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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Climate : Telemetry : Clay Soil : BioSciences : GIS & Mapping
Risk Analysis : Ground Remediation : Moisture Change
Data Analysis : Numeric Modelling & Simulations : Software

April 2014
Edition 107

The Clay Research Group

CONTENTS

Issue 107, April 2014

ASTON UNIVERSITY
BIRMINGHAM

26th June 2014

Details of the annual Aston Subsidence Conference inside. The program and booking form can be downloaded from the web at the address below. Select 'newsletters'.

A wide range of speakers reflecting the nature of the subsidence industry and aimed at keeping us up to date with developments in the field of law, plant physiology, geotechnics and the various ongoing research projects.

April Edition

This month we continue to explore the development of intelligent systems. The first stage is counting how many, then classifying "of what sort", establishing where, recording when and then accounting - how much?

For example, what are the chances of a claim being valid in Brent, compared with Caerphilly? Does that change if the homeowner reports fresh damage in April, with cracks in the landing? What are the cost differences likely to be, and if there is a difference is that due to construction methods, house values or something more subtle – demographics - age, occupation and so forth.

How does the claim differ from a sulphate claim in terms of situation of damage, age of property and geographic location? Can we build profiles for the range of claims by peril? What does a heave claim look like?

Data collection and analysis over the last 20 years has helped to improve our understanding of the subsidence peril, but also provided the tools with which we can build systems to assist practitioners.

Using combined probabilities it will be seen that the pattern of damage can be matched with one of a range of templates to determine correlation and variance to direct investigations, determine cause and liability and reduce the claim cycle.

If we can't do it, then every claim is a surprise, a novelty, unique to it's location. Subsidence is one of the more technical of insurance perils and as a result, it has things that can be valued and measured - as we will see over the next six months.

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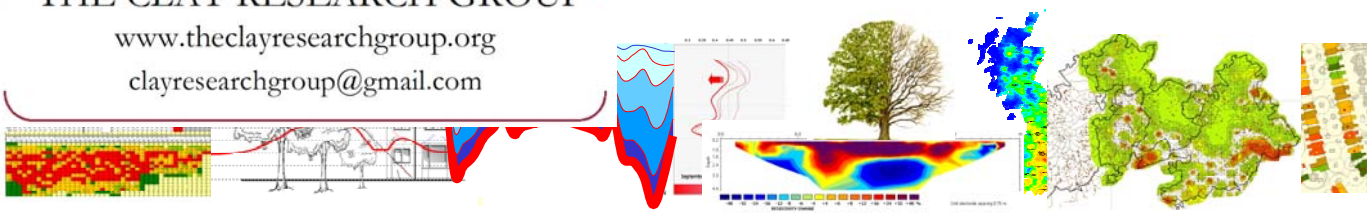

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ASTON UNIVERSITY
BIRMINGHAM

26th June, 2014

Tony Boobier is well known to all in the subsidence industry. Indeed, he was crowned "Mr Subsidence" some years ago.

Tony has worked as an adjuster and managed a subsidence and building repairs unit for one of the larger insurers before venturing forth to join IBM where his role led him to explore a topic of particular interest – "Big Data".

He will discuss the benefits of gathering and analysing data for both the business and the practitioner.

Dr. Jon Heuch is a consultant arboriculturalist and will be explaining how he approaches the problem of establishing which tree has caused damage when there are several.

Trees cause damage by removing water from the soil. Different species of trees appear to differ in their water use so that some species – oaks, poplars and willows, for example - are more frequently found to cause damage than others.

However it is not possible to recognise species by their soil moisture profile so the characteristics of significance are likely to be the extent of root growth – both laterally and vertically rather than their drying ability per se. How much do we know in general terms of where roots may grow and what can we say about specific cases in an urban environment?

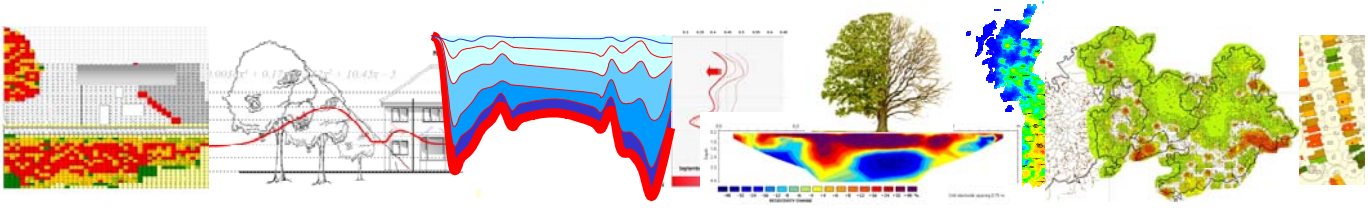
Anna Madichie's talk will focus on Robbins v London Borough of Bexley (2013) EWHC 1233 (Civ) and the issues that emerged during the case at first instance and the Grounds of Appeal raised by the Council.

Anna will start with a synopsis of the case and then explain how the decision of Robbins effects current tree root subsidence claims. She will explore breach of duty, causation and the issues around foreseeability.

Tom Clinton, the PhD student from Birmingham University, talks about his research into electrokinesis after the lunch break. He will outline the principles and bring us up to date with this novel way of 'fixing' clay soils to reduce their shrink/swell potential.

The objective is to develop a quick and economic way of stabilising foundations that move as a result of root induced clay shrinkage, whilst retaining the tree.

Tom's work has the potential to offer significant environmental, as well as financial, benefits.



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Stephen Plante provides a brief outline of the work of the Clay Research Group, talks about the weather, soil testing and precise level monitoring as well as the CRGs use of analytics.

What have been the benefits of counting which trees, where, on what soil, and then trying to model the output in terms of claim notifications?

How far have we got in developing intelligent applications, and is there a role for AI in handling the subsidence peril?

He then describes the benefits of the Intervention Technique in terms of resolving root induced clay shrinkage claims whilst retaining the tree. The technique has been used on many of the more complex claims over the last five years or so – what have we learnt?

Finally, a word from the conference chairman, Richard Rollit. Richard takes the bull (or the adjuster) by the horns, and wonders where things go wrong (if in fact they do), why and what can be done about it going forward.

Does the use of "Big Data" and analytics mean that customer service has to suffer? Or are they a force for good, with practitioners benefiting from seeing the bigger picture.

