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

June 2021
Issue 193

The Clay Research Group

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Issue 193, June 2021

Property Damage Task Force

A new body, known as the Property Damage Task Force is an initiative led by insurance risk and commercial law firm BLM, initially focusing on flooding claims and resilience. The aim of the cross-industry body is to bring together insurers, brokers, loss adjusters, legal specialists and corporates to look at emerging issues in property claims.

The panel currently includes representatives from the Association of British Insurers (ABI), Aon, Arch Insurance International, Hiscox, Pen Underwriting, QBE, Zurich, loss adjuster Sedgwick, forensic investigators Hawkins, GJB Consultancy, as well as a corporate organisation. The first meeting was held in April, and future meetings are to be quarterly.

BGS Update

The British Geological Survey delivered a webinar on the 19th May just prior to the launch its UK Climate Projection (UKCP) model, GeoClimate UKCP18, on the 20th May and outlining the benefits. For more information and details of the available suites go to:

https://www.bgs.ac.uk/datasets/geoclimate-ukcp09-and-ukcp18/

UKCP18 takes account of the increased risk of subsidence posed by global warming based on long term UK Climate Projection (UKCP) scenarios and estimates the risk of clay shrinkage for the years 2030 and 2070.

Key findings from the State of the UK Climate report produced by World Meteorological Organization:

- 2018 was the third sunniest year in a UK series starting in 1929
- Over the last decade, summers have been 13% wetter, and winters have been 12% wetter than the period 1961-1990

https://www.metoffice.gov.uk/about-us/press-office/news/weather-and-climate/2019/state-of-the-uk-climate-2018

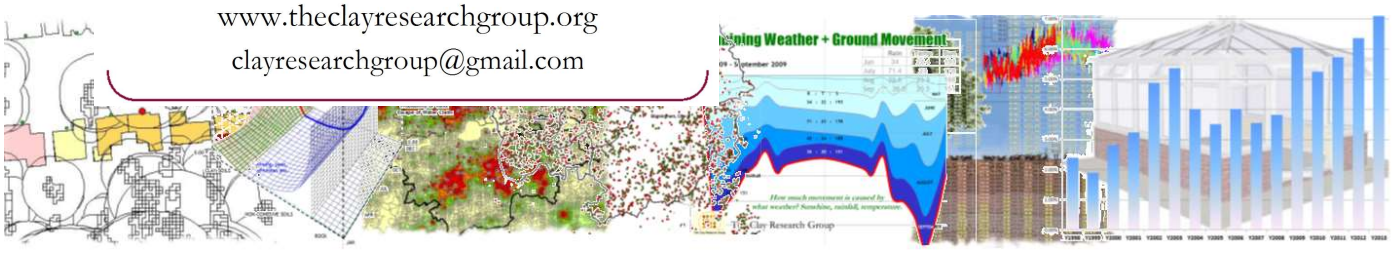
Next month we review our own work in this area.

Contributions Welcome

We welcome articles and comments from readers. If you have a contribution, please Email us at:

clayresearchgroup@gmail.com

THE CLAY RESEARCH GROUP
www.theclayresearchgroup.org
clayresearchgroup@gmail.com



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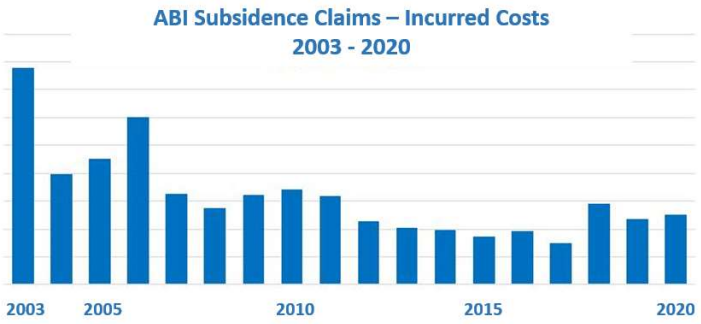
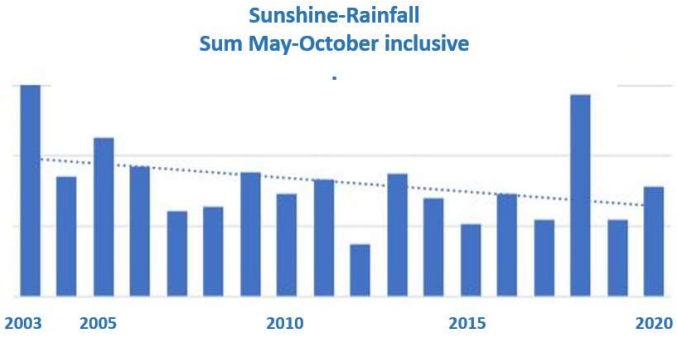
Does Global Warming = Rising Claims?

Temperatures are rising and yet subsidence claim numbers are falling which may seem perverse given the perceived risk posed by global warming. How do we reconcile gradually decreasing claim numbers since 2006, with this increase in warming – why is the general trend in subsidence claims cost/count declining?

According to data published by the Association of British Insurers (ABI) domestic subsidence claim spend and count have been declining steadily since the surge in 2003. This is in contrast to the Met Office report that *"All of the UK's ten warmest years on record have occurred since 2002. Beginning with the hottest, the top ten warmest years in sequence are: 2014; 2006; 2011; 2007; 2017; 2003; 2018; 2004; 2002; and 2005."*





The likely cause of reducing claims is an increase in rainfall. Key findings from the State of the UK Climate report:

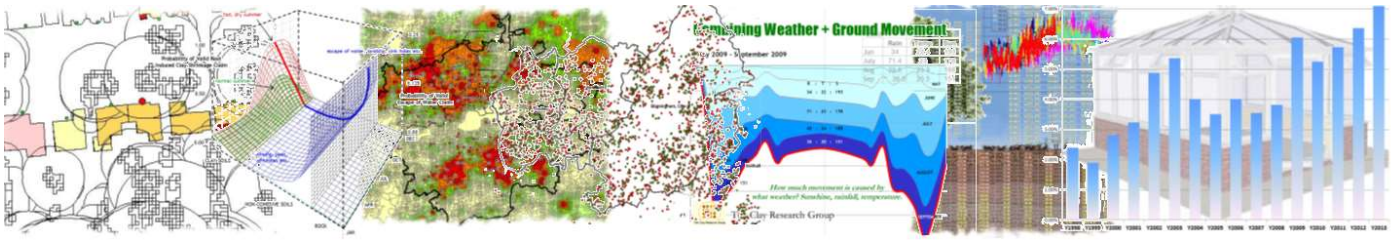
"Over the last decade, summers have been 13% wetter, and winters have been 12% wetter than the period 1961-1990."

