Showcasing PRIME: Probabilistic Regional Impacts from Model patterns and Emissions

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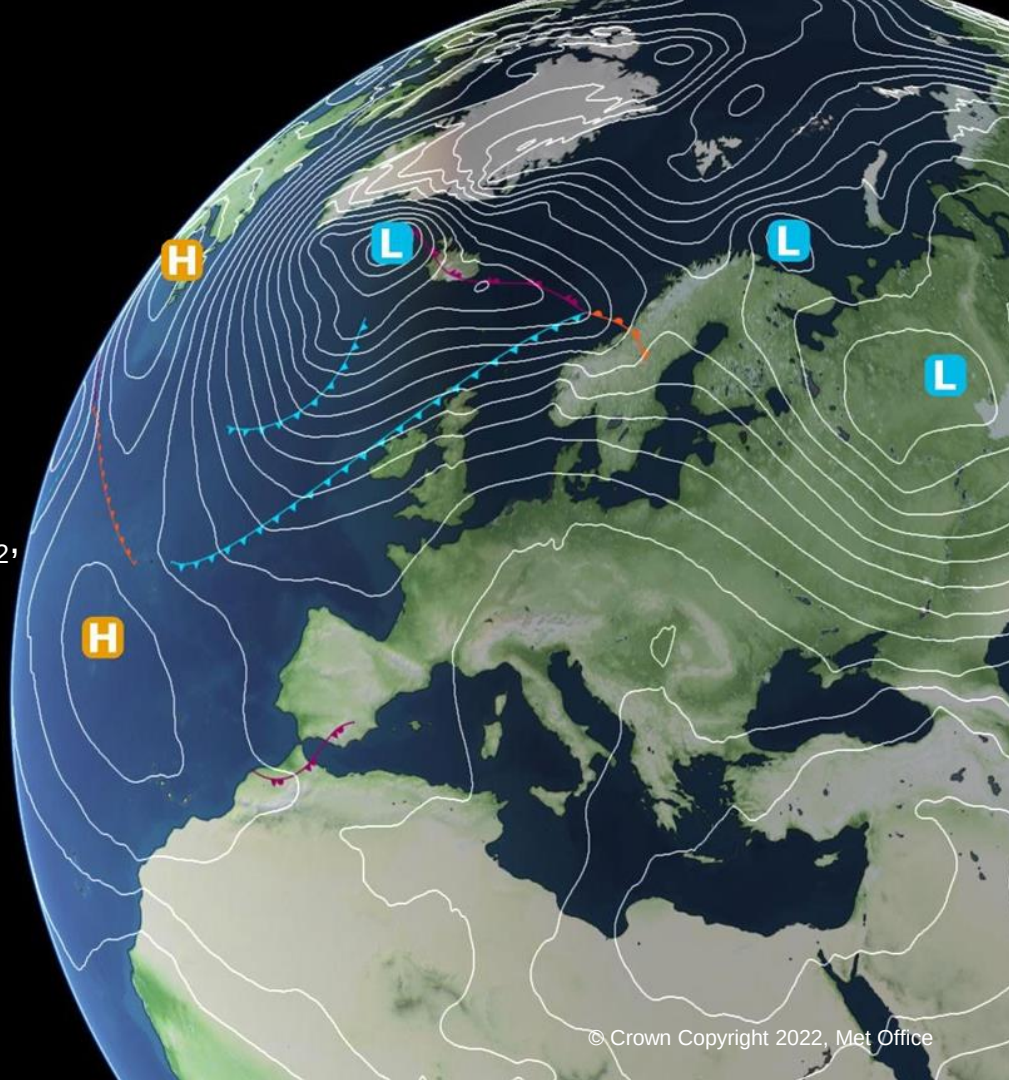

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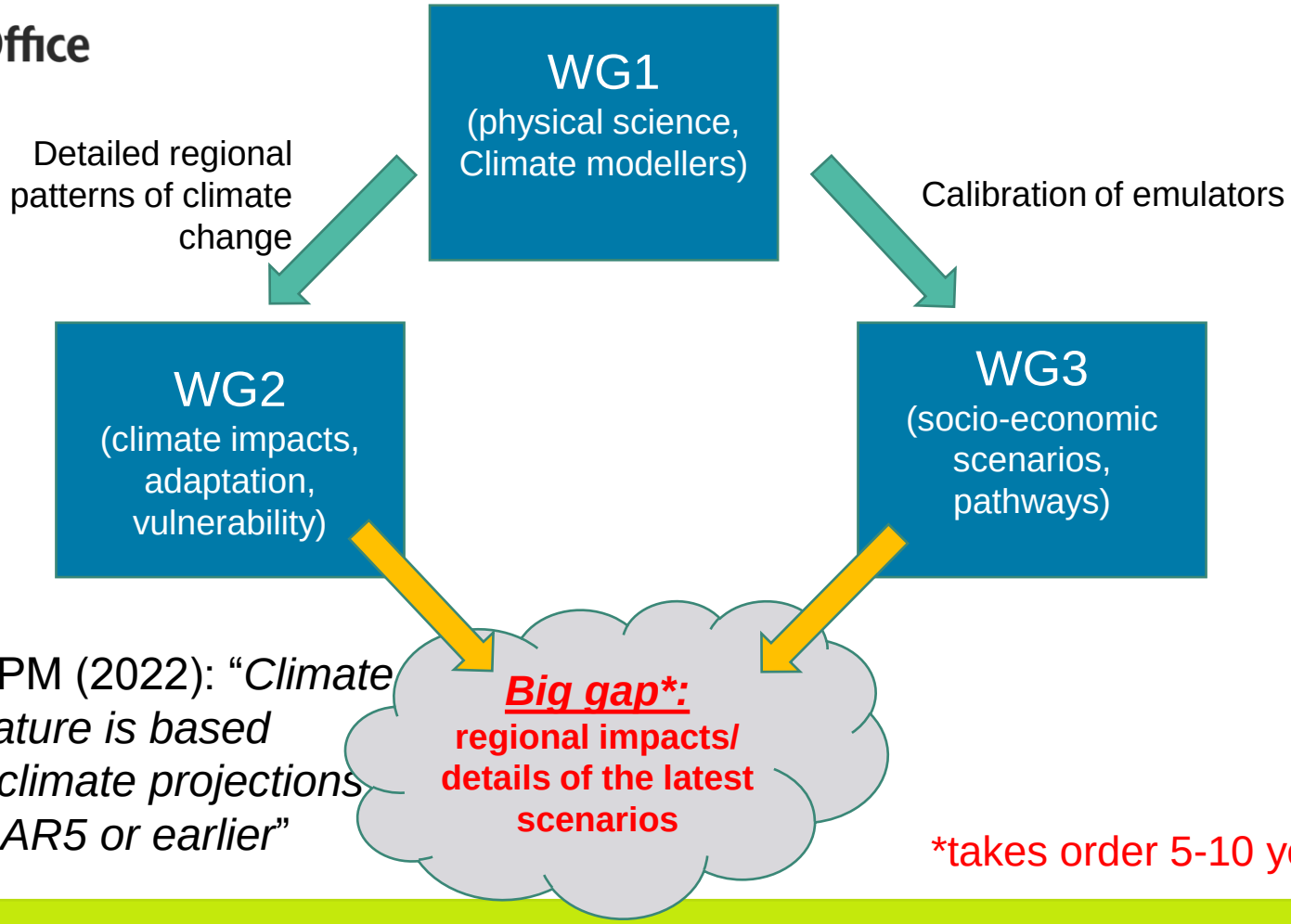


