

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



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January 2015

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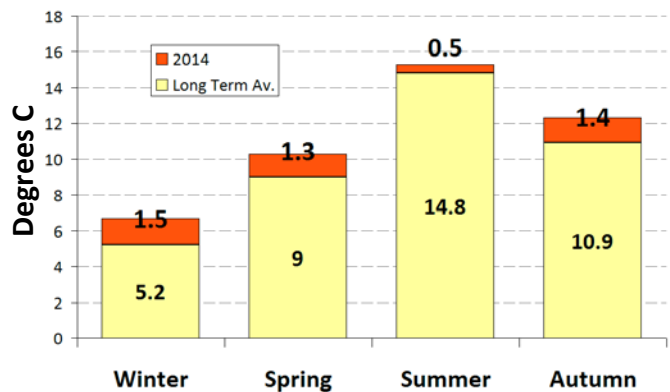
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Looking Back – 2014 in Review

2014 Warmest Year on Record, and 2015 could be Warmer.

2014 looks like being the warmest on record both for the UK and globally, subject to final calculations by the Met Office.



The long-term average (yellow bars in above graph) covers the period 1981 – 2010. Met Office prediction for 2015 “the global mean temperature for 2015 is expected to be between 0.52°C and 0.76°C above the long-term average of 14°C, with a central estimate of 0.64°C.”

The Aston Conference

Aston is booked for June 2015, and we welcome suggestions for topics and papers from anyone who would like to speak.

The last 8 years have been relatively quiet in terms of subsidence claim numbers but active in terms of business development and management. Big Data is playing an increasingly important role. Times are changing, and we would like Aston to reflect that change.

Last year several speakers provided insight into the next generation of claims handling. What is the future?

So, a slightly warmer year than 2014 – already suggested to be the warmest on record - but claim numbers are likely to be dictated by the amount of rainfall and at this stage there is no evidence to suggest we should anticipate an increase in 2015.

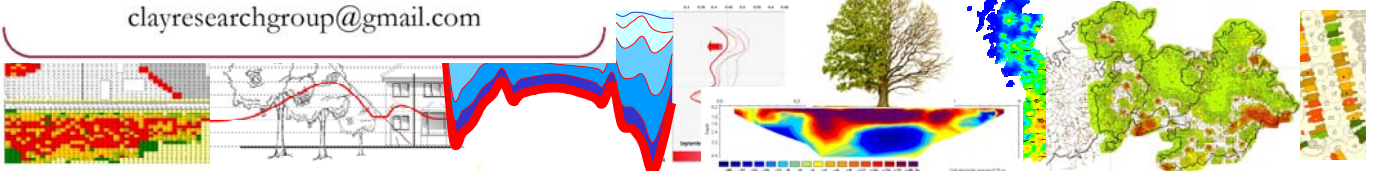


2015 has been declared the International Year of Soils by the 68th UN General Assembly (A/RES/68/232). Very little to do with subsidence beyond the sustainability issue of course, but a recognition of its importance.

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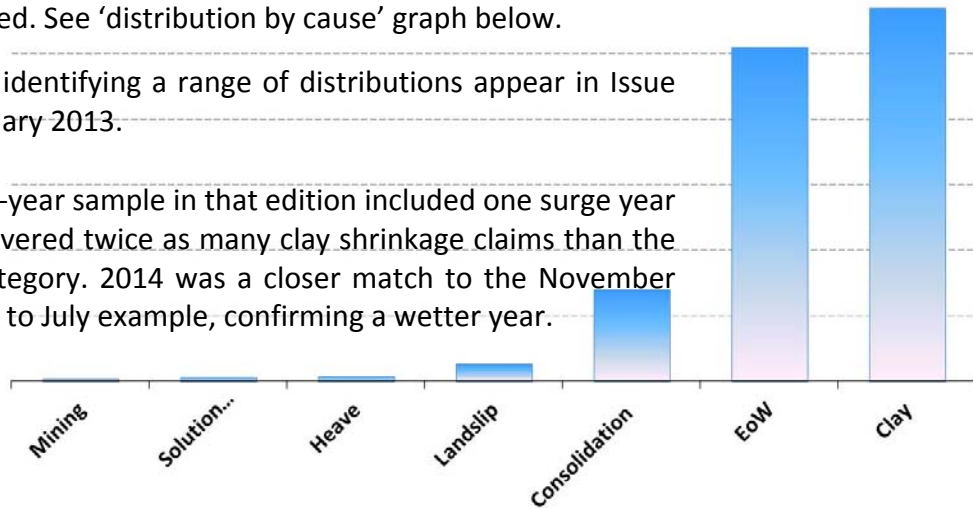
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2014 on Reflection and by Cause

In terms of claims, 2014 was a normal year with almost equal numbers of clay shrinkage and escape of water (subsidence caused by leaking drains etc.) causes diagnosed. See 'distribution by cause' graph below.

Profiles identifying a range of distributions appear in Issue 92, January 2013.

The five-year sample in that edition included one surge year and delivered twice as many clay shrinkage claims than the EoW category. 2014 was a closer match to the November through to July example, confirming a wetter year.