Above, modelling *sunshine–rainfall* from Met Office data collected from the Heathrow weather station illustrates the situation. What does the future hold? Below, the Met Office forecast:

Summers are projected to become hotter and are more likely to be drier, although wetter summers are also possible. By 2050, heatwaves like that seen in 2019 are expected to happen every other year. In 50 years' time, by 2070 we project:

- *Winter will be between 1 and 4.5°C warmer and up to 30% wetter*
- *Summer will be between 1 and 6°C warmer and up to 60% drier*

Heavy rainfall is also more likely. Since 1998, the UK has seen seven of the ten wettest years on record.



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Does Global Warming = Rising Claims?

Can we model the risk of subsidence associated with climate change? Is it simply a case of following the UKCP data and anticipating increasing subsidence claim numbers resulting from root induced clay shrinkage as a result of warming? A monthly average may reflect the total rainfall but there is a difference between large amount falling over a few days and intermittent bouts of rainfall every few days. Monthly averages don't reflect the combination of the elements. As the State of the Climate Report says, "*as they are derived from temperature only, users should be aware that other relevant factors such as solar gain, day length, wind and rain will also influence the actual responses of, for example, plant growth.*"

Dr Hawkins, from National Centre for Atmospheric Science, University of Reading, makes a good point when he says; *"attention on climate change often focuses on global average temperature increases, but climate change most often affects people with specific events, not averages."*

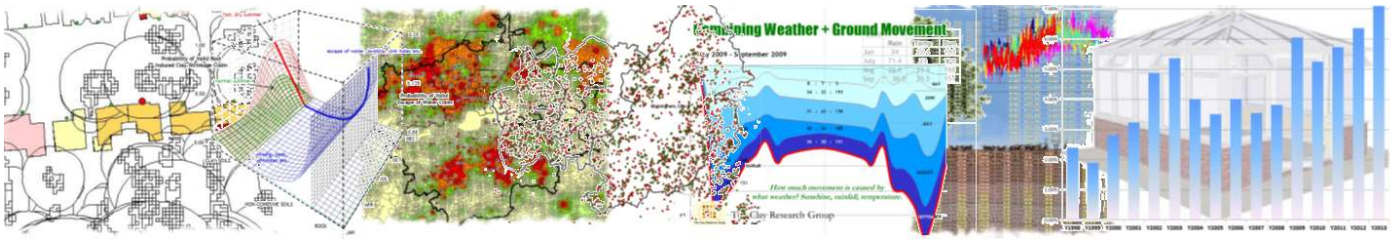
The British Geological Survey have launched a model, GeoClimate, estimating the risk of subsidence going forward, taking account of global warming. Briefly (their web site offers more detail) the model delivers risk values for 2030 and 2070 taking into account data analysis in the UK Climate Projection (UKCP) report.

The question relating to domestic subsidence is, with subsidence currently accounting for around 4 - 6% of insurers annual spend will they purchase a model anticipating risk in 50 years time? Does such a model have value? Do underwriters spend time calculating premiums so far ahead?

Perhaps an alternative approach might be to provide an underlying base model and adding an annual adjustment factor, ensuring the risk is updated taking into account weather patterns and experience gained over preceding years. Also, given the contribution from increased rainfall, account needs to be taken not just of warming and rainfall but humidity, vapour pressure deficit etc., if possible.

Taking the BGS model as an example, they might reasonably argue that an annual fee of £30k represents excellent value even if it only saves a few claims in a year although analysis of spend using insurer's own data on claim settlement may provide greater value – see page 11 for an example. Claim spend is a direct measure of risk, identifying the geological risk factors by implication (i.e. higher claim count on troublesome soils) and particularly when comparing seasonal change and normal and event years – see page 10.

On the following page, graphs illustrating the trendline for the increase in rainfall for *sunshine-rainfall* for the period January 2003 to December 2020 together with the percentage of incurred losses from insurer's annual spend for the same period. Together they illustrate the reduction in subsidence claim numbers and falling cost at a time when, according to the Met Office, "*the UK's ten warmest years on record have occurred*"