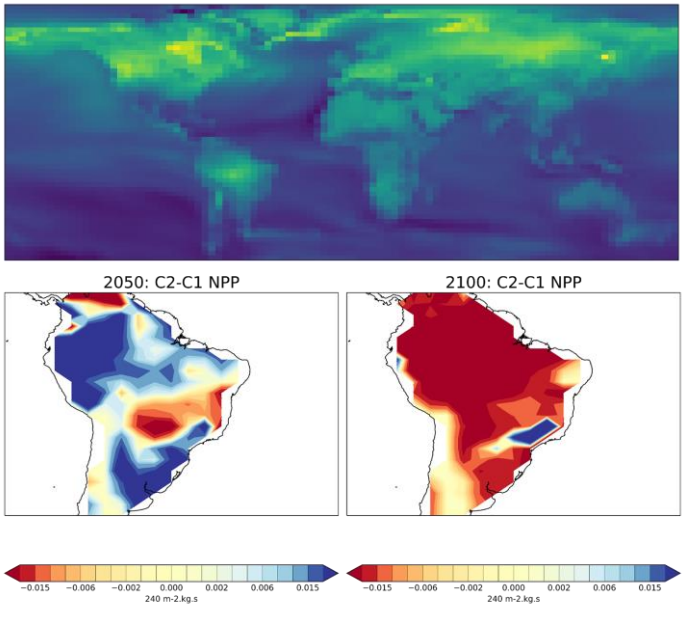
WG2 AR6 SPM (2022): "*Climate impacts literature is based primarily on climate projections assessed in AR5 or earlier*"

*takes order 5-10 years to fill!

Wouldn’t it be great if…?

Up-to-date pledges/scenarios

…days



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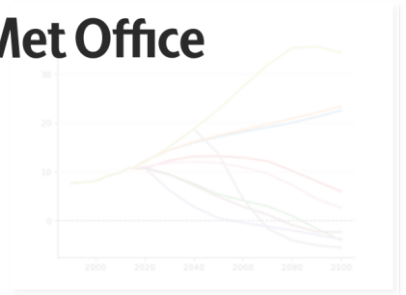

CMIP
climate
patterns

Emissions
scenarios

FaIR

Global T
CO_2 conc

and weather
generator

JULES
Joint UK Land
Environment Simulator

Land-based impacts

Climate
uncertainty
sampling

Well, we can!

PRIME

Probabilistic Regional Impacts from Model patterns and Emissions

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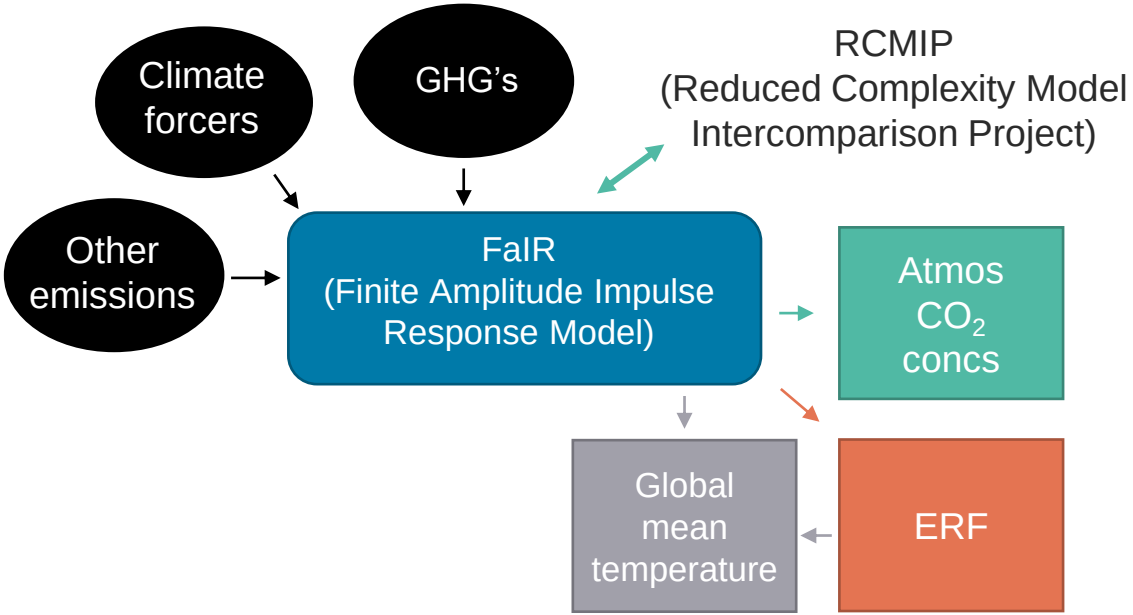
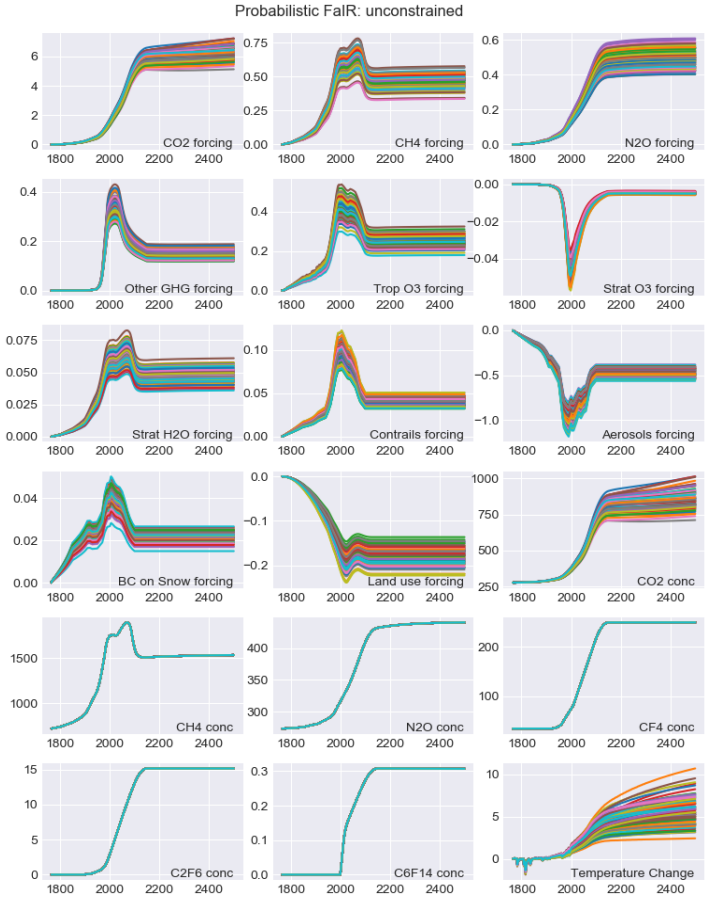
Sample across 3 axes of uncertainty:

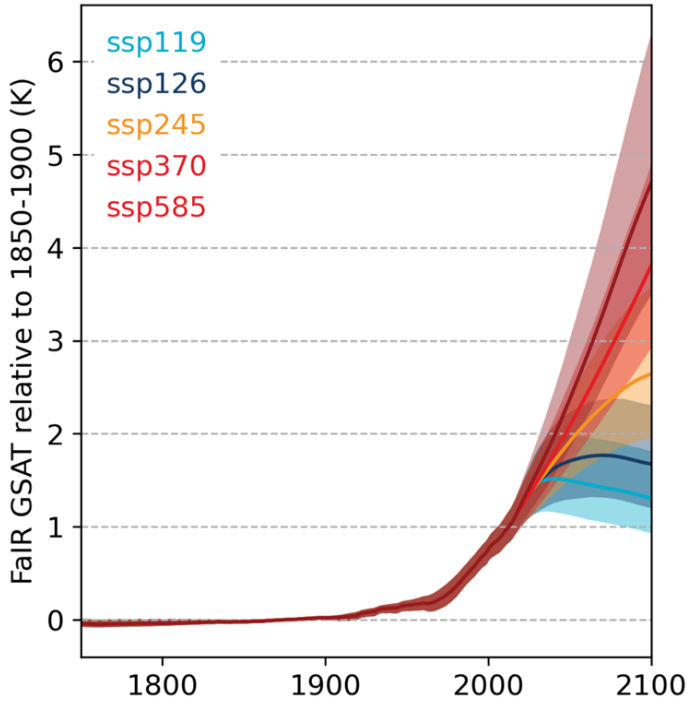
- Wide range of scenarios in a computationally-efficient manner
- IPCC-assessed range of climate sensitivity
- Full CMIP6 range of patterns of climate change

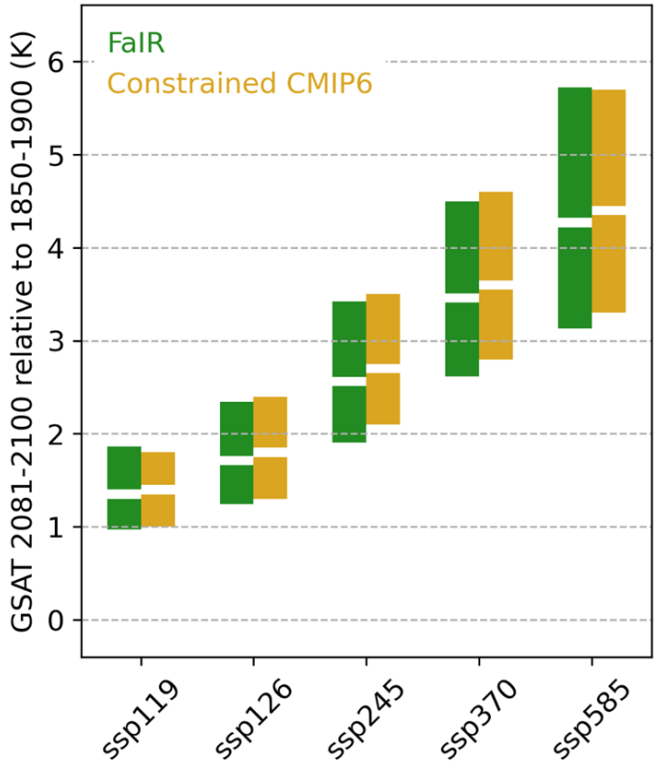
Met Office

FaIR






ssp119
ssp126
ssp245
ssp370
ssp585
FaIR GSAT relative to 1850-1900 (K)
0
1
2
3
4
5
6
1800
1900
2000
2100


FaIR
Constrained CMIP6
GSAT 2081-2100 relative to 1850-1900 (K)
0
1
2
3
4
5
6
ssp119
ssp126
ssp245
ssp370
ssp585

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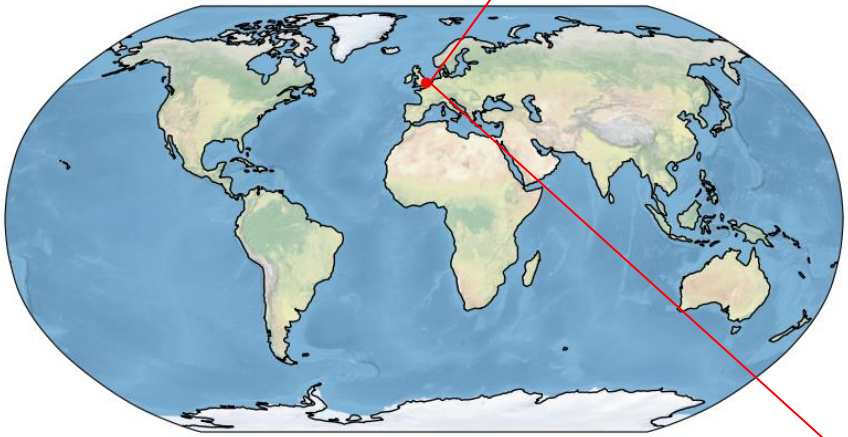
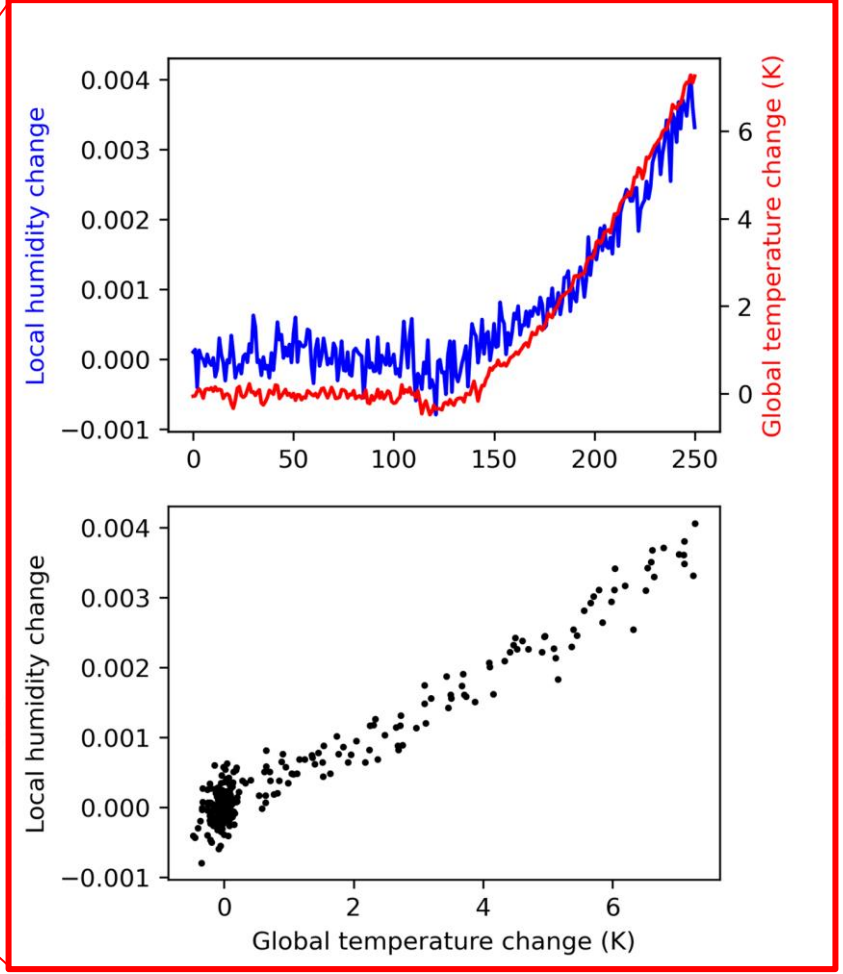
Pattern Scaling

