Geophysical Research Abstracts
Vol. 20, EGU2018-13862, 2018
EGU General Assembly 2018

Role of submarine ground water in supplying total alkalinity to the Mediterranean Sea

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Submarine springs are a typical phenomenon in the region along the eastern Mediterranean Sea (MS), and possibly provide a significant source of alkalinity to carbonate dominated regions. To estimate the contribution of fresh submarine groundwater discharge (SGD) to the South Levantine basin inorganic carbon cycle, total alkalinity (TA), dissolved inorganic carbon and inorganic nutrients were measured during 2016-2017 at three coastal stations under the influence of SGD at the shore of Tel-Shikmona, Israel. To fully grasp the regional influence of terrestrial SGD and its driving forces, results were combined with unpublished data sets from the Israel national monitoring program (NMP) from the years 2011-2015. A clear total alkalinity gradient was identified, with peak alkalinity levels measured in the spring emanations (6701 μmol/kg, n=46, σ=304.78) and decreasing seaward (2665μmol/kg, n=30, σ=95). Shikmona springs show clear seasonal variability, with peak values during winter months (December-February) and minimum during summer time (May-June). Seasonal disparity was observed at NMP coastal station as well, but the changes between seasons are less amplified. Except for a few months with high precipitation volume, TA is usually negative both offshore of the spring discharge and in the NMP station. Higher TA in the Israeli shore during winter months could be attributed to the recharge of Cretaceous carbonate aquifers. A simple mass balance using the data acquired in this study and estimation of terrestrial fluxes of SGD into the MS reveals that up to 32% of riverine carbon inputs and 13% of Black sea input are delivered by SGD. The input of alkalinity to the oceans from SGD with respect to the global oceanic alkalinity budgets has received little attention so far. The potential role of SGD in controlling the buffering factor of the oceans with respect to atmospheric CO_2 could have huge impact on the inorganic carbon fluxes in the area and requires further investigation.