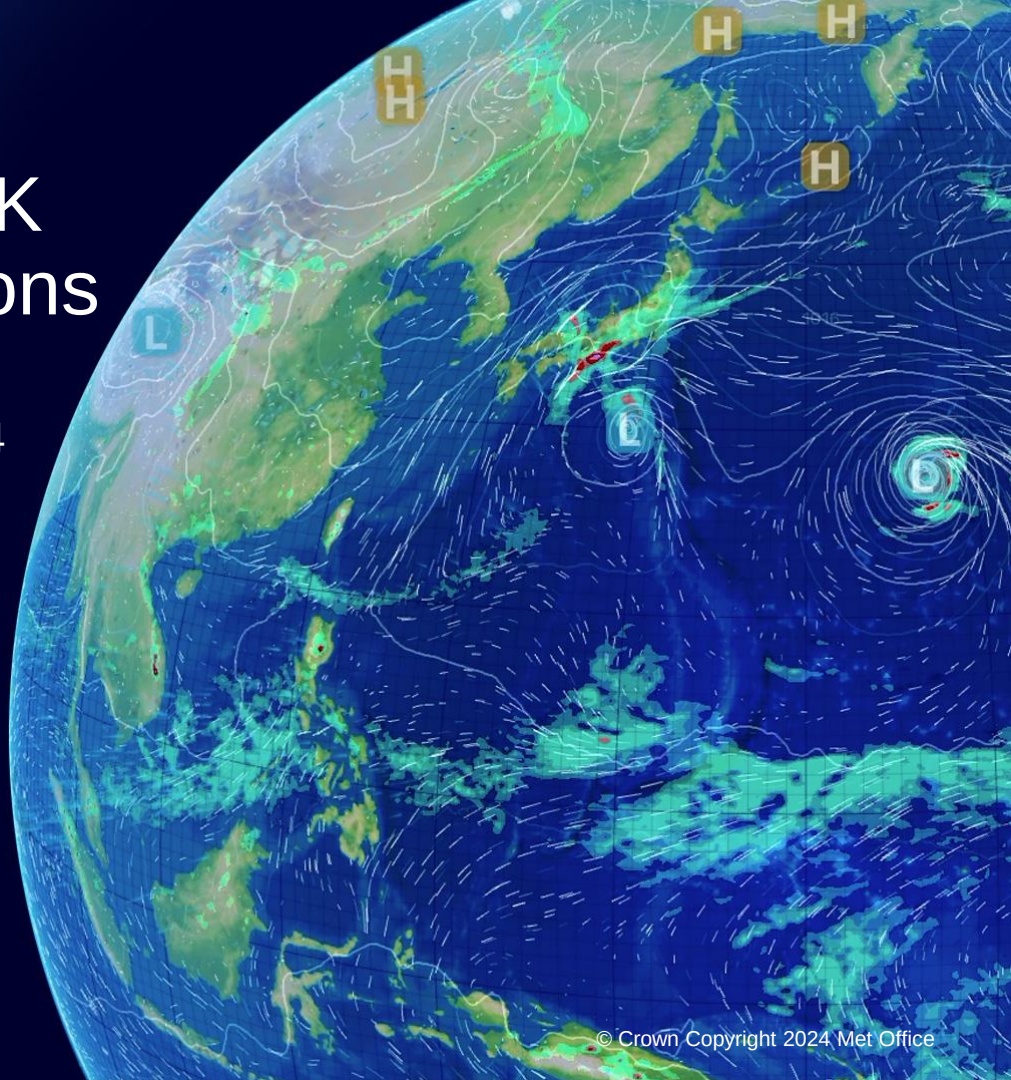
Future Changes in the UK climate and the implications for wheat production

WGIN Stakeholder meeting, 8 February 2024



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Met Office | Department for Environment Food & Rural Affairs | Department for Business, Energy & Industrial Strategy | Environment Agency

UKCP18: Climate change over land

How will the seasons change?

Summers

HOTTER

Winters

MILDER

DRIER

WETTER

How will extremes change?

