of different types of groundwater discharged zones; (2) quantification of the present day SGD to Bay of Bengal (3) identification of the sources of the discharged groundwater and (4) quantification of present day solute (nutrient and contaminates) flux to Bay of Bengal via SGD. In addition, implication of nutrient dynamics to coastal ecology of the Bay of Bengal has also been deciphered. Results of the thermal mapping of porewater have been used for mapping and visualizing the three-dimensional seasonal spatial extent of groundwater plume and identification of zones of focused or diffuse SGD. This work also provides the first direct/experimental estimate of SGD to the Bay of Bengal, which suggests total average annual SGD to the Bay of Bengal is about $8.98 \pm 0.6 \times 10^{8}$ m^3/y. Stable isotope composition of the porewater demonstrates significant seasonal variability in the source of the discharging groundwater. The measured solute concentrations in the discharging groundwater provied a general overview about the solute/nutrient and contaminant flux to the Bay of Bengal. The annual flux of NO_3^- were found to be 160±4.8 mM $m^{-2}d^-$ and the annual flux of Fe_{tot} has been estimated as 224±1.8 mM $m^{-2}d^{-1}$ for the study site. Hence by understanding the mechanism of the nutrient dynamics, we can assume that SGD input to Bay of Bengal will be vital for its ecosystem and sustainability in near future.

Keywords: Submarine groundwater Discharge, Bay of Bengal, Nutrient Flux, Nutrient Dynamics, Contaminant Flux, Marine Ecosystem