Local change in climate variables approximately linear with global temperature change





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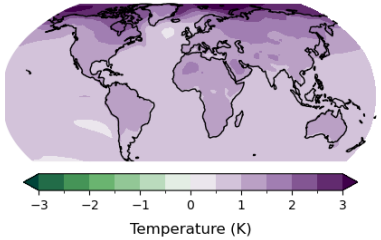
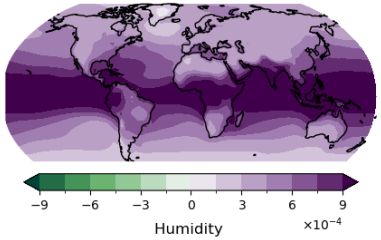
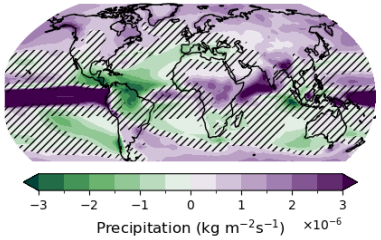
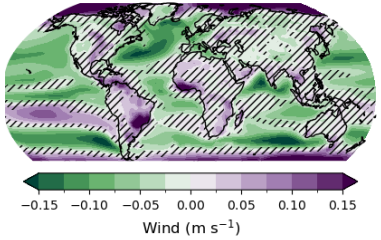
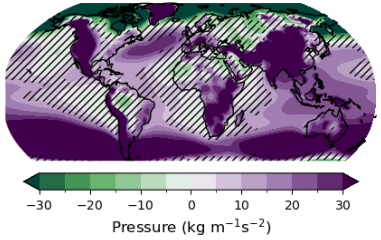
Spatial patterns representing changes in climate variables at 1K warming

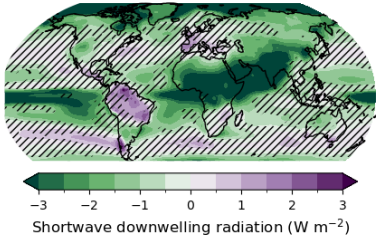


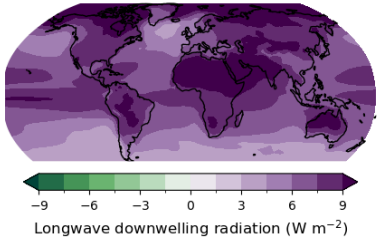


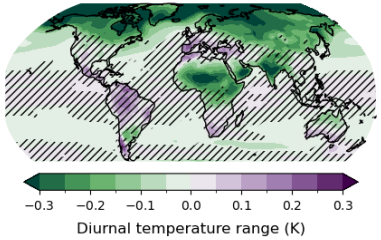












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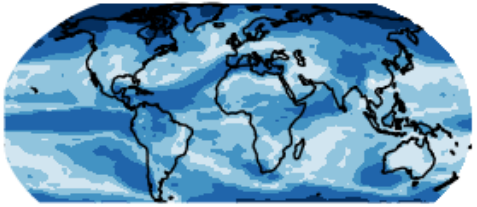
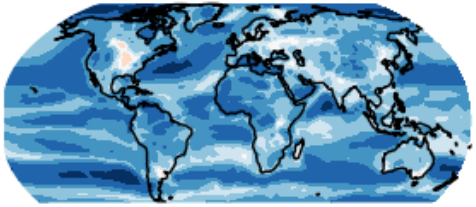
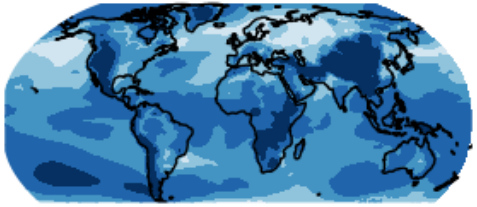
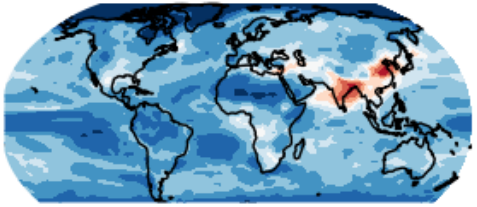
Temperature