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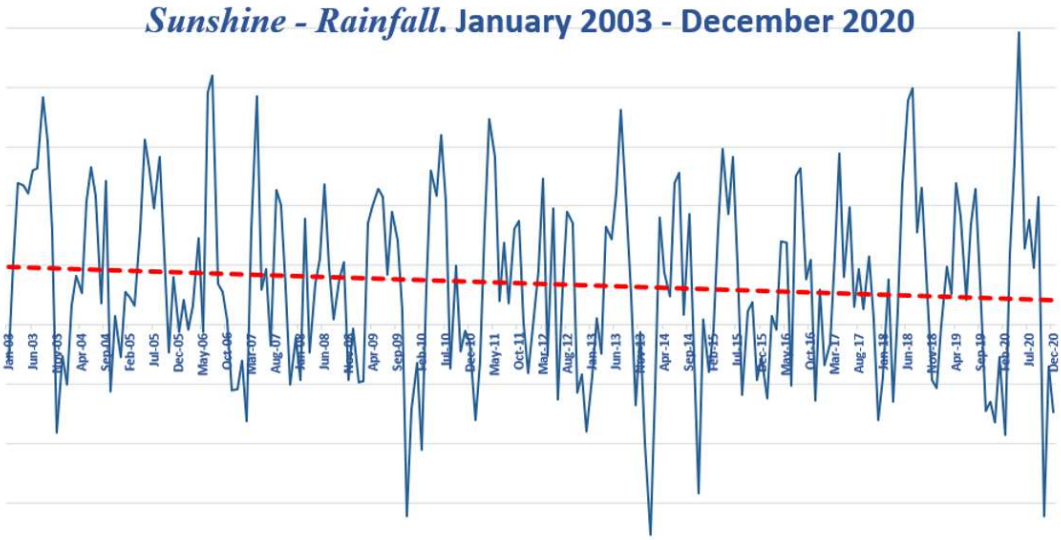
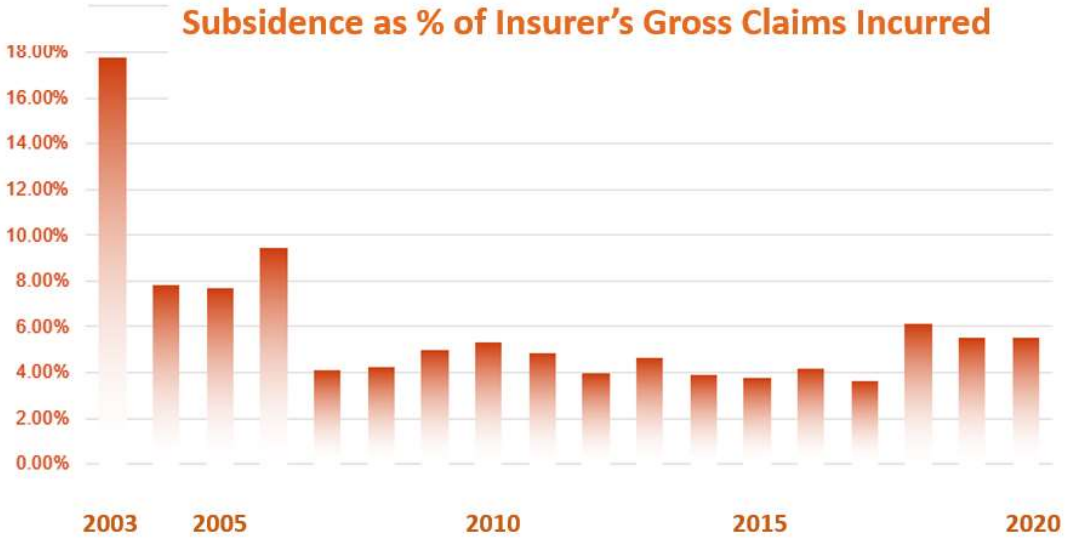
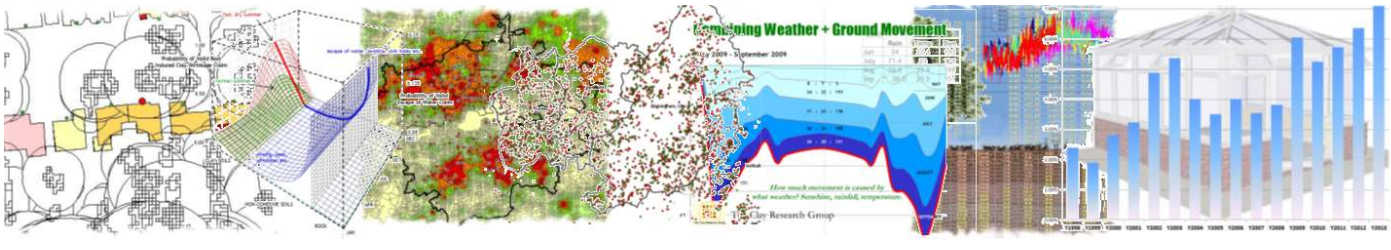
Graphs Illustrating an increase in rainfall and the falling cost and count of insurer's spend on domestic subsidence claims for the period January 2003 – December 2020







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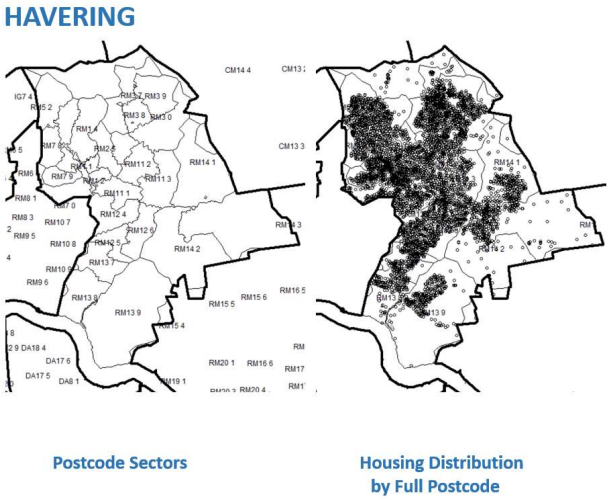
Subsidence Risk Analysis – HAVERING

Havering occupies an area of 112km^2 with a population of around 259,000. The district was originally covered in edition 149, October 2017 of the CRG newsletter. It is re-visited here to bring it in line with the current series and allow comparisons in terms of risk.



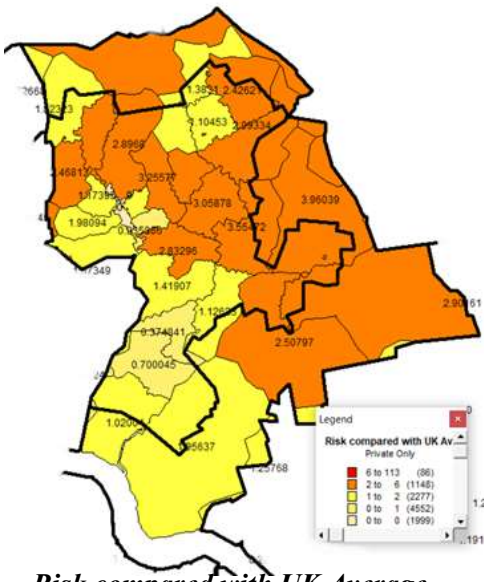
Distribution of housing stock using full postcode as a proxy. Each postcode in the UK covers on average 15 – 20 houses, although there are large variations.

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 because there are more houses?

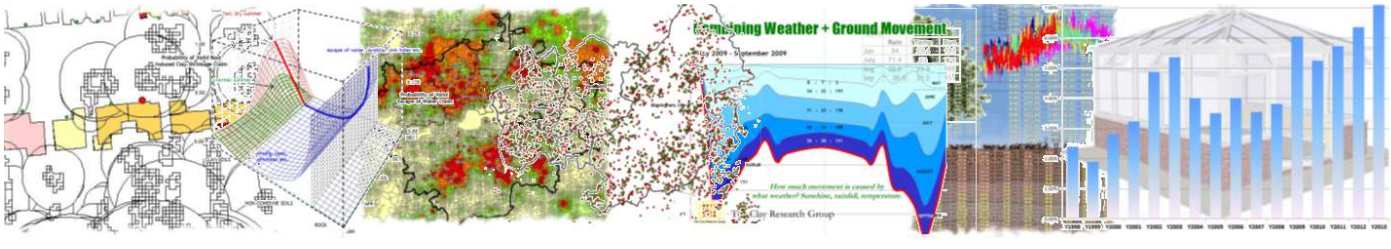
Using a frequency calculation (number of claims divided by private housing population) the relative risk across the borough at postcode sector level is revealed, rather than a 'claim count' value.

