THE STATE OF WILDFIRES PROJECT

State of Wildfires 2024-25

Douglas Kelley | Chantelle Burton | **Francesca Di Giuseppe** | **Matthew Jones** | Maria Barbosa **Zhongwei Liu** | Bob Potts | **Emily Wright** | **Joe McNorton** | **Carlota Segura Garcia** | **Esther Brambleby** **And many many more**

(including **Fiona R. Spuler**, **Jakob B. Wessel**, **Andrew Hartley**, **Eleanor Burkey**, **Anna Bradley**, **Andrew Ciavarella**, **Fraser Lott**, Katie Blackford, Lukas Fiedler, Seppe Lampe for JULES & HadGEM bits)

UKCEH Met Office ECMWF University of East Anglia

Wildfires are getting worse...

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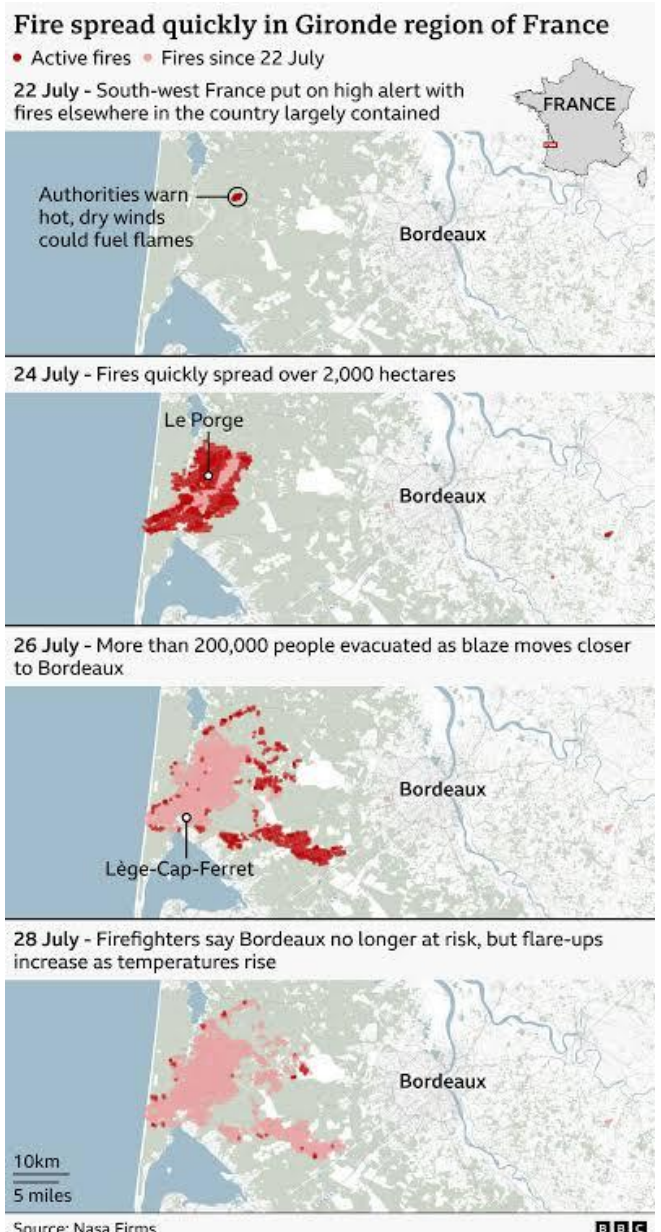


NORTH AMERICA

The 2024-25 fire season was the second most severe on record for North America

31,000 KM²
of burned area, **35% above average.**

194 TG C*
of carbon emissions, **112% above average.**
*700 million tonnes of CO_2

Focal event

Southern California, USA

The most disastrous wildfire event in modern US history occurred in Los Angeles County in January 2025 during a severe Santa Ana wind event.

Impact: The Palisades and Eaton Fires destroyed over 11,750 homes, killed at least 31 people, displaced over 150,000, and caused economic losses exceeding US$140 billion (including insured losses of US$20-75 billion). $PM_{2.5}$ levels peaked at 483 µg/m³, triggering a regional housing and insurance crisis.