Can they be used as a training tool, ensuring consistent delivery of a higher quality product?

The annual subsidence conference at Aston is a well attended event with delegates from all areas of subsidence claims handling including insurers, lawyers, adjusters, engineers, arborists and geotechnical engineers.

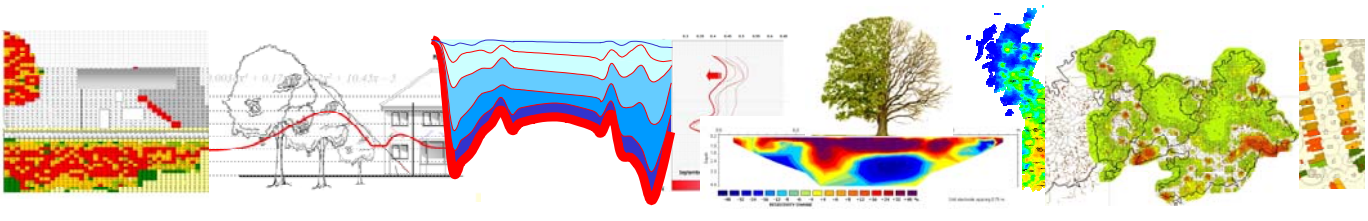
This years speakers are amongst the leading figures in the world of UK domestic subsidence.

Apart from the CPD points, it is an excellent venue for catching up with colleagues and networking.

Feedback is good – we have achieved a 95% satisfaction rating when delegates were asked if the conference raised their level of awareness and satisfied their expectations. Listening to feedback from last year around pricing, we have managed to negotiate a reduction in ticket price.

Last years feedback was positive. When asked what could be changed to improve the day, comments were "nothing … found it constructive and informative", "good range of presentations" and "has opened my eyes to the future and new techniques that we are adopting in order to get precise data quicker and in a more friendly way", "a well balanced set of presentations", "content was interesting" etc…

A copy of the program can be downloaded by selecting the newsletter tab at www.theclayresearchgroup.org.



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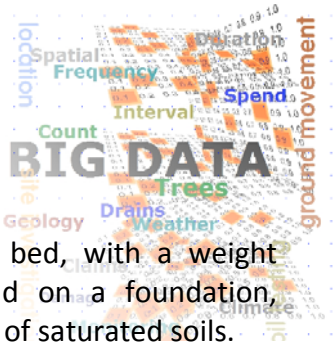
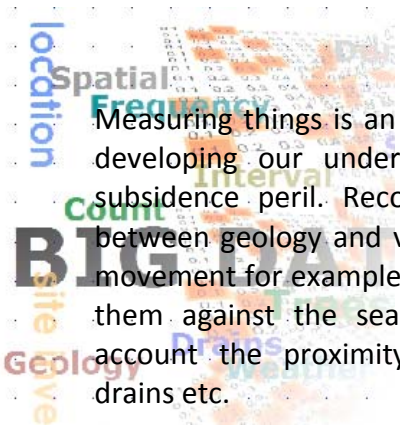


Analytics - Introduction



Measuring things is an essential part of developing our understanding of the subsidence peril. Recognising the link between geology and various causes of movement for example, and quantifying them against the season, taking into account the proximity of vegetation, drains etc.

Putting this information into a system is regarded by some as removing the customer care aspect. In fact, it enhances it.

Better informed engineers, surveyors and adjusters can resolve claims more quickly, and often, more cheaply.

Take the case of underpinning. The industry was confident that underpinning was the only way to resolve subsidence claims 30 years ago. Around 50% of valid claims were underpinned.

We supervised the excavation of trial holes, saw water leaking from drains into a saturated, silty mud. How on earth could that support the weight of a two-storey building?

That figure dropped to around 5%, suggesting that we were ill-informed – even ignorant – of some important facts.

Had it been a research project, there might have been a control group of claims that were not underpinned.

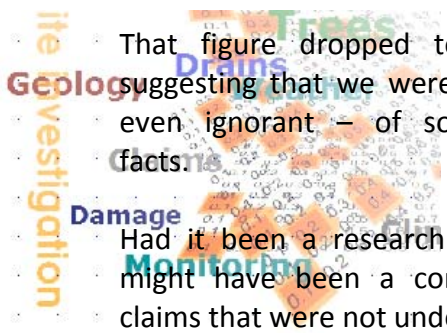
Or perhaps a test bed, with a weight replicating the load on a foundation, sitting onto a range of saturated soils.

Instead, insurers simply said "stop underpinning and let's see what happens". Contractors and engineers alike predicted dire consequences. Some smiled with the surety that insurers would be proven wrong over time.

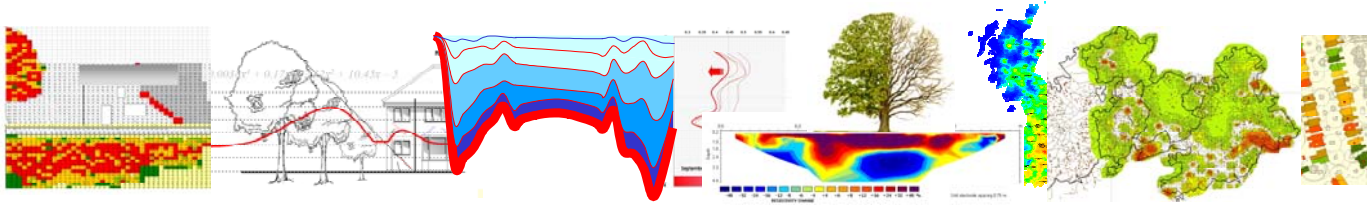
In fact, very little happened. Yes, some cases did come back, but probably no more than came back following piling or underpinning.

Much of the change was enabled by the outstanding work of the Building Research Establishment. Measuring and recording movement for a range of situations and making recommendations that delivered economic and lasting solutions at a sensible cost.

This approach has driven our interest in analytics. It has led us to explore how we might build decision tools and applications to assist engineers who do not have access to huge amounts of claims data. Perhaps support those who are not confident about interpreting soils or monitoring data.



Analytics are widely used to help improve customer care and reduce process. The next few editions of the newsletter will carry articles with this objective.



