



British Geological Survey

NATURAL ENVIRONMENT RESEARCH COUNCIL

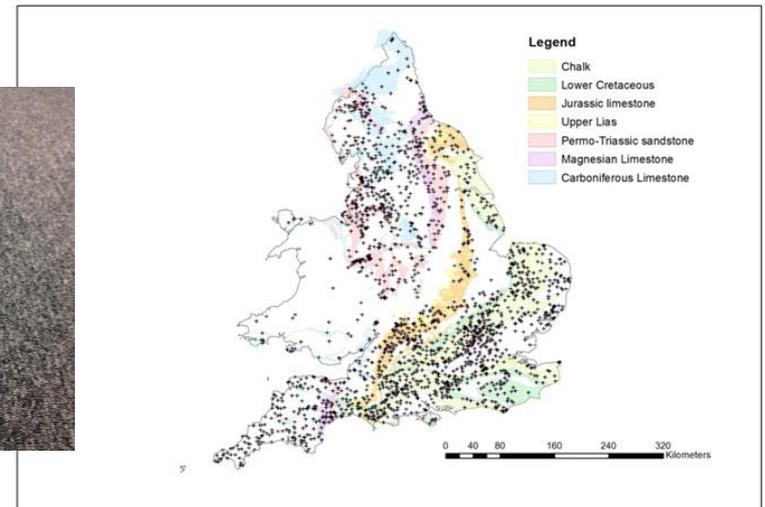
Gateway to the Earth

An assessment of micro-organic pollutants in groundwater across England and Wales

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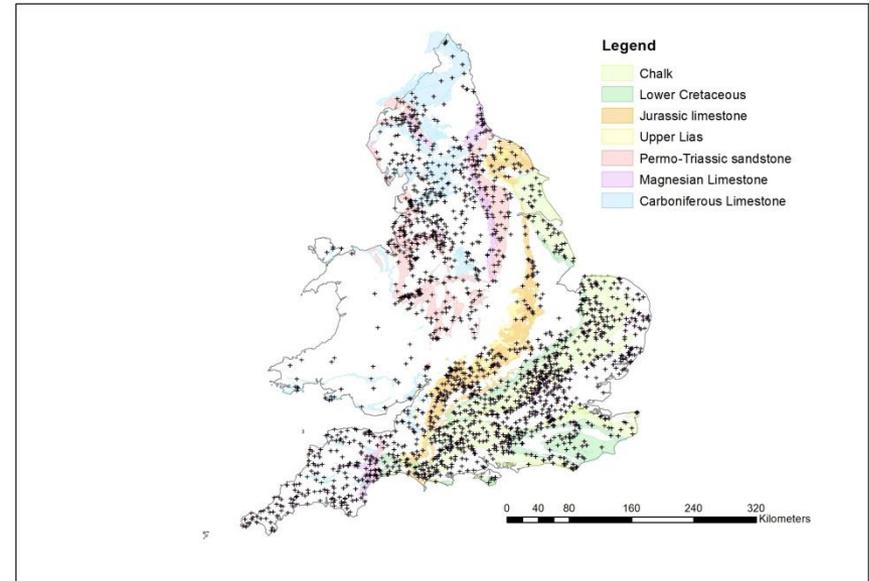
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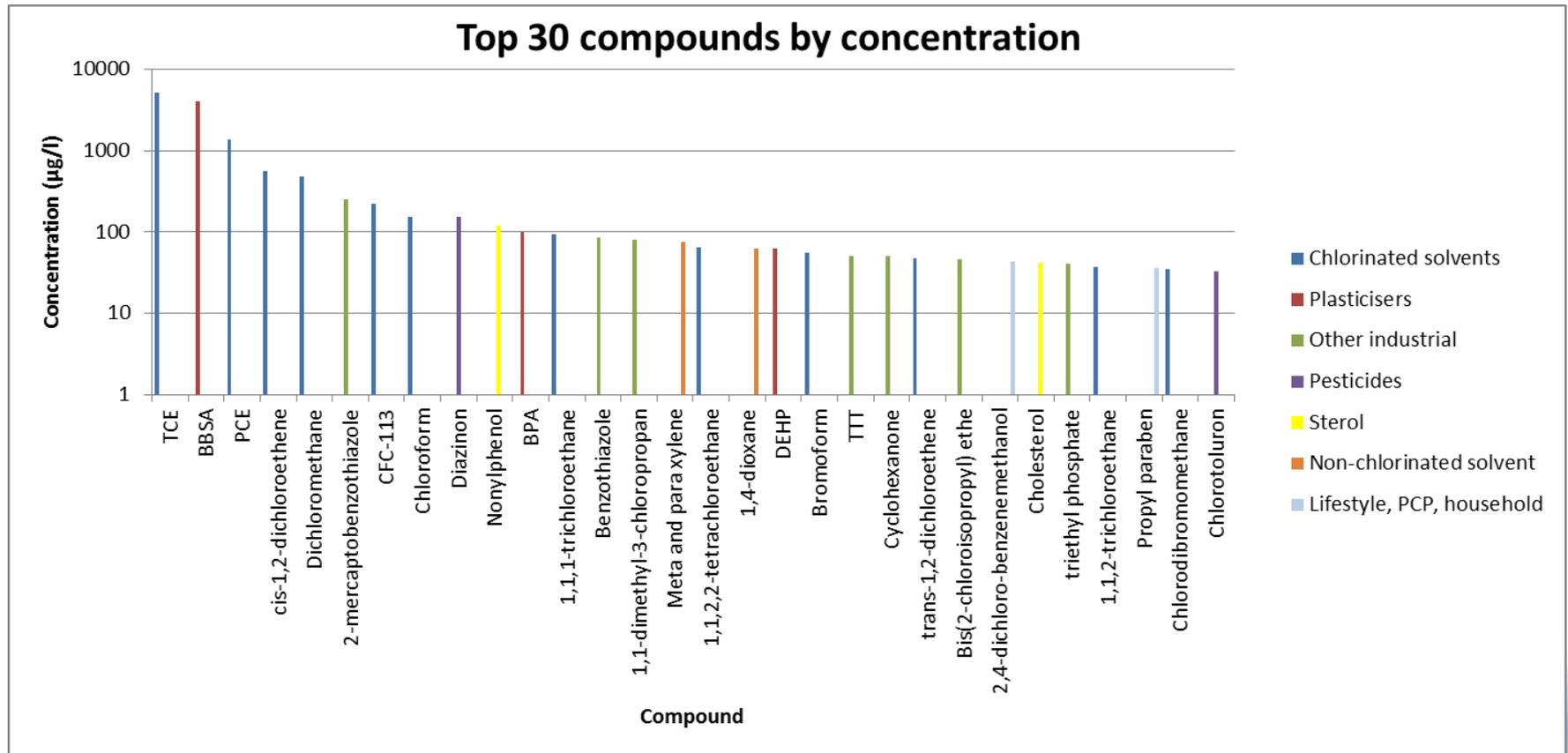


