Past and future fire weather hazard for the UK

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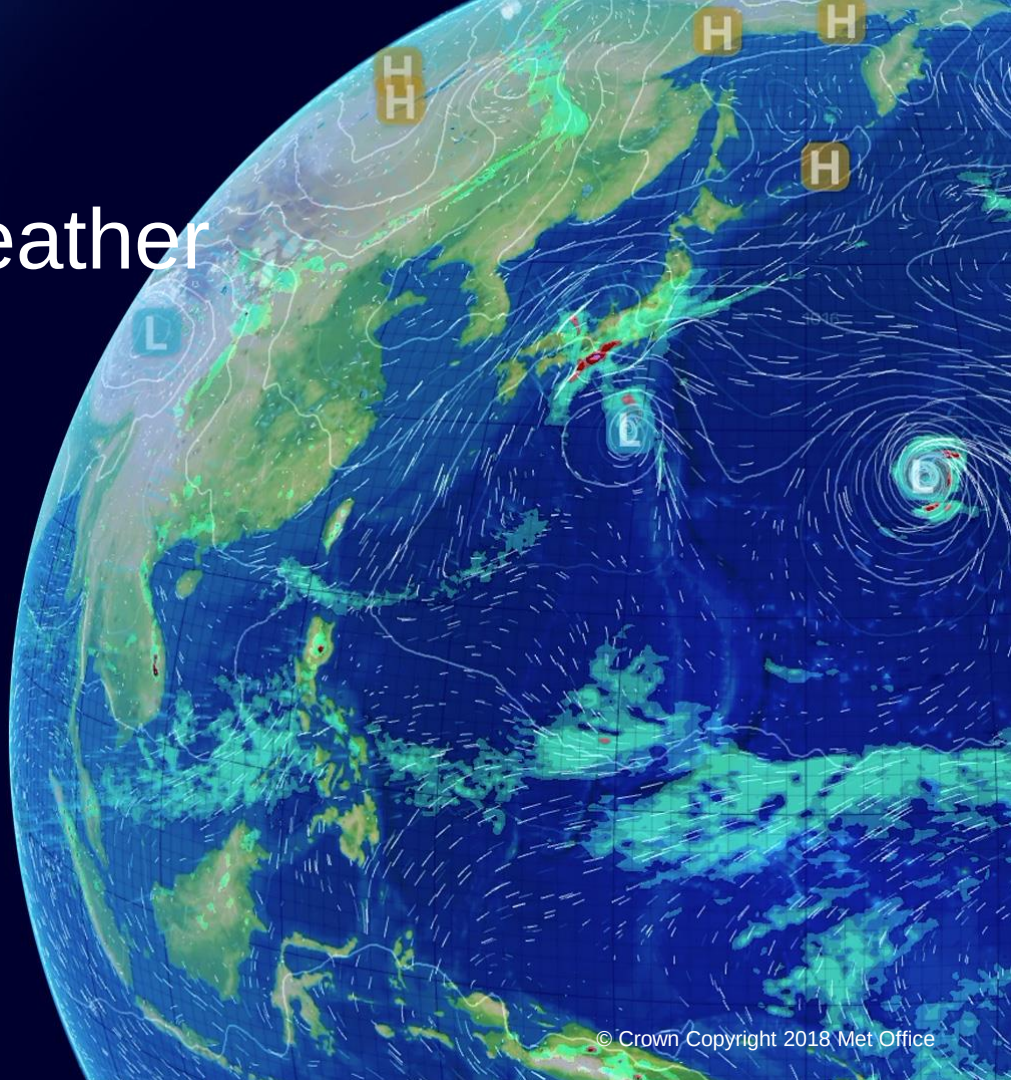
EWWF Wildfire Conference

Cardiff, 20 November 2019



Met Office

Summer 2018 UK Wildfires

Can we expect more of this in the future?

Session Plan

Past trends in UK wildfire

- Observed: Satellite-derived burned area
- Modelled: Met Office Fire Severity Index model
- 2018 summer wildfires case study
- Observed trends in temperature and precipitation

Future changes in fire weather hazard

- Intro to climate change scenarios and models
- Projected changes in temperature and precipitation
- Projected changes in frequency of elevated fire weather conditions

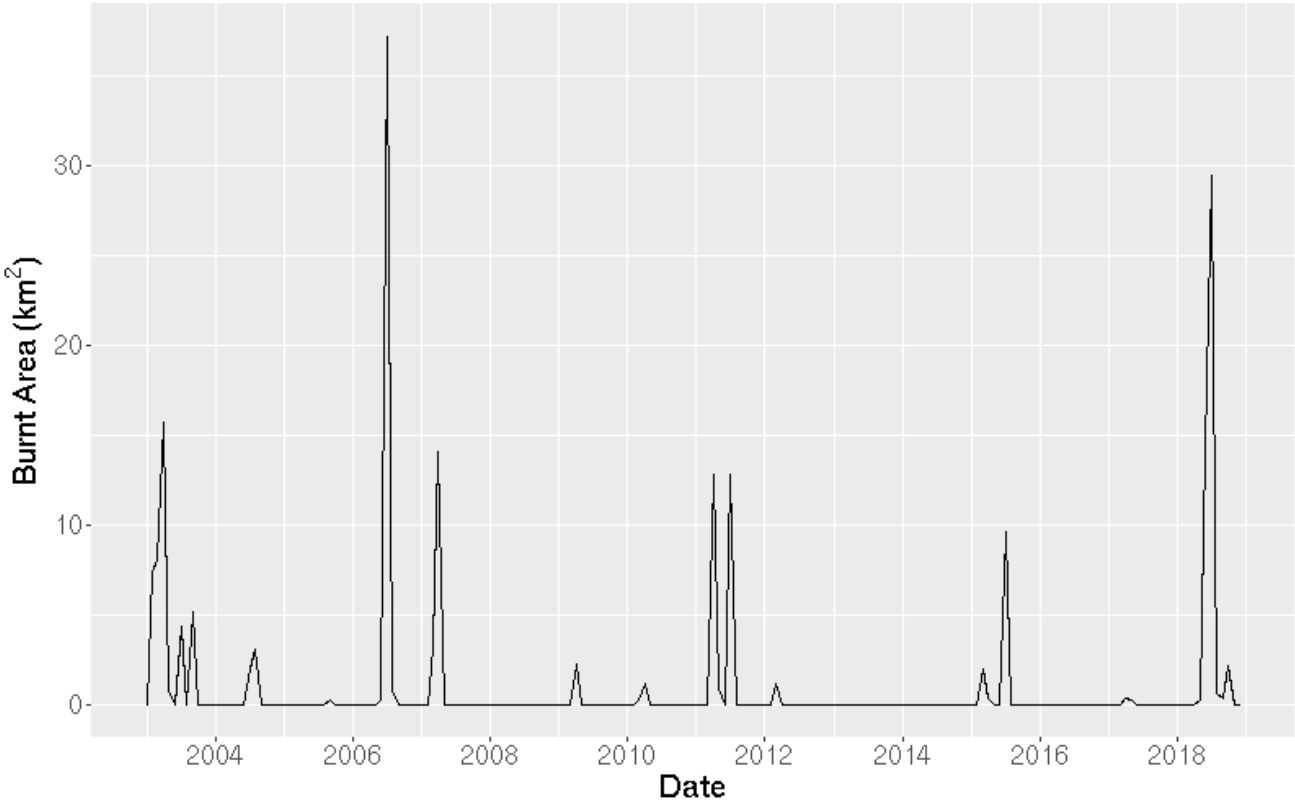
Satellite-derived Burned Area data

- Burned area detected by
  - Thermal emissions
  - Changes in vegetation reflectance
- Products
  - MODIS Collection 6 MCD64A1
  - European Space Agency (ESA) Fire Climate Change Initiative (CCI)
  - Copernicus European Forest Fire Information System (EFFIS)