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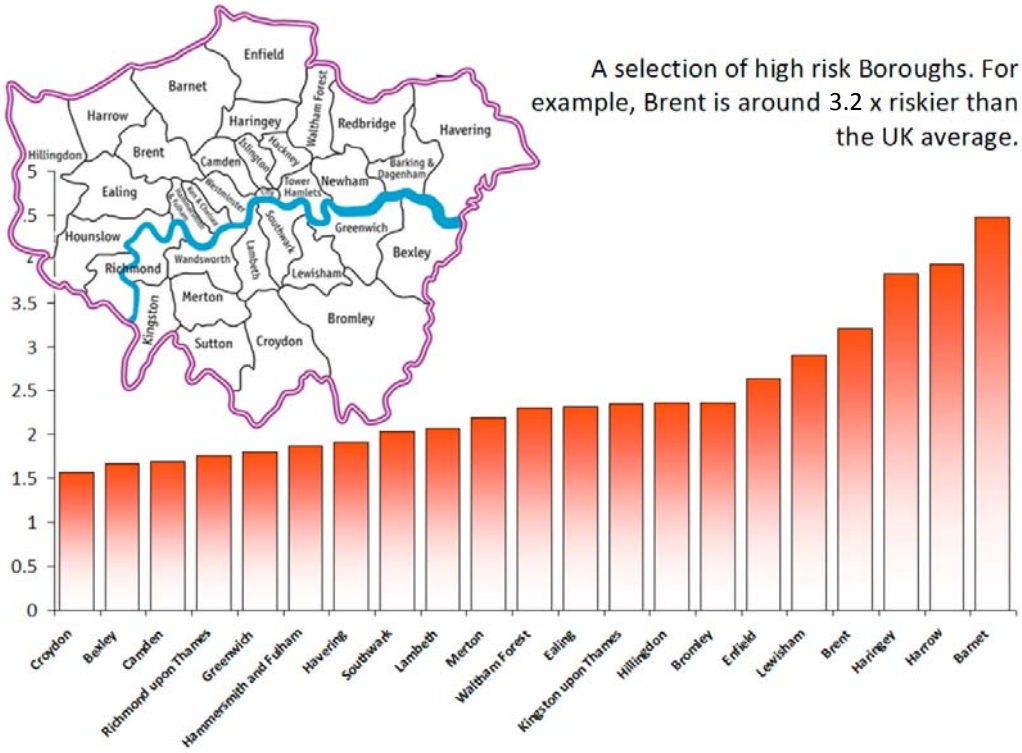

