# Veg distribution/mortality JPEG stuff

Douglas Kelley, Chantelle Burton, Camilla Mathison, Karina Williams, Andrew Hartley , Arthur Argles, Carolina Duran Rojas, Rich Ellis, Rachael Turton, France Gerard, Rahayu Adzhar, Eleanor Burke, Rhys Whitley, Dong Ning, Graham Weedon, Ron Parker, Anna Harper, Eddy Robertson.
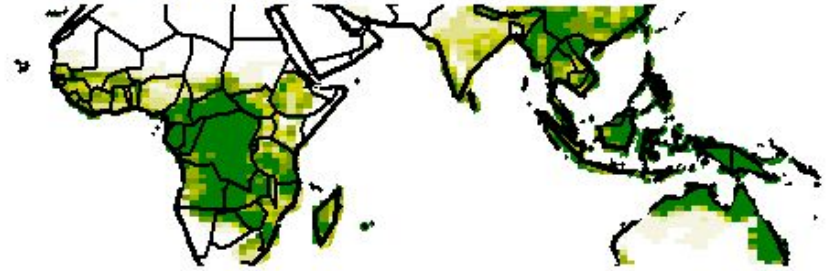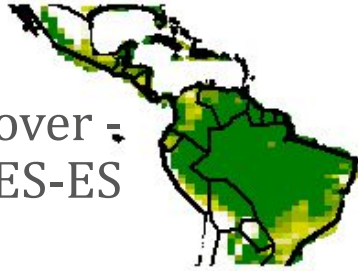
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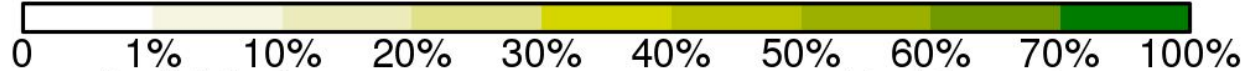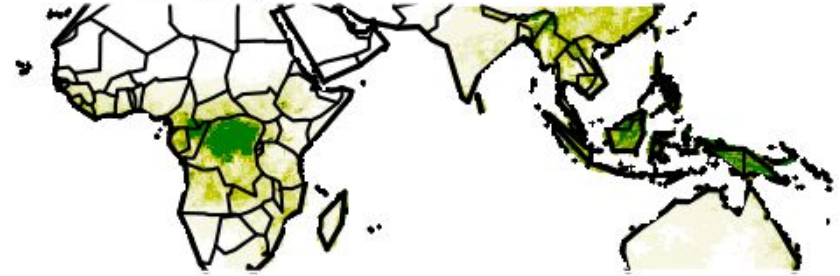
Too much tropical BL cover in UKESM
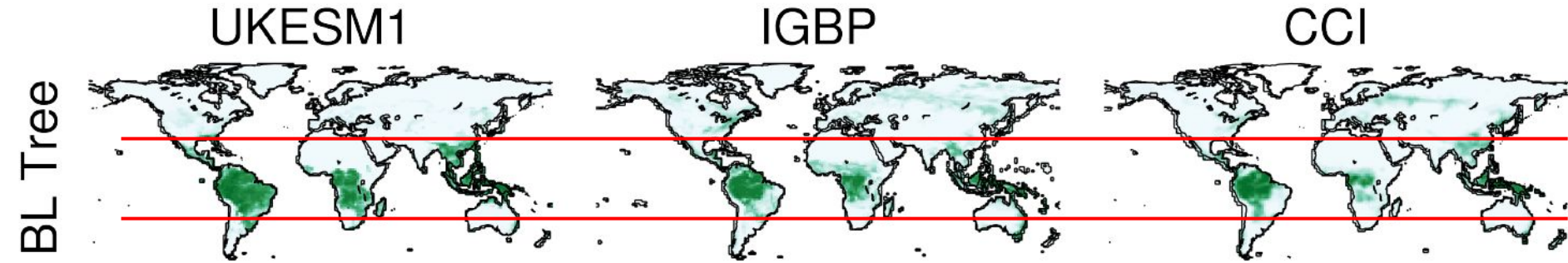
Sellar et al. UKESM1: Description and evaluation 2019

… and JULES-ES offline

Tree cover = JULES-ES
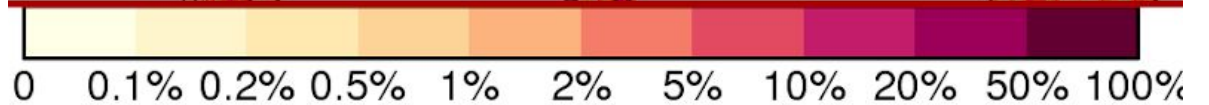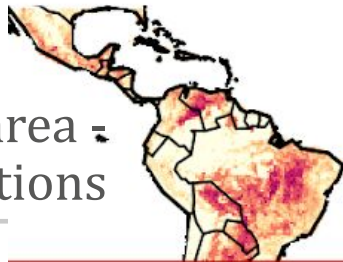
Tree cover = Observations VCF

0   1%   10%   20%   30%   40%   50%   60%   70%   100%

Burnt area = observations

0   0.1%   0.2%   0.5%   1%   2%   5%   10%   20%   50%   100%

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- We're using the dynamic veg model with PFTS competing and dying for changing veg fractions.
- Evaluate/constrain JULES-ES & UKESM simulated vegetation fractions

- Evaluating tools:
  i. JULES-ES driven by UKESM1 climate (Chantelle)
  ii. JULES-ES driven by ISIMIP (Camilla, Eleanor Burke)
  iii. **Observational constraints on veg distribution (me)**
  iv. Biome ML (Jeremy)

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JULES-ES driven by UKESM1 (Burton et al. 2021, Climate Resilience and Sustainability)

- One ensemble member for:
  - PI, Historic
  - ssp126, 370, 585
- Quick testing developments for UKESM.