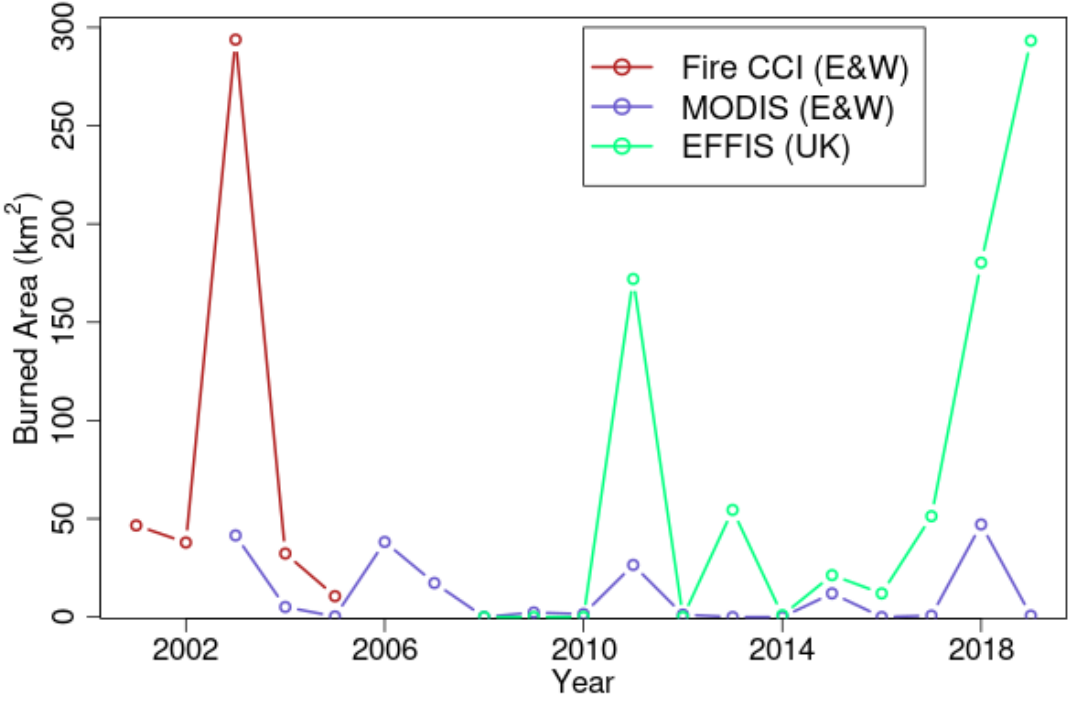
- Some limitations, but good results for large wildfires

Satellite data

- Satellite-derived monthly burned area for England & Wales from 2003
- Data from MODIS MCD64A1

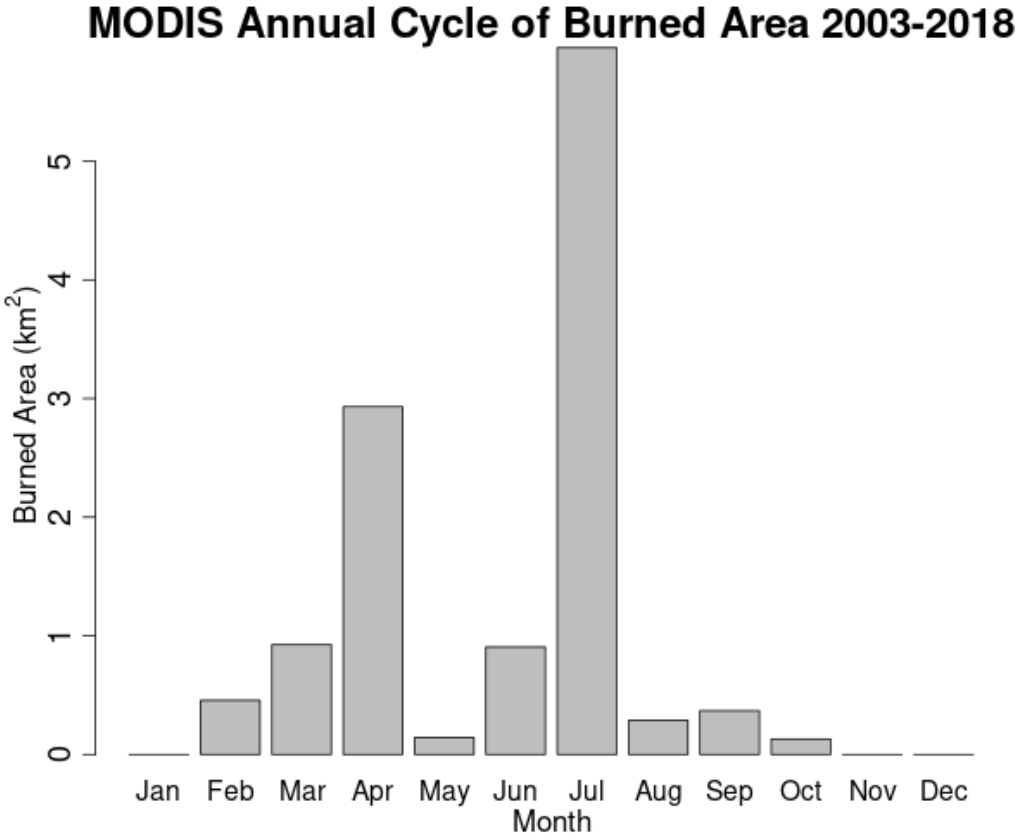


Annual Burned Area



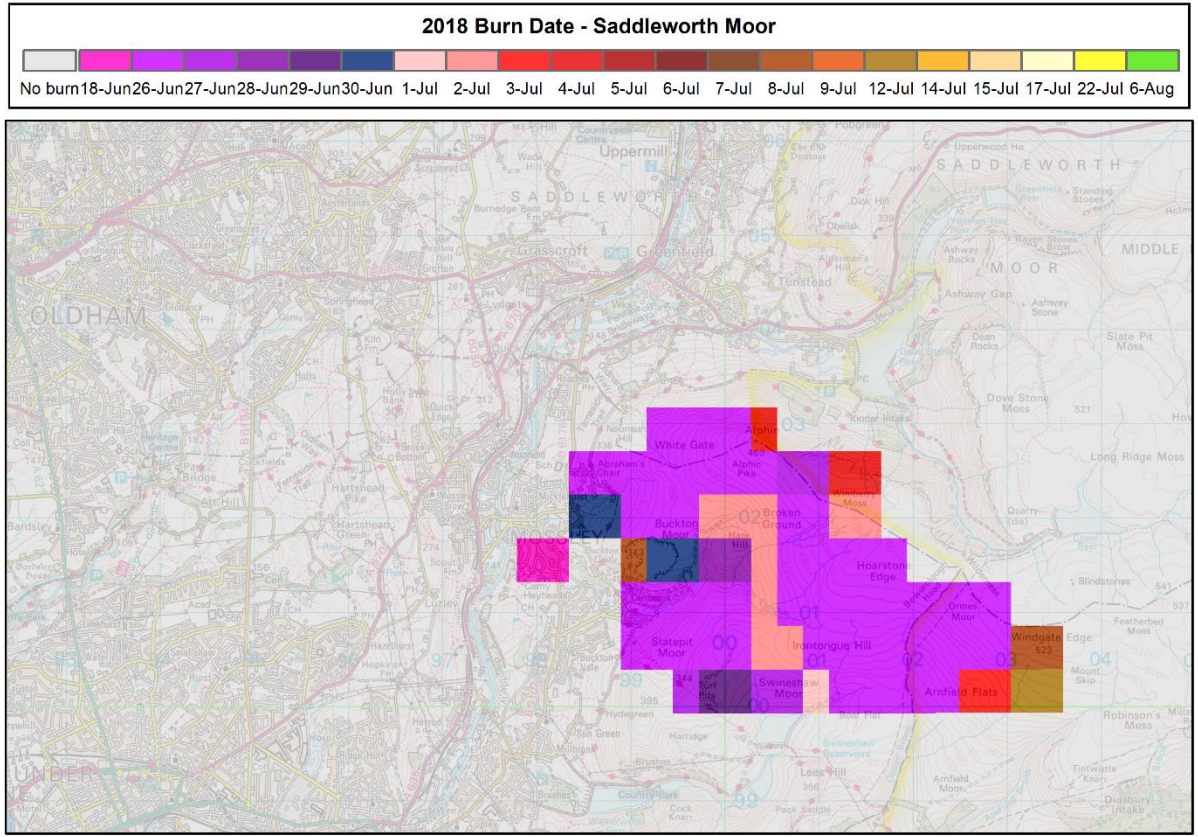
- Significant fire seasons in 2003, 2006, 2011 and 2018
- Feb-April 2019 large wildfires mainly in Scotland (included in EFFIS data but not MODIS)

- Based on limited data
- However, shows two main seasons for England & Wales wildfire



