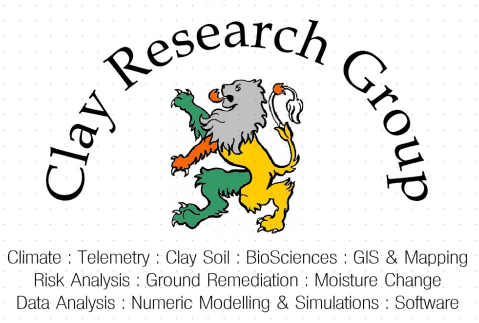
The
Clay Research Group

RESEARCH AREAS

Climate Change : Data Analysis : Electrical Resistivity Tomography
Time Domain Reflectometry : BioSciences : Ground Movement
Soil Testing Techniques : Telemetry : Numerical Modelling
Ground Remediation Techniques : Risk Analysis
Mapping : Software Analysis Tools
Intelligent Systems



November 2015

Edition 126

The Clay Research Group

CONTENTS

Issue 126, November, 2015

Articles and Feedback

We welcome contributions from readers on topics related to domestic subsidence. Unusual claims, technical reviews, spatial analysis (mapping), suggestions for the 2016 Aston Conference, reflections on developments and views on change etc..

THE CLAY RESEARCH GROUP
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November Already

An uneventful year in terms of domestic subsidence, at least in terms of claims received. Low numbers following the trend over recent years and a 50 - 50 split on valid claims between clay shrinkage and escape of water perils.

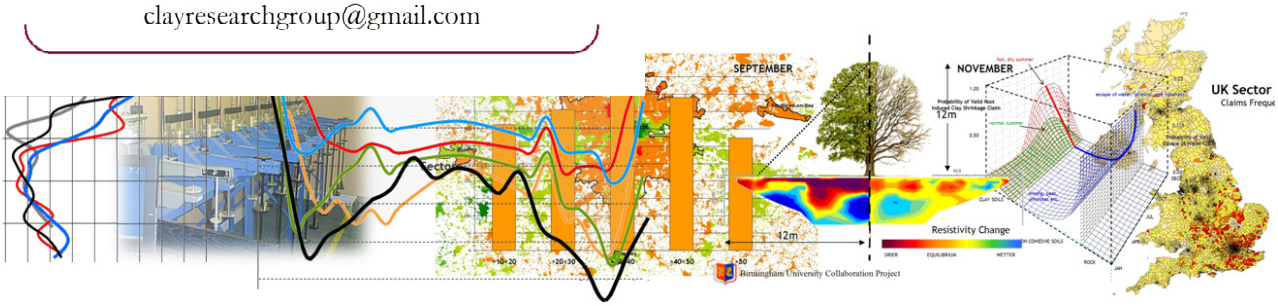
EPSRC Proposal

Disappointment that the academic team applying for the Engineering Grand Challenges Research grant have not been successful. A great deal of work goes into submissions for funding and in this particular instance the partners would have been working on topics of interest to the subsidence industry.

The submission was entitled "Re-Engineering the Ground's Ecosystem Provision to support Future Cities – A Rebalancing of Engineered and Natural Systems".

The team was headed up by the Engineering Geology Science Directorate (Dr. Helen Reeves of the BGS) and included the Universities of Birmingham (Professors Chris Rogers and Ian Jefferson), Newcastle (Prof. Stephanie Glendinning) and Strathclyde (Prof. Rebecca Lunn) in the team.

More opportunities shortly.



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St Albans Road Collapse

The Local Authority acted quickly following the collapse of a road in St Albans, with the void back-filled within the week. Unsure how far the voids extended and what lay at depth, Hertfordshire County Council engaged GeoTechnology to carry out a gravity anomaly survey, an extract of which is shown below, superimposed onto the OS map showing historic features.

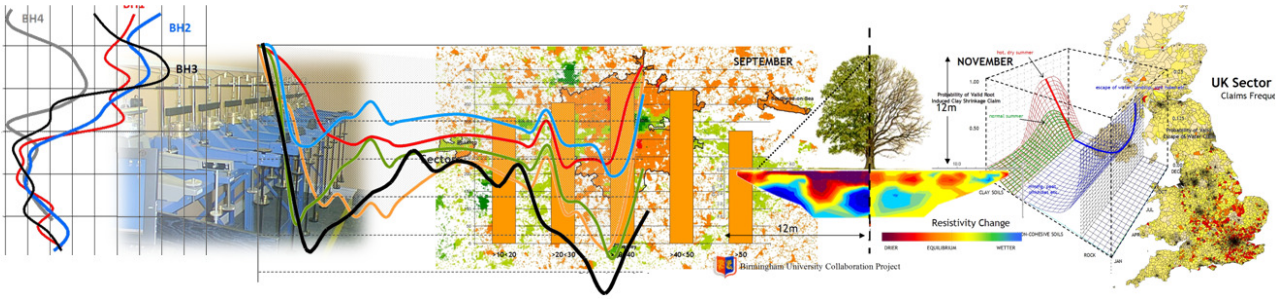
Gravity anomaly surveys measure differences in the mass of the soil below ground and are used to detect both voids and buried structures.

Briefly, red indicates increasing density (possible buried structures) and blue, zones of decreasing density - possible voids.

This sort of situation reveals the value of 'survey by drone' - see picture right.

The presence of tension cracks in paving adjoining the hole suggested a further collapse might have been possible, although less likely following the prompt back-filling.

Drones were able to plot the outline and descend into the void to assess the stability of the walls.