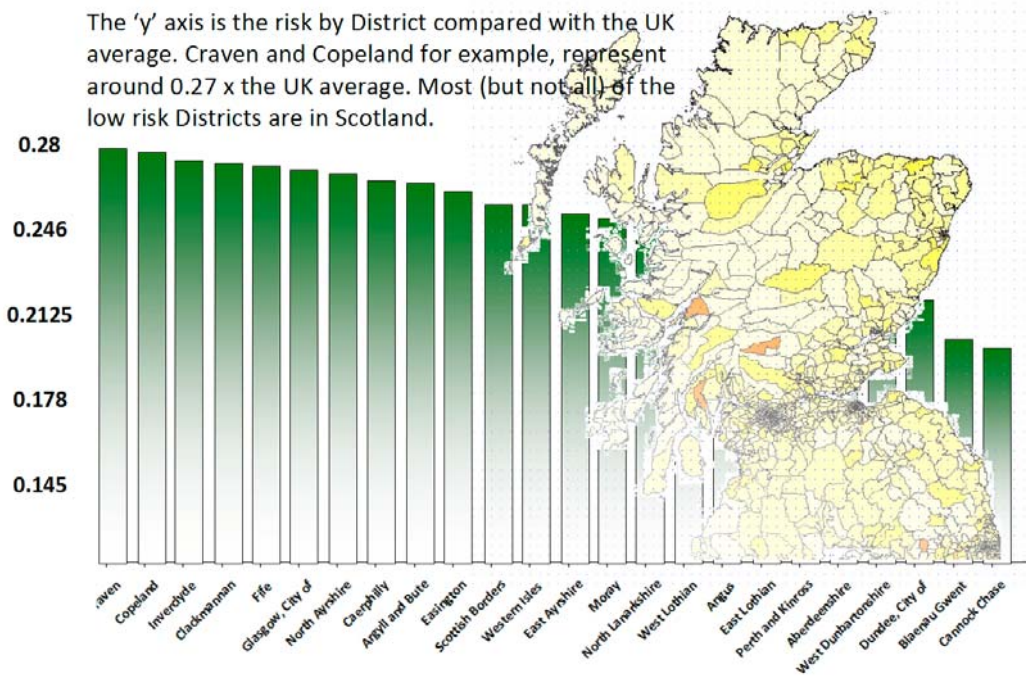

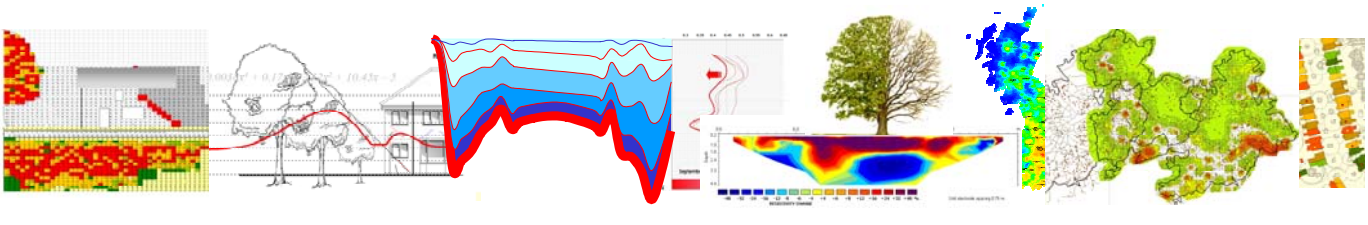

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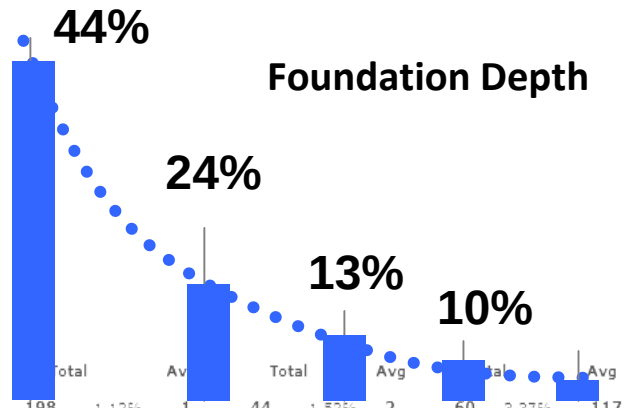
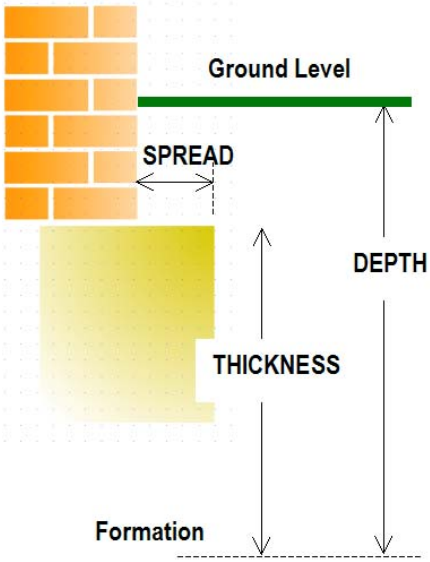
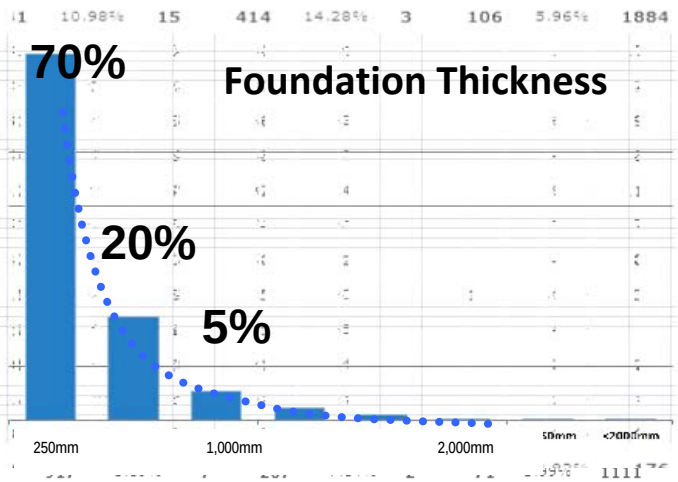
FOUNDATION DATA

36,000 Sample Size
Valid Claims Only

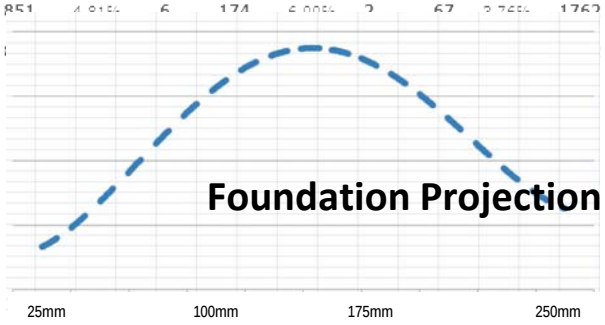


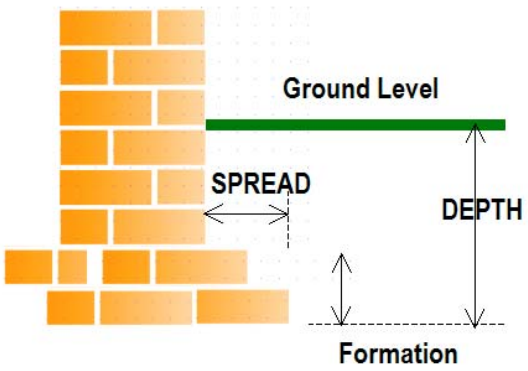


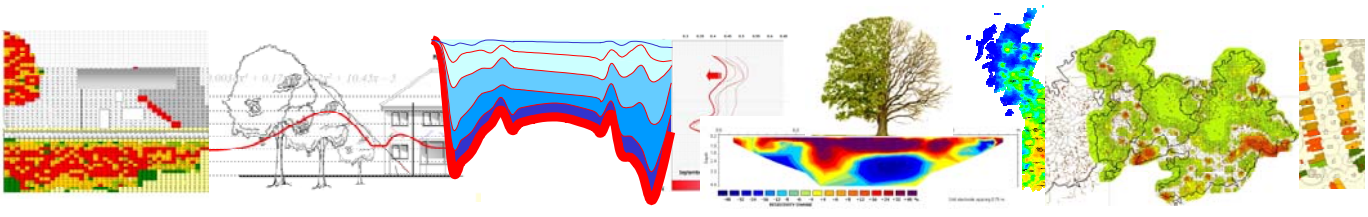


The foundation thickness includes the stepped brick footing (see below) that is commonly found in the older, higher risk, properties.

It will be no surprise to see that foundations less than 1m deep are often encountered in subsidence damaged properties. More surprising is the number (around 3%) exceeding 2mtrs deep sometimes associated with failed underpinning schemes.







