

Analyzing Groundwater Quality Data and Contamination Plumes: GWSDAT



Wayne Jones and Matthijs Bonte
Shell Global Solutions BV, London, United Kingdom, wayne.w.jones@shell.com

What is GWSDAT?

GWSDAT Summary:

- A user friendly, open source, decision support tool for the analysis and reporting of groundwater monitoring data.
- Smoothing Statistics: data analysis using spatiotemporal penalized spline statistical modelling
- Rapid interpretation of plume behaviour using plume metrics (mass, concentration, area).

Key Benefits:

- Improved data transparency to design and optimize groundwater monitoring.
- Clarity on the relations between dissolved contaminant concentrations, NAPL thicknesses, and groundwater flow.
- Rapid interpretation of complex data sets from large groundwater monitoring networks.
- Facilitated report and (graphics) generation.

How does it work?

Step 1: Access GWSDAT

Online:



www.gwsdat.net

Excel Add-in:



www.claire.co.uk/GWSDAT



www.api.org/GWSDAT

R package:

GitHub

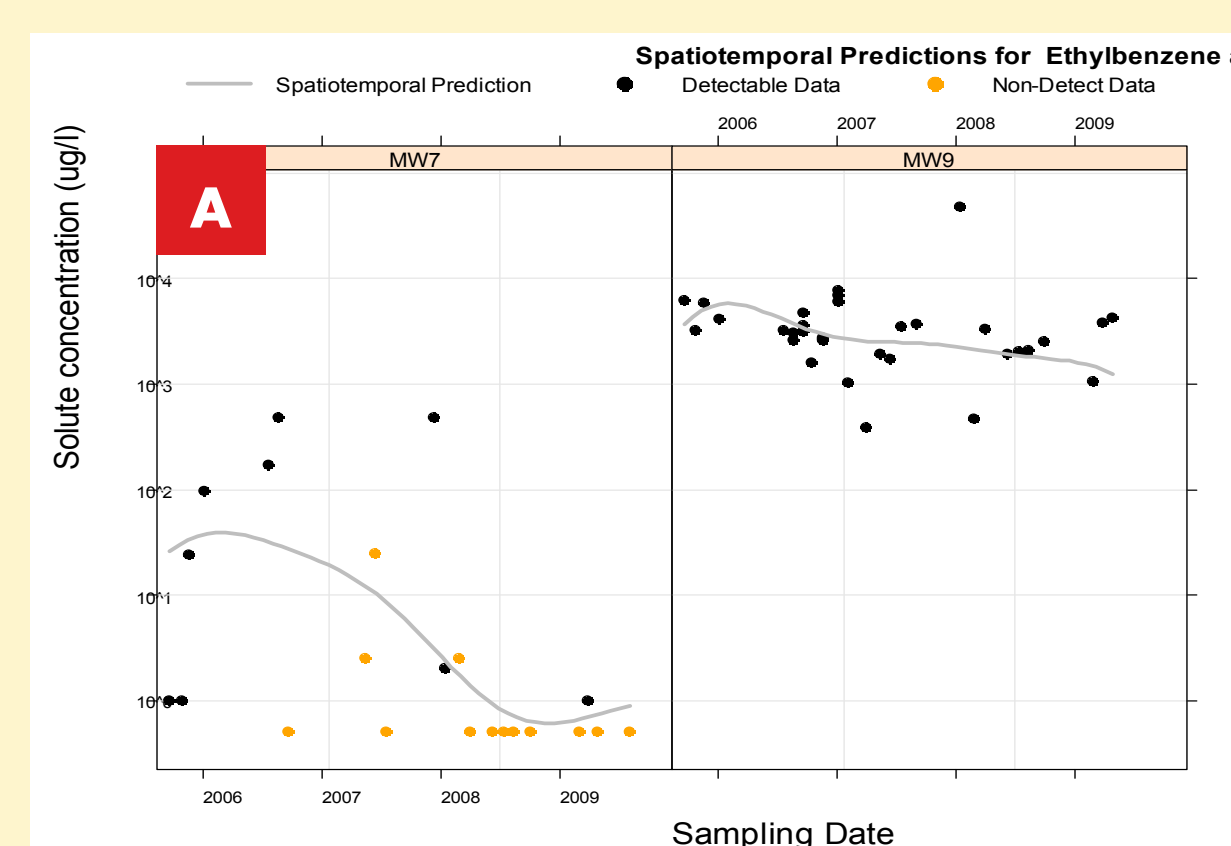


Step 2: Enter your data

