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
Artificial Intelligence

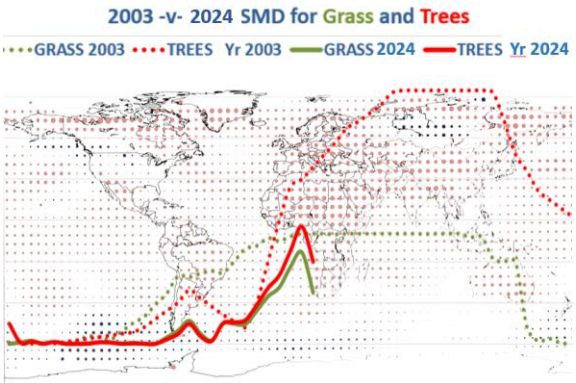
July 2024
Issue 230

The Clay Research Group

CONTENTS

SMD

Recent spell of wet weather in the UK has reduced the chance of 2024 being a surge year, although warmer weather is predicted towards the end of the month.



SMD Data provided by the Met office. Tile 161, Medium Available Water Capacity with grass and tree cover

Contributions Welcome

We welcome articles and comments from readers. If you have a contribution, please Email us at: *clayresearchgroup@gmail.com*

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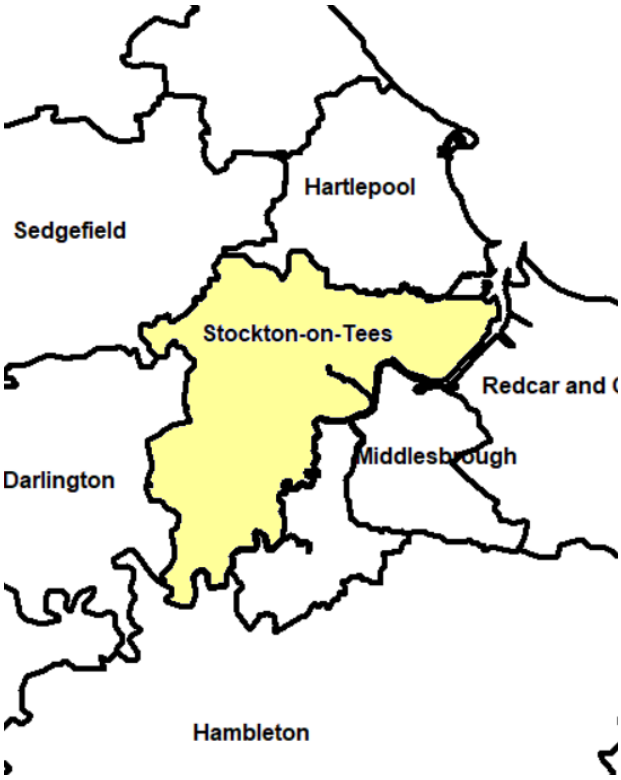
District and Sector Risk

Stockton-on-Tees is the subject of the 'Risk by District' series in this month's edition. It has superficial deposits of clay, gravel and Till overlying sandstone and mudstone – see Page 7.

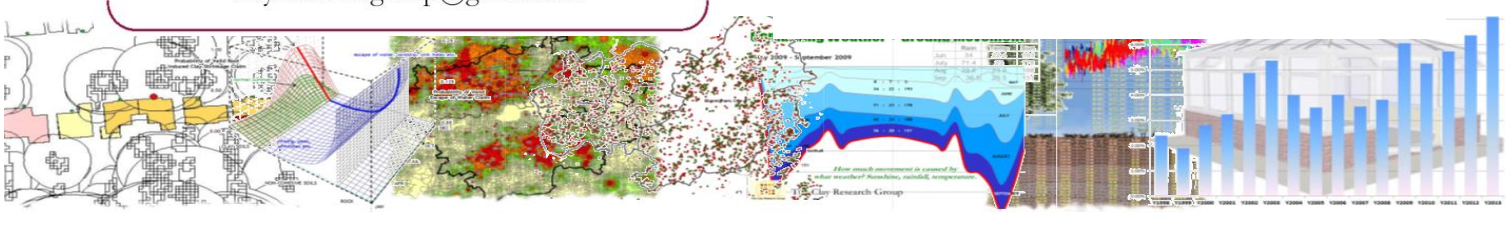


The risk maps are built from a data sample covering four claim years, including one surge and three 'normal' years.