Humidity

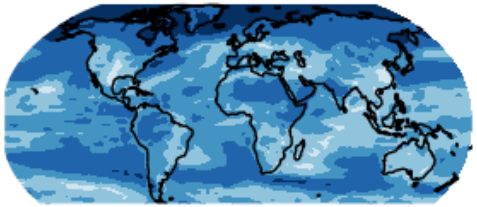

Precipitation

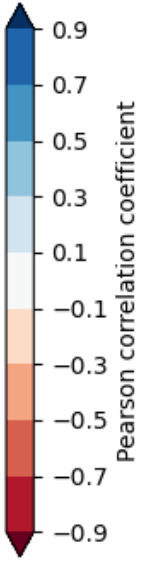

Wind

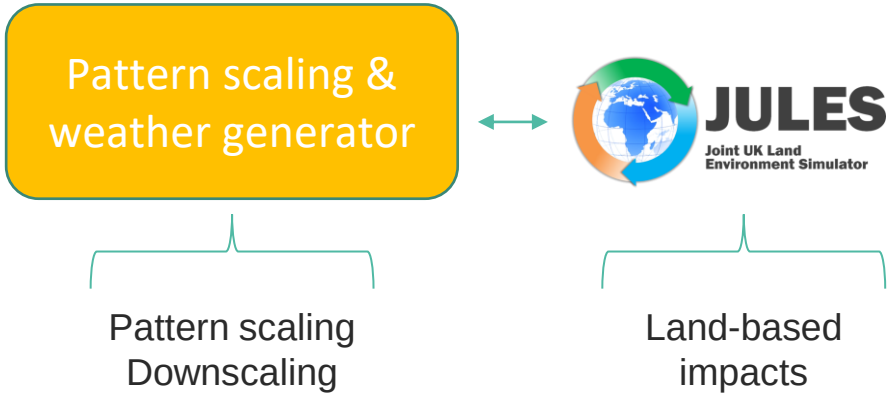

Pressure


Shortwave downwelling radiation


Longwave downwelling radiation

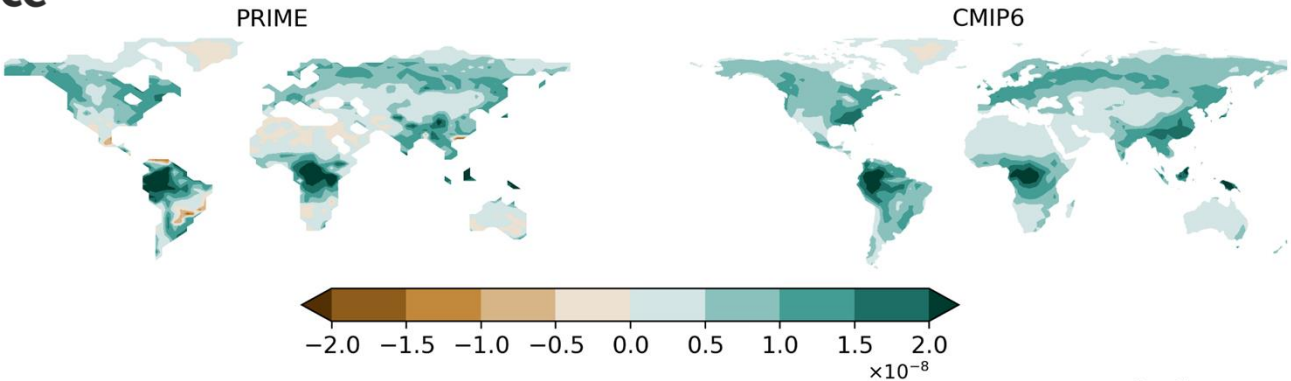

Diurnal temperature range



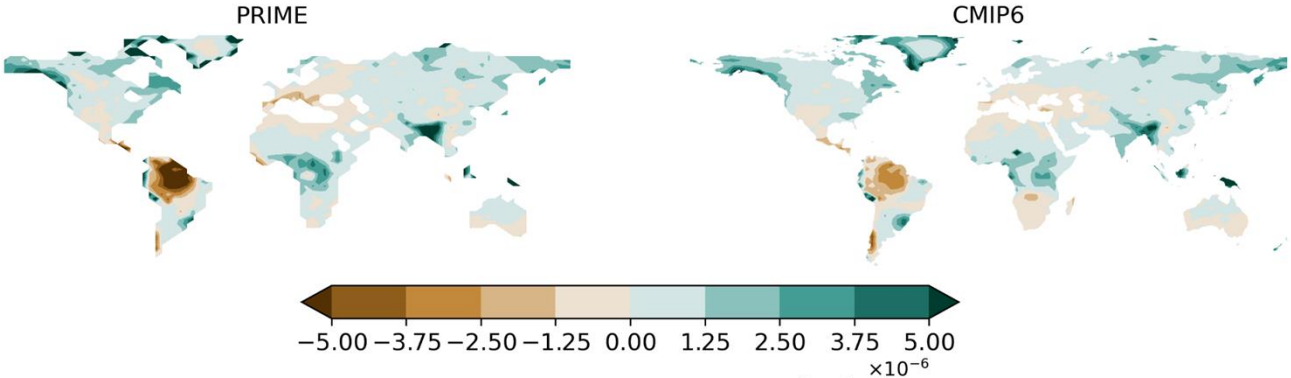

Pattern scaling &
weather generator
JULES
Joint UK Land
Environment Simulator
Pattern scaling
Downscaling
Land-based
impacts

2080-2100 means, ssp126

Met Office

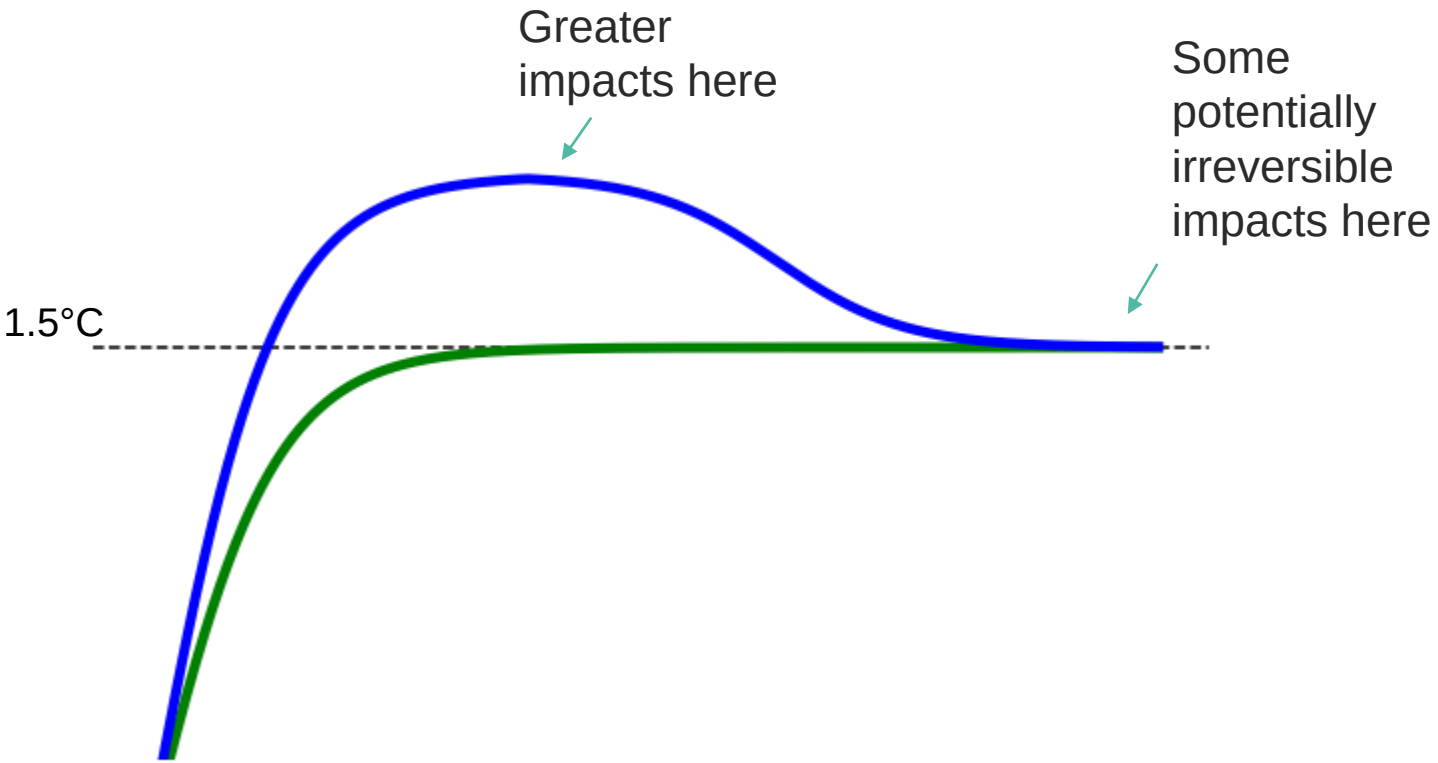


Change in gross primary productivity of biomass expressed as carbon (kg $m^{-2}s^{-1}$)

