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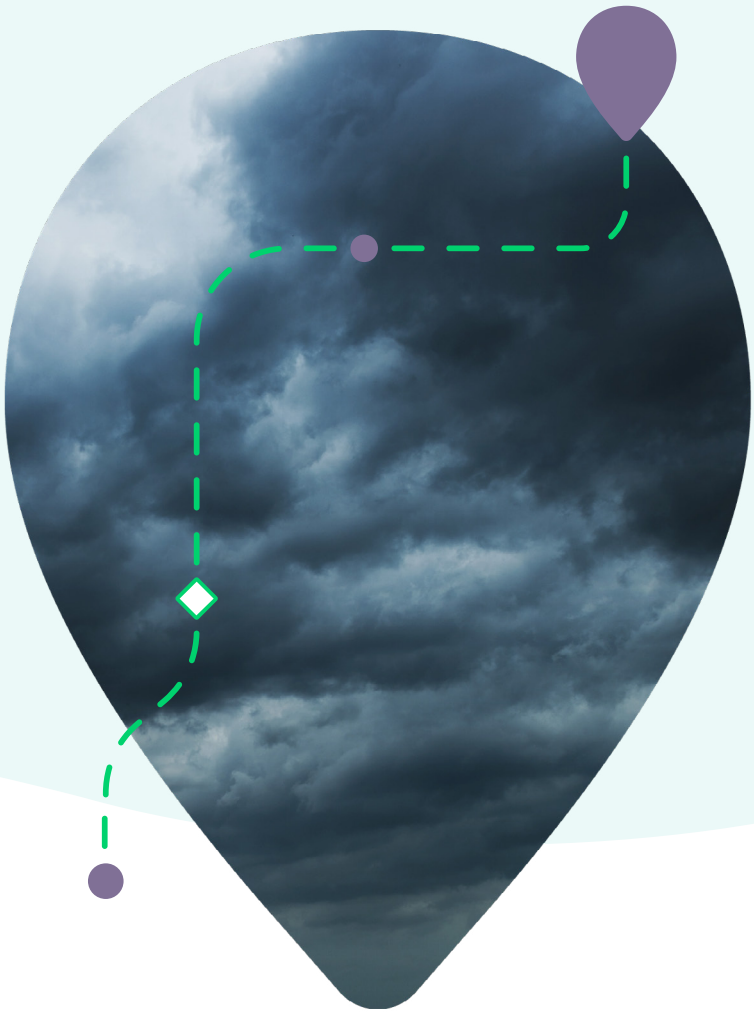


Our Climate Modelling Approach - A Guide for Legal Professionals

Introduction

The purpose of this paper is to summarise how climate models are put together and how we have used them to develop the ClimateIndex™ analysis tool.

Climate insights are included automatically as a standard feature of our key environmental searches for residential and commercial transactions. To us, they are a fundamental part of environmental due diligence, projecting to the future, rather than just examining current and past trends.

Some concern has been expressed that there has not been enough guidance on which climate modelling to use and this has dissuaded some law firms from developing a standardised climate advice approach to their clients.

In this paper, we want to guide legal professionals to an understanding of how our modelling is used to guide the ratings and outcomes for advice to clients. This can then provide confidence and assurance on the integrity of the approach so that clients are able to make long-term, sustainable land and property decisions.

What are Representative Concentration Pathways (RCPs)?

Our first stop in considering climate modelling is to understand the role of RCPs and how they determine the degree of impact that climate change could have on our society and infrastructure.

RCPs are socio-economic and emission scenarios that provide a set of pathways for how the future could evolve. They are not intended to provide forecasts predicting future outcomes.

Four 'pathways' were produced (and named) based on their radiative forcing level[1] target for the year 2100.

[1]Radiative forcing level is the change in energy balance in the earth's atmosphere;

What are Representative Concentration Pathways (RCPs)? *(continued)*

Climate scenario	Radiative forcing level target for the year 2100	High level description	Mean global temperature increase
RCP2.6	**2.6 W/m²**	Mitigation scenario	**1°C**
RCP4.5	**4.5 W/m²**	Medium stabilisation - radiative forcing stabilises shortly after 2100	**1.8°C**
RCP6.0	**6.0 W/m²**	Medium stabilisation - no adoption of climate policy	**2.2°C**
RCP8.5	**8.5 W/m²**	High greenhouse gas emission scenario	**3.7°C**

RCPs were introduced in the Intergovernmental Panel on Climate Change (IPCC)'s 5th assessment report[2] and was adopted in the UK as the Climate Projections 2018 (UKCP18).

