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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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August 2012

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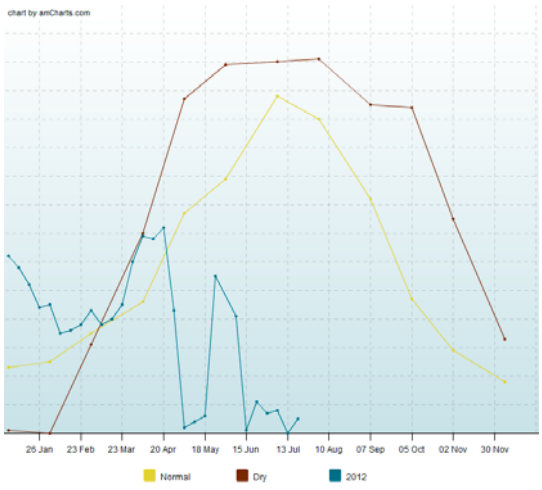
Issue 87, August, 2012



This Edition

July saw the publication of an Appeal decision in the case of Berent. It involves Islington and the Court explored what is reasonable in the context of amenity and budgets, as well as foreseeability – who knows which tree is going to cause what damage, and when? More inside.

The weather continues to confound prediction, although we did say in the March dry spell "periods of uninterrupted sunshine lasting for several months, starting in March and lasting through to say October are rare in the UK and statistically, the odds might (perhaps perversely) be against a surge."

A series of interesting papers appeared in July, amongst them an observation by the BGS that high subsidence claim numbers often follow two consecutive dry years, which puts us 'at risk' in 2012 apparently.

Berkley Earth have produced perhaps one of the most comprehensive studies of climate and they have released their data on the web, together with a series of papers for peer review – go to berkleyearth.org.

Equally interesting is the response from the web blogger Anthony Watts, which is also included. The debate continues with Climate Change parties blaming everything on change, whilst others put it down to 'Mother Nature'.

To confuse us even more, we see mention on the BBC web site that "palm trees grew in Antarctica around 53 million years ago". The study in Nature suggests Antarctic winter temperatures exceeded 10°C, while summers may have reached 25°C with CO^2 concentrations nearly twice the present levels.

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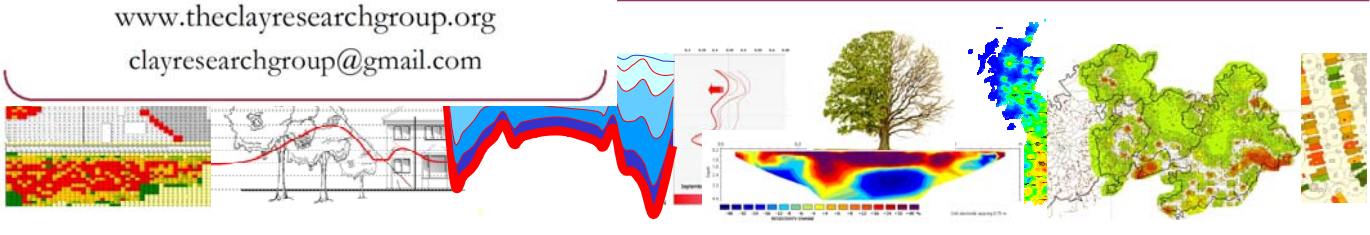

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Foreseeability – A Legal Update

Berent –v- Family Mosaic Housing and Islington

Lord Justice Tomlinson an the Court of Appeal arrived at a decision on foreseeability in terms of what a reasonable Local Authority might be expected to do when managing street trees, some of which might cause damage, and with a limited budget.

Briefly, and as far as our understanding of the law extends, they deduced that as nobody could predict which tree would cause what damage, where or when, the suggestion that the Council should know in advance, and take action by felling the tree, clearly wasn't sensible.

The alternative of felling all trees close to a building on a clay soil would be devastating to the amenity that trees provide and wasn't the answer.

If we have understood the judgement correctly, a Local Authority can no longer be judged to have been negligent in terms of foreseeability, but would of course still be liable for losses arising from the time it had been provided with good evidence. Jake Tibbetts provides a better resume on the LTOA web site – www.ltoa.org.uk

Apparently the Council should try to identify 'hot-spots' of claims and mitigate where possible, which links in to the Hortlink II project.

Is crown reduction a lasting solution when a tree has been implicated in causing subsidence damage? Is it an appropriate and lasting response? Perhaps the Local Authority already have data on this that they be willing to share with researchers. What is their experience of crown reduction? Do they receive many notifications of recurrent damage when trees are crown reduced, and then maintained?

LeafSNAP

Thanks to Paul Stanley for drawing our attention to a new iPhone app that identifies tree species from pictures of their leaves.

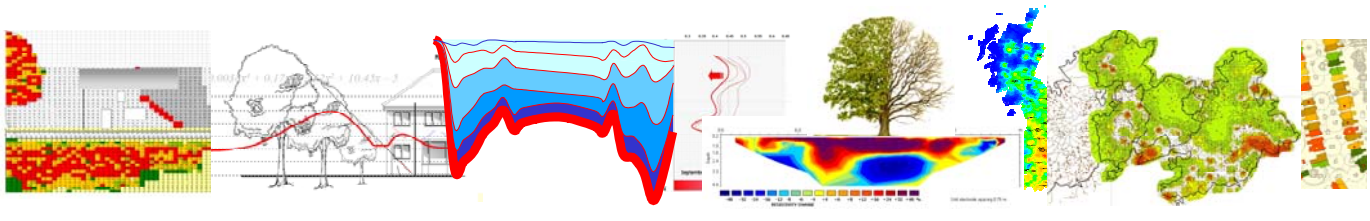
Apparently, the idea is that you take a photograph using the iPhone – from within the LeafSNAP application – and it searches for near matches using a pattern matching algorithm, offering pictures of fruit etc., to help the user.

Claims over Time

Taking an average of say 30,000 claims per year doesn't seem like a major problem. If around half of those claims are repudiations, then the figure drops to 15,000 valid subsidence claims every year.

Over the last 40 years, since subsidence cover was added to the Buildings policy, that amounts to a total of 600,000 properties damaged by subsidence against a housing population of some 26m.

Nearly 2.4% of the housing stock has suffered subsidence related damage in that time. 24 houses in every thousand.



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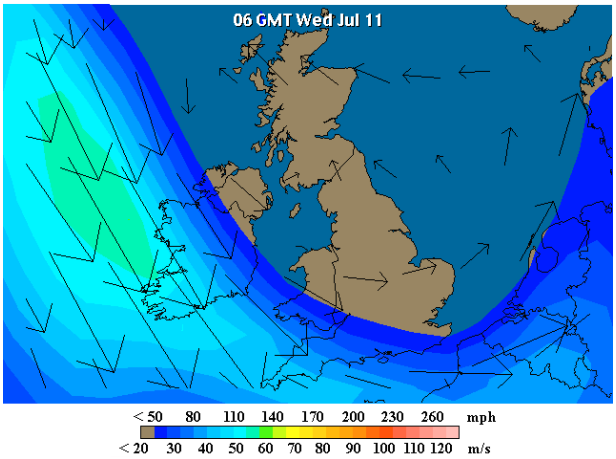
All change – again. Or, another year like the last.

