

# JULES-IMOGEN

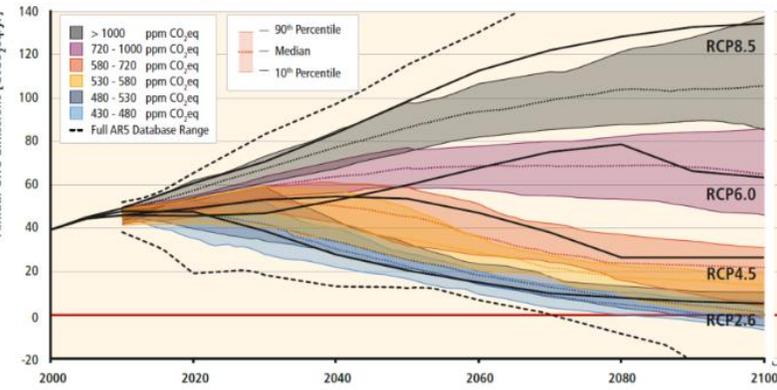
## a useful tool

Eleanor Burke and Chris Huntingford

# What is IMOGEN?

- An intermediate complexity climate model used to evaluate global and region terrestrial impacts of a changing climate
- Uses a pattern-scaling approach to climate change to drive a gridded version of JULES
- Emulates a range of future pathways representative of the available GCM simulations
- Includes radiative forcing from both CO<sub>2</sub> and CH<sub>4</sub>

GHG Emission Pathways 2000-2100: All AR5 Scenarios



Prescribed Anthropogenic Emissions

Atmospheric Composition

Simple Ocean Uptake Model

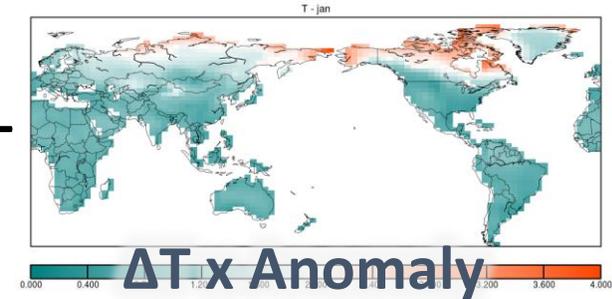
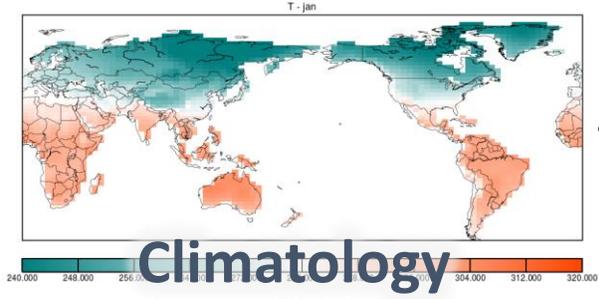
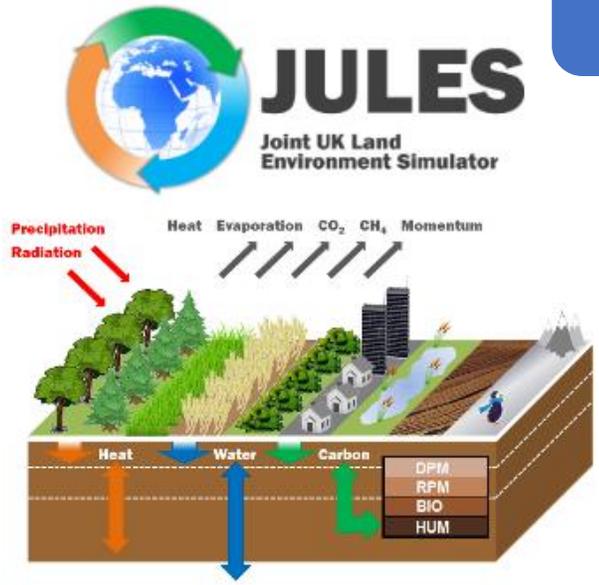
# IMOGEN