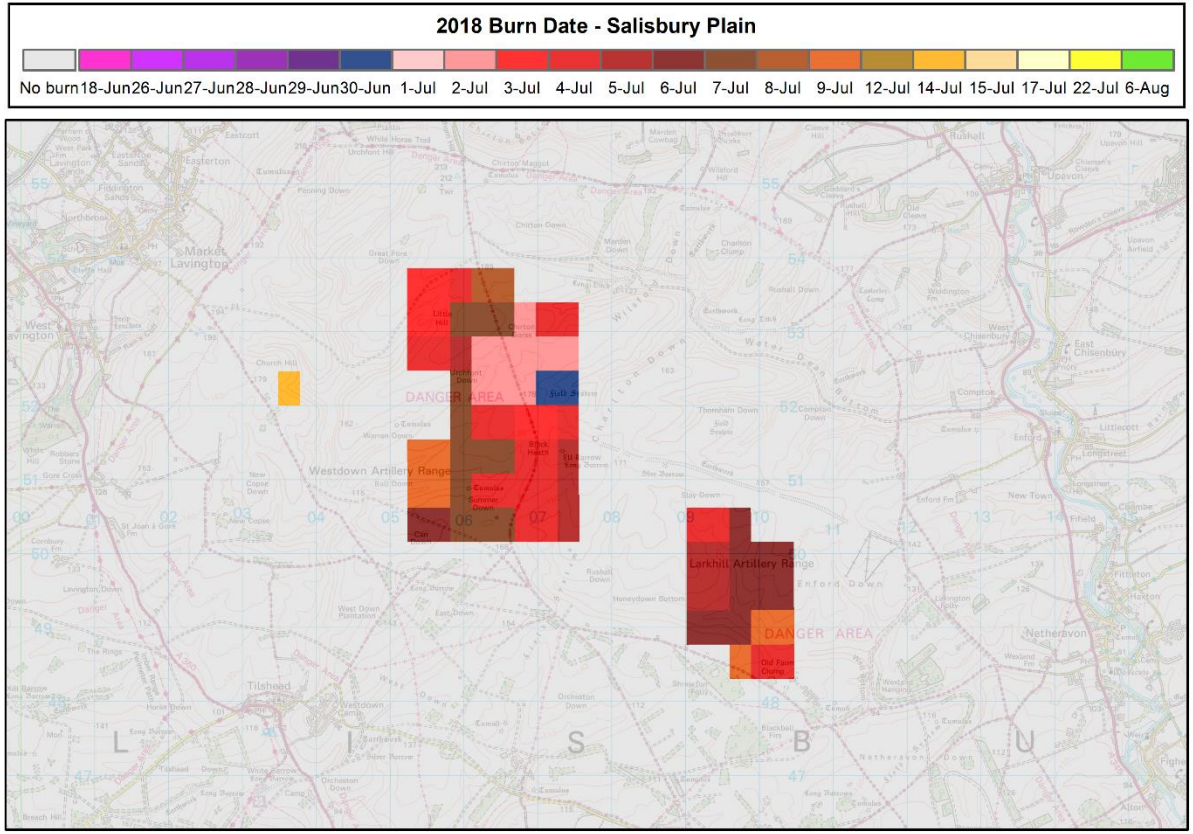
Satellite data June/July 2018

- Burned area by date for Saddleworth Moor
- Rural/urban interface
- Largest area burned 26 June
- Data from MODIS MCD64A1



Satellite data June/July 2018

- Burned area by date for Salisbury Plain
- Main burn dates 2-7 July
- Data from MODIS MCD64A1

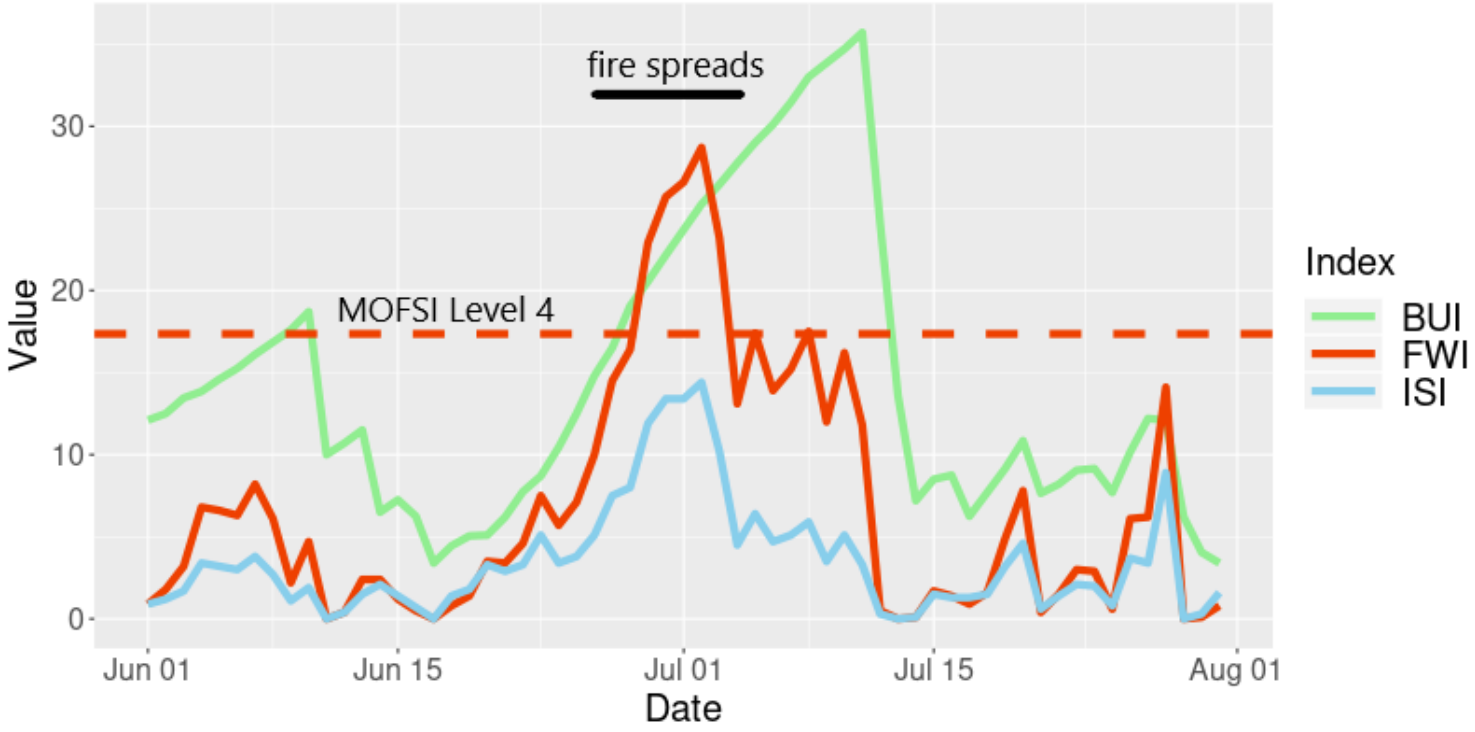


Met Office

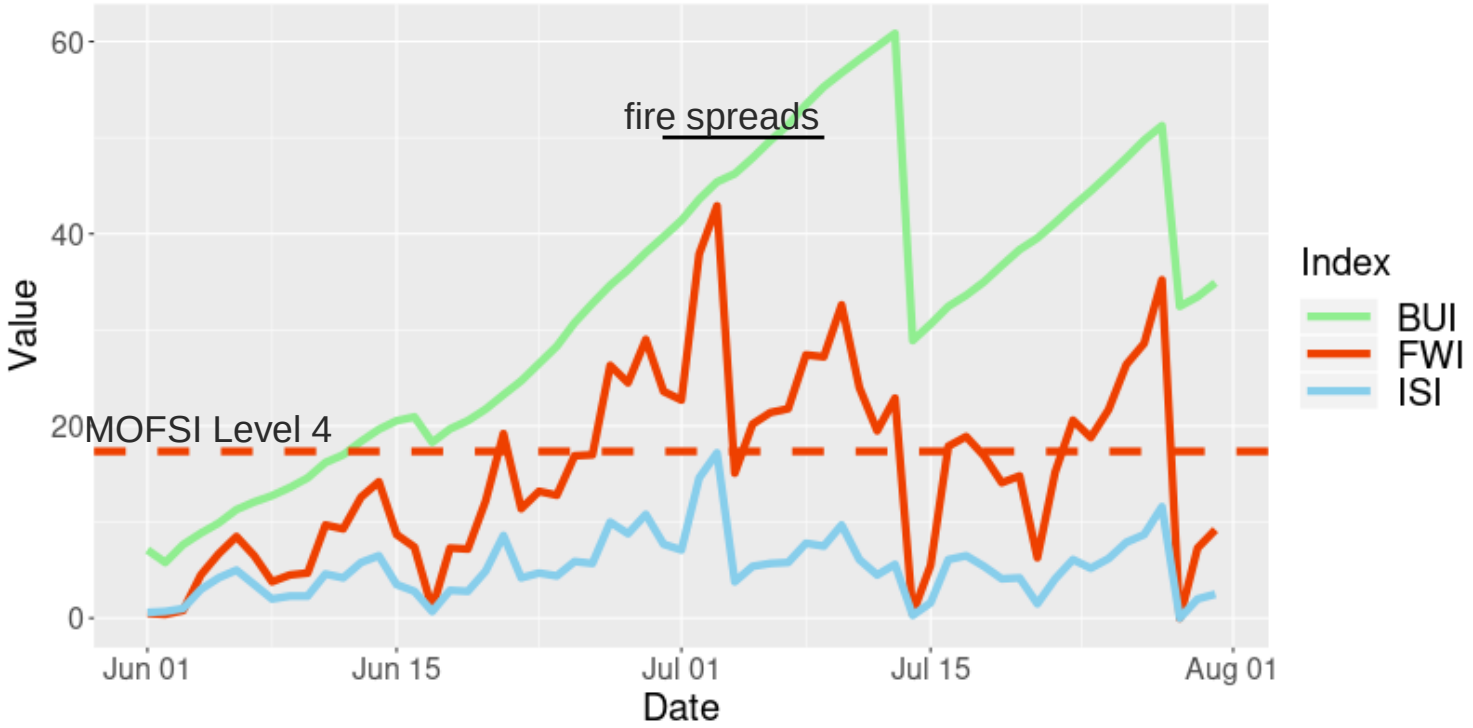
Met Office Fire Severity Index (MOFSI)