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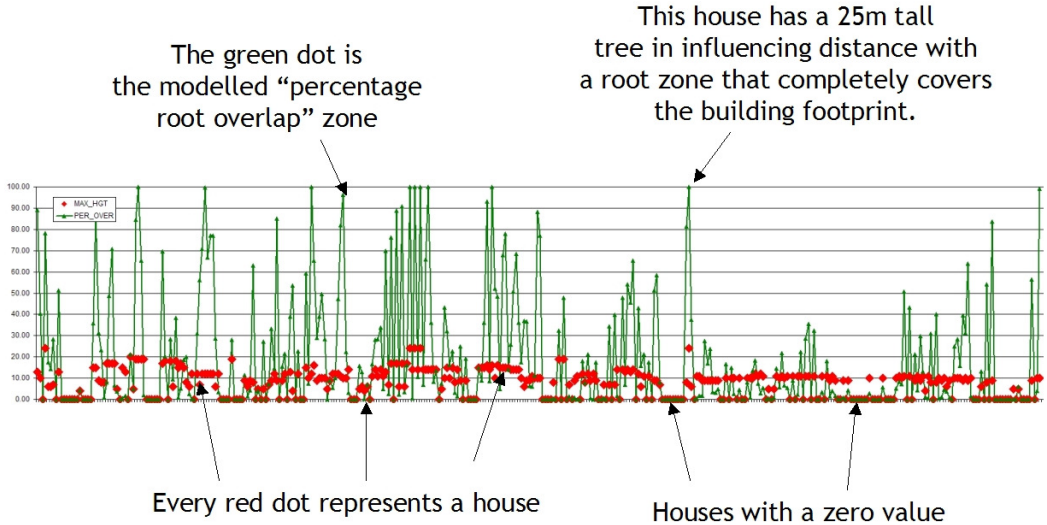
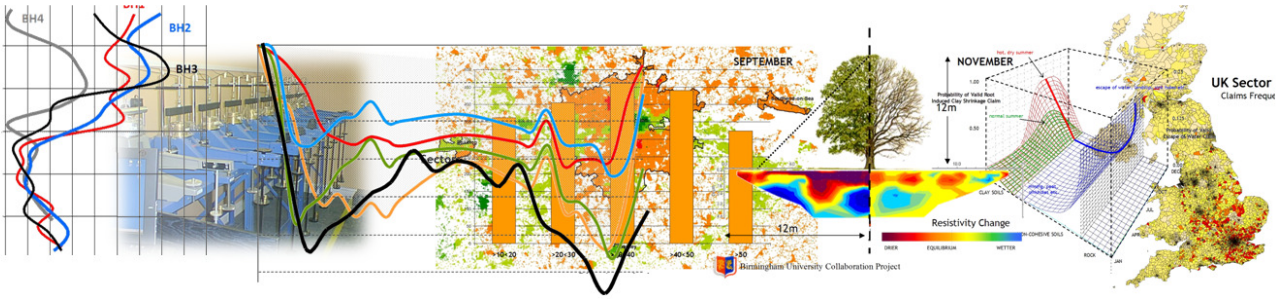
Pictures of houses, front gardens and trees are fine although in some instances, not as useful as a graph. Below, a digital street scene showing the individual houses as red dots, the height of trees within modelled influence of the building (position of the red dot on the 'y' axis) and the modelled root overlap (green plot).



A DIFFERENT STREET SCENE

Around 10 - 15% of the houses have no trees within influencing distance and the average height of the trees (shown by position of red dot) is around 10mtrs. A few in the example (around 9) have a modelled root overlap of 100%, with an average closer to 30%.

The value isn't in the graph but the underlying data. Values ascribed to each element deliver a risk factor but more importantly, that factor can learn from claims experience. The system might start by assuming a 100% tree root overlap is high risk, but the underlying algorithms might have a different idea, and more importantly, that value can adjusted over time.



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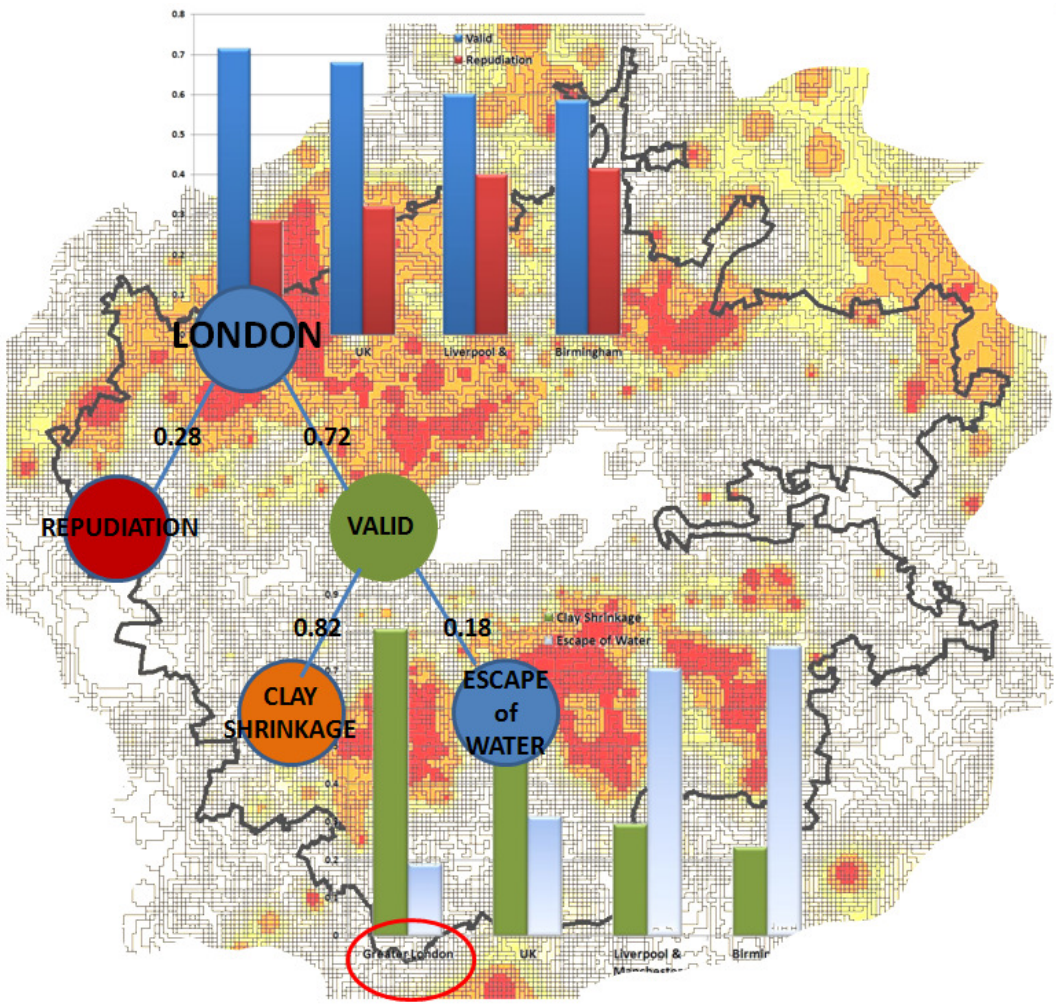
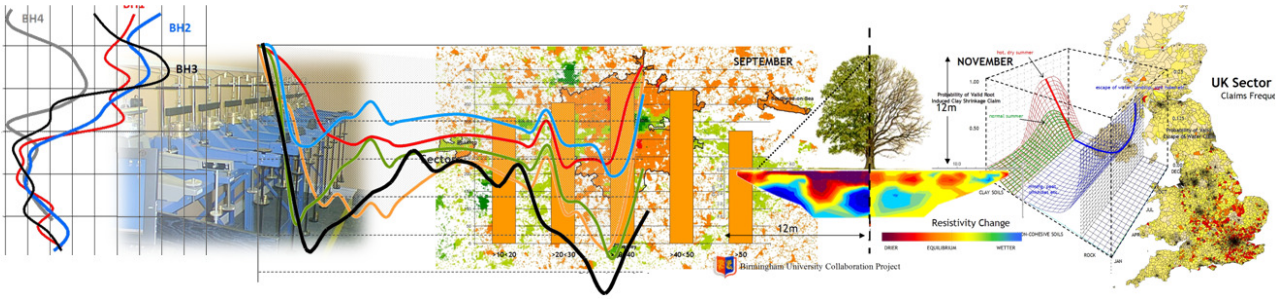
DECISION TREE - LONDON
System Data