Background and methods

- National dataset for broad screening of organics (2004 – 2012)
- 2650 sites in water quality network for England and Wales
- Data cleaning and QA (over 10 detects to rule out spurious results)
- Look at relationships between compounds and aquifers also land use on national scale

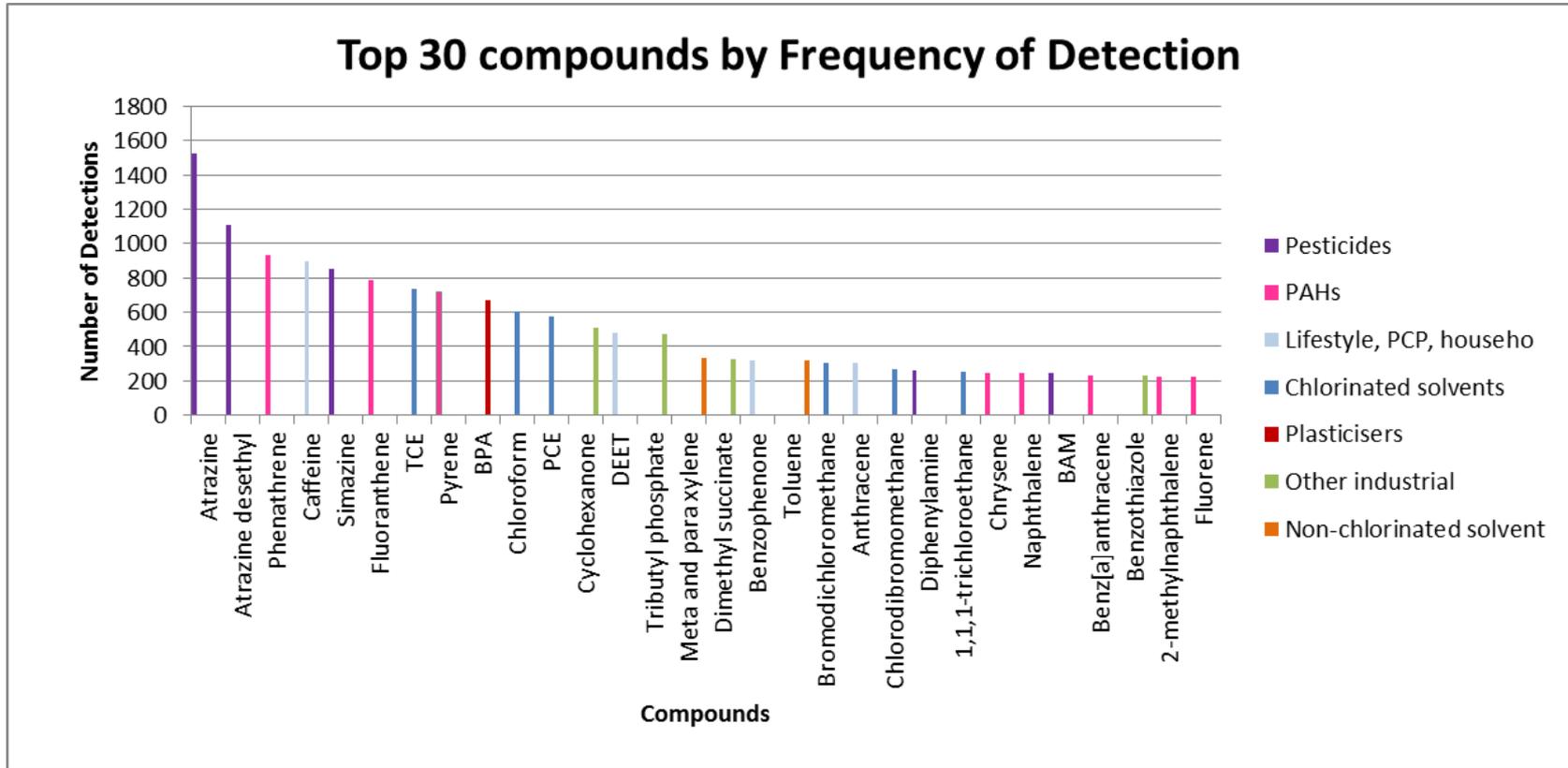


Overall National Assessment



- Dominated by chlorinated solvents (11)
- Absence of PAHs

Overall National Assessment



- Pesticides most frequently detected
- A number of PAHs
- Caffeine -4th most detected

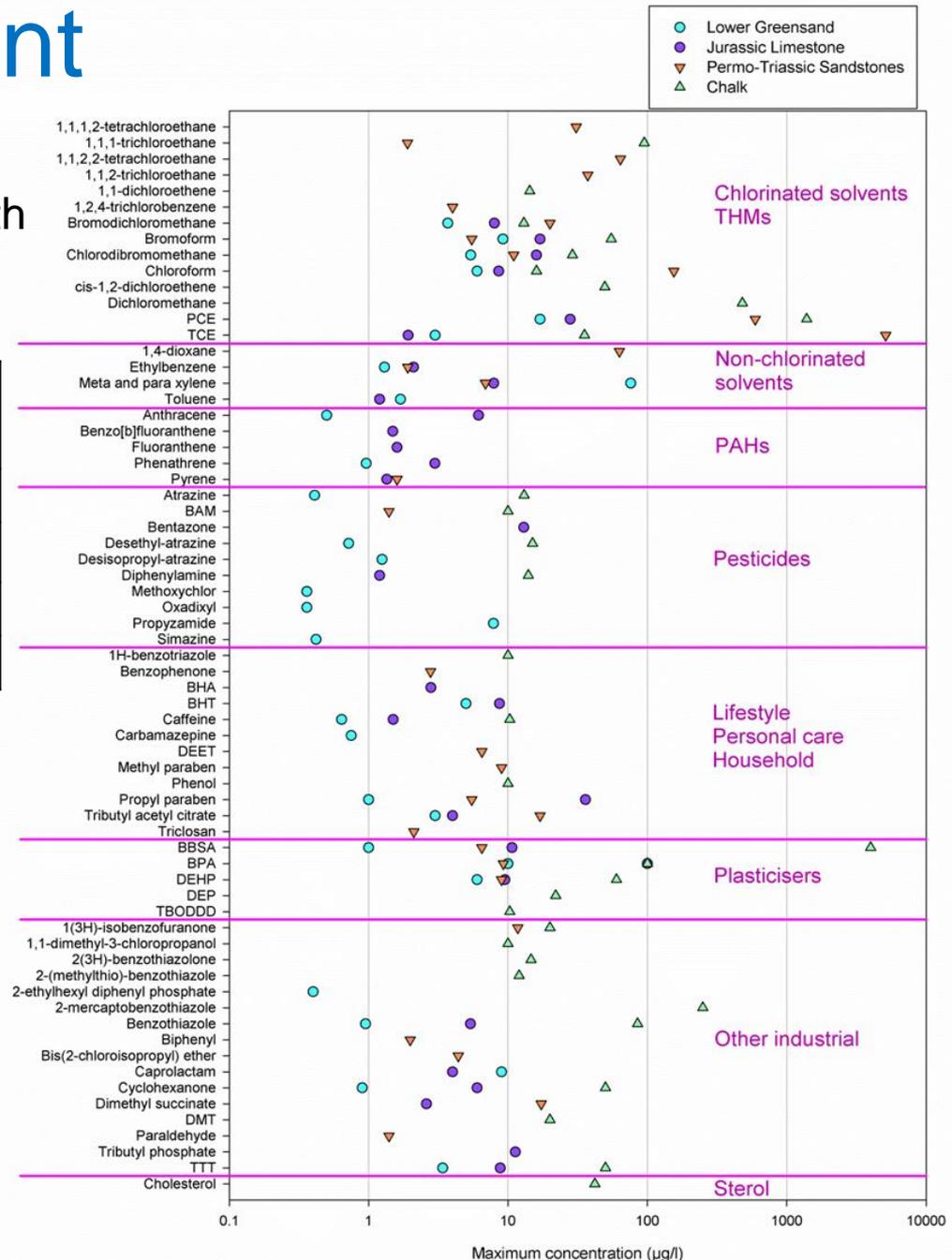
Aquifer assessment

Aggregated aquifers into standard groups. Plotted the 4 major aquifers with highest number of detects.