- Based on Canadian Fire Weather Index (FWI) model
- MOFSI fire danger classes adapted to the UK and season-dependent
- Combines temperature, humidity, wind and rainfall information
- Estimates the level of intensity of any grass or forest fires ignited
- Comprises 5 sub-indices:
  - Fine Fuel Moisture Content (FFMC): vegetation conditions
  - Initial Spread Index (ISI): rate of spread, mainly due to wind speed
  - Duff Moisture Code (DMC): surface soil conditions
  - Drought Code (DC): deep soil conditions
  - Build-up Index (BUI): precipitation deficit / soil moisture

MOFSI during Saddleworth Moor event June-July 2018

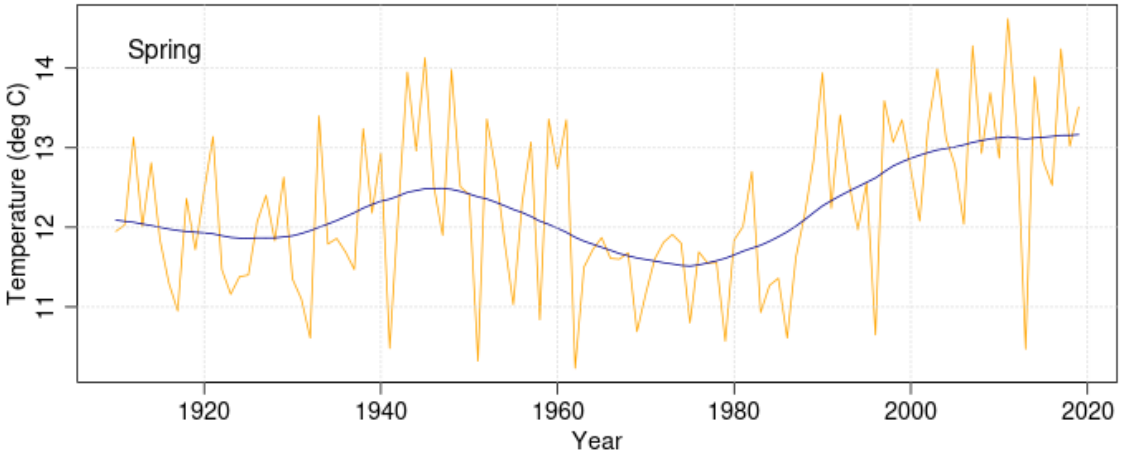


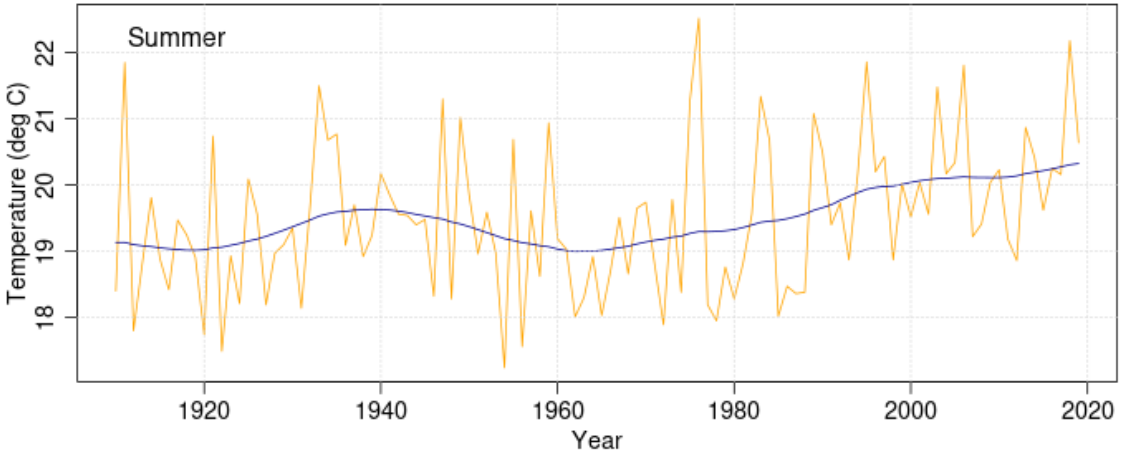
MOFSI during Salisbury Plain event June-July 2018



Observed climate change: temperature

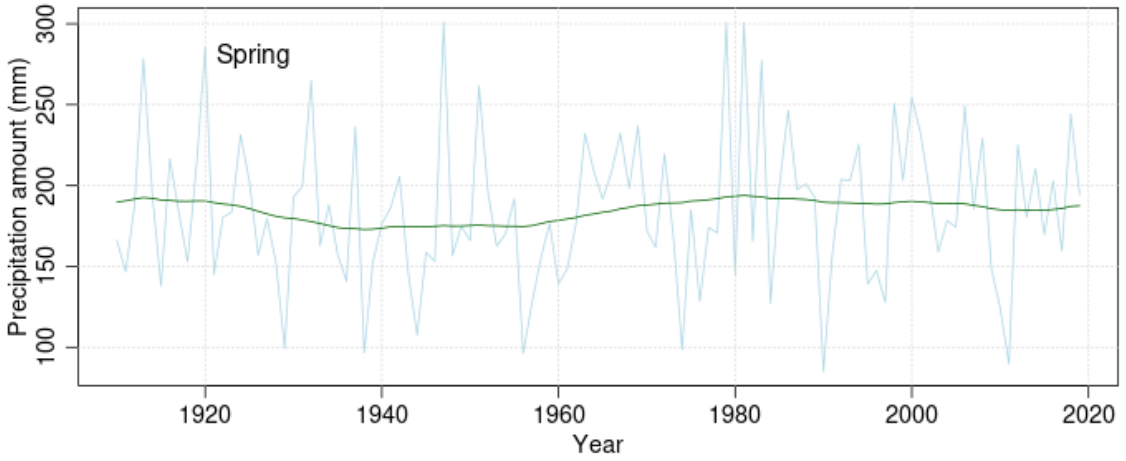
- England & Wales seasonal mean daily maximum air temperature with smoothing line
- HadUK Grid areal average data

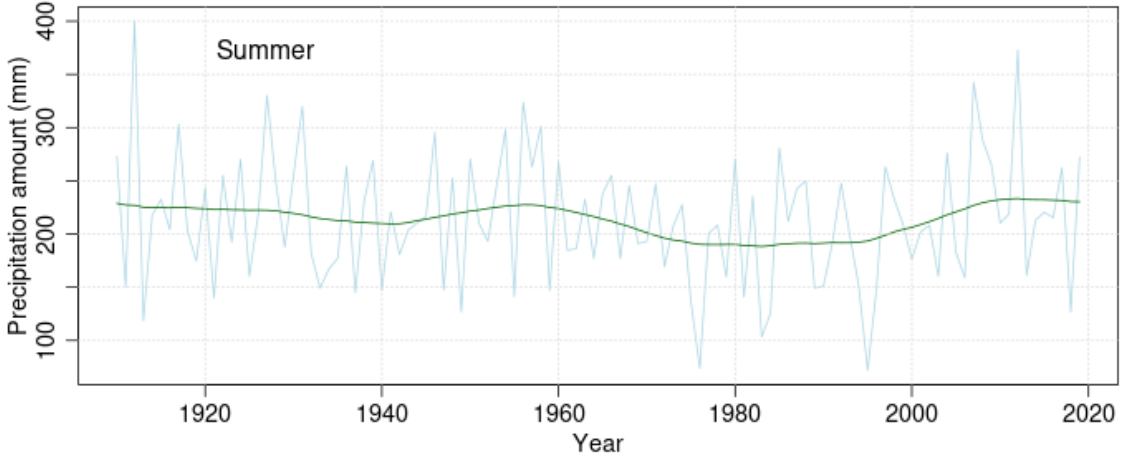




Observed climate change: precipitation

- England & Wales seasonal mean precipitation amount with smoothing line
- See State of the UK climate report https://www.metoffice.gov.uk/research/climate/maps-and-data/about/state-of-climate