Initial modelling at the highest resolution by the Met Office has been limited to providing a single climate scenario (RCP8.5), which constrained the development of environmental risk data, such as the British Geological Survey's (BGS) GeoClimate UKCP18 Premium.

However following the IPCC's 6th assessment report in 2021, new socioeconomic pathways were added to the modelling, such as impacts to the population and technology developments. This helped to inform policies and approaches to climate action at governmental level.

[2]https://www.ipcc.ch/assessment-report/ar5/

What climate scenarios are being used in the property market?

So, given the background to the development of RCP models, how have they been initially deployed in the property market by financial institutions and data providers that have run analysis in support?

We have reviewed some of the key organisations to consider their use of RCPs and/or other climate scenarios. These findings are summarised in the following table.

Organisation	Document	Scenario used					Notes
		RCP2.6	RCP4.5	RCP6	RCP8.5	Other	
Lending							
Bank of England	Climate Biennial Exploratory Scenario (CBES), May 2022	☐	☐	☐	☐	☑	The report advised that an 'exercise considered two possible routes to net-zero UK greenhouse gas emissions by 2050: an 'Early Action' (EA) scenario and a 'Late Action' (LA) scenario. A third 'No Additional Action' (NAA) scenariowexplores the physical risks that would begin to materialise if governments around the world fail to enact policy responses to global warming.
	Guidance for participants of the 2021 Biennial Exploratory Scenario: Financial risks from climate change						It was noted that the 'comparison of UKCP data with the CBES climate scenarios concluded that the Early and Late Action scenarios overlap with the global mean temperature range of the RCP 2.6 in UKCP and the No Additional Action scenario overlaps with UKCP's global mean temperature range of the RCP 6.0 emissions scenario.'

Organisation	Document	Scenario used					Notes
		RCP2.6	RCP4.5	RCP6	RCP8.5	Other	
Santander	Climate Finance Report 2022	☐	☐	☐	☐	☑	The report advised that an 'exercise considered two possible routes to net-zero UK greenhouse gas emissions by 2050: an 'Early Action' (EA) scenario and a 'Late Action' (LA) scenario. A third 'No Additional Action' (NAA) scenario explores the physical risks that would begin to materialise if governments around the world fail to enact policy responses to global warming.
							In lieu of advice from the European Banking Authority, Santander also considered RCP4.5 'to serve as a middle ground between the scenario that achieves the Paris Agreement target (RCP 2.6) and a scenario more typical of stress exercise (RCP 8.5).'
Barclays	Barclays PLC Environmental Social Governance Report 2019	☑	☐	☐	☐	☐	This document indicated the approach Group-wide Exploratory Climate Stress Test 2019, aligned 'most closely to the RCP2.6 pathway'
Natwest	Climate Related Disclosure Report 2022	☐	☐	☐	☐	☑	The report stated that 'impacts of physical risk were explored through the No Additional Action scenario
	2023 Climate-related Disclosures Report	☐	☐	☐	☐	☑	Scenario considered when modelling physical climate risk in 2023 as part of the their ICAAP[3] were 'Internally developed NGFS based Disruptive Policy scenario'
HSBC	Taskforce on Climate-Related Financial Disclosure (TCFD) Annual Report 2022	☐	☐	☐	☐	☑	Physical risks tracked using 'Paris Aligned Indices' developed with a third party.

[3]ICAAP - Internal Capital Adequacy Assessment Process

Organisation	Document	Scenario used					Notes
		RCP2.6	RCP4.5	RCP6	RCP8.5	Other	
Example Data Providers							
Met Office	Climate Finance Report 2022	✔	✔	✔	✔		All RCPs available for probabilistic and probabilistic of extremes projections at 25km. Local projections at 2.2km only available for RCP8.5.
Environment Agency	Climate impacts tool: guidance for Environment Agency staff	✔					No relevant national datasets are currently available. However, a methodology has been produced to expect planners and developers to make appropriate allowances for climate change in, for example flood risk assessments. For some higher risk decision, the Environment Agency 'may consider more precautionary climate projections (for example, RCP8.5, H++, High Impact Scenarios), to help assess the sensitivity of decisions to different climate projections or models.' The climate impacts screening tool uses a 'precautionary approach' and provides advice for use of the SSPs.
British Geological Survey	GeoClimate UKCP18 Premium				✔		Geoclimate UKCP18 Premium is limited by the data that has been produced by the Met Office climate data (UKCP18 Local 2.2 km projections).
Twinn/Ambiental	https://www.ambientalrisk.com/	✔	✔	✔	✔		Flood data available for all RCPs.