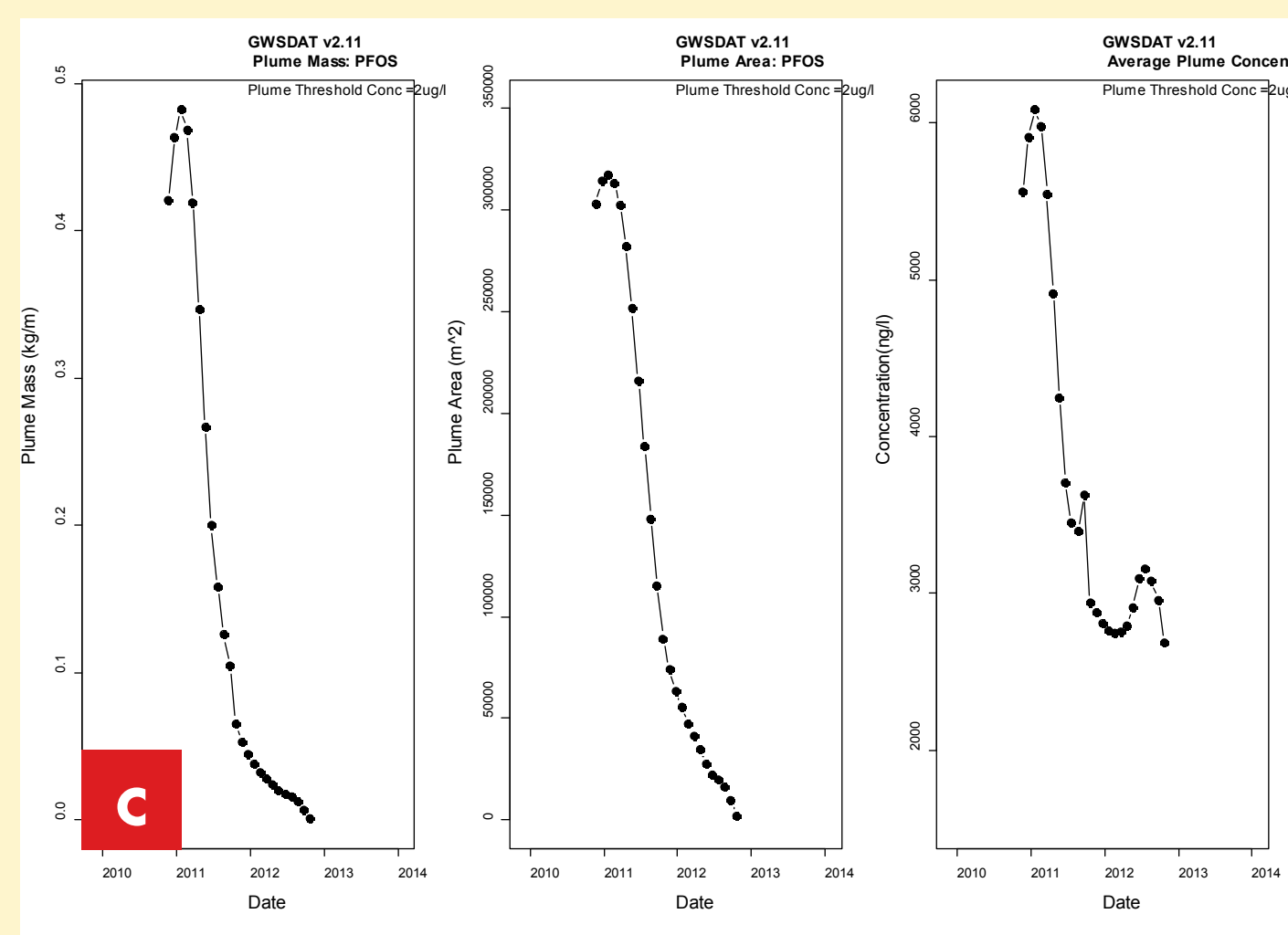
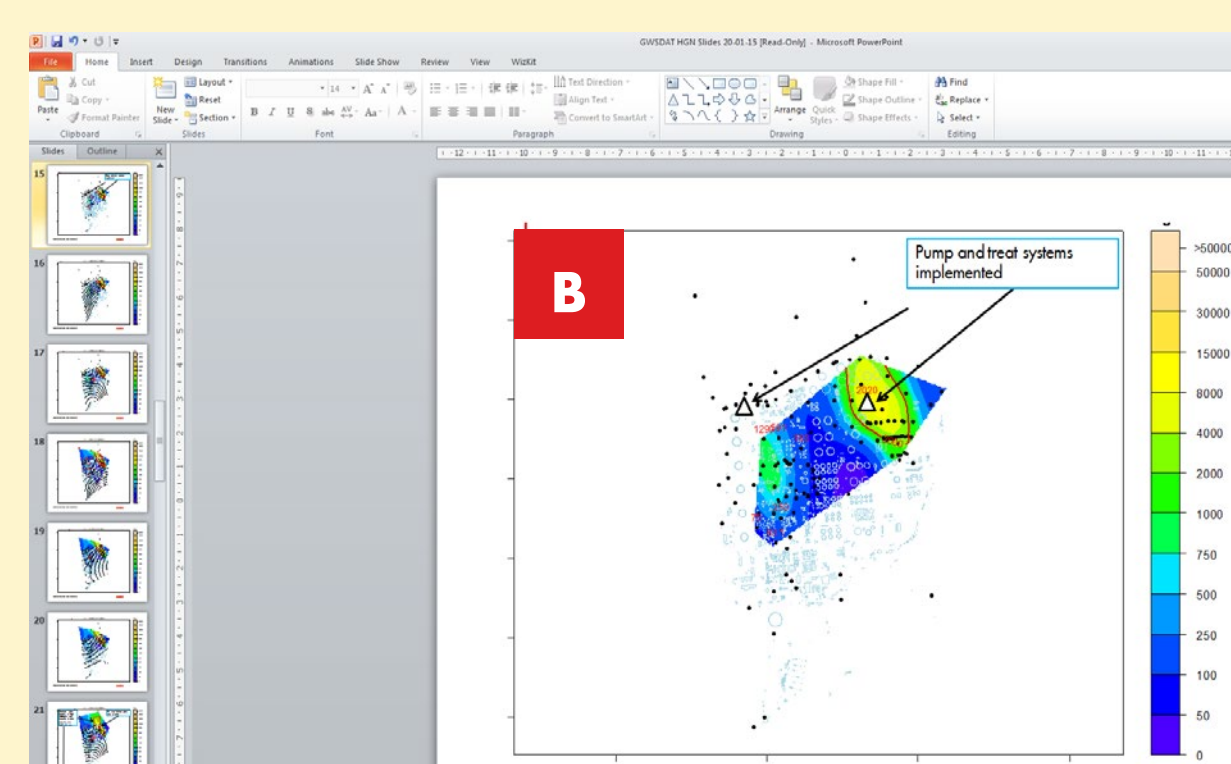
WellName	Constituent	SampleDate	Result	Units	Flags
GW01	THP	05/11/2008	14.5	mg/L	
GW02	THP	05/11/2008	17.5	mg/L	
GW03	THP	05/11/2008	19.0	mg/L	
GW04	THP	05/11/2008	21.0	mg/L	
GW05	THP	05/11/2008	23.0	mg/L	
GW06	THP	05/11/2008	25.0	mg/L	
GW07	THP	05/11/2008	27.0	mg/L	
GW08	THP	05/11/2008	29.0	mg/L	
GW09	THP	05/11/2008	31.0	mg/L	
GW10	THP	05/11/2008	33.0	mg/L	
GW11	THP	05/11/2008	35.0	mg/L	
GW12	THP	05/11/2008	37.0	mg/L	
GW13	THP	05/11/2008	39.0	mg/L	
GW14	THP	05/11/2008	41.0	mg/L	
GW15	THP	05/11/2008	43.0	mg/L	
GW16	THP	05/11/2008	45.0	mg/L	
GW17	THP	05/11/2008	47.0	mg/L	
GW18	THP	05/11/2008	49.0	mg/L	
GW19	THP	05/11/2008	51.0	mg/L	
GW20	THP	05/11/2008	53.0	mg/L	
GW21	THP	05/11/2008	55.0	mg/L	
GW22	THP	05/11/2008	57.0	mg/L	
GW23	THP	05/11/2008	59.0	mg/L	
GW24	THP	05/11/2008	61.0	mg/L	
GW25	THP	05/11/2008	63.0	mg/L	
GW26	THP	05/11/2008	65.0	mg/L	
GW27	THP	05/11/2008	67.0	mg/L	
GW28	THP	05/11/2008	69.0	mg/L	
GW29	THP	05/11/2008	71.0	mg/L	
GW30	THP	05/11/2008	73.0	mg/L	
GW31	THP	05/11/2008	75.0	mg/L	