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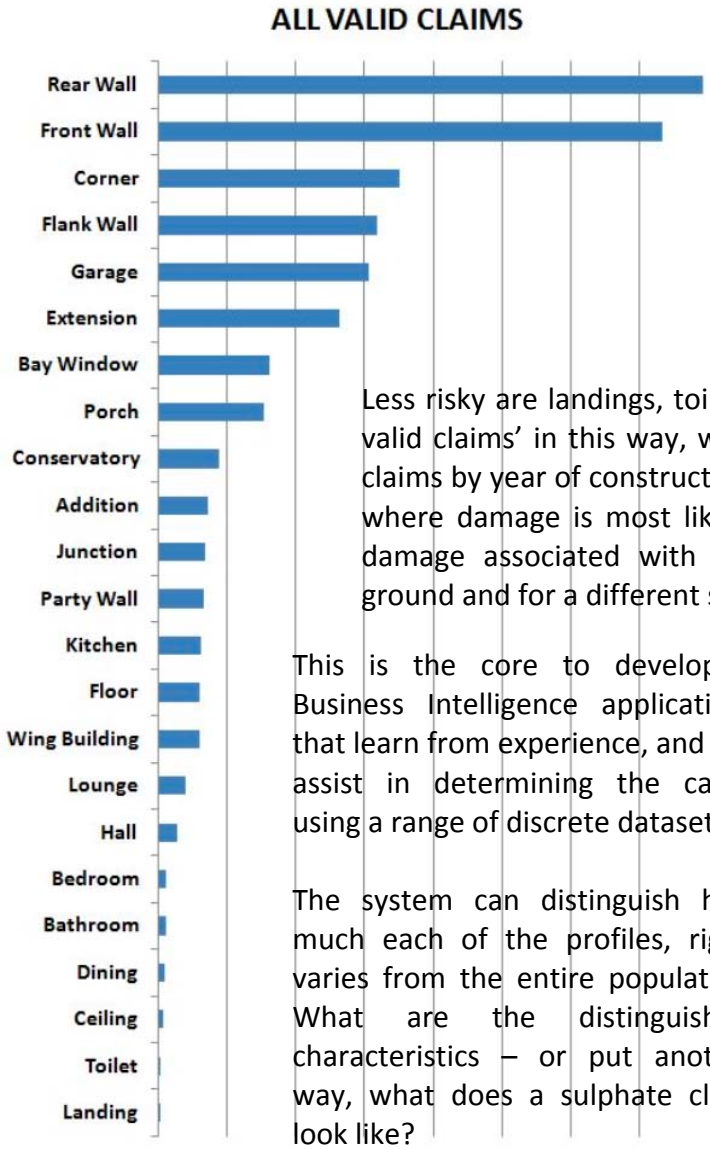


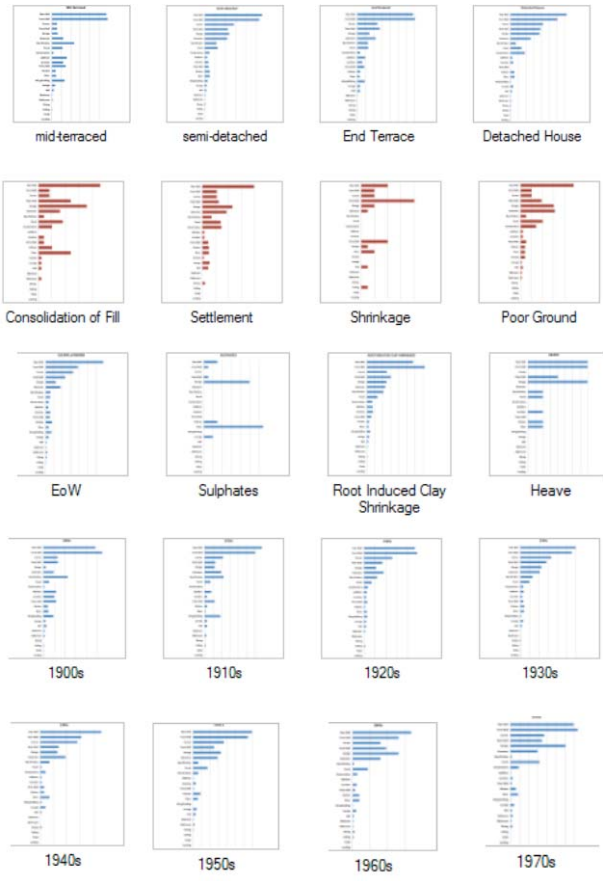
The bar graph, left, plots damage location from a database of 10,000 valid claims.

The rear and front walls are damaged most often, followed by corners of buildings. Garages, porches, bay windows and conservatories are also high risk.

Less risky are landings, toilets, ceilings and dining rooms. By charting 'all valid claims' in this way, we have a template against which we can plot claims by year of construction, style (terrace, end terrace etc.,) and locate where damage is most likely to appear for a range of situations. Does damage associated with sulphates differ from damage due to poor ground and for a different style of house, built at a different time?

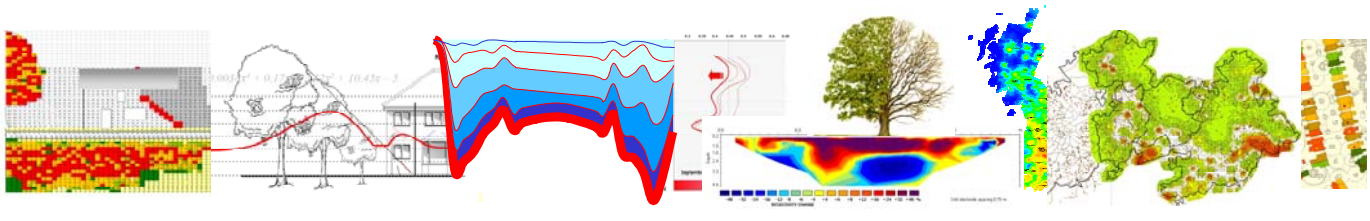
This is the core to developing Business Intelligence applications that learn from experience, and can assist in determining the cause using a range of discrete datasets.

The system can distinguish how much each of the profiles, right, varies from the entire population. What are the distinguishing characteristics – or put another way, what does a sulphate claim look like?



The fact that it looks nothing like the population is good news, as is the fact that it looks nothing like a heave profile.

Classification using 'valid' and 'repudiation' headings allows us to assess the degree of similarity and variance. Where it exists of course. Naturally there are many instances where there is little to distinguish between the profiles, but that is fine. This is one element of many.



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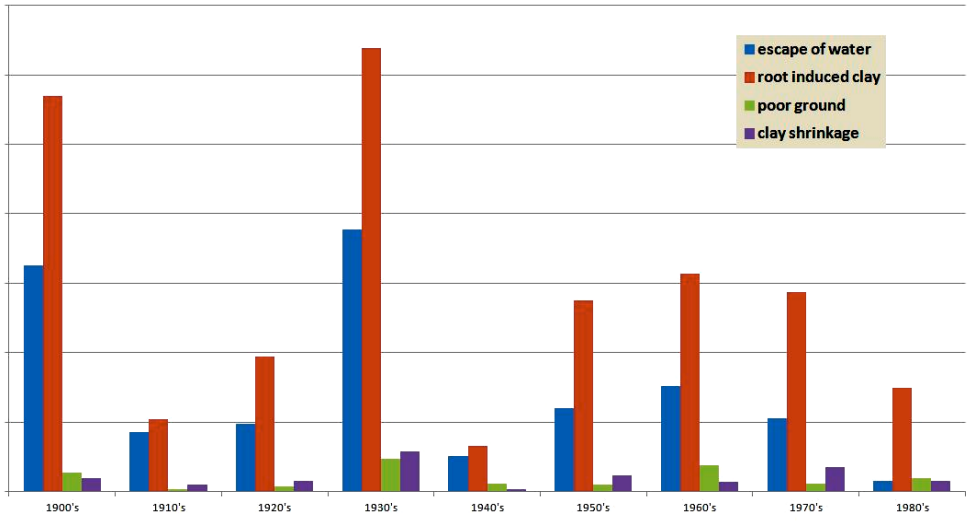
Peril by Age of Property

Claims by peril were plotted in Edition 92, January 2013, for a range of years distinguishing between summer and winter months, surge years and a characteristic sample taken over a five year period.

