



Internet based data sharing solutions for facilitating water quality data distribution to researchers, stakeholders, and policy makers, using R, Google Earth and leaflet

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The South African national Department of Water and Sanitation has operated a water quality database in various forms since the 1970s. Over time, the database became too large for any individual to comprehend. The potential for efficient extraction of information lay in a new system for viewing the data.

The benefits of a visual inventory extend to users beyond the confines of the government, including scientists, managers, technical staff, students, academics, consultants and the interested citizen. A prototype developed in the mid 1990s ran in Arc/Info, plotting water quality results for each point on a stacked timeline, with small maps at different scales, showing the locations of points. In 2005, when Google Earth became available with its KML markup language, a more interactive Internet version became feasible.

The new Arc/Info script not only generated the maps but also the HTML and KML files required for an online system. The program used text files exported from the WMS Informix database. Later, the process was ported to R, eventually reading directly from the main Informix database using RODBC.

The advantage of using Google Earth is that it deals with the heavy 2.5D geographical processing in the background, allowing the developer to focus on symbolising the data. Visualisation has now developed beyond the original time series plots, to include thumbnail plots, pre-packaged data tables and associated metadata in zip files. Other visualisations use static maps created with R maptools and interactive maps using R and JavaScript leaflet.

The database of a million records collected at more than 50 000 sites is now a manageable entity that users can, in a virtual sense, fly through and make the geographical link between water quality at monitoring sites and the influence of the surrounding landscape, land cover and land use. Site duplication and geographical errors on the database are detected and marked for correction.

The database is widely accessible, via the web site www.dwa.gov.za/iwqs. While users still need to request certain datasets from the database staff, because not everything is available on the Google Earth interface, the visual inventory helps them make more informed choices about what to ask for. The presence or absence of historical data in a study area can be assessed more quickly. Colour-coding according to simple water quality guidelines highlights sites of possible concern. Monitoring network planning and assessment of future data requirements are easier to carry out.

Much still needs to be done. The current system is limited to inorganic chemistry, eutrophication and microbial indicators. Trace elements, biomonitoring and organic compounds are not well represented. Skills and technology limitations mean that power of interactive data exploration and the potential for publishing derived information, such as loads, trend analysis or model output, have yet to be explored.