



Climate Change and its Potential Impacts

Doug Johnson
Met Office, Deputy Director Applied Science and Scientific Consulting

Foundation for Science and Technology Debate,
Royal Society, 22nd October 2014

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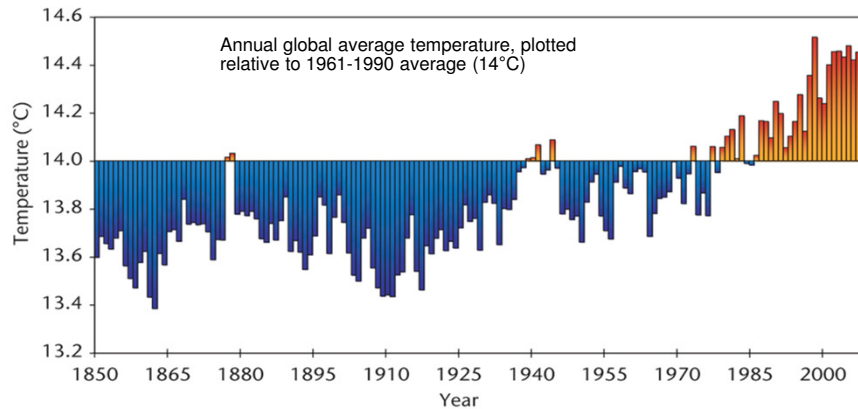
An aerial photograph showing extensive flooding in a rural area. The water has inundated large sections of agricultural fields and some residential areas. In the background, a town with several buildings is visible. The text "Mythe Waterworks - Tewkesbury Floods 2007" is overlaid in the top right corner of the image.

Content of Presentation

- Climate change facts
- Why we are treating climate change so seriously
- Impact on UK Transportation Networks
 - Temperature rise predictions
 - Drought and extreme rainfall predictions
 - Sea level rise impacts

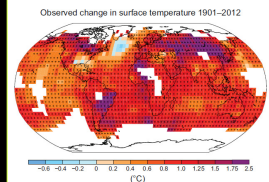
Climate change facts

The current climate change is unusual.
It is not just part of a natural cycle.



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IPCC Fifth Assessment Report



• Working Group I: The Physical Science Basis

- Warming of the climate system is unequivocal
- It is extremely likely that human influence has been the dominant cause

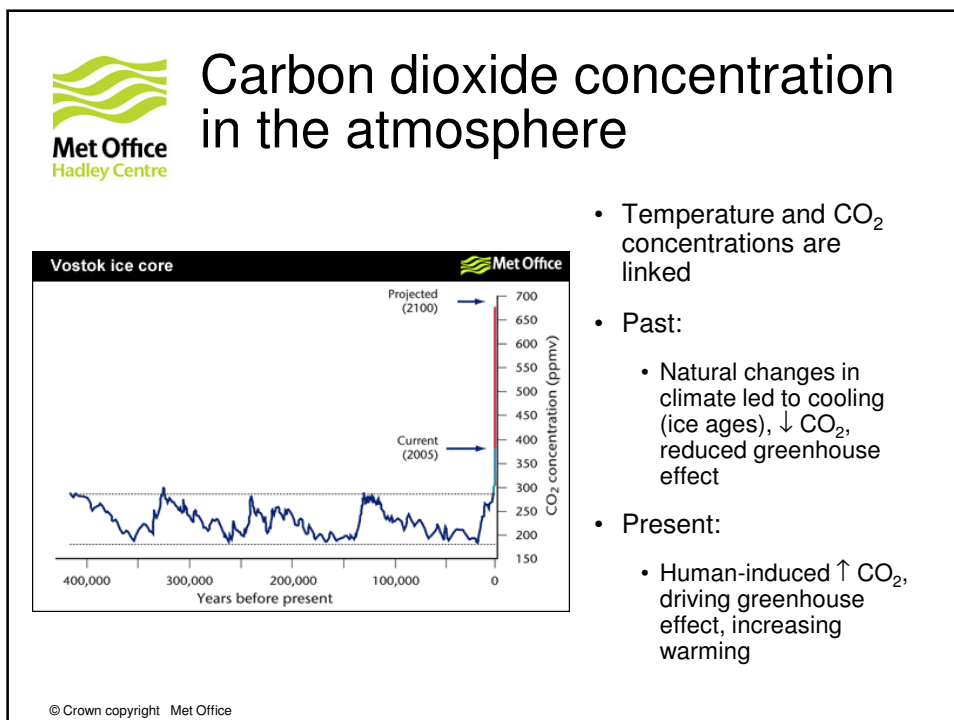
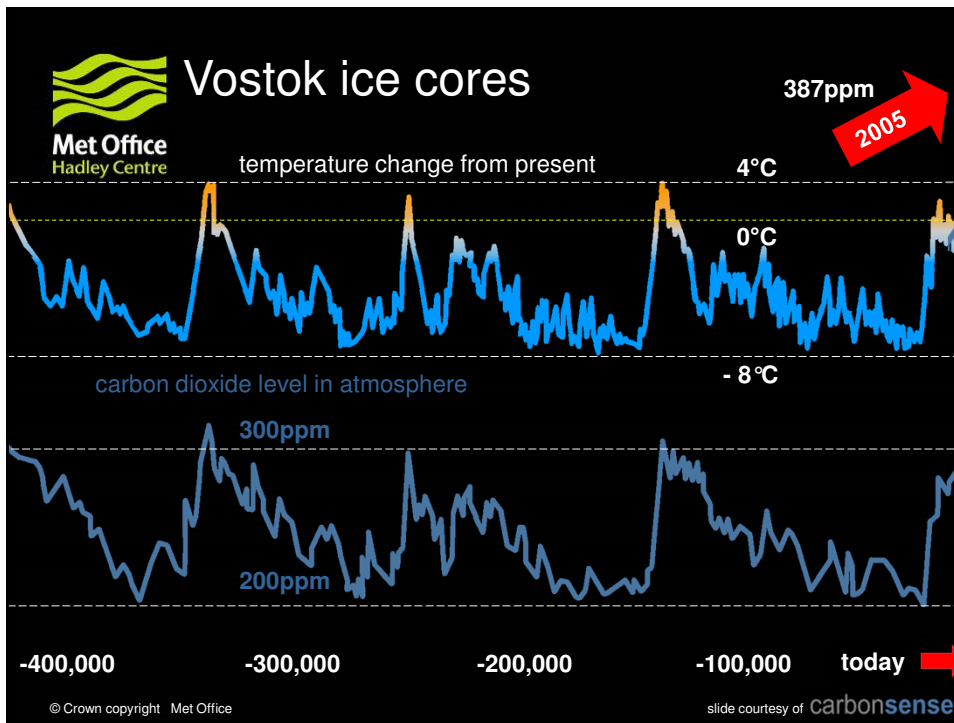
• Working Group II: Impacts, Adaptation and Vulnerability