Aquifer group	Number of sampled sites	Number of detects
Chalk	647	11546
Permo-Triassic Sandstones	372	2547
Jurassic Limestones	248	2511
Lower Greensand	78	1288

Top 30 maximum concentrations:

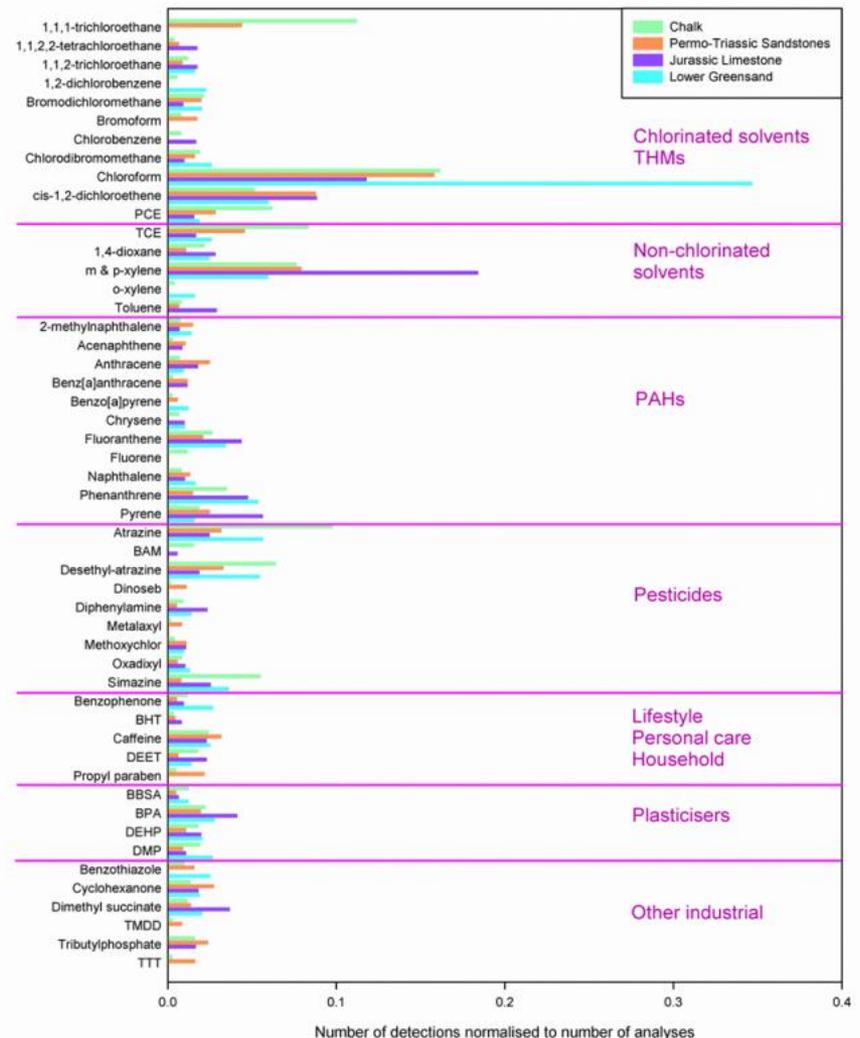
- Lower Greensand max values typically lower than other aquifers
- Highest maxima mainly in Chalk, possibly as more samples taken
- Highest maxima mainly chlorinated solvents in Chalk & PT Sandstones
- THMs found in all 4 aquifer groups with max concentration 155 ug/l