- Suite: u-cd136

- Email:

  chantelle.burton@metoffice.gov.uk

- **See Chantelles talk, Thursday 2:15pm**


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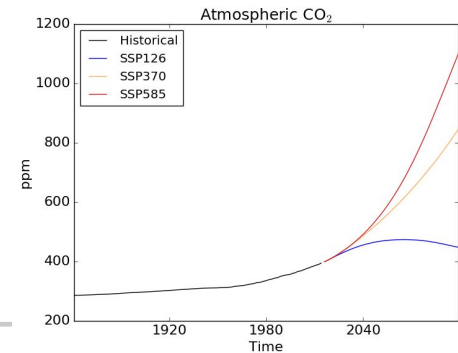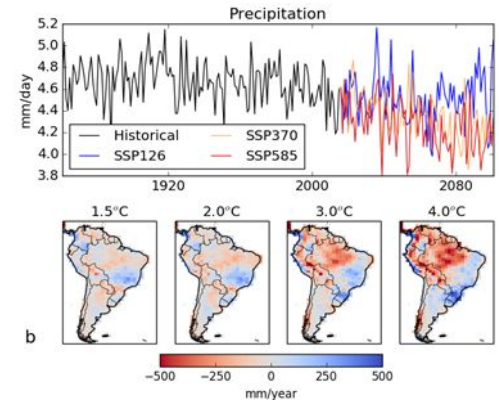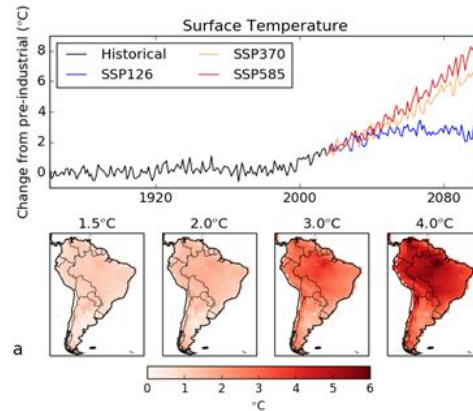
Intersectoral impact Model Intercomparison Project (ISIMIP)

- Multi-model ensemble (4 models for ISIMIP2b at CMIP5) bias corrected to present day
- Future simulations for RCP2.6/6.0
- Email: camilla.mathison@metoffice.gov.uk
- JULES-ISIMIP suite-id: u-cc669
- Email: eleanor.burke@metoffice.gov.uk
- **See Andy H's talk, Friday 10:10am**

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Frieler et al. GMD, 2017; Mathison et al. In prep
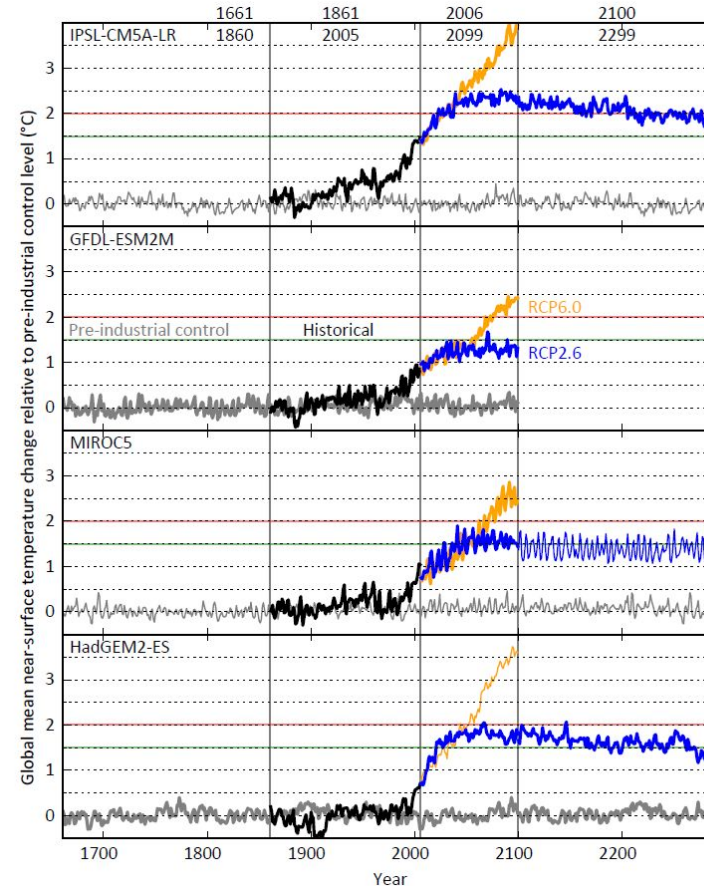
Infernance of fire/tree cover controls from observations

