



**Solute Conc. Unit**

- ng/l
- ug/l
- mg/l

**Plot Type**

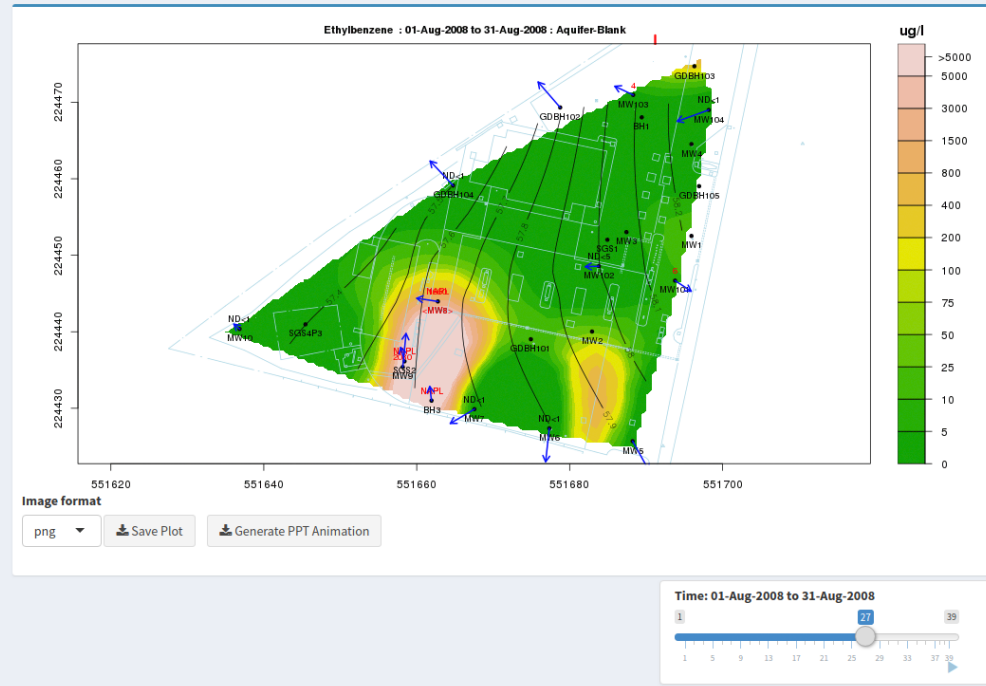
Conc-Terrain ▾

**Plot Options**

- Show Well Labels
- Scale colours to Data
- Show Conc. Values
- Show GW Contour
- Overlay ShapeFiles
- Plume Diagnostics

**Groundwater Flows**

- None
- Same Length
- Weighted Length



## PhD studentship funded by Shell:

# Methods and Software for Groundwater Monitoring Design

## Background

Over the last ten years we have been working with Shell on the statistical modelling of groundwater contamination. Shell has already part-funded two successful PhD projects and has now provided funding for another studentship.

Some of the methods developed as part of those PhDs form the inference engine of a software tool called GWSDAT. Over the past decade GWSDAT has found widespread use in the oil and gas industry. More information about GWSDAT is available at <http://gwsdat.net> as well as its [CRAN](#) and [Github](#) page.

## Project details

Our previous research has shown the clear benefits of using spatio-temporal models for modelling groundwater contamination rather than the prevalent, purely spatial models. The project will focus on the spatio-temporal design of monitoring networks and sampling schemes for modelling contamination in groundwater, i.e. we will try to answer questions like ...

- Where to best place a well?
- When to take samples and which wells to sample at a given time?
- Are there wells which are redundant, i.e. can we obtain almost equally accurate information without ever sampling at this well?

The aim of the PhD is to extend the work already carried out on the optimal design of monitoring networks for spatio-temporal models. Another important component will be the integration of the results into GWSDAT. This will require both working on computationally efficient implementations as well as software development in R Shiny.

Though a strong focus of the project is on the application of the method to the data provided by Shell, the project also offers the opportunity of significant methodological research work. Another major cornerstone of the project will be the development of software.

## Key deliverables

- Further develop and compare criteria for assessing the effectiveness of different spatio-temporal designs for different types of models (notably spline-based models and kriging).

- Develop computationally efficient algorithms for model fitting and for computing and/or approximating different optimality criteria as well as optimising these.
- Demonstrate and investigate the effectiveness of methods and strategies proposed using real groundwater monitoring data sets.
- Implement the proposed methods in R and integrate the implementation into GWSDAT, so that it can be used by non-statisticians.
- Document and communicate research findings and promote best practice to the company.
- Support the maintenance of GWSDAT.

## Research training and student experience

The successful candidate will be based in the School of Mathematics and Statistics at the University of Glasgow. The school has a vibrant and diverse community of postgraduate research students ( 60 students, of which 25 in Statistics). The School is based in a new building (built 2017). Postgraduate students have their own desks and computers in a shared office and access a dedicated large communal area for postgraduate research students.

In their first year, the successful candidate will take courses offered by the [Academy for PhD Training in Statistics \(APTS\)](#), undertake the generic skills and employability training offered by the University, and participate in postgraduate away-days which provide general research training, such as thesis writing in LaTeX and computational skills.

The project also offers insight into the operation of a large multinational company, further underpinning employability prospects on graduation. The student would be expected to be willing to travel regularly to Shell's offices in London and Rotterdam. The cost of travel and accommodation will be met by Shell.

## Funding available

The studentship will cover Home/EU fees for 3.5 years as well as a stipend in line with the Research Council Doctoral stipend level (£15,009 p.a. for 2019/20).

## How to apply

Please send your application, before Monday, April 15th at 10am (BST), by email to [ludger.evers@glasgow.ac.uk](mailto:ludger.evers@glasgow.ac.uk). Please include the following in your application.

- a cover letter of two pages explaining why you are interested in the project and indicating what skills and ideas you would contribute to the project;
- an up-to-date curriculum vitae;
- two academic references;
- evidence of a first degree which is a good Upper Second Class or First Class standard, or equivalent (can be in progress provided you will complete the degree before September 2019); and
- certification of proficiency in English (if required).

We anticipate to hold interviews on Thursday, April 18th. You will be interviewed by the two academic supervisors and a representative from Shell. The interviews will be via Skype or (at your option, if you live in the UK or Ireland) in person.

## Informal enquiries

For further information and informal expression of interests please don't hesitate to contact the prospective academic supervisors.

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<http://gwmdat.net>

<http://shell.ac.uk>