June 2012 was the wettest on record, with double the average rainfall. 145.3mm fell, breaking the previous record of 136mm set in June 2007.

Apparently it was also one of the dullest with just 119 hours of sunshine, only slightly more than the 115 hours in June 1987.



Weather experts tell us the Jet Stream is to blame, moving further south than usual, and bringing wetter, colder weather.

Matt Ridley of the Times raised some interesting points in a recent article (2nd July, 2012) when he asked what the relevance was of reporting a "record this", or "record that" in terms of temperature, rainfall etc. Do they actually mean anything? Or is every day a record depending on what measure we adopt, and over what period, and where?

How are we to meaningfully distinguish between a few record hours of sunshine, with peaks lasting just a brief interval, from those a few degrees less, but lasting days? If it is cold in London, and particularly hot in Stoke-on-Trent, what does this really mean?

This poses the question, are climatologists looking for evidence of increases in temperature, instead of making objective assessments? Does it mean anything when we see 'record this', or 'record that'?

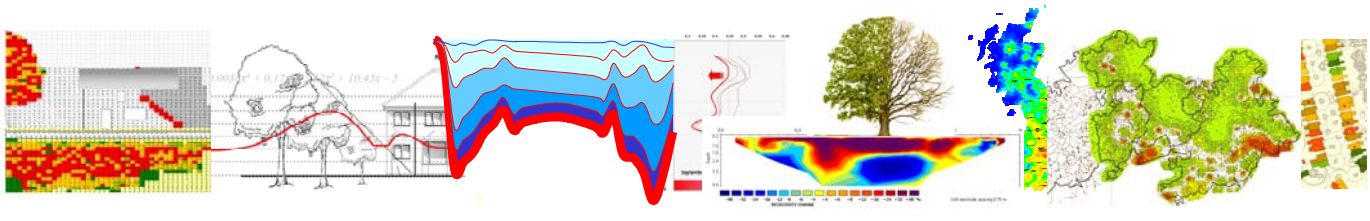
Ridley wondered what reports of 'record temperatures in June' really means. Was it hotter for a few hours, or over the whole day? For a few days, or a week? Was it followed by hours, days or weeks of lower than average temperatures?

He cites the case of record rainfall in 2009 when a rain gauge in Cumbria recorded 316mm falling in 24 hours. However, it didn't break the daily rainfall record of 279mm, recorded in Dorset in 1955 even though it was more. That is because rainfall is officially measured in the 24 hour period from 9am to 9am.

Record temperatures in one part of the UK have very limited value in terms of Climate Change if other parts are below average.

This is a problem that has been identified throughout the academic community (and not purely to do with climate modelling) and has been reported in high ranking journals like Nature.

Asking someone to 'look for evidence of 'x'', means they are unlikely to find 'y', and even if they do find what they are looking for, it's significance can become amplified beyond its true value. That said, the Berkley Earth research may have overcome some of these concerns – see pages 12 and 13.



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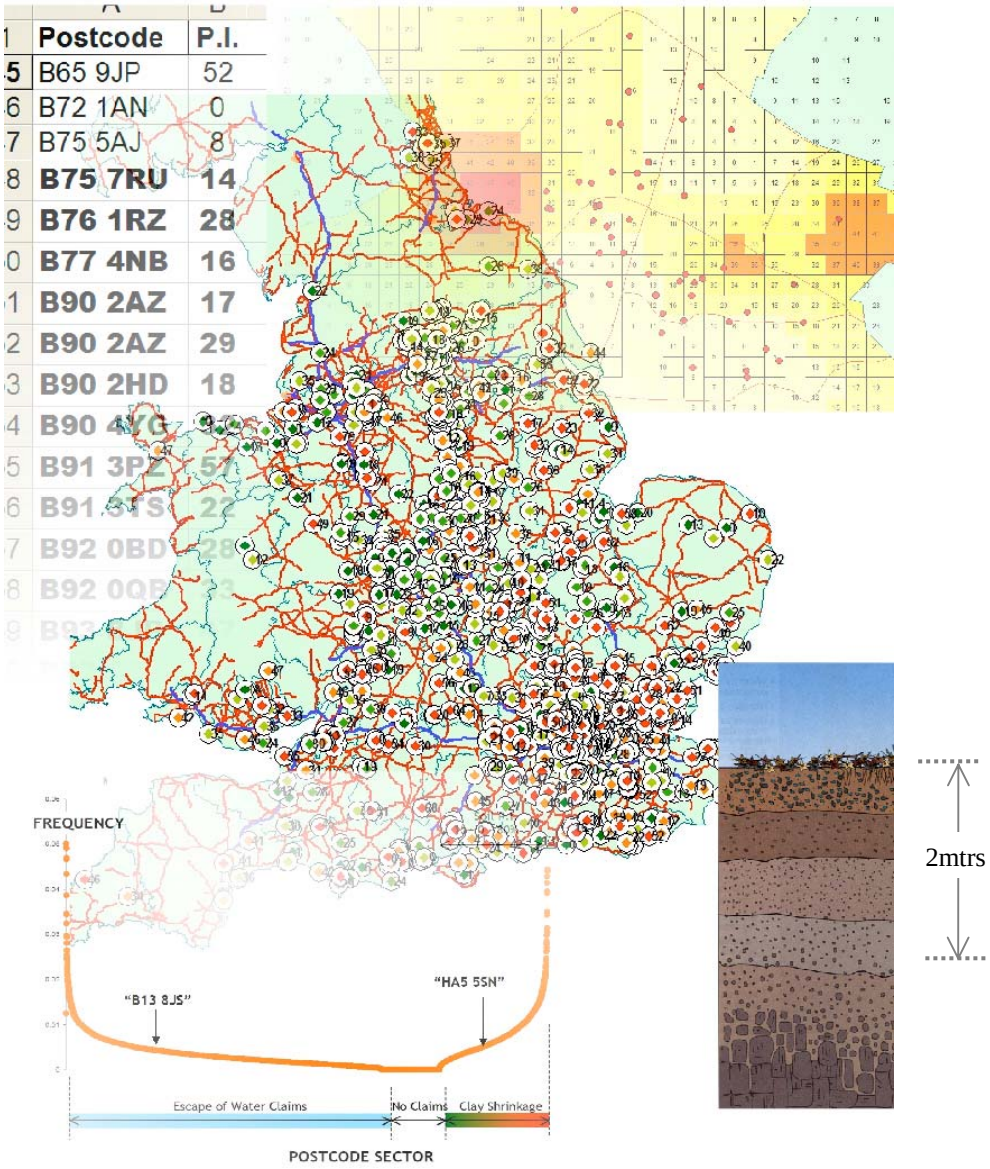
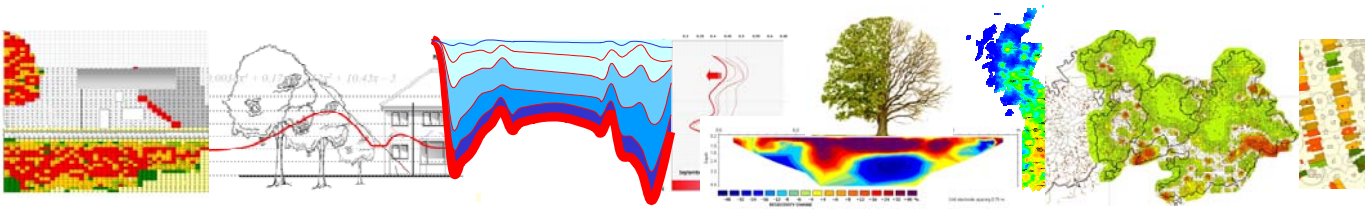
Investigations, Data, Mapping and Delivery



