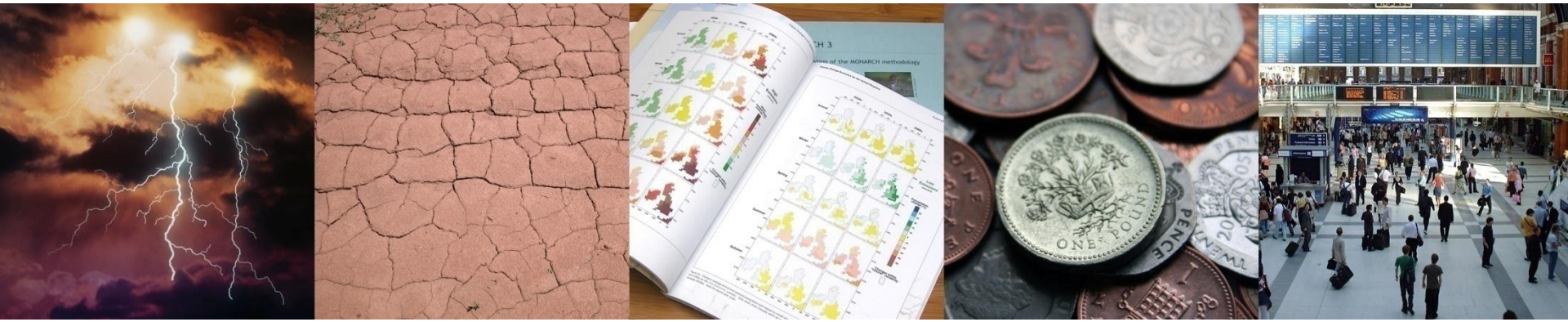
Planning to adapt to climate change

Climate change projections and risks for the North West

16th March 2011



Laurie Newton

UK Climate Impacts Programme

UK Climate Impacts Programme

The UK Climate Impacts Programme (UKCIP)

Mission:

To help organisations assess how they might be affected by climate change, so that they can prepare for its impacts.

Set up by UK Government in 1997

based at University of Oxford

(mostly) Defra-funded

recently expanded to 20+ people

current work-programme to 2011

works through:

partnerships and programmes

capacity building

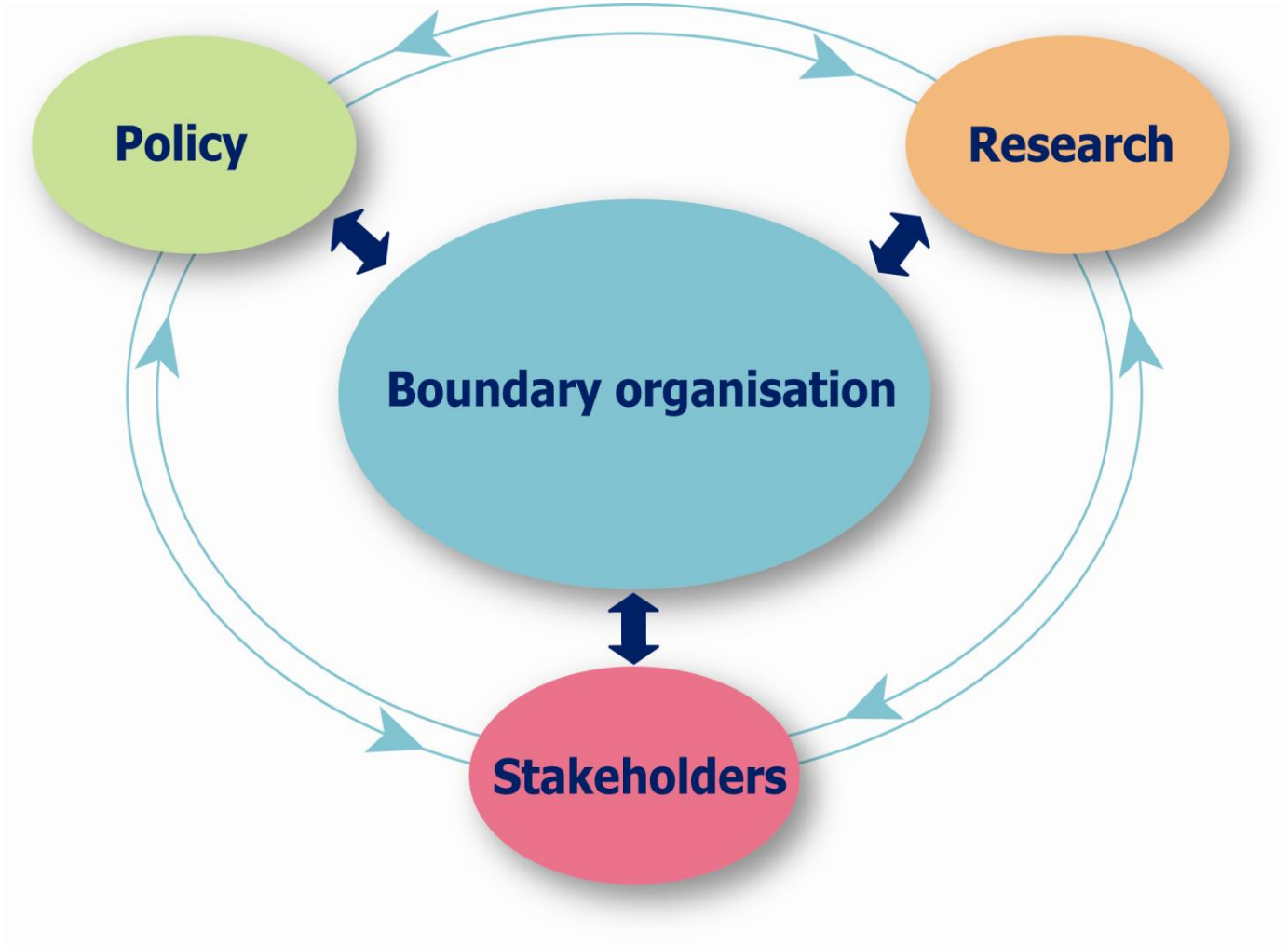
stakeholder-led research





UKCIP is a 'boundary organisation'

facilitates relationships between three groups of key actors



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Twin responses to global climate change

"There are two methods of curing the mischiefs of faction: the one by removing its causes, the other by controlling its effects."

James Madison et al, The Federalist Papers

1. **mitigation** of climate change

   attempts to slow down global warming by reducing greenhouse gas emissions

2. **adaptation** to climate change

   responding to the predicted impacts of unavoidable climate change

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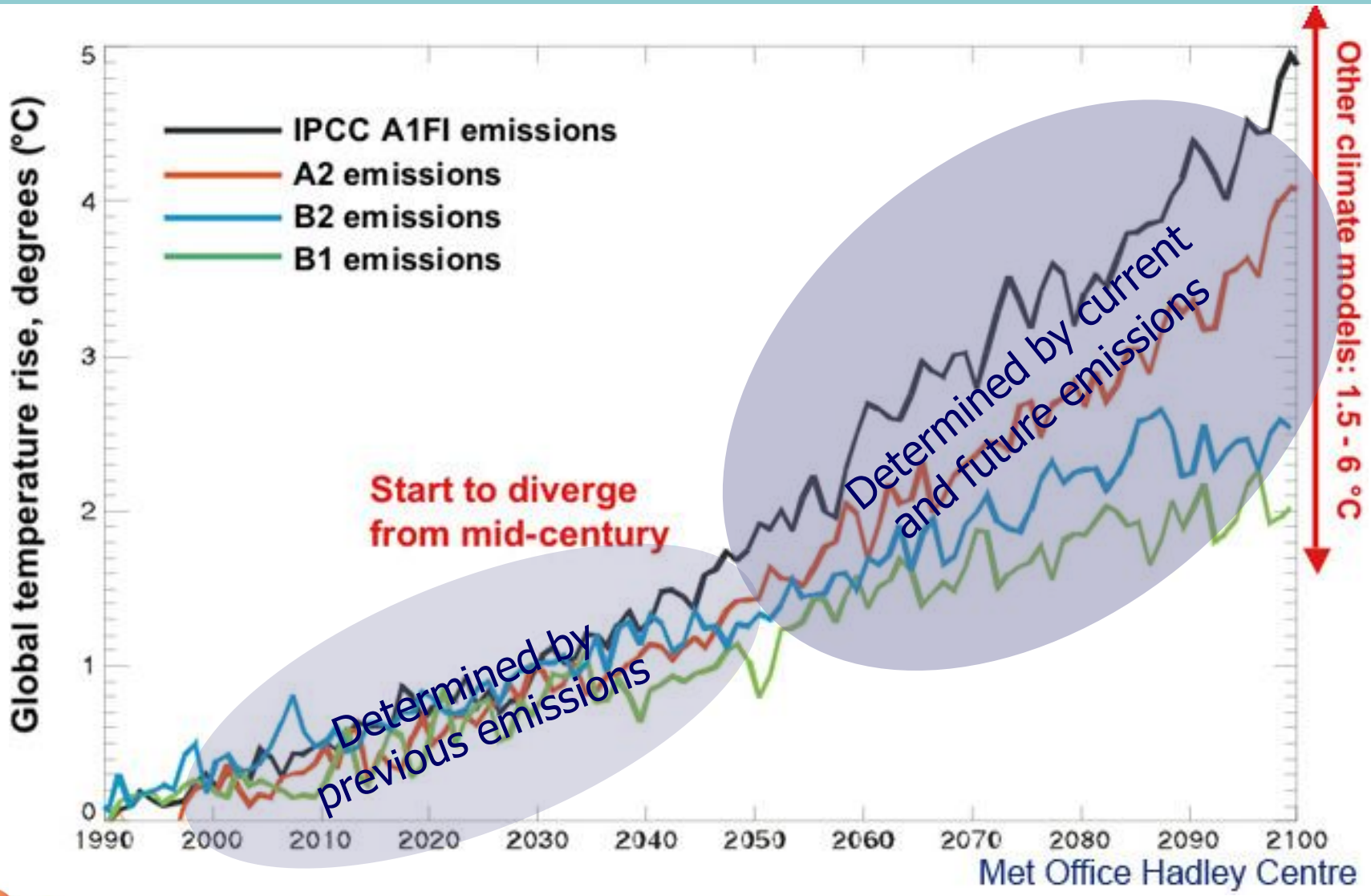
Climate change is unavoidable