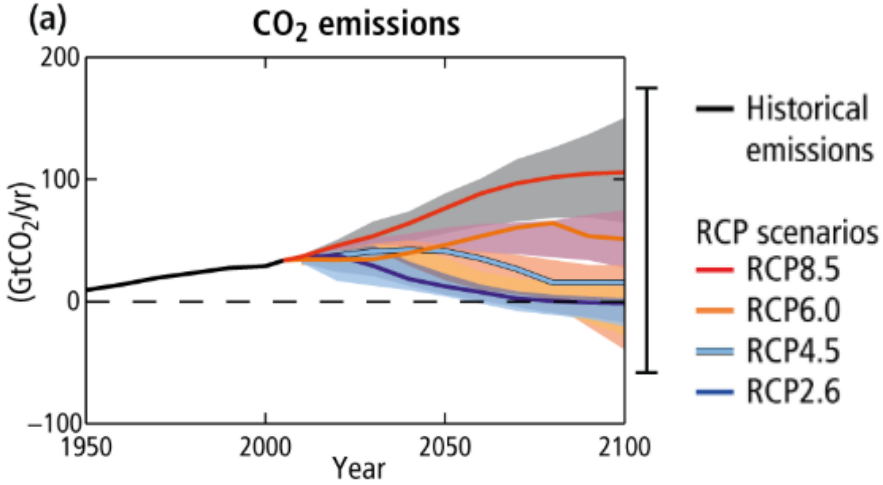


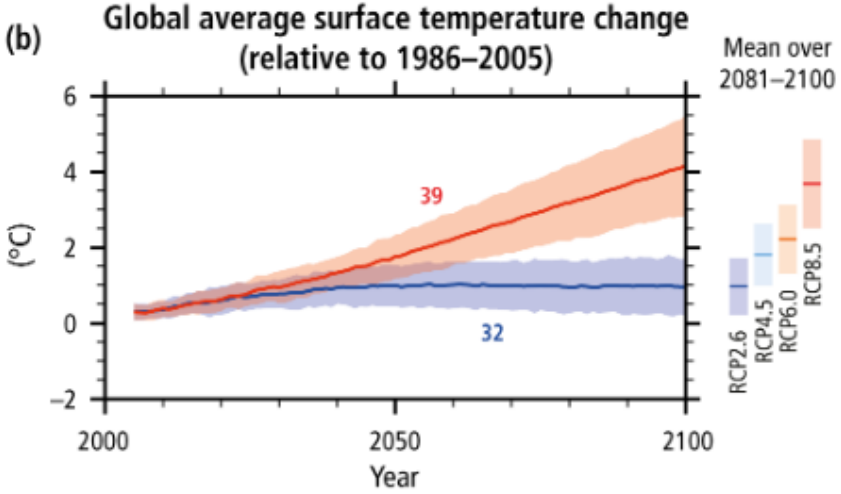
Future changes

Met Office

Climate change scenarios

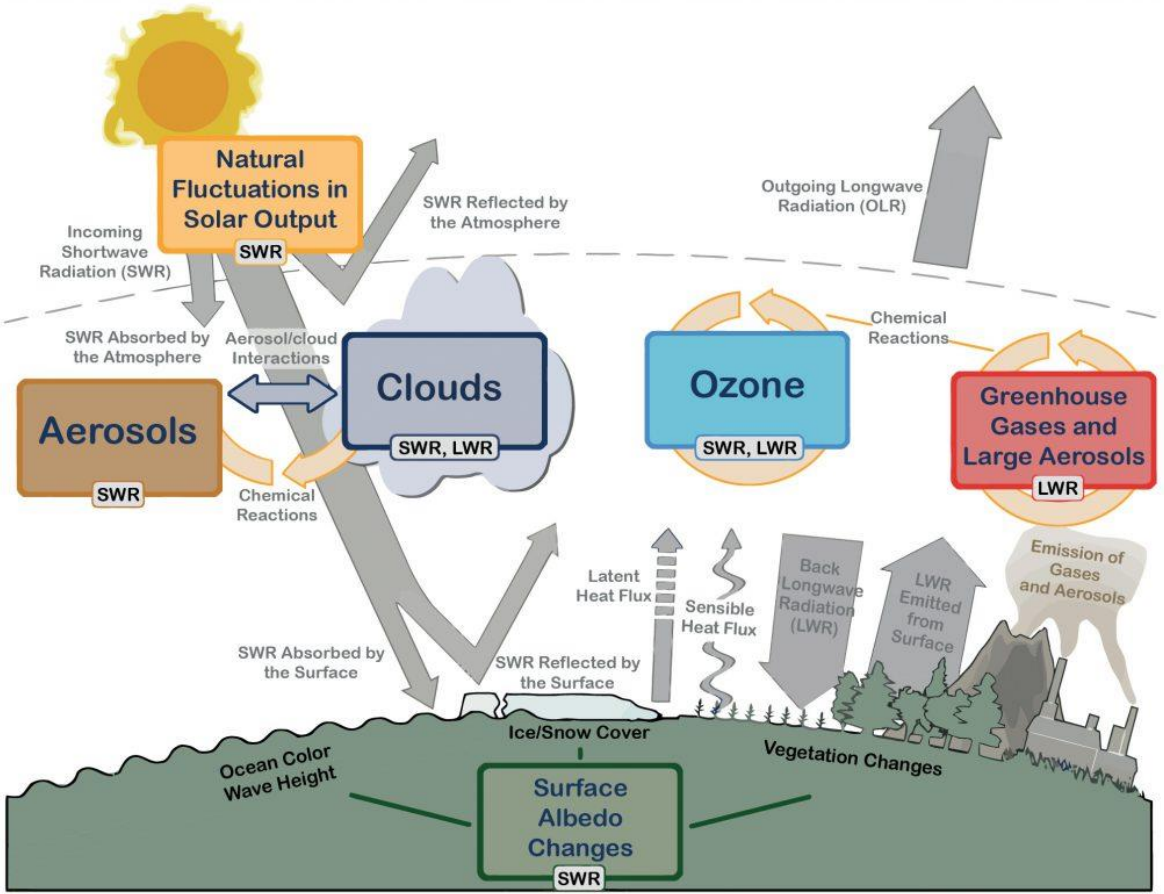
- Representative Concentration Pathways - scenarios for greenhouse gases
- Assumptions about socioeconomic factors
- Plan for a wide range of possible future changes





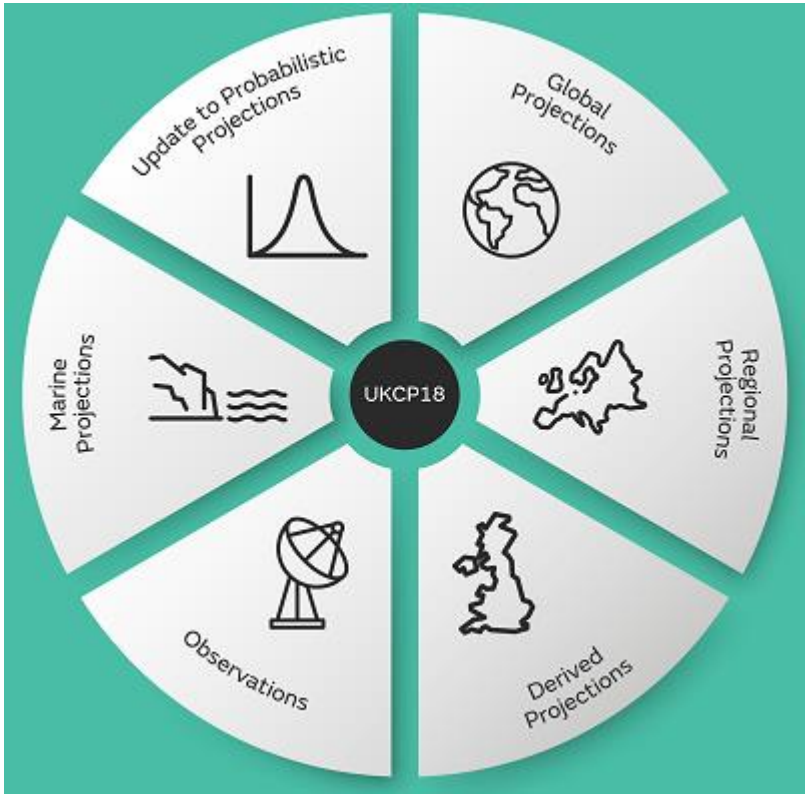
Climate models

- Climate models simulate the atmosphere, oceans, ice and land for the whole planet
- Physical processes are translated into equations written in code which is run on huge supercomputers
- Earth is divided into 3D grid cells – spatial resolution