TDAG

The next TDAG seminar will be 18 July 2024 at 2pm, 'Engaging with communities to support local tree planting and deliver change.' You can register at:

https://bham-ac-uk.zoom.us/meeting/register/tZMudOitrz8qHdYU4Xdgvr45nujTJ0LGTxRV



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Increasing Cost of Subsidence Claims

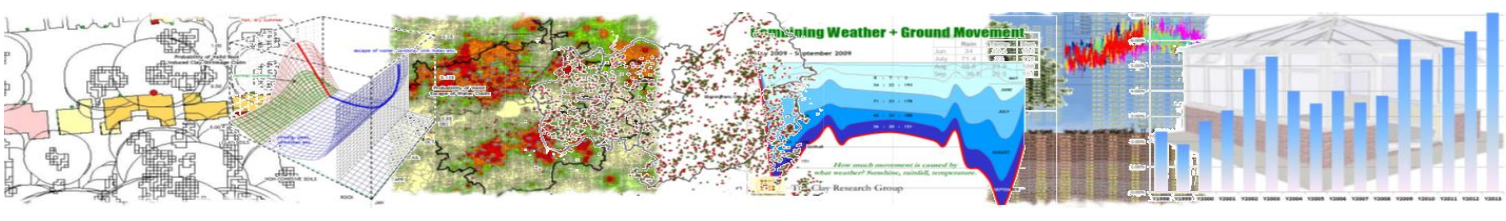
Richard Rollit, Technical Director, Innovation Group produced an analysis of subsidence claim costs in the Innovation June edition of their Technical Bulletin following an analysis of ABI figures. Apparently, 12,693 subsidence claims were notified in 2023, with an average estimated value of £11,007.

The figures suggest costs have increased by 85% over the last 5 years and Richard explains the likely reasons: Brexit, supply chain disruption, the wars in Ukraine and Gazza together with general inflation and the sharp hike in energy prices.

Richard explains:

> *"The most likely cause specific to the subsidence peril is likely to be claims involving Local Authority trees. This change reflects the difficult we see in trying to remove Local Authority trees and having to underpin or install a root barrier more frequently. The difficulty in removing trees reflects a greater awareness of the benefits trees bring, together with the introduction of the Environment Act and the Duty to Consult on street tree removal.*
>
> *However, the greatest impact on cost have been changes in case law which significantly reduces the amount we can recover.*
>
> *If we go back to 2011 it was only necessary to show the tree was the 'effective and substantive cause of damage' for a recovery to succeed. The recovery would include the costs of repairing the initial damage and any underpinning costs if the LA did not act reasonably. The decisions in Berent v Family Mosaic Housing (May 2011), then Pattichis v Enfield (Nov 2016) and Gurdwara v Royal Borough of Kensington & Chelsea (May 2019) have fundamentally changed how third-party liability is assessed.*
>
> *Nowadays we can only recover costs if the damage was foreseeable and usually this limits recoveries to underpinning or root barriers costs. Generally, we can no longer recover the cost of repairing the initial damage."*

To receive a copy of the Innovation Technical Bulletin, contact Richard at richard.rollit@innovation.group



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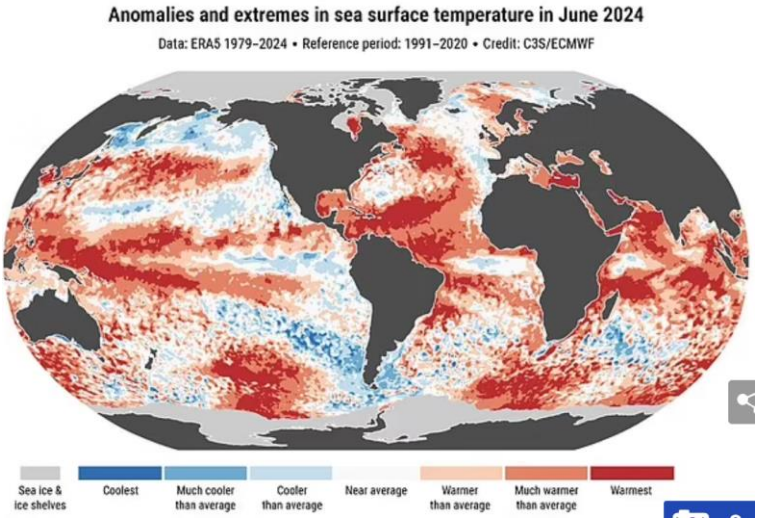
Warmest June - Globally

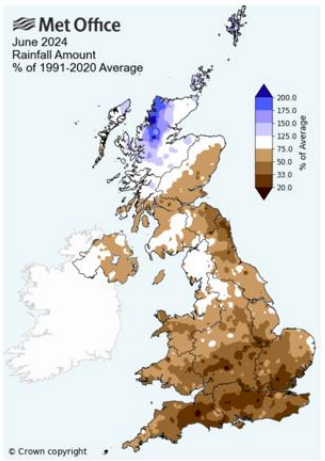
Globally, June was the warmest month on record. Every month since June 2023 set a record globally. Not the case for the UK unfortunately which, according to the Met Office, was below average.