The underlying map of the UK plots the borehole data we have collected over the years. Because the laboratory only test clay soils, the map reflects the location of the various series – London clay, Mercia Mudstone etc. Unlike the BGS maps, we have no means of distinguishing between them in terms of provenance, but the data do reflect risk. They tell us where claims have been made, and the soil shrink/swell potential at a depth appropriate to mature tree root activity. This data has produced risk graphs (bottom left in the above image) and complex models that have improved our understanding of the link between claims of various types (root induced clay shrinkage, escape of water etc), their cost and geology.



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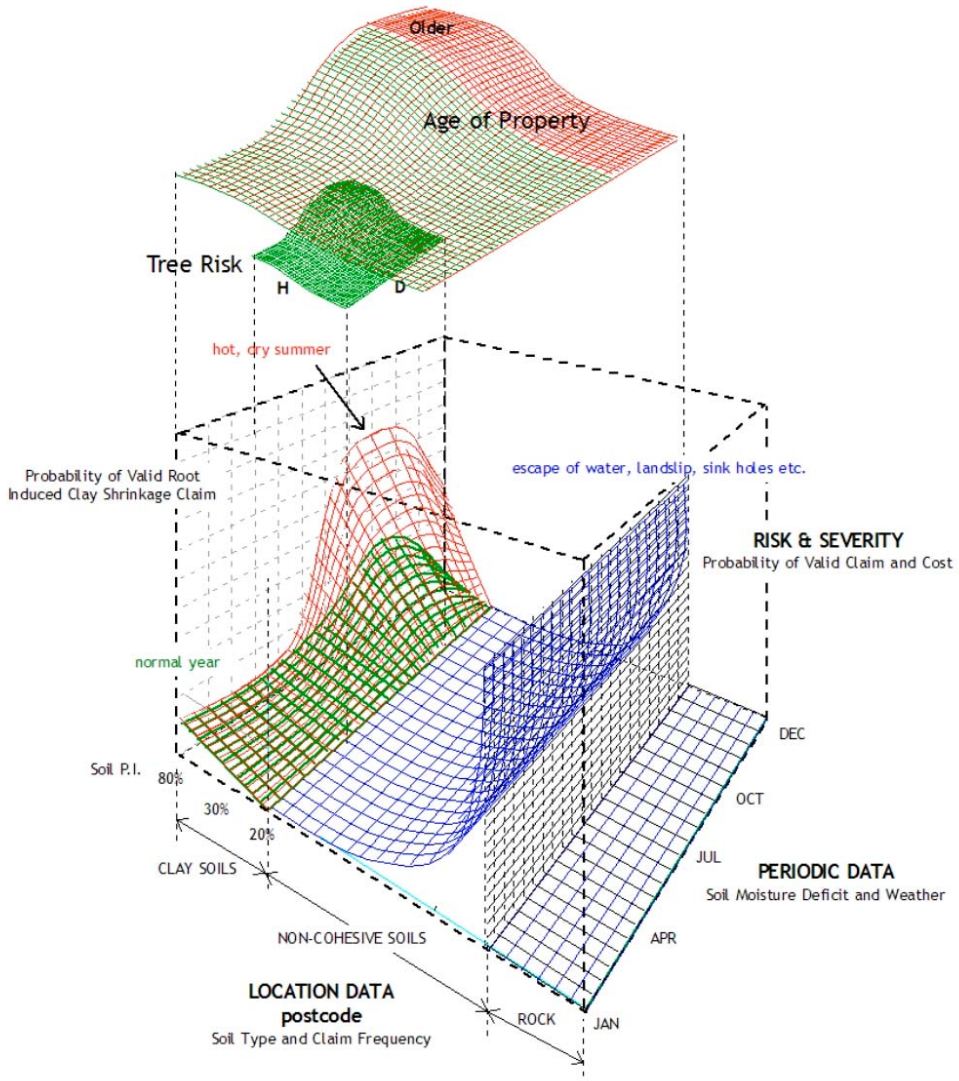
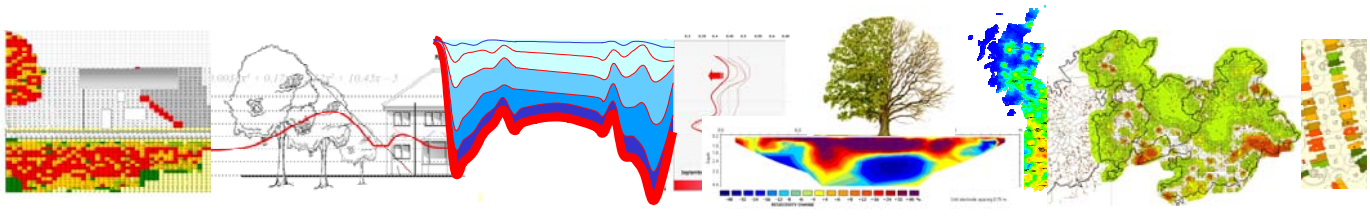
The Answer is a Cube - On Average. Probably.

Summing up the previous page, the combined probabilities of the various elements – location, frequency, soil type, periodic signature etc - can be represented by a mathematical cube as shown below. The core risk data - frequency and soils – forms the foundation. Layers representing specific information at the time of policy enquiry can be added as required. Demographic data, age of property, tree species and style of house etc.



The cube is a powerful tool in terms of triage and underwriting, encapsulating risk in a simple model.



