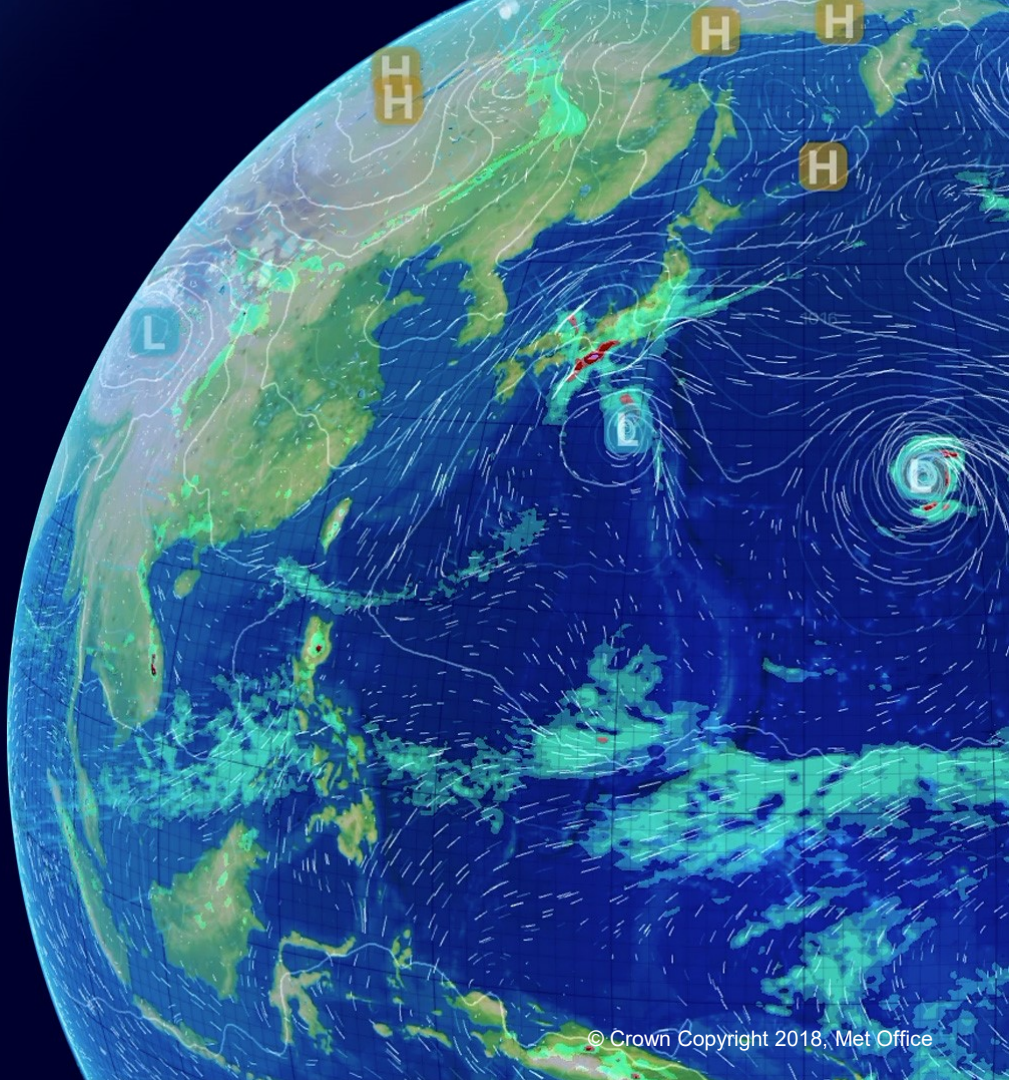




JULES-ES+fire

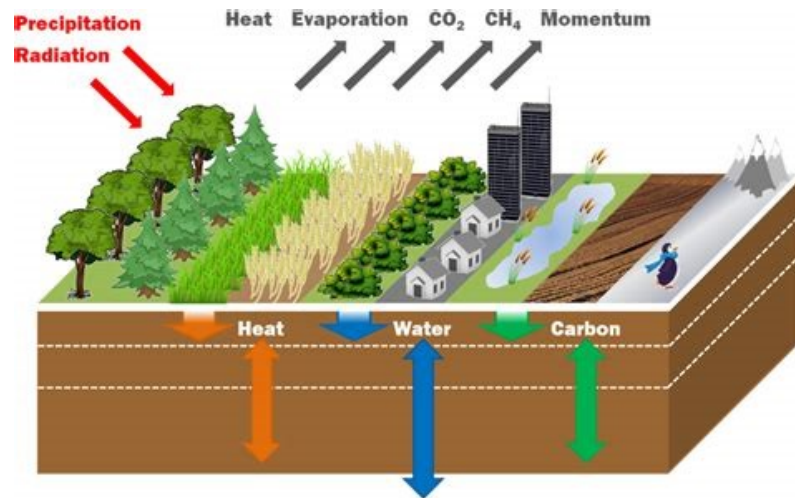
Chantelle Burton

Met Office Hadley Centre

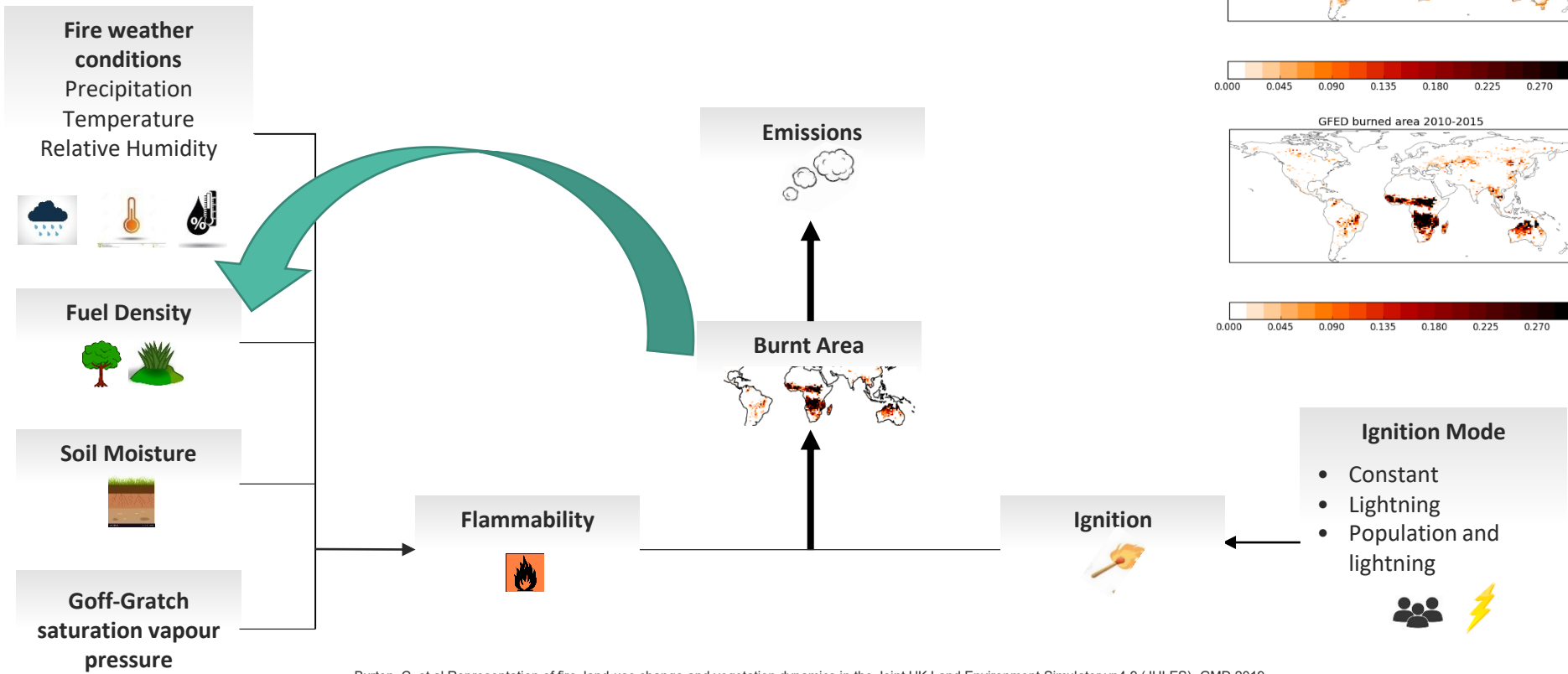


Overview

- JULES-ES configuration
 - 13 PFTs (crop and pasture separate)
 - Used for UKESM land surface
- TRENDY 2019
- Work on including fire (INFERNO)
- Early results (carbon)
- Other work in progress