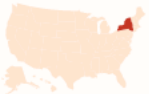
Highlights

Western Canada

Northwest Territories, British Columbia, Alberta and Saskatchewan experienced their second-highest emissions year on record with a combined emissions anomaly of +191 Tg C and provincial anomalies in the range of +184-441%

Alberta, Canada

Extreme wildfires in summer 2024 destroyed 358 structures and led to $1.23 billion in damages, second only to the Fort McMurray fire of 2016. The town of Jasper was evacuated. Two firefighter fatalities occurred.



New York, USA

In an unusual late-season outbreak, every borough experienced multiple wildfires during a two-week span in October-November 2024, an unprecedented fire signal in a densely populated urban environment.

Mexico

Mexico experienced its worst wildfire season on record with over 8,000 wildfires and more than 16,500 km² burned. Particularly severe activity occurred in March-May, reportedly driven by drought and elevated temperatures.

“The January 2025 LA Fires became the most expensive wildfires ever recorded in just a few short days, and New Yorkers found out that their city can also burn when it is dry and hot enough. This should be a wake-up call for the US that climate change is making wildfires increasingly impossible to control and we need to broadly implement a multi-faceted set of mitigation strategies to avert future fire disasters.”

Prof Crystal Kolden
Director of the UC Merced Fire Resilience Center, University of California Merced

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An international partnership

