

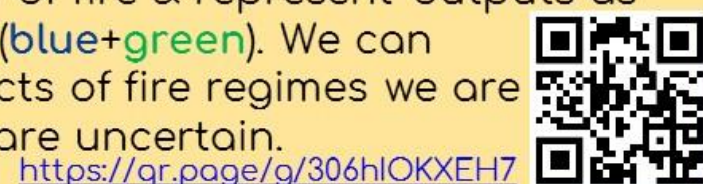
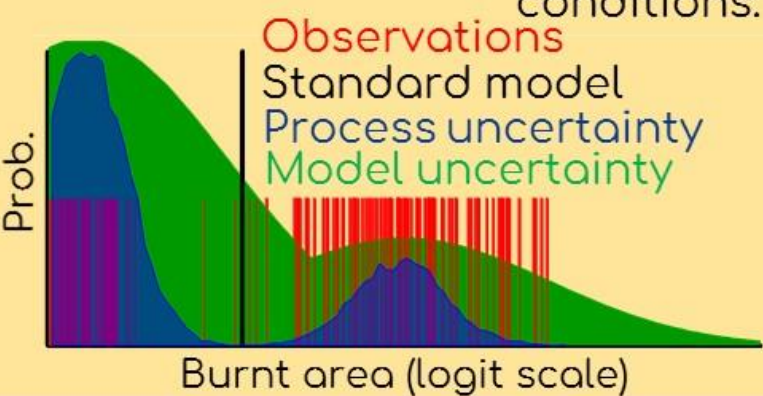
ConFire: An uncertainty method for fire attribution

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Chris Huntingford, Megan Brown, Ning Dong, Elizabeth Cooper



Under the same meteorological
conditions:

Global fire models struggle to simulate many aspects of burnt area¹. That is because similar large scale meteorological conditions can cause a variety of burnt areas (red, left)². With ConFire^{2,3}, we use Bayesian Inference (see QR for info) to optimise a model to satellite observations of fire & represent outputs as probability densities (blue+green). We can determine what aspects of fire regimes we are confident in & which are uncertain.



<https://qr.page/g/306hOKXEh7>

Extreme fire events²

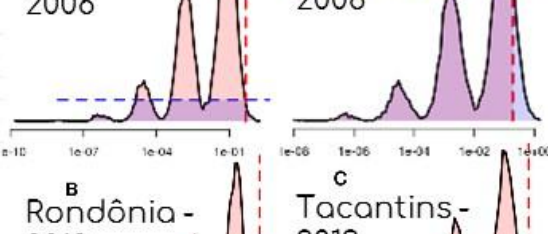
Attributing fire event causes is difficult using standard modelling. However, probability densities let us assess a potential driver's likely influence. For the 2019 Amazonia fires over the arc of deforestation, we show that observed burning (red dashed line) was more extreme than the meteorological conditions and historic land use/land cover suggest (towards the model outputs tail distribution). Therefore, it is very likely (93% - blue line) that the burning levels were caused by sudden changes in human management or land cover, which the model did not consider.



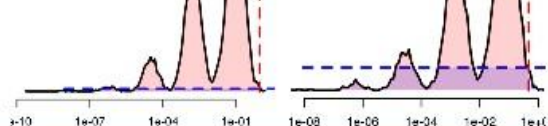
2006 - extreme year
likely explained
by meteorology



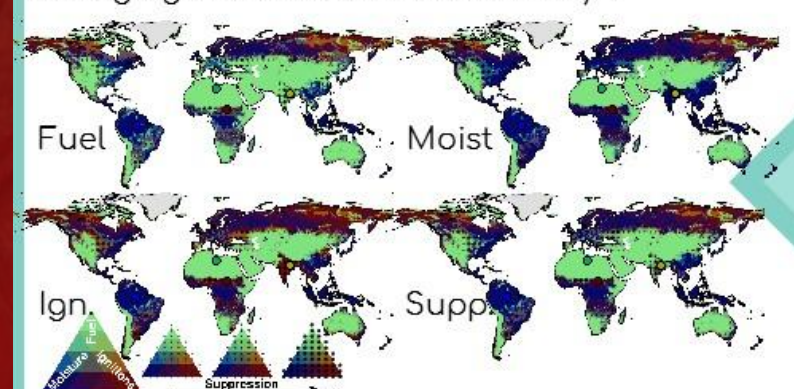
2019 fire
anomaly



2019 - extreme
year likely not driven
by meteorology



Sensitivity of burnt area to controls



Historical fire regime change³

We find burning in tropical forests is limited by and sensitive to moisture (blue), and arid regions are sensitive to fuel. Elsewhere, exact drivers are uncertain. Boreal, for example, could be sensitive to ignition changes, moisture or both. The impact of human suppression in Central USA and Northern African Savanna is also uncertain. Despite this, we can be confident in the large scale drivers of much of the world's changing fire regimes (see QR code)

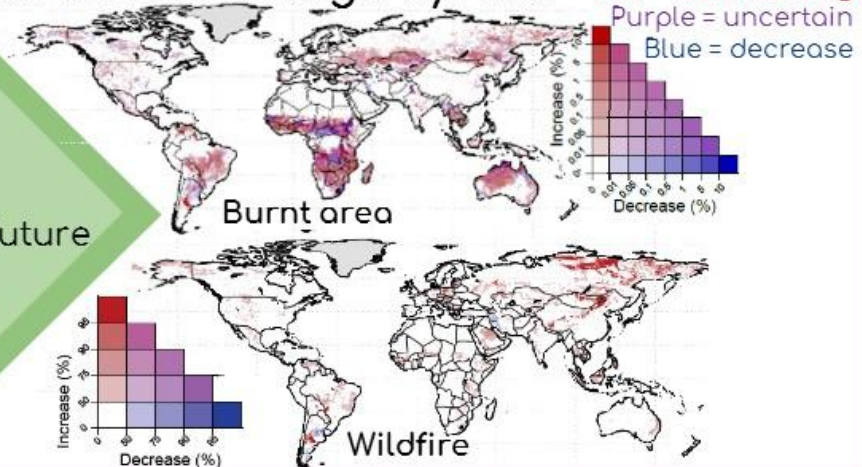


Future changes in Wildfire⁴

We can look at the change in the "tail" of our model output to project change in extreme fires. We sample uncertainty in socioeconomic pathways with multiple future emissions scenarios (see QR code), and Earth system response uncertainty to forcing with a multi-model climate ensemble. Changes in burnt areas are very uncertain in the future (changing colours, left globe). However, we find significant increases in wildfire (defined as a 1-in-100 likelihood event, 2010-2020) in Siberian peatland and forest, Amazonia and Indonesia by 2100 (right) - all carbon-rich ecosystems.