There are a series of interlinked decision trees of the sort illustrated below, each dealing with a specific location and with values that change not only by month but by geology, vegetation and to an extent demographics as determined by the claims history at sector level.



Data reflect probabilities for a specific month in a particular year, and vary based on past experience. The example is based on a summer period.



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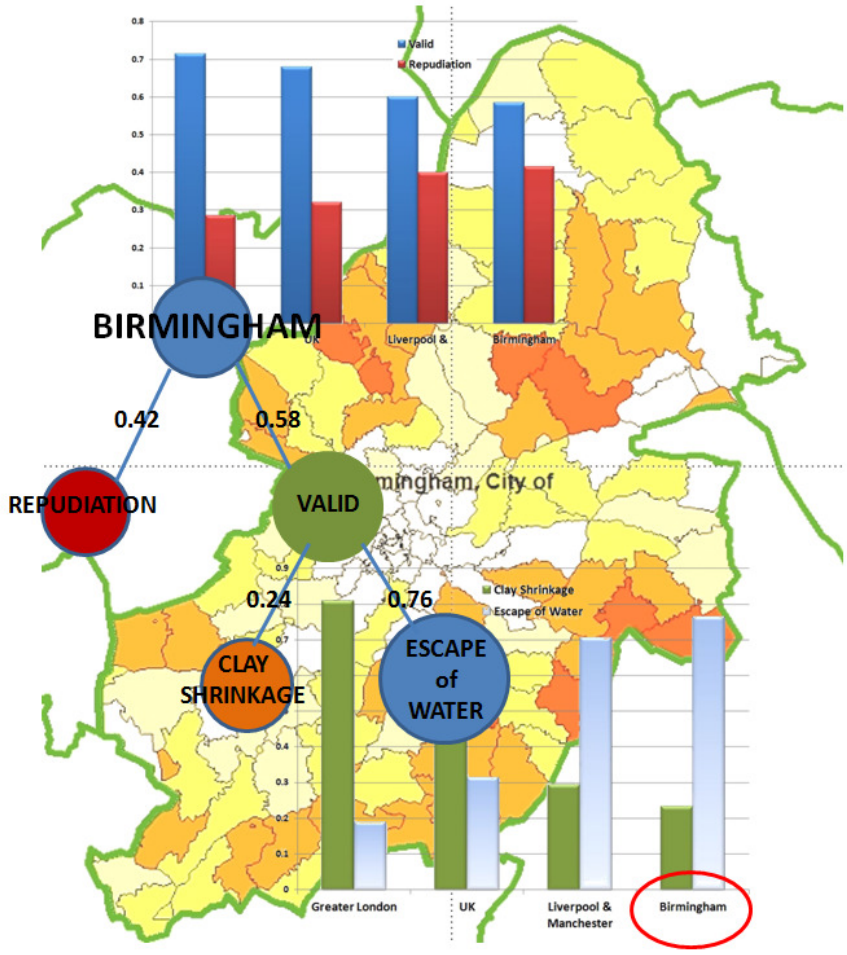
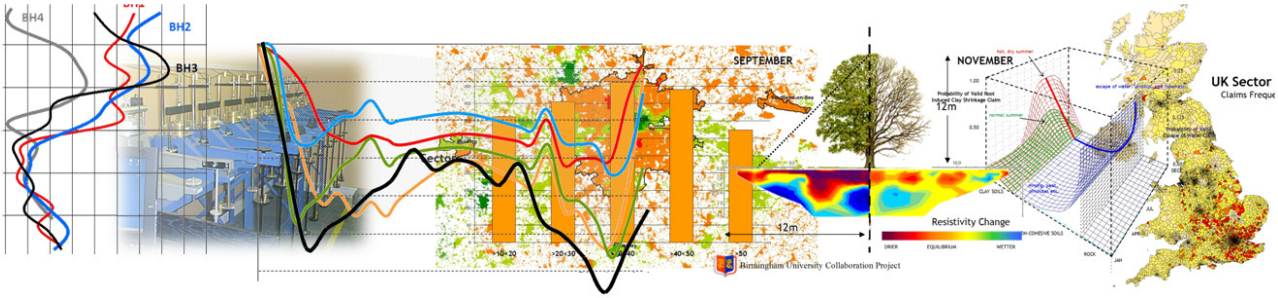
DECISION TREE - BIRMINGHAM
System Data

Sector level data delivers similar results to unit level (see next month's edition for the correlation) and either approach can be adopted however the underlying data is stored. See following pages for examples of how the geological data is interrogated and street level examples of risk mapping.