INFERNO



Burton, C. et al Representation of fire, land-use change and vegetation dynamics in the Joint UK Land Environment Simulator vn4.9 (JULES), GMD 2019

Interactive Fire and Emission algoRithm for Natural enviroNments

Overview: ilamb

ILAMB Benchmark Results

Mean State

Relationship

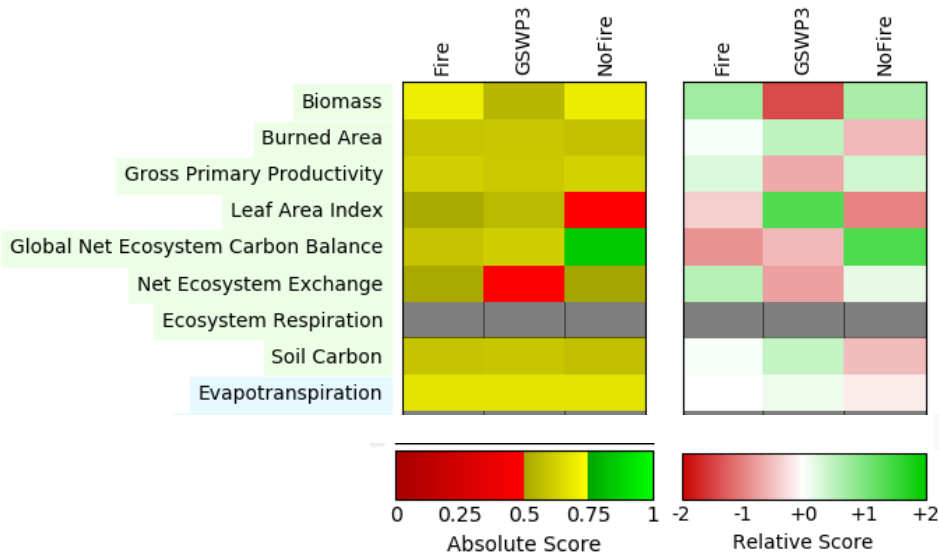
Results Table

Mean State Scores

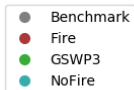
CRUJRA vs GSWP3

Columns

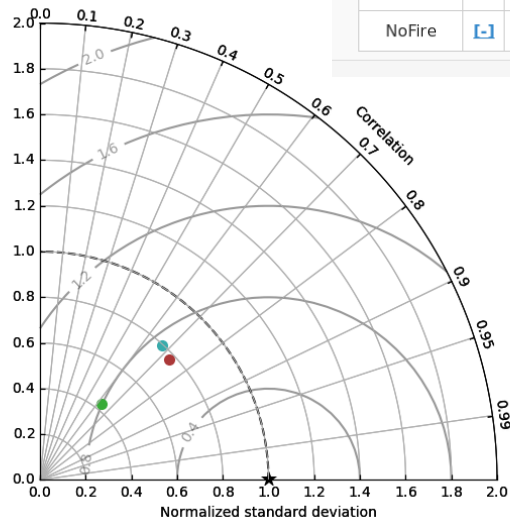
	Fire	GSWP3	NoFire
Biomass	0.70	0.55	0.70
Burned Area	0.59	0.60	0.57
Gross Primary Productivity	0.62	0.60	0.62
Leaf Area Index	0.51	0.55	0.49
Global Net Ecosystem Carbon Balance	0.58	0.62	0.85
Net Ecosystem Exchange	0.51	0.48	0.50
Ecosystem Respiration	~	~	~
Soil Carbon	0.58	0.59	0.57
Ecosystem and Carbon Cycle Summary	0.52	0.51	0.56
Evapotranspiration	0.67	0.67	0.67