RCP6.0 fire change by 2100



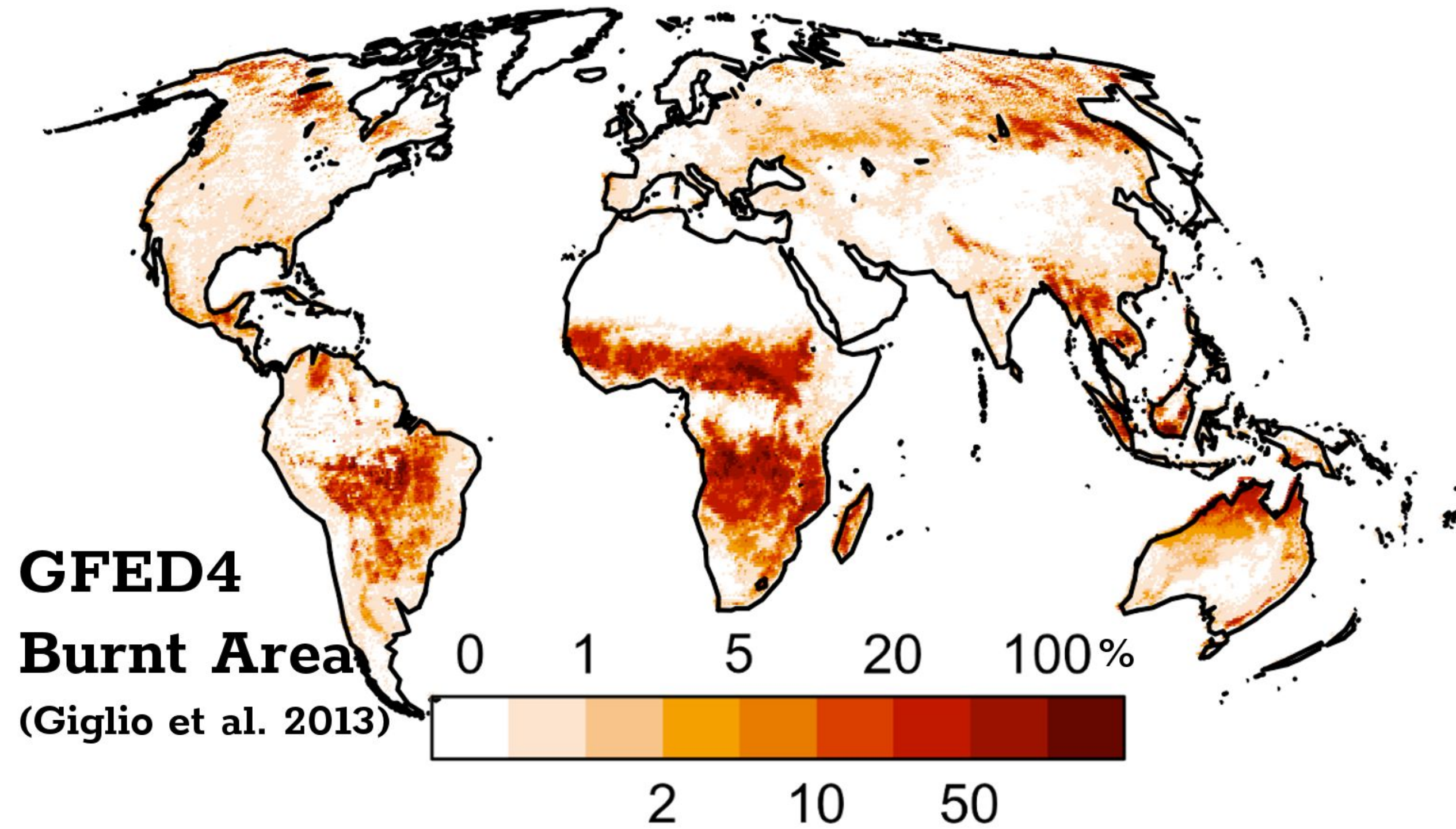
See ConFire poster

[Click here](#)

How we projected wildfire changes, given big uncertainties in global fire modelling



Fire that is not “wild” fire



Wildland prescribed fire at Miller Woods - flickr -
- CC BY-NC 2.0



Fire in Top End savanna NT by Jaana Dielenberg - flickr -
CC BY-NC 2.0

Day after burning



6 months after fire

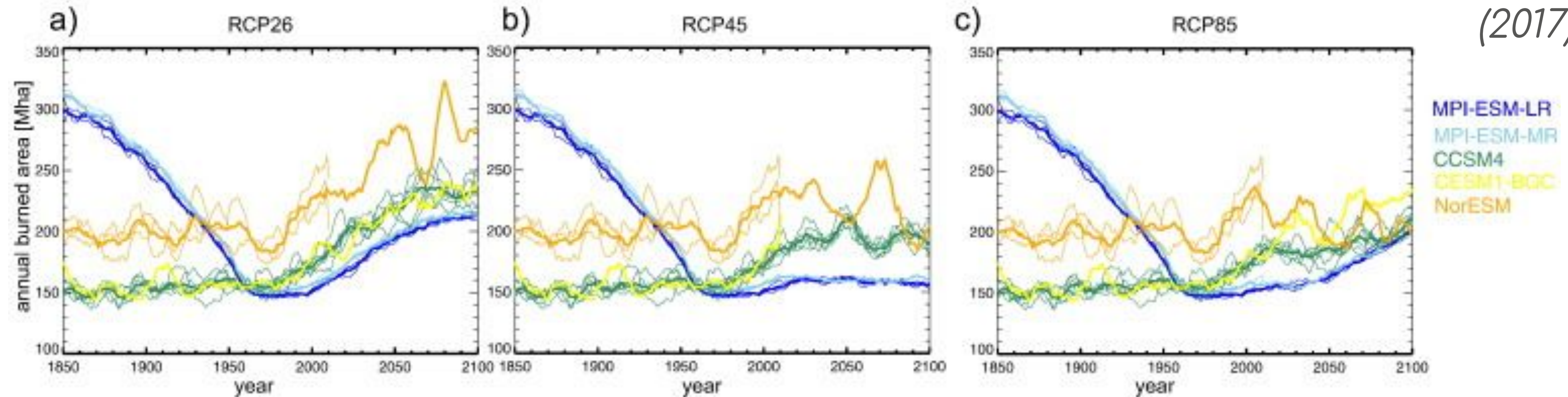
What are “wildfires”?