Although sink holes/solution features/landslips drew a lot of attention, overall they remain small in number. The Environment Agency anticipate we can expect more coastal erosion over the coming years and have mapped areas at risk – see extract from their web site below.



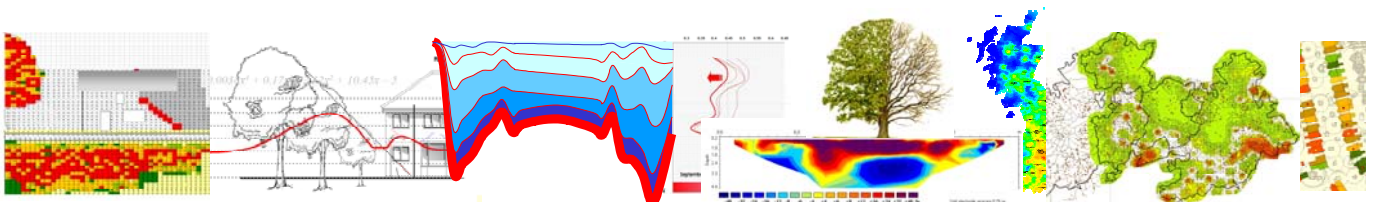
British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL



Right, landslide vulnerability identified by a red dot on this map from the EA web site. This extract shows the coastline extending between Scarborough and Hartlepool.

Following advice from the British Geological Survey the Met Office issued a warning that coastal areas in the south-west of England are in particular danger of collapsing cliff edges and rockfall, but stressed that all areas enduring heavy rain are at risk.

<https://www.gov.uk/government/organisations/environment-agency>



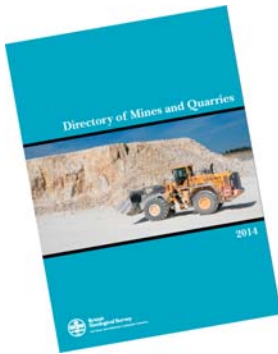
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ENVIRONMENT AGENCY

Rainfall & SMD Data

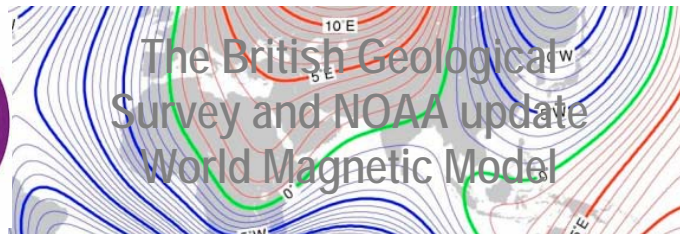
Rainfall relative to historic data supplied by the Environment Agency in their “Monthly Water Situation Report”. This extract is from their Hertfordshire and North London edition for the month of November. They also produce charts showing the Soil Moisture Deficit relative to long-term averages.



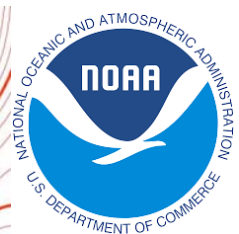
Directory of Mines and Quarries



The British Geological Survey has produced a Directory of Mines and Quarries, listing sites across the UK by mineral/product available for download from <http://www.bgs.ac.uk/>.