Energy Balance Model

JULES Estimates Land Carbon Exchange

Global Warming

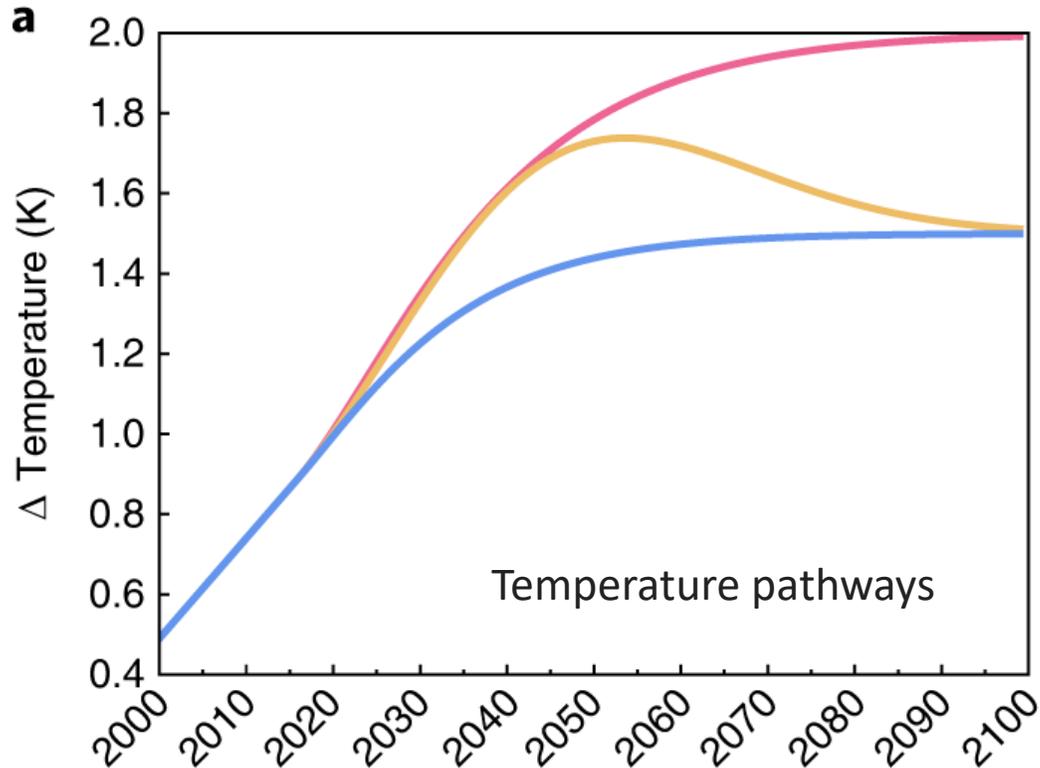
Pattern Scale of Met Data from 34 GCMs



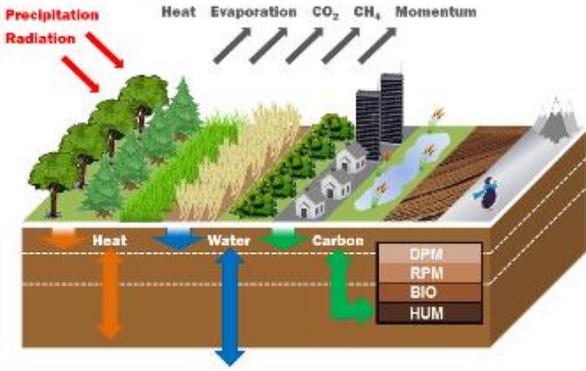
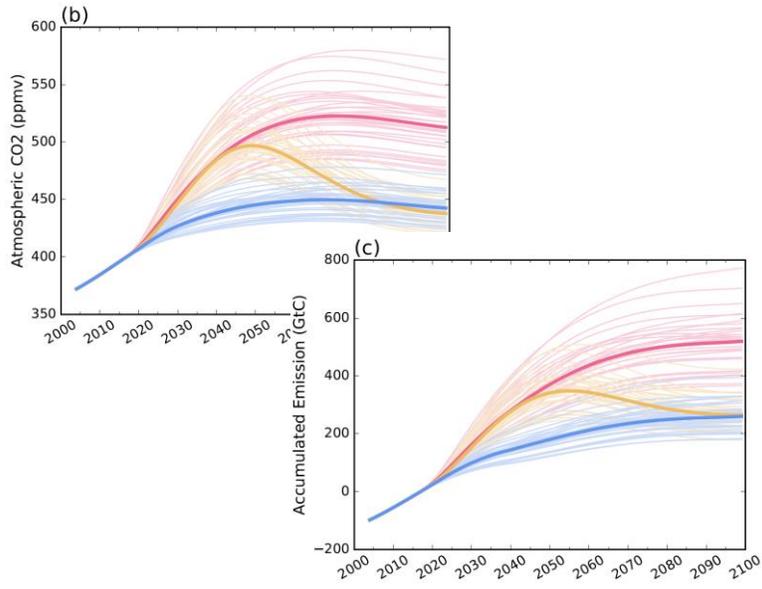
[GMD - IMOGEN: an intermediate complexity model to evaluate terrestrial impacts of a changing climate \(copernicus.org\)](http://copernicus.org)