Future projections on fire

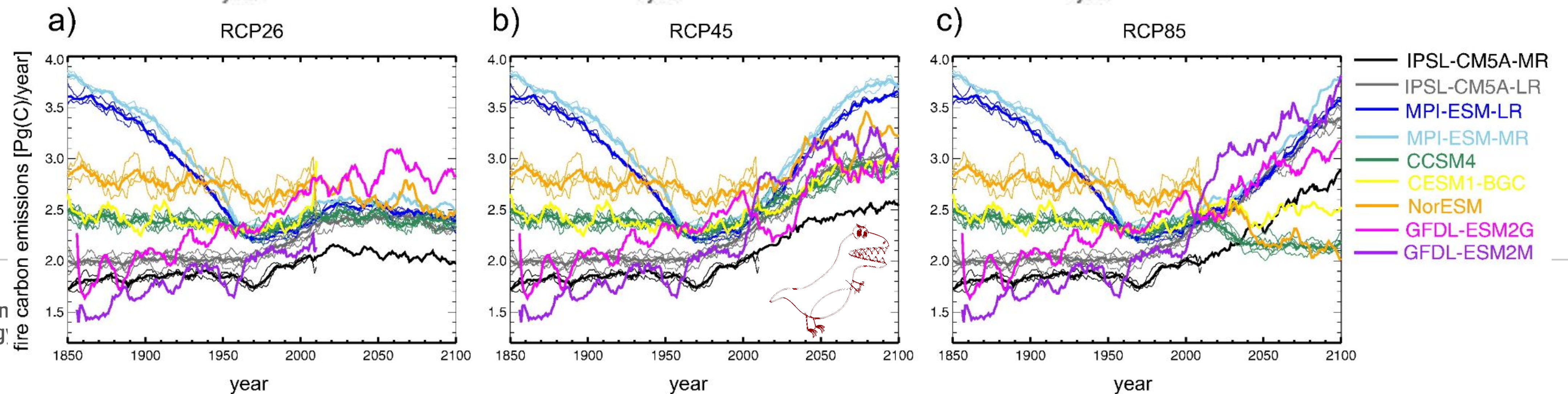
*Kloster &
Lasslop
(2017)*

Burnt Area



Fire C
emissions

UK Cen
Ecolog



Multi-model projections are too broad to say anything meaningful future burning.

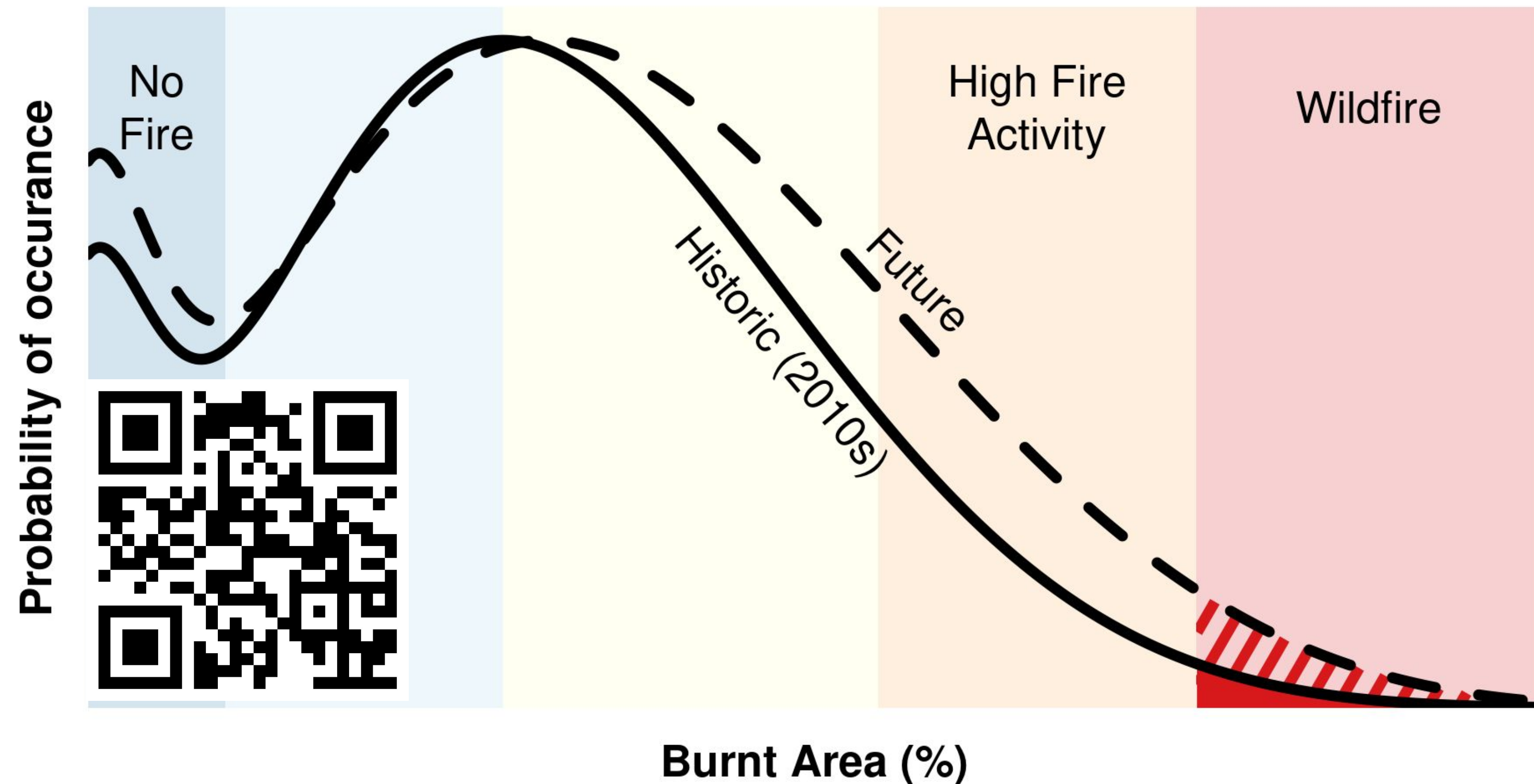
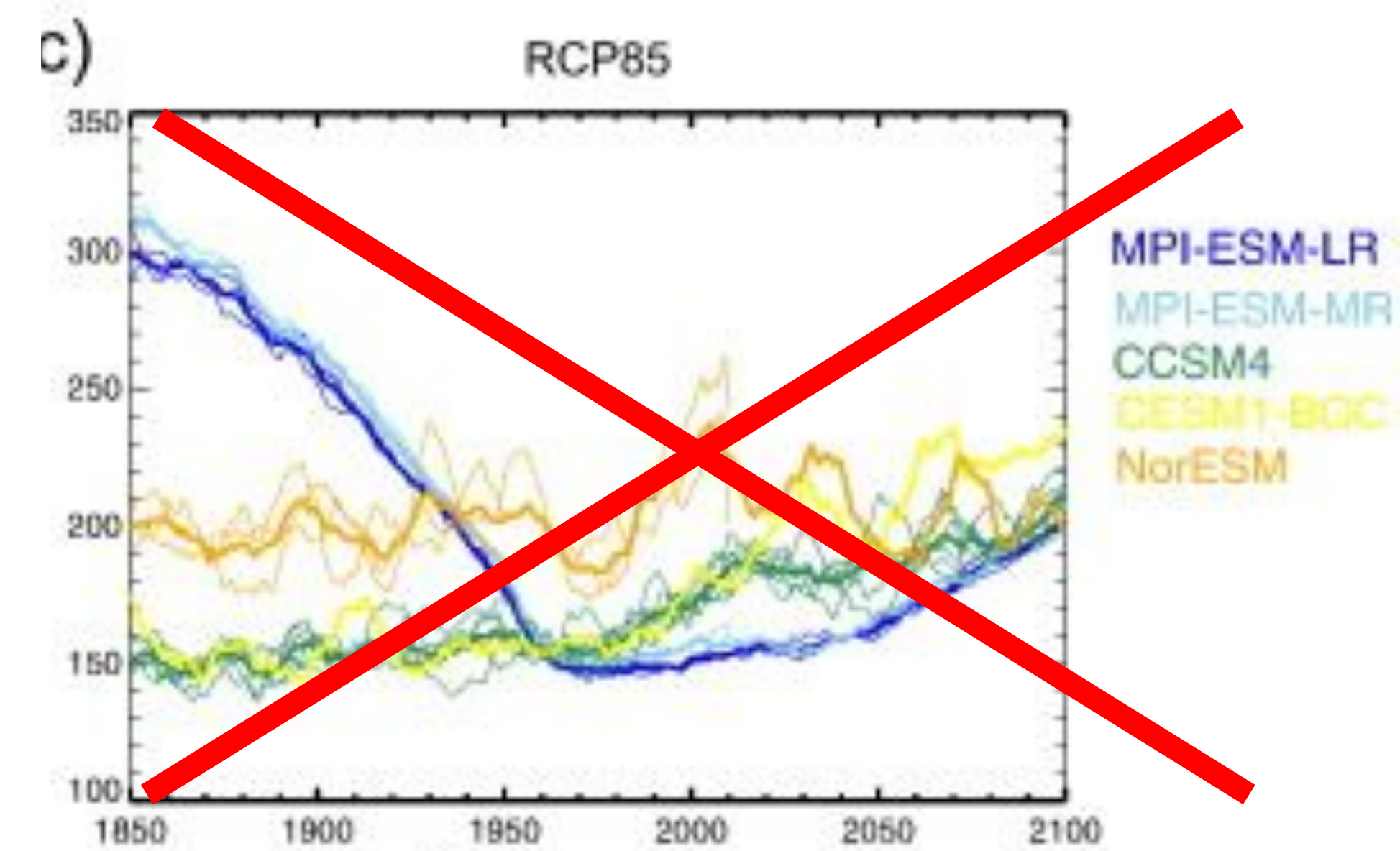
Most global fire models do not simulate “wildfire”