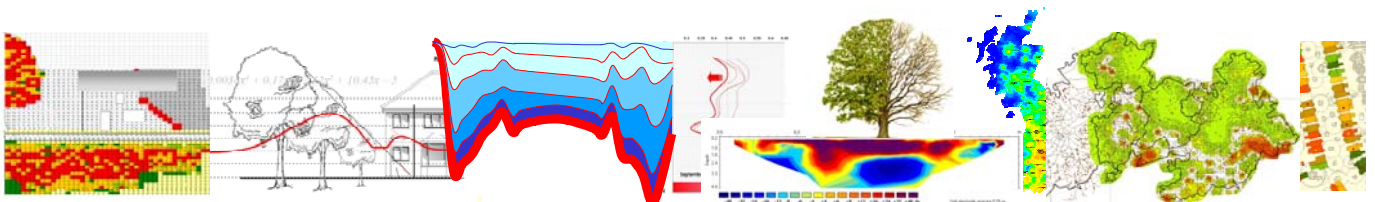


The British Geological Survey and NOAA update World Magnetic Model



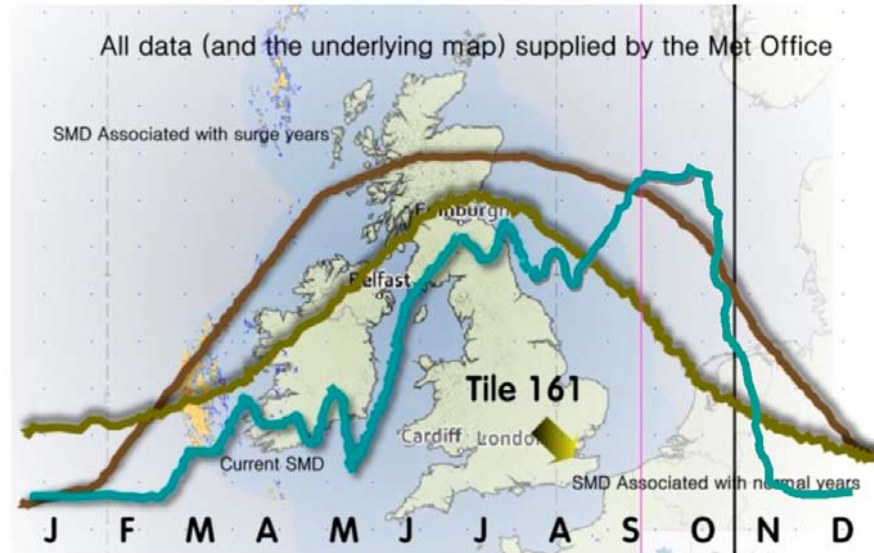
The British Geological Survey announced that the World Magnetic Model (WMM), a representation of Earth’s large-scale magnetic field and an indispensable complement to GPS devices used by NATO, the United States and United Kingdom militaries, as well as civil applications ranging from mineral exploration to smartphone apps, has been updated.

The World Magnetic Model was jointly prepared by the British Geological Survey in the UK and the National Oceanic and Atmospheric Administration (NOAA) in the USA, on behalf of the UK Defence Geographic Centre and the US National Geospatial-Intelligence Agency.



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Soil Moisture Deficit for 2014



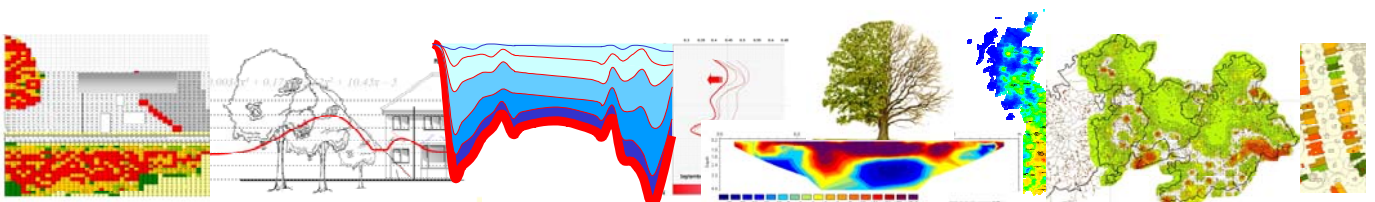
The SMD for 2014 started very slowly with little threat until the middle of September when the soil dried very quickly, producing a late and short-lived increase before declining in early October. in claim numbers.

5,000 Years Ahead

This model of the future appeared in The Sunday Times magazine recently, entitled 'That Sinking Feeling'.

The model takes account of sea water rise should all of the ice and snow melt, plotted against ground contour maps. The authors estimate the volume of ice and snow to be around 5.7 cubic miles.

As can be seen, London will disappear along with much of the East Coast. The article points out that the last time this happened was 34m years ago.



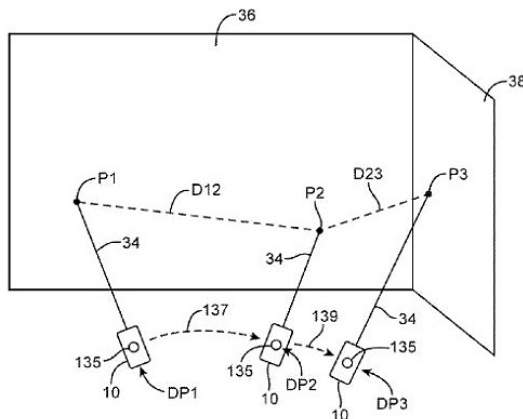
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Coming Soon - Rapid Surveys using the iPhone

Issue 109, June 2014, contained an article about using the iPhone and Google tablet to carry out accurate, 3D surveys. In earlier editions (105 and 107 - February and April issues) there were articles about LIDAR surveys of the Leaning Tower of Pisa being completed in 20 minutes.

The benefit to subsidence practitioners is obvious. Below is an illustration from the Apple patent application.

The application says: “Conventional laser measuring devices measure only the distance from the device to a given surface. These devices are unable to measure distances between multiple points that are separate from the device and therefore require the user to place the device in specific locations for which measurements are desired.”

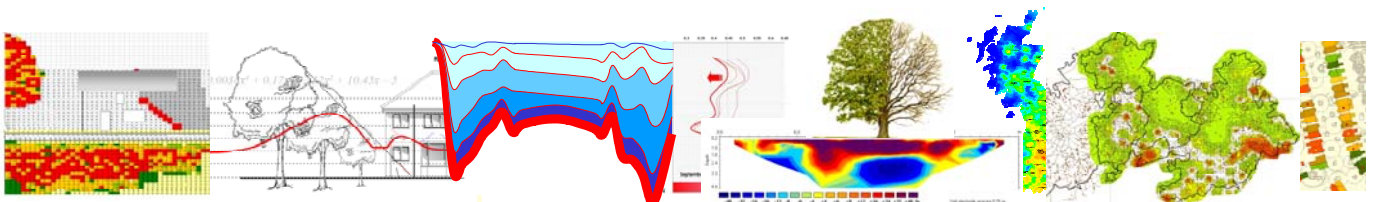


© Apple/USPTO

Above, a sketch from the Apple patent application and right, a survey of the Leaning Tower of Pisa using a similar methodology. See earlier issues for more information.