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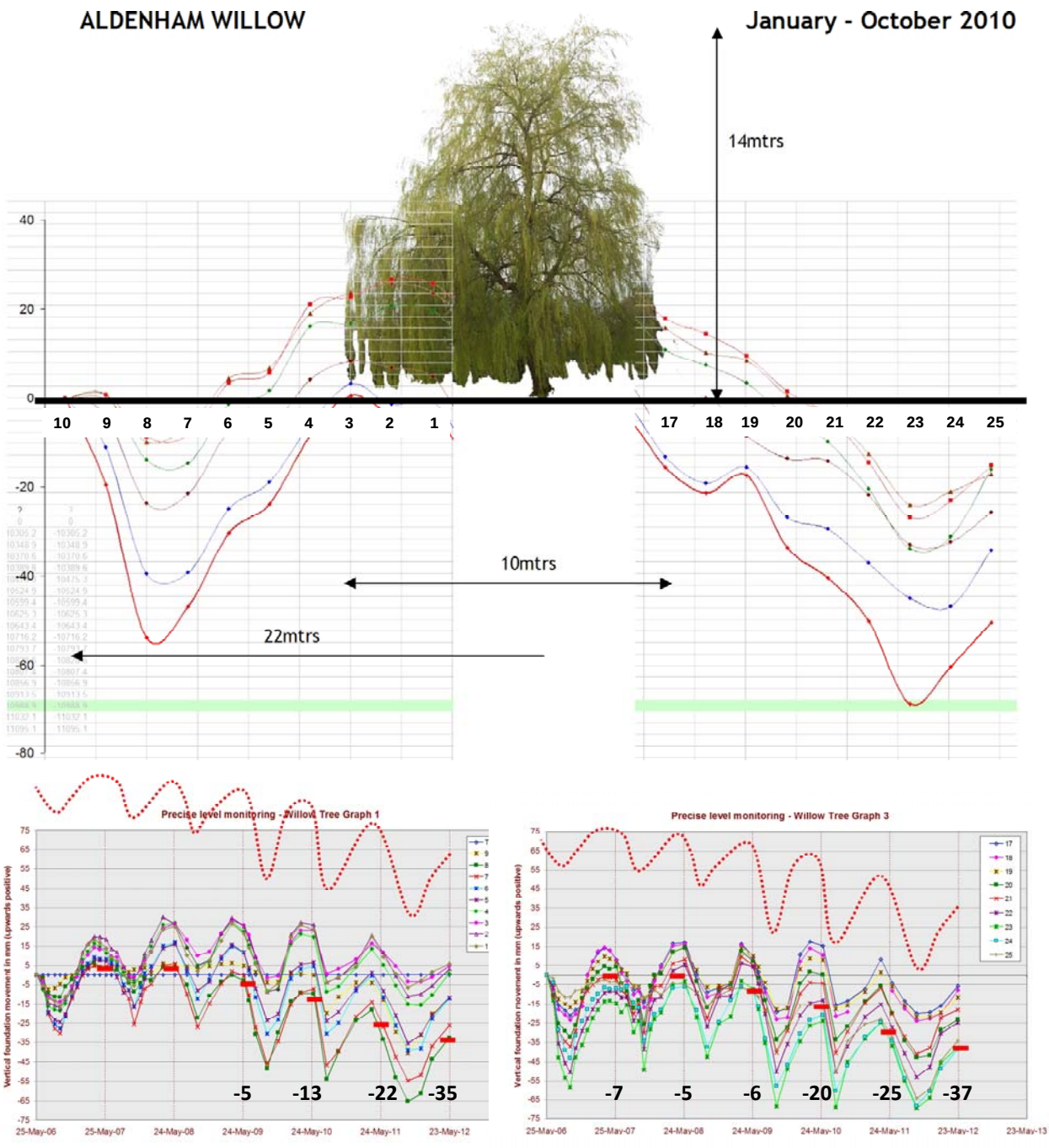
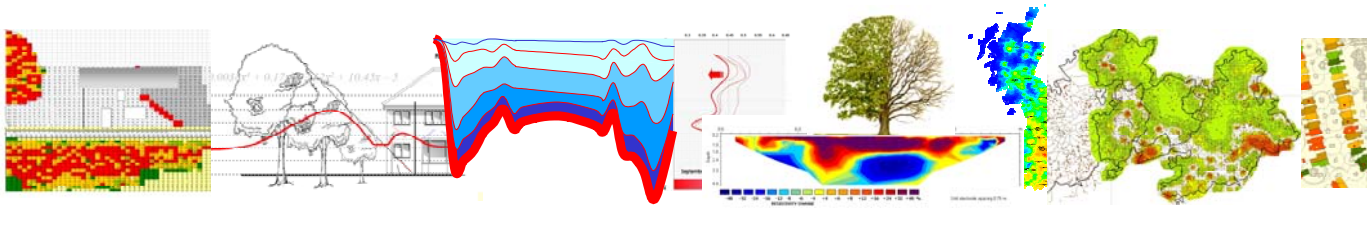


Top, the pattern of ground movement across the measured root zone, suggesting that the persistent deficit beneath the tree canopy is extending laterally, towards the root periphery. Seasonal movement is greater at Stations 8 (left) and 23 (right) but there is incomplete recovery in May. These two stations are approximately the same distance from the trunk, and show peak subsidence of 65mm in the summer, with 35 – 37mm remaining in May, when recovery would normally be complete.