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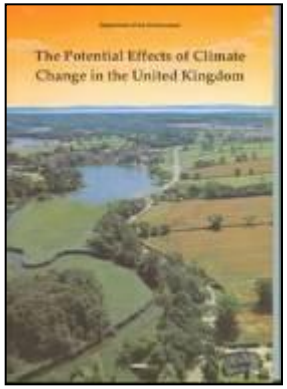
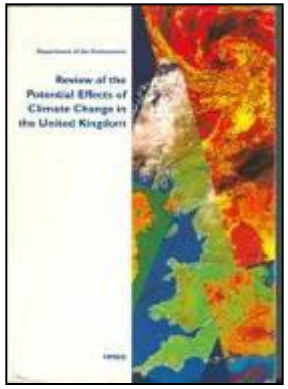
UK climate scenarios

- UK climate scenarios produced since 1991
- UKCIP published climate scenarios in 1998 and 2002
- Each version has become more detailed, building upon:
  - improved scientific knowledge
  - increased computing power
  - stakeholder requirements
- Each has represented best scientific understanding at that time
- Audience has evolved and grown

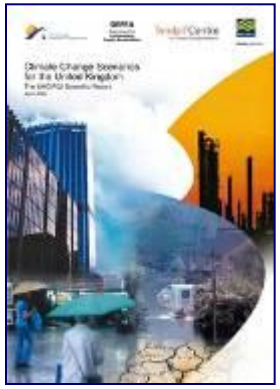


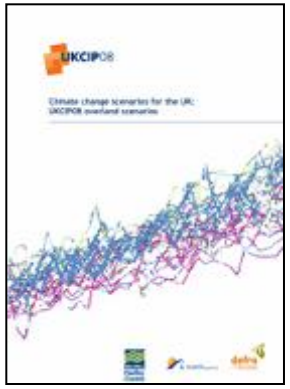
CCIRG91



CCIRG96

UKCIP98


UKCIP02



UKCP09

UKCIPnext

UK Climate Impacts Programme

UKCP09 improves quantification of uncertainty

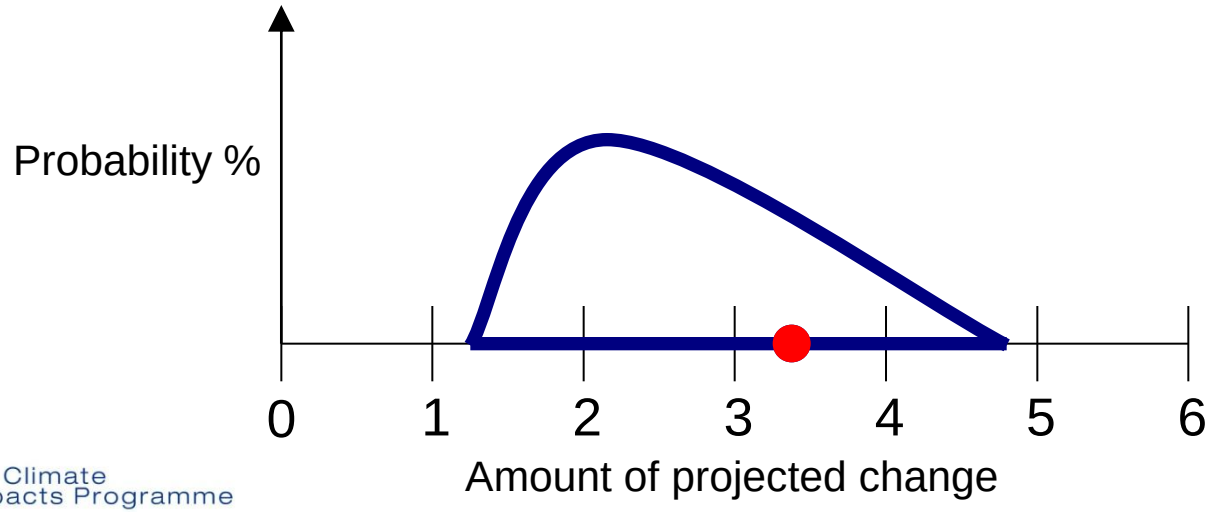
For a particular climate variable, emission scenario and time period

Earlier scenarios said:

"there will be this much change"

UKCP09 say:

"based on our current understanding, there is __% probability change will be between..."



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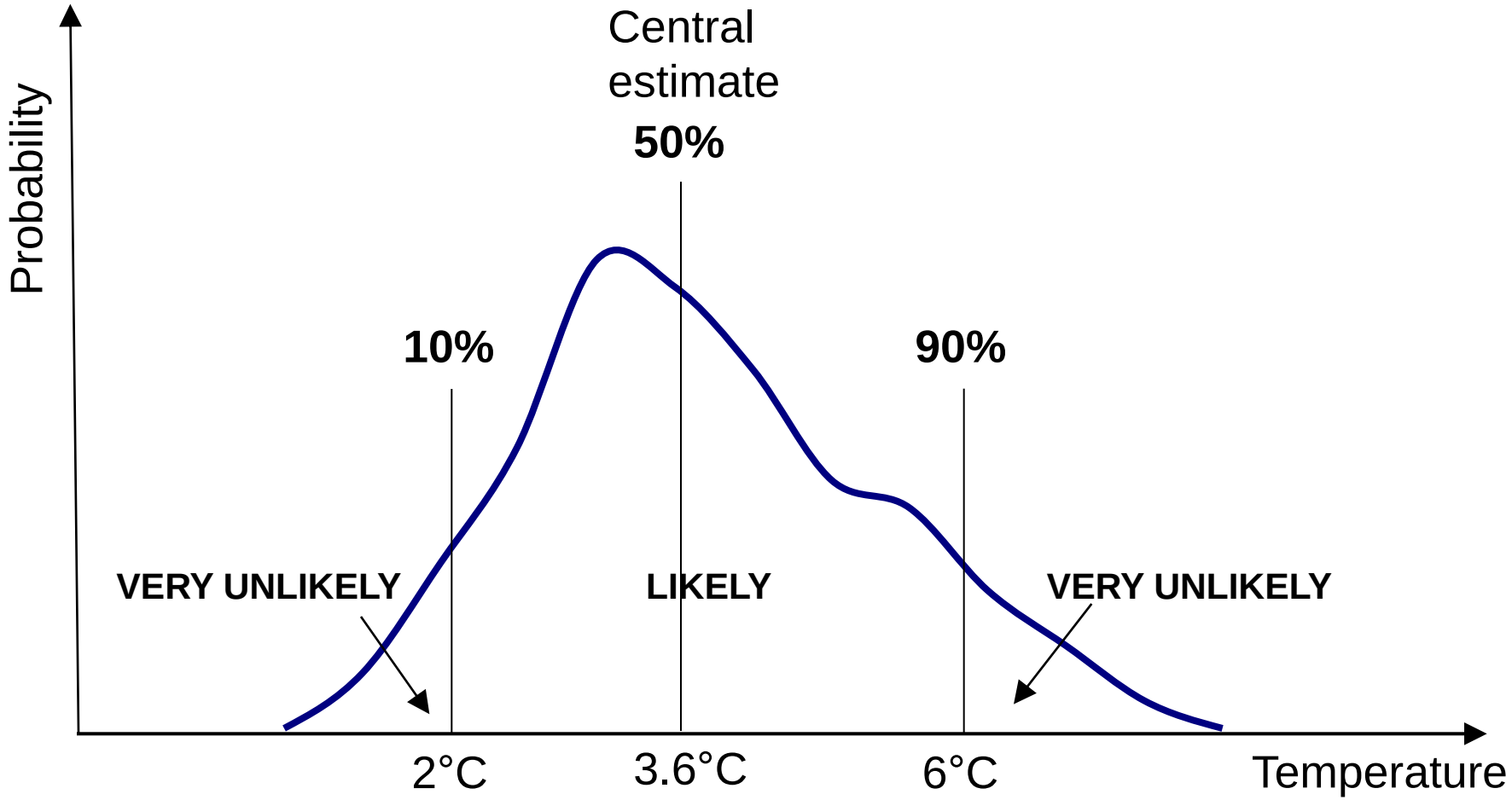
Probabilistic data - Key Findings