GW32	THP	05/11/2008	77.0	mg/L	
GW33	THP	05/11/2008	79.0	mg/L	
GW34	THP	05/11/2008	81.0	mg/L	
GW35	THP	05/11/2008	83.0	mg/L	
GW36	THP	05/11/2008	85.0	mg/L	
GW37	THP	05/11/2008	87.0	mg/L	
GW38	THP	05/11/2008	89.0	mg/L	
GW39	THP	05/11/2008	91.0	mg/L	
GW40	THP	05/11/2008	93.0	mg/L	
GW41	THP	05/11/2008	95.0	mg/L	
GW42	THP	05/11/2008	97.0	mg/L	
GW43	THP	05/11/2008	99.0	mg/L	
GW44	THP	05/11/2008	101.0	mg/L	
GW45	THP	05/11/2008	103.0	mg/L	
GW46	THP	05/11/2008	105.0	mg/L	
GW47	THP	05/11/2008	107.0	mg/L	
GW48	THP	05/11/2008	109.0	mg/L	
GW49	THP	05/11/2008	111.0	mg/L	
GW50	THP	05/11/2008	113.0	mg/L	
GW51	THP	05/11/2008	115.0	mg/L	
GW52	THP	05/11/2008	117.0	mg/L	
GW53	THP	05/11/2008	119.0	mg/L	
GW54	THP	05/11/2008	121.0	mg/L	
GW55	THP	05/11/2008	123.0	mg/L	
GW56	THP	05/11/2008	125.0	mg/L	
GW57	THP	05/11/2008	127.0	mg/L	
GW58	THP	05/11/2008	129.0	mg/L	
GW59	THP	05/11/2008	131.0	mg/L	
GW60	THP	05/11/2008	133.0	mg/L	
GW61	THP	05/11/2008	135.0	mg/L	
GW62	THP	05/11/2008	137.0	mg/L	
GW63	THP	05/11/2008	139.0	mg/L	
GW64	THP	05/11/2008	141.0	mg/L	
GW65	THP	05/11/2008	143.0	mg/L	
GW66	THP	05/11/2008	145.0	mg/L	