Organisation	Document	Scenario used					Notes
		RCP2.6	RCP4.5	RCP6	RCP8.5	Other	
Policy/guidance							
Law Society	The impact of climate change on solicitors dated April 2023	☐	☐	☐	☐	☐	Climate scenarios are not referred to within this document. Although there is active consideration of them in property-sector specific guidance which is in development.
HM Government/ Defra	A Green Future: Our 25 Year Plan to Improve the Environment	☐	☐	☐	☐	☐	Indicated that there was an intention to 'take account of new scientific knowledge and explore future scenarios and policy options'.
HM Government	Environmental Improvement Plan 2023	☐	☐	☐	☐	✔	The delivery plan stated with respect to building resilience by adapting to climate change, need to consider evidence that 'we must be prepared for warming up to 4°C.'
Kendon et al	State of the UK Climate 2022	✔	✔	✔	✔	☐	The report advised that 'RCPs are broadly comparable with SSPs for temperature response (i.e. RCP 4.5 is broadly comparable with SSP2-4.5) although there are some differences in the details including the greenhouse gas mix.'

The table shows a clear range of preference for climate scenarios, but the choice varies based on the purpose and requirements of the assessment. A survey of financial firms undertaken by the Global Association of Risk Professionals (GARP) published in 2022[4] also found that for physical risks, the most widely used are the IPCC's Representative Concentration Pathway (RCP8.5) leading to a 'hot-house world and disorderly scenarios.' Transition risks had more variation, including some degree of 'orderly scenarios.'

However, what does this do in terms of impact to property and infrastructure? A more extreme, worst case scenario is likely to impact more communities and assets and risk future blight that could impact valuations on longer-term mortgages now.

[4] https://www.garp.org/risk-intelligence/sustainability-climate/climate-scenario-analysis-121222

Sensitivity analysis of climate scenarios - Flooding case study

To illustrate this point, we analysed properties that we have reported on using the ClimateIndex™ rating in the first half of 2023. This indicated the percentage of properties across Great Britain with elevated fluvial (river-based) flood risk in 30 years as follows:

- **RCP2.6 - 4.27%**
- **RCP4.5 - 4.70%**
- **RCP8.5 - 5.06%**

If this analysis was extrapolated out across all properties in Great Britain, it would indicate that approximately 168,000 additional properties to be impacted by fluvial flood risk between the RCP2.6 and RCP4.5, then a further 137,000 in the RCP8.5 scenario.

Whilst the variance is fairly small, each of these properties represents a future potential issue with valuation, lending or insurance cover - each of which could seriously impact re-sale of the property or limit it to cash purchasers willing to take the risk, under advice.

It is therefore essential that we can apply national modelling standards to mapping and local conditions to ensure that we can deliver a property-specific risk assessment with climate prediction.

As **topography** is a key driver of the flood risk at property, in many cases different climate scenarios do not significantly impact the overall flood risk. If a property is significantly above the floodplain, it won't be at risk of river flooding in **any** climate scenario.

However, the example below, set in a fairly flat area, such as a broad flood plain, shows a case where the extent of the flood risk can change fairly significantly as we work through each RCP scenario.

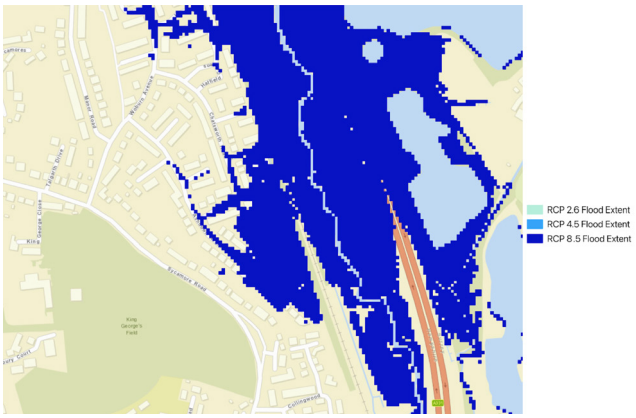
Sensitivity analysis of climate scenarios - Flooding case study *(continued)*

However, the example below, set in a fairly flat area, such as a broad flood plain, shows a case where the extent of the flood risk can change fairly significantly as we work through each RCP scenario.