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UKCEH

Met Office

ECMWF

University of East Anglia

Natural Resources Canada

Coventry University

NC STATE UNIVERSITY

THE UNIVERSITY OF MELBOURNE

University of Leicester

MAX-PLANCK-INSTITUT FÜR METEOROLOGIE

University of Exeter

ETH

UNIVERSITY OF MARYLAND

BeZero

European Commission JOINT RESEARCH CENTRE

UH

INPE

UF UNIVERSITY of FLORIDA

NASA

UNIVERSIDADE EDUARDO MONDLANE

CSIR GHANA

INRAE

Atmosphere Monitoring Service atmosphere.copernicus.eu

The Alan Turing Institute

RISE

UNIVERSITY of BOTSWANA

South African NATIONAL PARKS

IPAM Amazônia

ufscar

ELGO - DIMITRA HELLENIC AGRICULTURAL ORGANIZATION - DIMITRA

UBC

INSTITUT PERTANIAN BOGOR

UFRJ UNIVERSIDADE FEDERAL DO RIO DE JANEIRO

CFA

ECOS

BOISE STATE UNIVERSITY

IMPERIAL

IMIB

MeteoSwiss

GRID ARENDAL A UNEP Partner

Unpacking the 2024-25 Fire Season

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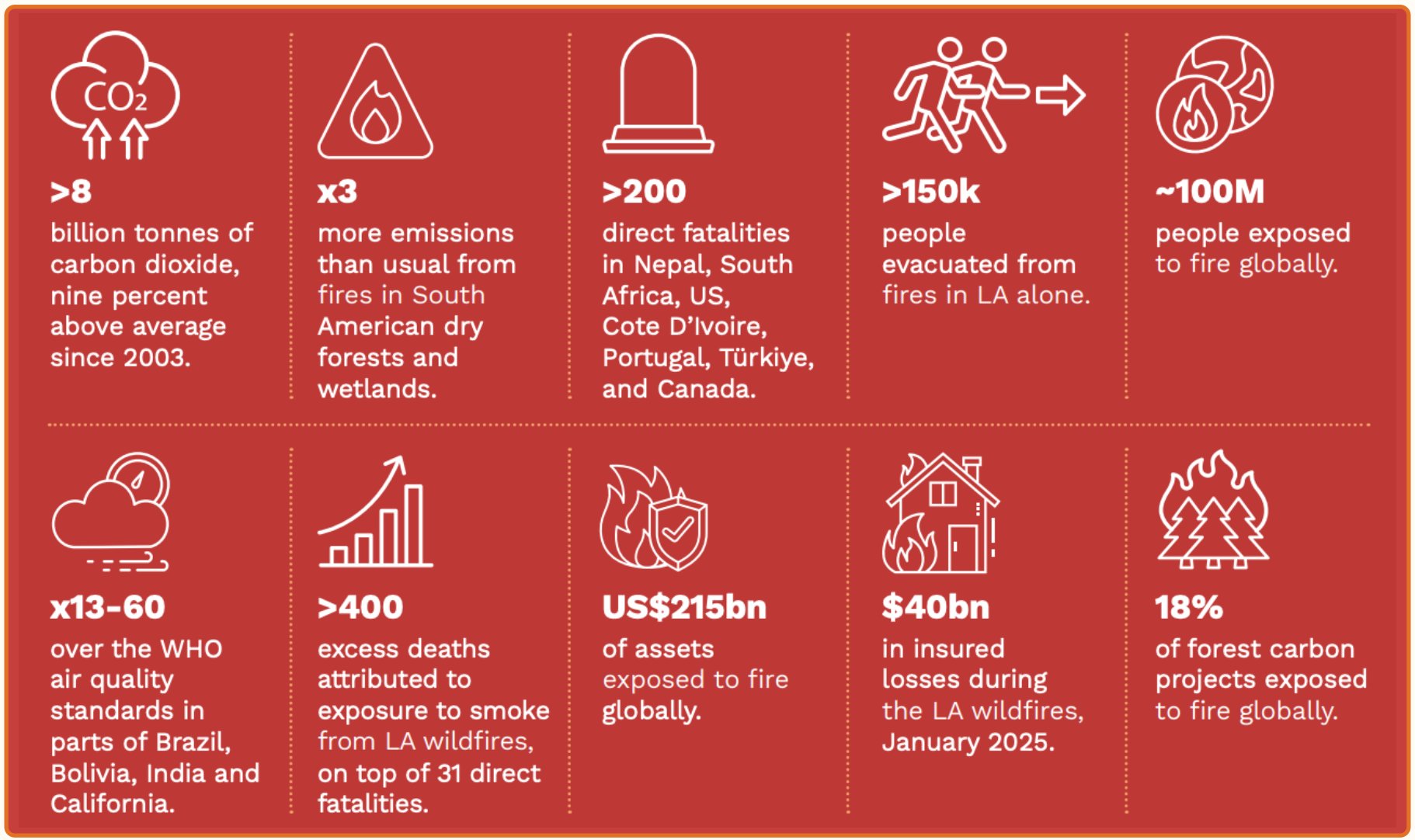

Deep dive focal regions

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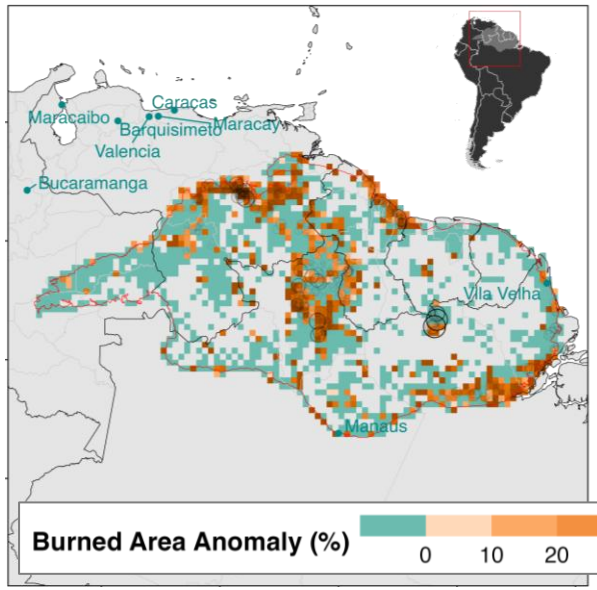
Northeast Amazonia