- Recent extremes reveal significant vulnerability to climate variability
- Risks of impacts reduced by limiting the rate and magnitude of climate change

• Working Group III: Mitigation of Climate Change

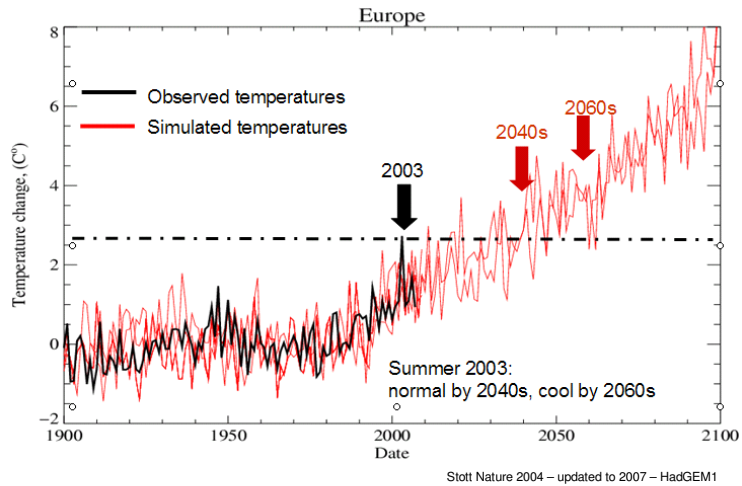
- Manmade greenhouse gas emissions continue to increase
- Slower emissions reduction means more expensive and more difficult to stay below 2°C warming

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European 2003 summer temperatures



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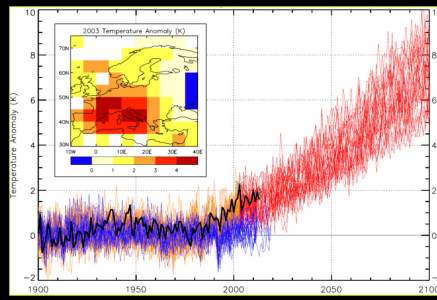
UK Extremes

Too hot:

- Climate change doubled risk of temperatures seen in Europe in 2003
- Continuing on track for 2003 to be normal in Europe by 2040s

Too cold:

- Over long term winters warmer in UK
- But 20-30% chance of cold winters until 2020s
- Need to adapt to broader range



