Internet-based analysis of long-term data: motion charts to visualise water quality in South African rivers

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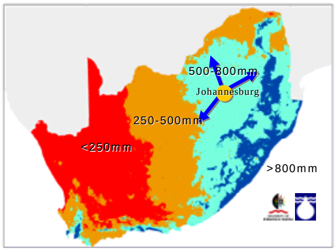
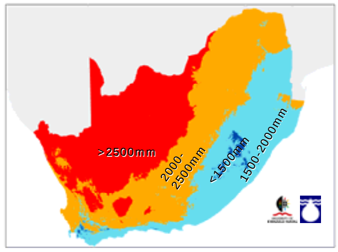
Rainfall < 500mm/yr and runoff <10%, together with rapid urban, mining and industrial expansion during the past 120 years, have caused many South African watercourses to become conduits for waste during periods of low flow. The poor quality of water affects downstream users and the aquatic environment. Working within budgetary constraints, water resource managers are compelled to make optimal use of the available water quality data for managing this difficult situation. Datasets can be so large and have been in existence for so long that few people, if any comprehend the full extent of the information available.

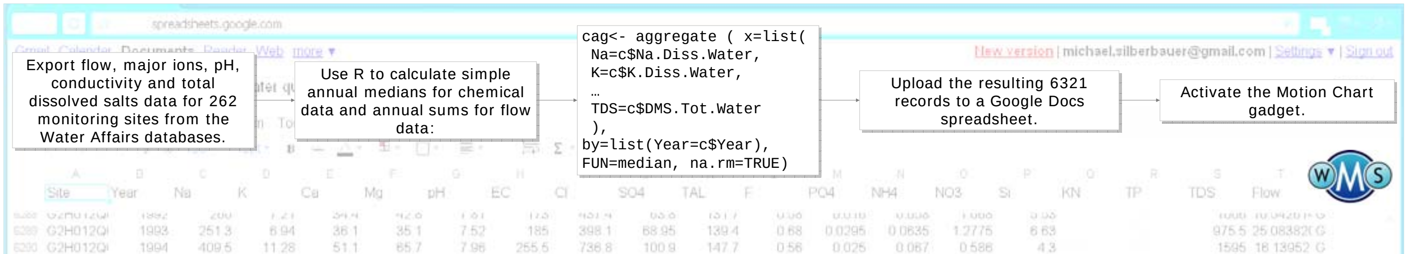
A rapid way for evaluating the information contained in long-term data sets is visualisation. New and more informative methods for representing quantitative data have become available during the past two decades. The Google Motion Chart or “Gapminder Trendalyzer” is one such tool.

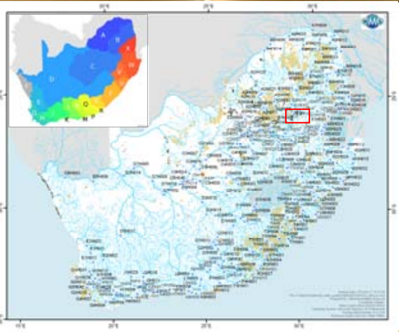


Annual rainfall rates for South Africa. Runoff from Johannesburg affects the areas shown by the blue arrows.



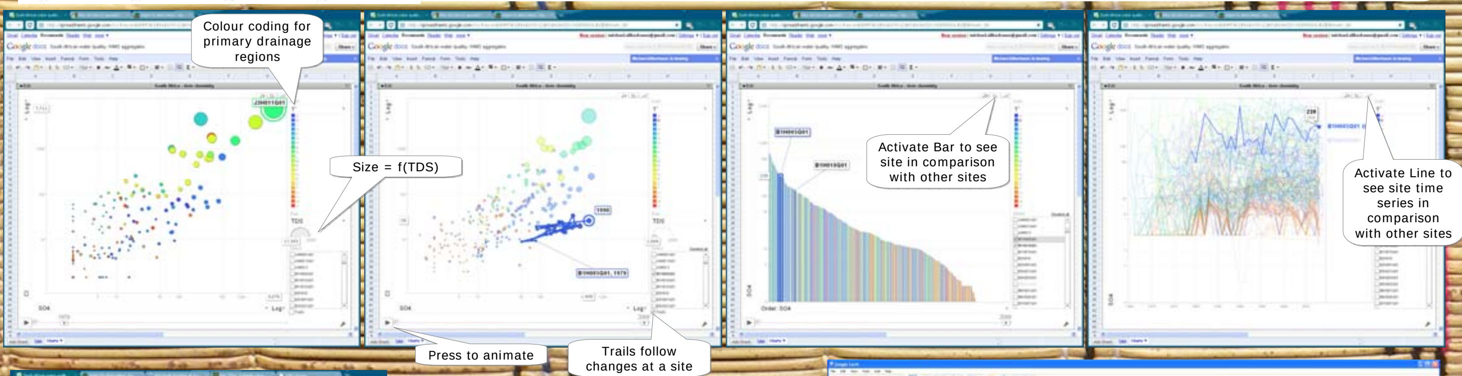
Evaporation rates.
Climate data: Schulze et al. 2006.

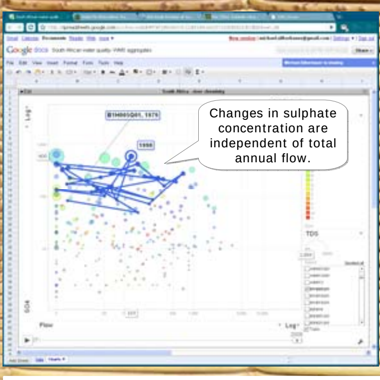




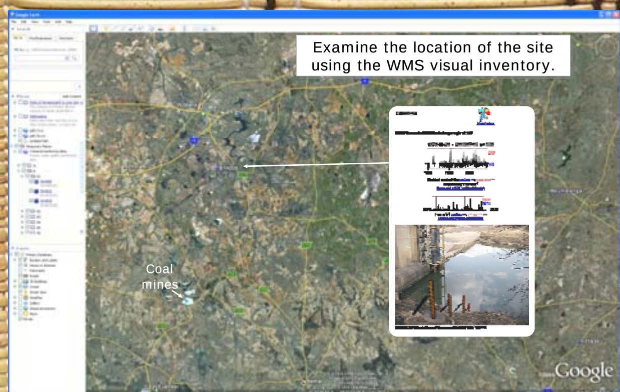
Results

The 262 sites appear in geographical space in the map to the left. In the first chart below, the sites appear in ionic space, in this instance with sulphate on the x-axis and chloride on the y-axis. The second chart trails the changes in time for a site where chloride stays within a range of 10 to 35 mg/l between 1979 and 2008, while sulphate careers wildly between 50 and 600 mg/l. The third chart places the site in the context of the complete data set, while the fourth chart is a more conventional time-series plot of all the data, with advanced visualisation to allow the site of interest to stand out from the other 261 sites. Be aware, though, that the Motion Chart performs automatic linear gap filling, which can be misleading.





A check in the geo-referenced inventory confirms that this site is in a region receiving drainage from coal mines and deserves further attention by more conventional means. We have now reached the limits of this “hydrosimplicity” approach, and need to apply more conventional catchment management methods.



Reference Schulze (2006) South African Atlas of Climatology and Agrohydrology

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