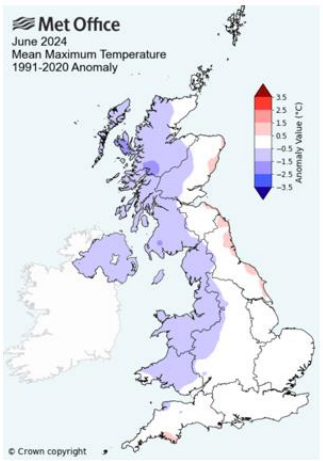


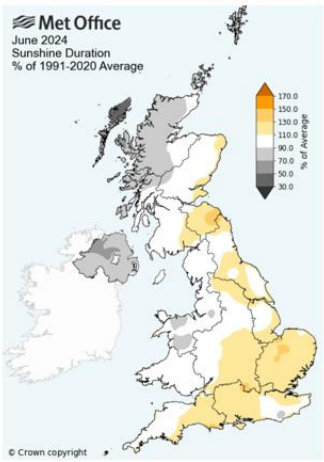
Met Office Anomaly Maps for June 2024

Anomaly maps from the Met Office web site for the month of June 2024 reproduced below.

The month can be summed up as being drier with a below average temperature to the west and slightly more sunshine to the south-east than the average for June when compared with the 1991 – 2020 average.







https://www.metoffice.gov.uk/research/climate/maps-and-data/uk-actual-and-anomaly-maps

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ChatGPT – Soil Moisture Deficit

QUESTION TO ChatGPT: Does the Soil Moisture Deficit (SMD) help predict whether there will be an increase in subsidence claim numbers?

ChatGPT RESPONSE: Yes, the Soil Moisture Deficit (SMD) can help predict whether there will be an increase in subsidence claim numbers. Here's how it works:

Definition of Soil Moisture Deficit (SMD):

- SMD is the measure of the amount of water needed to bring the soil moisture content back to field capacity, which is the amount of water soil can hold after excess water has drained away.
- High SMD indicates dry soil, while low SMD indicates moist soil.

Impact on Soil and Structures:

- Clay soils, which are common in many regions, expand when wet and shrink when dry. This expansion and contraction can lead to ground movement, known as subsidence.
- Buildings and structures built on such soils can suffer from subsidence if the soil underneath shrinks significantly.

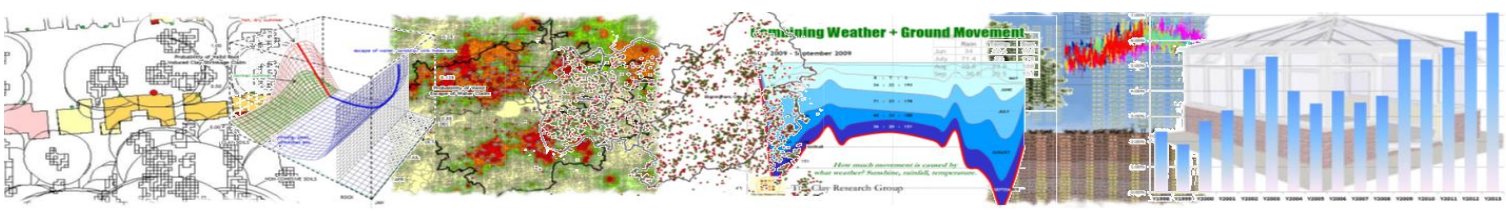
Correlation Between SMD and Subsidence Claims:

- During periods of high SMD, the soil becomes very dry, leading to greater risk of subsidence as clay soils shrink.
- An increase in SMD typically correlates with prolonged dry weather, which can result in a higher number of subsidence incidents and, consequently, an increase in subsidence insurance claims.
- Monitoring SMD allows insurers and property owners to anticipate and potentially mitigate the risk of subsidence by implementing preventative measures.

Predictive Use of SMD:

- Historical data analysis often shows a clear relationship between high SMD values and increased subsidence claims.
- By tracking SMD values over time, it is possible to forecast periods of high subsidence risk and prepare accordingly.

In summary, SMD is a valuable tool for predicting the likelihood of subsidence and can help in managing and mitigating the associated risks, leading to more informed decision-making for property maintenance and insurance claims management.



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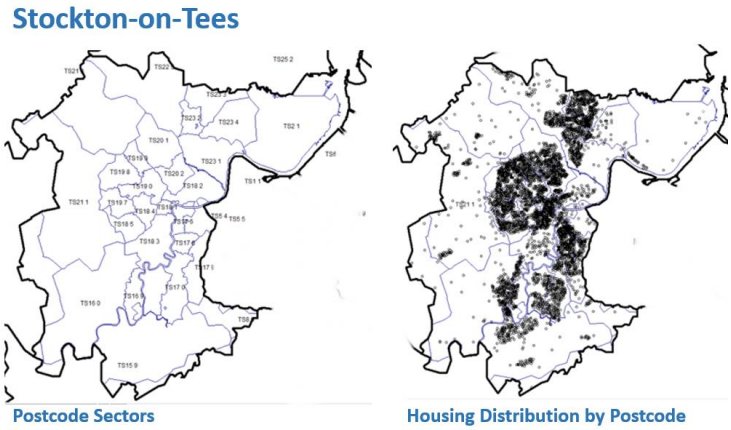
Subsidence Risk Analysis – Stockton-on-Tees

Stockton-on-Tees is located in County Durham and occupies an area of 204km^2 with a population of around 85,000.