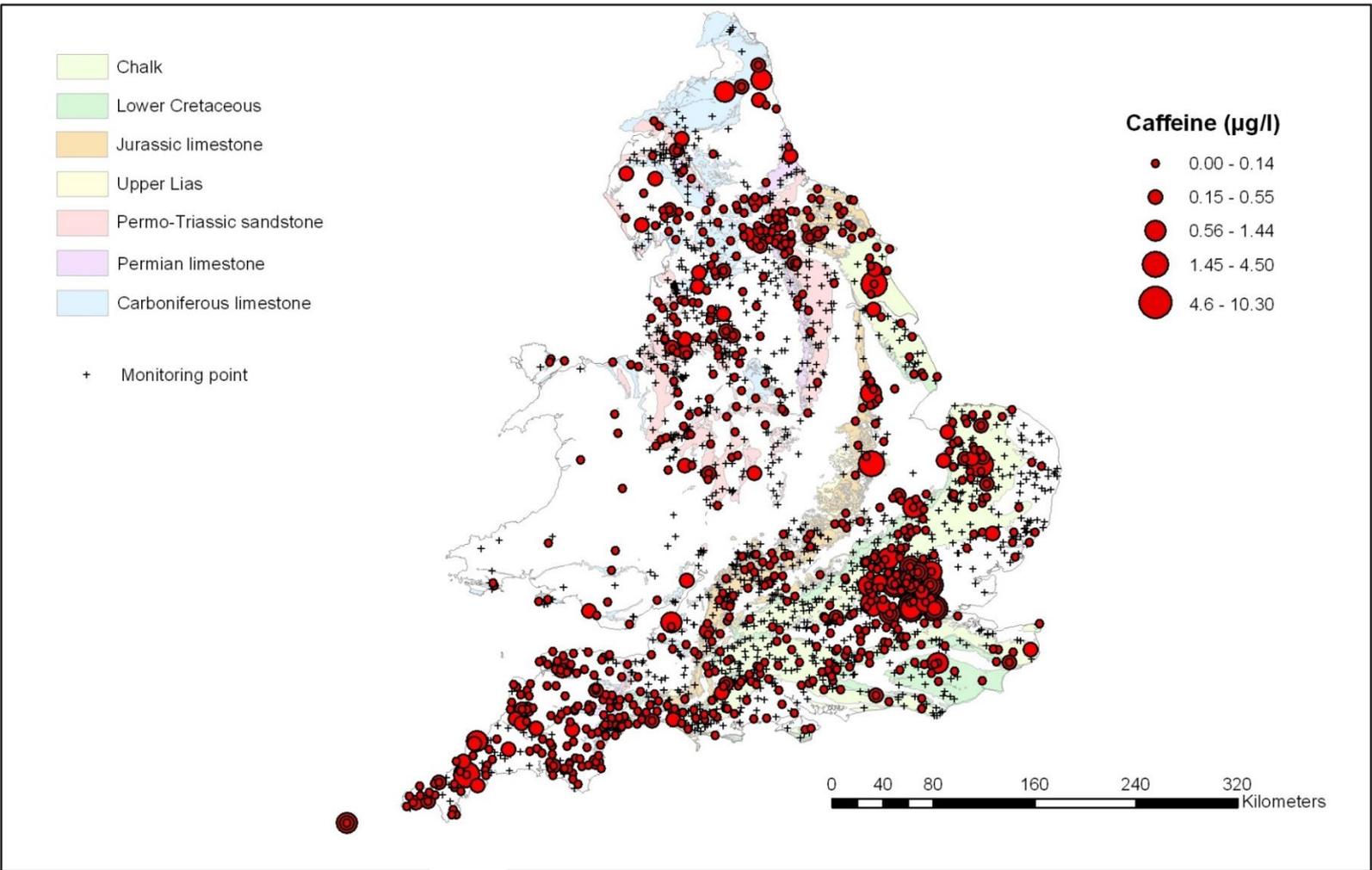
Aquifer assessment: detections

Frequency of detection, combined Top 30 list of 51 compounds:

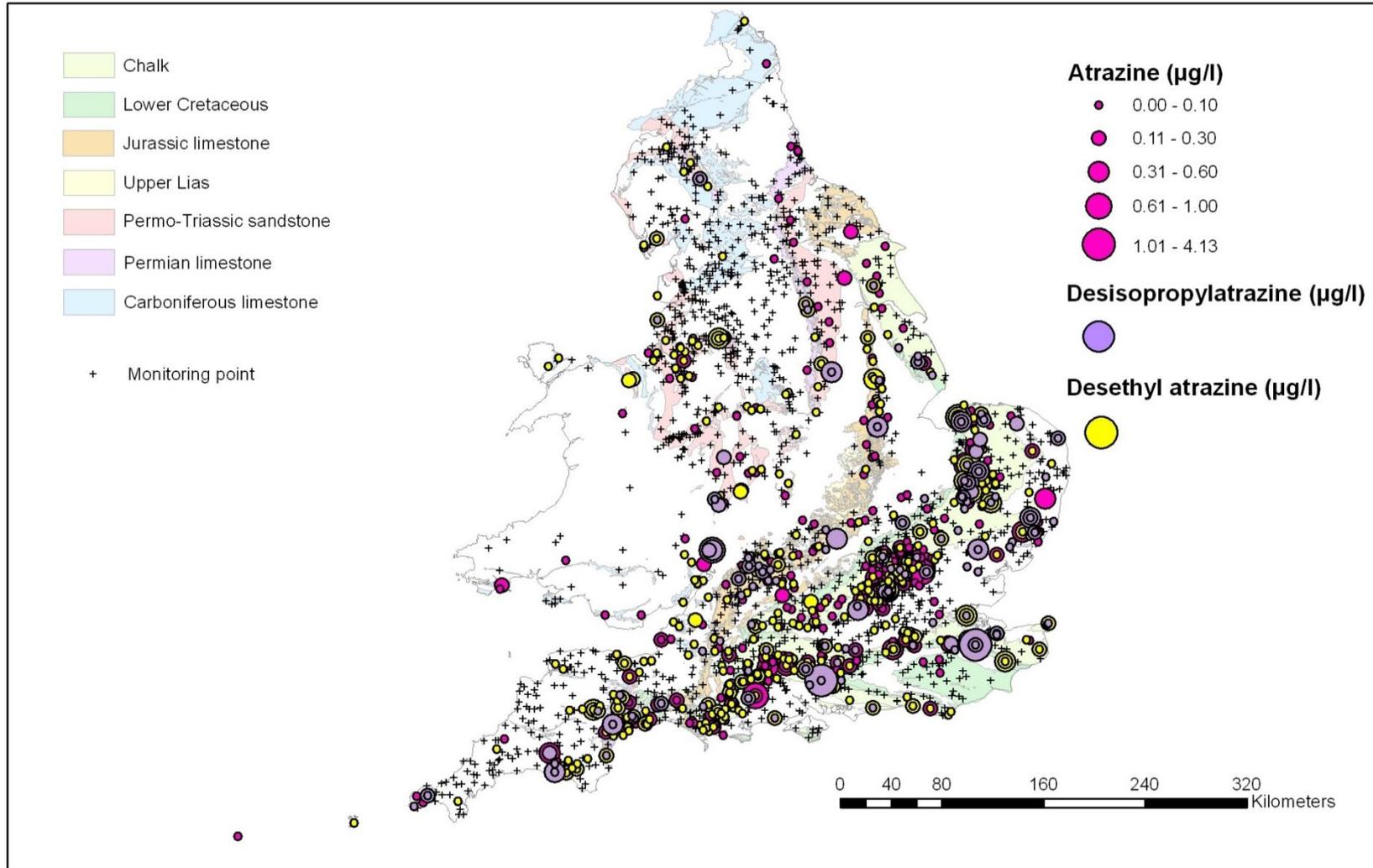
- Chloroform (THM) most frequently detected, in about a third of Lower Greensand samples, and 12-16% of samples from the other 3 aquifer groups
- PAHs were widely detected in all 4 aquifer groups, with 11 compounds here
- Pesticides were most frequently detected in the Chalk and Lower Greensand; atrazine detected in 10% of samples from the Chalk, atrazine desethyl in 6%.