- Bayesian inference for observational constraints of fire/veg cover drivers.
- (de-)Attribution/Impact likelihood
- Working on direct application to JULES-ES for parameter constraints
- www.github.com/douglask3/
  Fire version: amazon_fires/tree/EGU2020
  Tree version: savanna_fire_feedback_test/tree/JULES_experiments
- Email: doukel@ceh.ac.uk

Ecology & Hydrology
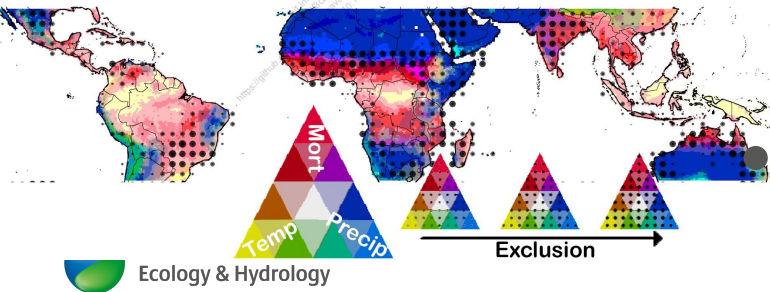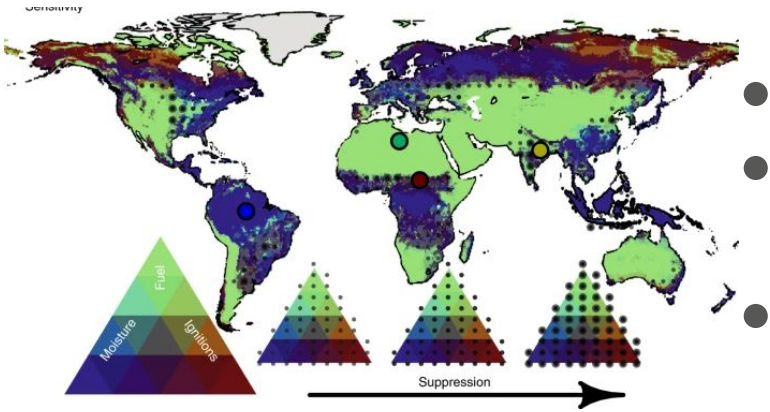
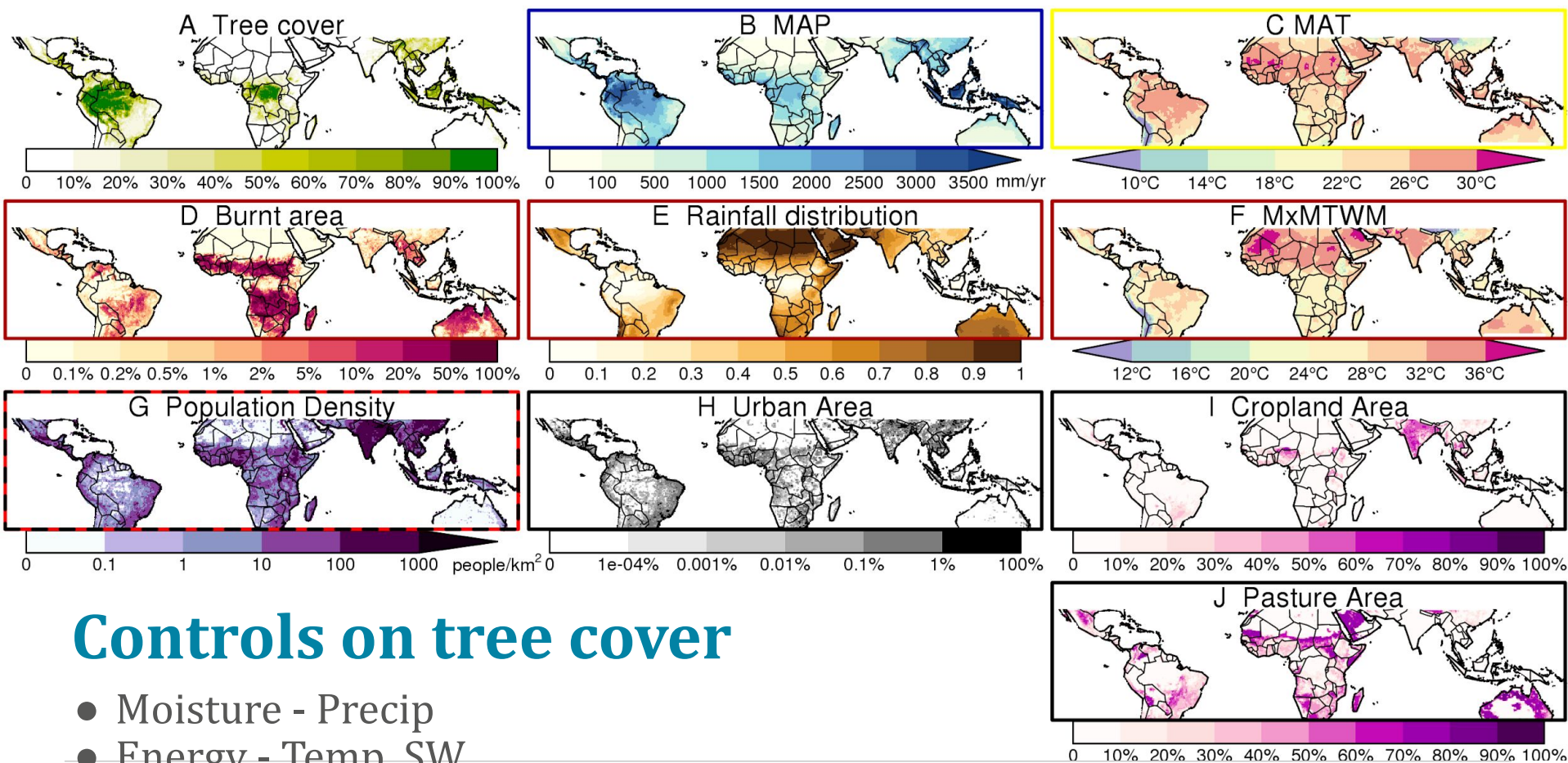*Kelley et al. NCC, 2019;*
Kelley et al. Biogeosciences, 2021