Distribution of housing stock using full postcode as a proxy. Each sector covers around 2,000 houses on average across the UK and full postcodes include around 15 – 20 houses on average, although there are large variations.

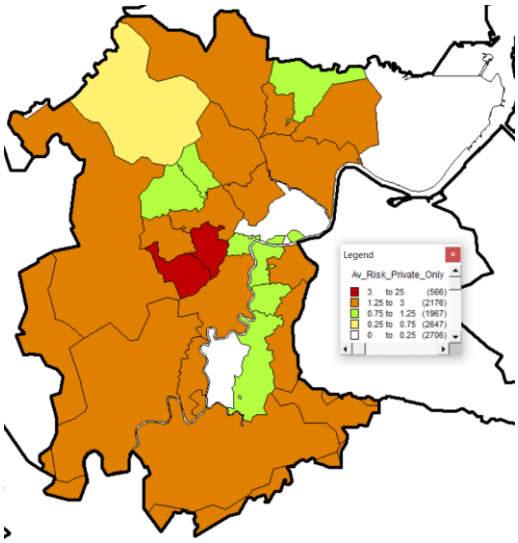
Sector and housing distribution across the district (left, using full postcode as a proxy) helps to clarify the significance of the risk maps on the following pages. Are there simply more claims in a sector because there are more houses?

Using a frequency calculation (number of claims divided by private housing population) the relative risk across the borough at postcode sector level is revealed, rather than a 'claim count' value.

From the sample we hold sectors are rated for the risk of domestic subsidence compared with the UK average – see map, right.

Stockton-on-Tees is rated 71st out of 413 districts in the UK from the sample analysed and is around 1.55x the risk of the UK average, or 0.402 on a normalised 0 - 1 scale.

There is a varied risk across the district as can be seen from the sector map, right. The varied geology (see pages 7 and 8) no doubt accounts for this with shrinkable clay soils to the north and till and sandstone to the south.



Sector risk compared to UK average from the sample analysed. Private ownership.

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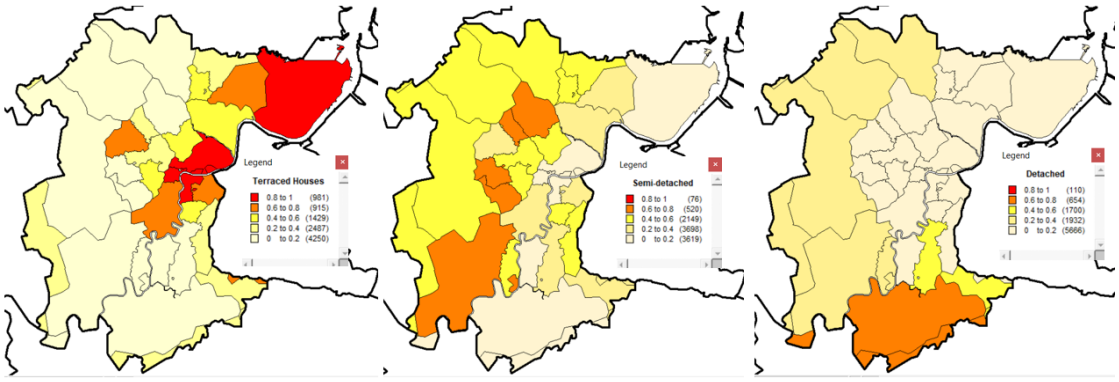
Stockton-on-Tees. Properties by Style and Ownership

Below, the general distribution of properties by style of construction, distinguishing between terraced, semi-detached and detached. Unfortunately, the more useful data is missing at sector level – property age. Risk increases with age of property and the model can be further refined if this information is provided by the homeowner at the time of taking out the policy.