- DEET detected in 1-2% of samples from all aquifer groups, caffeine 2-3% and benzophenone 1-3%



National Distribution of Caffeine



National distribution of Atrazine and metabolites



Landuse

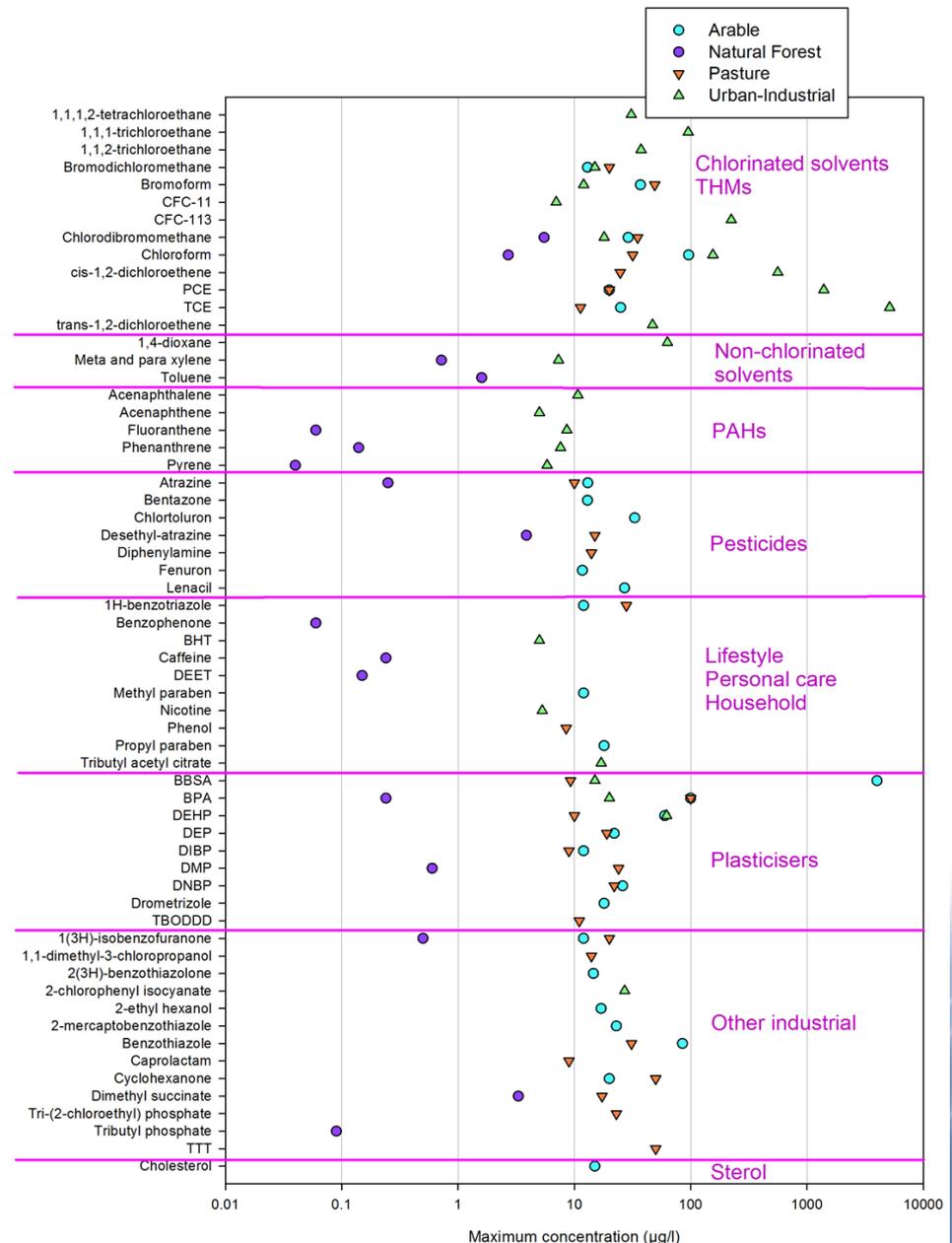
Method – CORINE landuse dataset for Europe (EEA, 2006) with a 60% of dominant type within 500 m radius