MODEL COLORS



Spatial Taylor diagram



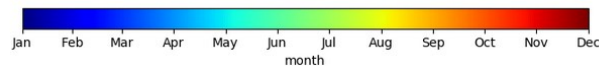
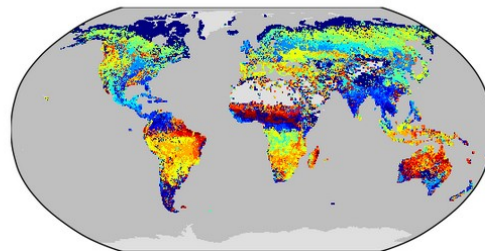
	Download Data	Period Mean (original grids) [Pg]	Model Period Mean (intersection) [Pg]	Model Period Mean (complement) [Pg]	Benchmark Period Mean (intersection) [Pg]	Benchmark Period Mean (complement) [Pg]	Bias [kg m ⁻²]	Bias Score [1]	Spatial Distribution Score [1]	Overall Score [1]
Benchmark	[L]	455.								
Fire	[L]	485.	457.	28.2	452.	2.89	0.962	0.63	0.81	0.72
GSWP3	[L]	279.	259.	20.5	452.	2.89	-1.54	0.50	0.42	0.46
NoFire	[L]	635.	590.	44.9	452.	2.89	2.45	0.62	0.79	0.71

Biomass

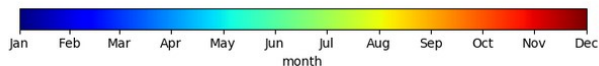
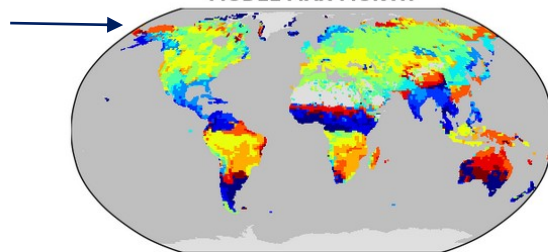
Larger differences
between forcing datasets

Month of max burned area

BENCHMARK MAX MONTH

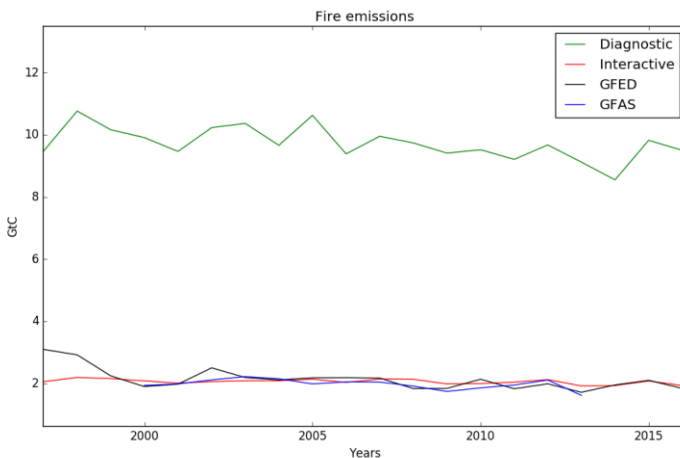
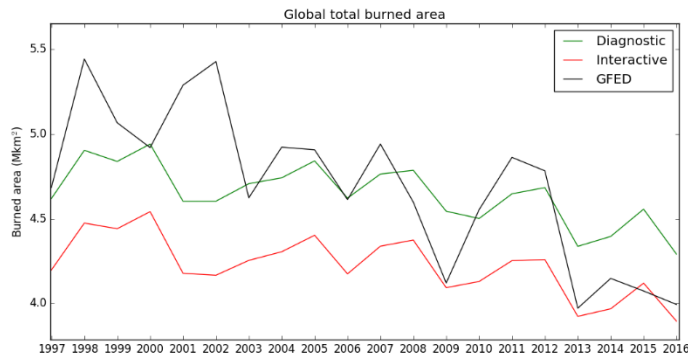


MODEL MAX MONTH

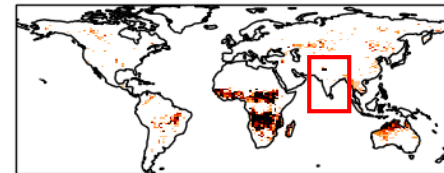


Fire variables

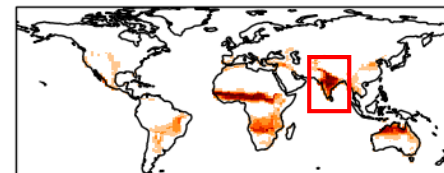
- Burned area and emissions compare with PD GFED4.1s observations
- Burned area and emissions are higher without vegetation mortality
- Reduce burning in crop areas