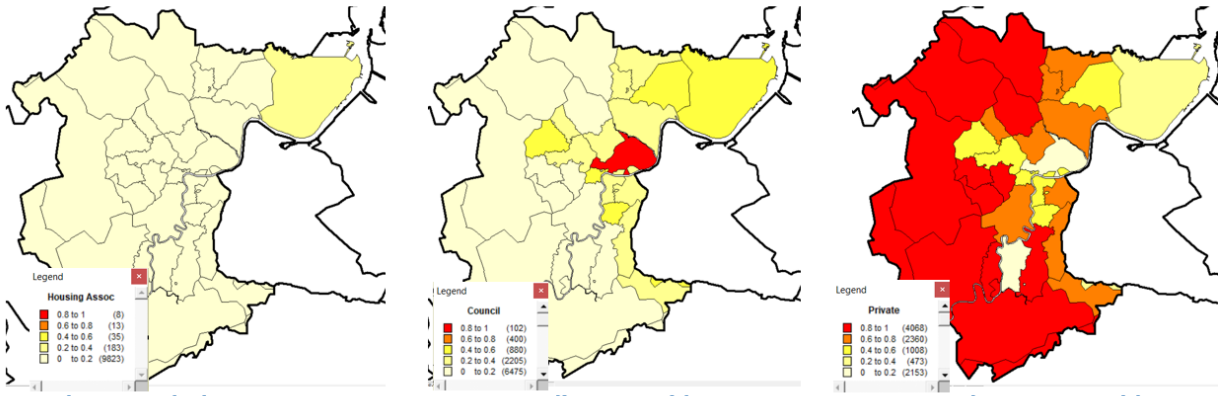
Stockton-on-Tees - Distribution by House Type



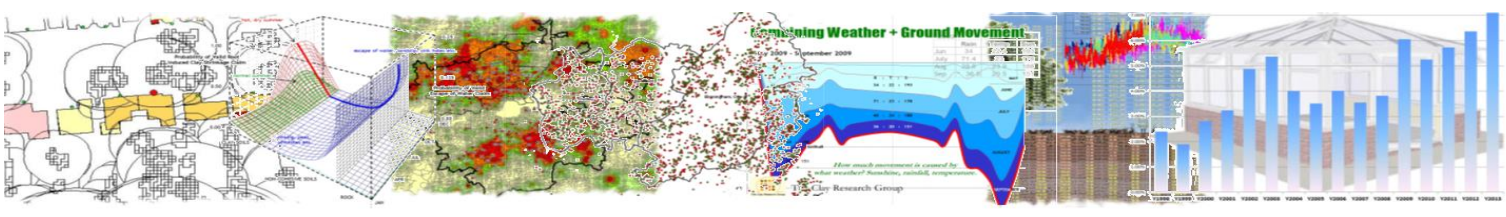
Terraced Semi-Detached Detached

Distribution by ownership is shown below. Detached private properties are the dominant class across the borough.

Stockton-on-Tees - Distribution by Ownership



Housing Association Council Ownership Private Ownership



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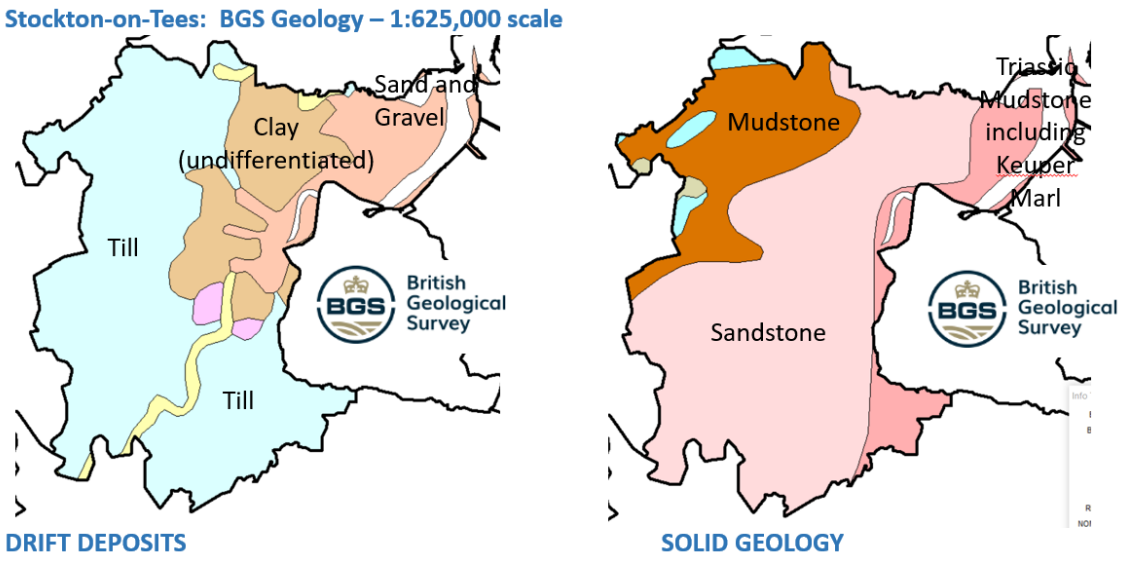
Subsidence Risk Analysis – Stockton-on-Tees