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

Across the borough, Havering is rated as medium risk and is 80th in the UK from the sample analysed, although the distribution across the borough varies considerably as can be seen from the sector map.



Risk compared with UK Average.
Havering is rated as medium risk for domestic subsidence claims from the sample analysed based on the high frequency to the north of the borough. Above, values at postcode sector level compared with UK average.



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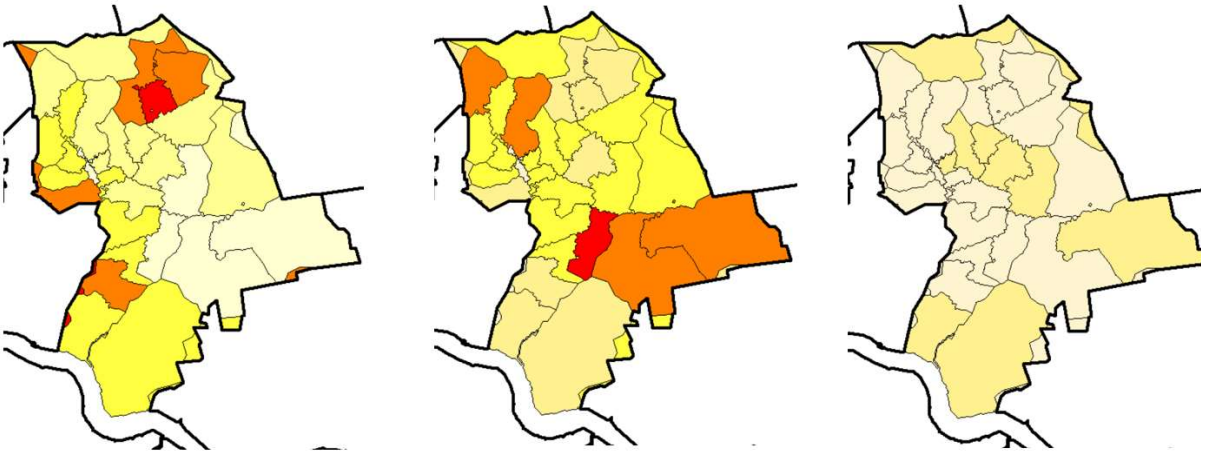
HAVERING - Properties by Style and Ownership

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 data on the proposal form allows insurers to assign a rating to individual properties.

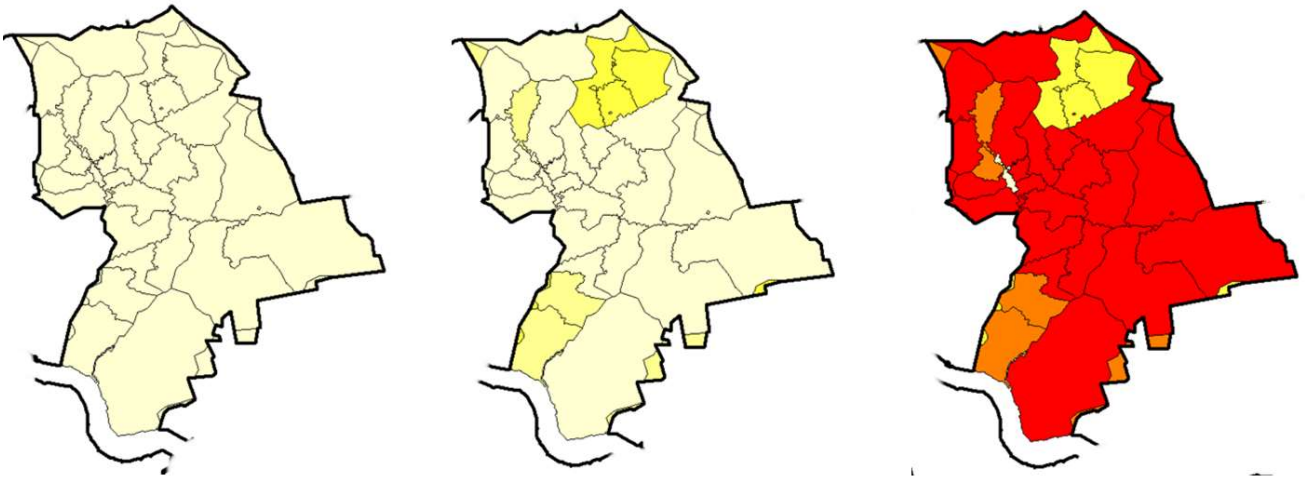
DISTRIBUTION BY HOUSE TYPE – HAVERING



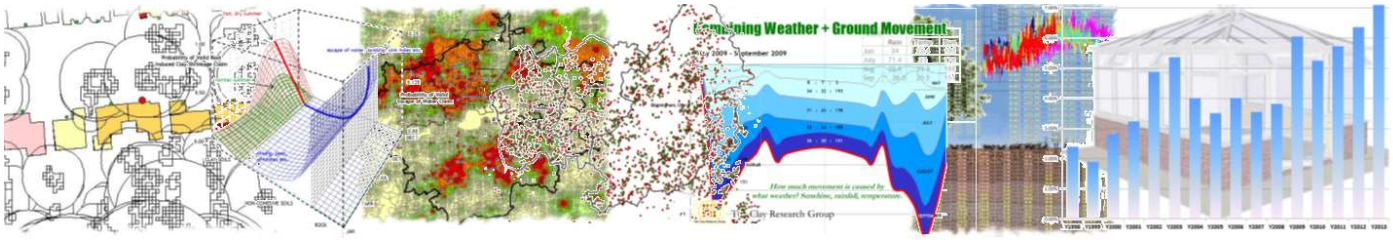
Terraced | Semi-Detached | Detached

Distribution by ownership is shown below. The maps reveal a high frequency of privately owned properties to the south, which will influence the outcome of the risk analysis.