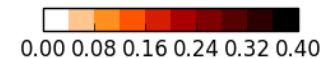
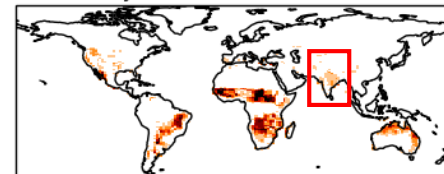
GFED burnt area 2012-2016



TRENDY 5PFT 2010-2014

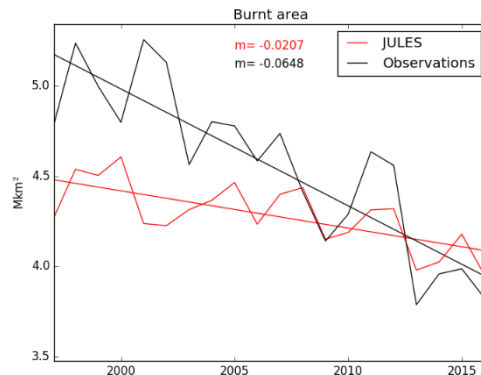


JULES-ES 2012-2016

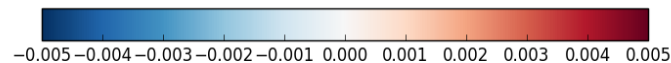
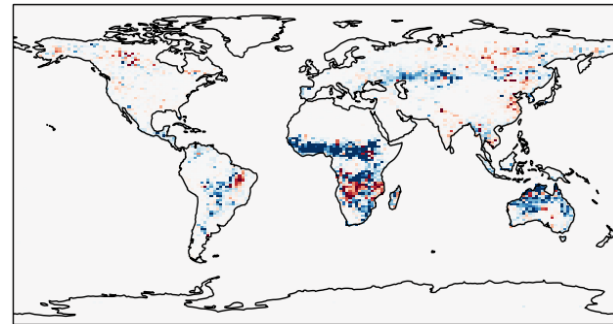


Burned area trend

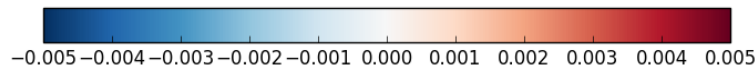
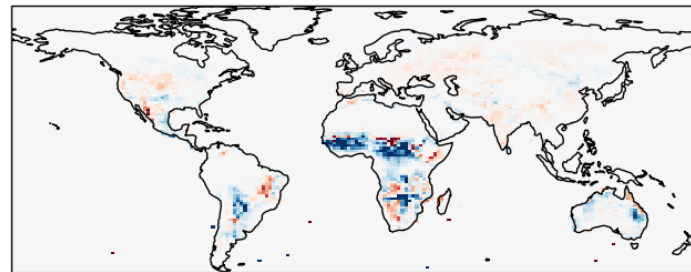
- Slightly negative trend in time series, although not as strong as observations
- Negative trend in obs dominated by NH Africa -> likely driven reduction in agricultural burning -> socio-economic trends in burning not included
- Otherwise spatial trend is fairly well captured



