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Climate variability and its impacts on the spatial and temporal variation of groundwater quality in an island

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Abstract The island of Mauritius exploits both surface and groundwater to cater for its demands. Currently groundwater accounts for slightly more than 50% of the total domestic water demand. The island is volcanic in nature and is characterised by vesicular fractured basalts and large caverns. This highly permeable geology renders the groundwater bodies highly vulnerable to agricultural activities, urban runoff and disposal of wastewater. The local water authority monitors the quality of groundwater on a regular basis as a precautionary measure. So far, data collected have shown that only nitrate levels were on the high side with an average value of around 28mg/L; the remaining physicochemical parameters have always been within permissible limits. However, recently the groundwater quality data have showed that the pH values at a few selected boreholes were declining over time. Data collected from 2007 to 2010 indicated that the pH values varied in the range from 6 to 7 for 80% of the time. Given that the aquifers of the island are in hydraulic contact with the sea, seawater intrusion could have been a potential cause of this low pH trend, but this possibility was ruled out since the boreholes tested were located inland. The other potential causes of the low pH were the change in rainfall patterns, the pollution from land-use activities, the change in pumping rates at the boreholes, and the geological structure of the island. Latest figures on long-term average rainfall noted that the island has been recording less rainfall with time. Long-term average annual rainfall value was 2260 mm for the period 1931–1960, and this dropped to 1993 mm for the period 1971–2000. The drop in rainfall recorded is also reflected in the recharge to the aquifers, when the groundwater levels are plotted over time. A correlation coefficient of 0.5 was obtained between monthly rainfall and weekly values of groundwater levels. Impacts of land-use activities were investigated by testing the quality of groundwater at nearby wells, and here also the results indicated the same declining trend in pH values. Historical values of the exploitation of groundwater at these boreholes revealed no drastic change in pumping rates over time, so the impact of pumping was also ruled out. Another potential cause of the declining trend in pH is the possible presence of deep volcanic activities, which cannot be overlooked, but this cause is yet to be investigated. This study however helped to highlight the need for sound water resource management policies for a small island.
Key words water; rivers; groundwater; Mauritius