

Climate Objectives and Feedback Effects on Future Emissions - COVFEFE

Eddy Comyn-Platt¹; Garry Hayman¹; Chris Huntingford¹; Sarah Chadburn²; Eleanor Burke³; Anna Harper²; Peter Cox²; Bill Collins⁴; Chris Webber⁴; Tom Powell²; Toby Marthews¹

1 – Centre of Ecology and Hydrology; 2 – University of Exeter; 3 – UK Met Office; 4 – University of Reading

NERC Programme – Understanding the Pathways to and Impacts of a 1.5°C Rise in Global Temperature



- Evidence for the UK Committee on Climate Change, with regard to their statutory advice on national carbon budgets.
- Input to the International Panel on Climate Change (IPCC) special report, which is expected to have a publication submission deadline in late 2017 or early 2018.

Three projects with common methods (**JULES-IMOGEN**) formed an “Intra-Consortia”

CLIFFTOP

Climate feedbacks from wetlands and permafrost thaw in a warming world

Garry Hayman, Sarah Chadburn, Eddy Comyn-Platt, Toby Marthews, Eleanor Burke, Nic Gedney, Eleanor Blyth and Hanna Lee

CLUES

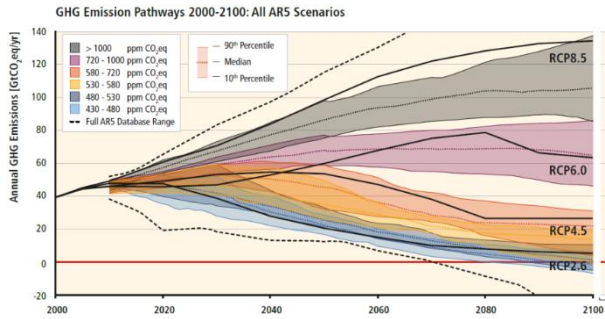
Climate, Land-Use, and Ecosystem Services at 1.5°C

Anna Harper, Peter Cox, Chris Huntingford, Tom Powell

MOC1.5

Methane, Ozone and the Carbon Budget for 1.5°C

Bill Collins, Steven Sitch, Jason Lowe, Chris Webber



Prescribed Anthropogenic Emissions

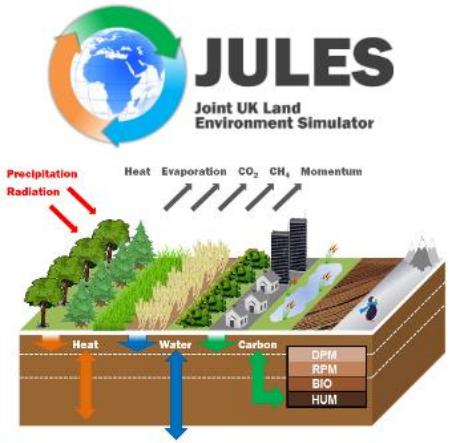
Atmospheric Composition

Simple Ocean Uptake Model

JULES Estimates Land Carbon Exchange

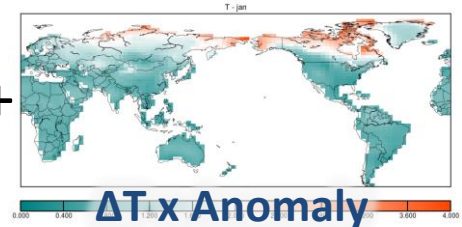
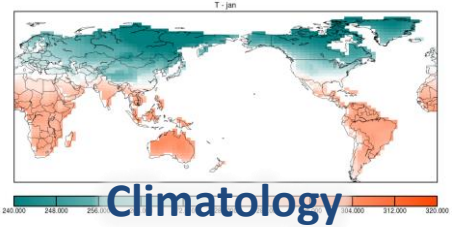
IMOGEN