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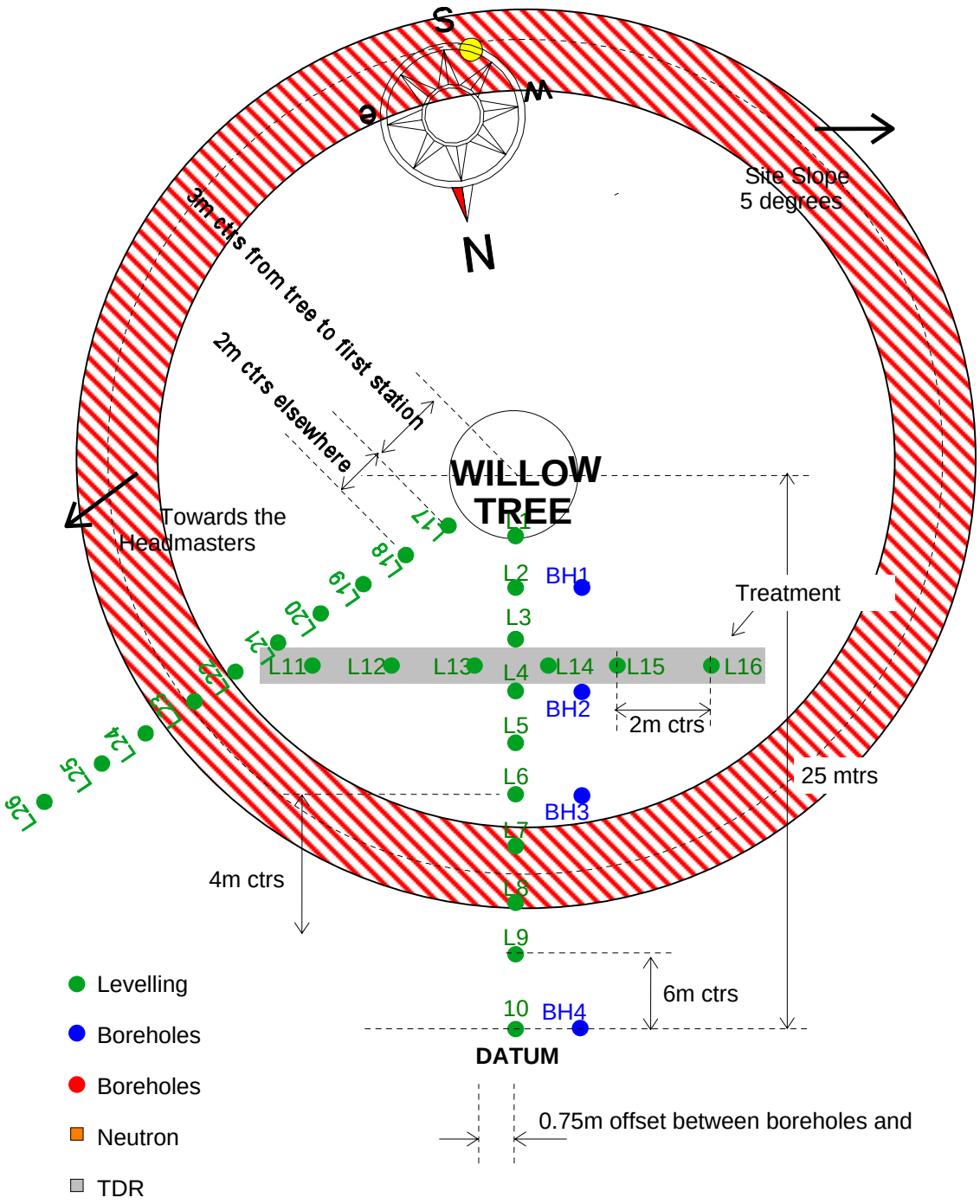
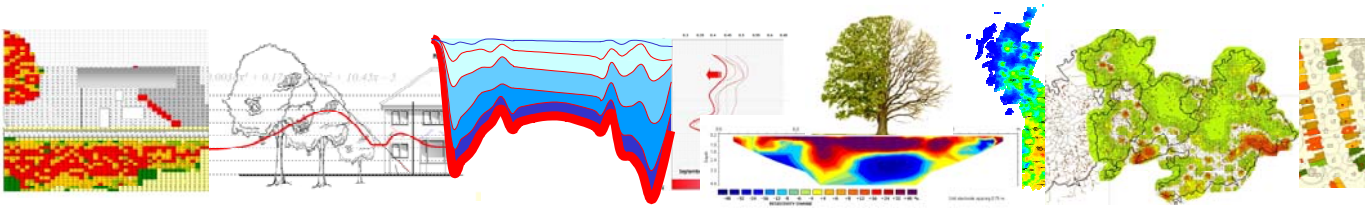


Precise levelling of the Willow site has provided a unique glimpse of ground movement over a longer period of time than would normally be possible. There hasn't been a surge year since monitoring commenced, and the ground response to drying in a long, dry summer will add to our understanding of the difference between years, and the trees response.



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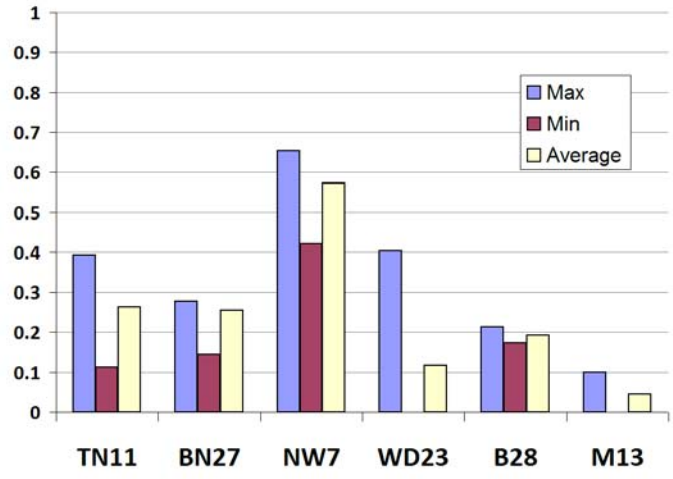
A High Definition Risk Model

The full postcode risk model helps insurers to understand not only the frequency risk of subsidence across the UK, but also the severity – that is to say, the cost implications.



The graph above illustrates the variations between, and within, the specified postcodes. Of the sample, NW7 is clearly the riskiest, with less variance and a higher average than the others.

One of the benefits is that the risk is presented on a normalised 0 – 1 scale, and includes both elements – frequency and cost. The underwriter doesn't have to distinguish between the number of claims and any cost variations between say claims resulting from clay shrinkage and other types of soil.

For example, NW7 is more than twice the risk of B28 on average. At full postcode level the data allows a much higher level of precision.

This 'data based' approach also means that it is easily implemented on web servers for use in on-line quotation systems or in triage applications.

In the Press

Lots of interesting publications in July, some of which appear elsewhere in the newsletter.

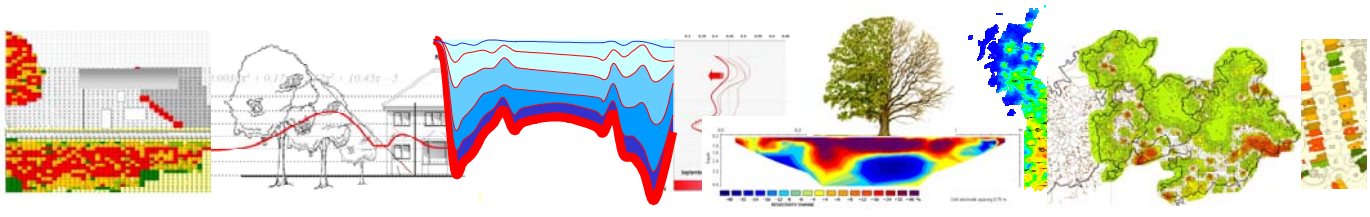
Berkley Earth have published a huge database of weather records from across the world, and compiled a series of papers, all available for download from the web, describing in detail their methodology and conclusions for peer review.

Thomas *et al* (July 2012) looked at trees and compared their performance with grass, climbing ivy etc., in ***"Effectiveness of Green Infrastructure for Improvement of Air Quality in Urban Street Canyons"*** in the Journal, Environmental Science & Technology.

They conclude that judicious placement of grass, climbing ivy and other plants in the urban environment can reduce the concentration at street level of NO^2 by as much as 40 percent and PM by 60 percent - much more than previously believed.

Trees were shown to be effective, but only if care is taken to avoid trapping pollutants beneath their crowns.

The BGS have published an interesting analysis of weather patterns, and used correlative techniques to link them to surge years as a predictive tool.