Working assumption for UKESM2…...

"Once we have fire in, our tree cover distribution **should** look better"....

But there's no observational constraints on how much fire (or many other sources of disturbance) have on tree cover
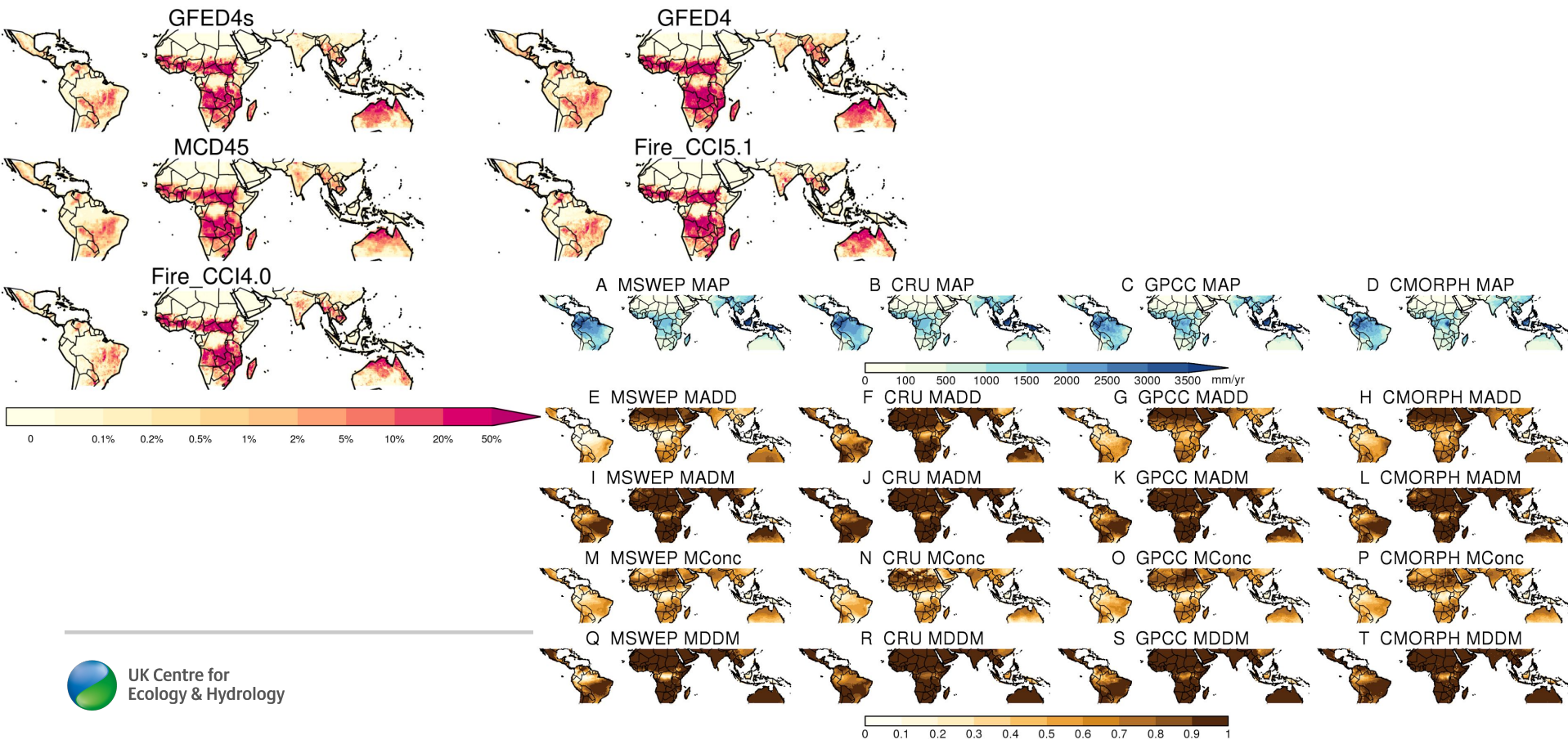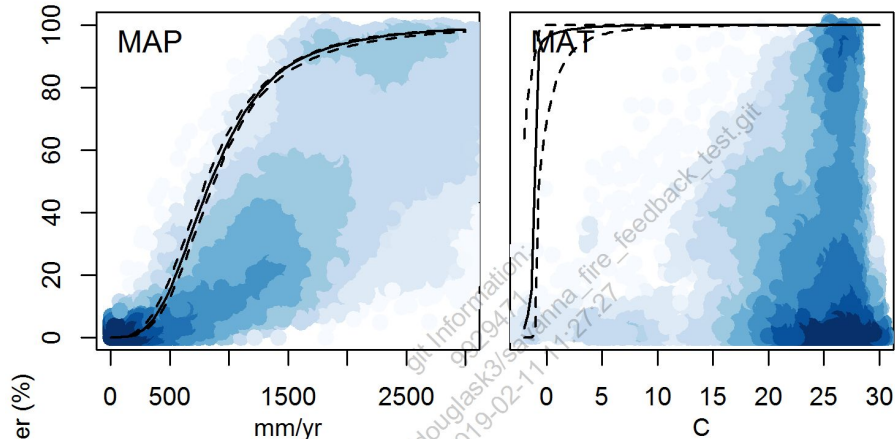
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Controls on tree cover