“This can be difficult in, for example, a furnished room with items that restrict access to all parts of the room. Additionally, these devices can be bulky pieces of equipment that require batteries or battery packs and must be purchased and transported separately from other equipment and electronic devices. It would therefore be desirable to be able to provide improved electronic devices with mapping circuitry. The laser system works by measuring the time it takes for the light to be reflected back to the sensor mounted in the iPhone, allowing it to measure the distance from an object. It can also build up a picture of the texture of the surface it is pointed at by looking at the amount of light that is scattered.”



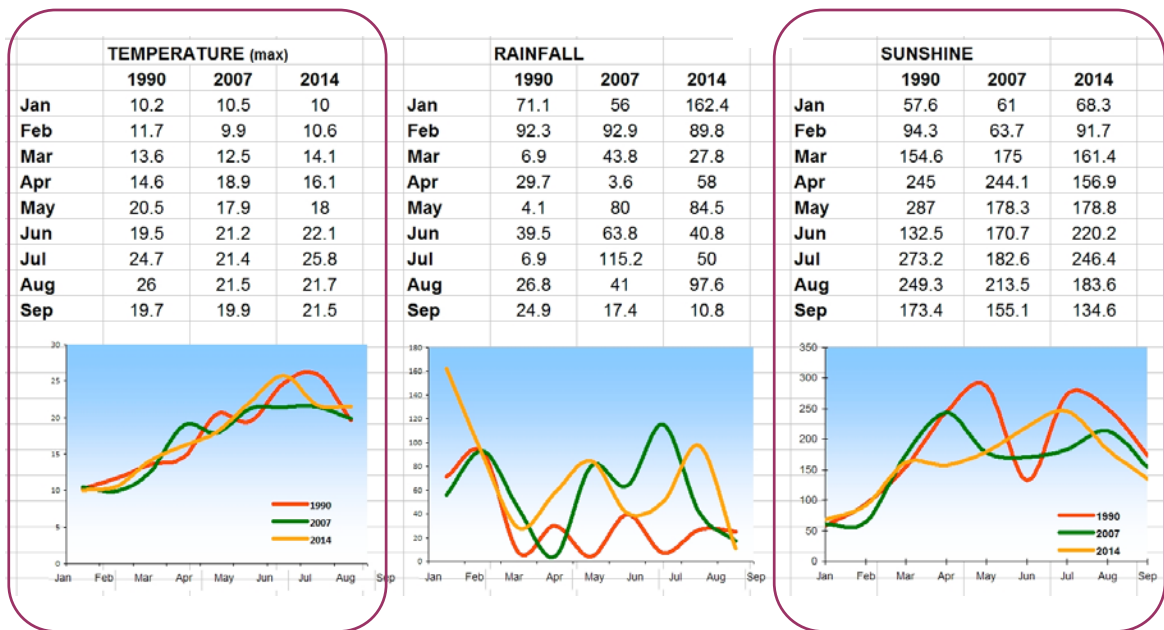
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Comparison Weather Data for Event and Normal Years

Below are temperature, rainfall and hours of sunshine data for West London (Heathrow Airport) gathered by the Met Office for the years noted, from January through to September.

1990 has been selected because it was a particularly busy year with 55,000 claims notified. For comparison purposes, we have used 2007, which produced 32,000 claims and finally, 2014, another year with low claim numbers.

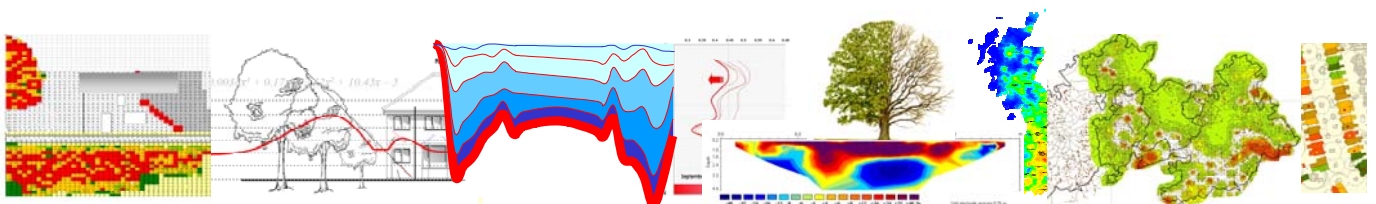
What distinguished a busy year from a normal one?



Weather data from the Met Office for 1990, 2007 and 2014, for the months Jan – Sep.