50% as likely as not

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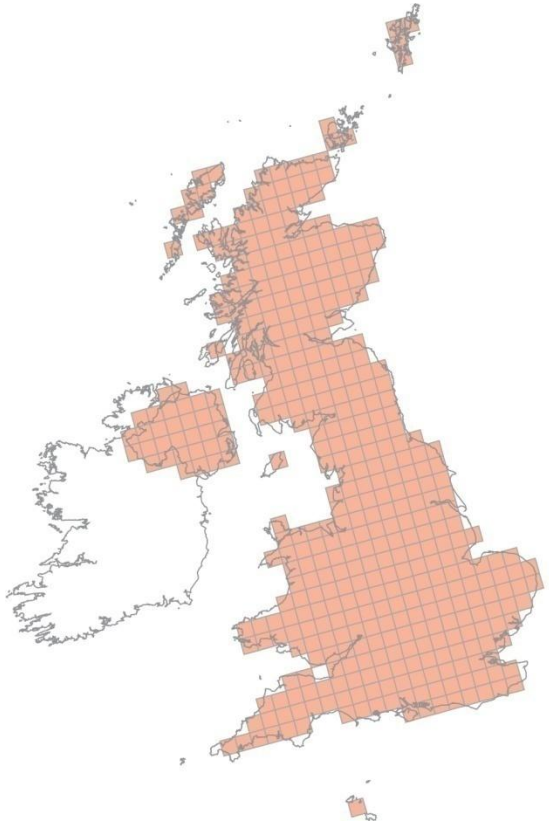
Improved spatial resolution

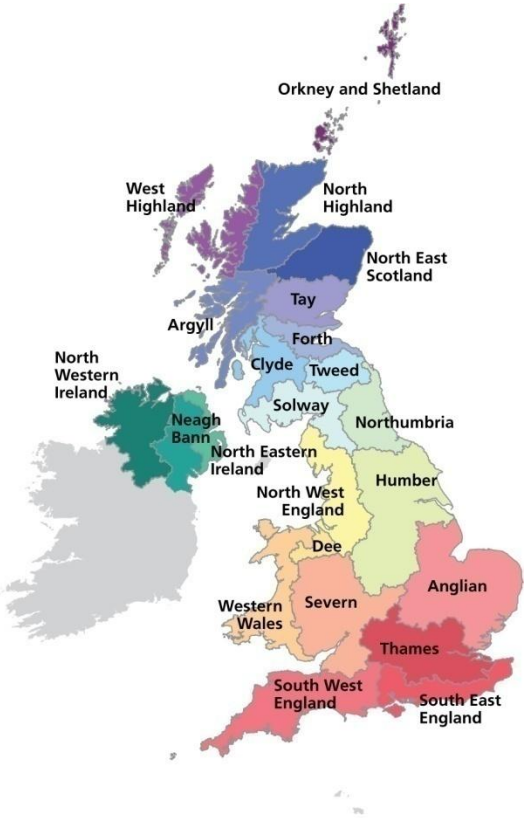
Information available for:

25 km grids



Administrative regions

River catchments



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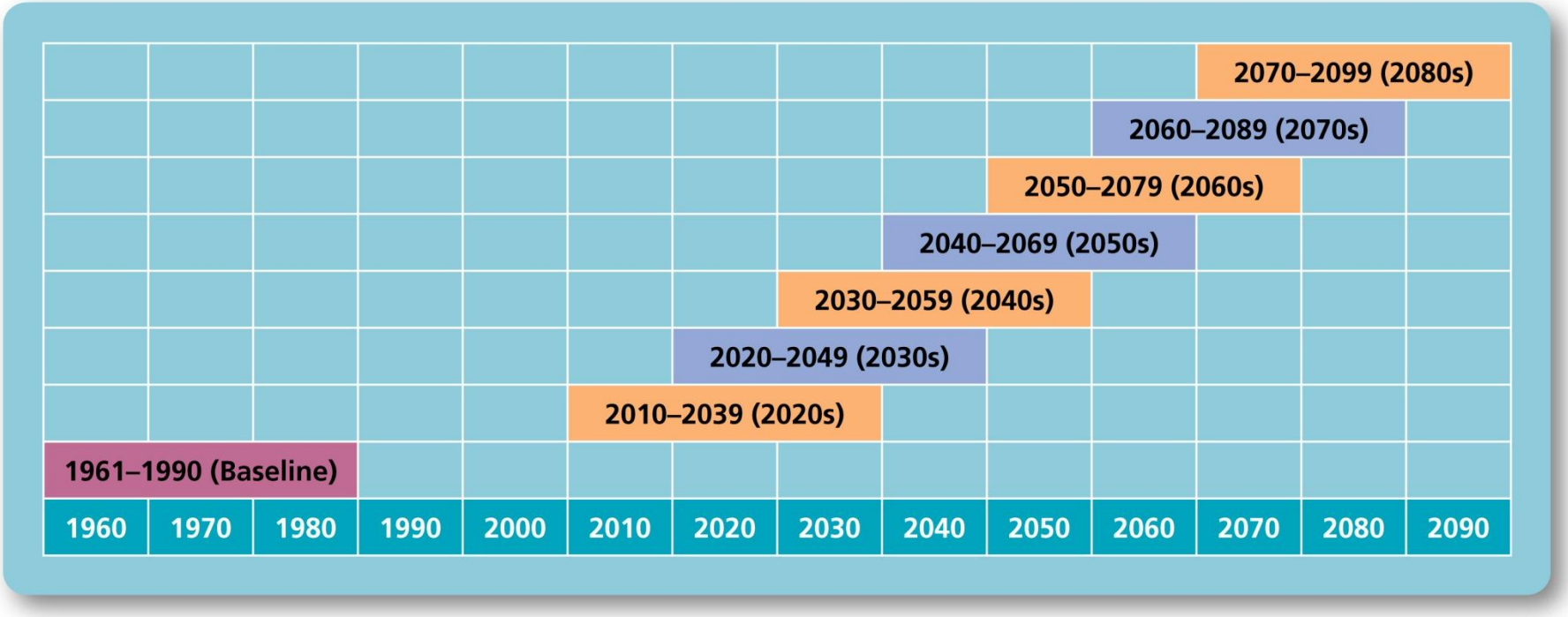
Improved temporal detail