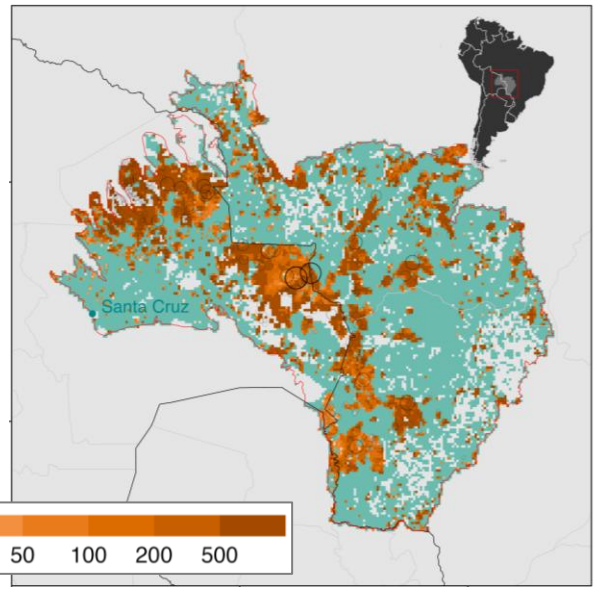
January-March 2024



- **Forest fire extent** more than 4x average and highest on record, surpassing the record set only one year prior (2023-24).
- **Highest forest loss** since 2016; 60% of loss caused by wildfire.
- **Humanitarian impacts of compound** air and water crisis: ~70,000 people already without water access then exposed to poor air quality.

Pantanal-Chiquitano

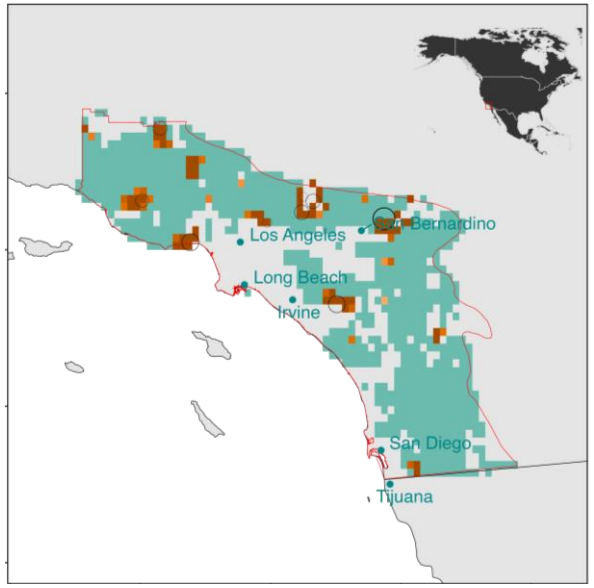
August-September 2024



- **Fire extent twice the previous record**, triggering fire C emissions 6x average.
- **$PM_{2.5}$ concentrations** up to 60x WHO limit.
- **US$ 222M losses** for regional agribusinesses.
- **~80 days of firefighting** challenged by remote access and logistics.

Southern California

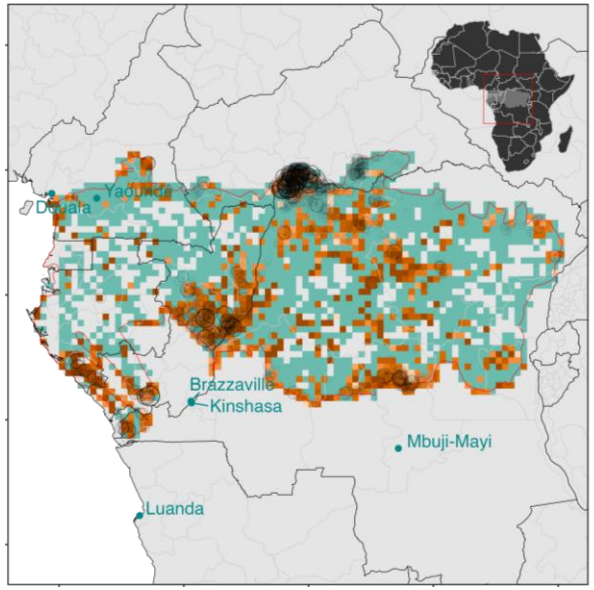
January 2025



- **31 deaths. >11k homes** destroyed. **153,000 people** evacuated in LA.
- **$PM_{2.5}$ concentrations** up to 30x WHO limit with **400 excess deaths**.
- **US$ 140B** total in LA - costliest wildfires in modern US history.
- **US$ 4.6–8.9B** lost economic output with **~2,000 businesses** affected.
- **Homelessness crisis** worsened by loss of affordable housing units.

Congo Basin

July-August 2024



- **Burned area highest on record** and ~30% above average.
- **Highest forest loss** since 2015 in DRC and Republic of the Congo, **+150%** rise versus year prior, primarily driven by uptick in wildfire.
- **Highlights tendency for underreporting** of the effects of extreme fire events in Africa.