- Moisture - Precip
- Energy - Temp. SW
- Stress - fire, rainfall distribution, Heat, Wind
- Exclusion - Agriculture, urban area, population density.

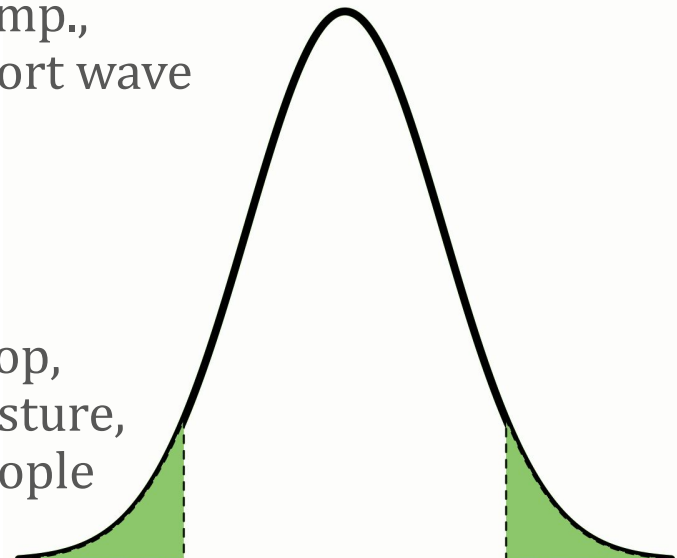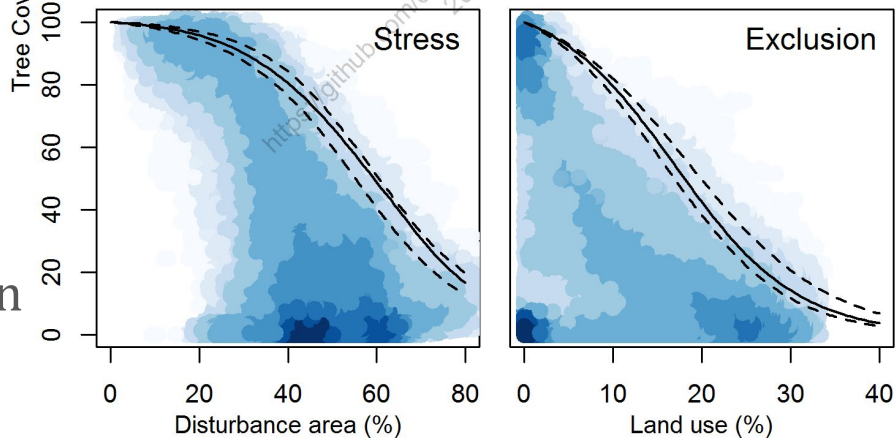# Sampled observational uncertainty

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Mean annual precip

Bayesian inference technique

Mean annual Temp., Short wave

Fire, heat, wind, rainfall distribution

Crop, pasture, people

MAP

MAT

Stress

Exclusion

Tree Cover (%)

mm/yr

C

Disturbance area (%)

Land use (%)