Sector level data provides similar risk models to unit level with a correlation of around 0.79.



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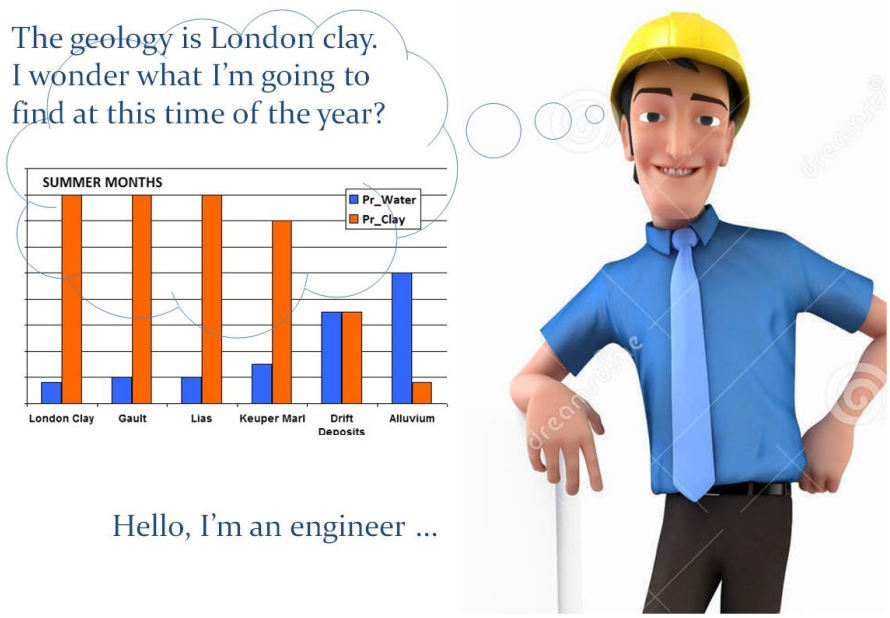
Periodic Signatures and Geology

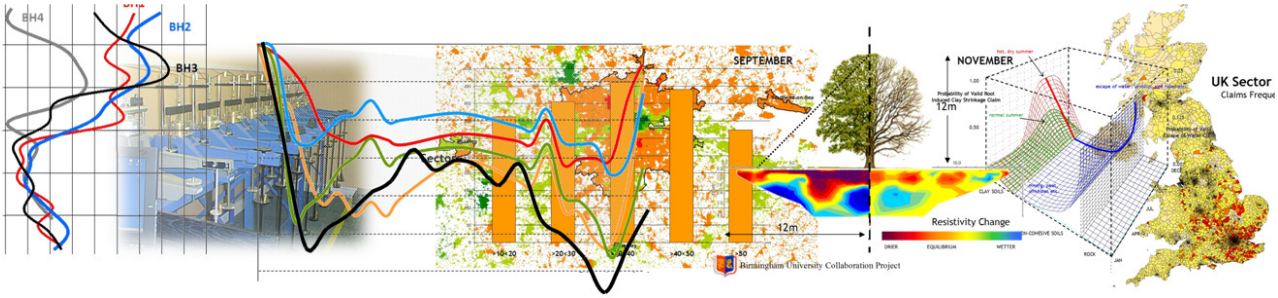
Deriving more from our data

Most experienced subsidence engineers will have some idea what they are dealing with just from the location and damage description. Certain roads have a history and the peril encountered (clay shrinkage, escape of water etc.) is unlikely to vary a great deal.



When a clay soil is encountered, what are the probabilities of the claim being (a) valid and (b) tree related? The highly shrinkable series - London clay, Gault and Lias carry the highest risk as we would expect, followed by the Mercia mudstone. Drift deposits fall into the 50-50 category depending on clay content and alluvial and sandy soils are predominantly associated with escape of water claims. No surprises, but the exercise provides comparable values for modelling.

The unknown is whether the claim will be valid or repudiated. Having some idea of the probability of either may be useful. There is a far higher probability that a claim will be valid on the clay series, in the summer. The probability drops significantly on non-cohesive deposits.



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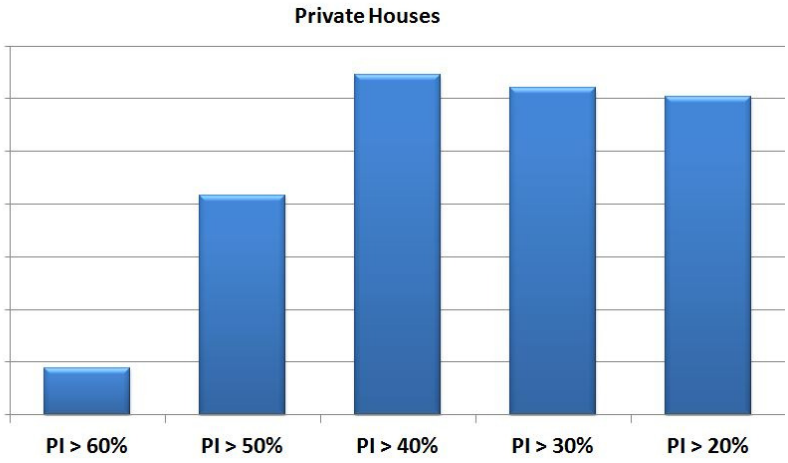
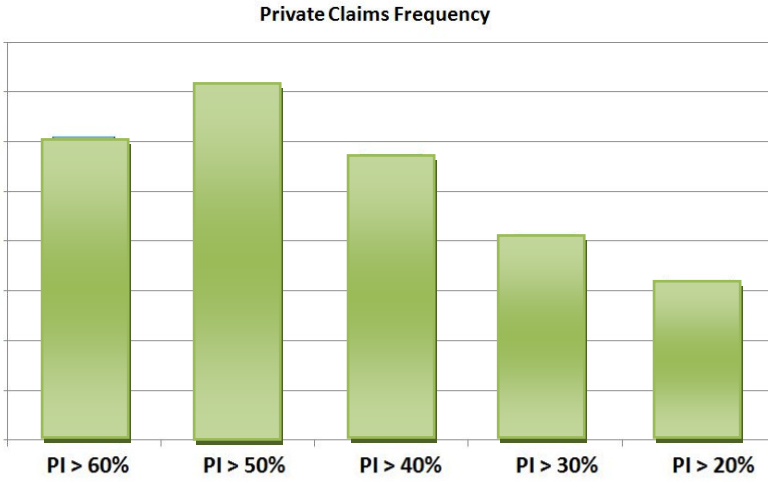
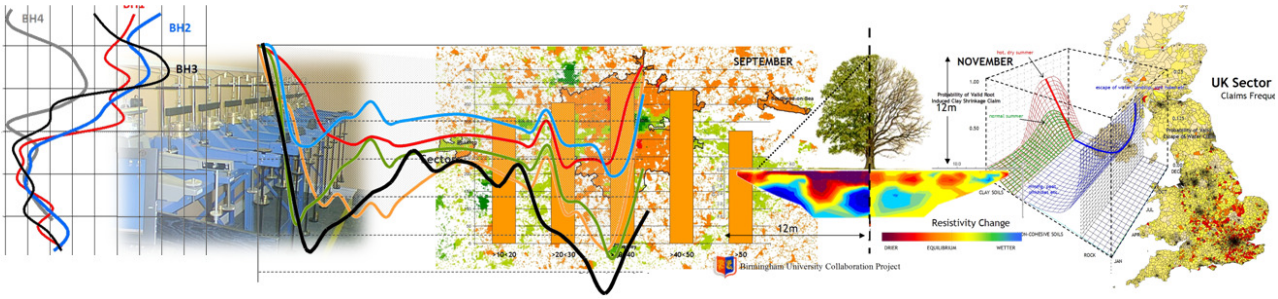
Houses on Clay. Frequency and Risk