RCP2.6 Flood Extent

RCP4.5 Flood Extent

RCP8.5 Flood Extent



A tipping point is reached as climatic conditions worsen between RCP4.5 and RCP8.5, which causes additional properties to be vulnerable to elevated flood risk.

RCPs & Property-Specific Assessment: Sensitivity Analysis

So it is clear that the choice of RCP could have a significant variance on an individual property based on its own unique circumstances. This is why one of the first key decisions we took when we designed the ClimateIndex™ modelling approach, was the need to apply sensitivity analysis in order to account for highly localised conditions. Applying a national model with broad-brush rules wouldn't be suitable.

Climate change is forecast to worsen across all modelled RCPs, and our approach provides a higher weight to risk that modelled to present even in best case conditions.

Firstly, we need to be clear about what each of these RCPs mean to property - RCP8.5 is the worst case scenario, requiring greenhouse gases emissions to roughly double by 2050. Our judgement is that, based on current trends and proposed implementation of policies to reduce emissions, this is less likely and so is given the lowest weighting.

The weighted scoring therefore increases based on RCP6.0 and RCP4.5 and then further in RCP2.6 climate scenarios. We apply the greatest weighting to RCP2.6 as we believe that if a property becomes at risk due changes to the climate in this scenario, those risks are most likely to impact the property in the future.

Climate change is forecast to worsen across all modelled RCPs, and our approach provides a higher weight to risk that modelled to present even in best case conditions.

We also need to be able to adapt as conditions and available data dictate. climate projections are dynamic and based on changing trends and therefore taking a balanced and blended approach and adapting to local circumstances across the different risk types provides, we believe, the best strategy.

For example, only RCP8.5 data is currently available for subsidence from the BGS using UKCP18, and therefore we can consider this in the context of the worst case scenario only. If new data for existing and/or different climate scenarios becomes available, this can be easily implemented within ClimateIndex™.

Whilst coastal erosion is expected to be exacerbated by climate change through increased storms and sea level rise, the existing data offering from the Environment Agency does not consider different scenarios. Our pragmatic approach has been to use the likelihoods given, and have been used as a proxy for different climate scenarios.

Our Climate Model

The ClimateIndex™ analysis module is designed to provide environmental due diligence advice on how climate change might change the likelihood and/or severity of physical environmental risk to a property. It helps fulfil the legal obligations for conveyancers for the consideration of climate change risks and provide banks and their valuation networks with potential indicators of future value risk.

Data is used to provide a baseline assessment, before providing a view on how they might change in the future (i.e. a climate signal). This is driven by the weighted sensitivity analysis, as described in the previous section.

The analysis is provided in 5 and 30 year time horizons, which comply with banking industry taxonomy, meets Bank of England/PRA reporting requirements and fulfils the duration of most mortgages and also typical maximum lifetime of property ownership.

How we account for different RCP scenarios

Groundsure's blended consideration of multiple climate scenarios		
Climate scenario	Relative likelihood of risk manifestation	Relative weighting if elevated risk modelled
RCP2.6	Most likely	Highest
RCP4.5	↑	↑
RCP8.5	Least likely	Lowest
Generally the consideration of all climate change scenarios produces incrementally worse conditions in the UK for flooding, subsidence and coastal erosion. If elevated risk is modelled to impact a property in the highest emissions scenario (RCP 8.5) only, then our concept considers it to be less likely than if risk was modelled in other scenarios. Therefore if elevated risk to a property is modelled based on conditions in a RCP2.6 (and inherently also RCP4.5 and RCP8.5), we consider that to be most likely to manifest. However, if elevated risks are only modelled in RCP8.5, there is a reduced likelihood of manifestation. As the worst case scenario is still considered, we can still consider outlier cases where risk tipping points can occur without blighted too many properties.		

Advising Clients on Climate Risk using modelled data

Environmental searches enable assessments on complex matters to be undertaken at a cost that can be considered on all property transactions. They provide a framework to highlight risk factors and enable them to seek further specialist advice only when required.