GFED Burnt area trend 1997-2016

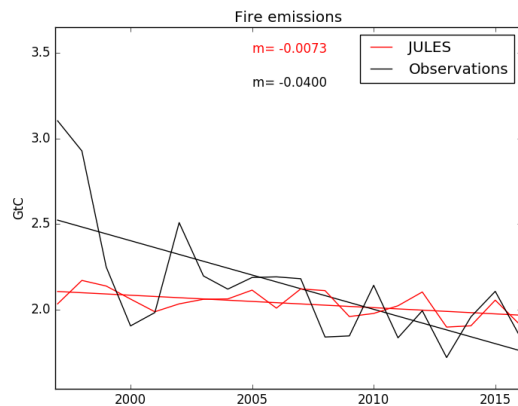


Burnt area trend 1997-2016

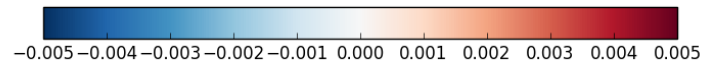
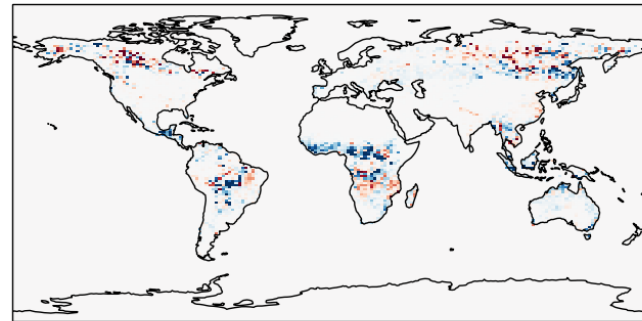


Emissions trend

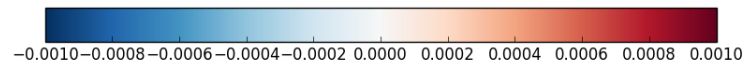
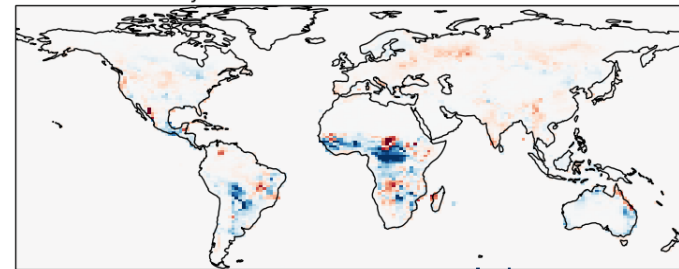
- Slightly negative trend in time series, although not as strong as observations
- Negative trend in obs dominated by NH Africa -> likely driven by end of growing season burning -> socio-economic trends in burning are not included in the model
- Otherwise spatial trend is fairly well captured



GFED Emissions trend 1997-2016

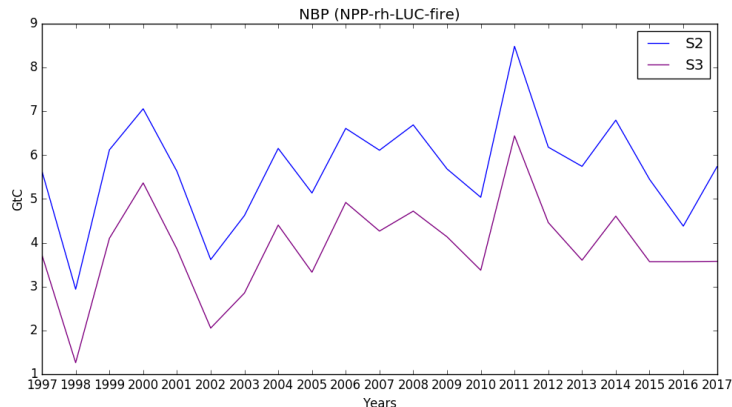
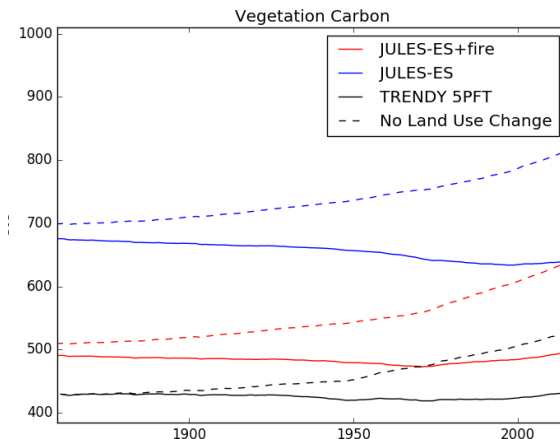
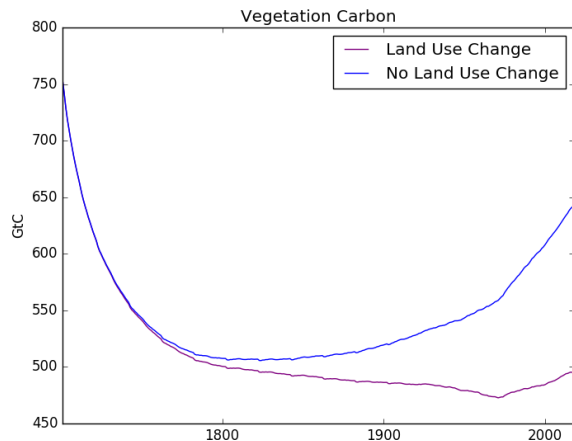


