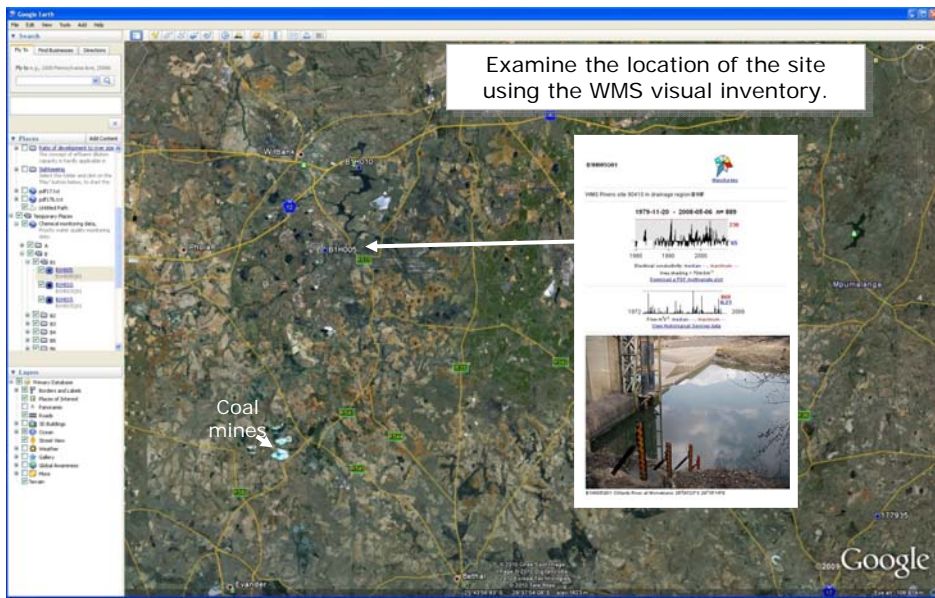# Motion charts for visualising long-term water quality in South African rivers
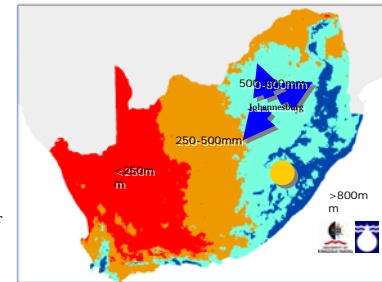
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Examine the location of the site using the WMS visual inventory.



Coal mines

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.

The advantages of this data visualisation approach are the ability to interactively choose variables on the two axes, tag sites of interest, move the time locator backwards and forwards and switch between linear and logarithmic representations. The user can quickly discern any gross patterns in the data set. Difficulties with the tool in its present state are:

1. the need to have a stable and reasonably quick Internet connection, which is not always possible in Africa;
2. the inability to handle really large data sets;
3. the complexities of customising the tool to introduce more complex visualisations such as the multivariate Maucha diagram.

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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.



500-800mm
Johannesburg
250-500mm
<250mm
>800mm

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



>2500mm
2000-2500mm
1500-2000mm
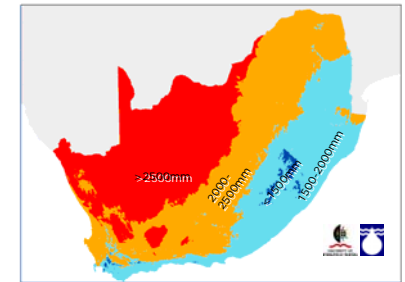
Evaporation rates.
Climate data: Schulze (2006) South African Atlas of Climatology and Agrohydrology.

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.

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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.

Export flow, major ions, pH, conductivity and total dissolved salts data for 262 monitoring sites from the Water Affairs databases. **HYDSTRA**

www.dwa.gov.za/iwqs/water_quality/NCMP/nwrqsr.asp

Use **R** to calculate simple annual medians for chemical data and annual sums for flow data:

```
cag<- aggregate ( x=list(
  Na=c$Na.Diss.Water,
  K=c$K.Diss.Water,
  …
  TDS=c$DMS.Tot.Water
  ),
by=list(Year=c$Year),
FUN=median, na.rm=TRUE)
```

Upload the resulting 6321 records to a Google Docs spreadsheet.

Activate the Motion Chart gadget.

Colour coding for primary drainage regions

Size = f(TDS)
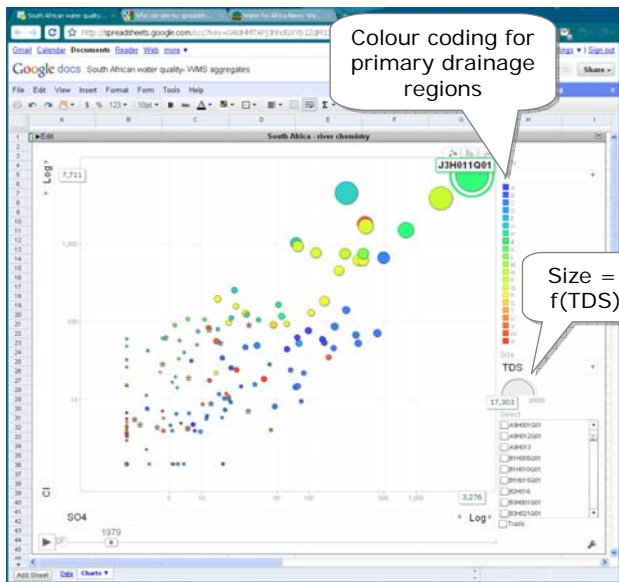
In chart 1, the sites appear in ionic space, in this instance with sulphate on the x-axis and chloride on the y-axis