	Landscape fires	Wildfires
Frequency	Often seasonal; occur under moderate fire conditions; quite often intentionally lit	Linked to extreme fire weather
Intensity	Low to moderate intensity with short episodes of high intensity	Mostly high intensity with some periods of moderate intensity
Suppressibility	Easily controlled with regular firefighting resources	Control measures may exceed regular firefighting resources
Impact	Low impact, with a positive impact on some species	High impact on one or more values (social, economic, environmental)

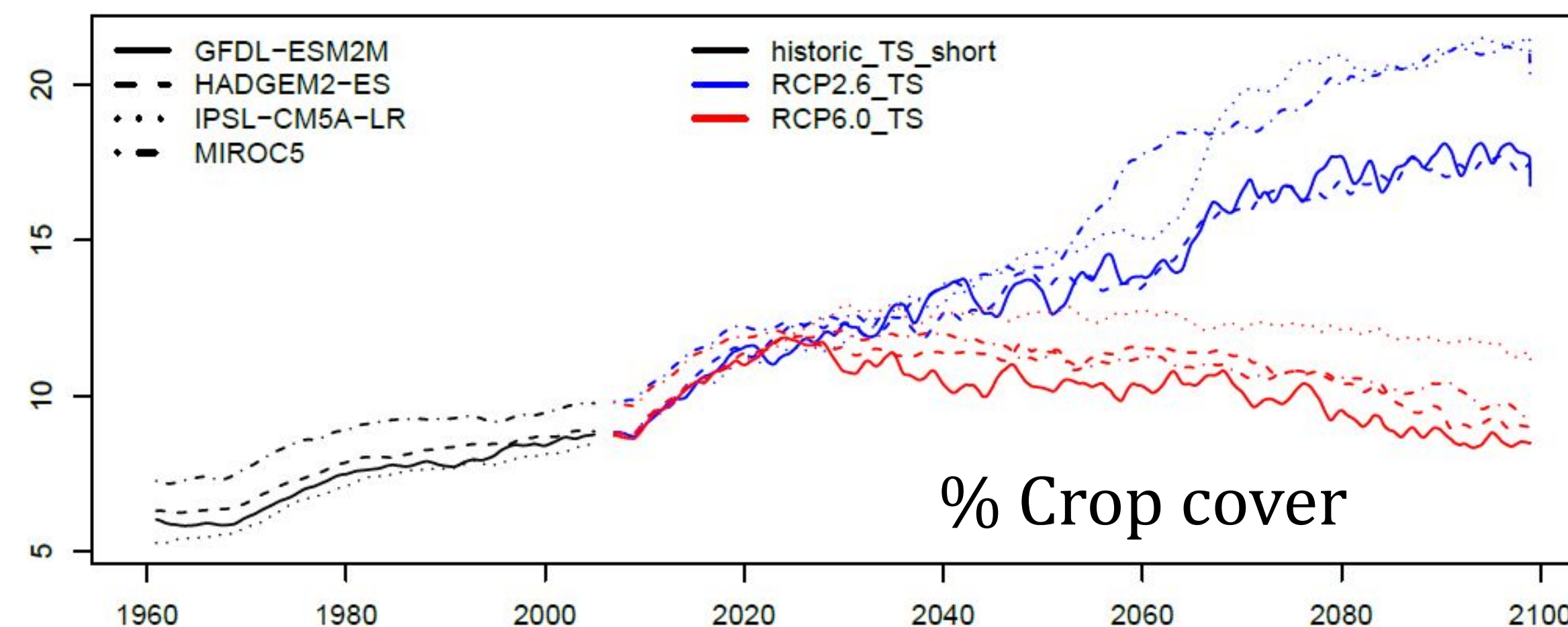
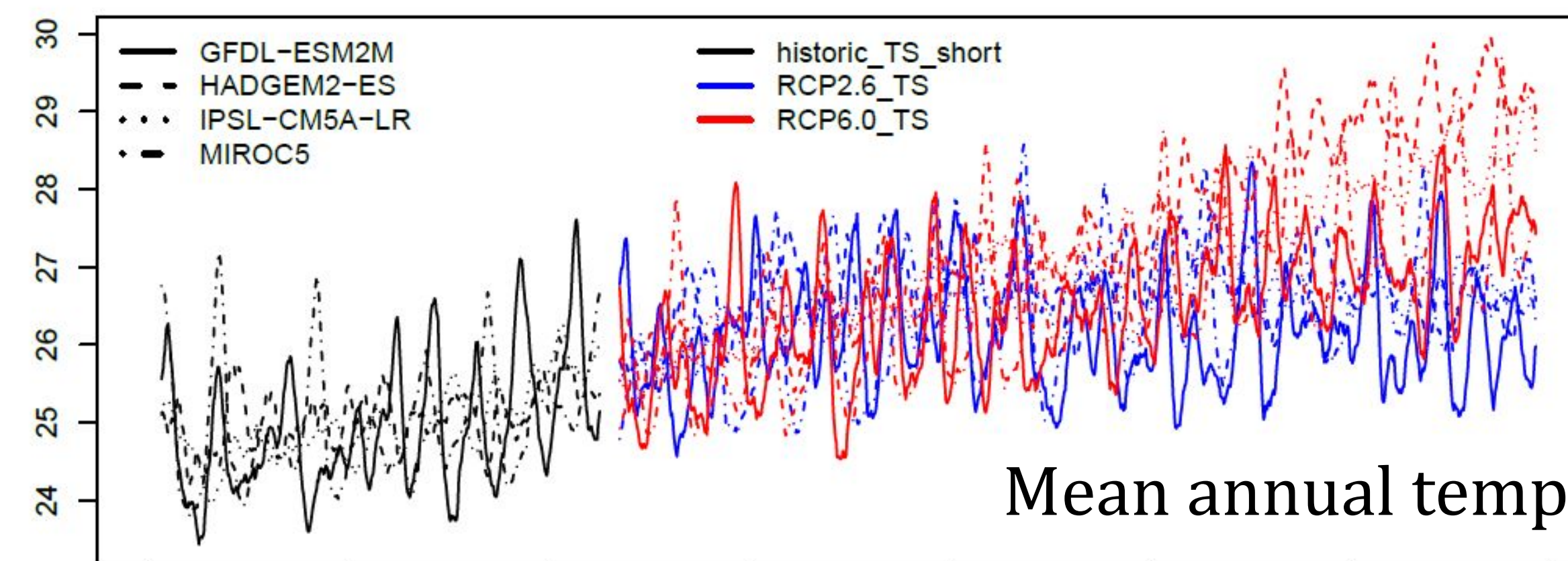
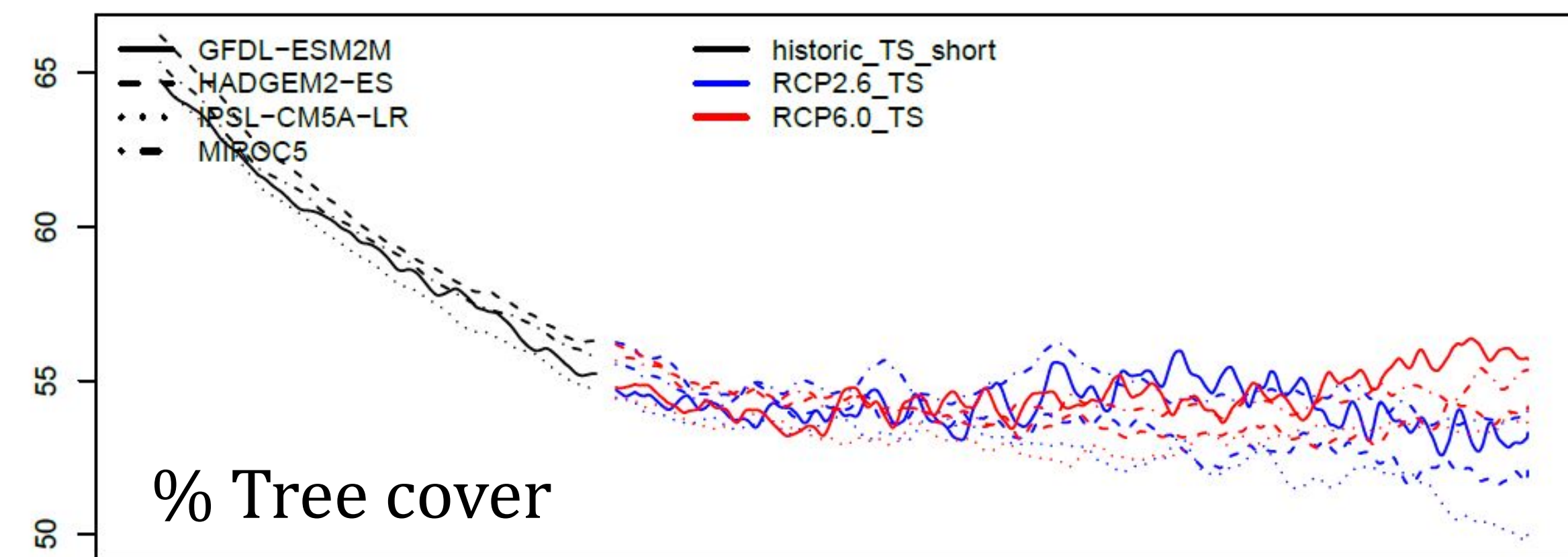
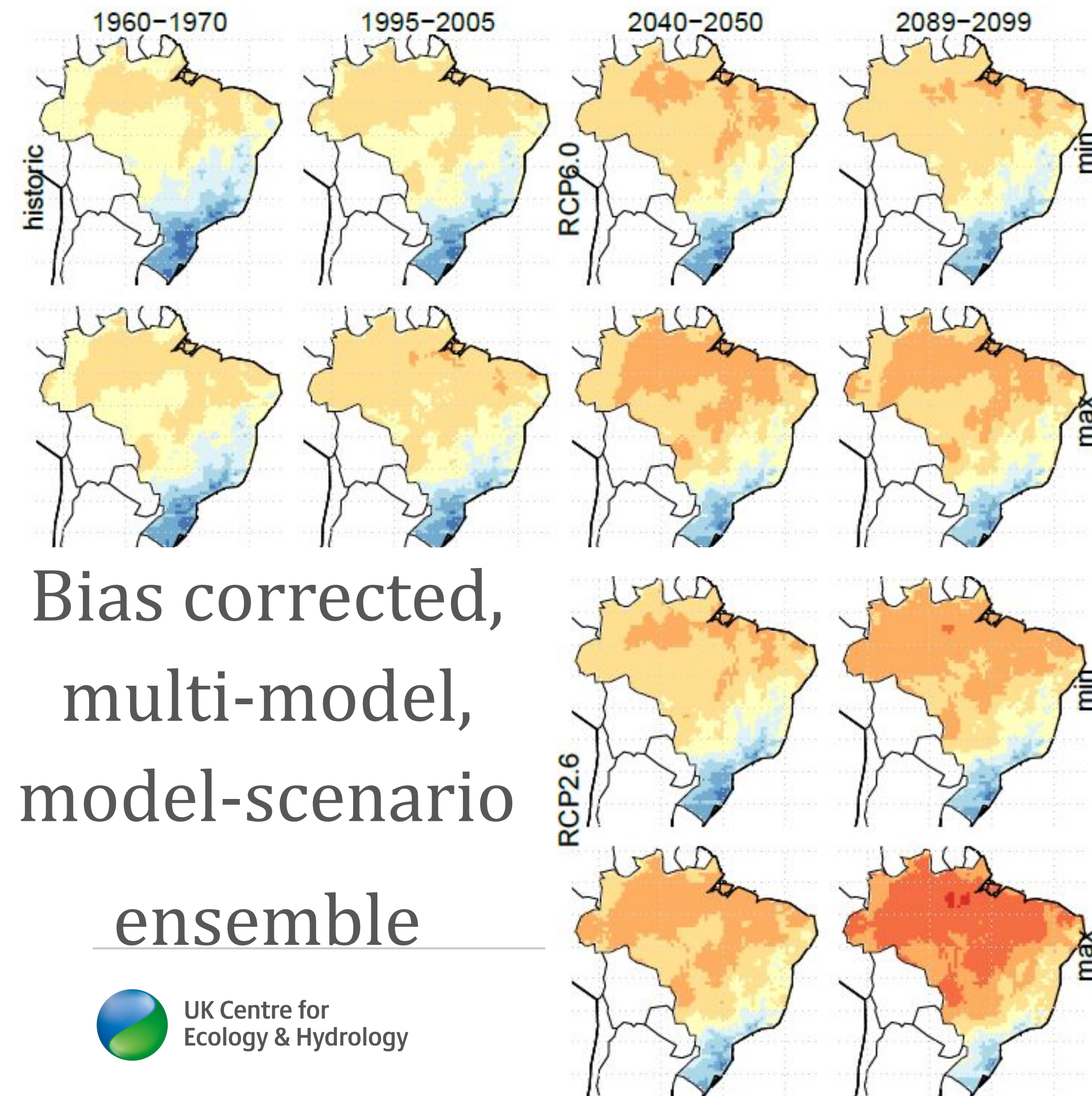
A 1-in-100 year burnt area under 2010-2020 climate conditions and land cover