These graphs have appeared before. Top, the count of private houses on outcropping clay soil, by plasticity index (PI). Only a small number are built on the highly plastic series with a PI greater than 60%. The largest number are on soil with a PI between 20 and 50%.





Bottom graph, the risk expressed as frequency - i.e. the number of claims divided by the housing population, illustrating the link between subsidence and clay soils is a function of their volume change potential. Highly shrinkable clay soils are far riskier than their counterparts.



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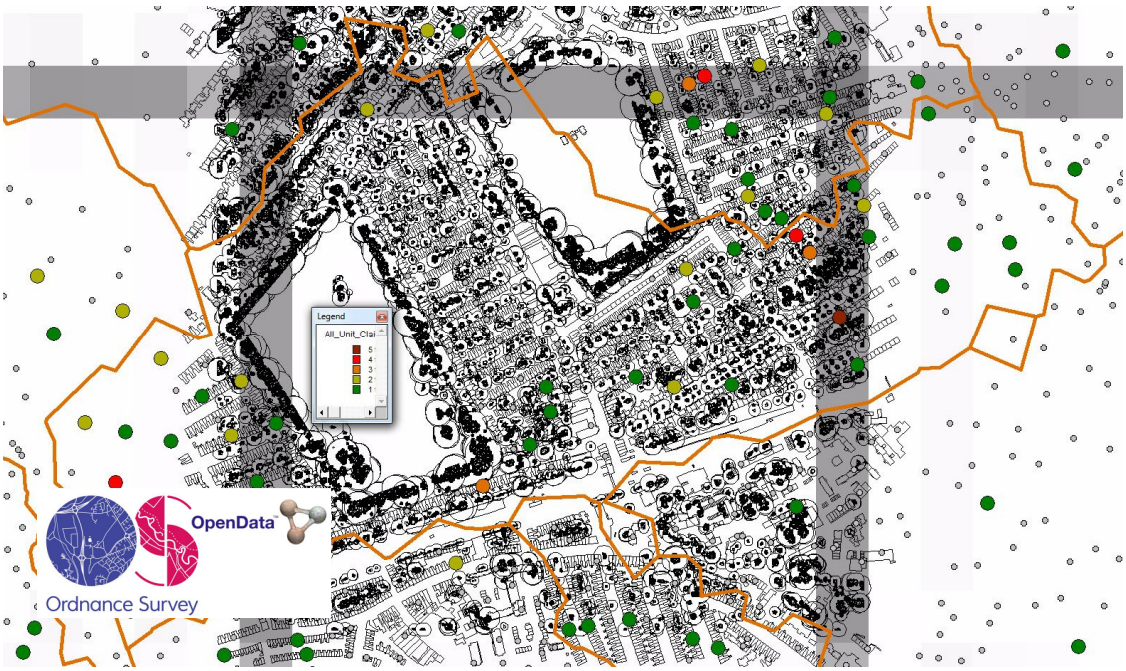
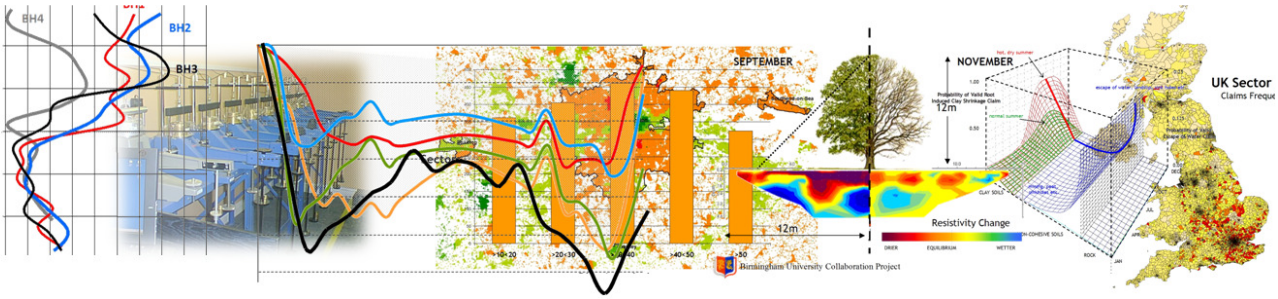
Risky Roads - postcode unit data.

Below, a postcode sector outlined in orange, superimposed onto the OS tiled grid in bold grey outline. Unit level postcodes using OS Open Data centroids are shown in grey and, on average, contain between 15 - 20 houses. A unit postcode is in the form 'B13 8JS'.

