

Assessing salt accumulation rates and mapping groundwater salinity across the Indus Basin

E. Zarate^{*1}, J Podgorski², S.A.M.A.S Eqani³, H Rashid⁴, S Ilyas⁵, M Basharat⁶, I Naveed⁴, M Asharaf⁴, G Krishan⁷, AM MacDonald⁸, DJ Lapworth¹

¹ British Geological Survey, Maclean Building, Benson Lane, Wallingford, Oxfordshire, OX10 8BB

²Eawag, Swiss Federal Institute of Aquatic Science and Technology, Department Water Resources and Drinking Water, 8600 Dübendorf, Switzerland.

³ Ecohealth and Toxicology Lab, COMSATS University Islamabad, Park Road, 44000 Islamabad, Pakistan.

⁴ Pakistan Council of Research in Water Resources (PCRWR), Khayaban-e-Johar Road, Sector H-8/1, Islamabad 44000

⁵ Department of Environmental Sciences, Forman Christian College (A Chartered University), Lahore 54600, Pakistan

⁶ International Waterlogging and Salinity Research Institute (IWASRI), Water and Power Development Authority (WAPDA), Lahore 54000, Pakistan

⁷ National Institute of Hydrology, Roorkee-247667, Uttarakhand, India

⁸ British Geological Survey, Lyell Centre, Research Av South, Edinburgh EH14 4AP, United Kingdom

*Corresponding author: emzar@bgs.ac.uk

The Indus Basin supports the world's largest system of irrigated agriculture and supports over 300 million people in India and Pakistan. Groundwater is critical for food production and drinking water across the Indus Basin. Despite abundant groundwater resources, rising salinity over several decades has affected roughly half of all irrigated land, and severely decreased productivity. Understanding the sources and accumulation of salt within the Indus Basin is crucial for sustainable management of water resources for the future. However, while previous studies have focused on isolated areas, the spatio-temporal variability of accumulation rates across the full extent of the basin is unknown. Early estimates suggested that there may be several tens of million tons travelling through the system annually from surface water sources, and up to 50 Gigatons of salt within the top 100 m of the aquifer. This study embarks on the first basin wide assessment of the salt balance for the Indus, combining over 25,000 groundwater salinity measurements across Pakistan and India with surface water flow in the Indus and its tributaries to quantify basin inputs and outputs of salt and updated groundwater salt storage within the top 100m. Early results indicate it could take c.1000 years of inflow of salt from rivers to accumulate the volume, longer if deeper (>100 m) groundwater was considered. Tritium and other residence time indicators show relatively young water (<50 years old) in top 50 m, suggesting that there could be a decoupling of the salt and water cycles across the Indus Basin. However, more work is needed to constrain the salt stores and fluxes and improve estimates of accumulation rates within the basin.

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