ConFire - linking uncertainty to likelihood.

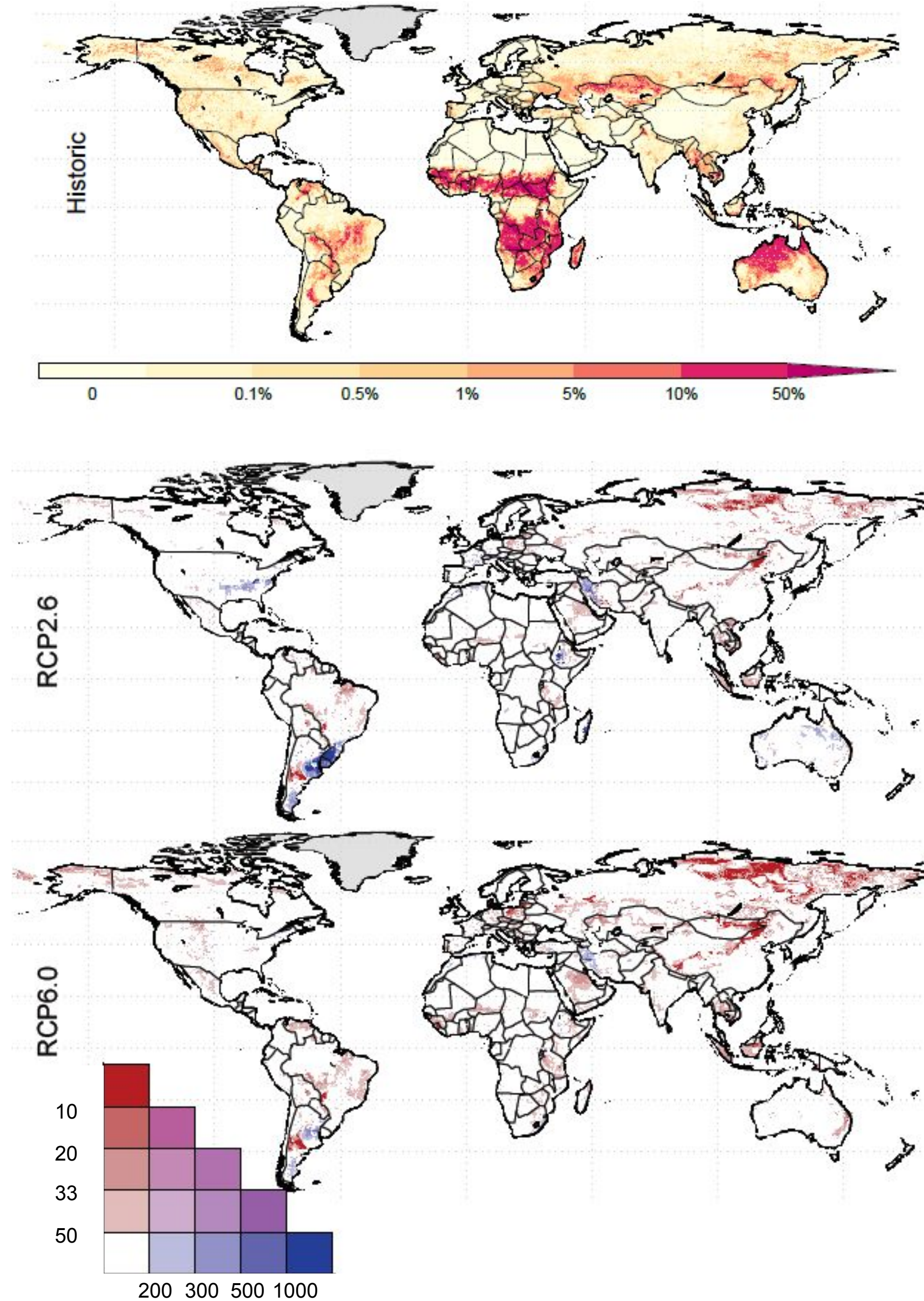
Use **observations** to find the **best model estimate** of wildfire and account for **remaining uncertainties** in climate, veg & fire model