GW67	THP	05/11/2008	147.0	mg/L	
GW68	THP	05/11/2008	149.0	mg/L	
GW69	THP	05/11/2008	151.0	mg/L	
GW70	THP	05/11/2008	153.0	mg/L	
GW71	THP	05/11/2008	155.0	mg/L	
GW72	THP	05/11/2008	157.0	mg/L	
GW73	THP	05/11/2008	159.0	mg/L	
GW74	THP	05/11/2008	161.0	mg/L	
GW75	THP	05/11/2008	163.0	mg/L	
GW76	THP	05/11/2008	165.0	mg/L	
GW77	THP	05/11/2008	167.0	mg/L	
GW78	THP	05/11/2008	169.0	mg/L	
GW79	THP	05/11/2008	171.0	mg/L	
GW80	THP	05/11/2008	173.0	mg/L	
GW81	THP	05/11/2008	175.0	mg/L	
GW82	THP	05/11/2008	177.0	mg/L	
GW83	THP	05/11/2008	179.0	mg/L	
GW84	THP	05/11/2008	181.0	mg/L	
GW85	THP	05/11/2008	183.0	mg/L	
GW86	THP	05/11/2008	185.0	mg/L	
GW87	THP	05/11/2008	187.0	mg/L	
GW88	THP	05/11/2008	189.0	mg/L	
GW89	THP	05/11/2008	191.0	mg/L	
GW90	THP	05/11/2008	193.0	mg/L	
GW91	THP	05/11/2008	195.0	mg/L	
GW92	THP	05/11/2008	197.0	mg/L	
GW93	THP	05/11/2008	199.0	mg/L	
GW94	THP	05/11/2008	201.0	mg/L	
GW95	THP	05/11/2008	203.0	mg/L	
GW96	THP	05/11/2008	205.0	mg/L	
GW97	THP	05/11/2008	207.0	mg/L	
GW98	THP	05/11/2008	209.0	mg/L	
GW99	THP	05/11/2008	211.0	mg/L	
GW100	THP	05/11/2008	213.0	mg/L	

