

Hydrology and water management in the Anthropocene: challenges and opportunities with particular reference to India

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The Anthropocene period is characterised by multiple stressors triggered by human-induced changes in the hydrological cycle and land surface transformations. The arrival of humans on this planet has significantly altered the biophysical systems, particularly since the Industrial Revolution, commonly known as the era of the Great Acceleration. It is important to recognise these changes in the hydrological systems and start planning country-specific and sustainable strategies to mitigate the challenges posed in terms of water availability and demands, water-related disasters, river health and river ecology. It is of particular importance to realise that our water resource system may already cross the tipping point of exploitation. Water is undoubtedly the most essential commodity for humans, but it is equally important to understand the needs of other ecosystems that depend on water. This article documents the challenges and opportunities of water resource management in the Anthropocene, which is particularly relevant to India and proposes a series of urgent measures to mitigate the situation. We reason that a better understanding of our hydrological systems will contribute to water security and resilience to society in terms of water and the environment and contribute to the growth of the nation.

Anthropocene are ~1750 CE and ~1950 CE (the era of great acceleration in technology). However, it is an uncontested fact that Earth's environment and climate have been significantly altered by human-induced changes in recent centuries attributed to multiple events, e.g. domestication of plants and animals (11.7 ka), agricultural practices and deforestation (10–5 ka) and Anthropogenic soils (2 ka). In the case of river systems, a 'command and control' approach to river management^{2–5} across the world has visible impacts in terms of degrading river health and reduced ecosystem services.

India has six major climatic subtypes as per the Köppen climate classification⁶. Diverse microclimates make India one of the most climatically diverse nations globally⁷. The Indian rivers are characterised by significant hydroclimatic variability and a wide range of population densities. The interventions and exploitation of rivers and groundwater to meet societal needs have already surpassed water resources' annual replenition rates in most basins and have crossed the sustainable threshold⁸. The ever-increasing population and the rising water demand in tropical regions have put many rivers under severe stress, with particularly strong impacts in India and Southeast Asia⁹.