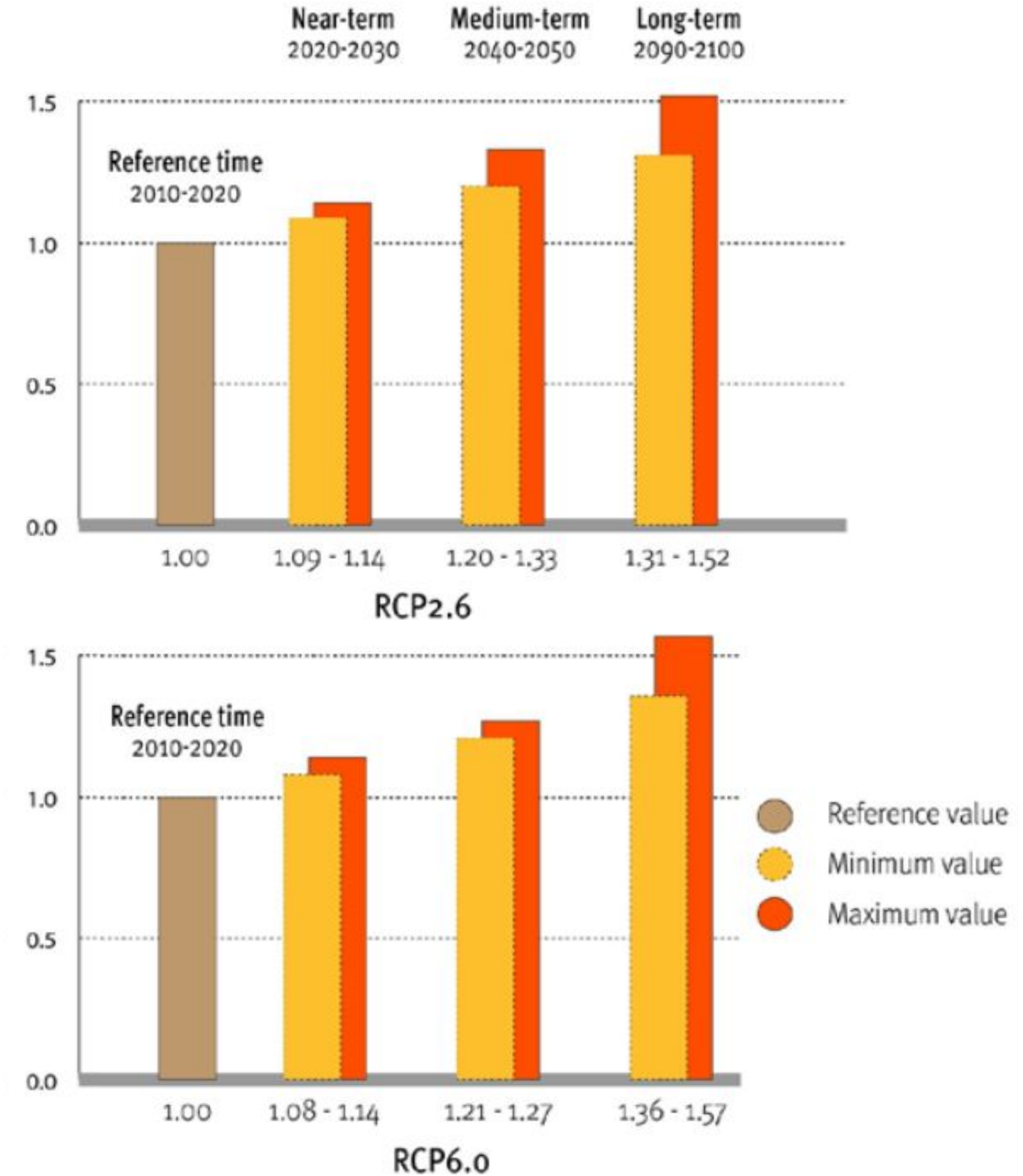
JULES-ISIMIP futures



Changes in burnt area



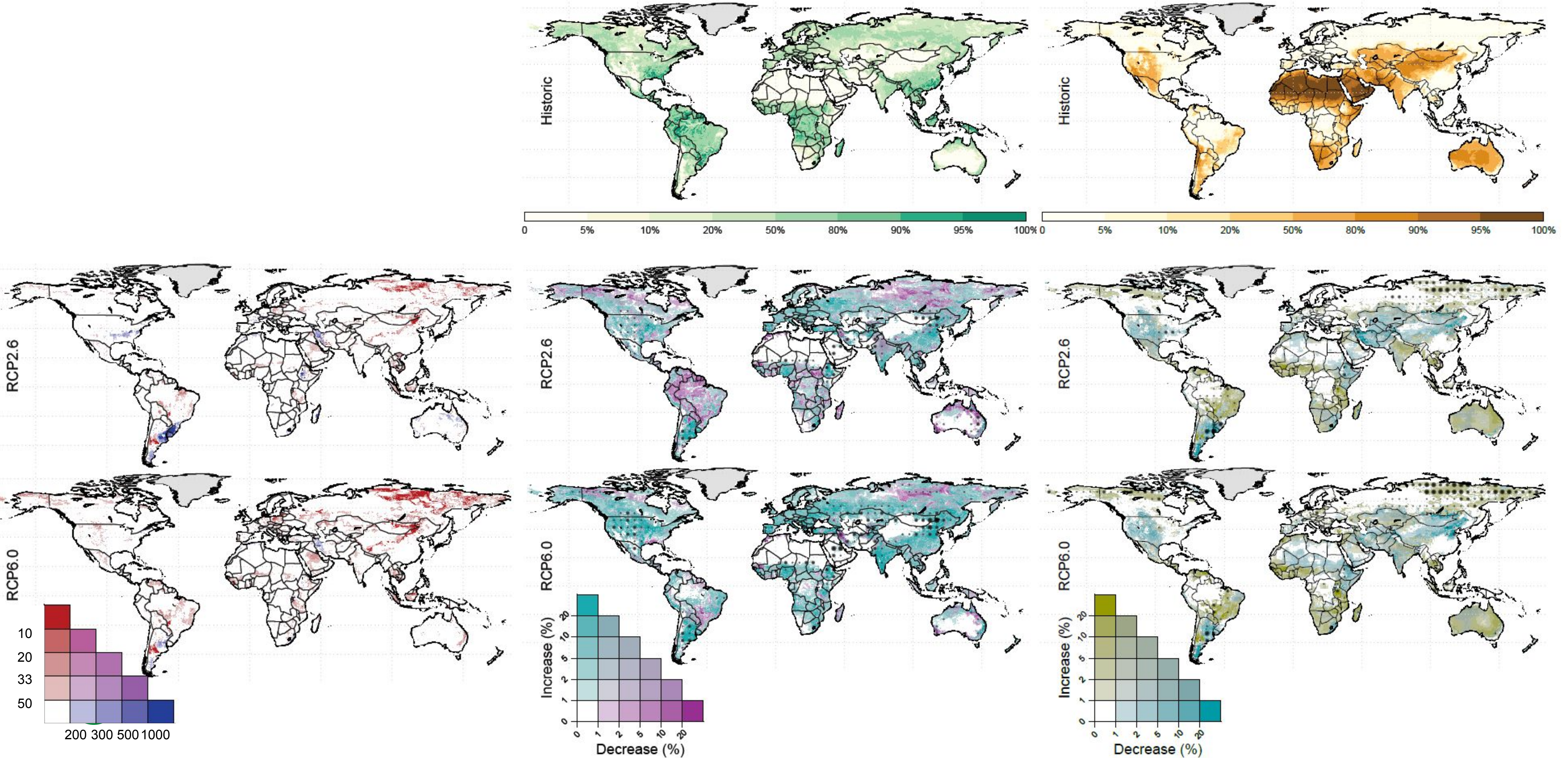
Global change in wildfire events



Changes in Controls

Fuel load

Fuel dryness

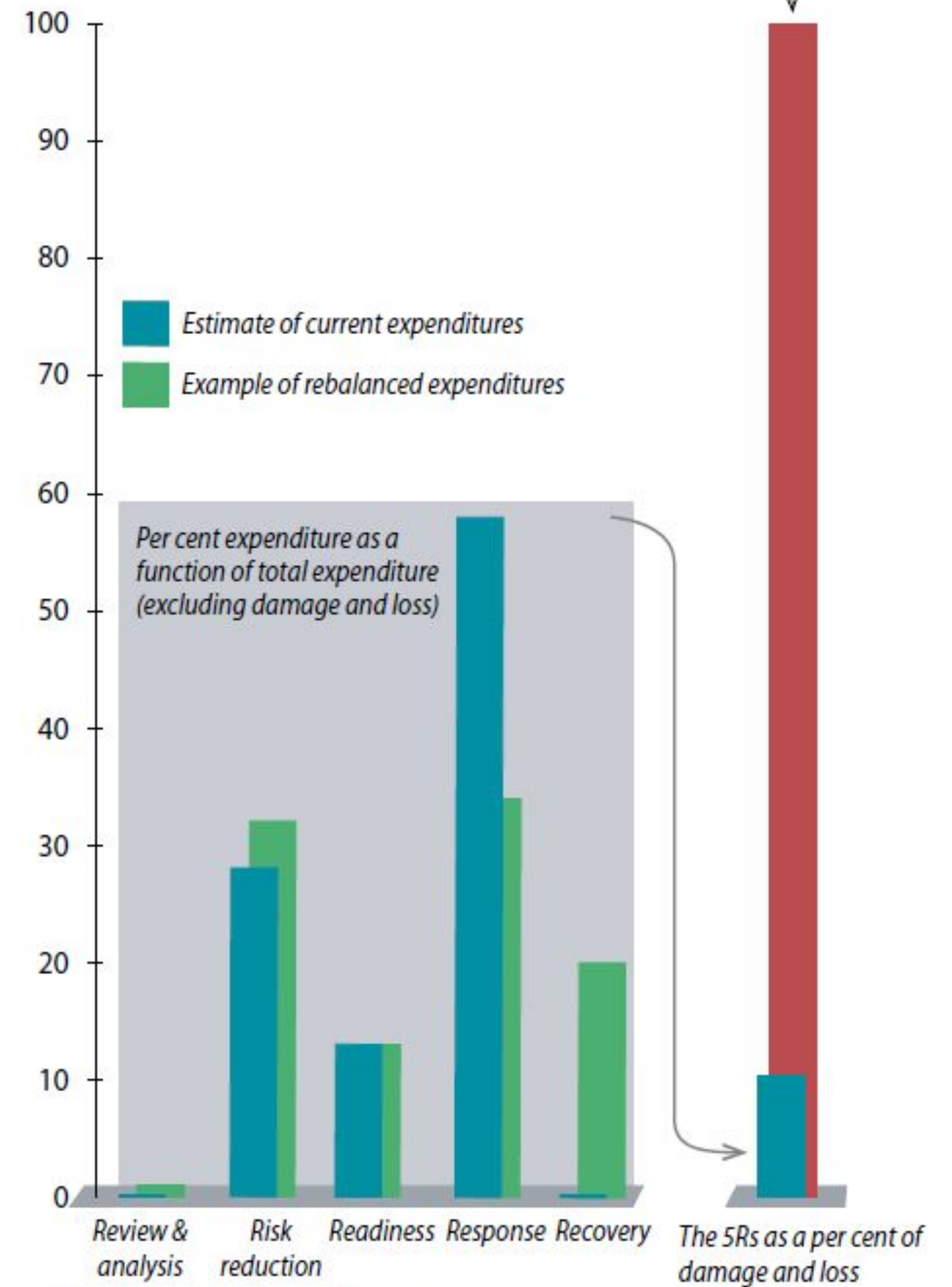


What's missing

There is still large gap between fire modelling and global change, impacts, land management policy and fire management techniques

The 5Rs compared to damage and loss

Damage and loss expenses are set to 100 per cent



Illustrated by Kristina Thygesen GRID-Arendal

Source: Thomas et al. 2015



Likely future(s) of global wildfire

**Douglas Kelley Camilla Mathison,
Chantelle Burton, Megan Brown,
Tiina Kurvits, Elaine Baker,
Andrew Sullivan
+ the JULES-ISIMIP/ConFire
teams
& “Spreading like wildfire”
UNEP authors**