Available as 7 overlapping 30 year time periods



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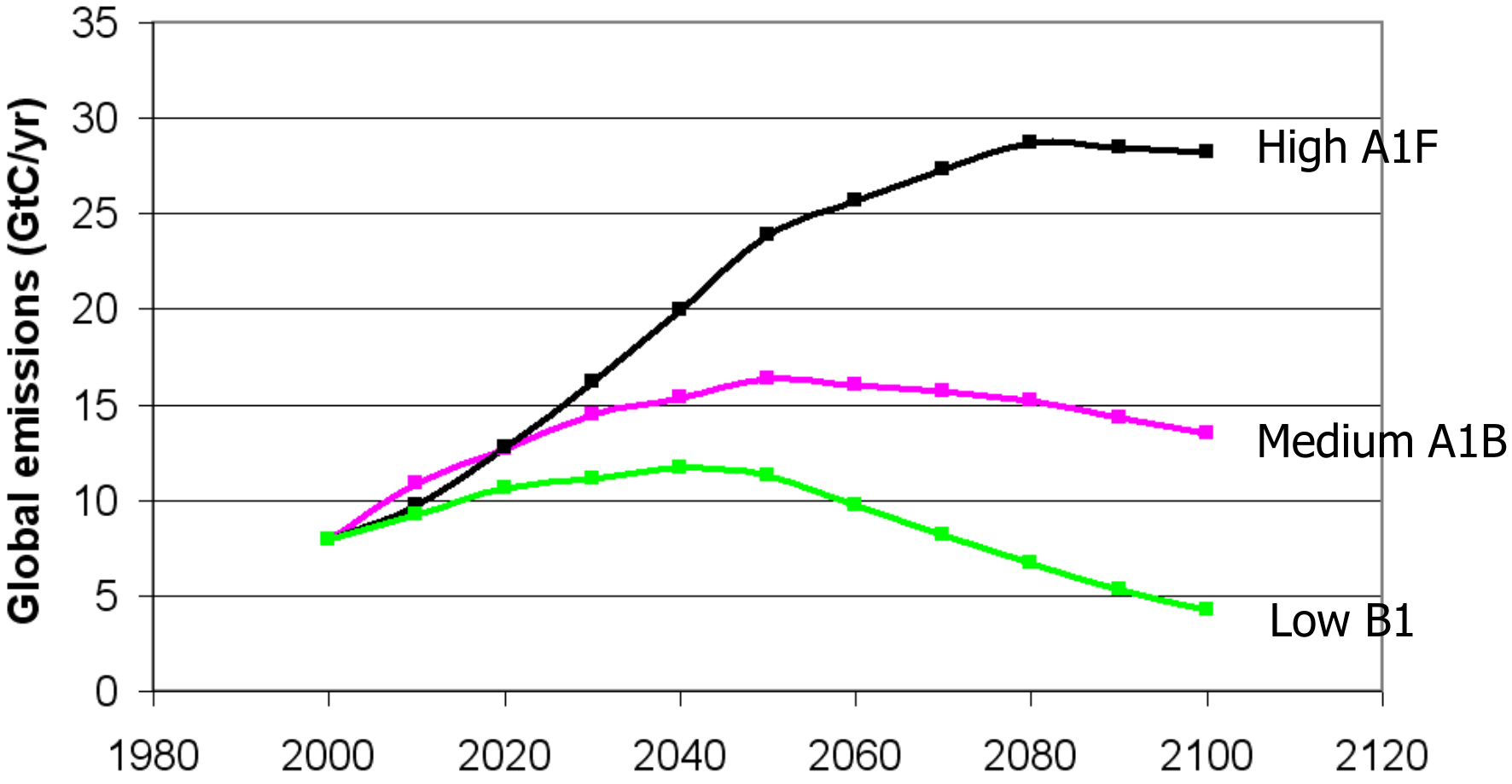
IPCC SRES emission scenarios



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UKCIP variables over land areas

- Mean temperature
- Mean daily maximum temperature
- Mean daily minimum temperature
- 99th percentile of daily maximum temperature in a season ("Warmest day of the season")
- 1st percentile of daily maximum temperature in a season ("Coolest day of the season")
- 99th percentile of the daily minimum temperature in a season ("Warmest night of the season")
- 1st percentile of daily minimum temperature in a season ("Coldest night of the season")

UK Climate Impacts Programme

UKCIP variables over land areas

- Precipitation rate
- 99th percentile of daily precipitation rate in the season ("Wettest day of the season")
- Specific humidity
- Relative humidity
- Total cloud
- Net surface long wave flux
- Net surface short wave flux
- Total downward short wave flux
- Mean sea level pressure

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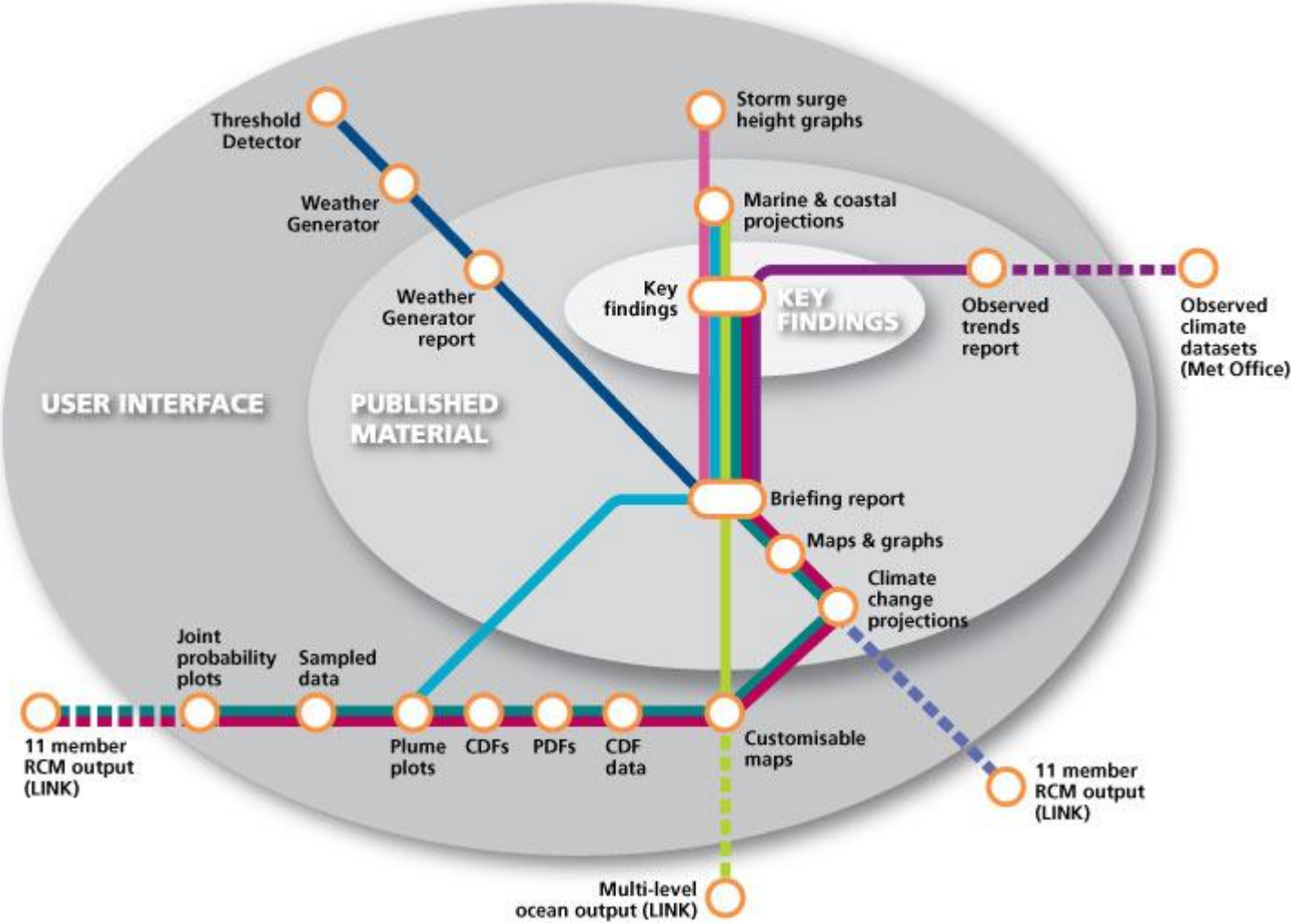
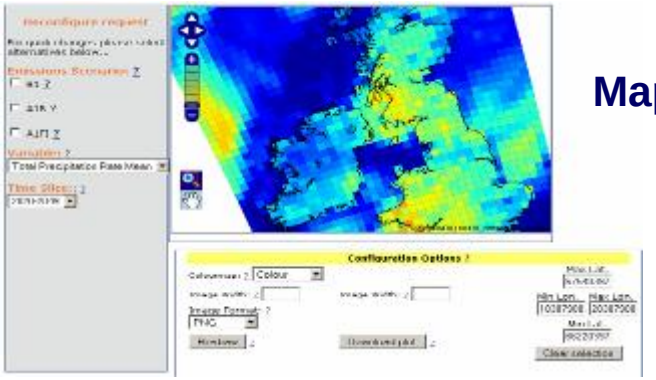
UKCP09 resources



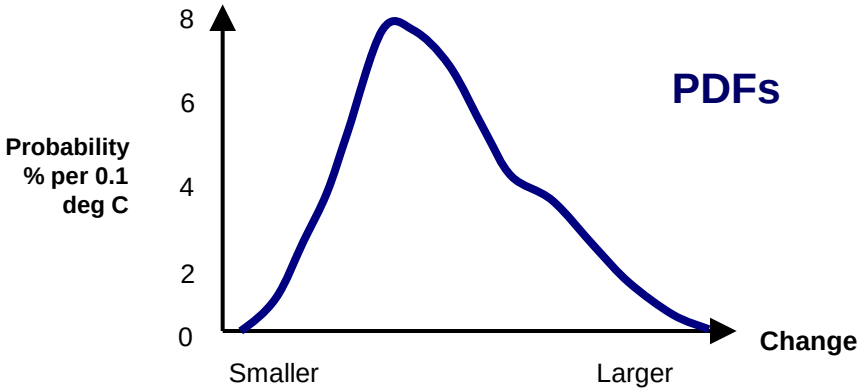
UK Climate Impacts Programme

Probabilistic climate projections

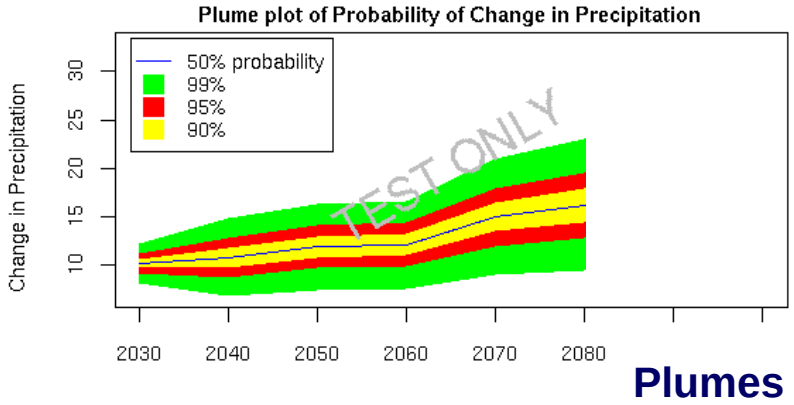
Probabilistic climate information can be visualised in a variety of ways:



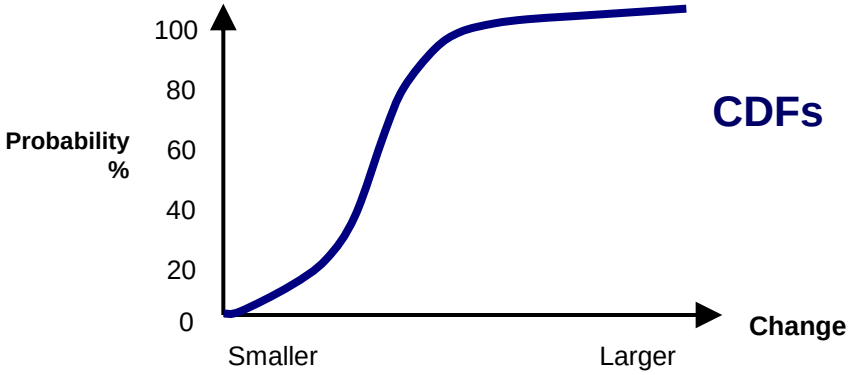
Maps



PDFs



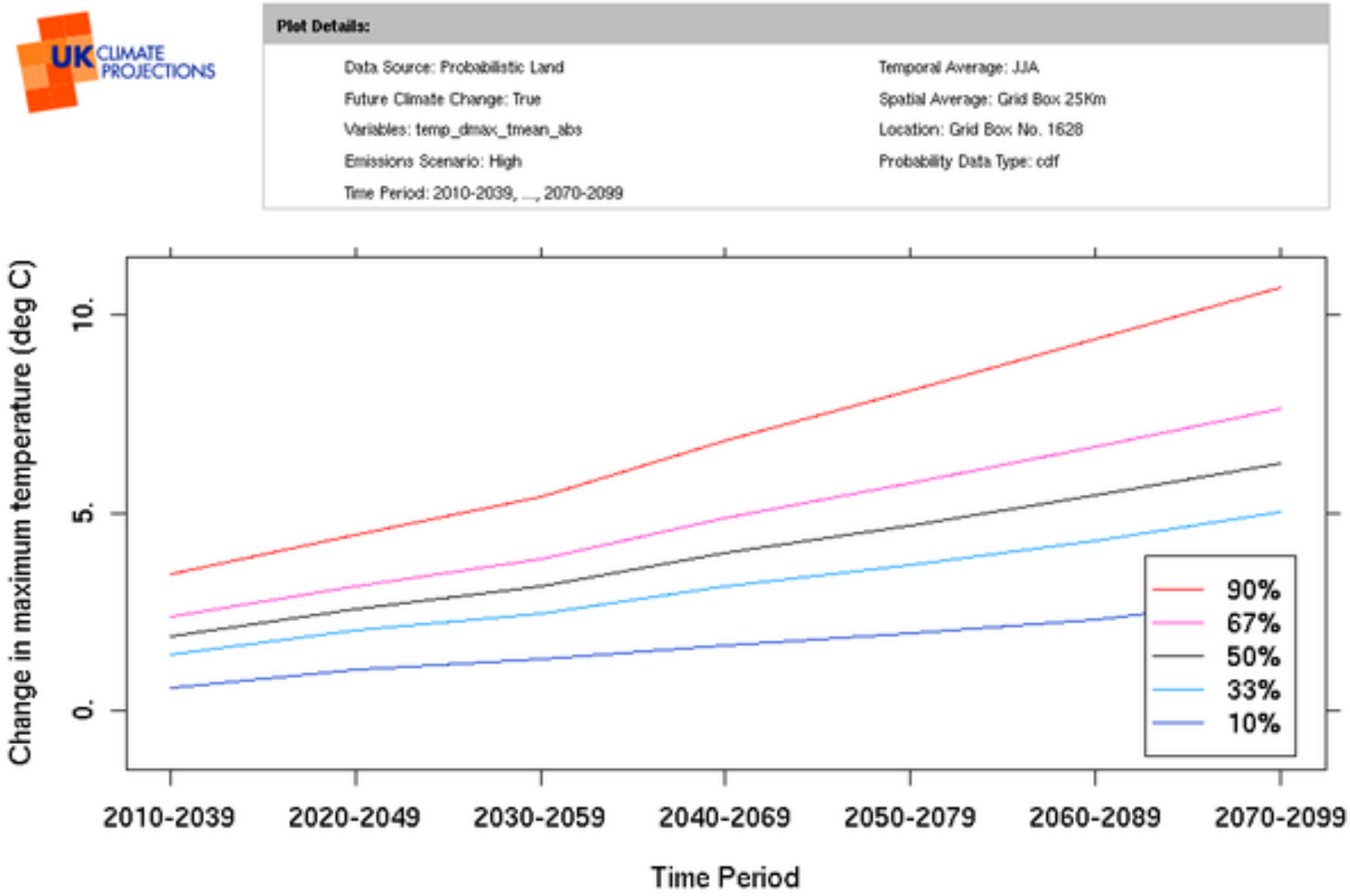
Plumes



CDFs

UK Climate Impacts Programme

Example of a plume plot



UK Climate Impacts Programme

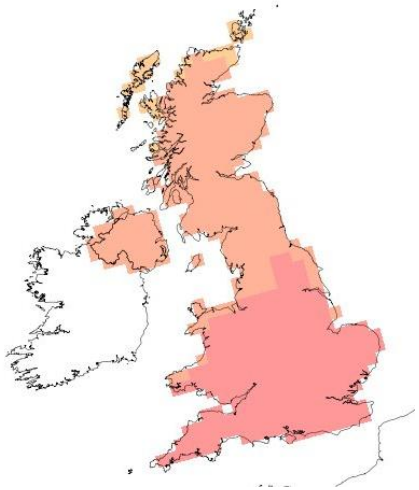
The core messages from UKCP09 are similar to those of UKCIP02

Annual / seasonal averages

- Warmer, drier summers (spring, autumn too)
- Milder, wetter winters
- Rising sea levels
- Seasonal shifts