There isn't a lot of difference looking at the temperature data, although 1990 does exceed the other years in August by more than 4 degrees. The 'hours of sunshine' data produces an irregular pattern with 1990 being high in May and August, but dipping below both in June.

A distinguishing feature is the rainfall deficit throughout 1990. The red line bumps along the bottom of the chart and is consistently lower than for 2007 and 2014. There is growing support for the role that rainfall (or its absence) plays in event years.



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Do the math. Or, put another way, pity the poor underwriter.

Setting rates is more complicated than may first appear. Clay soils are 2.5 - 3 times riskier than 'other' soils in terms of frequency of occurrence. There is significant variation even within various clay series determined by their shrink/swell capacity. Claim settlements cost around 20% more than 'non-clay' claims. To put this in perspective and taking four claims – one EoW and the other 3 clay – costs would be as follows. The EoW claim would, on average, cost £5k compared with $3 \times £5k \times 1.2$ (i.e. uplifted 20%) = £18k for the clay related claims.

So, claims on clay soils are 3.6 times riskier financially across a claims portfolio.

However, only around 20% of the UK postcode sectors are on clay soil, which changes the outcome. It simply means houses on clay are more vulnerable to subsidence than houses not on clay but it doesn't take account of soil distribution. For example, although fewer than 500 sectors (around 40% of the sectors) are on clay soil within the M25 they are amongst the most heavily populated areas.

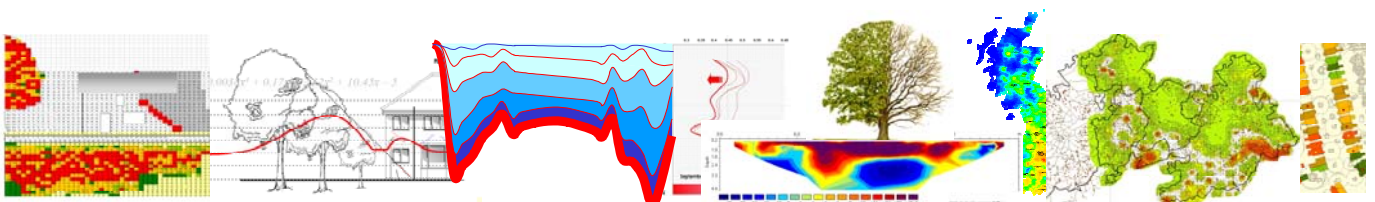
This 40% of sectors delivers 74% of the claims.

And then we have to account for trees. There is 1 tree for every house - on average and including housing association properties. This reduces to just over 1.2 if we are looking at private insured properties only.

The correlation between the number of trees in a postcode sector and the number of claims divided by the number of houses (to derive risk frequency) is weak at just under 0.5. Not very compelling and we can see that it isn't the case that high numbers of trees necessarily produce high numbers of claims. As the legal profession has summarised, "trees take their victims as they find them".

It's a game of chance driven by season. The risk fluctuates by month, and every now and again we experience a hot year when claim numbers can double. Will the homeowner stay with the current insurer for one year, or ten? What are the chances of experiencing a surge year in the life of the policy? How many premiums will it take to recoup the losses and just how many houses are at risk in a portfolio at a particular time? Will premiums cover the exposure?

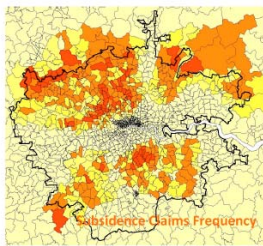
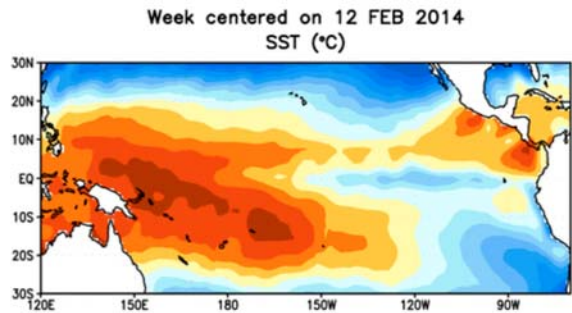
So, spare a thought for the underwriter. Subsidence is the least of their problems financially, but it does impact on client retention when there is a claim.



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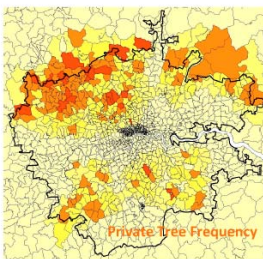
2014 – Looking Back

The **January** and **February** editions were occupied by weather news and events, covering the geology associated with the appearance of sinkholes and a review of the available mapping resources. There were updates on the Hortlink II project and a look at developments in surveying using LiDAR devices. Twelve months later we see how quickly technology moves with news of the Apple patent application to integrate this into their iPhone. 3D mapping is a very real prospect in the next few years and our work on pattern recognition may assist practitioners diagnose causation quicker and more reliably.

