Climate
Change
Committee

Integrated modelling needs for climate change risk assessment

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Climate Change Committee

Our changing climate

Observed and projected changes in UK hazards due to climate change

	Observed change	Expected change by mid-century	Global warming of 2°C above preindustrial levels by 2100	Global warming of 4°C above preindustrial levels by 2100
Average annual UK temperatures	**0.6°C** from 1981 - 2000	**~1.3°C** from 1981 - 2000	**~1.5°C** from 1981 - 2000	**~3°C** from 1981 – 2000
Hot summer occurrence – '2018 summer'	**10 – 25%** chance each year	**~50%** chance each year	**~50%** chance each year	**>>50%** chance each year
Average summer rainfall	**0** no significant long-term trend	**~10%** drier than over 1981 - 2000	**~15%** drier than over 1981 - 2000	**~30%** drier than over 1981 - 2000
Average winter rainfall	**0** no significant long-term trend	**~5%** wetter than over 1981 - 2000	**~5%** wetter than over 1981 - 2000	**~20%** wetter than over 1981 - 2000
Heavy rainfall	**0** some increase, but not significant long-term trend	**~10%** increase	**~20%** increase	**~50%** increase
Sea level rise	**~6.5cm** above 1981 – 2000	**10 – 30cm** above 1981 – 2000	**25 – 45cm** above 1981 – 2000	**55 – 80cm** above 1981 – 2000

Source
UKCP18 projections

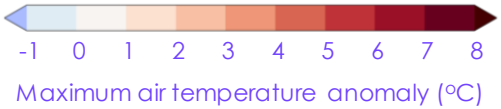
Our changing climate

Change in maximum summer air temperature from 1981-2000 baseline

Present Day

2°C scenario, 2050s

4°C scenario, 2080s

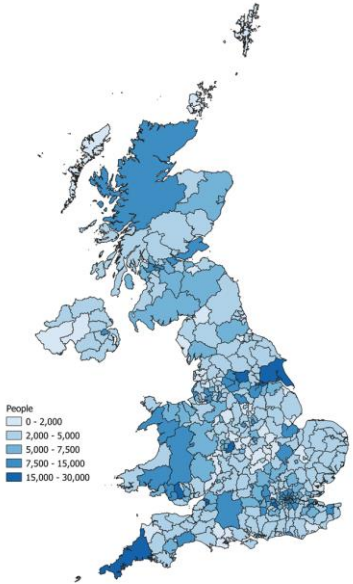


Source

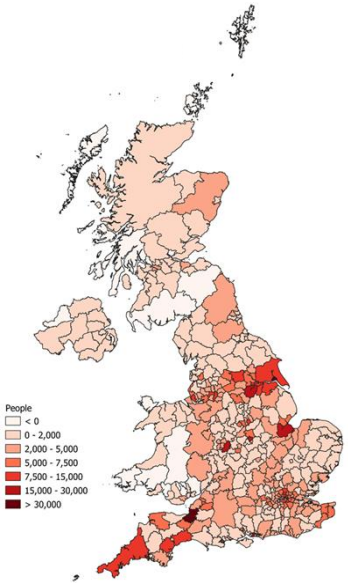
UKCP18 projections

Our changing climate

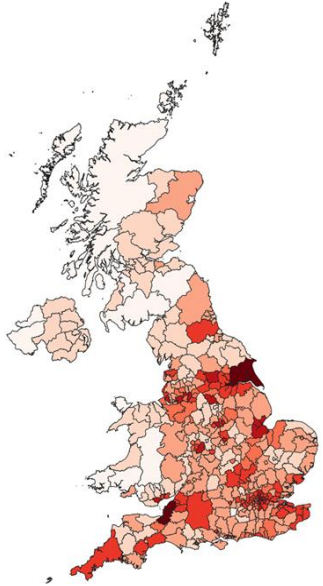
Change in number of people at flood risk from present day