DISTRIBUTION BY OWNERSHIP – HAVERING



Housing Association | Council Ownership | Private Ownership



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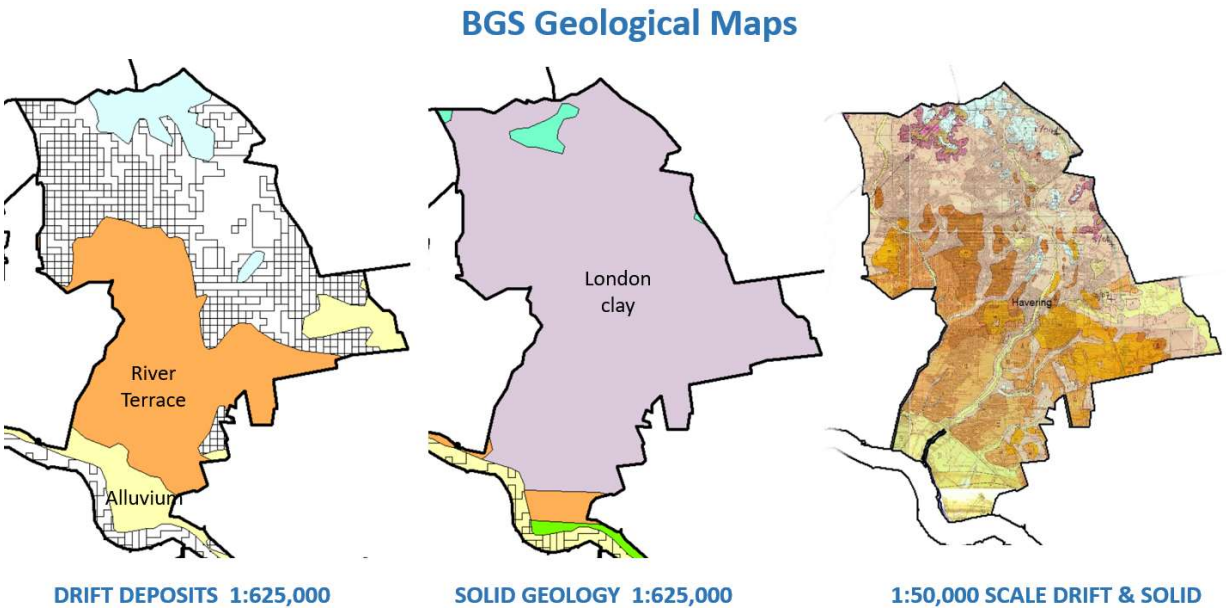
Subsidence Risk Analysis – HAVERING

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.

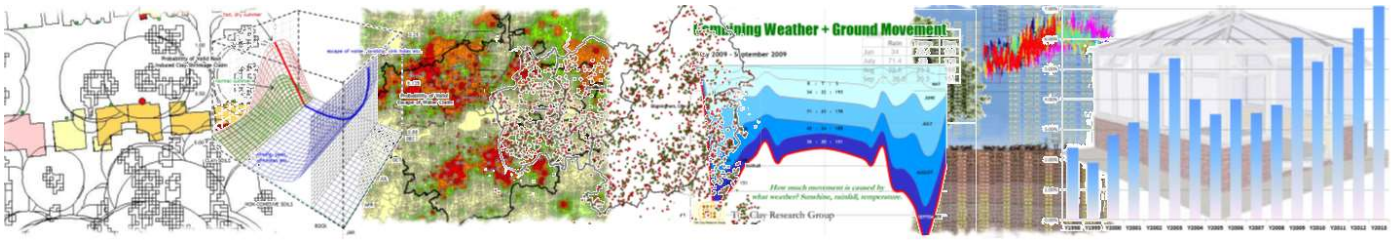
See page 10 for a seasonal analysis which reveals that in the summer there is around a 70% probability of a claim being valid, and of the valid claims, there is a high probability (greater than 80% in the sample) that the cause will be clay shrinkage.

In the winter the situation reverses. The likelihood of a claim being declined is around 70%.

The maps at the foot of Page 8 show the increase in claims in summer to north of the district and on Page 9, the concentration of Escape of Water claims to the south.



Above, comparing the level of definition between the 1:625,000 and 1:50,000 series extract from the British Geological Survey maps. Working at postcode sector and referring to the 1:50,000 series maps deliver far greater benefit when assessing risk.



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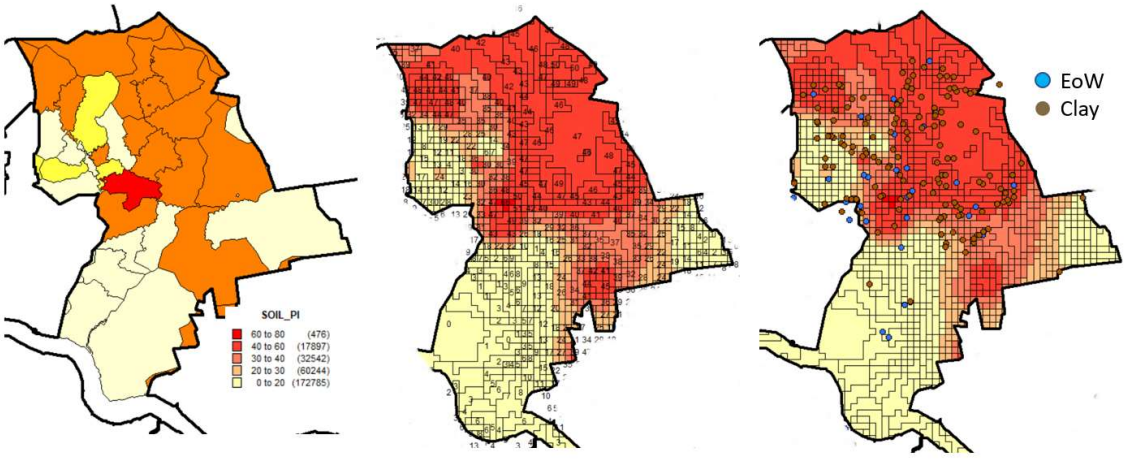
Liability by Geology and Season

Below, the average PI by postcode sector (left) derived from site investigations and interpolated to develop the CRG 250m grid (right). The presence of a shrinkable clay in the CRG model matches the BGS maps on the previous page with clay having an average PI of around 46% where it exists. The higher the PI values, the darker red the CRG grid.