UK Climate Projections

- UKCP18 – most up-to-date assessment of how the climate of the UK may change over the 21st century
- Set of global projections from different models at 60km resolution
- High resolution UK projections 12km and 2.2km
- Information will help us adapt to manage the growing risks of climate change

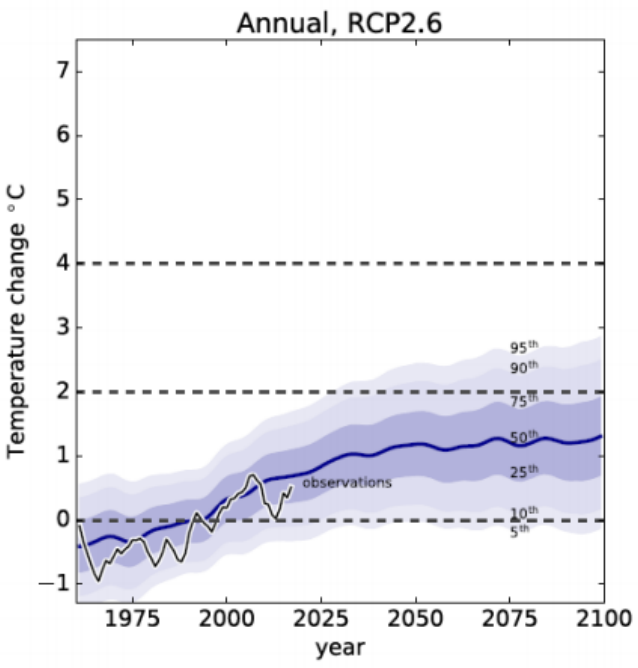


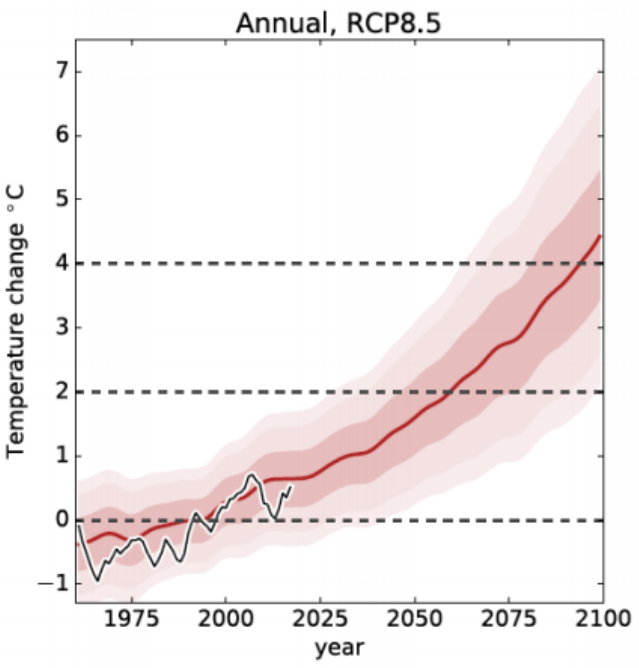
UKCP18 headline result

“A greater chance of **warmer, wetter winters** and **hotter, drier summers**”

UKCP18 key results: temperature

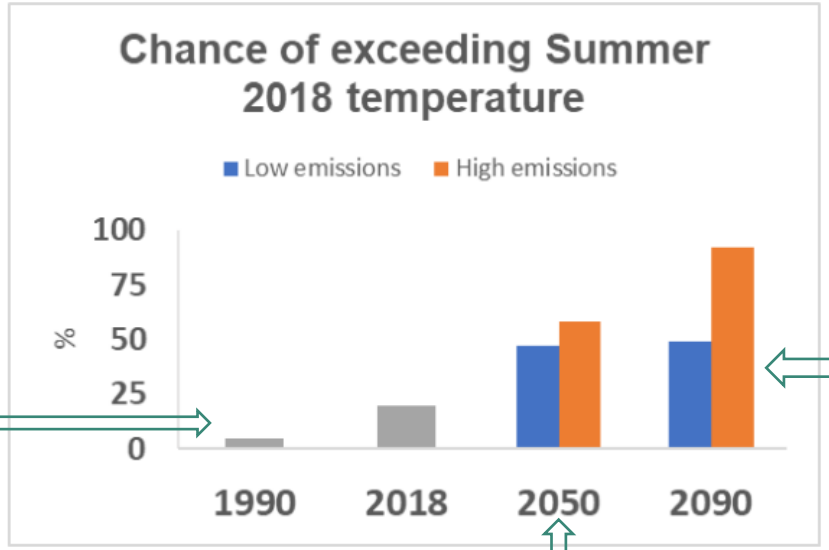
- Future warming depends on the amount of greenhouse gases the world emits
- RCP2.6 compatible with aims to limit warming to 2°C
- In RCP8.5 the rate of change increases towards the end of the century





UKCP18 key results: summer heatwave

Chance of such hot summers as 2018 low in baseline period (<10%)

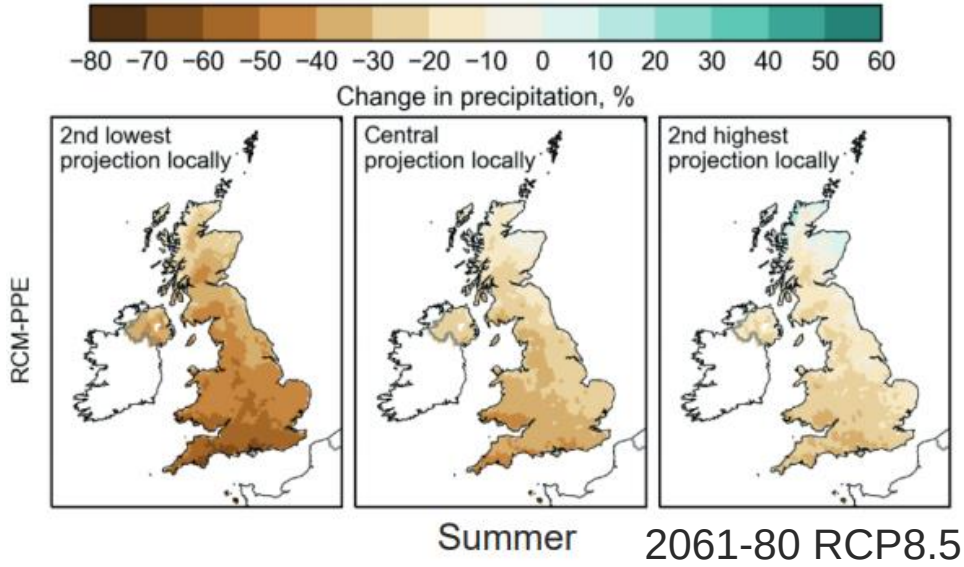


Beyond 2050 the chance of a warmer summer than 2018 depends more strongly on emissions scenario

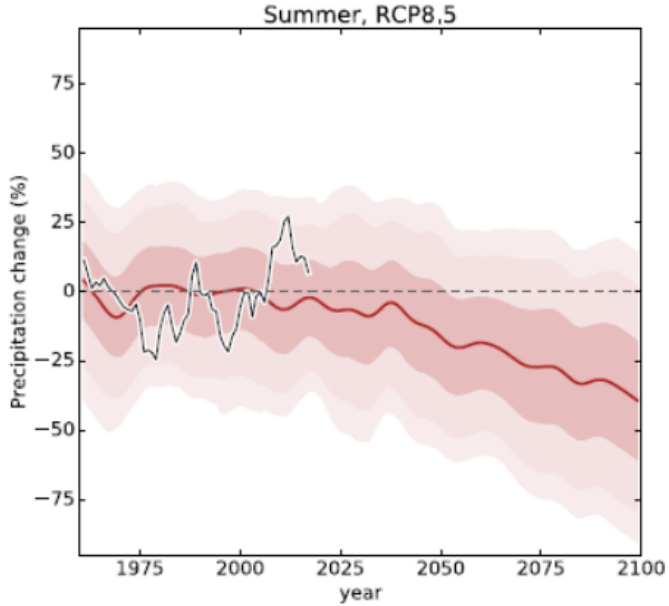
By mid-century the chance of hot summers will be around 50%