Four Categories:

- Natural Forest (NF)
- Urban and Industrial
- Arable
- Pasture/grazing

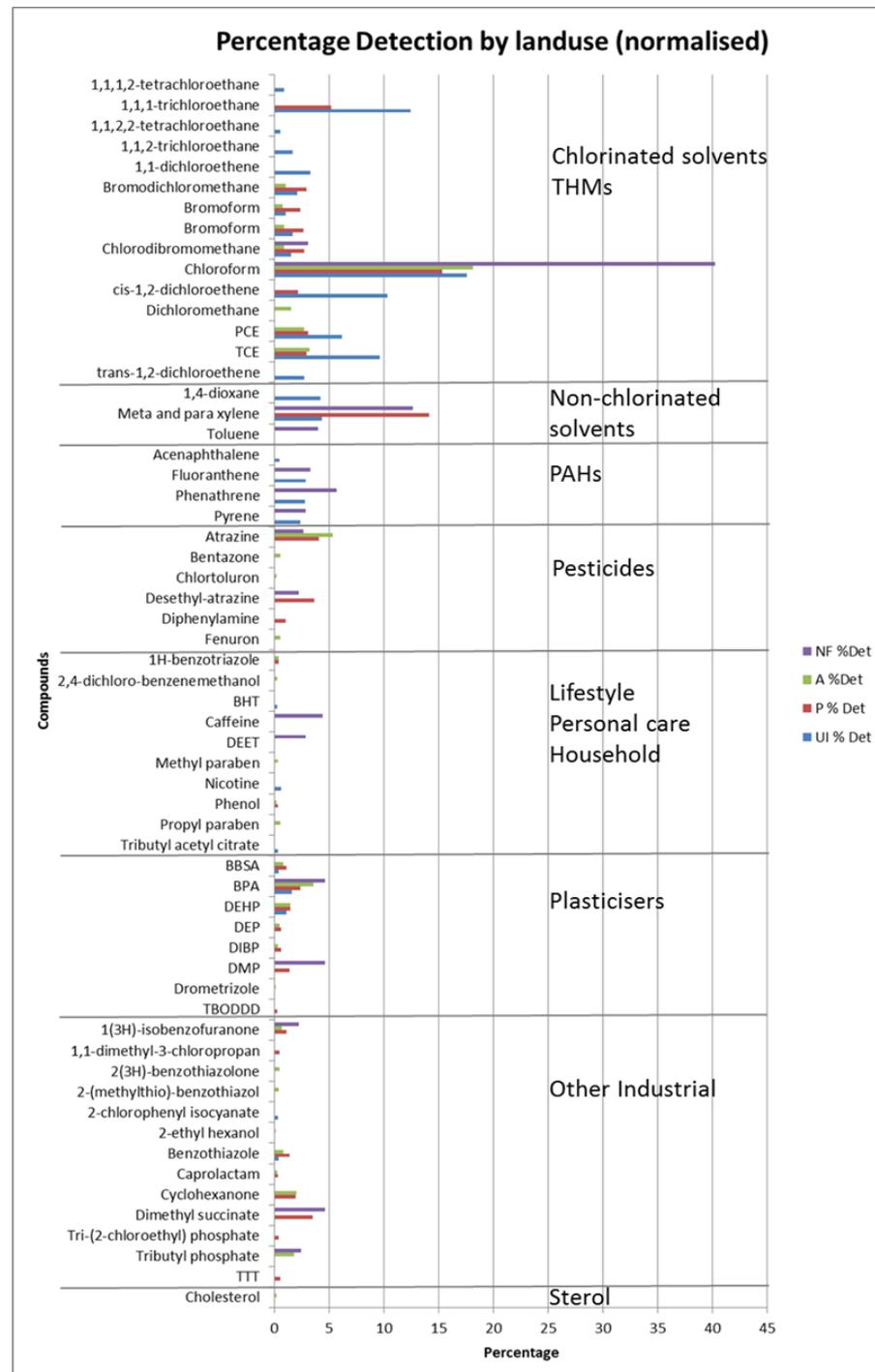
Mixed use was not considered due to multiple sources for the same compounds, out of 2605 sites 25.11% classed as mixed.