# Inverted IMOGEN

- Follows prescribed global warming pathways



[ESD - Flexible parameter-sparse global temperature time profiles that stabilise at 1.5 and 2.0 °C \(copernicus.org\)](#)



Derived Anthropogenic Emissions

Atmospheric Composition

Simple Ocean Uptake Model

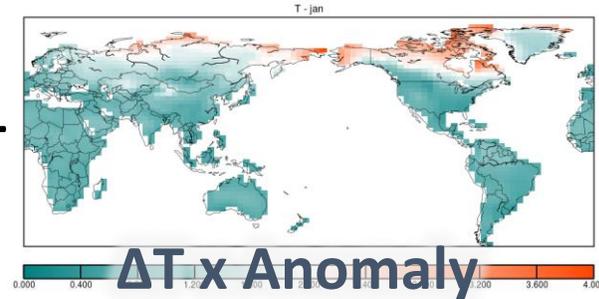
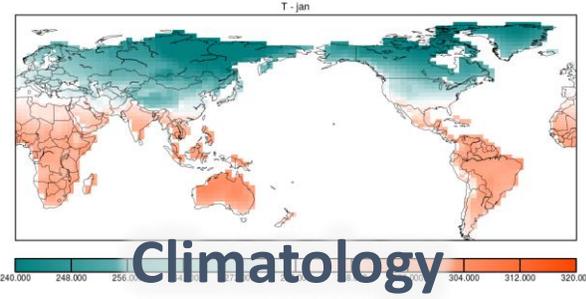
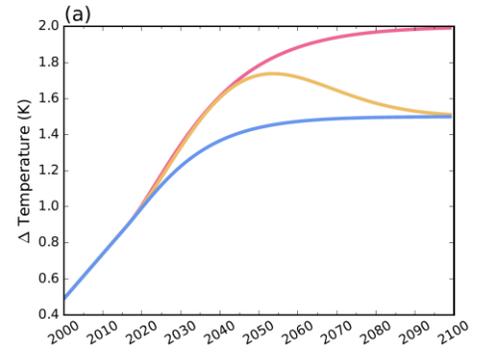
Inverted Energy Balance Model

**IMOGEN<sup>-1</sup>**

JULES Estimates Land Carbon Exchange

Global Warming

Pattern Scale of Met Data from 34 GCMs



Carbon budgets for 1.5 and 2 °C targets lowered by natural wetland and permafrost feedbacks | Nature Geoscience

# Selected applications

[Significant feedbacks of wetland methane release on climate change and the causes of their uncertainty \(iop.org\)](#)

[Carbon budgets for 1.5 and 2 °C targets lowered by natural wetland and permafrost feedbacks | Nature Geoscience](#)