The Legal Opinion[5] by Stephen Tromans KC discusses how licensed conveyancers and real estate lawyers owe a duty of care to warn and advise their clients about risks that may adversely affect the property being purchased and includes climate change risks.

We empowered the fulfilment of this duty by integrating an assessment within our core report offering.

Following release of the Law Society Guidance on Climate Risks[6] in March 2023, concern was subsequently expressed by some real estate and knowledge lawyers about the lack of clarity around RCPs and which scenario should be used. A response to this is anticipated in the sector-specific guidance that The Law Society and its representative committee.

However, given the inherent limitations of forecasted data, it is our judgement that a blend of weighted RCP models is the most pragmatic and appropriate approach and that sticking to one RCP scenario is flawed.

Explaining The ClimateIndex™ rating

When discussing the basis for the RCP modelling in the ClimateIndex™ rating with a client, it is important to advise that:

- A range of RCP scenarios exist (and vary by best available dataset)
- There is not one single scenario that can be chosen at a local level and be treated as THE scenario
- The ClimateIndex™ model applies a weighting to each scenario and then considers the local conditions - e.g. topography for flood risk and adapts the outcome accordingly.
- The ClimateIndex™ rating from A to F is the weighted outcome of each of the physical risks, based on the RCP assumption for that data set.

[5] https://www.groundsure.com/stephen-tromans-legal-opinion/

[6] https://www.groundsure.com/law-society-climate-guidance-guide/

Trust and confidence in Climate Risk Analysis

We have assessed environmental risks to property for many years and our in-house expertise has enabled us to provide a view that balances different risks depending on their impact to a property transaction. In cases where climate change risks have been assessed, advice on what to do is also integrated. Consultancy support is also available to customers with any queries about our reports.

We have delivered nearly 700,000 property transactions with climate risk analysis since the launch of ClimateIndex™. Conveyancers and real estate lawyers have found it easy to use and to explain the ratings to clients as an indicator of future physical risk and any potential impacts on the transaction.

Summary

Properties can be impacted by an array of physical environmental risks, and these can lead to significant liabilities, the most extreme of which is a total value loss from coastal erosion. There are also potential impacts to lending and insurance availability. But it is also important to stress that the vast majority of properties will escape the worst that the climate can throw at them and have a comparatively low risk.

Conveyancers and commercial real estate lawyers are not climate scientists and they need to have the trust and confidence in a data and analytics provider that has applied a pragmatic, balanced approach to climate risk for their environmental due diligence.

They should also recognise that data and modelling changes over time as better science, trend data and analytics tools allow. As shown in the table on page 3, the Environment Agency (EA) is not currently providing any climate risk data for flooding across England. Whilst the EA do plan the publish flood risk data for national climate change scenarios for the first time by the end of 2024[7], decisions must be made on property transactions irrespective of this update. It is inevitable that the perception of risk at many properties could change overnight, in the same way that occurred when the revised radon map was published by the BGS.

[7] https://www.gov.uk/guidance/updates-to-national-flood-and-coastal-erosion-risk-information#:~:text=The%20Environment%20Agency%20plans,for%20the%20first%20time

Summary *(Continued)*

This will be an evolving picture and it is important that a climate modelling provider has a flexible position on future RCPs and is not prescriptive on a specific scenario.

We have demonstrated how our ClimateIndex™ model works and how a blended and weighted approach using a range of RCP scenarios based on the best available data is a sensible methodology.

We await further sector-specific guidance from The Law Society in due course, but it is important that hesitant firms ensure their duty of care and duty to warn and engage now with ClimateIndex™ as this is already automatically part of their environmental due diligence tool kit.

Training and Support

If you would like to arrange in-house or virtual training for your conveyancing or commercial real estate teams on climate risks, the Law Society Guidance, use of ClimateIndex™ risk ratings and standard clauses to communicate to clients, then we are here to help.

Email us on **info@groundsure.com** or call **01273 257755**.

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Groundsure is a leading UK environmental and climate data authority. We give land and property professionals expert information on risks including land contamination, flooding and ground stability, as well as forward guidance on potential climate risks, to advise their clients in the transaction. We provide high value, property-specific opinions and analysis of land use, turning data into practical, actionable insight.

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