The map below is produced on a graduated scale showing the number of claims from our database at unit level. The legend is shown on the map, with one claim shaded green, two yellow etc., up to '5 or more' shown in very dark red. Instances with several claims in a street may reflect repeat damage to one or more houses.



LiDAR survey mapping tree height, crown area, distance from building all superimposed onto OS mapping.



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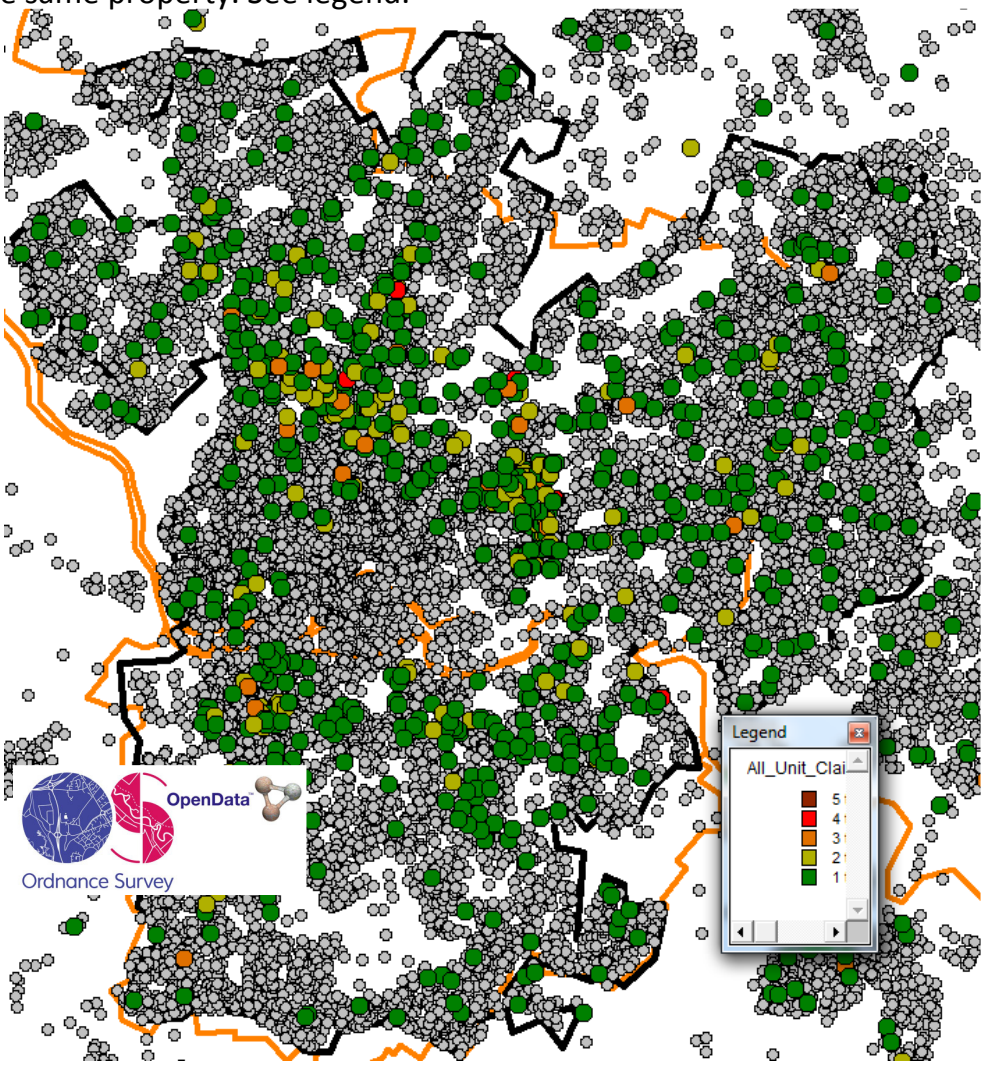
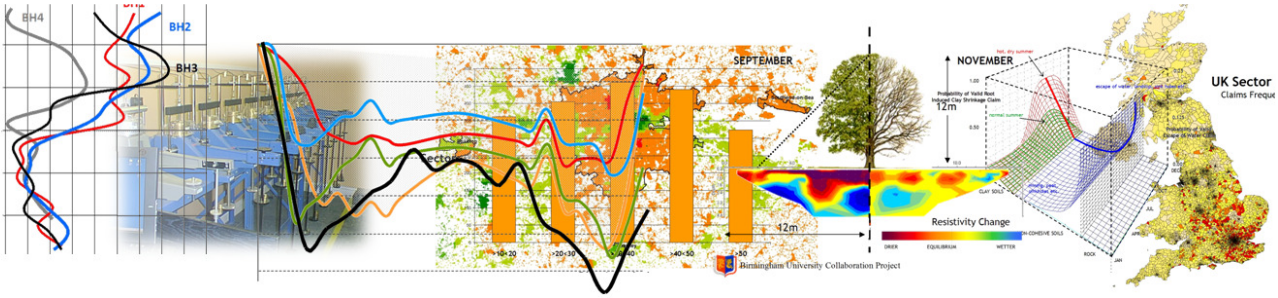
Bristol, Street by Street

Unit postcode map of Bristol, showing roads and streets by claim locations over a 5 year term. A grey dot means no claims, green records one claim, and dark red is five or more in any road or street, although of these, some (for example, where there are several in a street) may be repeat claims on the same property. See legend.



Enter a postcode to zoom in to the locality and then click on adjoining dots to view brief claim details. Claim validity and operating peril etc.