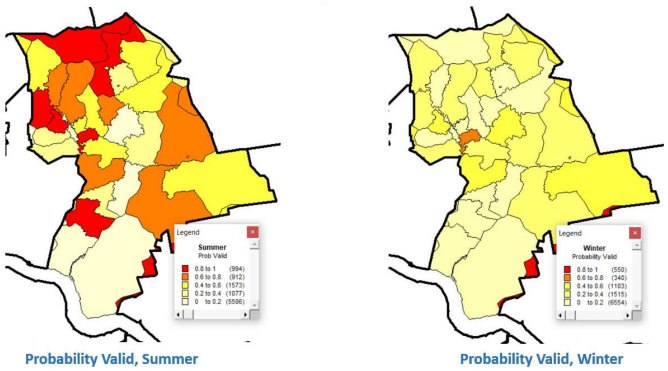
SOIL PLASTICITY INDEX – HAVERING



Soil PI Averaged by Sector | PI Interpolated on 250m CRG grid | Claims by Cause Relative to Grid

Zero values for PI in some sectors may reflect the absence of site investigation data - not necessarily the absence of shrinkable clay. The widespread influence of the shrinkable clay plays an important role in determining whether a claim is likely to be valid or declined by season. A single claim in an area with low population can raise the risk as a result of using frequency estimates.

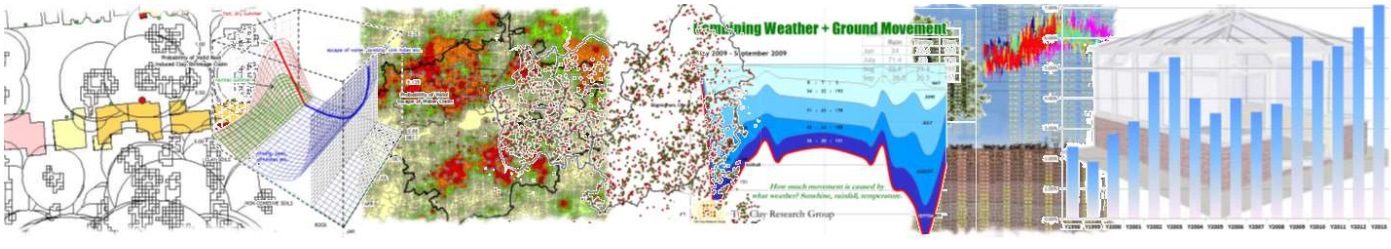
PROBABILITY VALID by SEASON - HAVERING



Probability Valid, Summer | Probability Valid, Winter

Mapping the risk by season (table at foot of page 10) is perhaps the most useful way of assessing the most likely cause, liability and geology using the values listed.

The maps left show the seasonal difference from the sample used. An enhanced version using a different approach is shown on the following page.



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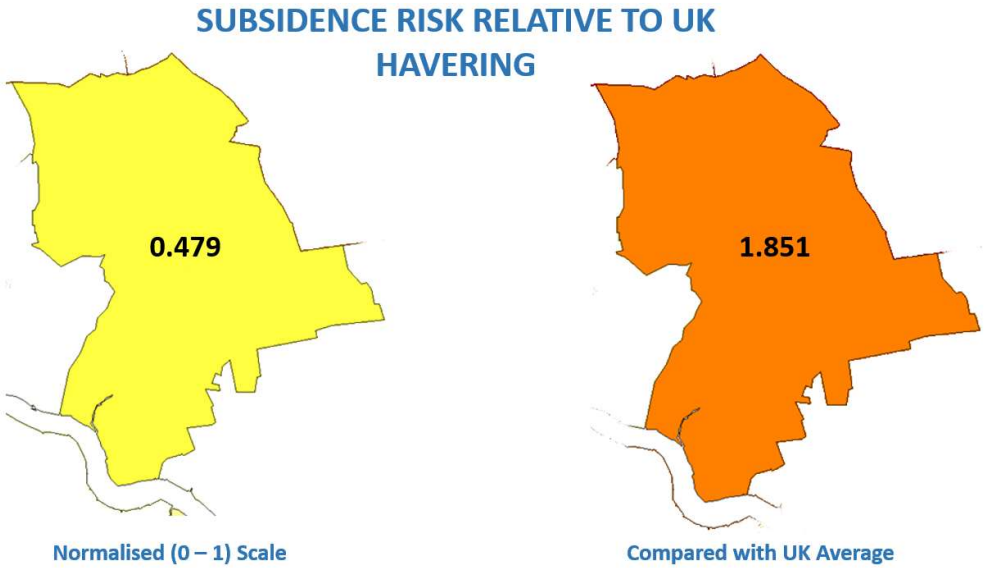
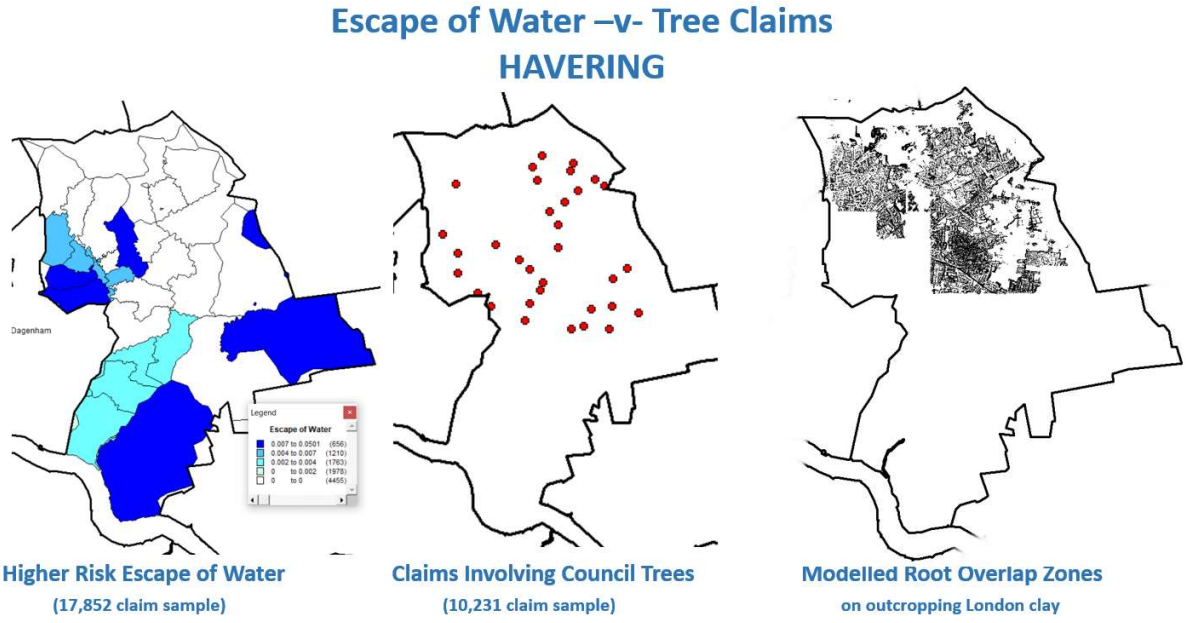
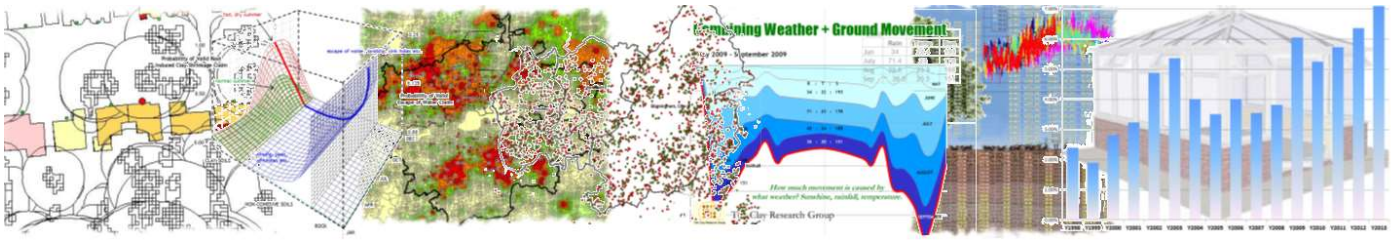
District Risk -v- UK Average. EoW and Council Tree Risk.