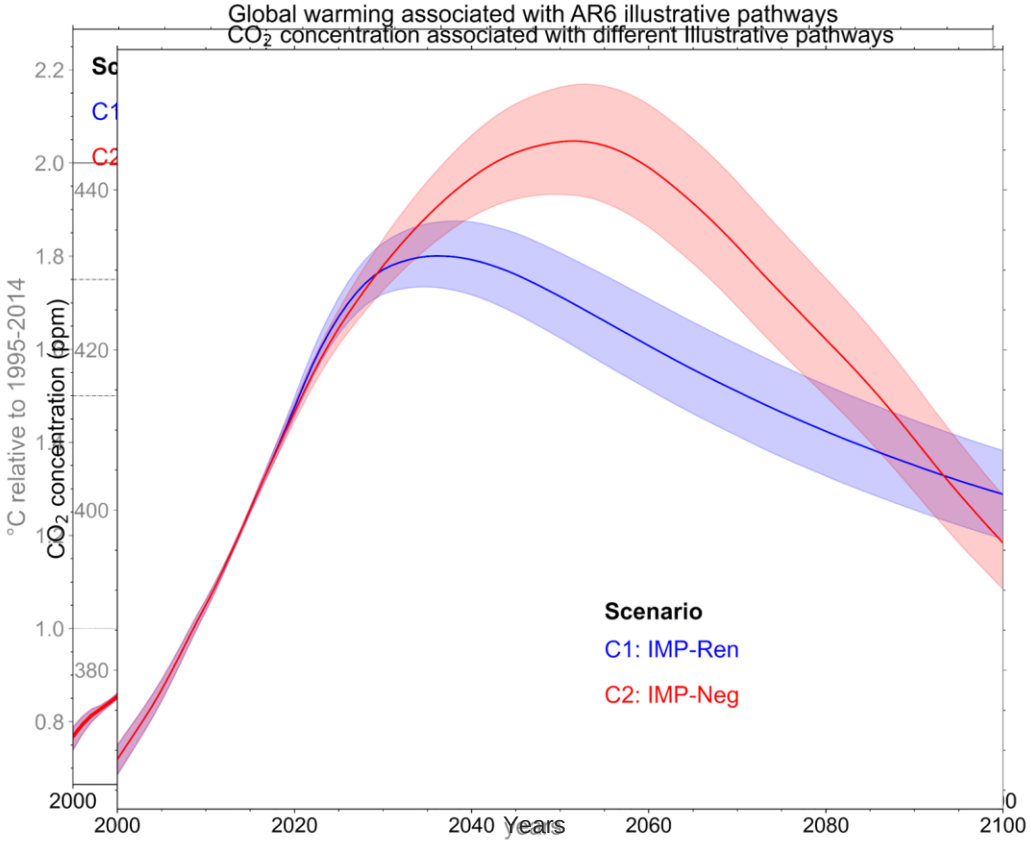


Change in total runoff (kg $m^{-2}s^{-1}$)