JULES Emissions trend 1997-2016



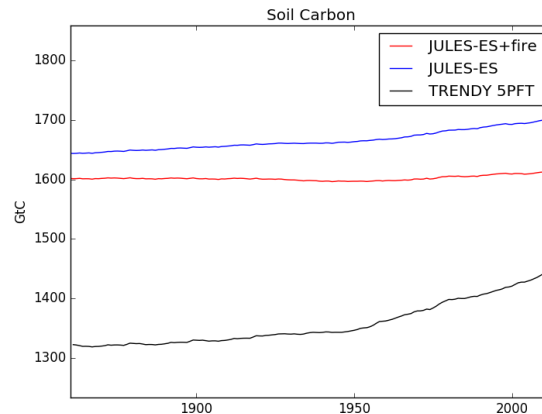
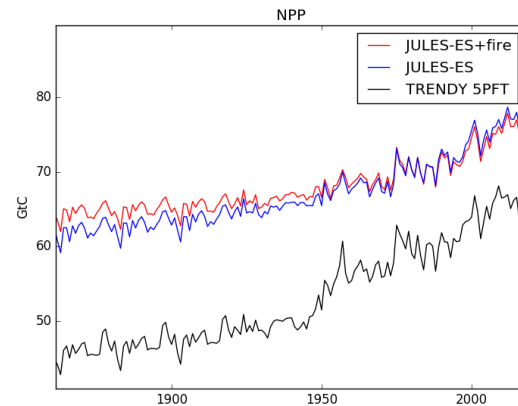
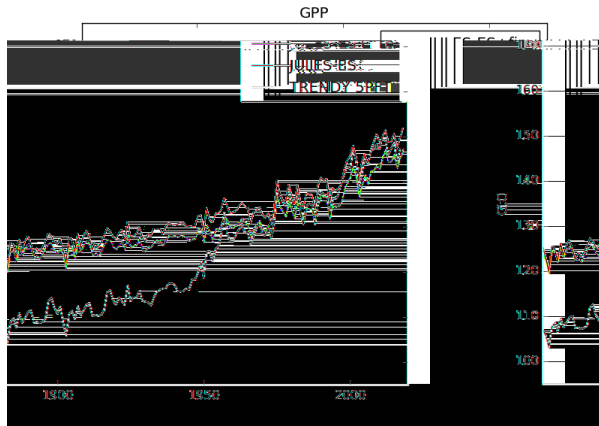
Vegetation carbon

- Observations: ~466GtC (IPCC AR5)
- JULES-ES+fire ~500GtC
- Increase in cveg around 1970 is replicated
- NBP is positive in present day