- NF lower concentrations
- Plasticisers and Chlorinated solvents in all 4 categories
- Pesticides – A&P
- TCE highest record in UI followed by BBSA in A

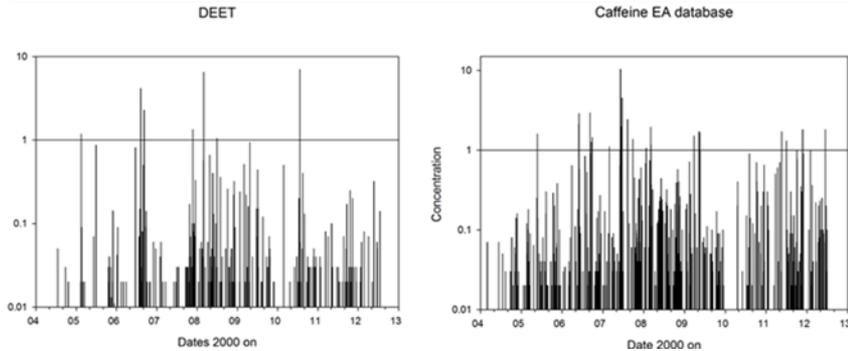


% detections

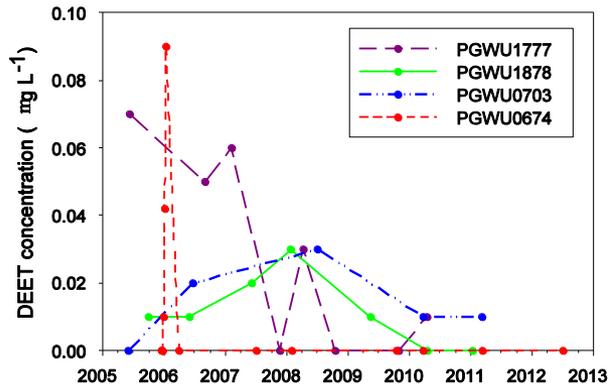
- Chloroform has highest % detection at 40% in NF
- Over 10% detection also include chloroform in other 3 environments, xylene in UI, P, NF; 1,1,1 trichloroethane and cis1,2dichloro in UI
- Caffeine and DEET only found within NF
- CFCs removed!



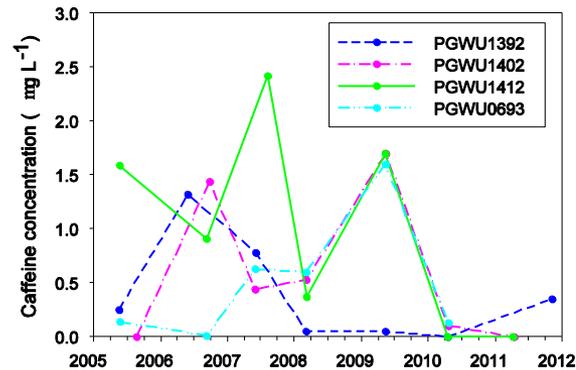
National and site specific trends for selected compounds



DEET concentrations at unconfined Chalk sites
(sites with 3 or more detections)



Caffeine concentrations at confined Chalk sites
(sites with 5 or more detections)



Initial findings

- High concentrations of chlorinated solvents dominate the national picture
- Nationally frequency of detects dominated by pesticides and PAHs
- Lower Greensand max values typically lower than other aquifers
- Highest maxima mainly chlorinated solvents in Chalk & PT Sandstones
- Chloroform (THM) most frequently detected, in about a third of Lower Greensand samples, and 12-16% of samples from the other 3 aquifer groups
- NF lower concentrations with chloroform dominating all of the landuse types
- DEET & Caffeine –distribution and frequency of detection on national scale (c 10%)
- Data that is useful to include in national scale long term monitoring datasets linked to laboratory methods and monitoring network sites changes