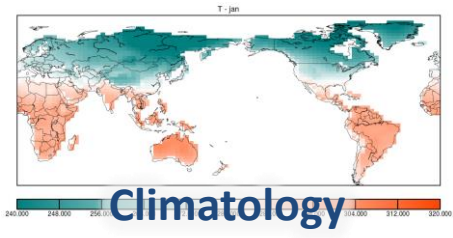
Radiative Forcing Power



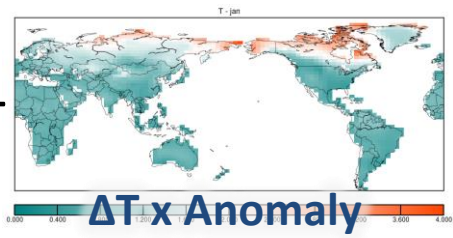
Pattern Scaling of Met Data

Temperature Anomaly

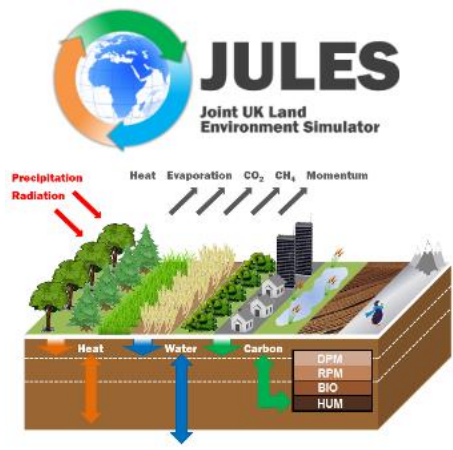
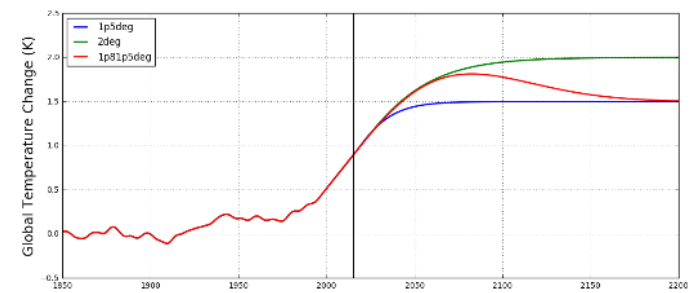




+



Prescribed Temperature Anomaly



Pattern Scaling of Met Data

JULES Estimates Land Carbon Exchange

IMOGEN⁻¹

Radiative Forcing Power

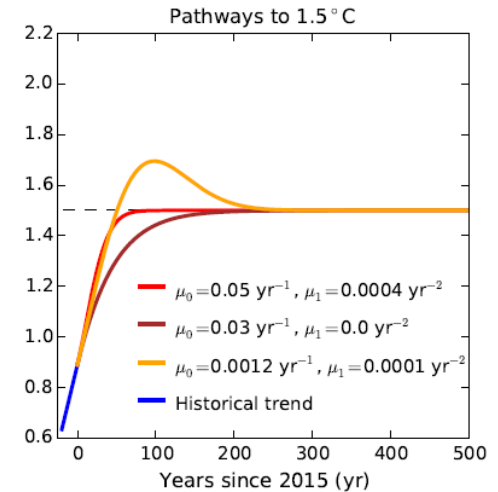
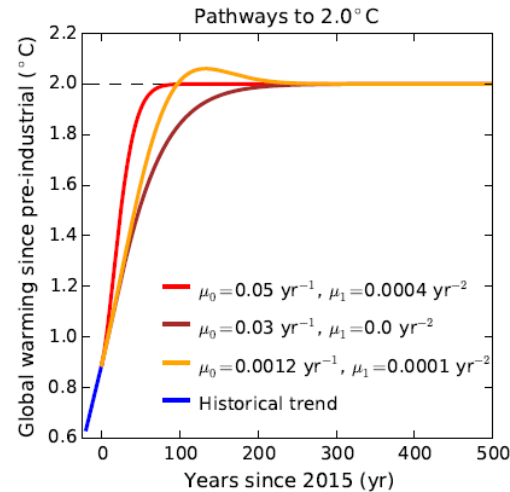
Atmospheric Composition