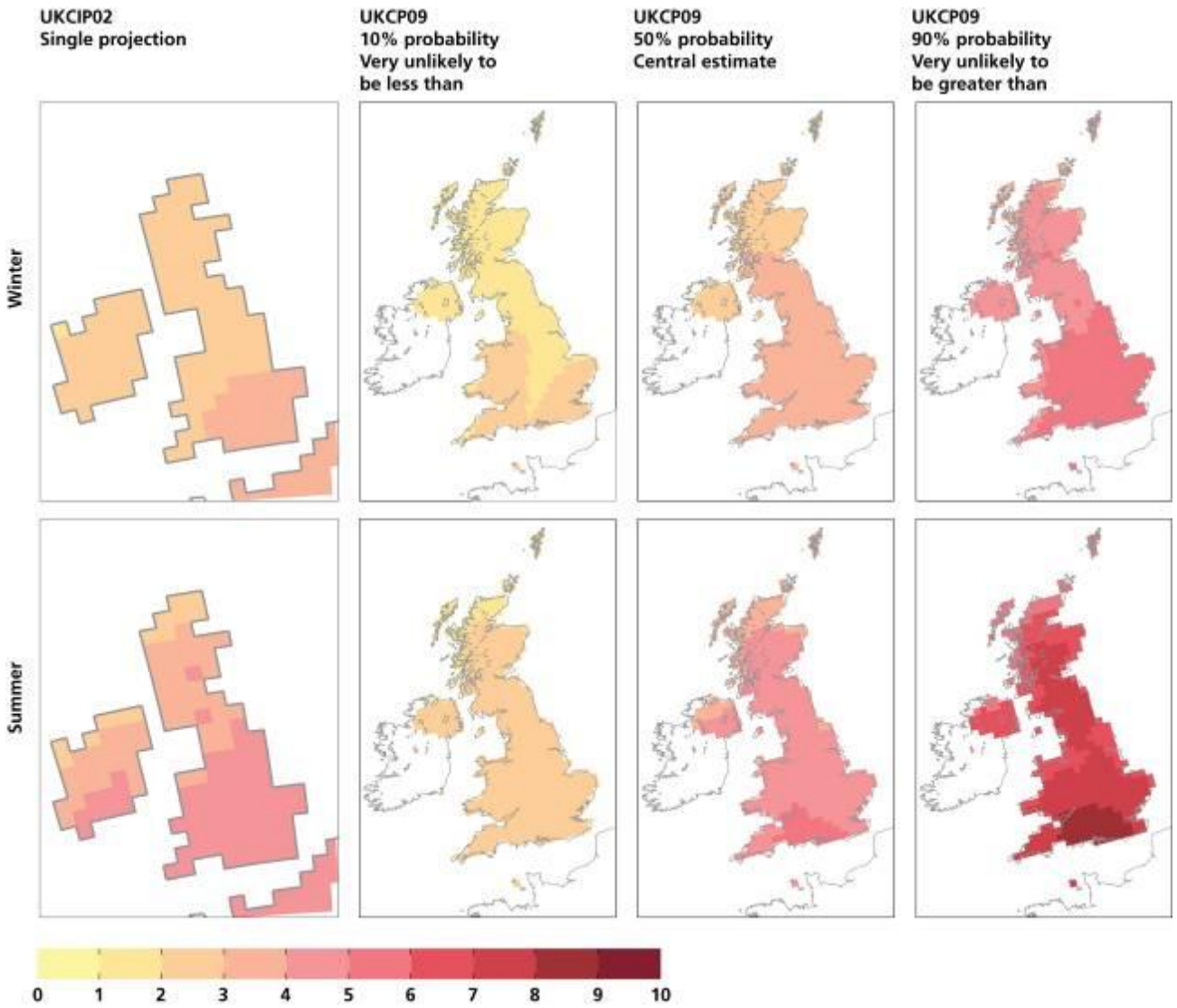
Extremes

- More very hot days
- More intense downpours of rain
- Shorter return periods for high water levels at coast
- Uncertain changes in storms – possible increase in winter



UK Climate Impacts Programme

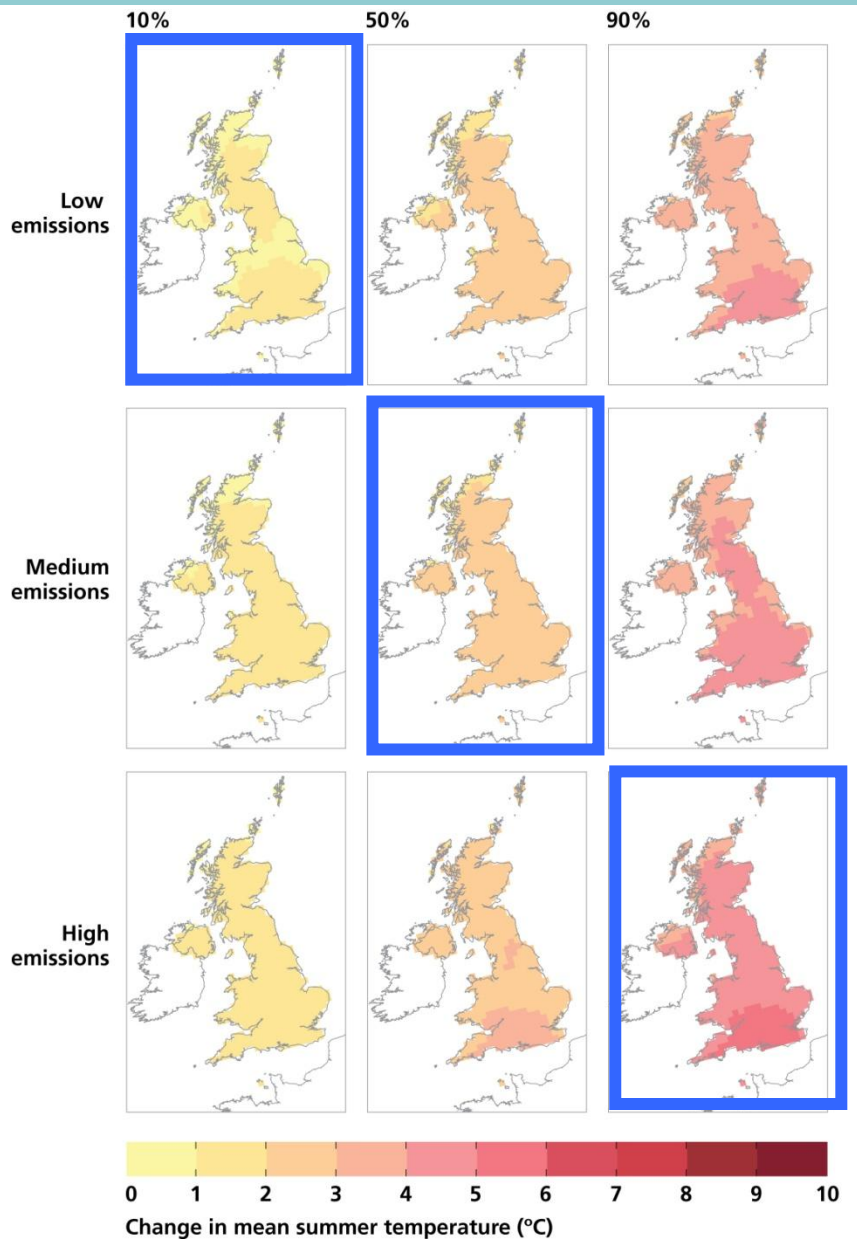
Seasonal mean temperature



UK Climate Impacts Programme

Change in mean summer temperatures (2050s)

Wider range



UK Climate Impacts Programme

Key findings for North West England, 2080s

High emissions scenario

The wider range is from the lowest to highest value for all emissions scenarios and three (10, 50, and 90%) probability levels for each 30-year time period.

- Under high emissions, the central estimate of increase in **winter mean temperature** is 3.1ºC; it is very unlikely to be less than 1.9ºC and is very unlikely to be more than 4.8ºC. A wider range of uncertainty is from 1.3ºC to 4.8ºC.

- Under high emissions, the central estimate of increase in **summer mean temperature** is 4.7ºC; it is very unlikely to be less than 2.5ºC and is very unlikely to be more than 7.3ºC. A wider range of uncertainty is from 1.3ºC to 7.3ºC.

- Under high emissions, the central estimate of increase in **summer mean daily maximum temperature** is 6ºC; it is very unlikely to be less than 2.3ºC and is very unlikely to be more than 10.1ºC. A wider range of uncertainty is from 1ºC to 10.1ºC.

- Under high emissions, the central estimate of increase in **summer mean daily minimum temperature** is 4.6ºC; it is very unlikely to be less than 2.2ºC and is very unlikely to be more than 7.8ºC. A wider range of uncertainty is from 1.1ºC to 7.8ºC.

- Under high emissions, the central estimate of change in **annual mean precipitation** is 1%; it is very unlikely to be less than –10% and is very unlikely to be more than 12%. A wider range of uncertainty is from –10% to 12%.

- Under high emissions, the central estimate of change in **winter mean precipitation** is 26%; it is very unlikely to be less than 9% and is very unlikely to be more than 50%. A wider range of uncertainty is from 3% to 50%.

- Under high emissions, the central estimate of change in **summer mean precipitation** is –28%; it is very unlikely to be less than –51% and is very unlikely to be more than –2%. A wider range of uncertainty is from –51% to 3%.

Detail from key findings for North West

Key findings for North West England, 2080s

High emissions scenario

The wider range is from the lowest to highest value for all emissions scenarios and three (10, 50, and 90%) probability levels for each 30-year time period.

- Under high emissions, the central estimate of increase in **winter mean temperature** is 3.1ºC; it is very unlikely to be less than 1.9ºC and is very unlikely to be more than 4.8ºC. A wider range of uncertainty is from 1.3ºC to 4.8ºC.

- Under high emissions, the central estimate of increase in **summer mean temperature** is 4.7ºC; it is very unlikely to be less than 2.5ºC and is very unlikely to be more than 7.3ºC. A wider range of uncertainty is from 1.3ºC to 7.3ºC.