Present Day



2°C scenario, 2050s

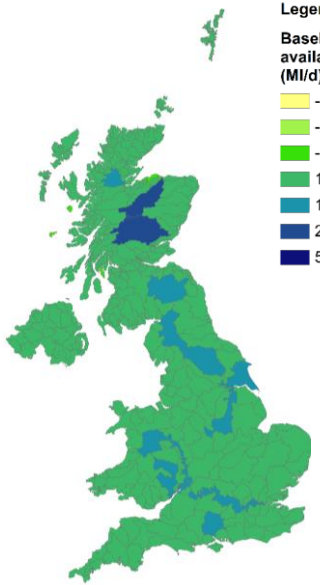


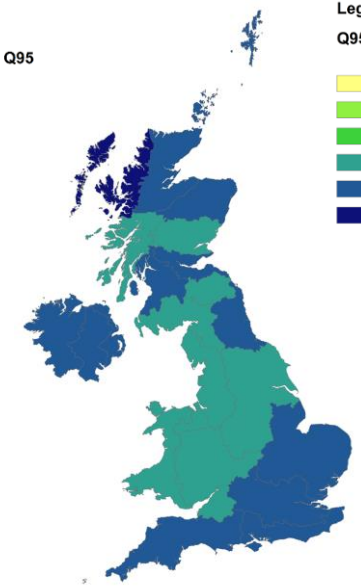
4°C scenario, 2080s

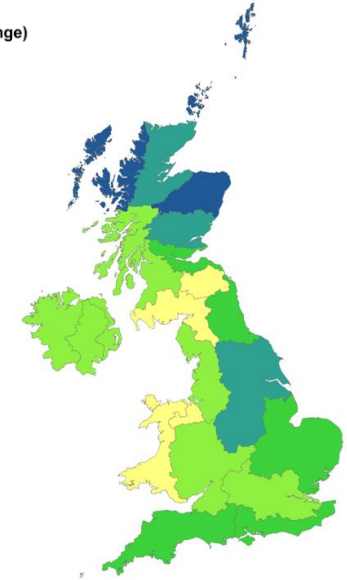
Source

Sayers et al. 2020

Our changing climate
Projections of future water availability







Present Day

2°C scenario, 2050s

4°C scenario, 2080s

Source
HR Wallingford 2020

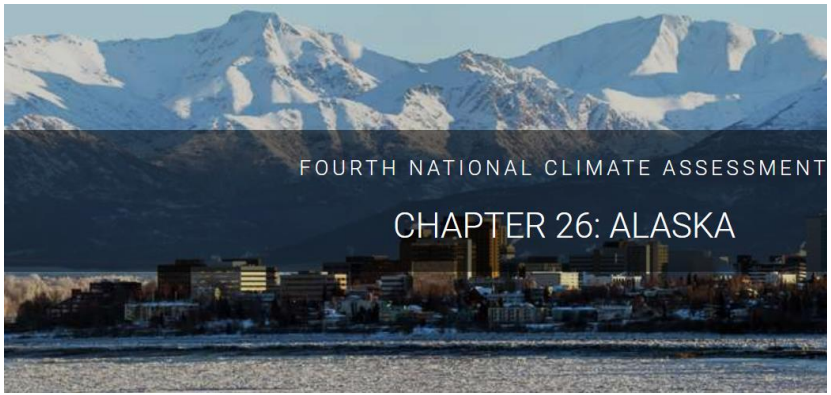
Issue 1: UK climate change risk assessments – sectoral or spatial?

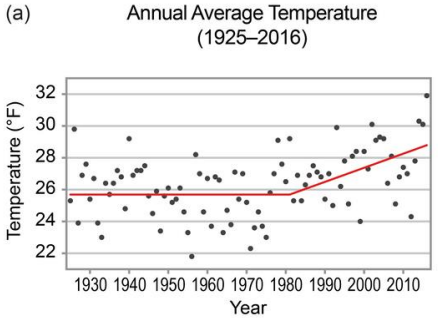
Spatial assessments cost more – so to date we have taken a sectoral approach in the UK