Permissible Anthropogenic Emissions

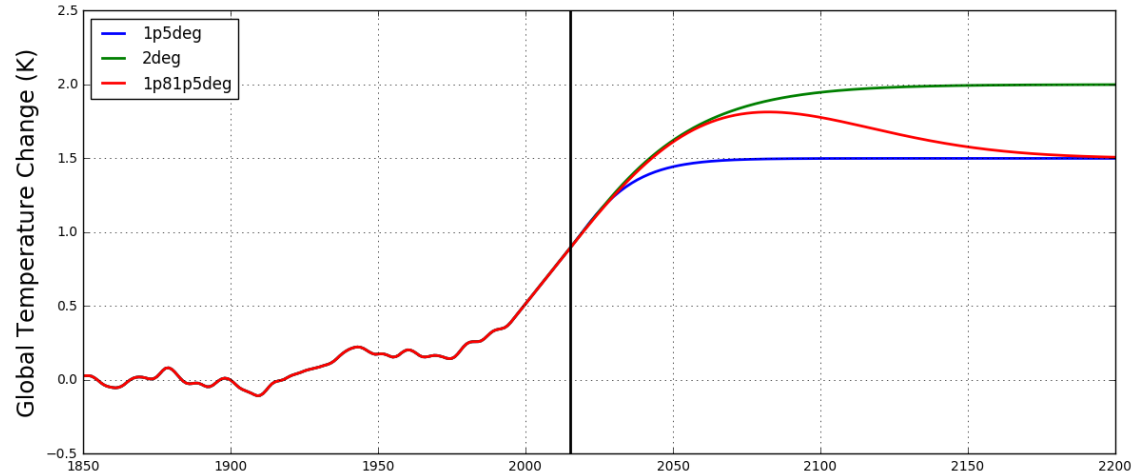
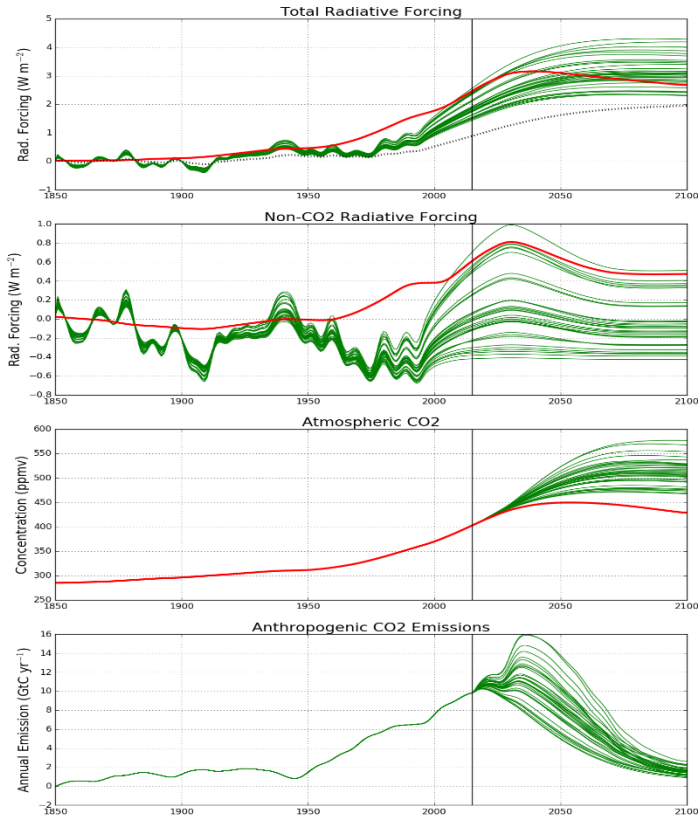
Simple Ocean Uptake Model

Intra-Consortia Baseline Scenario

- Temperature profiles
 - Huntingford et al. (2017) formulation
- Non-CO2 Radiative Forcing Contributions
 - SSP2-RCP2.6-IMAGE