UK Climate Impacts Programme

Key findings for North West 2020

2020s Low emissions

	Mean temperature, winter °C				Mean temperature, summer				Mean daily maximum temperature, summer C				Mean daily minimum temperature, summer C				Annual mean precipitation %				Winter mean precipitation %				Summer mean precipitation &			
probability level	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider rang	10	50	90	Wider rang	10	50	90	Wider ran
North West	0	1	2	0	2	1	2	3	1	2.5	1	2	4	0	3.5	1	2	3	1	2.6	-3	1	7	-4	7	-3	4	14	-3	14	-19	-5	9	-22	10

2020s Medium emissions

	Mean temperature, winter °C				Mean temperature, summer				Mean daily maximum temperature,				Mean daily minimum temperature,				Annual mean precipitation %				Winter mean precipitation %				Summer mean precipitation &			
probability level	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider rang	10	50	90	Wider rang	10	50	90	Wider ran
North West	1	1	2	0	2	1	2	3	1	2.5	0	2	4	0	3.5	1	2	3	1	2.6	-4	0	6	-4	7	-1	6	14	-3	14	-22	-7	9	-22	10

2020s High emissions

	Mean temperature, winter °C				Mean temperature, summer				Mean daily maximum temperature,				Mean daily minimum temperature,				Annual mean precipitation %				Winter mean precipitation %				Summer mean precipitation &			
probability level	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider ra	10	50	90	Wider rang	10	50	90	Wider rang	10	50	90	Wider ran
North West	0	1	2	0	2	1	2	3	1	2.5	1	2	3	0	3.5	1	1	3	1	2.6	-4	0	6	-4	7	-3	4	13	-3	14	-18	-4	10	-22	10

UK Climate Impacts Programme

Key findings for North West 2050

2050s Low emissions

	Mean temperature, winter °C				Mean temperature, summer				Mean daily maximum temperature, summer C				Mean daily minimum temperature, summer C				Annual mean precipitation %				Winter mean precipitation %				Summer mean precipitation &			
probability level	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range
North West	0.8	1.8	2.8	0.8	3.3	1.1	2.4	3.8	1.1	4.7	1	3	5.3	1	6.5	0.9	2.3	3.9	0.9	4.9	-6	0	6	-6	7	0	8	20	0	27	-32	-13	8	-36	8

2050s Medium emissions

	Mean temperature, winter °C				Mean temperature, summer				Mean daily maximum temperature,				Mean daily minimum temperature, summer C				Annual mean precipitation %				Winter mean precipitation %				Summer mean precipitation &			
probability level	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range
North West	1	2	3	0.8	3.3	1.2	2.6	4.1	1.1	4.7	1	3.3	5.8	1	6.5	1	2.5	4.4	0.9	4.9	-5	0	6	-6	7	3	13	26	0	27	-34	-17	1	-36	8

2050s High emissions

	Mean temperature, winter °C				Mean temperature, summer				Mean daily maximum temperature,				Mean daily minimum temperature, summer C				Annual mean precipitation %				Winter mean precipitation %				Summer mean precipitation &			
probability level	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider rai	10	50	90	Wider range	10	50	90	Wider range	10	50	90	Wider range
North West	1.2	2.2	3.3	0.8	3.3	1.4	3	4.7	1.1	4.7	1.3	3.8	6.5	1	6.5	1.3	2.9	4.9	0.9	4.9	-6	0	7	-6	7	3	13	27	0	27	-36	-17	3	-36	8

UK Climate Impacts Programme

Key findings for North West 2080

2080s Low emissions

	Mean temperature, winter °C					Mean temperature, summer					Mean daily maximum temperature, summer C					Mean daily minimum temperature, summer C					Annual mean precipitation %					Winter mean precipitation %					Summer mean precipitation &				
probability level (%)	10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider rang	
North West	1.3	2.3	3.6	1.3	4.8	1.3	2.8	4.6	1.3	7.3	1	3.6	6.6	1	10.1	1.1	2.8	4.9	1.1	7.8	-5	0	8	-8	12	4	15	30	3	50	-34	-15	4	-50	4

2080s Medium emissions

	Mean temperature, winter °C					Mean temperature, summer					Mean daily maximum temperature,					Mean daily minimum temperature, summer C					Annual mean precipitation %					Winter mean precipitation %					Summer mean precipitation &				
probability level (%)	10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider rang	
North West	1.4	2.6	4.1	1.3	4.8	2	3.7	5.9	1.3	7.3	1.7	4.7	8.3	1	10.1	1.6	3.7	6.4	1.1	7.8	-6	0	8	-8	12	3	16	35	3	50	-42	-21	0	-50	4

2080s High emissions

	Mean temperature, winter °C					Mean temperature, summer					Mean daily maximum temperature,					Mean daily minimum temperature, summer C					Annual mean precipitation %					Winter mean precipitation %					Summer mean precipitation &				
probability level (%)	10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider rai		10	50	90	Wider range		10	50	90	Wider range		10	50	90	Wider rang	
North West	1.9	3.2	4.8	1.3	4.8	2.5	4.7	7.3	1.3	7.3	2.4	6	10	1	10.1	2.2	4.6	7.8	1.1	7.8	-8	0	12	-8	12	9	26	50	3	50	-50	-27	0	-50	4

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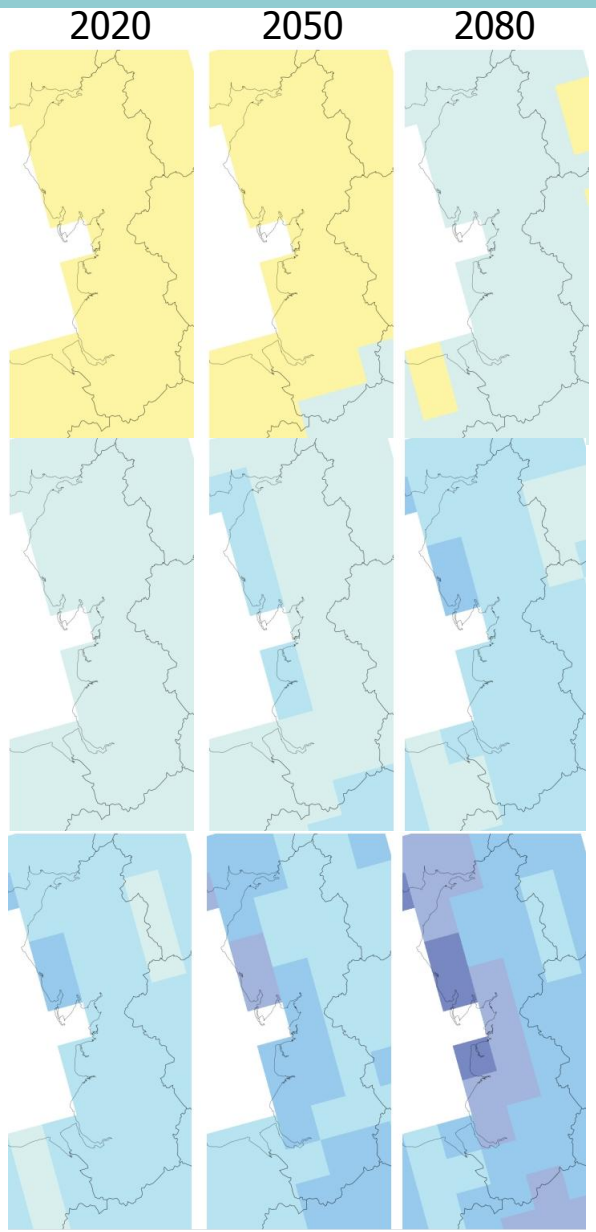
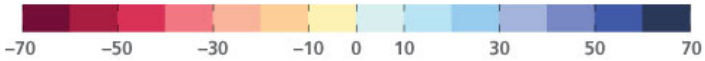
Change in winter mean precipitation (Low)