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September Review

Met Office Charts
Rainfall and Temperature

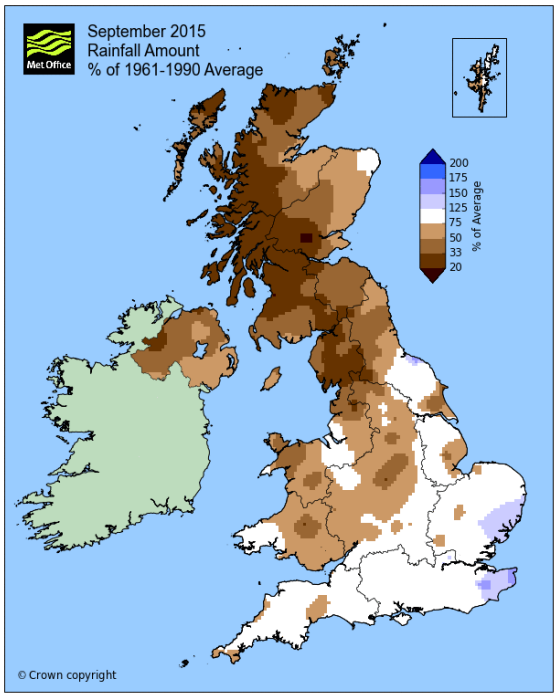
Right, September rainfall and mean maximum temperature compared with a thirty year average - 1961 - 1990.

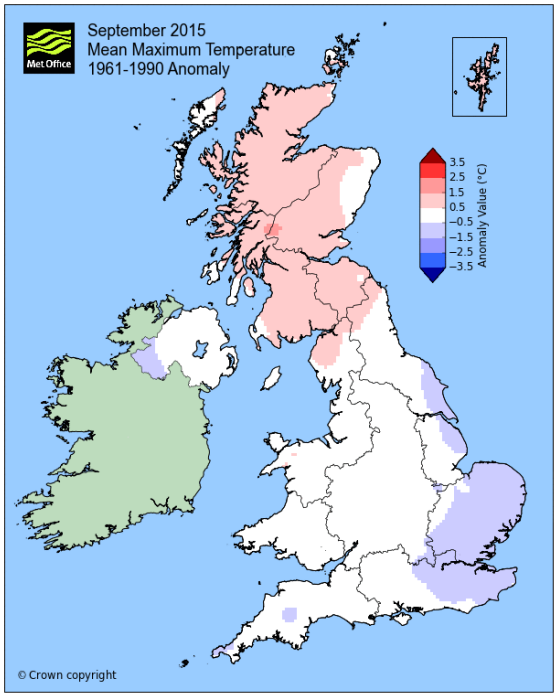
Top, the map reveals far dryer conditions towards the north of the UK with only 20% of the 30 year average rainfall in September.

Bottom, slightly warmer to the north and cooler to the south east, with the midlands and south west matching the 30 year average.

For further information, including images of interactive weather charts, go to ...

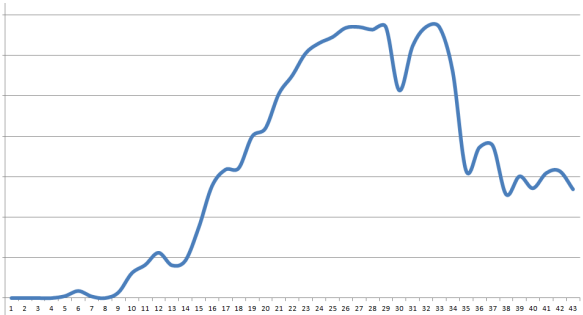
www.metoffice.gov.uk/public/weather



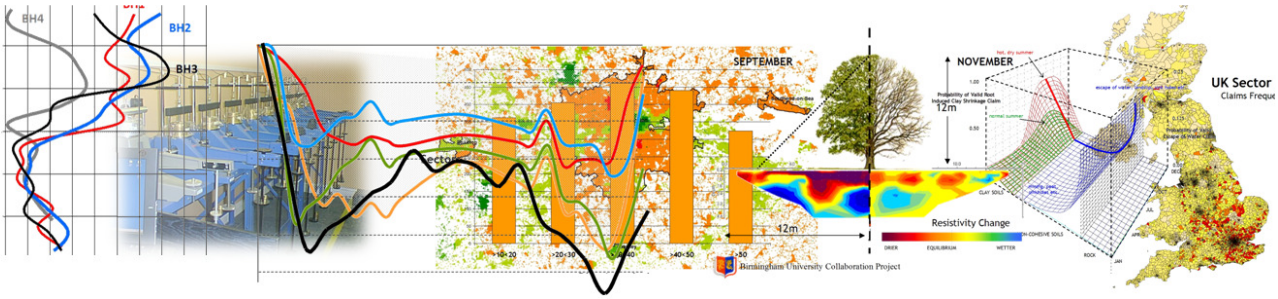


SMD Update

Met Office Data, Tile 161, Medium AWAC, grass cover.



The SMD rose sharply in early summer, peaked in June and July and declined in August.