Maximum temperature of a summer's day could increase by as much as 10°C in some places

Rainfall is expected to be more intense,

Changing climate impacts on agriculture

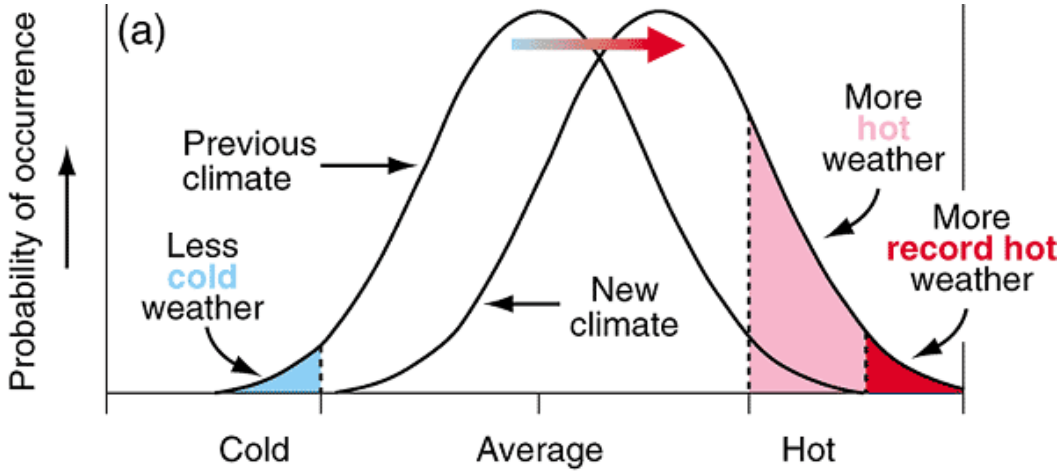
"Climate change poses a direct risk to **crops**, **livestock** and commercial **trees** through increased exposure to **heat stress**, **drought risk**, **waterlogging**, **flooding**, **fire**, and **pests**, **diseases** and **invasive non-native species**"

"Independent Assessment of UK Climate Risk", Climate Change Committee, June 2021

Changing climate impacts on agriculture

Inter-annual variability

- Variability between years is critical
  - ➢ Will still get some cold, wet summers
- Climate change results in increasing likelihood of some extremes



Source: "Climate Change 2001: Working Group I: The Scientific Basis", IPCC, 2001

Hotter, drier summers on average → Increased intensity / frequency of heat waves / droughts

Met Office and the GINs

Met Office / Defra / GIN collaboration

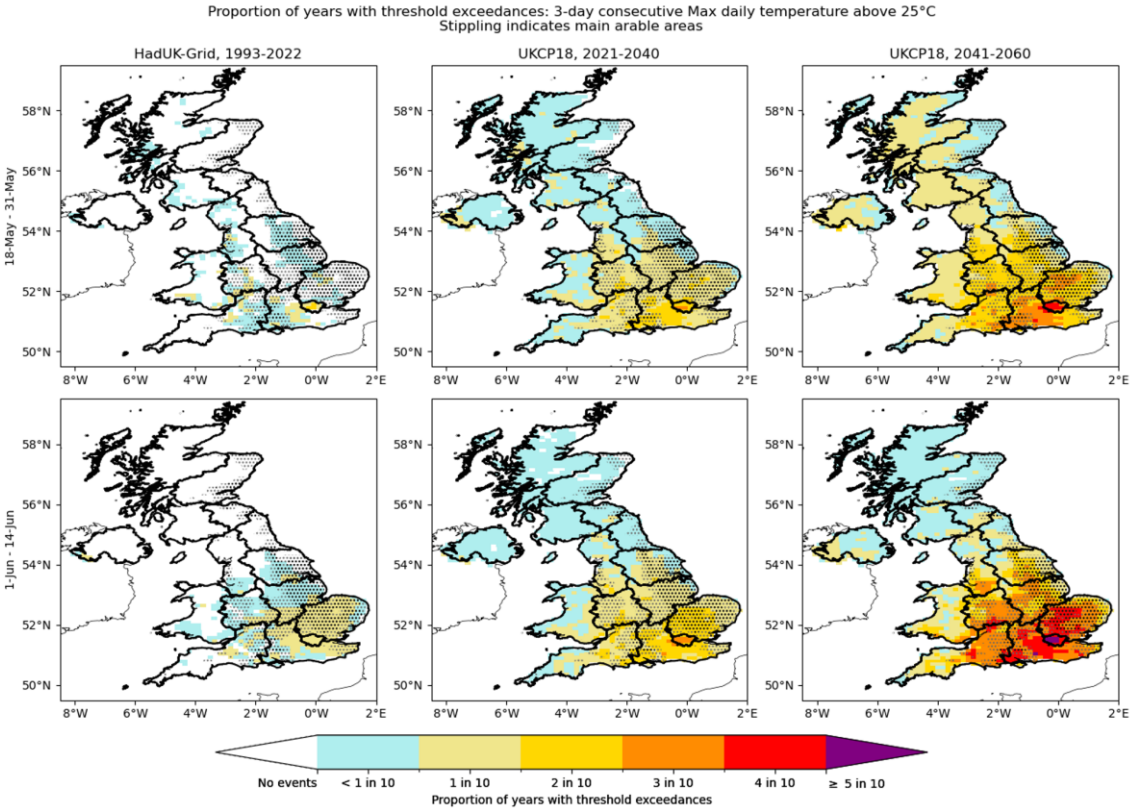
- Defra are seeking to better align work on crop development, climate adaptation and resilience
- Resource made available to develop opportunities for collaboration between Met Office and GINs
  - **2022/23**: Initial case study with **VeGIN**
  - **2023/24**: Further development of **VeGIN** collaboration; new collaboration with **WGIN**