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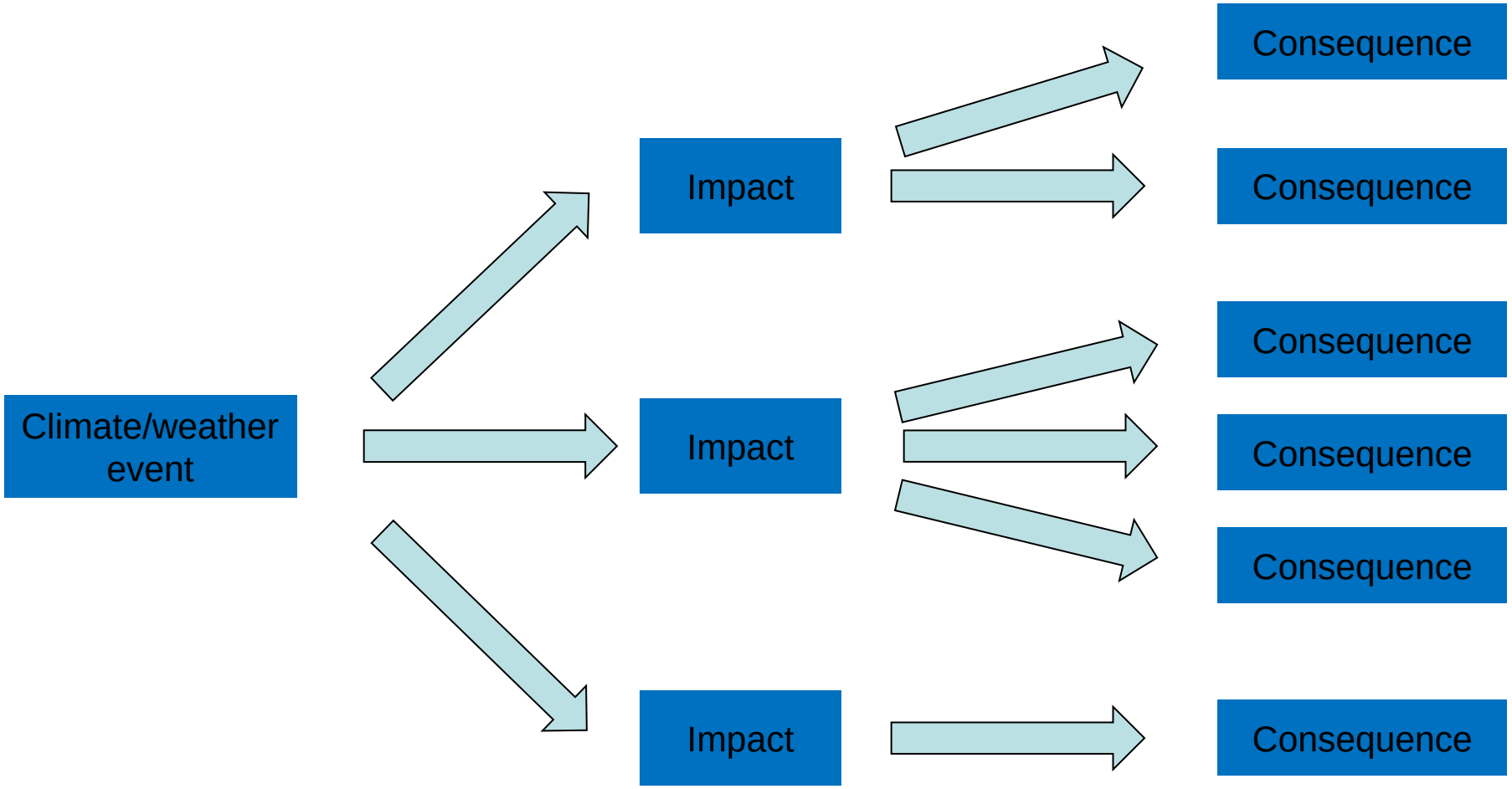
Weather, impacts and consequences



Consequences may vary for different receptors

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Some issues identified in NW scoping study

The coastal zone will be subject to increasing risk of tidal inundation due to a likely increase in the probability of storm surges reaching dangerous levels in the Irish Sea. Much of the North West has a low-lying coastline which is already at risk from flooding. At least a third of the North West's coastline has 'hard' sea defence structures.

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Some issues identified in NW scoping study

The loss of mudflats and saltmarshes as the sea pushes up against hard defences would have a major impact on the internationally significant bird feeding grounds found in the extensive bays and estuaries of the North West. Some ports and harbours, coastal-based industries and occupations are also vulnerable to more extreme tidal events.

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Some issues identified in NW scoping study

The Uplands

The uplands could change significantly in character as soils, moorland vegetation and land uses adjust to warmer and wetter conditions.

Water Supply & Demand

Climate change adds significantly to the uncertainty surrounding future levels of water supply and demand. Water shortages could result from extended periods of drought and more variability in the pattern and extent of rainfall in the North West.

UK Climate Impacts Programme

Some issues identified in NW scoping study

Sectors Benefiiting

Tourism, recreation and agriculture are amongst those sectors which may stand to benefit from the predicted climate change. It is our judgement that there are potential benefits resulting from climate change in some economic sectors, especially tourism and recreation and agriculture, but we can be less certain about the scale of such benefits and they are likely to be distributed unevenly across those sectors. Warmer winter weather will also reduce the number of deaths of older people, and will reduce disruption to the transport system.

Potential impacts on built environment

Adapting to the impact of climate change on buildings, neighbourhoods and cities

A Briefing Guide for the North West

Prepared on behalf of **CCI NW**
for the **Northwest Climate Change Adaptation Group**
by **Eclipse Research Consultants**
121 Arbury Road
Cambridge
CB4 2JD
Phone: 00 44 1223 500847
Email: jcooper@dircon.co.uk

March 2010

Main changes	Likely impacts
 **Higher temperatures**	Higher day time peaks Higher night time lows Higher winter temperatures Enhanced urban heat island effect Reduced air quality (e.g. increase in summer ozone episodes) Health implications, e.g. heat stress in frail and elderly
 **Drier summers and drought**	Reduced water availability/shortages Reduced water quality Reduced soil moisture content/ increased subsidence Changes in biodiversity Health implications
 **Sea temperature rise**	Sea level rise Increased sea surge height
 **Increased precipitation**	More rainfall in winter Heavier rain in winter and summer/hail/snow (BUT less snow projected) Increased river flooding Increased urban drainage flooding Health implications
 **Higher wind speeds**	Increased storm damage Outage of emergency, infrastructure and transportation services

NI188 self-assessment returns 2009/10

Region	Level 0	Level 1	Level 2	Level 3	Total
East Midlands	4	6	33	1	44
East of England	4	21	27	1	53
London	3	20	6	4	33
North East	0	4	5	3	12
North West	8	15	16	2	41
South East	9	38	25	0	72
South West	3	12	24	0	39
West Midlands	6	17	9	0	32
Yorks and Humber	1	17	4	0	22
Totals	**38**	**150**	**149**	**11**	**348**

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Risks to building developments include:

Increased risk of flash flooding (in urban areas), increased risk of riverine flooding, increased risk of coastal flooding and erosion may all be relevant depending upon the location of the development

- Greater problems with the maintenance of comfortable internal temperatures during hot summers and heatwaves – may lead to increased summer energy bills for air conditioning

- Increased risk of damage to building fabric from extreme weather, intense rainfall

- Greater pressure on water supplies that could be scarcer during prolonged dry periods – may require water efficiency measures

- Economic activity located in new developments may be affected by knock-on impacts of climate change on transport in relation to users reaching their place of work

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Risks to road and public transport include:

Increased flood risk for transport infrastructure, in flood plains coastal locations or under intense rainfall Increased risk of hot weather damage and disruption, and increased costs

Greater potential for accidents related to extreme weather conditions

Greater risks to buildings and infrastructure from extreme weather

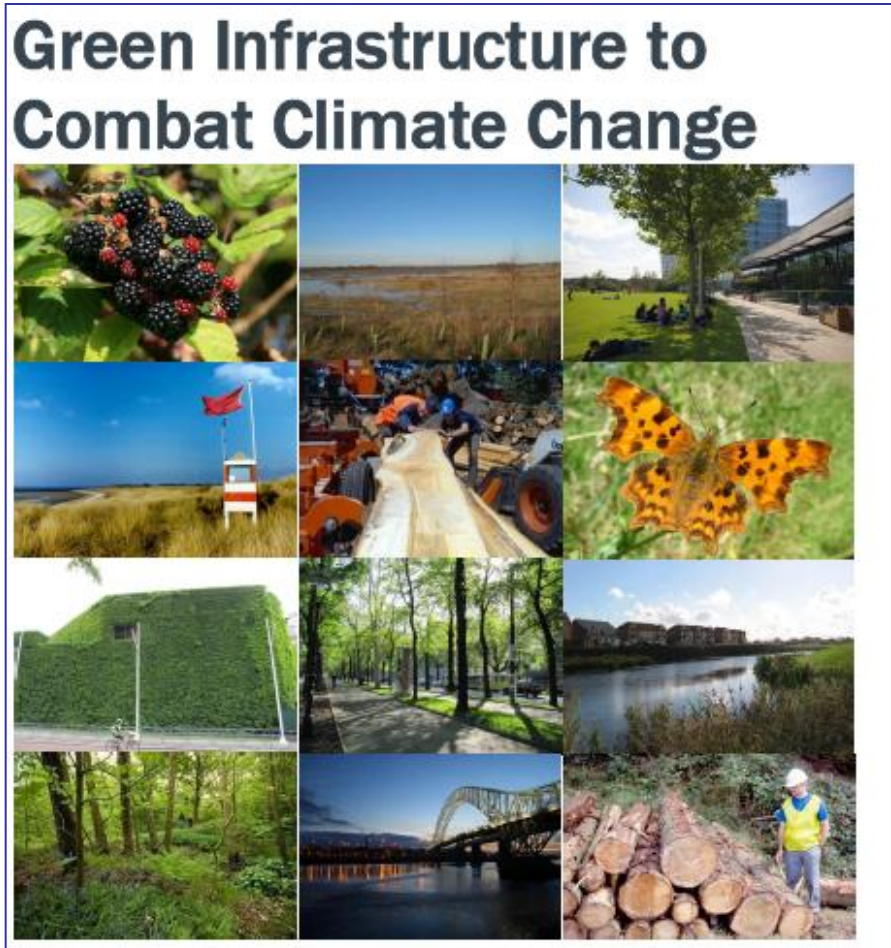
Knock-on effects to other sectors of the economy which depend upon transport networks

Using green infrastructure

Restoration of River Quaggy, Sutcliffe Park Greenwich

Managing soil erosion

Formby Woods (copyright: McCoy Wynne)



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