UKCP18 key results: precipitation

Summer precipitation is projected to decrease, but when it rains there may be more intense storms



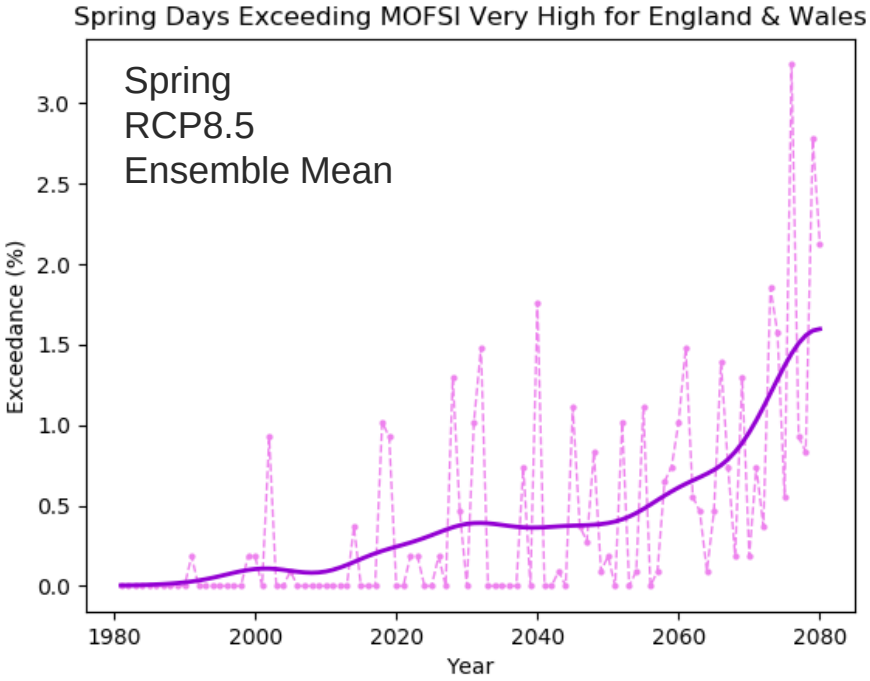
2061-80 RCP8.5

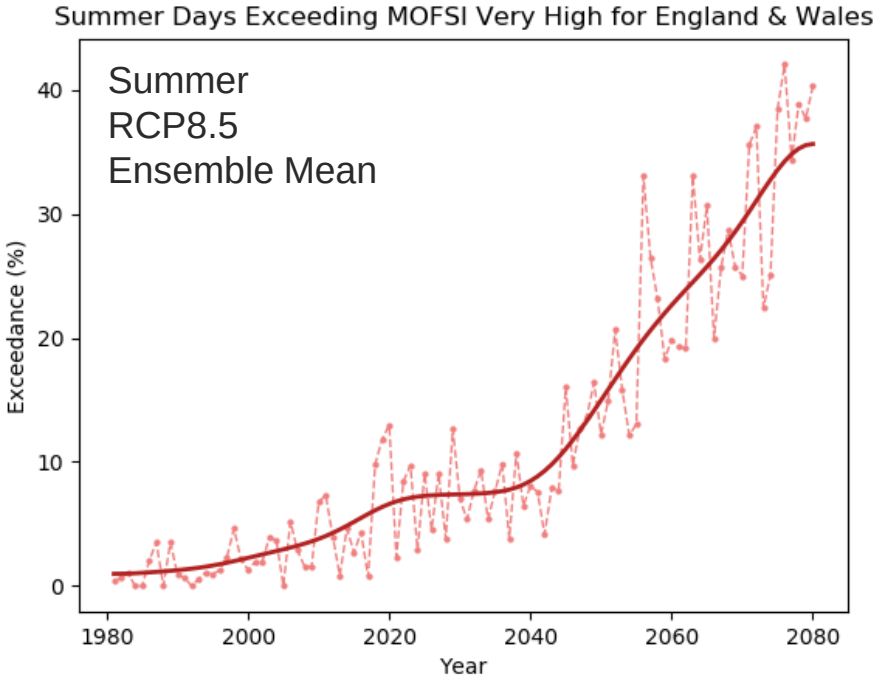


Research on future UK wildfire risk

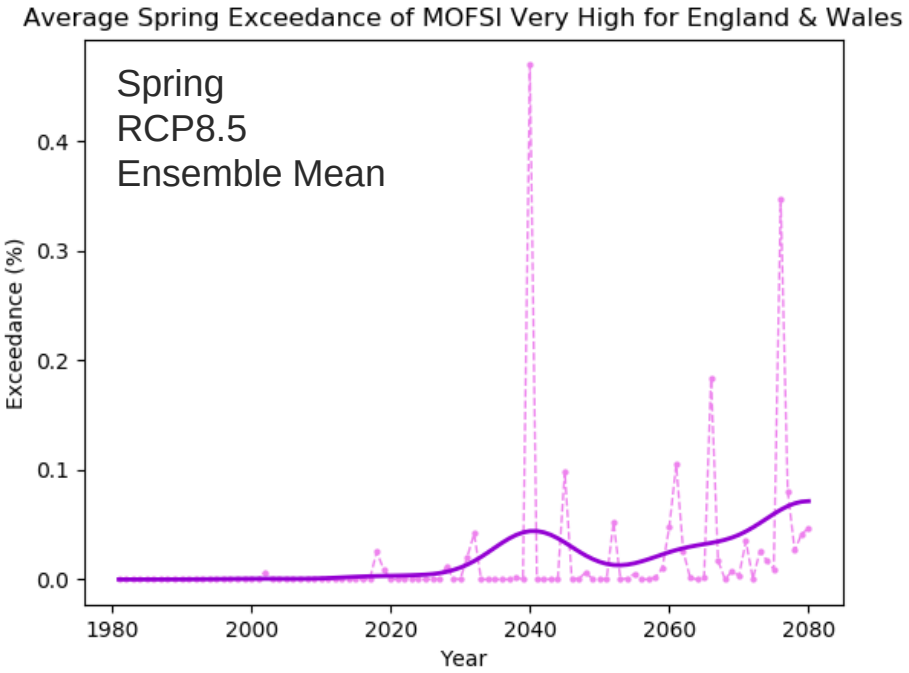
- Research at a preliminary stage
- Expected to feed into 3rd UK Climate Change Risk Assessment (CCRA)
- Based on UKCP18 Regional Projections at 12 km resolution
- Assumes RCP8.5 emissions scenario
- 12 Ensemble Members represent uncertainty in model parameters but doesn't cover full range of uncertainty
- Uses daily temperature, relative humidity, wind speed and precipitation outputs to run FWI model
- Results shown for exceedances of MOFSI 'very high' threshold of 17.4 (summer) and 12.6 (spring)

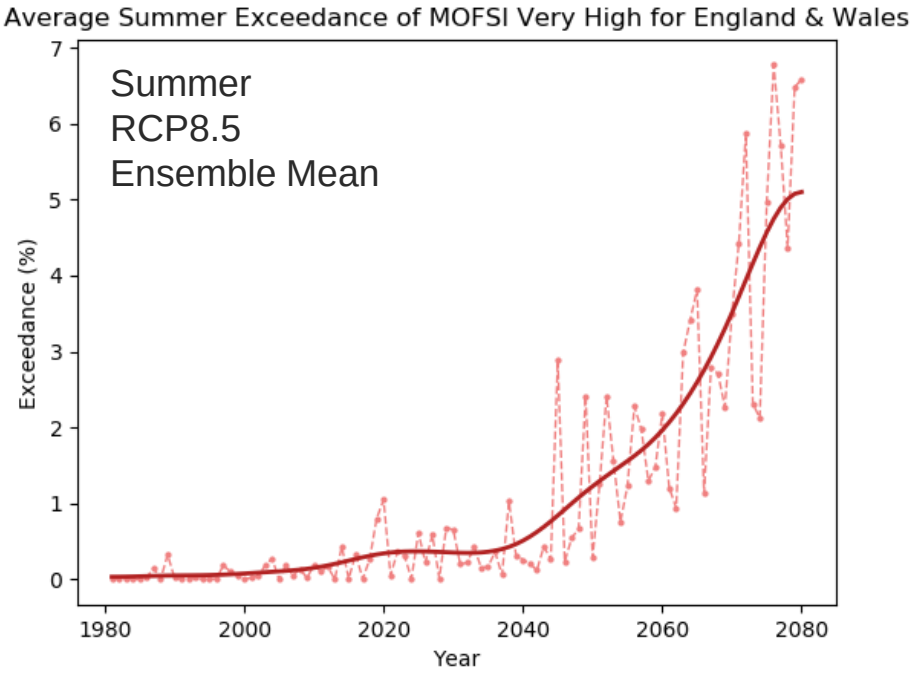
Projection results: % days with ‘very high’ fire danger