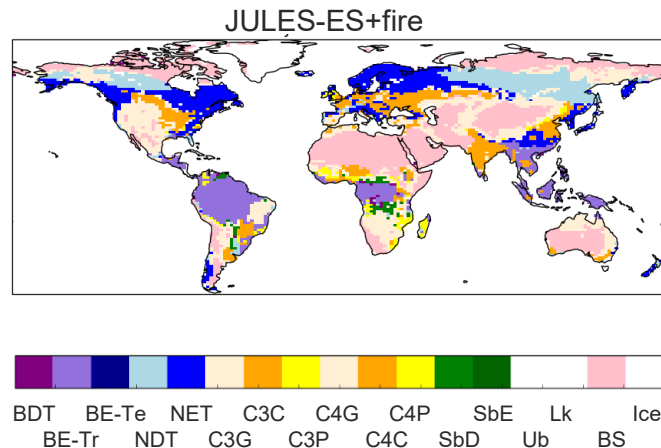
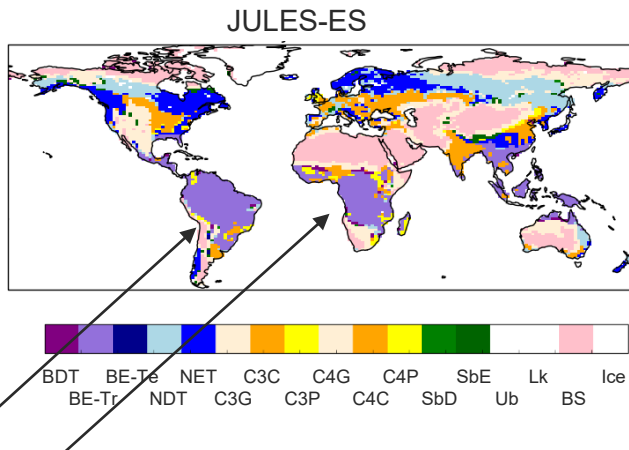
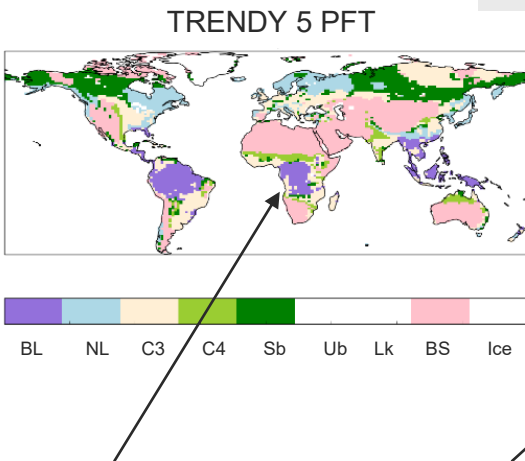
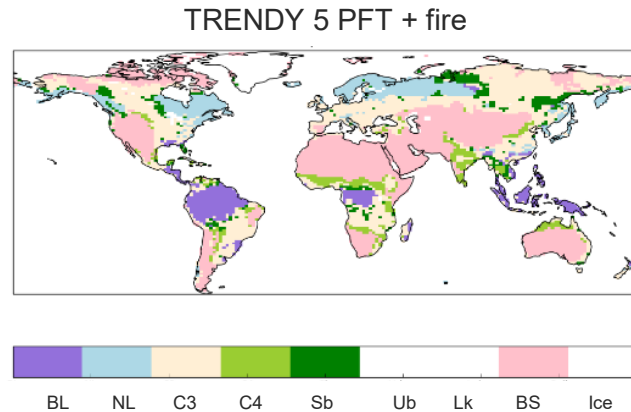
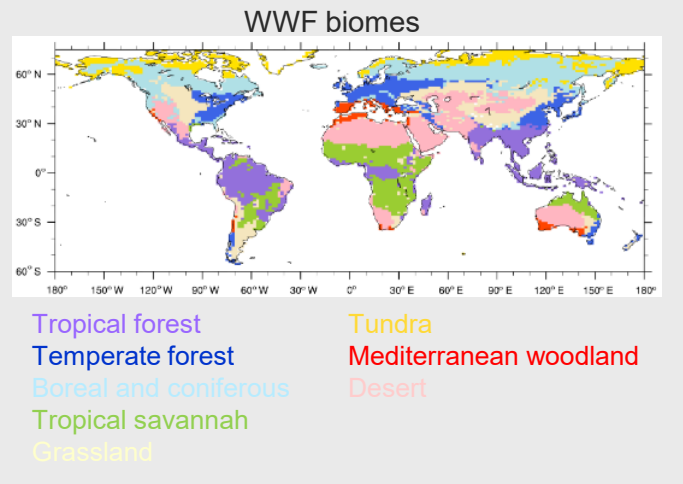


Productivity

- Observations:
GPP ~100-130 GtC
NPP ~55 GtC
Soil Carbon ~1700GtC
- Soil carbon is lower with fire,
but higher than previous
configurations



Vegetation cover



High tropical tree cover without fire

Ongoing issues

- Still don't capture strong negative trend (due to human influence in Africa?)
- Interannual variability: El Nino years not well captured (especially emissions – no peat burning)

Work in progress

- Crop fragmentation – Kelley et al (accepted)
- Mortality JPEG – identifying other causes of mortality, which may mean fire mortality reduces