Below, left, mapping the frequency of escape of water claims from the sample reflects the presence of drift deposits (sands and gravels etc) to the south of the borough, bordering the Thames. The absence of shading does not indicate an absence of claims, but a low frequency. Below, centre, map plotting claims where damage has been attributable to vegetation in the ownership of the local authority from a sample of around 10,231 claims covering the UK. Right, a map showing the modelled root encroachment beneath domestic properties in Havering using a root radius = 1.2 x the tree height for both public and private trees.





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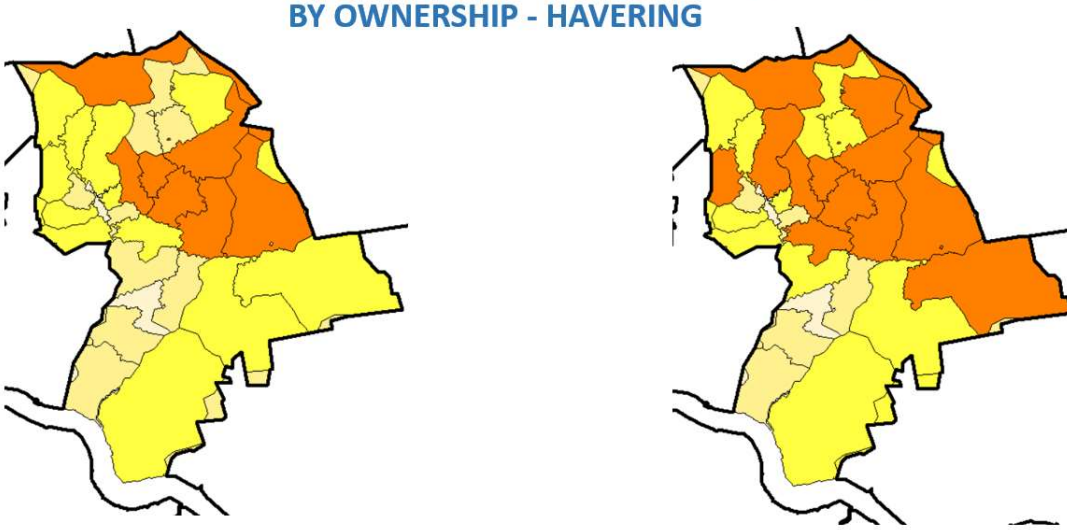
HAVERING - Frequencies & Probabilities

Mapping claims frequency against the total housing stock by ownership, (left council and housing association combined and right, private ownership only), reveals the importance of understanding properties at risk by portfolio. There are several sectors in the 'private only' map with an increased risk.

POSTCODE SECTOR SUBSIDENCE RISK (FREQUENCY) BY OWNERSHIP - HAVERING



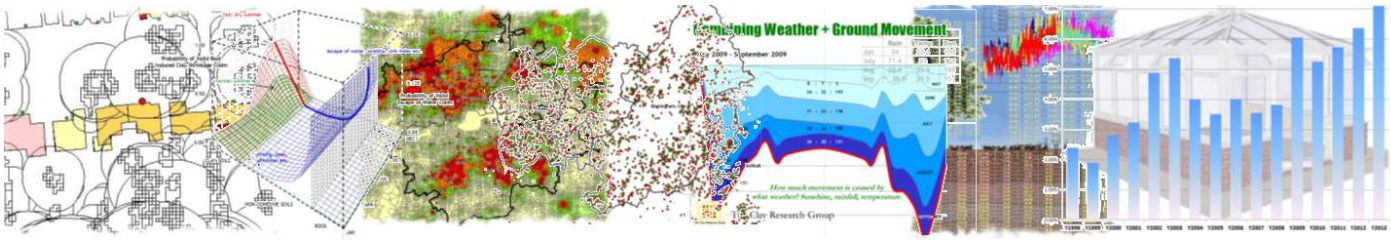
Combined Public and Private Frequency

Private Only

On a general note, the 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 just under 25%, and in the winter, it reaches around 70%. Valid claims in the summer are likely to be due to clay shrinkage, and in the winter, escape of water.