The 262 sites in geographical space.
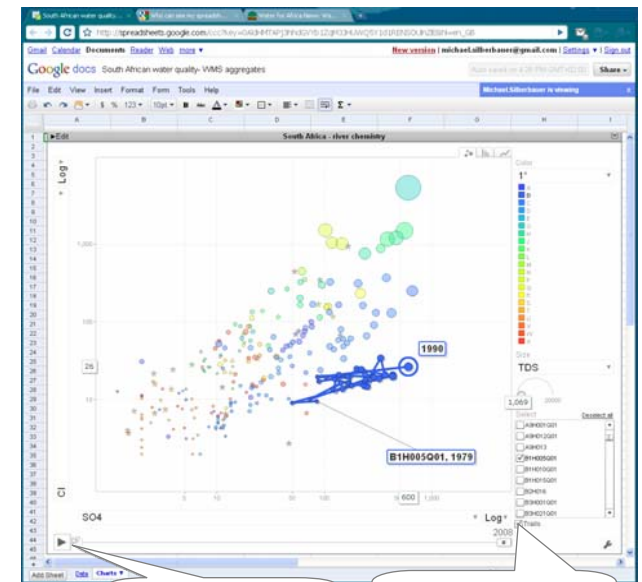
Press to animate

Trails follow changes at a site

Chart 2 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.
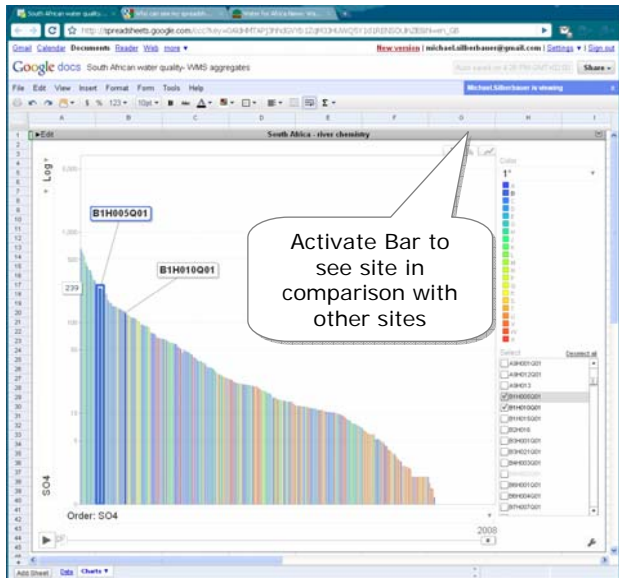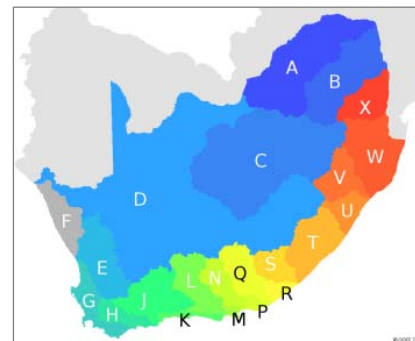
Activate Bar to see site in comparison with other sites

The colour coding of the primary drainage regions corresponds to the colours of the bubbles and lines in the charts.

Activate Line to see site time series in comparison with other sites

Chart 3 places the site in the context of the complete data set.

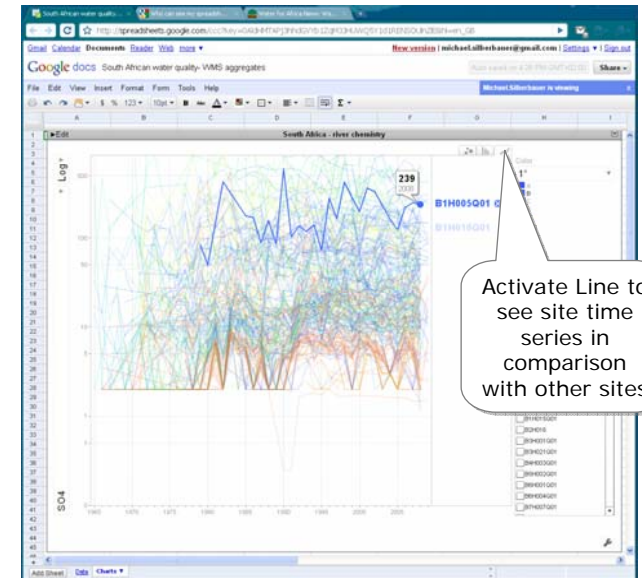Be aware that the Motion Chart performs automatic linear gap filling, which can be misleading.

Chart 4 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.