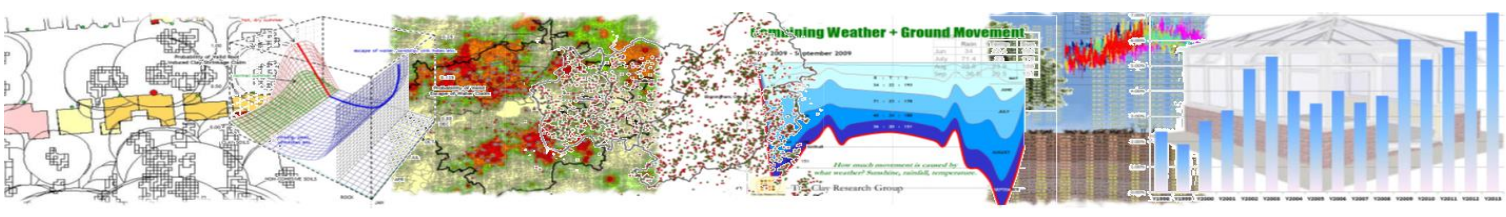
Below, extracts from the British Geological Survey low resolution 1:625,000 scale geological maps showing the solid and drift series. View at: http://mapapps.bgs.ac.uk/geologyofbritain/home.html for more detail.

See page 10 for a seasonal analysis of the sample which reveals that, at district level, there is around a 70% probability of a claim being valid in the summer and, of the valid claims, there is around a 60% chance that the damage will have been caused by clay shrinkage. In the winter, the likelihood of a claim being valid falls to around 60% and of the valid claims there is a 60% chance of the cause being escape of water.

Maps at the foot of the following page plot the seasonal distribution and provide an indication of risk by geological series.



Above, extracts from the 1:625,000 series British Geological Survey maps. Working at postcode sector level and referring to the 1:50,000 series delivers far greater benefit when assessing risk.



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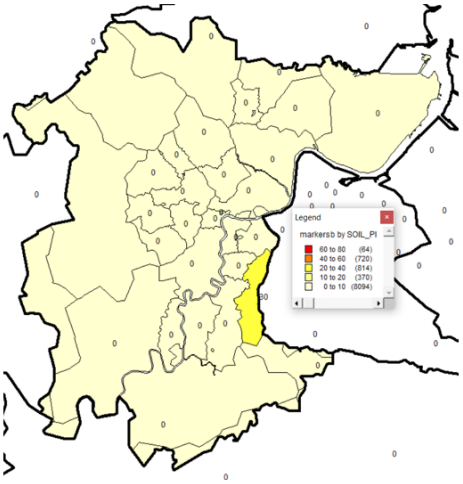
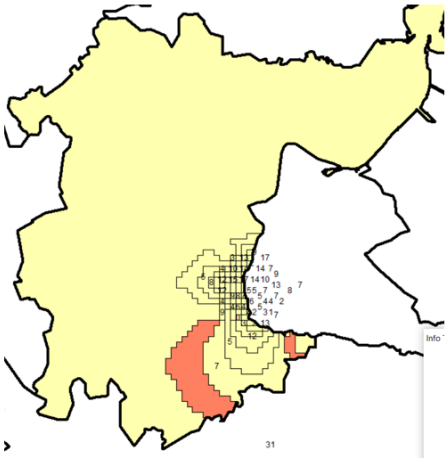
Liability by Geology and Season

Below, the average PI by postcode sector (left) derived from site investigations and interpolated to develop the CRG 250m grid (right). The higher the PI values, the darker red the CRG grid.

Stockton-on-Tees – Soil Plasticity Index



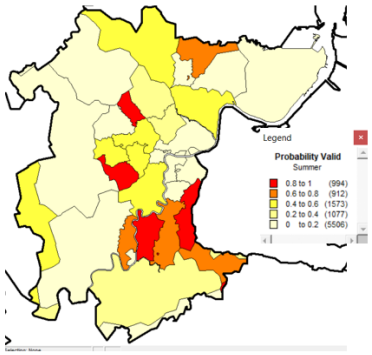
Soil PI Averaged by Sector



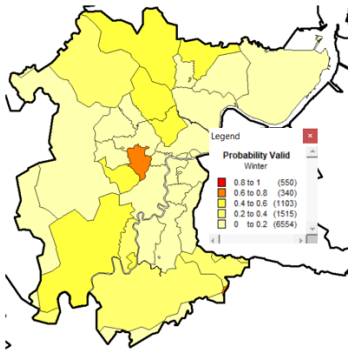
PI Interpolated on 250m CRG grid

Zero values for PI in some sectors may reflect the absence of site investigation data - not necessarily the absence of shrinkable clay. A single claim in an area with low population can raise the risk as a result of using frequency estimates.

Stockton-on-Tees – by season



Probability Valid, Summer



Probability Valid, Winter

The maps, left, show the seasonal difference from the sample used.

Combining the risk maps by season and reviewing the table on page 10 is perhaps the most useful way of assessing the potential liability, likely cause and geology using the values listed.

The 'claim by cause' distribution and the risk posed by the soil types is illustrated at the foot of the following page. A high frequency risk can be the product of just a few claims in an area with a low housing density of course and claim count should be used to identify such anomalies.

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District Risk. EoW and Council Tree Risk.