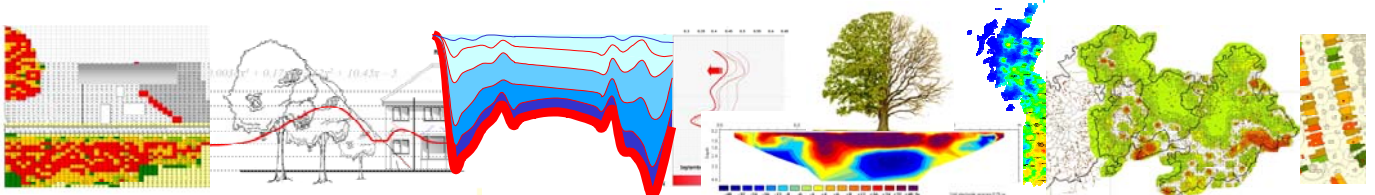
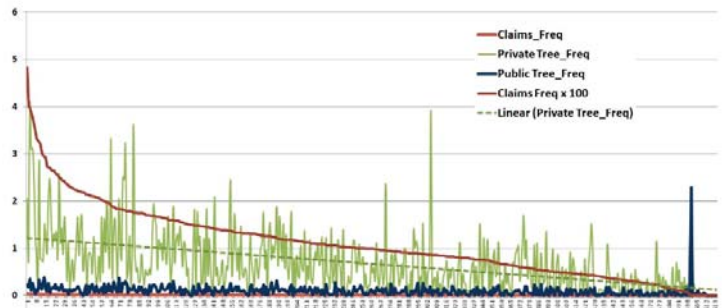


Claims /
Number of Houses

The **January** newsletter asked whether tree frequency influenced risk. Is it the case that more claims are notified where there are more trees? On a borough by borough basis, we could find no correlation. Values were returned in the order of 0.4 – 0.5. This was a broad-brush approach looking at fairly large areas. This year we will be looking to see if there is a correlation at postcode sector level.

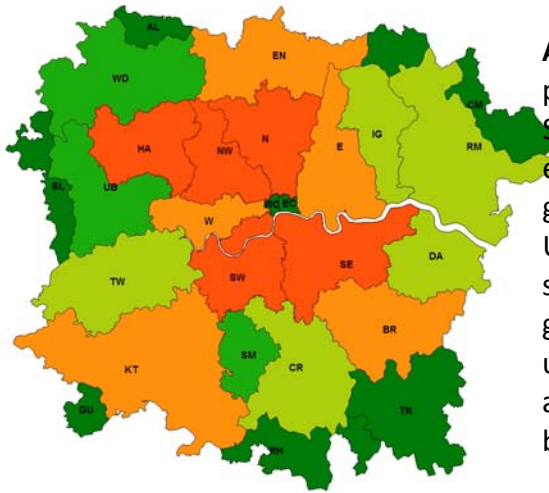
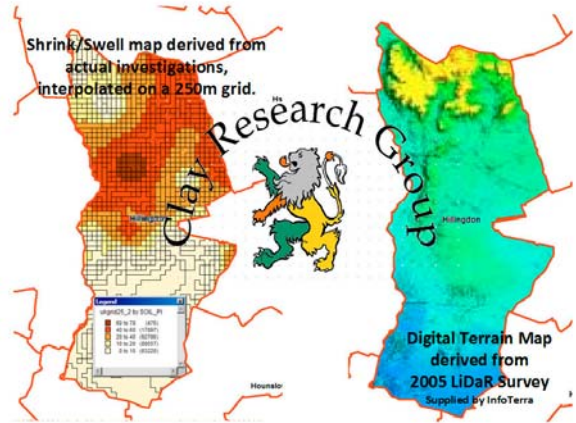


Private Trees /
Number of Houses



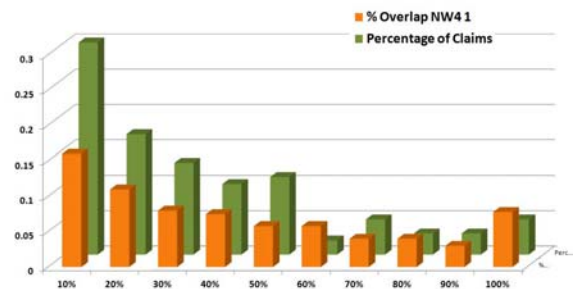
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The **March** edition contained a study of Hillingdon Borough, mapping claim distribution, trees, geology, property type (detached/terraced/semi-detached) alongside a digital terrain map. All reported cases of sink-holes were mapped and details of weather charts, including CRUTEM4 superimposed onto Google Earth, and the Cameron Beccario ocean surface current map using data from NOAA and OSCAR.