Impacts – during and after overshoot

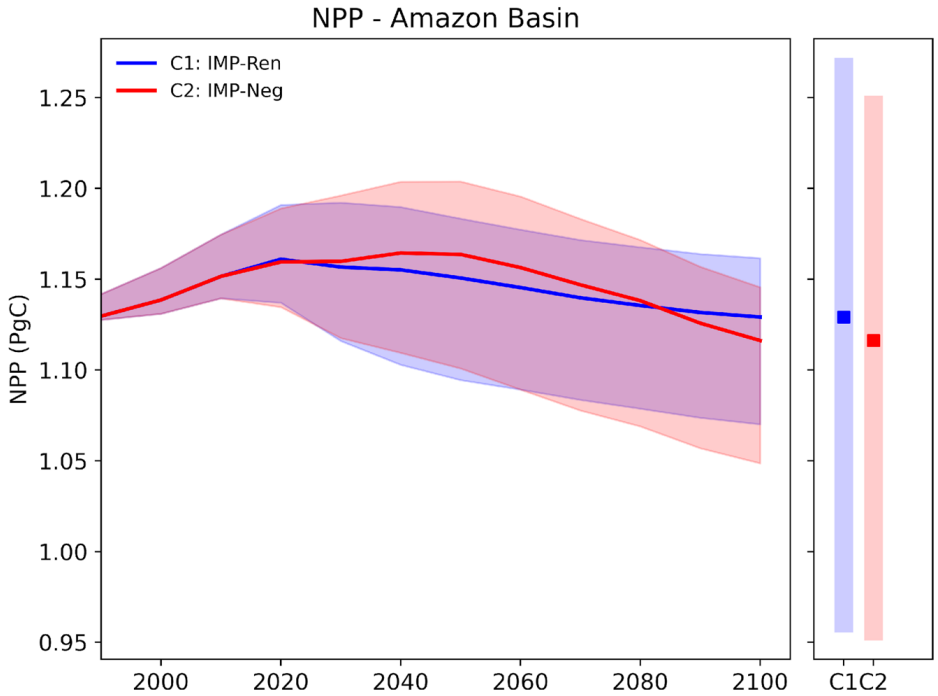


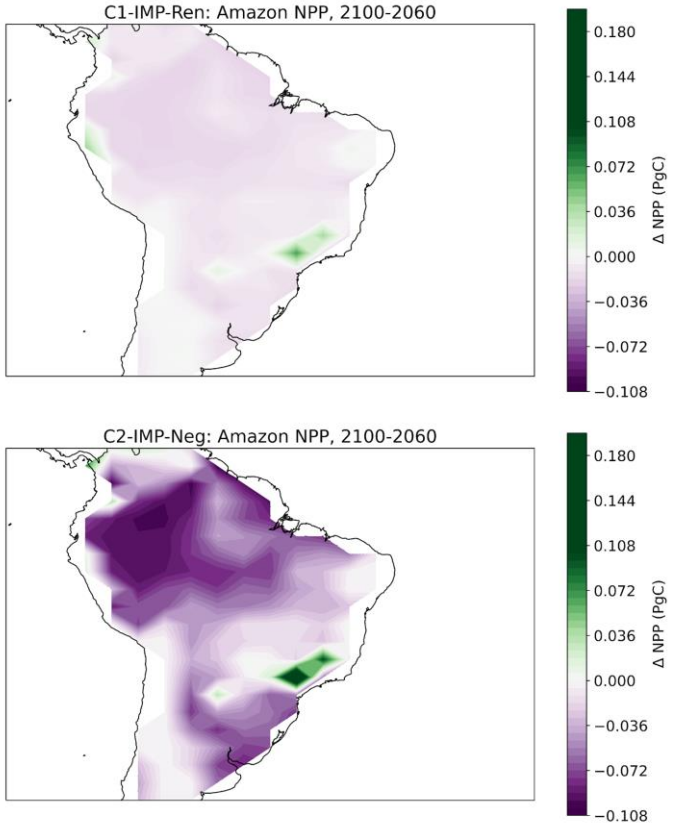
1.5 with or without overshoot



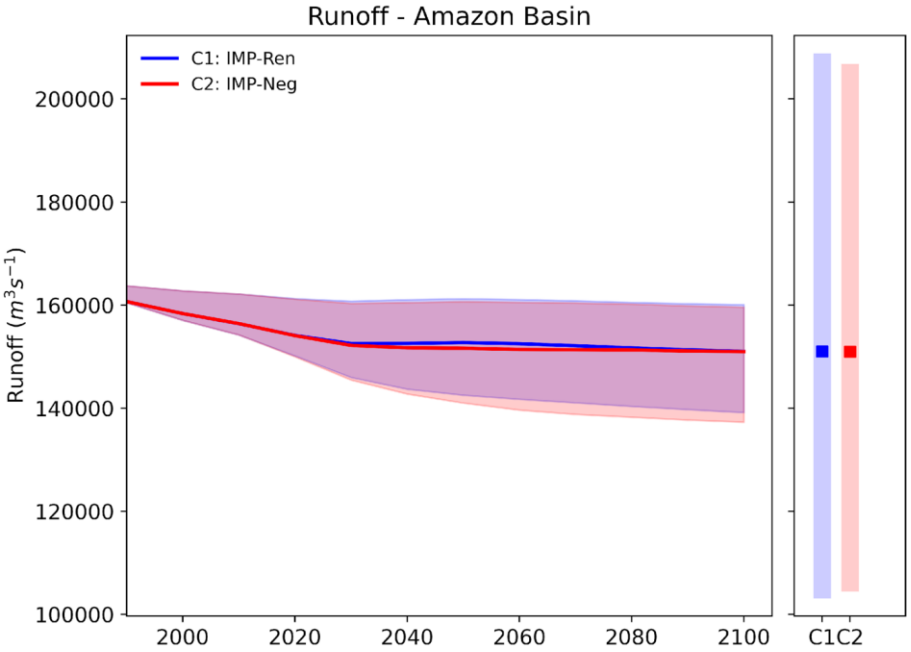
- 2 illustrative pathways, IPCC WGIII AR6
- C1-IMP-Ren: "with no or limited overshoot"
- C2-IMP-Neg: follows "high overshoot"

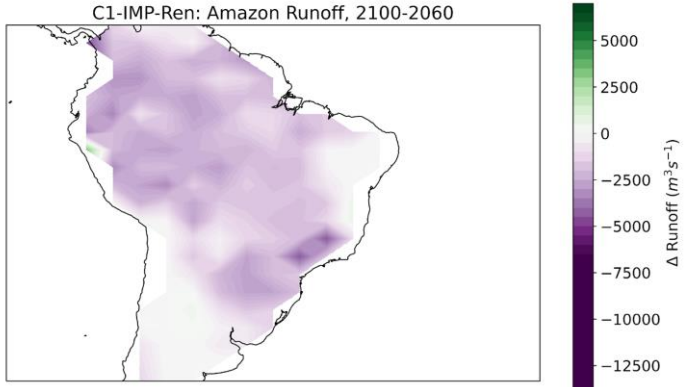
1.5°C with or without overshoot

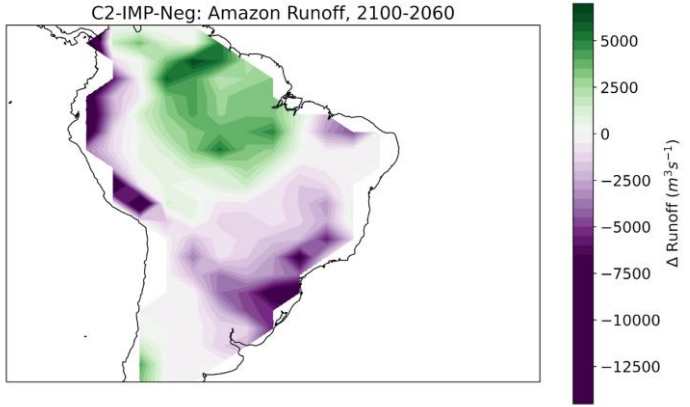




1.5°C with or without overshoot





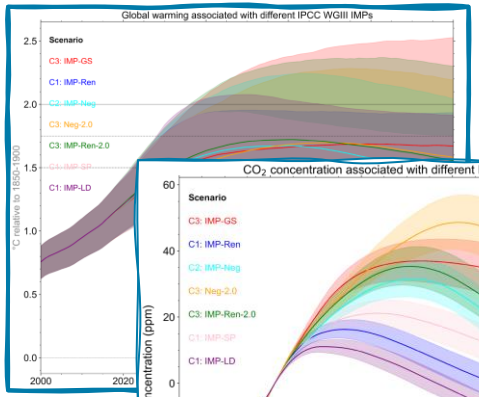


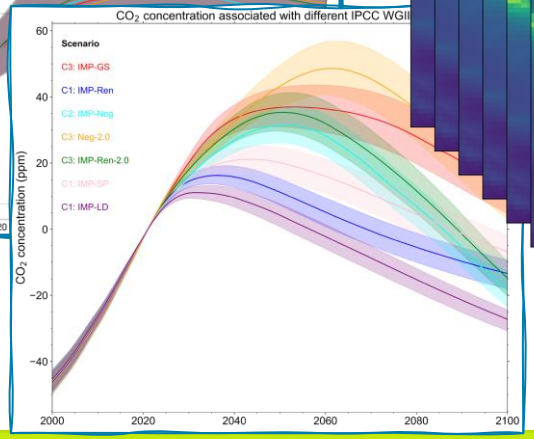
PRIME and data sciences…

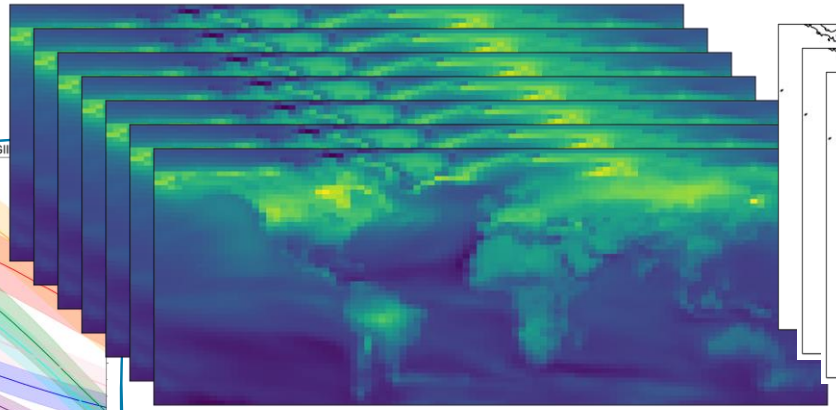
M-Percentiles from FaIR

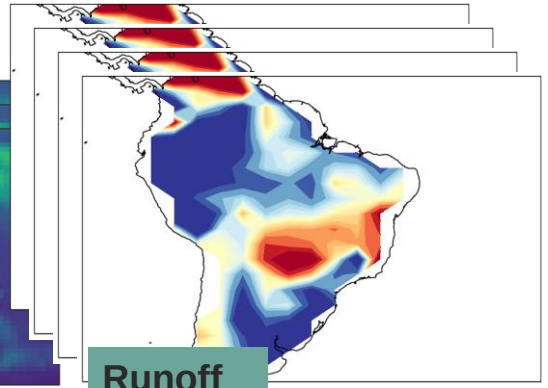
N-Patterns

Potentially thousands of ensemble members and a lot of data! Opportunity to look at lots of impacts…