Stockton-on-Tees - Subsidence Risk Relative to UK

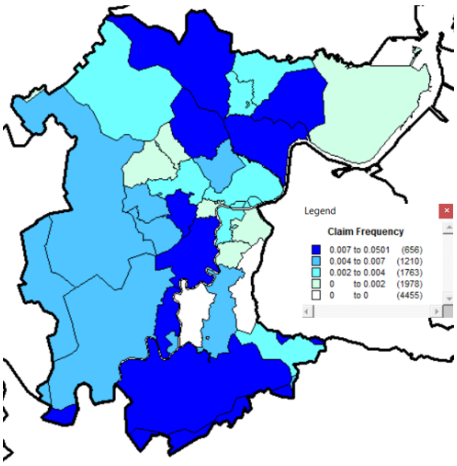
Normalised (0 – 1) Scale

Relative to UK Average

Below, left, mapping the frequency of escape of water claims confirms the presence of non-cohesive soils. The distribution on the map reflects the presence of drift deposits of till, sand and gravel. As we would expect, the 50,000 scale BGS map provides a more detailed picture. The CRG 1:250 grid reflects claims experience.

Below right, map plotting claims where damage has been attributable to vegetation in the ownership of the local authority from a sample of around 2,858 UK claims.

Stockton-on-Tees



Higher Risk Escape of Water

Claims Involving Council Tree

(2,858 UK claim sample)

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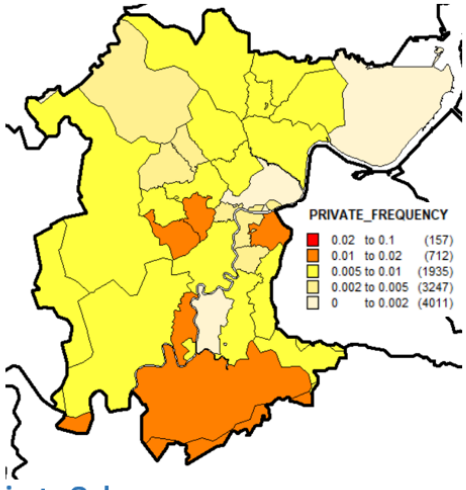
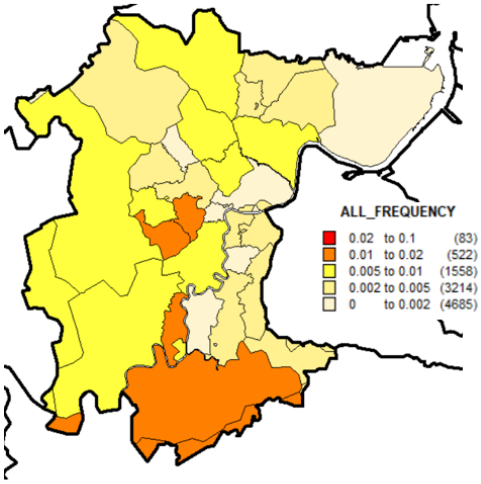
Stockton-on-Tees - Frequencies & Probabilities

Below, mapping the risk of subsidence by ownership. Claims frequency that includes council and housing association properties delivers a misleading value of risk as they tend to self-insure. The following show the normalised risk, taking account of the private housing population – that is, the rating compared with the average value for each category.

Stockton-on-Tees - Sector Risk Compared with UK Average



Private Only



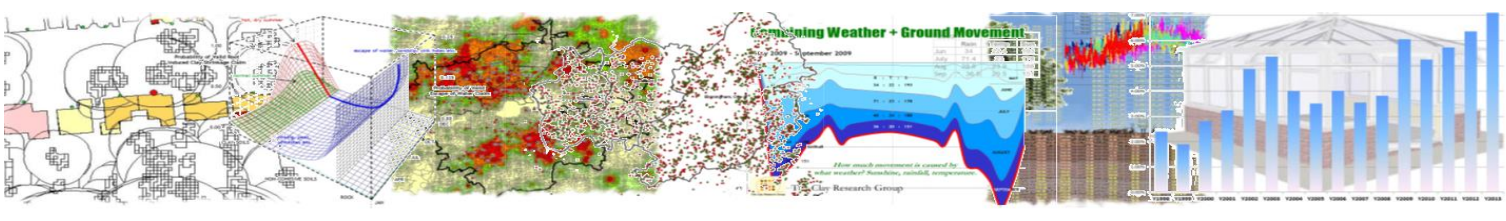
All Properties

On a general note, a reversal of rates for valid-v-declined by season is a characteristic of the underlying geology. For clay soils, the probability of a claim being declined in the summer is usually low, and in the winter, it is high.

Valid claims in the summer are likely to be due to clay shrinkage, and in the winter, escape of water. For non-cohesive soils, sands, gravels etc., the numbers tend to be fairly steady throughout the year.