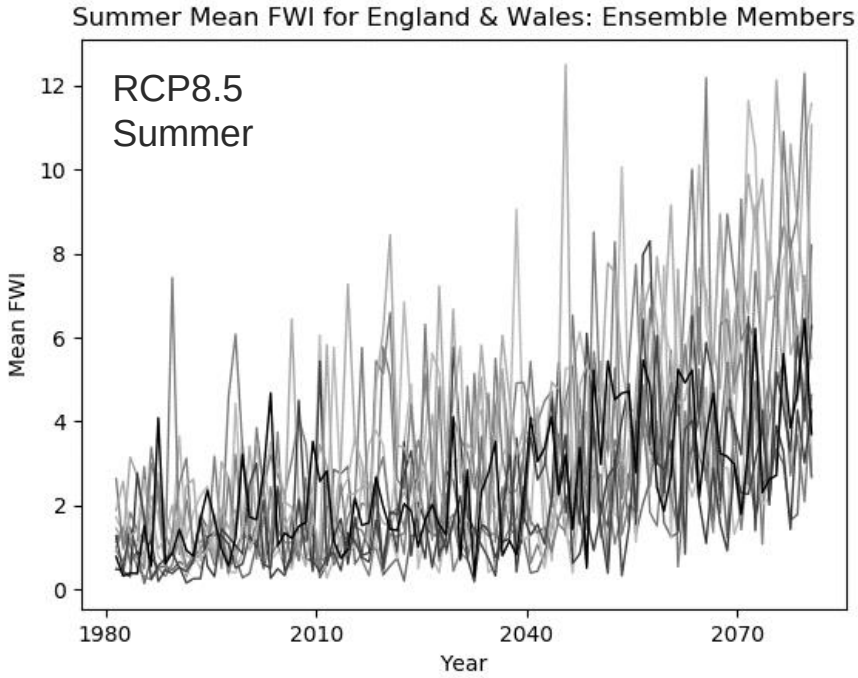


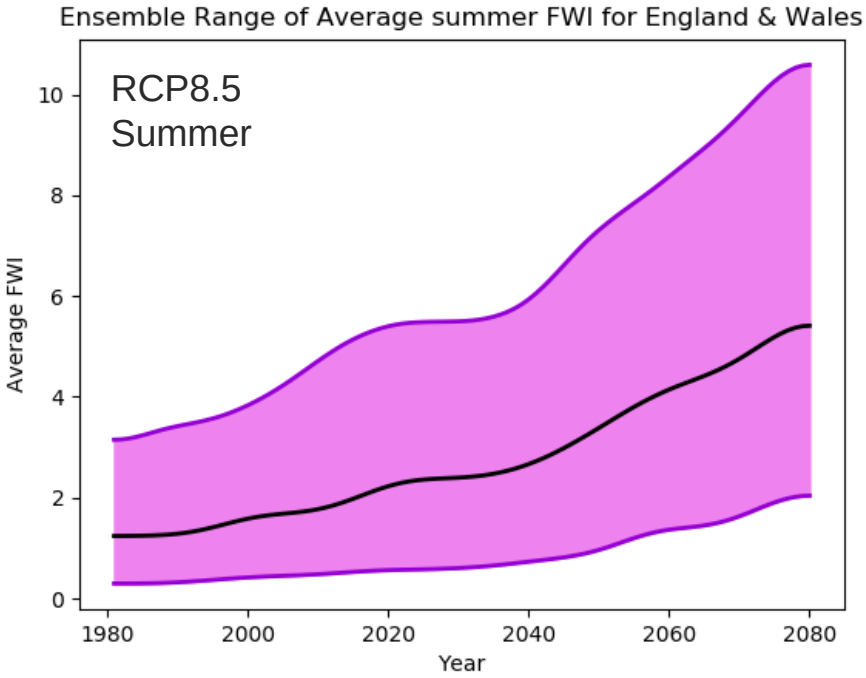
% area with ‘very high’ fire danger





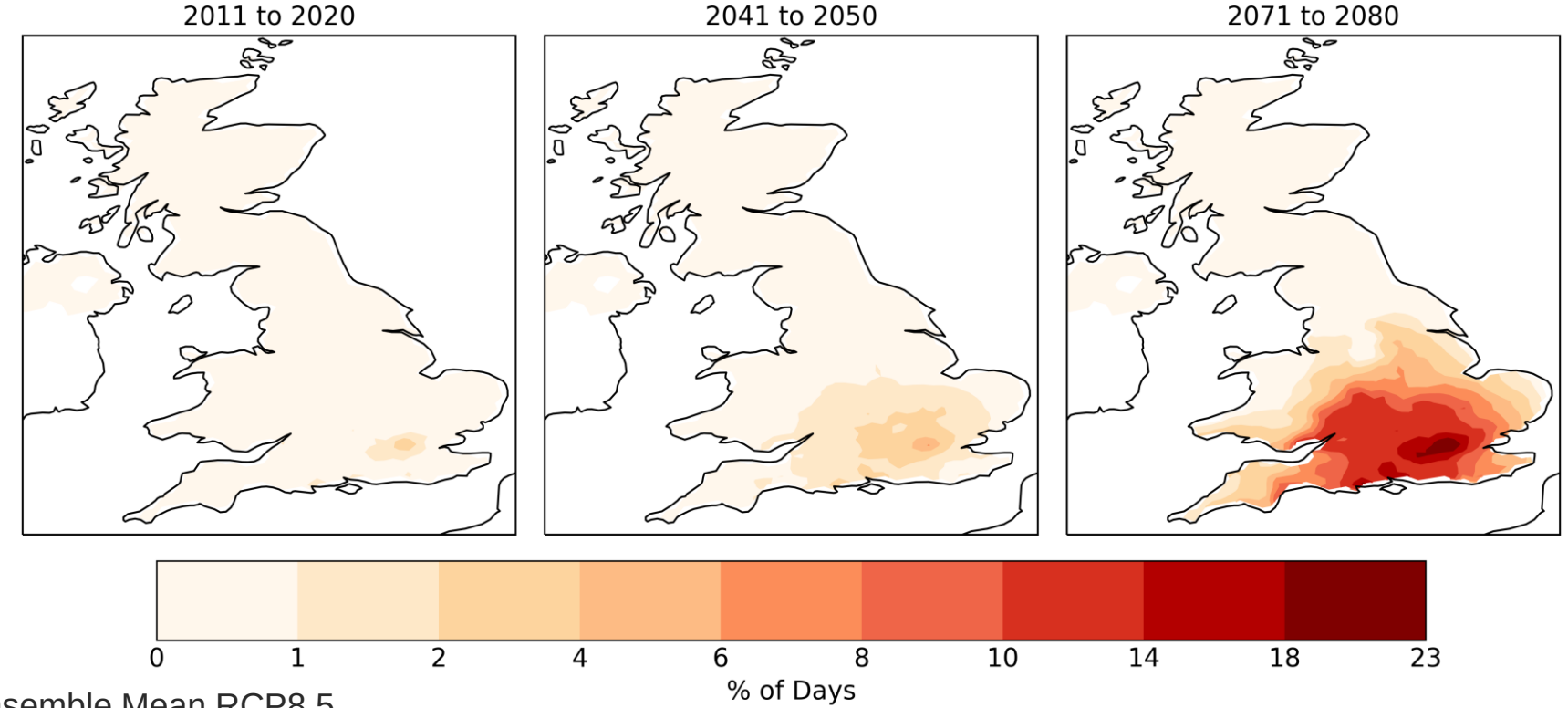
Average FWI Ensemble Range





Met Office

% of summer days for which the FSI exceeds the ‘very high’ threshold



Ensemble Mean RCP8.5

Summary

- Hotter, drier summers in future lead to increasing wildfire hazard
- Rapid increase in fire danger beyond 2050 can be limited if the world is successful in reducing emissions of greenhouse gases
- Warmer, wetter winters may lead to increased production of vegetation
- Consider Adaptation responses

www.metoffice.gov.uk

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