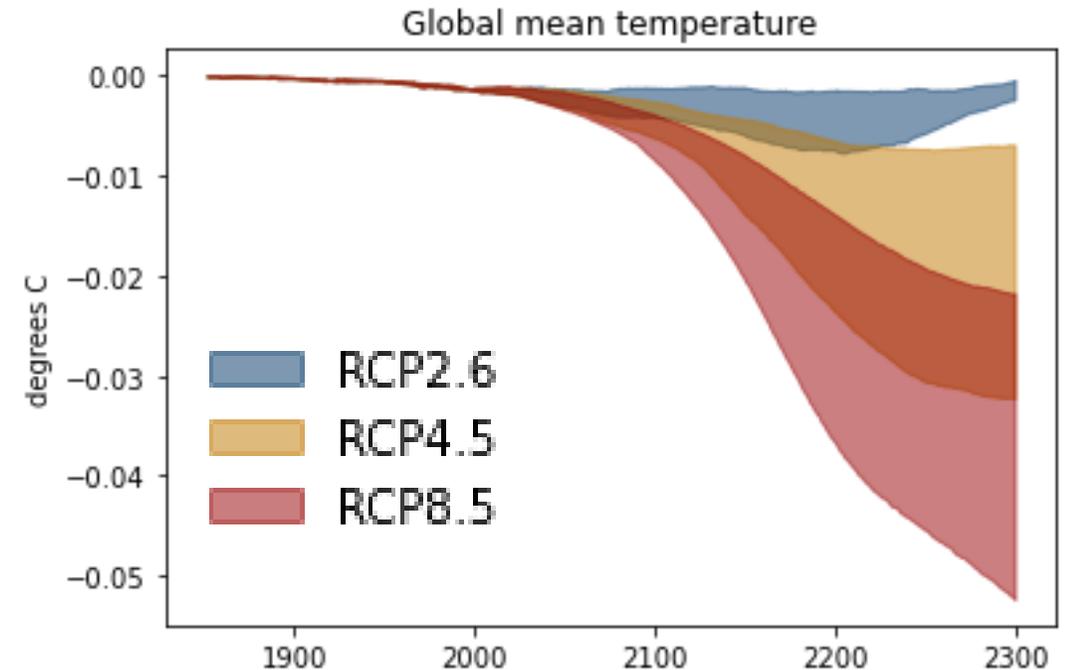
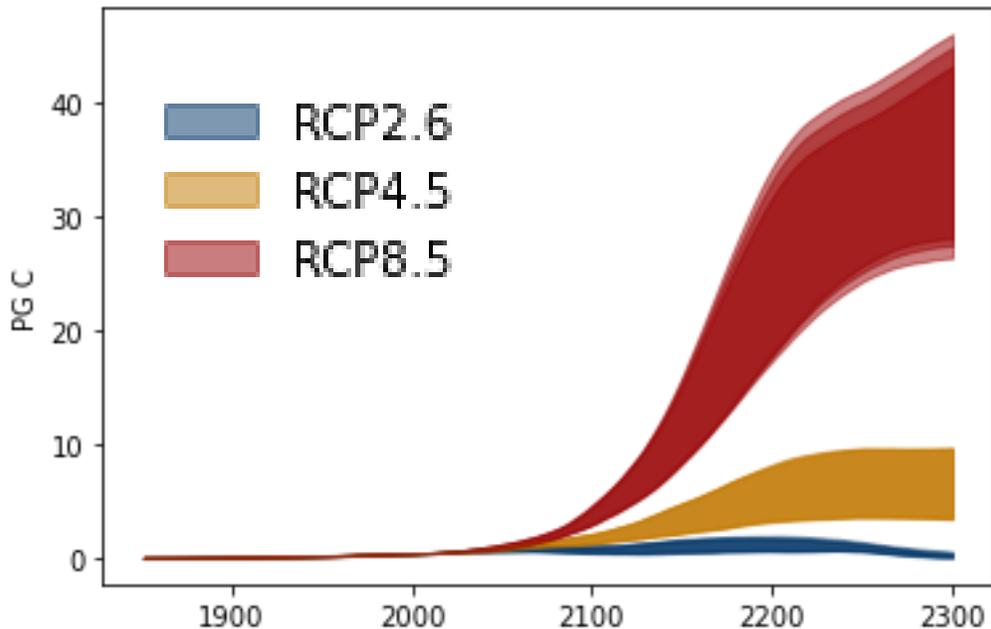
[Land-use emissions play a critical role in land-based mitigation for Paris climate targets | Nature Communications](#)

[ESD - Regional variation in the effectiveness of methane-based and land-based climate mitigation options \(copernicus.org\)](#)

[CO2 loss by permafrost thawing implies additional emissions reductions to limit warming to 1.5 or 2 °C - IOPscience](#)