Intra-Consortia Baseline Scenario

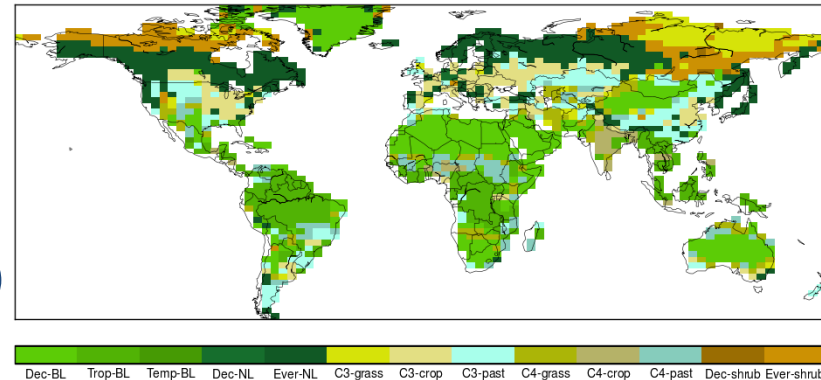
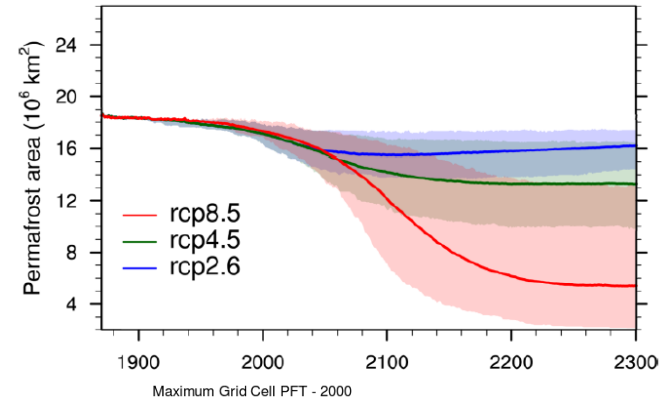


$$\Delta Q_{non\ CO_2} = m\Delta Q_{non\ CO_2}^{SSP} + c$$

Intra-Consortia Baseline Scenario

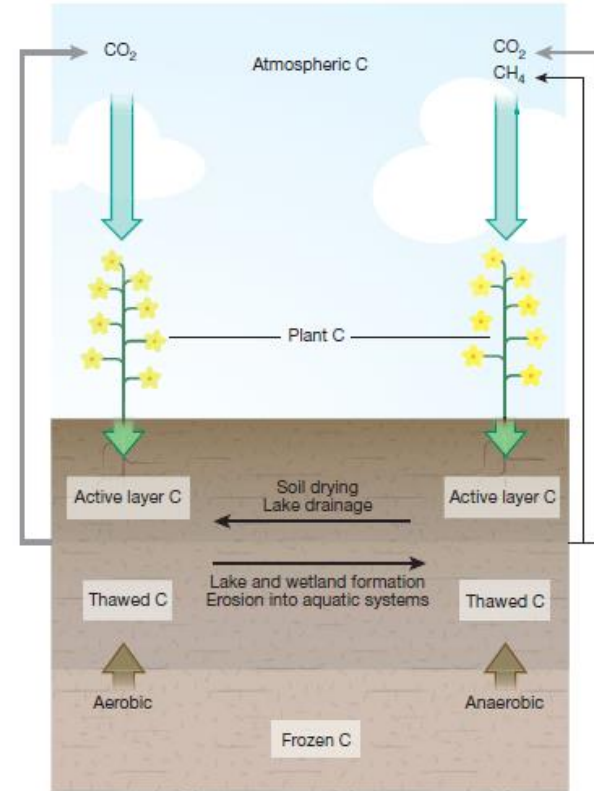
JULES Key Features:

- 14 Soil Layers
- Layered Soil Carbon and Permafrost
 - Chadburn et al., 2015; Burke et al., 2017.
- 13 PFTs and LULUC projections
 - Anna Harper et al., 2016.
- Ozone damage
 - Scaled to CH₄
- TOPMODEL (Gedney et al., 2004)
- 3 Snow Layers



CLIFFTOP Methane Feedback

- Permafrost Thaw
 - Burke et al., 2017
- Methane Feedback
 - Gedney et al, 2017 in preparation