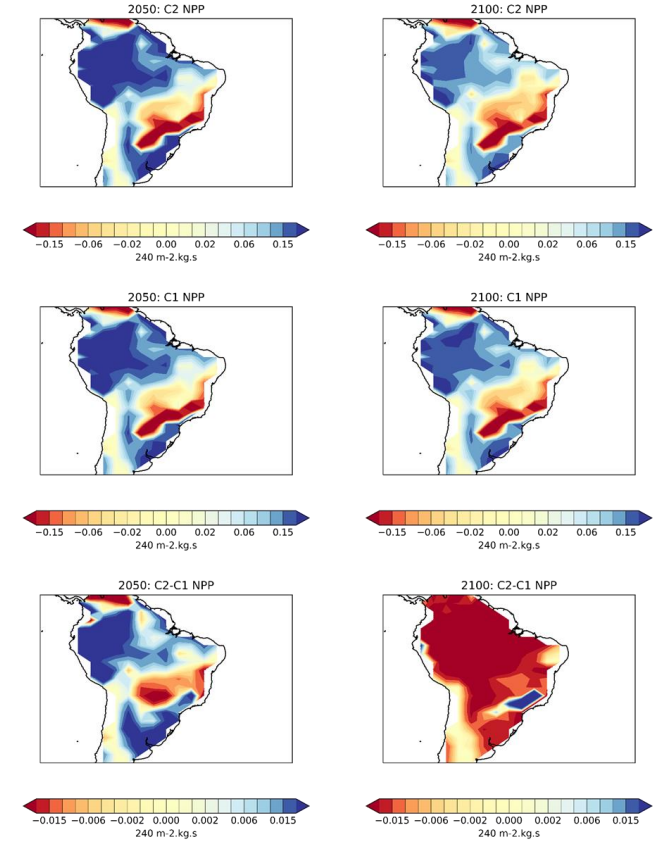


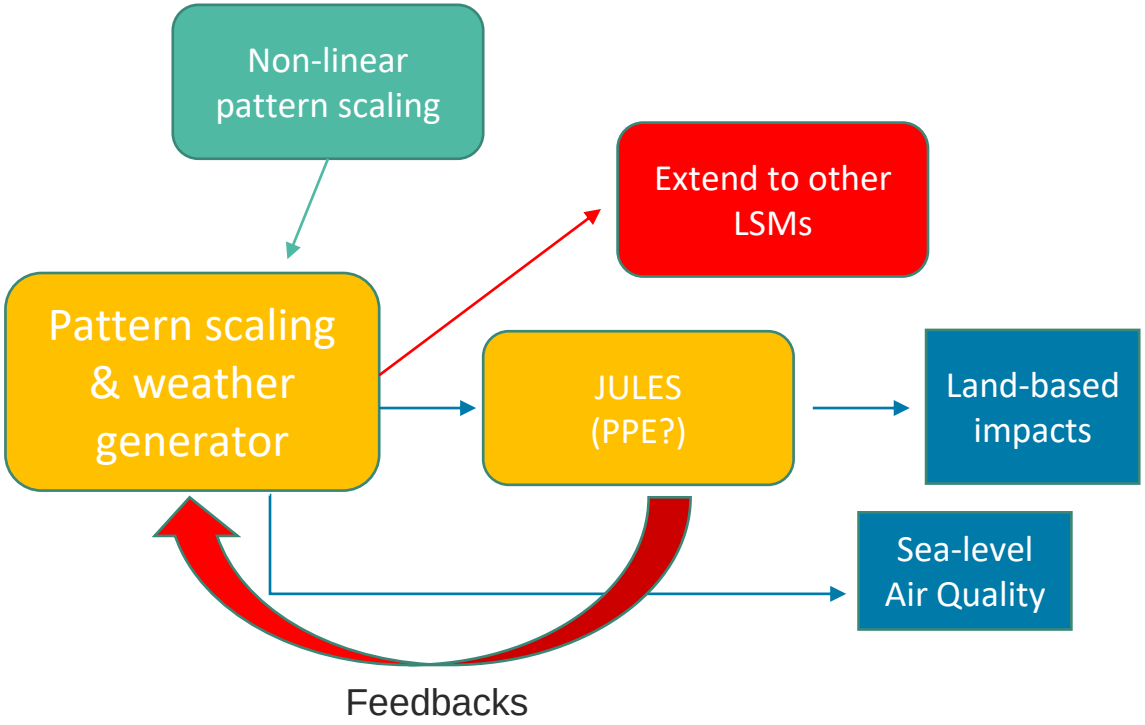
Runoff

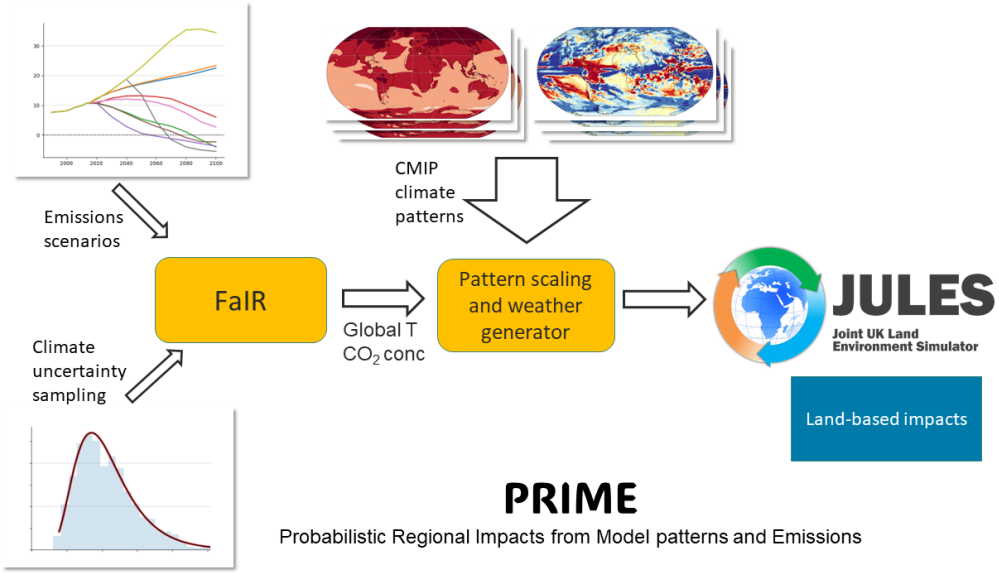
NEP & NBP

GPP and NPP…

Substantial potential for future expansion







Interested?
Get in touch:
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gregory.munday@metoffice.gov.uk
(or anyone on the title slide!)

Keep an eye out for our upcoming publications:

A rapid application missions-to-impacts tool for scenario assessment: Probabilistic Regional Impacts from Model patterns and Emissions (PRIME) (Mathison et al., in prep)

Ecosystem response at 1.5°C with and without overshoot (Munday et al., in prep)