$$f(x) = \frac{1}{1+e^{-k_c \cdot (x_c - x_{c,0})}}$$

(See talk Thursday at 2pm)
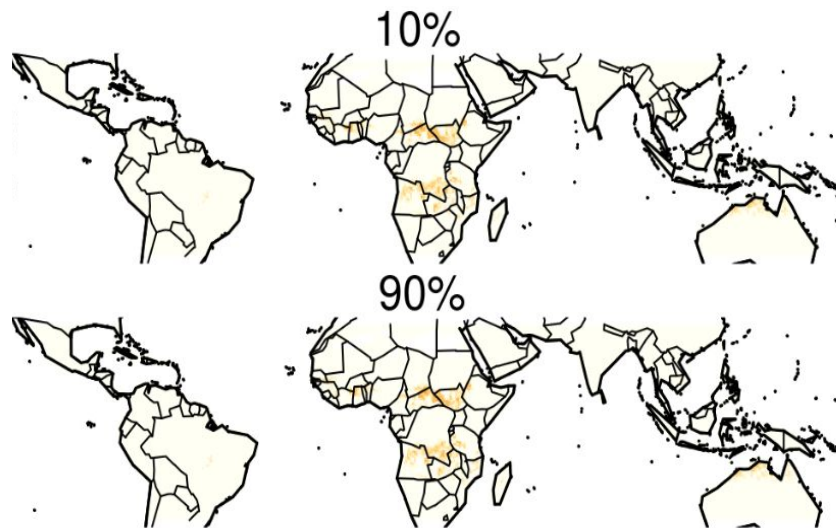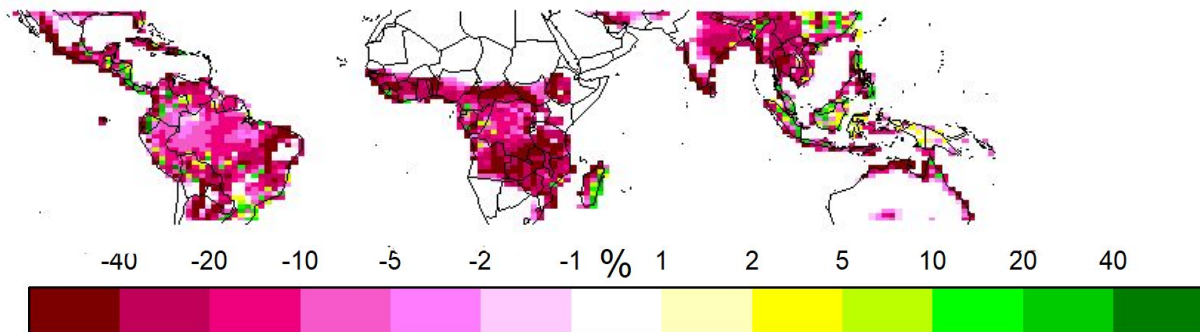
UK Centre for Ecology & Hydrology