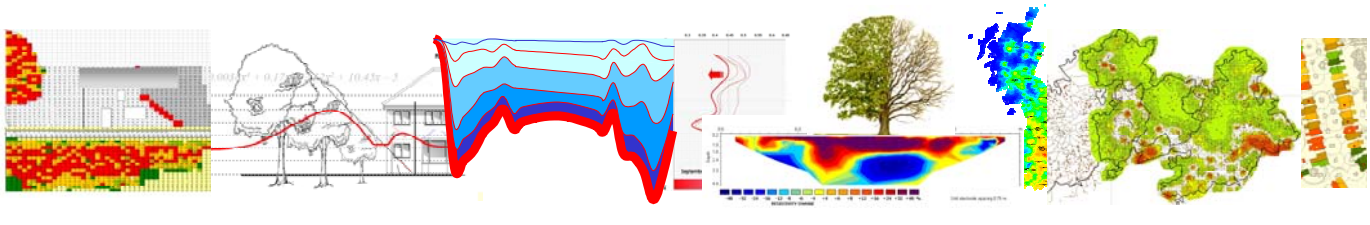
Below, claims by peril, by age of property for each decade have been recorded from a sample of valid claims. The total number of claims is falling with the age of the property confirming that modern houses are safer than older properties.

The relative standing between subsidence caused by escape of water and root induced clay shrinkage remains fairly constant. Subsidence numbers attributable to poor ground are small in number, as is clay shrinkage in the absence of vegetation.



The graph does not record the timing of the event, but the age of the house effected. For example, there were likely more 1930's houses damaged in the 1990 and 2003 event years, followed by houses built in the 1900s.

The graph does not take account of frequency of damage compared with numbers of houses constructed in these years. See elsewhere in this newsletter.



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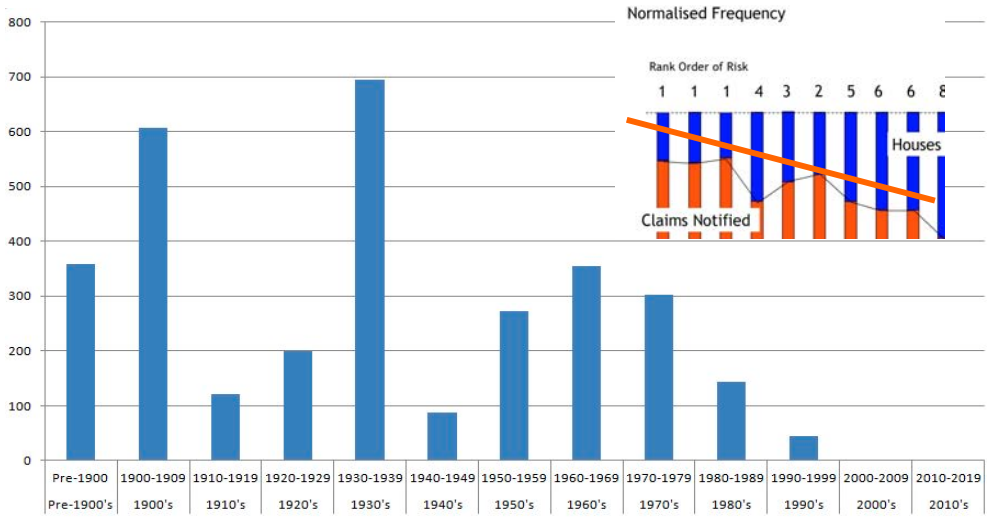
Damage by Decade

36,000 Sample Size - Valid Claims Only

Insert shows normalised plot of damaged properties compared with builds. Older properties present a higher risk when looking at frequency of damage.

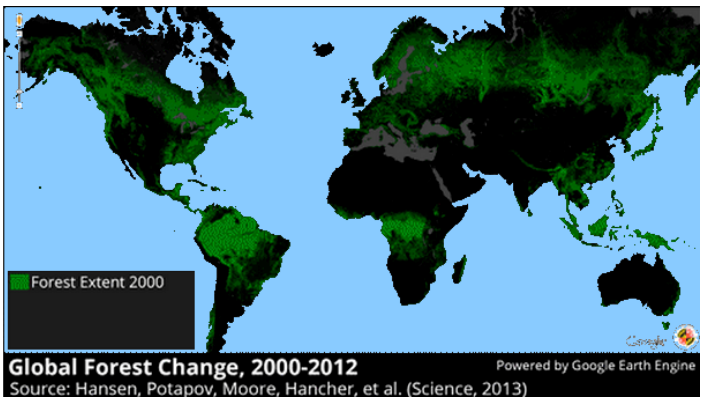


Sponsored by Google

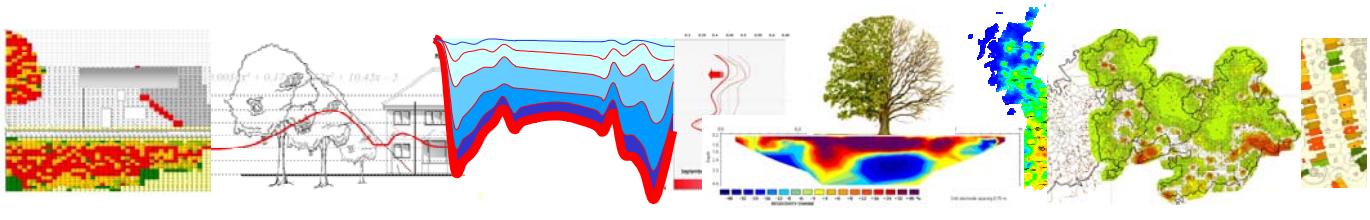
The map, right, reveals the extent of forest cover around the world using Landsat imagery.