Liability by Season - HAVERING

District	valid summer clay	valid summer EoW	Repudiation Rate (summer)	valid winter clay	valid winter EoW	Repudiation Rate (winter)
Havering	0.642	0.124	0.234	0.05	0.26	0.69



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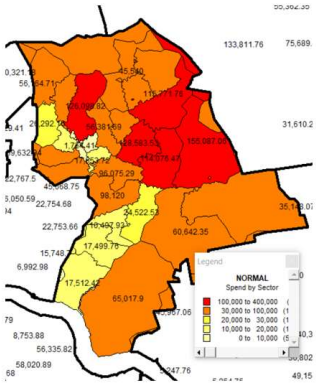
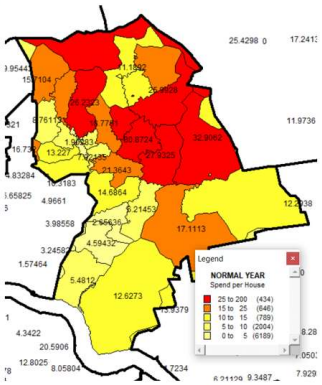
Subsidence Claim Spend by Postcode Sector and by Household in Surge & Normal Years

The maps below show the aggregated claim cost from the claim 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.

NORMAL YEAR SPEND – SAMPLE £200m
HAVERING



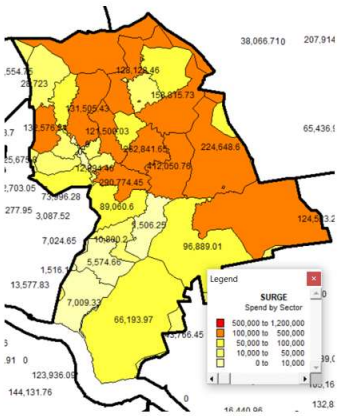
Spend by Sector



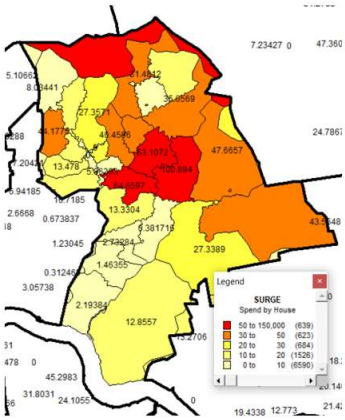
Spend Averaged over Housing Population

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 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.

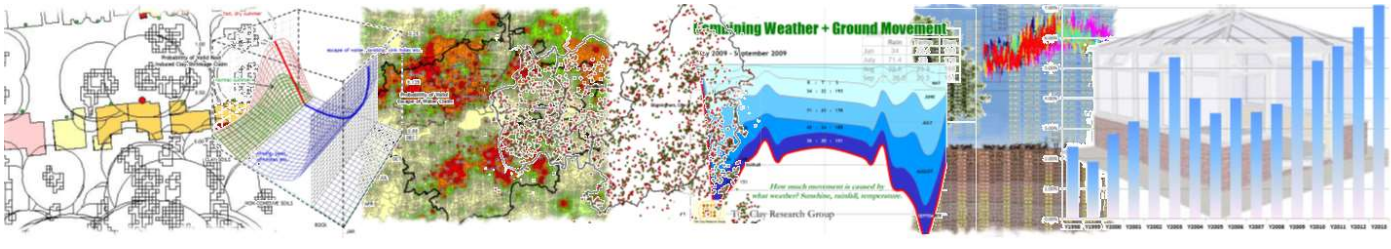
SPEND in SURGE – SAMPLE £419m
HAVERING



Spend by Sector



Spend Averaged over Housing Population



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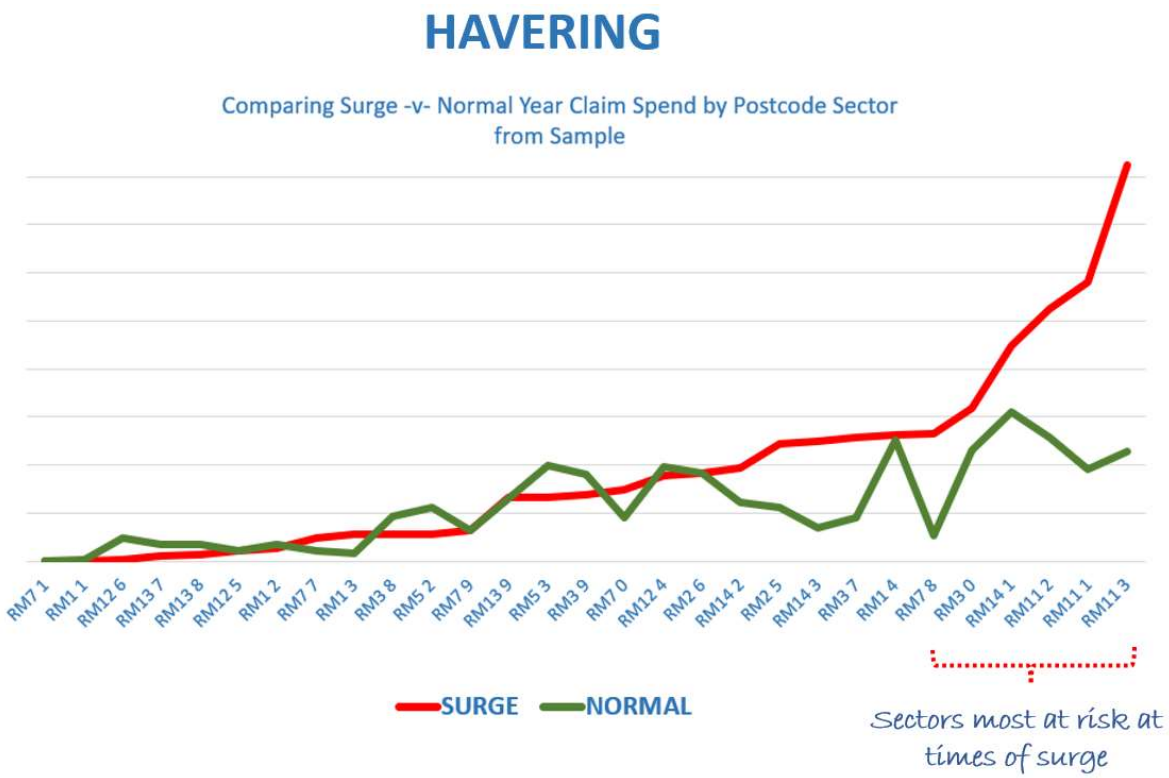

The above graph identifies the variable risk across the district at postcode sector level from the sample, distinguishing between normal and surge years. Divergence between the plots indicates those sectors most at risk at times of surge (red line).

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 is based on losses for surge of just over £400m, and for normal years, £200m.