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Environmental Control of Daily Stem Growth Patterns in Five Temperate Broad-leaved Tree Species

Kocher, P, *et al*
Tree Physiology

The research team analysed the environmental factors controlling stem diameter variation and radial growth in five co-existing temperate broad-leaved tree species (genera *Fraxinus*, *Acer*, *Carpinus*, *Tilia* and *Fagus).*

Apparently, daily stem radius change (SRCd) was primarily influenced by the atmospheric demand for water vapor (expressed either as vapor pressure deficit (*D*) or relative air humidity (RH)) while rainfall, soil matrix potential, temperature and radiation were only secondary factors. SRCd increased linearly with increasing RH and decreasing *D* in all species.

The positive effect of a low atmospheric water vapor demand on SRCd was largest in June during the period of maximal radial growth rate.

The five species also differed in the positive slope of the growth/RH relationship with the steepest increase found in *Fraxinus* and the lowest in *Fagus*. "We explain the strong positive effect of high RH and low *D* on radial stem increment by lowered transpiration which reduces negative pressure in the conducting system and increases turgor in the stem cambium cells, thereby favoring cell division and expansion."

They conclude …"the results suggest that mechanistic models of tree growth need to consider the atmospheric water status in addition to the known controlling environmental factors: temperature, soil moisture and precipitation. The results further have implications for sensitivity analyses of tree growth to climatic changes."

Impact of Treated Wastewater Irrigation on Antibiotic Resistance in Agricultural Soils.

Yael Negreanu, Zohar Pasternak, Edouard Jurkevitch, Eddie Cytryn.

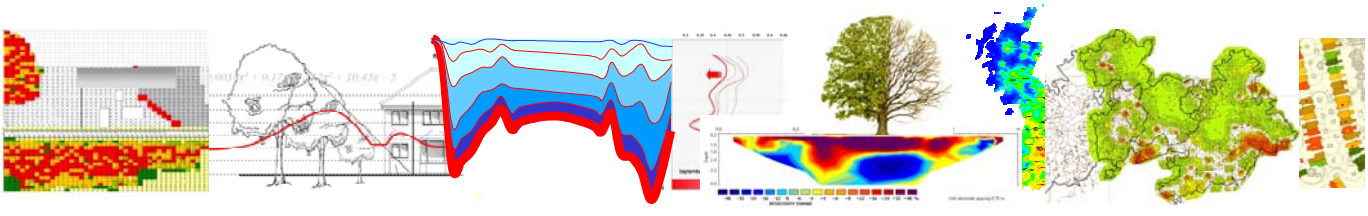
Environmental Science & Technology, 2012; 46 (9):

Previous studies have suggested that wastewater effluents can expand natural reservoirs of antibiotic resistance, which may contribute to clinically associated antibiotic resistance.

Arid and semi-arid areas of the world are plagued by severe water shortages, which are expected to increase as a result of growing population and global climate change.

As a result, more areas are turning to treated wastewater (TWW) to irrigate croplands. In Israel, for instance, TWW provides more than half of the water used for irrigation.

The researchers wanted to find out if long-term irrigation with treated wastewater enhances antibiotic resistance in soil microbial communities, which could potentially be transferred through agricultural produce to clinically relevant bacteria.



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An interesting study by researchers from the BGS relating to a possible link between precipitation and subsidence claims.

The suggestion is that 2012 might deliver a surge because 2010 and 2011 were particularly dry years.

The Relationship between Shrink–swell Occurrence and Climate in South-east England

Harrison, *et al,*
Proceedings of the Geologists' Association
Published online 12 June 2012

A team of researchers from the British Geological Survey and Birmingham University have analysed climate data and compared it with the shrink-swell characteristics of clay soils to enhance our understanding of the consequences of Climate Change on domestic subsidence claims.

"Analysis of historical climate data and comparison with subsidence claims data demonstrated the relatively close relationship of subsidence with two years' previous precipitation. Boundaries are identified, with precipitation above 394 mm for the previous two years, leading to a lower level subsidence claims, and below 350 mm leading to a higher incidence. Combined with this inverse relationship, a direct relationship with temperature is identified, with a rise above 22.6 °C in the mean maximum temperature for an accounting quarter leading to a peak in claims."

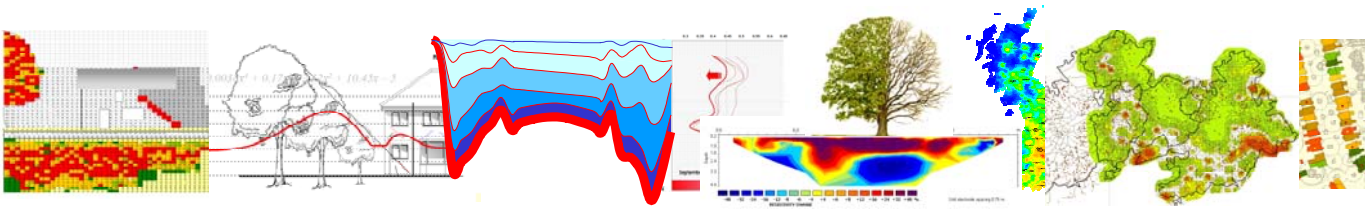
This is an interesting suggestion, linking two previous years rainfall with subsidence claims in the third. Their press release goes on to say …

"The research takes into account the effect of rainfall and temperature, and despite the very wet weather experienced since April, there is still an increased potential for clay soils to shrink and swell this year.

The details of the research show that if summer temperatures reach a monthly average above 22°C there will be the additional effect of increasing the potential for clay minerals to shrink and swell. The last time this occurred was in 2010, so if there were to be a repeat warm summer this year there could be increased potential for subsidence. Even if we continue to have a wet summer, due to the effect of the low rainfall over the last 2 years, it is still likely that the number of subsidence claims will rise."

This information links weather to the susceptibility of fine grained soils to shrink when dry and will help them refine their risk product, GeoSure. The authors also point out the relevance in terms of longer term modelling related to Climate Change.

Access the BGS site at www.bgs.ac.uk for further information on services provided, including mapping and access to their library of boreholes across the UK.



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Orbital Forcing of Tree-Ring Data

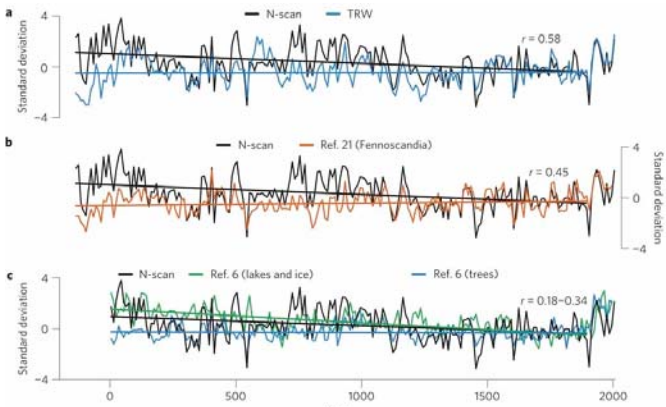
Professor Dr Jan Esper, *et al*

Nature Climate Change - Published online 08 July 2012

The temperature chart above shows cyclical cooling and warming associated with variations in the earth's orbit around the sun over the last 2,000 years.