Researchers from the University of Maryland have built a map that quantifies global forest change from 2000 to 2012.

They say, “the 30 metre resolution thematic map of the Earth’s land surface plots forest change at a resolution that is high enough to be locally relevant.”



Google have a research division that provides grant support to projects they consider of value. As well as funding, they allow access to their mapping products and provide storage space on their servers.



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Precise Levelling at the Site of the Aldenham Willow for the Period May 2006 to the Current Time

Precise levels taken on the site of the Aldenham willow tree since May 2006 reveal the development of a persistent moisture deficit year on year.

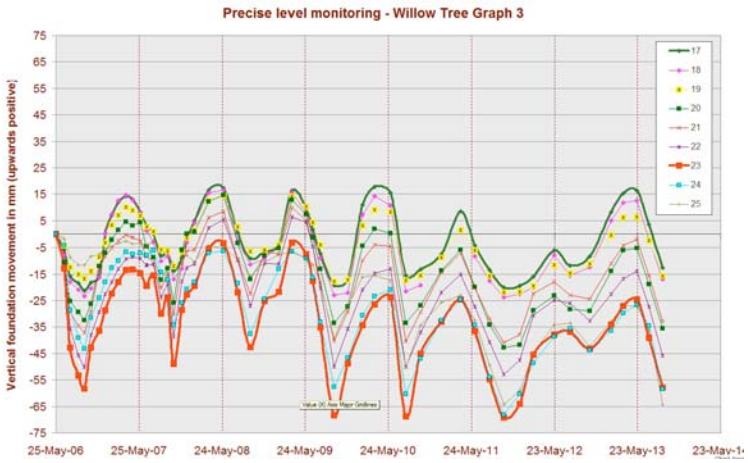
It is more pronounced in arrays 1 & 2, and at stations furthest away from the tree (red line indicates movement at Stations 8 and 23).

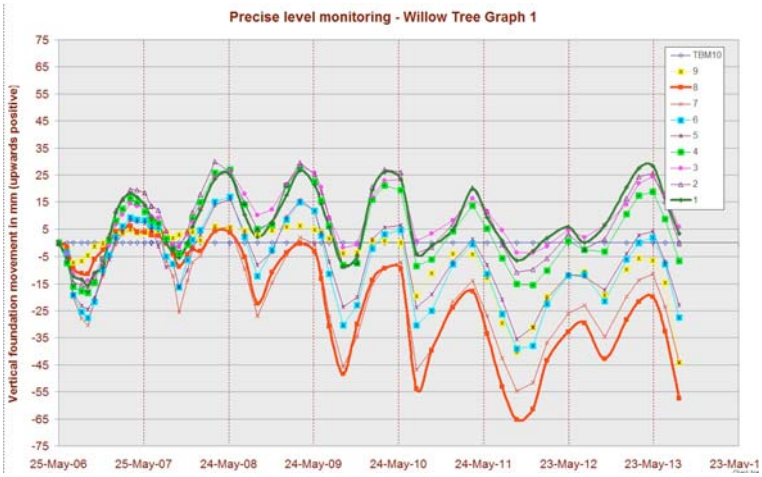
Movement at stations 11 – 16, half way along array No. 1 shows no persistent deficit, but there is a suggestion in all graphs of a persistent deficit – i.e. indicating that the ground was already desiccated at the time levelling commenced in 2006.

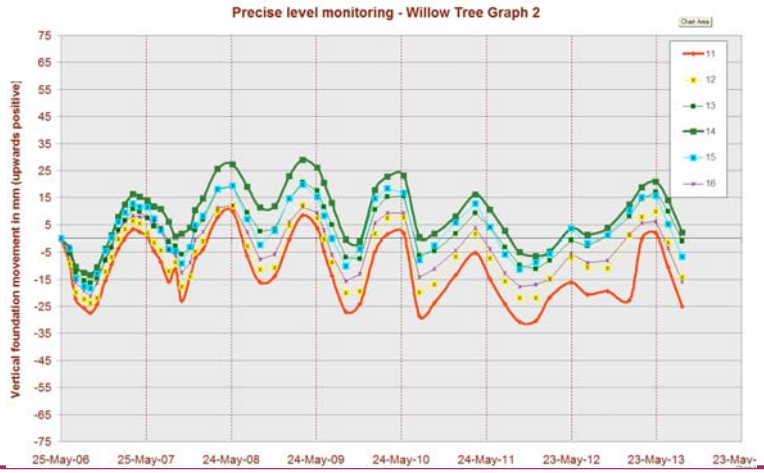
For example, recovery at Stations 1, 14 & 17 take the levels above their starting point.

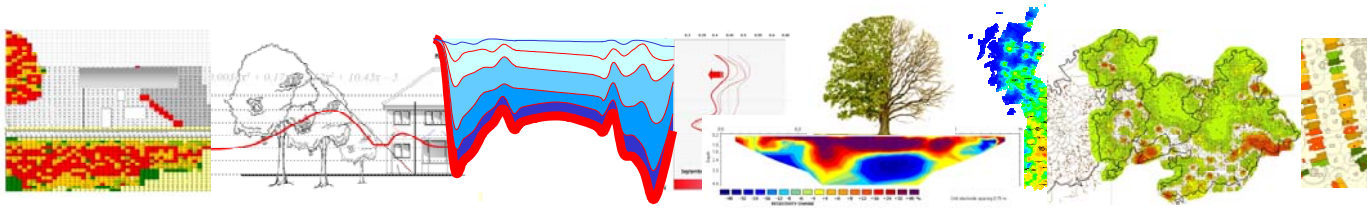
This deficit is establishing itself even through the heavy rainfall over recent years and amounts to 20 - 25mm, although 2012 is clearly distinguishable as being a wetter, with less subsidence than preceding years.

The regular periodic signature suggests that roots are more active perhaps at the periphery as the tree seeks moisture from further afield as the soil nearer the trunk becomes drier.