More frequent hotter summers



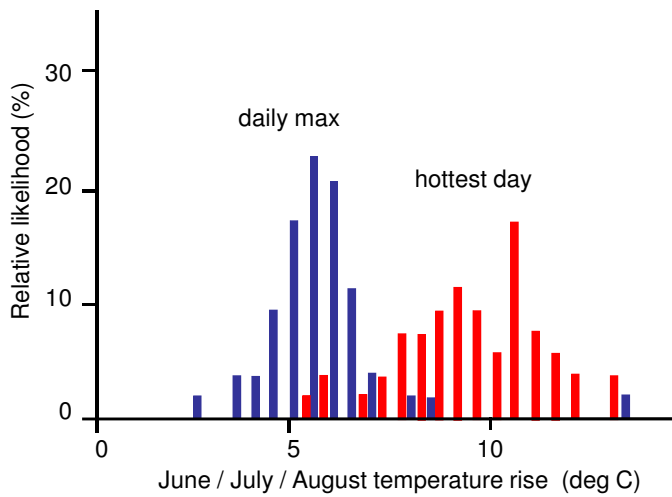
Fewer colder winters but variability will continue

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Risk based analysis

Summer temperature changes in UK city



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photo: Philip Wade



UK Extremes

Too wet:

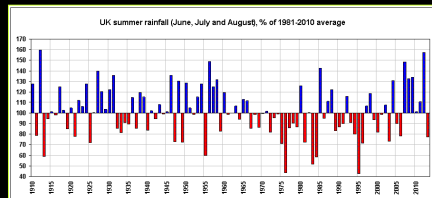
- Evidence that extreme daily rainfall is becoming more intense around the world
- Hints that character of UK rainfall is changing



More intense rainfall

Too dry:

- On average summers hotter and drier
- 35% chance of wet summer until 2040s

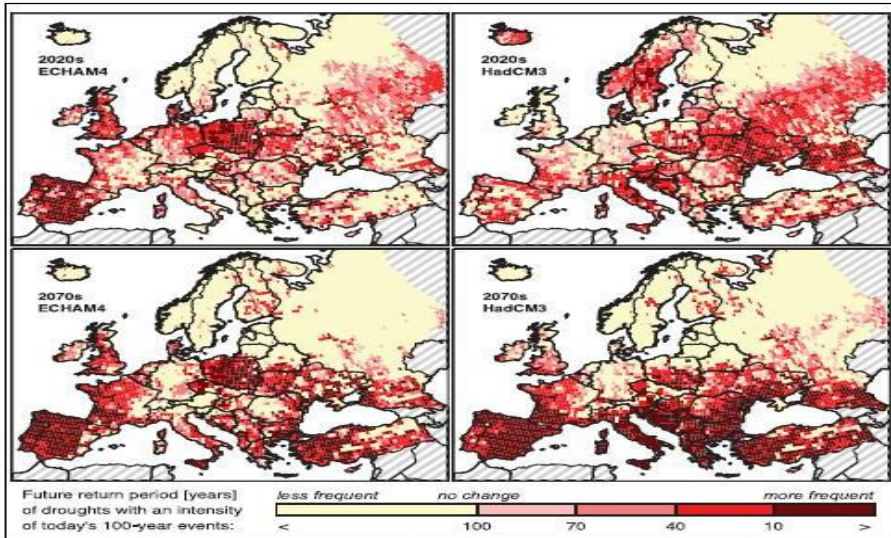


Wet summers continue due to climate natural variability

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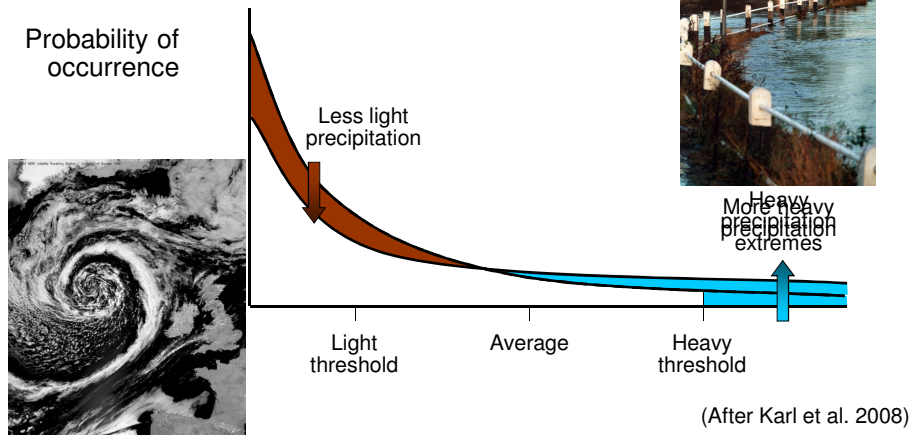