"Over recent millennia, orbital forcing has continually reduced summer insolation in the Northern Hemisphere. Peak insolation changes in Northern Hemisphere high latitudes, at -65°N between June–August (JJA), have been identified as the prime forcing of climate variability over the past million years. Together with long-term CO2 variability resulting from biogeochemical feedbacks of the marine and terrestrial ecosystems, these insolation cycles have initiated the interplay between glacial and interglacial periods."

Professor Dr Jan Esper of Johannes Gutenberg University in Mainz, Germany, say the very warm period during the years 21 to 50AD has been underestimated by climate scientists. A study suggests the Britain of 2,000 years ago experienced a lengthy period of hotter summers than today.

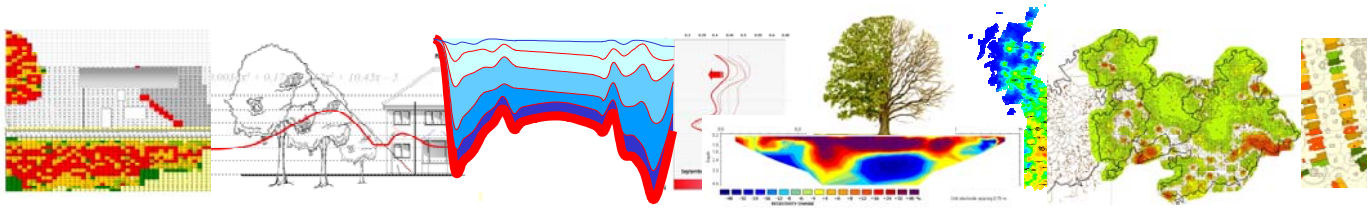


These are the Medieval Warm Period, which is well known, but also a period during the toga-wearing Roman times when temperatures were apparently 1 deg C warmer than now

The research team used data from tree rings – a key indicator of past climate – to claim the world has been on a 'long-term cooling trend' for two millennia until the global warming of the twentieth century.

Dr Esper says, *"the figure we calculated may not seem particularly significant, however it is not negligible when compared to global warming, which up to now has been less than 1 deg C."*.

In general the team found a slow cooling of 0.6C over 2,000 years, which they attributed to changes in the Earth's orbit which took it further away from the Sun and is based on measurements stretching back to 138BC.



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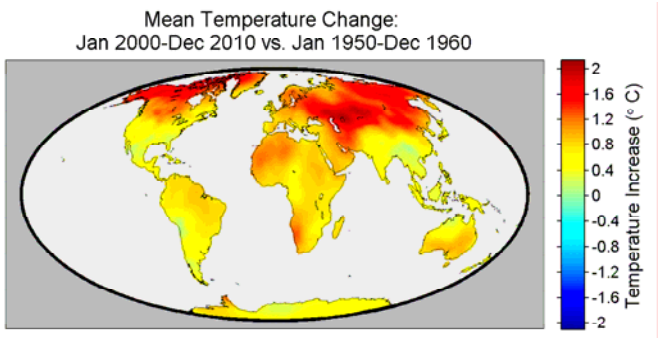
A New Climate Study

Published on line by the Berkley Earth Surface Research Team.

Berkley Earth have produced what must be one of the most comprehensive studies of Climate Change in their recent work, published on the web in late July 2012. Billlions of readings have been compared, and the underlying data is available for download on the web, together with a series of papers, for peer review.

Berkeley Earth has just released analysis of land-surface temperature records going back 250 years, about 100 years further than previous studies. The analysis shows that the rise in average world land temperature globe is approximately 1.5 degrees C in the past 250 years, and about 0.9 degrees in the past 50 years.

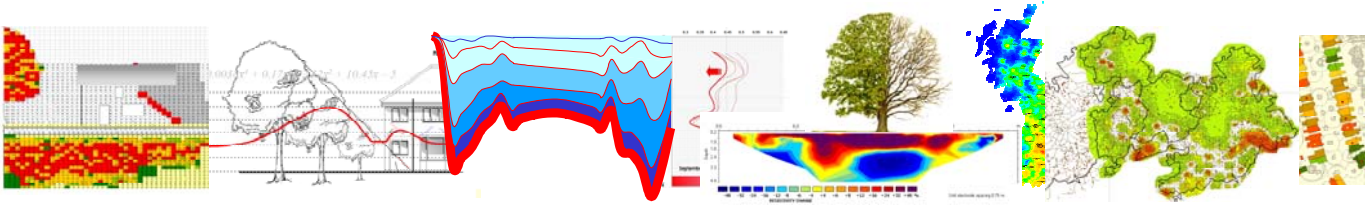


Estimated temperature change for the period 1950-60 to 2000-10. Reproduced from the on-line paper "A New Estimate of the Average Earth Surface Land Temperature Spanning 1753 to 2011"

Berkeley Earth also has carefully studied issues raised by sceptics, such as possible biases from urban heating, data selection, poor station quality, and data adjustment. They say "we have demonstrated that these do not unduly bias the results."

Many of the changes in land-surface temperature can be explained by a combination of volcanoes and a proxy for human greenhouse gas emissions.

As far as they could see, solar variation does not seem to impact the temperature trend.



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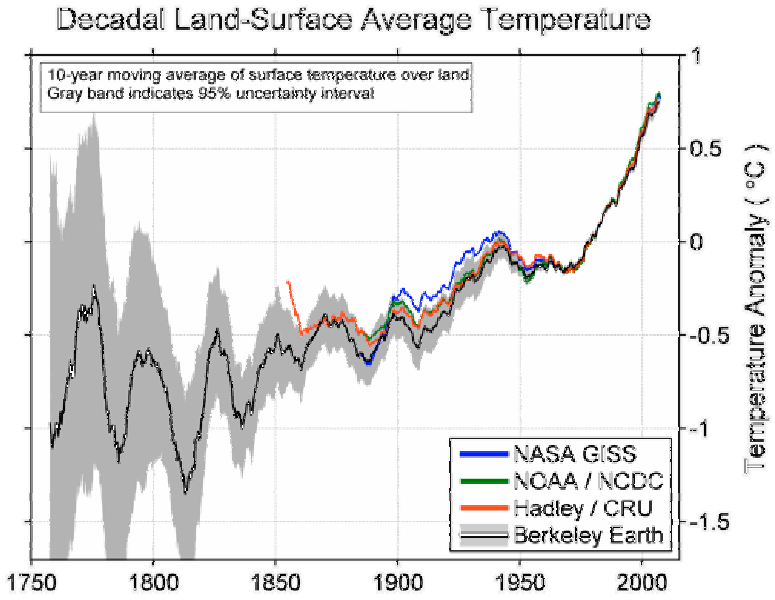
A New Climate Study

Published on line by the Berkley Earth Surface Research Team.

According to the study, the UK temperature has increased by around 2.4 degC over the last 40-50 years. Countries that have suffered less, with increases below 1 deg, include Chile, Paraguay and Laos. The full list is published on their web site.

The study also takes into account volcanic eruptions and man made changes etc.