- Enter data via a standard intuitive spreadsheet.
- Add shapefile for basemap.

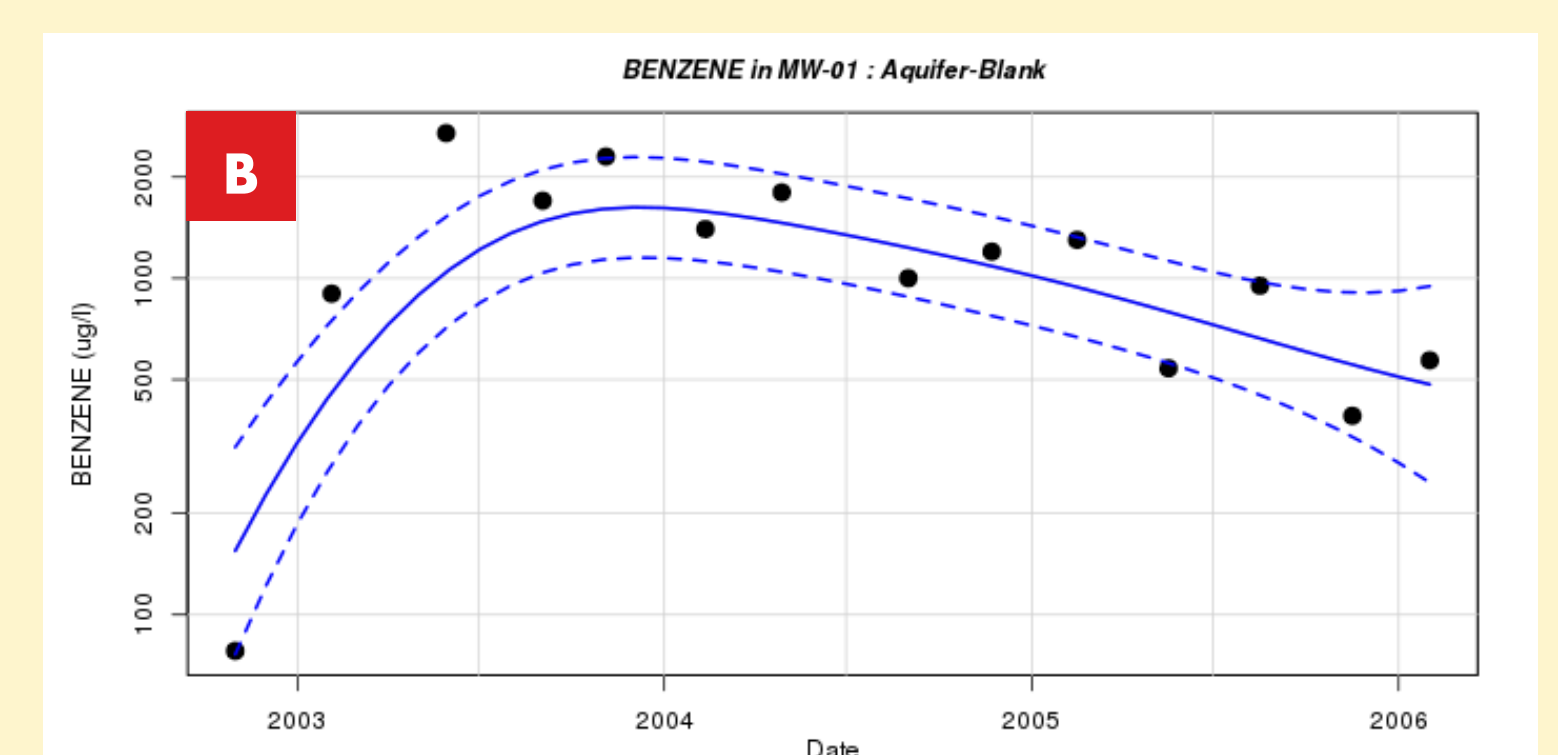
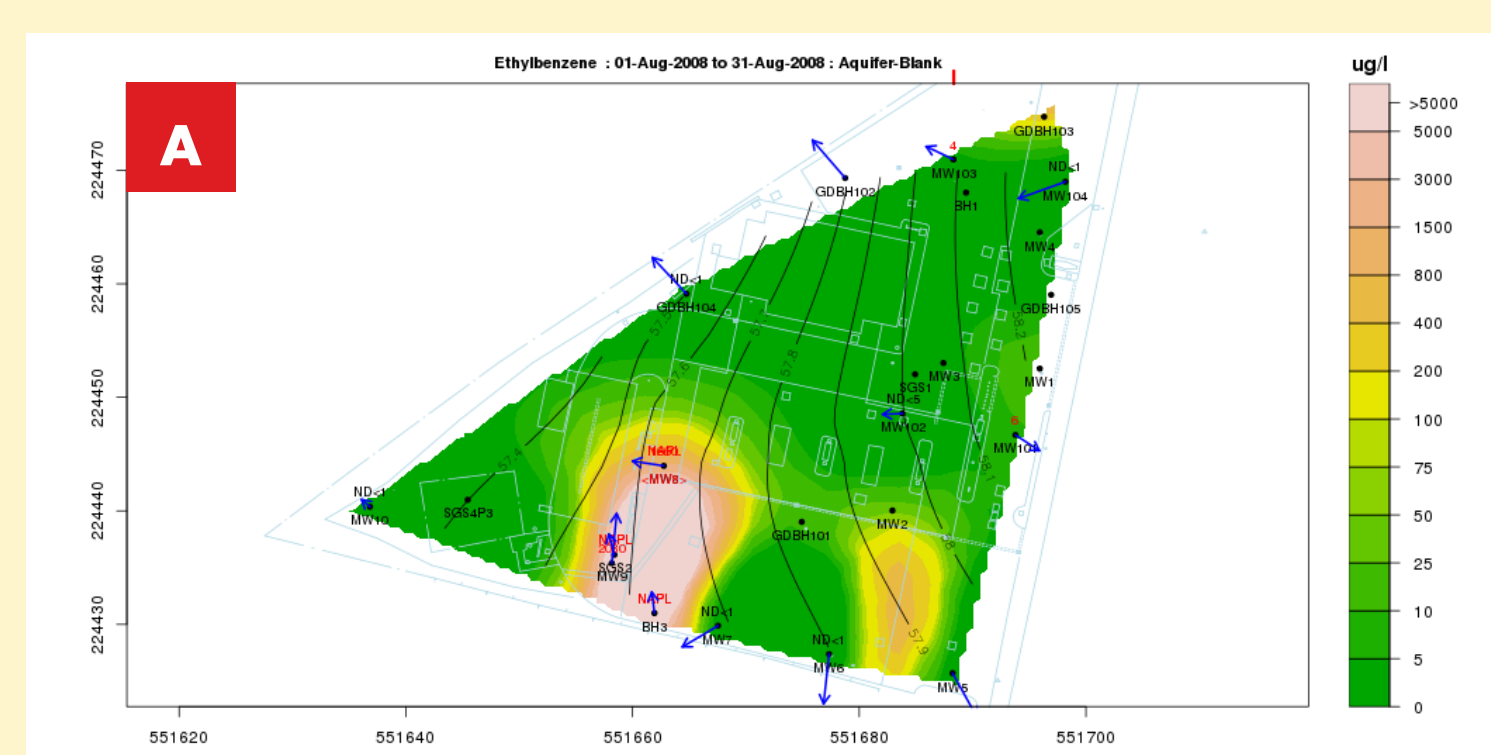
Step 4: Report Generation