Increase in European Drought Frequency



Increase in probability of extremes in a warmer climate

• Precipitation in future

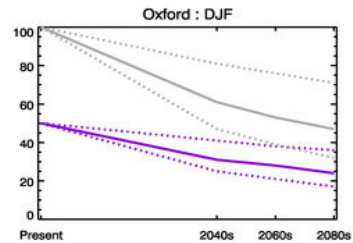
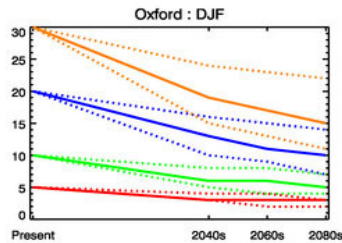




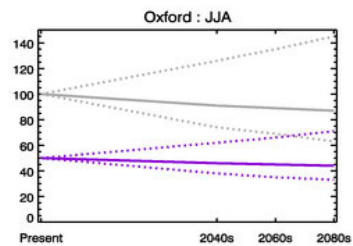
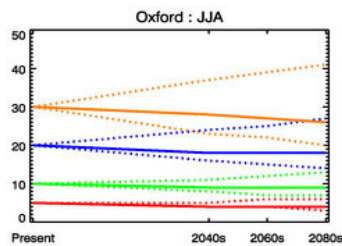
Predicted Changes In Oxford Rainfall Return Periods

Rainfall return period (yrs)

Winter



Summer



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Conclusions of New Results From Very High Resolution Climate Model

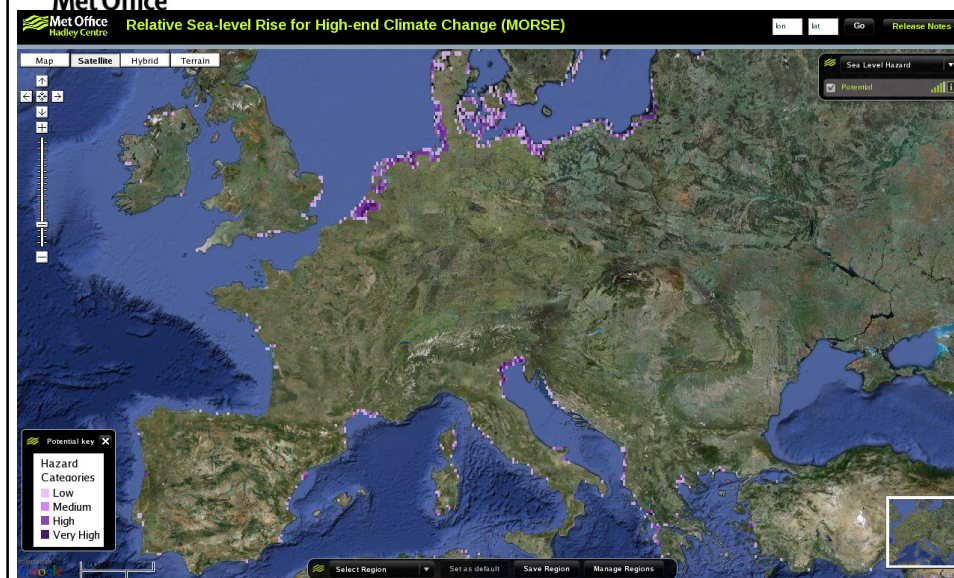
- Future projections of changes to UK **winter rainfall** are **robust** from coarser to higher resolution models.
- Convection-permitting model shows an **intensification of hourly rainfall in summer** not seen at coarser resolution.
- Evidence of significantly more events exceeding high thresholds (e.g. 30mm/h) **indicative of more flash flooding**.
- Accurate representation of the **local storm dynamics** is essential for predicting changes to convective extremes, ... when included we find **summer downpours intensify with warming**

Kendon *et al*, Heavier summer downpours with climate change revealed by weather forecast resolution model, published in *Nature Climate Change* June 2014.

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Sea Level Rise Predictions: Impact On European Coastlines



Top Level Summary of Potential Climate Change Impacts On Transport

- 1. Increased temperatures:**
 - Increased rail buckling
 - Increased maintenance of road surfaces
 - Over heating of electrical equipment
 - Expansion of moveable infrastructure e.g. swing bridges
- 2. Increased higher intensity rainfall**
 - Increase in flash flooding
 - Increase in river flooding
 - Increase in landslides
 - Increase failure of electrical equipment
- 3. Sea level rise and increased storminess**
 - Damage to coastal infrastructure
 - Increase in the number of trees blown down
 - Increase in vehicles blown over
 - More speed restrictions on bridges
- 4. Increased periods of drought**
 - Increased subsidence due to reduction in soil moisture
 - Weakening of earthworks for when rain returns
- 5. Shorter winter season**
 - Less snow and frost days

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