Australia's water quality trends over two decades

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Abstract: Water quality of rivers and streams can be highly variable over time due to changing hydro-climatic conditions (streamflow, rainfall, temperature) in the interaction with catchment physio-geographic conditions (topography, soils, geology) and local human activities (agriculture, land use management, urbanisation). Understanding these variations (in particular, the relative importance of long-term trends compared to short-term fluctuations) informs strategic decisions for catchment management, including water resources preservation and restoration measures. This is the first study to provide an overview of river water quality trends across the entire Australian continent. The large variability in hydro-climatic and landscape conditions makes Australia in ideal experiment to study contrasting temporal trends across contrasting catchment conditions. Specifically, we analysed the temporal trends of five water quality parameters that are of key interests for catchment management in Australia, namely, electrical conductivity (EC), dissolved oxygen (DO), total suspended solid (TSS), total nitrogen (TN) and total phosphorus (TP), over two decades, 2000–2019. Historical water quality data from 375 catchments across the five major climate zones – arid, Mediterranean, temperate, subtropical, and tropical – were compiled and analysed to address the following two questions on Australian water quality trends:

- What are the large-scale patterns of trends in river water quality over Australia in the recent two decades (2000–2019)?
- Within the two decades, are water quality trends generally monotonic or are they changing over time?

These questions were addressed by estimating the trends of each water quality parameter for each catchment with the Weighted Regressions on Time, Discharge, and Season method (WRTDS; Hirsch et al. 2010). WRTDS decomposes water quality time-series into a long-term trend component, a seasonal component, and a streamflow-related component. Our preliminary findings suggest that the magnitudes of trends of each water quality parameter over the entire twenty years (2000–2019) vary substantially across different climate zones. Ongoing work focuses on identifying any temporal variation of these trends, as well as attributing the variation of trends across catchments to a range of potential hydro-climatic and land use factors. These findings will provide critical information on the water quality trends and their drivers across the Australian continent, thereby facilitating water quality management.

REFERENCES

Hirsch RM, Moyer DL, Archfield SA. Weighted Regressions on Time, Discharge, and Season (WRTDS), with an Application to Chesapeake Bay River Inputs. J Am Water Resour Assoc. 2010 Oct;46(5):857-880. doi: 10.1111/j.1752-1688.2010.00482.x. PMID: 22457569; PMCID: PMC3307614.

Keywords: *River water quality, dissolved oxygen, electrical conductivity, salinity, sediments, nutrients*