Met Office / WGIN collaboration

- Objective: Use climate information to provide advice on wheat breeding targets
  - Focus on changing heat stress risks during wheat anthesis period
  - Analysis of changes to mean monthly temperatures during main wheat growing period
  - Understanding changes to Growing Degree Days
- WGIN also producing separate report on developmental effects of climate change on UK wheat
  - Review of inventory of current genetic variation for breeding
  - Analysis of potential beneficial interactions between wheat varieties and predicted climate

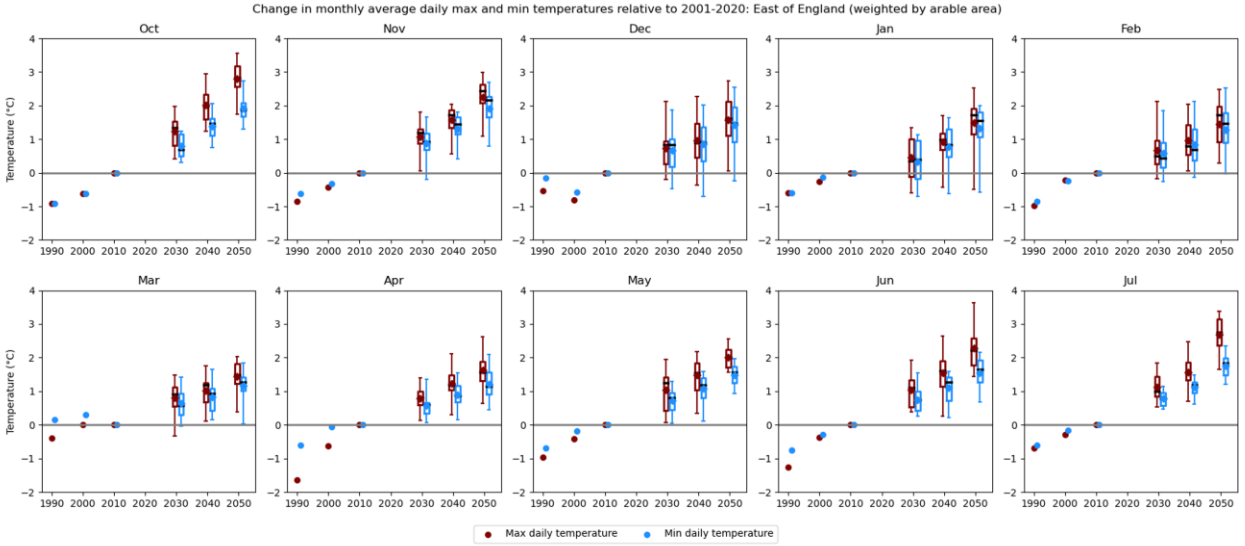
Results

Heat Stress at anthesis



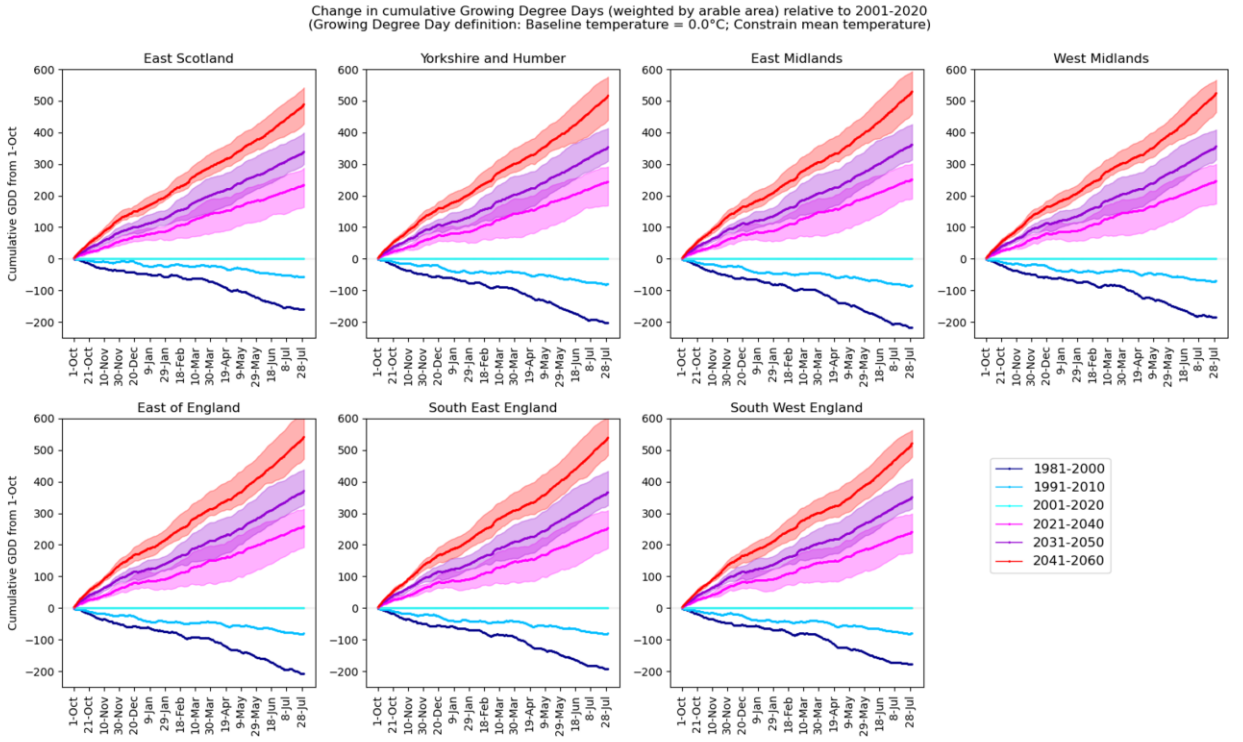
- 2 potential anthesis periods: 18 May-31 May and 1 Jun-14 Jun
- 3 time periods: Historical (1993-2022), Near future (2021-2040), Mid-century (2041-2060)
- Heat stress events occur 2-3 (or more) years out of 10 by mid-21st century across arable region

Mean monthly temperature projections during the main wheat growing period



- All months show increases in average daily maximum and daily minimum temperatures
- Increases are not uniform across the year, or for each variable
- Projected increases are smaller during the winter months (Dec – Feb) than at other times of year
- Average daily maximum temperatures are projected to increase by more than average daily minimum temperatures

Growing Degree Days



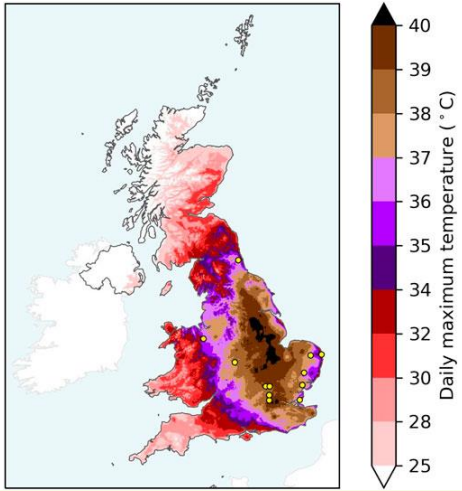