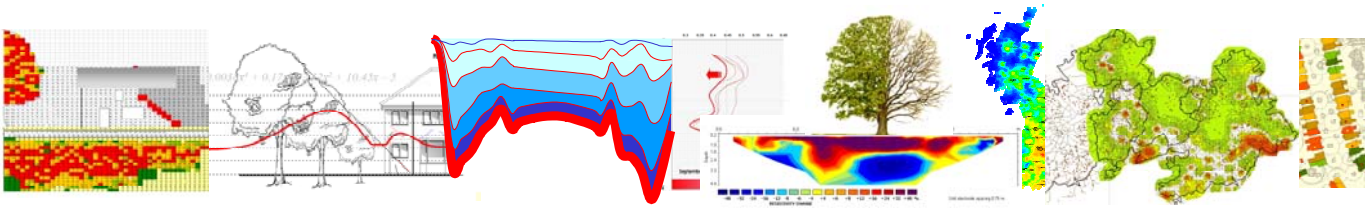


Land temperature with 1- and 10-year running averages. The shaded regions are the one- and two-standard deviation uncertainties calculated including both statistical and spatial sampling errors. Prior land results from the other groups are also plotted. The NASA GISS record had a land mask applied; the HadCRU curve is the simple land average, not the hemispheric-weighted one.

The Berkeley Earth team values the simplicity of its analysis, which they say does not depend on the large complex global climate models that have been criticised by climate sceptics for their hidden assumptions and adjustable parameters.

View the raw data, papers and method on line at http://berkeleyearth.org/

They estimate that warming in the UK is around 2.4degC since 1960.



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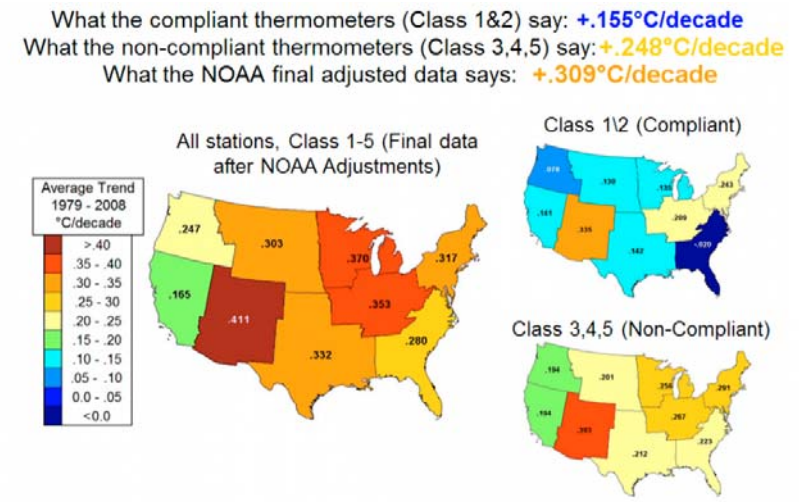
Extract from the Watts web site …

"The USHCN is one of the main metrics used to gauge the temperature changes in the United States. The first wide scale effort to address siting issues, Watts, (2009), a collated photographic survey, showed that approximately 90% of USHCN stations were compromised by encroachment of urbanity in the form of heat sinks and sources, such as concrete, asphalt, air conditioning system heat exchangers, roadways, airport tarmac, and other issues. This finding was backed up by an August 2011 U.S. General Accounting Office investigation and report titled: Climate Monitoring: NOAA Can Improve Management of the U.S. Historical Climatology Network."

Still on the topic of the Berkley Earth research, a small group have voiced concern about the findings, including one of the original authors, Professor Judith Curry of the Institute of Georgia Institute of Technology. Professor Curry says, "Their latest paper on the 250-year record concludes that the best explanation for the observed warming is greenhouse gas emissions. Their analysis is way over-simplistic and not at all convincing in my opinion."

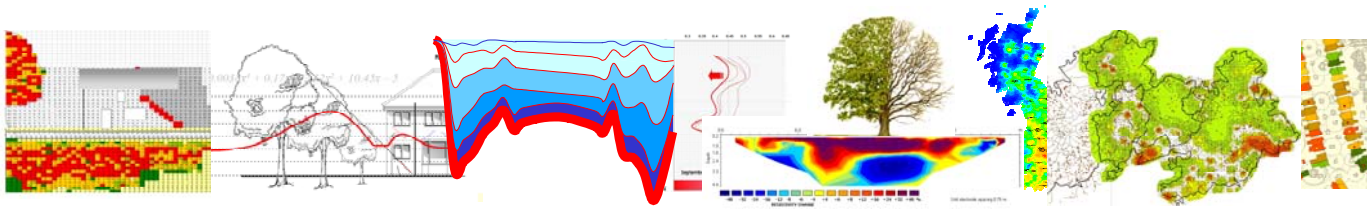
She also told the New York Times: "I was invited to be a co-author on the new paper. I declined. I gave them my review of the paper, which was highly critical. I don't think this new paper adds anything to our understanding of attribution of the warming."

Another group were quick to add their concerns. The web sceptic Anthony Watts (Watts up With That) thinks the study includes some "spurious doubling", and goes on to do some further analysis (extract below) by grading the various weather stations.



In an over-simplistic nutshell, we think his case is that if you install a thermometer in a factory, you will record temperature rises related to the industrial revolution. This doesn't do the study justice but in essence he suggests that some of the sites from which readings have been taken are situated too close to 'urban heat islands', and that this biases the output.

The interesting point about the Watts article is that, even if he is right and the sites need factoring as he suggests, there is still a temperature increase but that increase is only 50% of the Berkley values.



The Clay Research Group

The UK National Ecosystem Assessment

The BBC reporter, Mark Easton, reporting on the findings of the NEA relating to land use.

The NEA have calculated that 6.8% of the UK's land area is now classified as urban. Mark Easton of the BBC reports on a recent study by (NEA) thought this "quite remarkable when we consider that it is an assessment that includes rural development and roads".

The study doesn't just take account of the large cities when it makes the estimate – it includes smaller villages and roads etc. It includes the tarmac and paved surfaces in its calculations. Easton notes that …

- 80% of us live in towns and cities.
- Woodland is now calculated to cover 12.7% of the UK, the highest proportion since 1924 when records began.
- The urban landscape accounts for 10.6% of England, 1.9% of Scotland, 3.6% of Northern Ireland and 4.1% of Wales.
- In urban England, 54% of the land in our towns and cities is greenspace - parks, allotments, sports pitches and so on.
- domestic gardens account for another 18% of urban land use
- rivers, canals, lakes and reservoirs add an additional 6.6%
- in London an estimated 3,200 hectares of front gardens have been covered in concrete, bricks or gravel.
- 78.6% of urban areas is designated as natural rather than built on.
- 93% of the UK is not urban. But even that isn't the end of the story because urban is not the same as built on.

According to the most detailed analysis ever conducted, almost 98% of England is, in their words, natural.