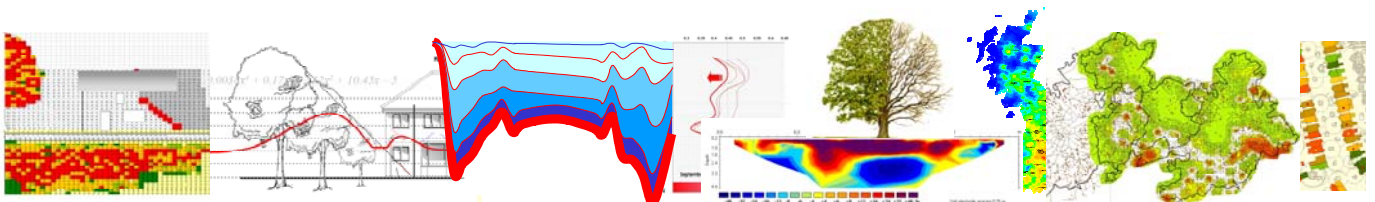


April saw a return to more normal weather patterns and preparations for the Aston Subsidence Conference to be held in June. The edition contained an article about Big Data and graphs revealing high risk London boroughs and UK districts, foundation details from our library of site investigations, a ‘peril by age of property’ graph and a glimpse of the work we are undertaking on developing datasets for A.I. applications, outlining what a valid claim looks like by peril and age of property.

May described the increased risk that clay soils present using a series of graphs and concluded that, on average, and not distinguishing between the series, clay soils were around 3 times riskier than ‘other’ soil types.

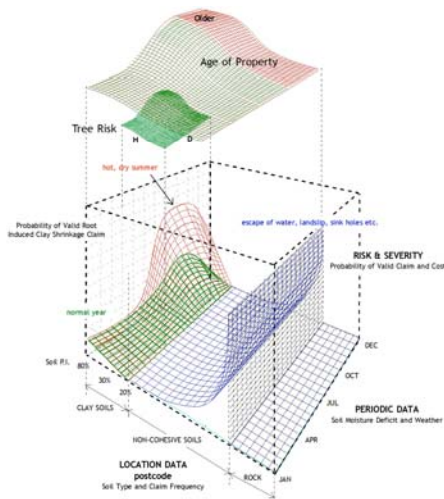


Comparing claims and data from our subsidence model, it was concluded that modelled root overlaps of 10% were riskier than higher values. This most likely reflects the high number of cases reported where conifers and shrubs were involved.



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May edition also looked at system driven cause locator and ways of automating diagnosis using scale mapping. This introduced the concept of accurate surveys using the iPhone and things called IBs (Intelligent Buildings) and BIMs (Building Information Modelling). There is little doubt that emerging technologies will play an increasing role in the subsidence industry in triage, remote assessment, remote monitoring and improved investigations, all assisting in diagnosis.

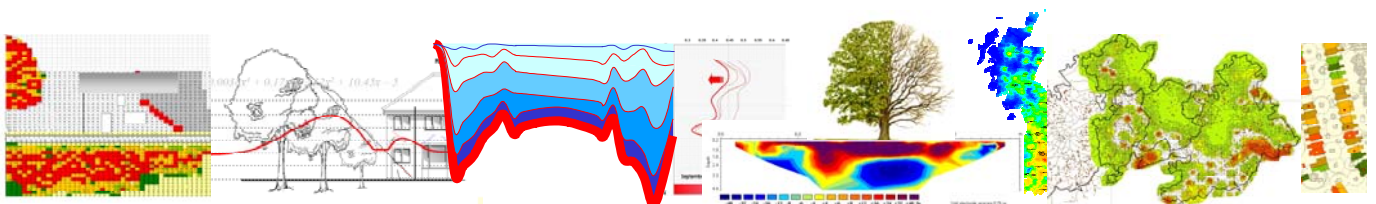


By **June** we were looking at probability charts again, and exploring how this New World of technology might be applied to domestic house surveys. Google announced ‘Project Tango’ whereby using a hand-held tablet costing less than £600, rooms could be measured and 3D images constructed.

We also looked at risk in relation to conservatories and discovered that most claims related to root induced clay shrinkage combined with shallow foundations.

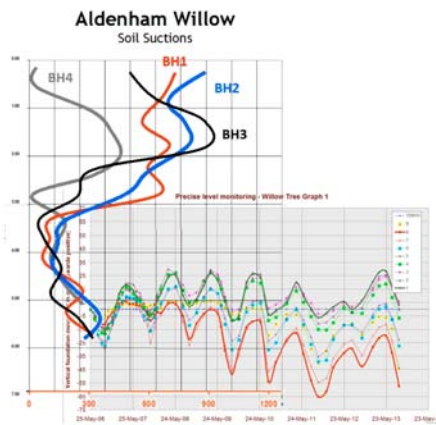
Although spells of hot weather were experienced, increased rainfall suppressed claim numbers.

July recorded the topics covered at the Aston Subsidence Conference. Tony Boobier spoke about Big Data and the importance of analytics. He reported how social networks (Facebook, Twitter etc) were one of the growing trends. Paul Stanley described his work on remote handling of claims using crowd sourcing and Anna Madichie provided an update on case law. Tom Clinton explained his work relating to the EKO stabilisation of clay soils. Richard Rollit pondered whether policy wording needed to be re-visited to bring it in line with claims handling good practice, whilst Jon Heuch outlined the problems facing expert witnesses in cases involving tree root nuisance.