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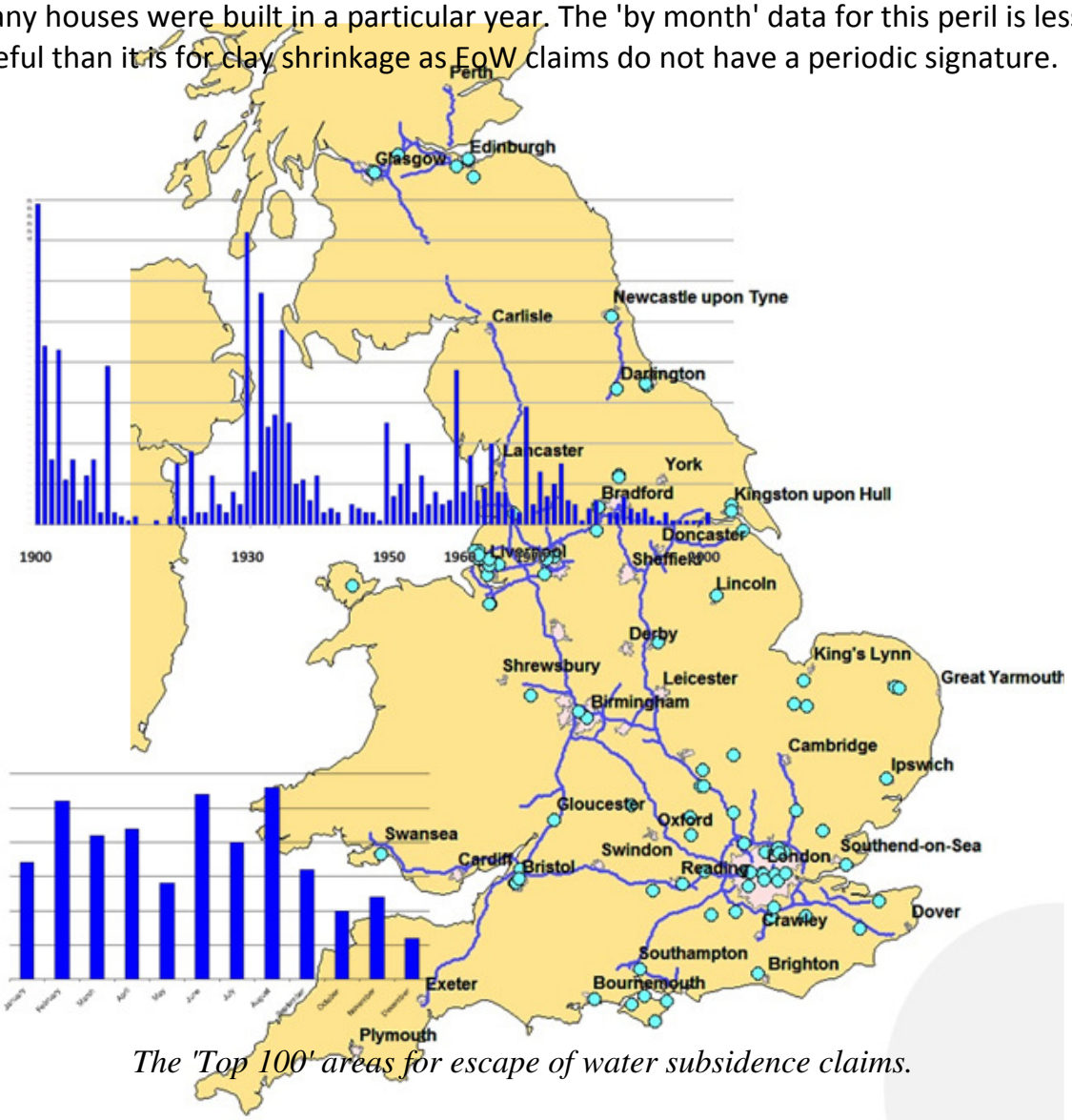
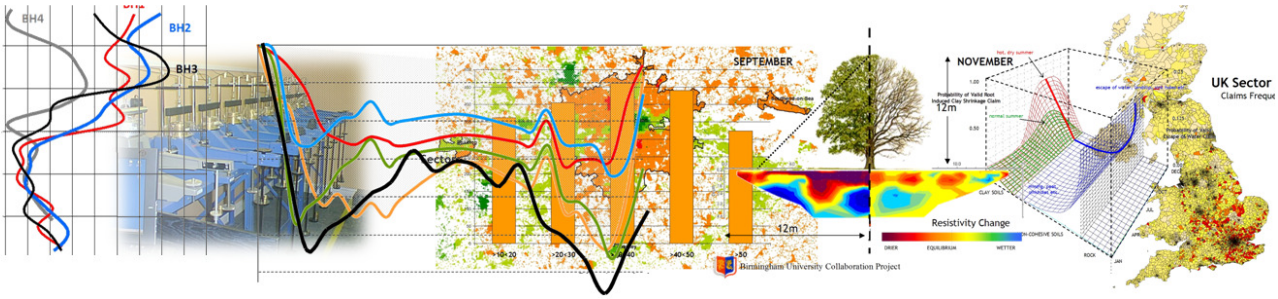
Escape of Water Vulnerability

Knowing where claims of a particular peril are likely to occur, the vulnerable houses by date of construction and likely month of notification are useful. The 'house by age' data should be modified taking into account frequency - i.e., how many houses were built in a particular year. The 'by month' data for this peril is less useful than it is for clay shrinkage as EoW claims do not have a periodic signature.



The 'Top 100' areas for escape of water subsidence claims.

The top chart plots year of construction relating to escape of water claims (not date of claim notification). Unlike clay shrinkage claims, there is no distinct periodic signature. The bottom chart plots month of notification from a sample of just over 10,000 claims.



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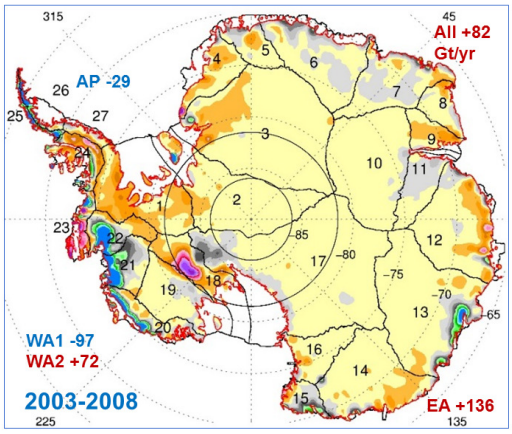
Increasing Antarctic Ice

Extract from NASA report dated
30th October, 2015

"An increase in Antarctic snow accumulation that began 10,000 years ago is currently adding enough ice to the continent to outweigh the increased losses from its thinning glaciers.



The research challenges the conclusions of other studies, including the Intergovernmental Panel on Climate Change's (IPCC) 2013 report, which says that Antarctica is overall losing land ice.

According to the new analysis of satellite data, the Antarctic ice sheet showed a net gain of 112 billion tons of ice a year from 1992 to 2001. That net gain slowed to 82 billion tons of ice per year between 2003 and 2008."

www.nasa.gov

Decreasing Arctic Ice

Extract from NASA web site

"The annual minimum extent of Arctic sea ice was 1.70 million square miles (4.41 million square kilometres) on Sept. 11. This year's minimum is 699,000 square miles lower than the 1981-2010 average.

The sea ice cap grows and shrinks cyclically with the seasons. Its minimum summertime extent, which occurs at the end of the melt season, has been decreasing since the late 1970s in response to warming temperatures.

In some recent years, low sea-ice minimum extent has been at least in part exacerbated by meteorological factors, but that was not the case this year.

"This year is the fourth lowest, and yet we haven't seen any major weather event or persistent weather pattern in the Arctic this summer that helped push the extent lower as often happens," said Walt Meier, a sea ice scientist with NASA's Goddard Space Flight Centre."