

Changes in hydro-geochemistry due to the floods – A case study of Southwest Punjab, India

Gopal Krishan^{1*}, Donald John MacAllister², Bentje Brauns², Dan Lapworth², Vivek Gupta³;

Alan MacDonald², SD Khobragade¹, Vivek Diwakar¹

¹*National Institute of Hydrology, India;*

²*British Geological Survey, UK;*

³*Indian Institute of Technology Mandi, India*

*Corresponding author: drgopal.krishan.nihr@gov.in

ABSTRACT

In the present study, the groundwater chemistry has been assessed for the year 2023 floods by sampling for the years 2022 and 2024 in a semi-arid southwest region of Punjab. The water samples were taken from the 34 piezometers varying in depths from >10 m to 37m. Water table has been found shallow and presumed that the high influence of floodwaters that quickly reach the groundwater table, on groundwater quality parameters like pH, EC and ions. It was observed that the values of EC increased in post-flood period. The Gibb's plot indicates through comparison between the pre-flood (2022) and post-flood (2024) data a significant geochemical shift towards evaporation dominance in most piezometers. This trend suggests an increasing salinity in the groundwater system. When comparing the data from both years on the USSL diagram, it is evident that water quality has deteriorated. A majority of the piezometers showed a noticeable shift toward higher salinity (C3–C4) and increased sodium hazard (S3–S4) zones. Piper plot indicated water chemistry is evolving towards greater sodium enrichment and salinity. These trends indicates that the groundwater is becoming less suitable for irrigation purposes, posing potential risks to soil structure, crop productivity, and long-term agricultural sustainability without appropriate management interventions. Continuous monitoring and management will be essential to prevent further degradation of groundwater quality, especially for irrigation use. There are only few studies related to the flood impact on groundwater systems, the data will be very useful for the policy and planning needs in the context of climate change in the Punjab.

Keywords: Shallow water levels; Groundwater quality; Gibb's plot; Piper plot; Semiarid;

Punjab flood 2023