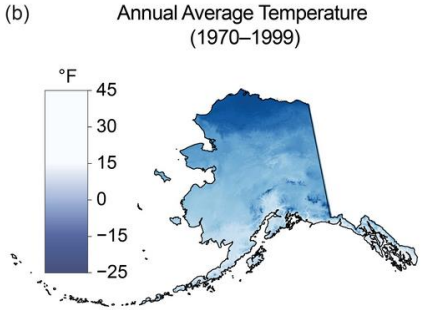
N1 Risks to terrestrial species and habitats	**N2** Risks to terrestrial species annd habitats from pests, pathogens and INNS	**N4** Risk to soils from changing conditions, including seasonal aridity and wetness	**N5** Risks to natural carbon stores and sequestration from changing conditions	**N6** Risks to and opportunities for agricultural and forestry productivity	**N7** Risks to agriculture from pests, pathogens and INNS	**N8** Risks to forestry from pests, pathogens and INNS	**N11** Risks to freshwater species and habitats
N12 Risks to freshwater species and habitats from pests, pathogens and INNS	**N14** Risks to marine species, habitats and fisheries	**N16** Risks to marine species and habitats from pests, pathogens and INNS	**N17** Risks and opportunities to coastal species and habitats	**I1** Risks to infrastructure networks from cascading failures	**I2** Risks to infrastructure services from river and surface water flooding	**I5** Risks to transport networks from slope and embankment failure	**I8** Risks to public water supplies from reduced water availability
I12 Risks to transport from high and low temperatures, high winds, lightning	**H1** Risks to health and wellbeing from high temperatures	**H3** Risks to people, communities and buildings from flooding	**H4** Risks to people, communities and buildings from sea level rise	**H6** Risks and opportunities from summer and winter household energy demand	**H8** Risks to health from vector-borne diseases	**H11** Risks to cultural heritage	**H12** Risks to health and social care delivery
H13 Risks to education and prison services	**B1** Risks to business sites from flooding	**B2** Risks to business locations and infrastructure from coastal change	**B6** Risks to business from disruption to supply chains and distribution networks	**ID1** Risks to UK food availability, safety, and quality from climate change overseas	**ID5** Risks to international law and governance from climate change overseas that will impact the UK	**ID4** Risks to the UK from international violent conflict resulting from climate change	**ID9** Risk to UK public health from climate change overseas
ID7 Risks from climate change on international trade routes	**ID10** Risk multiplication from the interactions and cascades of named risks across systems and geographies	**N3** Opportunities from new species colonisations in terrestrial habitats	**N9** Opportunities for agricultural and forestry productivity from new species	**N10** Risks to aquifers and agricultural land from sea level rise, saltwater intrusion	**N15** Opportunities for marine species, habitats and fisheries	**N18** Risks and opportunities from climate change to landscape character	**I3** Risks to infrastructure services from coastal flooding and erosion
I4 Risks to bridges and pipelines from flooding and erosion	**I6** Risks to hydroelectric generation from low or high river flows	**I7** Risks to subterranean and surface infrastructure from subsidence	**I9** Risks to energy generation from reduced water availability	**I10** Risks to energy from high and low temperatures, high winds, lightning	**I13** Risks to digital from high and low temperatures, high winds, lightning	**H2** Opportunities for health and wellbeing from higher temperatures	**H5** Risks to building fabric
H7 Risks to health and wellbeing from changes in air quality	**H9** Risks to food safety and food security	**H10** Risks to health from poor water quality and household water supply interruptions	**B3** Risks to businesses from water scarcity	**B5** Risks to business from reduced employee productivity – infrastructure disruption and higher temperatures	**B7** Opportunities for business - changing demand for goods and services	**N13** Opportunities to marine species, habitats and fisheries (SCA)	**I11** Risks to offshore infrastructure from storms and high waves (SCA)
B4 Risks to finance, investment, insurance, access to capital (SCA)	**ID8** Risk to the UK finance sector from climate change overseas (SCA)	**ID2** Opportunities for UK food availability and exports (WB)	**ID3** Risks to the UK from climate-related international human mobility (WB)	**ID6** Opportunities (including arctic ice melt) on international trade routes (WB)			

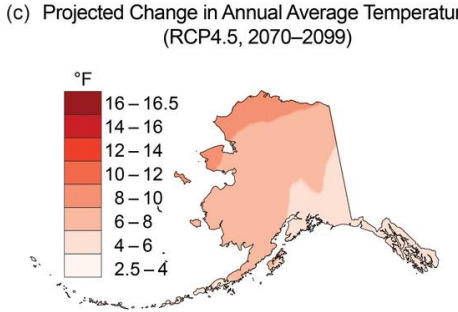
Other national assessments take a spatial approach

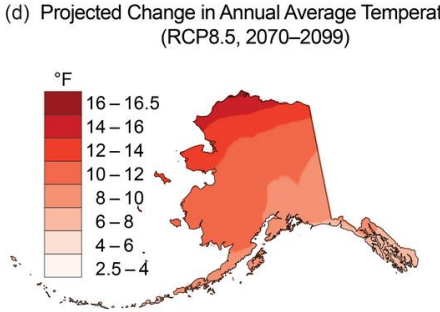
US National assessment looks at BOTH sectors and regions











https://nca2018.globalchange.gov/

Issue 2: Inconsistent underlying evidence

The CCRA uses a method designed to cope with inconsistent evidence – but consistent assumptions on climate and socioeconomics would be better!

Supported by capacity building

Source

Urgency Scoring Framework. Updated from CCRA2 (Warren et al., 2016).

Issue 3: 'Stop-start' nature of risk assessments

CCC Letter to all Research Council Chief Execs, 2016:

"The review conducted has identified very significant gaps in scientific understanding of climate risks to the UK that are not being addressed by the research community. In many instances the evidence required for the CCRA would best be delivered by a more coordinated approach to modelling climate risks at a national scale".

Data requirements for CCRAs
Basis so far, and gaps

- CCRA2 and CCRA3 were assembled through existing literature with a small amount of new modelling, tendered out to consultants (CCRA water and flooding projections)
- Model and method IP was owned by the consultants; results IP was owned by the CCC
- In order to move away from this, model frameworks need to be open source and simple enough for non-technical civil servants to access and generate results
- This could be achieved through a user interface (as is the case for UKCP18) or through generating a large number of pre-run outputs using different assumptions, agreed with the customer in advance. The former is likely to be better than the latter.

- **Can DAFNI help to bridge this divide?**
  - Ability to search and run outputs for sectors vs geographies; different timeframes; aggregation of multiple risks?
  - An accessible user interface (i.e. one that is usable to someone with no model or GIS background)?
  - Using metrics that match up with policy-relevant datasets that are already in use?

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