- Plots can directly be exported (A)
- Export a sequence of plots of different time slices (B)
- Export plume metrics graphs (C)



Step 3: Interactively Analyse your data



- Concentration contour maps (panel A)
- Individual well Timer series plots (panel B)
- Concentration Trend and threshold indicator matrix. (panel C).

Trend, 01-Feb-2006 to 28-Feb-2006	BENZENE	TOLUENE	XYLENE
MW-01	Strong Downward Trend: Half-Life < 1 Year	Not Available	Not Available
MW-02	Downward Trend: 1 Year < Half-Life < 2 Years	Not Available	Not Available
MW-03	Stable: Doubling-Time > 2 Years, Half-Life > 2 Years	Not Available	Not Available
MW-04	Upward Trend: 1 Year < Doubling-Time < 2 Years	Not Available	Not Available
MW-05	Strong Upward Trend: Doubling-Time < 1 Year	Not Available	Not Available
MW-06	Not Available	Not Available	Not Available
MW-07	Not Available	Not Available	Not Available
MW-08	Not Available	Not Available	Not Available
MW-09	Not Available	Not Available	Not Available
MW-10	(Significantly) Below Threshold Limit	Not Available	Not Available
MW-11	Above (Not Significantly below) Threshold Limit	Not Available	Not Available

More information?

- Jones, W.R.; M. J. Spence; A. W. Bowman, L. Evers, D. A. Molinari (2014) A software tool for the spatiotemporal analysis and reporting of groundwater monitoring data. Environmental Modelling & Software: 55, p242-249 (doi:10.1016/j.envsoft.2014.01.020)
- Jones, W.R.; M. J. Spence; M. Bonte (2015) Analyzing Groundwater Quality Data and Contamination Plumes with GWSDAT. Ground Water: 53:4: p513-514 (doi: 10.1111/gwat.12340)
- Bowman, A. W.; L. Evers, D. A. Molinari, W. R. Jones, M. J. Spence (2015) Efficient and automatic methods for flexible regression on spatiotemporal data, with applications to groundwater monitoring. Environmetrics (DOI: 10.1002/env.2347)