- Change in cumulative GDD from 1 October by region
  - Weighted by arable area (Marston et al., 2022)
  - Relative to 2001-2020 for selected historic and future periods
- Over the October – July growing period, cumulative GDD increases for all regions
  - Increases of around 500 GDD by the 2041-2060 period (compared to 2001-2020)

Other activity

- Paper exploring **impacts** and **adaptation options** through two case studies, the UK **poultry** and **wheat** sectors in 2022:
  - "*2022 UK heatwave impacts on agrifood: implications for a climate-resilient food system*"[1]

UK maximum temperatures on 19 July 2022

- Yellow dots represent supermarket stores that experienced refrigeration system issues during the summer 2022 heatwave



Region	2022 wheat yield (%) difference relative to 2017–2021 average
UK	8.1
North East	8.6
North West	10.9
Yorkshire	11.2
East Midlands	10.2
West Midlands	10.6
Eastern	3.3
South East	6.5
South West	8.8
Wales	10.1
Scotland	14.6

[1] "*2022 UK heatwave impacts on agrifood: implications for a climate-resilient food system*" (Davie et al., 2023) https://doi.org/10.3389/fenvs.2023.1282284

Further Research

- Wider range of weather / climate variables E.g.:
  - Heavy rainfall and drying days at pre-drilling and drilling
  - High overnight temperatures in spring and summer
- Compound events
- Changing pest and disease risks

Thank you

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