Liability by Season - Stockton-on-Tees

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Stockton-on-Tees	0.394	0.236	0.37	0.23	0.39	0.382



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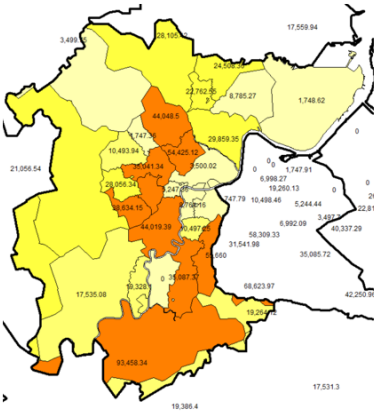
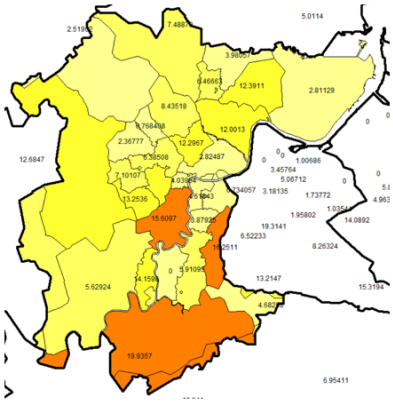
Aggregate Subsidence Claim Spend by Postcode Sector and Household in Normal & Surge Years

The maps below show the aggregated claim cost from the sample per postcode sector for both normal (top) and surge (bottom) years. The figures will vary by the insurer's exposure, claim sample and distribution of course.

NORMAL YEAR SPEND – Stockton-on-Tees



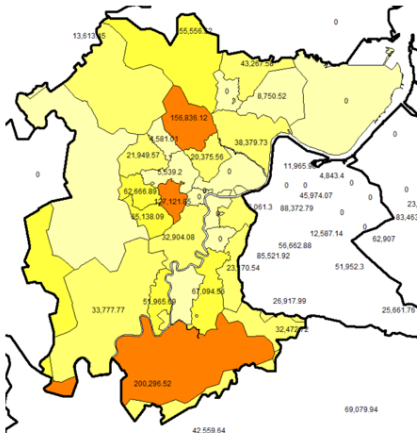
Spend by Sector



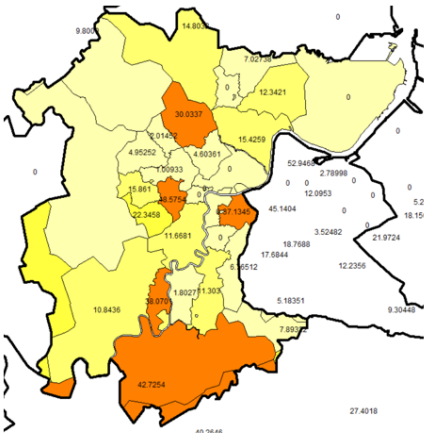
Spend Averaged Over Private Housing Population

It will also be a function of the distribution of vegetation and age and style of construction of the housing stock. The images to the left in both examples (above and below) represent gross sector spend and those to the right, sector spend averaged across private housing population to derive a notional premium per house for the subsidence peril. The figures can be distorted by a small number of high value claims.

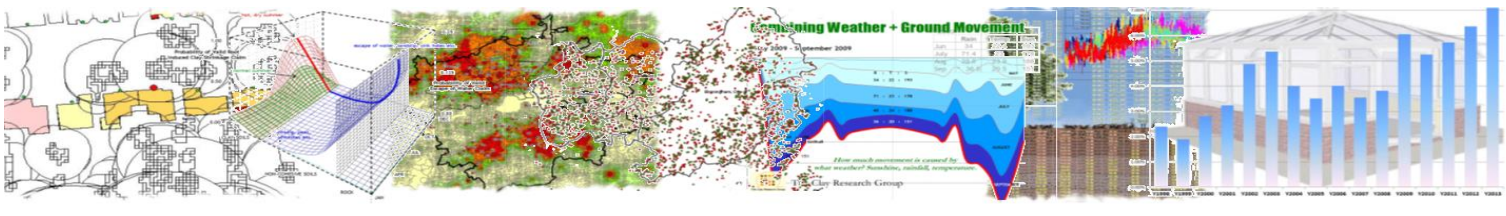
SPEND in SURGE – Stockton-on-Tees



Spend by Sector



Spend Averaged over Private Housing Population



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The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

It is of course the case that a single expensive claim (a sinkhole for example) can distort the outcome using the above approach. With sufficient data it would be possible to build a street level model.

In making an assessment of risk, housing distribution and count by postcode sector play a significant role. One sector may appear to be a higher risk than another based on frequency, whereas basing the assessment on count may deliver a different outcome. This can also skew the assessment of risk related to the geology, making what appears to be a high-risk series less or more of a threat than it actually is.

The models comparing the cost of surge and normal years are based on losses for surge of just over £400m, and for normal years, £200m.