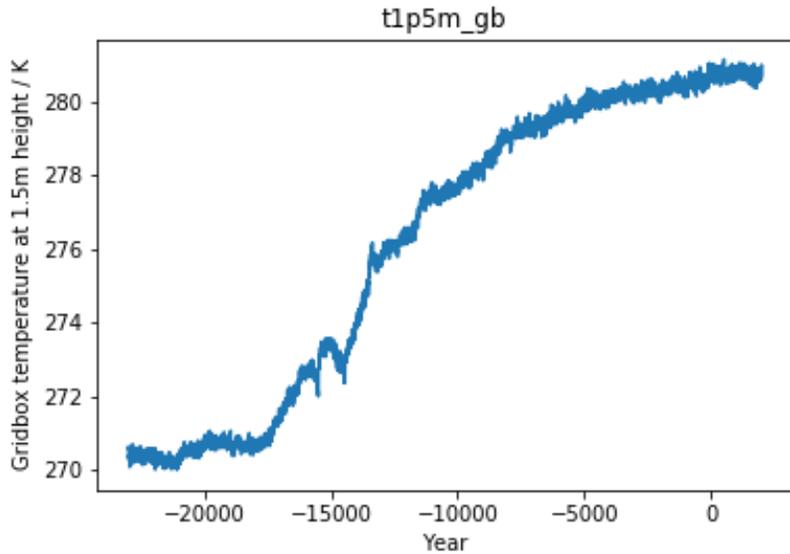
# Thawing permafrost as a nitrogen fertiliser: implications for climate feedbacks

Increase in vegetation C  
after N fertilization from  
thawing permafrost.



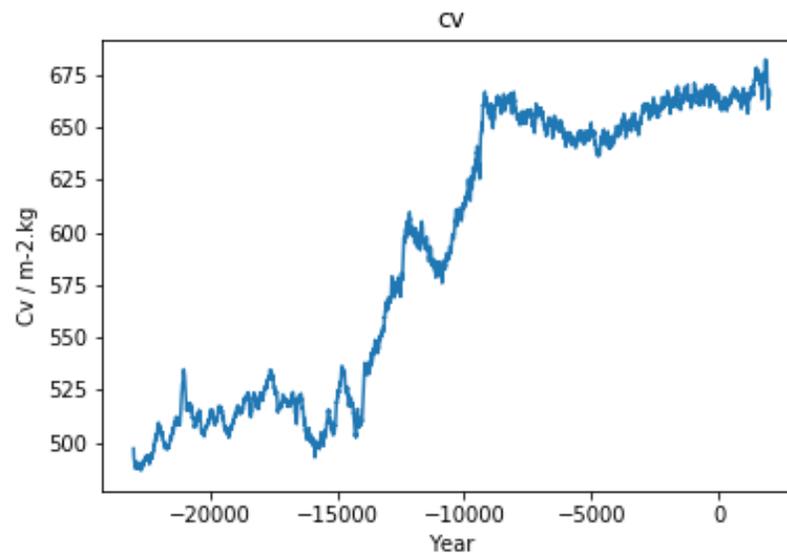
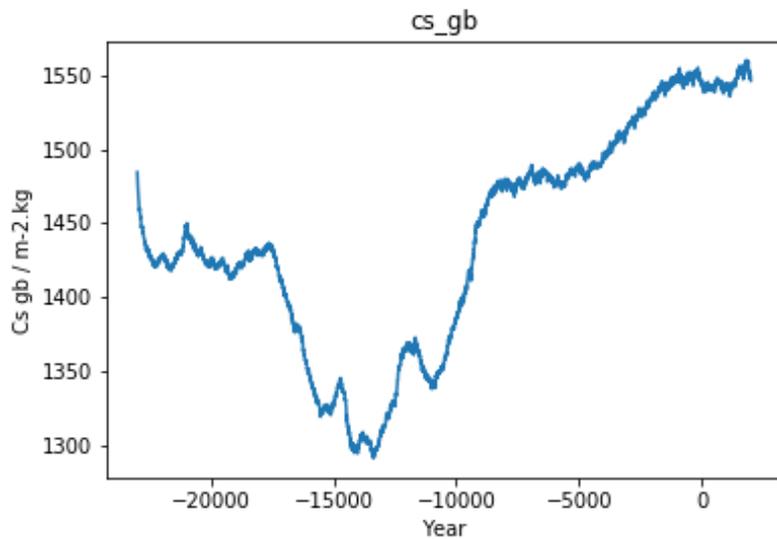
Negative feedback onto  
global mean temperature

# Paleo-JULES-IMOGEN



Preliminary work setting up a paleo simulation with JULES-IMOGEN.

Not quite finished because has a present-day ice-sheet.



# Future directions

Testing the impact of multiple climate feedbacks including permafrost, fire and landuse.

Updating scenarios and driving GCM patterns to CMIP6 and increasing resolution to 0.5 degrees.

Possible linking with the FAIR climate model.