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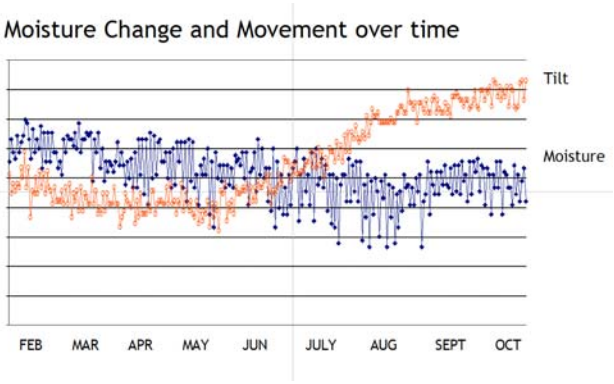
Diurnal Movement - 1

Remote monitoring has the potential to deliver value in the diagnosis of root induced clay shrinkage claims. Instead of gathering information every two or three months and piecing the story together, telemetry allows us to detect change quickly, with a reduced carbon footprint.

Below, building movement (rotation) is detected by a tilt sensor (red line) and moisture change by a TDR moisture sensor (blue). The two are in harmony with increased rotation coincident with soil drying.



Whilst it is known that plant transpiration has a diurnal pattern (see reference, right), is there some soil water recharge sufficient to cause the building to respond and is the equipment sensitive enough to record this?

If so, does soil moisture fluctuate daily, partially recharging in the evening even when there was no rainfall? Clearly trees transpire in the daytime and close down at night, but where would moisture come from for the partial re-charge?

If the readings are reliable and associated with very small moisture fluctuations we can only assume there is some capillary recharge at depth but we have no evidence for this.

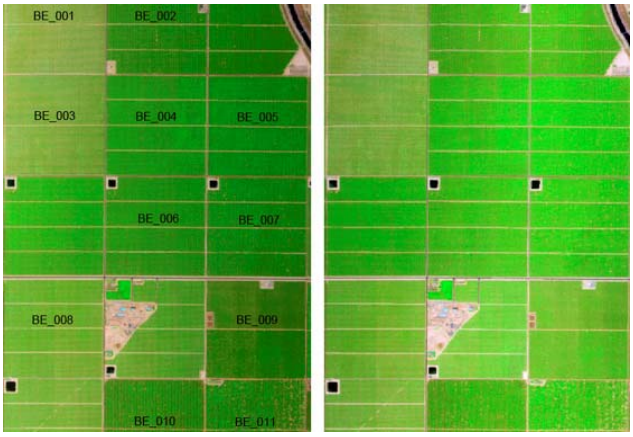
Or were we recording a change in temperature?

Diurnal Movement - 2

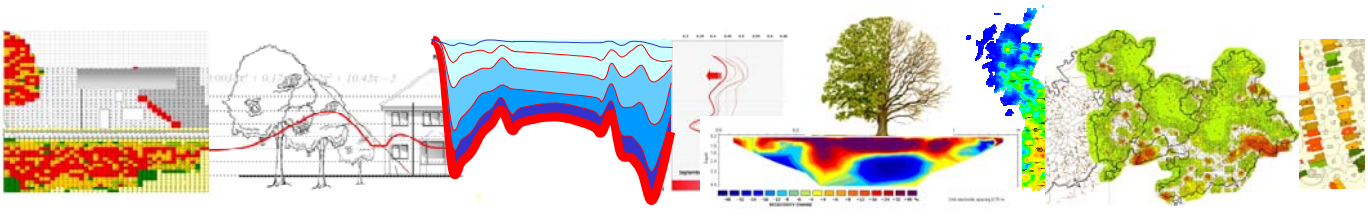
Dr. Davis at the University of California used data gathered from sensors on board NASA flights over California's San Joaquin Valley to assess the role vegetation plays in diurnal water fluctuations.

The aircraft carried several specialised instruments designed to evaluate diurnal water stress in the canopy area of almond and pistachio orchards.

Morning, left, and afternoon, right, MASTER imagery of the study site consisting of three pistachio and eight almond blocks.



Lightness in color on the right image indicates the lower vegetation canopy water content. Labels on left image are orchard block numbers.



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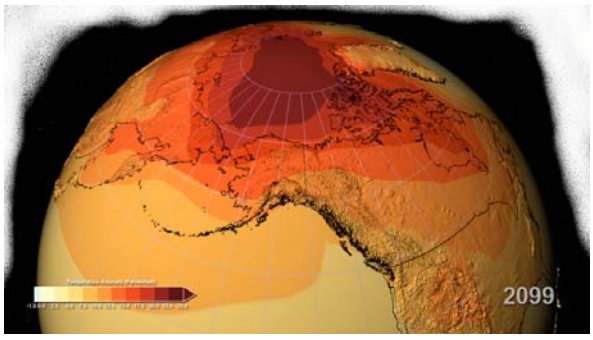
"Inhomogeneous Forcing and Transient Climate Sensitivity"

Drew T. Shindell.

Nature Climate Change, 2014 – Source, Daily Science

Although global temperatures increased at a rate of 0.12°C per decade since 1951, since 1998 the rate of warming has been only 0.05°C per decade. This seems perverse given that atmospheric carbon dioxide continues to rise at a rate similar to previous decades.



Shindell's study suggests that continued warming will take place in line with previous estimates, despite the recent slowdown.

According to a report in Science Daily "this research hinges on a new and more detailed calculation of the sensitivity of Earth's climate to the factors that cause it to change, such as greenhouse gas emissions."

"Drew Shindell, a climatologist at NASA's Goddard Institute for Space Studies in New York, found the Earth is likely to experience roughly 20 percent more warming than estimates that were largely based on surface temperature observations during the past 150 years."

Apparently, some recent research has suggested Earth may be less sensitive to greenhouse gas increases than previously thought.

Science Daily reports "The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), which was issued in 2013 and was the consensus report on the state of climate change science, also reduced the lower range of Earth's potential for global warming."

"To put a number to climate change, researchers calculate what is called Earth's "transient climate response." This calculation determines how much global temperatures will change as atmospheric carbon dioxide continues to increase - at about 1 percent per year - until the total amount of atmospheric carbon dioxide has doubled."

"The estimates for transient climate response range from near 1.4 °C offered by recent research, to the IPCC's estimate of 1.0 °C."

Shindell's study estimates a transient climate response of 1.7 °C, and determined it is unlikely values will be below 1.3 °C.