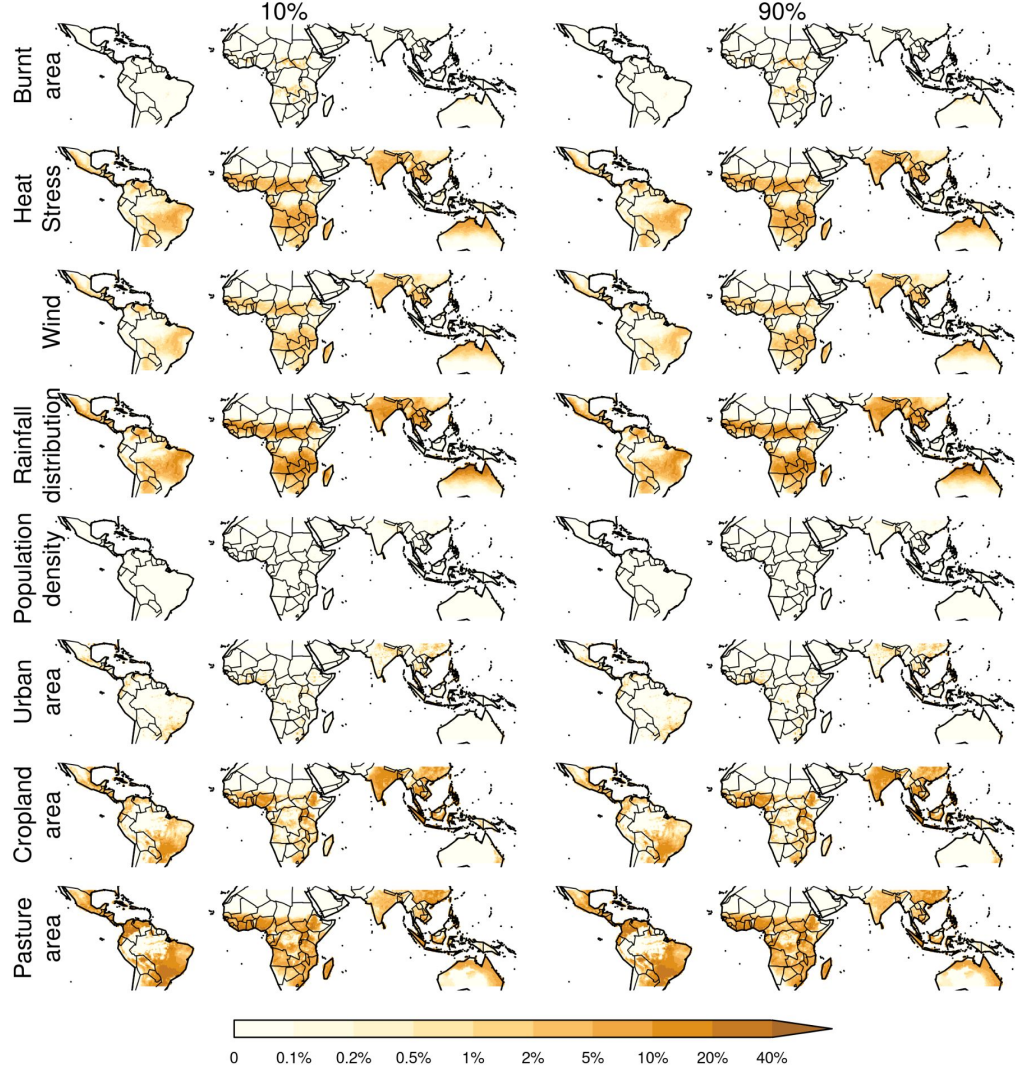# Impact of burnt area on tree expanse

- 0.32 - 3.27%
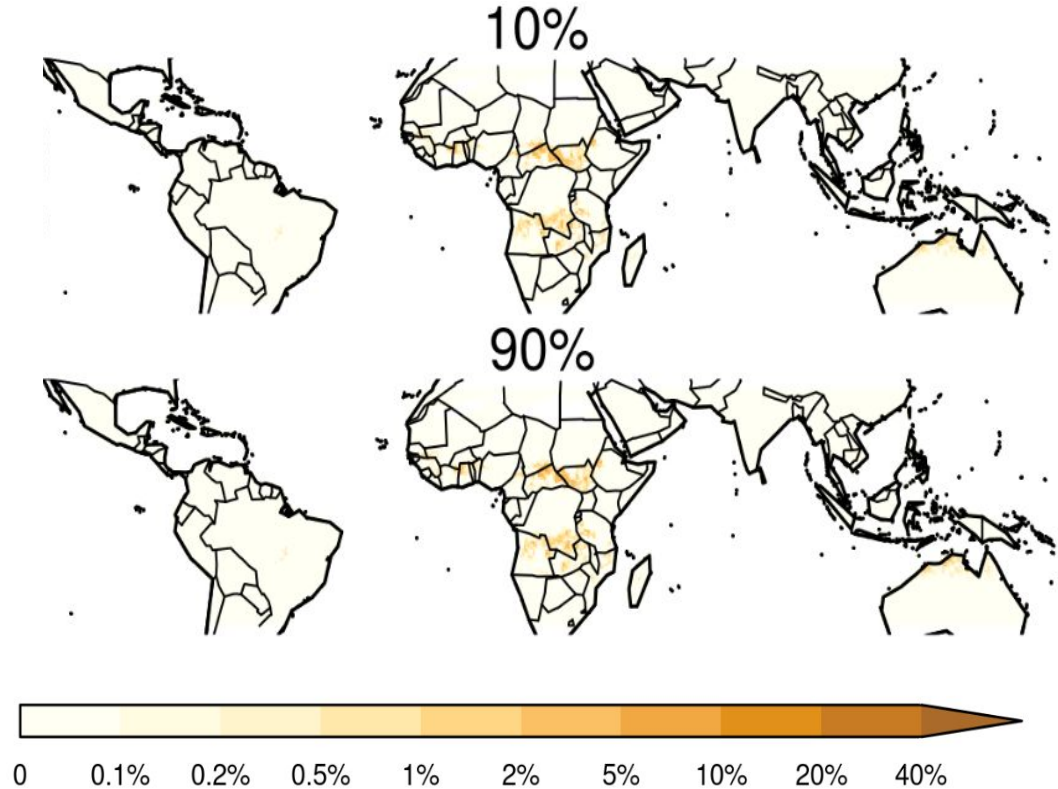
Compared to JULES-ES

30.6% in JULES-ES
Vs 0.32 - 3.27%

Impact of stress & Exclusion

- Fire - 0.32 - 3.27%
- Heat stress - 6.74-29.53%
- Wind - 3.03 - 9.51%
- Rainfall Distribution - 11.71-30.41%
- (Humans - 42.53-58.21%)

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Jules Experiments

A Rainfall set to 10,000 mm/yr

B Fire mortality set to zero

C Rainfall Distribution removed

D T_{upp} on V_{cmax} removed

E None: Pop den deforestation not included

F, G, H Human land cover type set to zero in turn

I All land cover set to zero

# Lots of uncertainty in sensitivity of Tropical Forest cover to fire.

+1% burnt area

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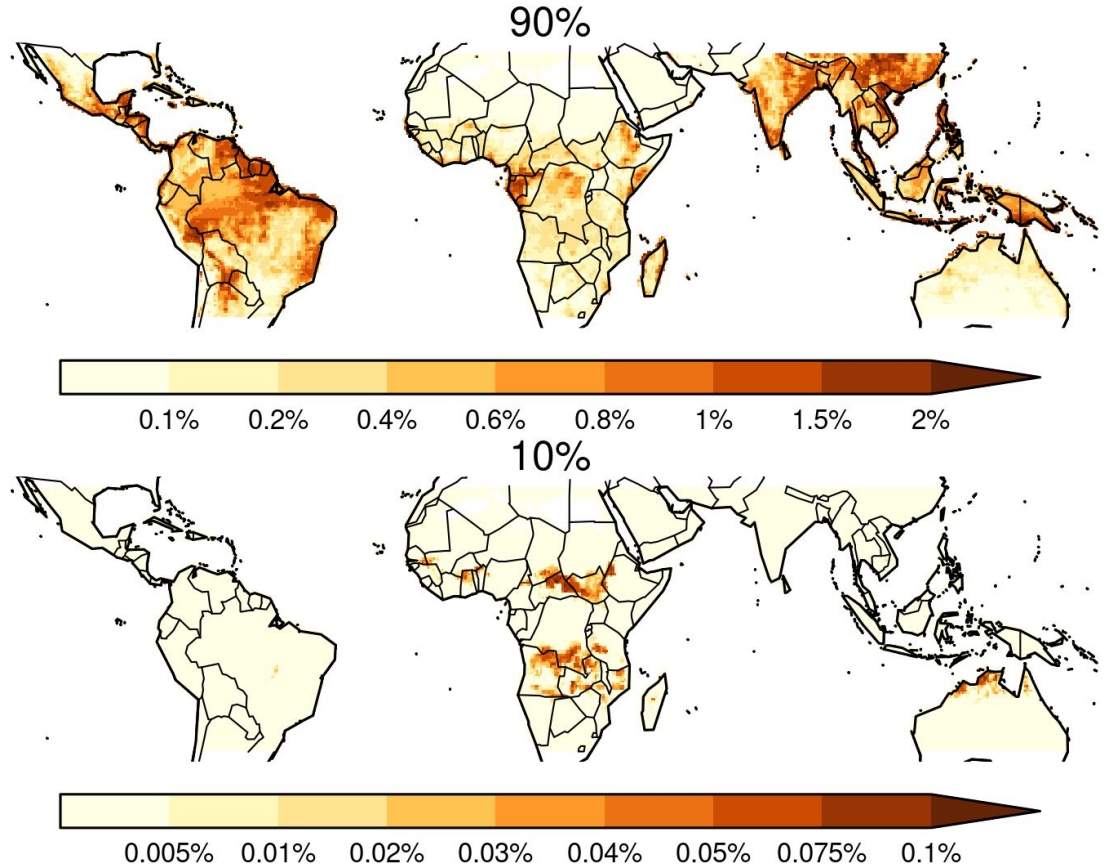
Defining biomes using ML (Jeremy W)