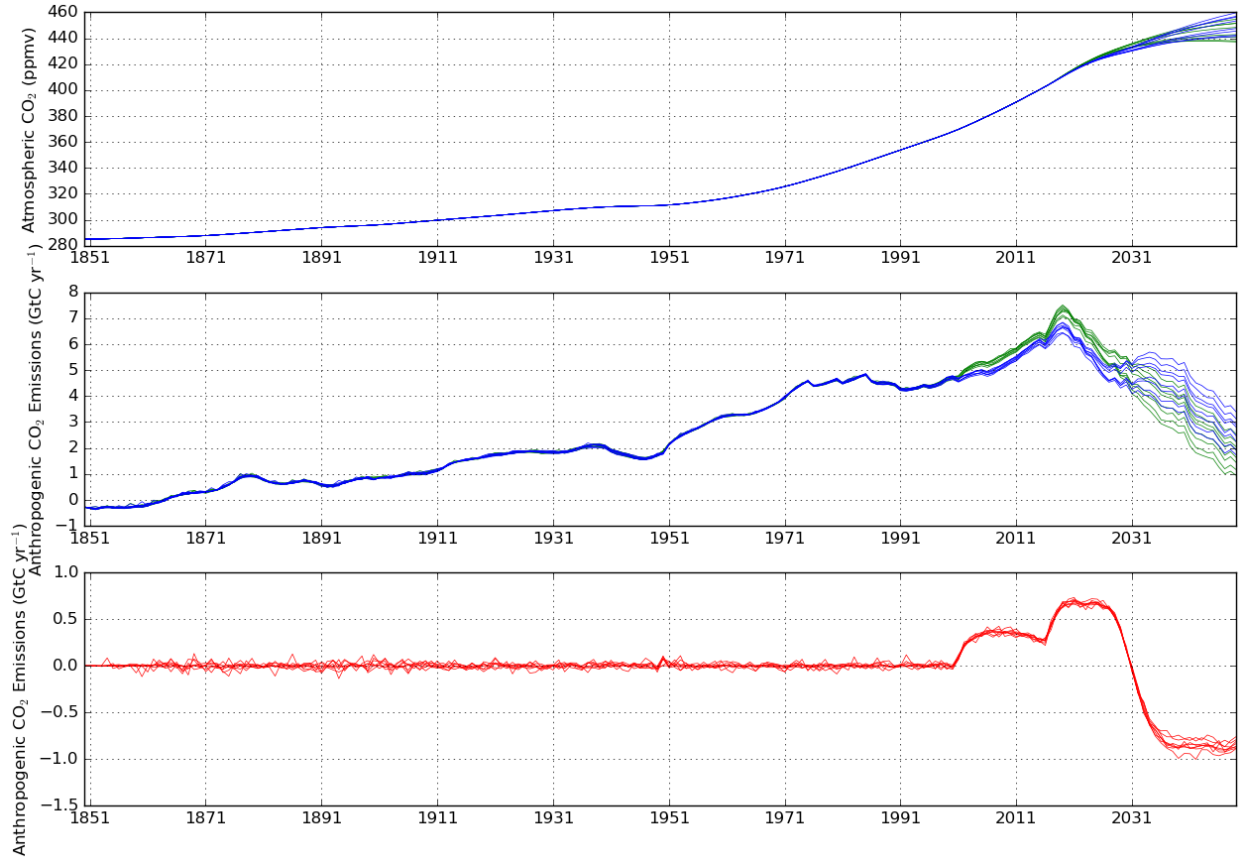
Schuur et al., 2015

Results

Baseline Scenario

CH4 Feedback

Baseline – CH4-FB

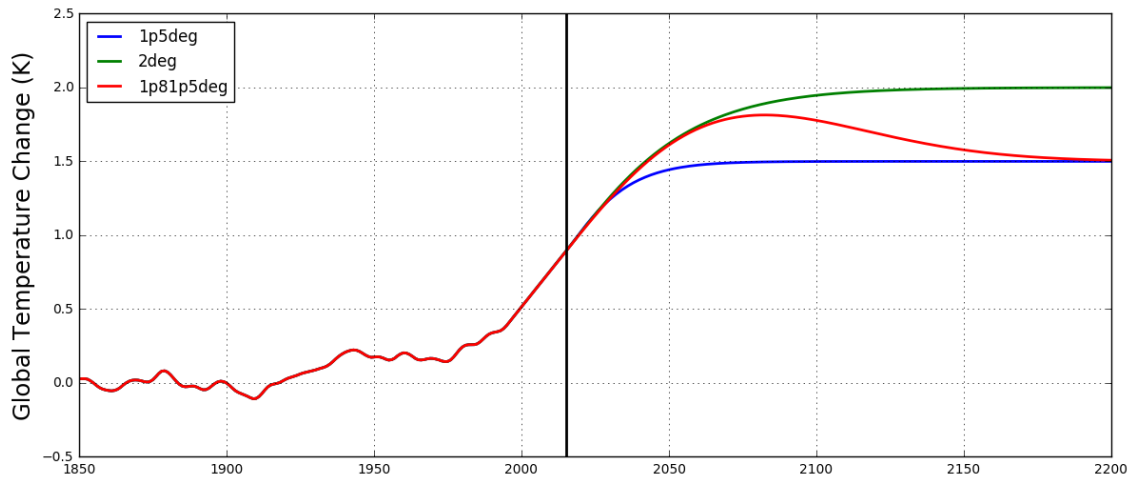
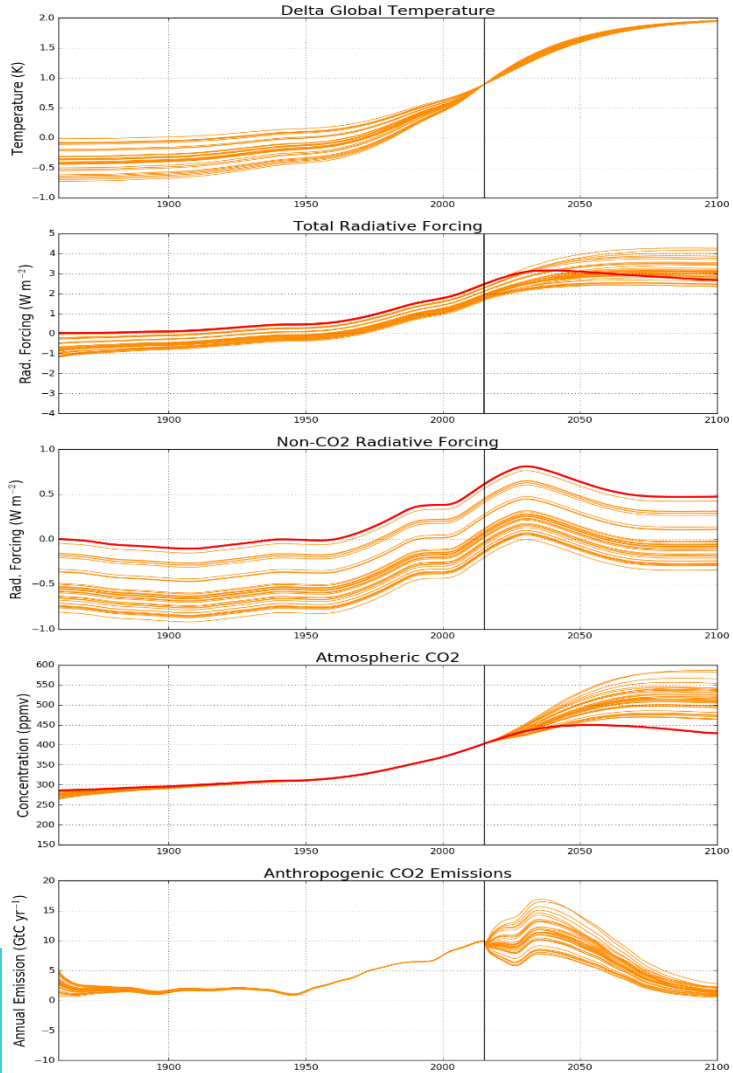


Summary and Future work

- We have a state of the art JULES-IMOGEN configuration setup and available as a ROSE suite, available for distribution
- We need to finalise our decision on Temperature and Radiative forcing approach so we can set our finalised simulations going
- First lot of publications will be on their way out later in the year
- There will be a wealth of data to mine to study the impacts of these targets after we get our initial results out.
- This will form a new IMOGEN configuration available on the jules_doc trac.

Project	Comment/Interaction
1	<ul style="list-style-type: none"> All using JULES-IMOGEN Agree/use common 'baseline' scenario Hold joint project meeting(s)
2	
3	
4	<ul style="list-style-type: none"> Use common 'baseline' scenario Hold joint project meeting(s)
5	<ul style="list-style-type: none"> Econometric modelling with Climate Emulator. ENTS DVGM (with 1 pft, 1 crop, 1 soil reservoir and water bucket) Focus on
6	<ul style="list-style-type: none"> Explore bias in air-sea exchange of CO2 Any link through scenarios
7	<ul style="list-style-type: none"> Simple terrestrial C cycle Any link through scenarios
8	<ul style="list-style-type: none"> Any link through scenarios
9	<ul style="list-style-type: none"> Any link through scenarios
10	<ul style="list-style-type: none"> Biodiversity Any link through scenarios Involved in AVOID programme

Baseline Scenario



et al. (2017). "Flexible parameter-sparse global time-profiles that stabilise at 1.5°C and 2.0°C.", *Earth Syst. Dynam. Discuss.*