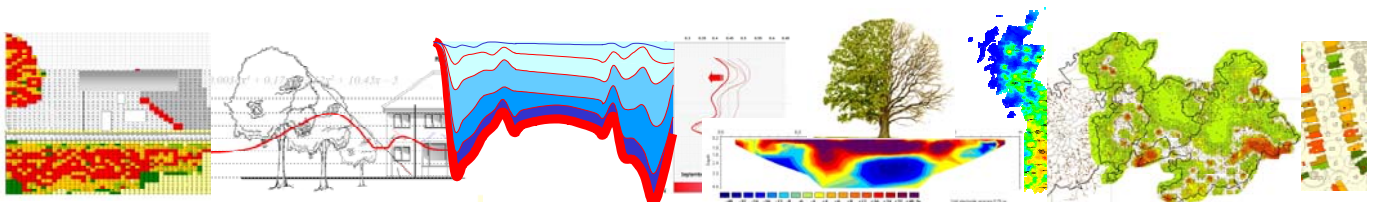
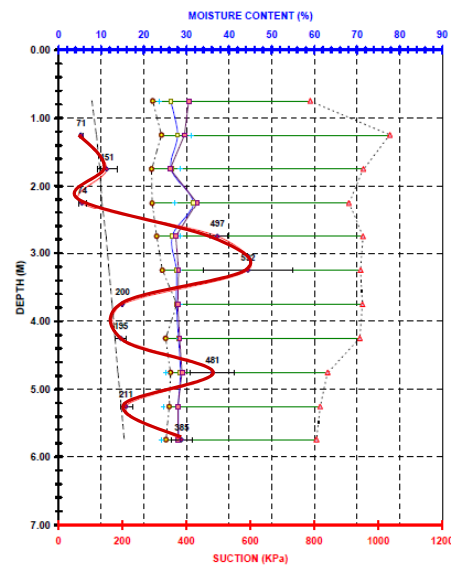
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August reported on the commencement of field trials for the EKO project by Tom Clinton from Birmingham University at the Aldenham research site. Jon Heuch agreed to assess the effect of treatment on the willow tree by visual inspection and Foundation Piling Limited kindly agreed to meet the cost of setting up the test rig which included sinking piles, laying foundation pads and carrying out the treatment.



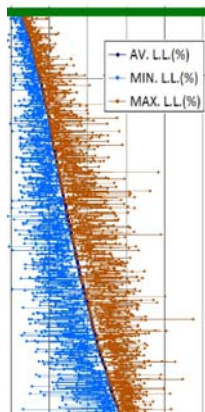
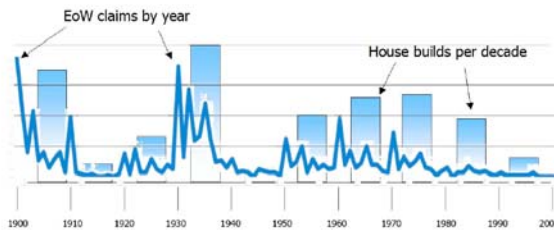
The **September** edition re-visited the investigations at Aldenham, relative to the EKO project. Seasonal ground movement had been recorded since 2006, and bores sunk at intervals to measure desiccation using a range of techniques. This data will hopefully provide the background to determine the success of the EKO treatment.

In **October**, other academics joined the team researching ground movement at Aldenham. Dr. Nigel Cassidy from Keele University joined Prof. Ian Jefferson and Phil Atkins from Birmingham University to try to map the root zone of the oak tree using ground penetrating radar and electrical resistivity. It was hoped that by utilising vibro-acoustics the root zone might become visible. The October edition included an article from Clive Bennett explaining why the stress history of clay soils plays a part in assessing desiccation using index properties and there was an article on tree re-location.

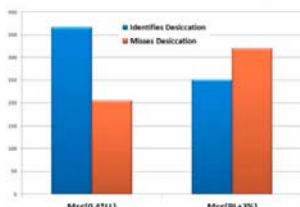


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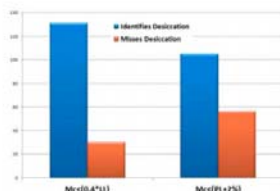
The **November** edition covered a range of topics. It explored the variation in risk across a sector – in this case, NW6 6. Below, a graph showing damage by peril (in this case, EoW) by age of house. There was an article on simple rehydration to resolve a case where there was a persistent deficit. There was also an article – something explored earlier – showing the issues with traditional soil tests to detect desiccation and discovering that more wasn't necessarily better.



December saw the first case of wet weather damage associated with heavy rainfall. A mineshaft opened immediately against the rear wall of the property shown left and only prompt action by the engineers, claims handlers and contractors prevented a collapse. Other articles explored the variability of the burning rate across the UK and further results on soils in terms of variability with depth and putting numbers to just how reliable moisture content comparisons with index properties are. When compared with recorded suctions, it was found that the LL was better than the PL by 20%, and with high suctions (> 1,000kPa), the LL achieved a success rate of 80%, falling to 64% with suctions in the range 500-1,000kPa.



Suctions in range 500 - 1,000kPa. Sample A.



Suctions exceeding 1,000kPa Sample B