Clustering Results

- Using same variables to find "clusters" of bioclimate space
- Will be used for biome-based model eval
- Plans to use on JULES/UKESM output
- Email: jeremy.walton@metoffice.gov.uk
- **See Jeremy's talk, Thurs 10:35am**

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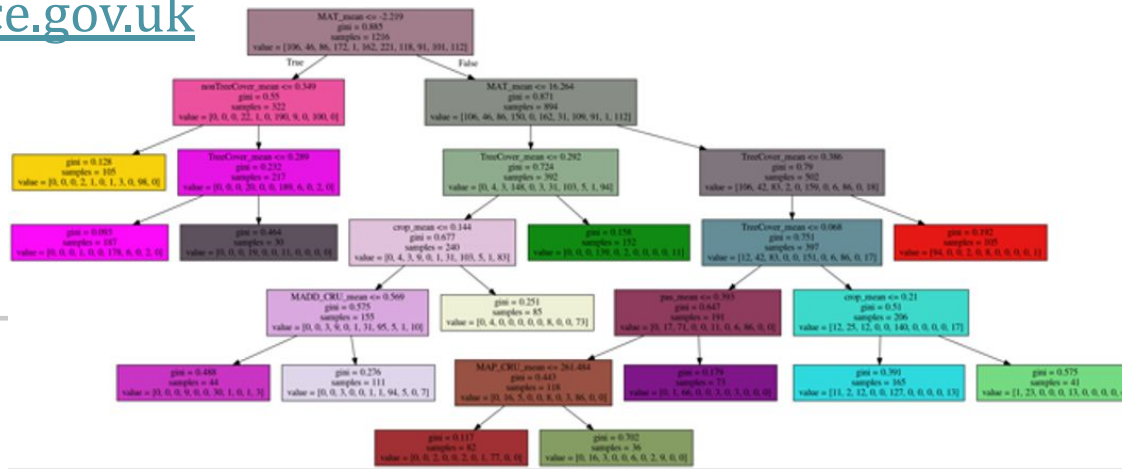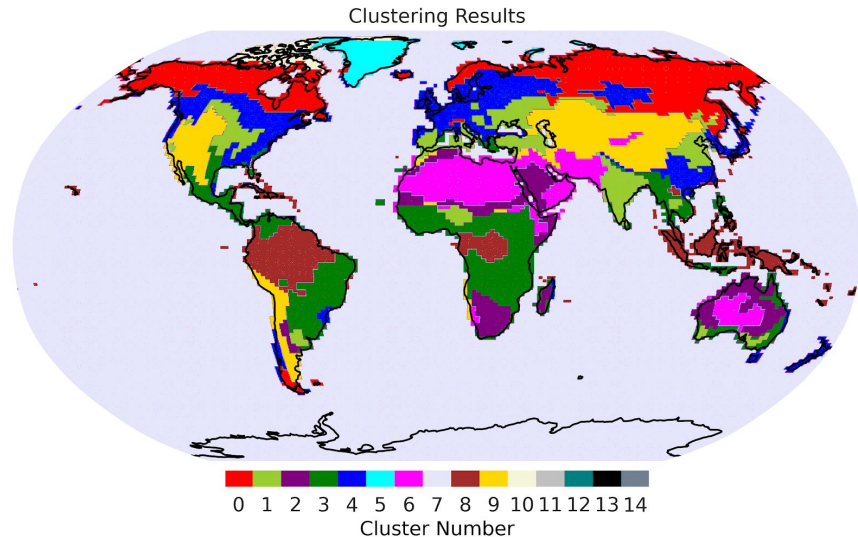
JULES-ES UKEMS1 chantelle.burton@metoffice.gov.uk
JULES-ES ISIMIP camilla.mathison@metoffice.gov.uk

eleanor.burke@metoffice.gov.uk

Bayesian Optimization doukel@ceh.ac.uk
Biome ML jeremy.walton@metoffice.gov.uk

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No dinosaurs became extinct in the making of this presentation

Wanna come along to our meetups? 3rd Thursday of the month, 3pm. doukel@ceh.ac.uk :D

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2 days after fire/6 months after fire

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