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Did climate change influence these events? And if so, how much?

How much will future climate change influence br

Why not INFERNO

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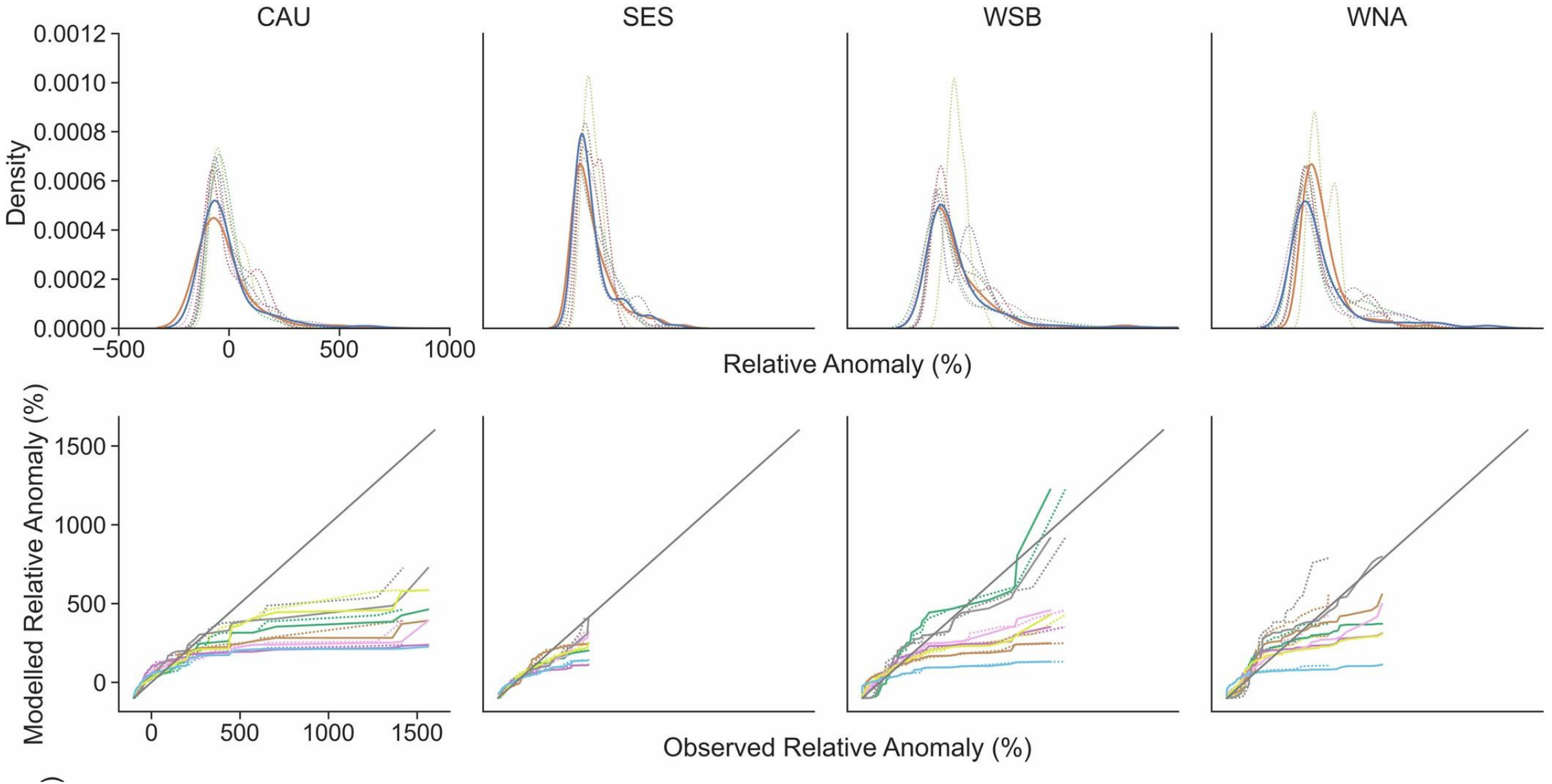

Controls On Fire

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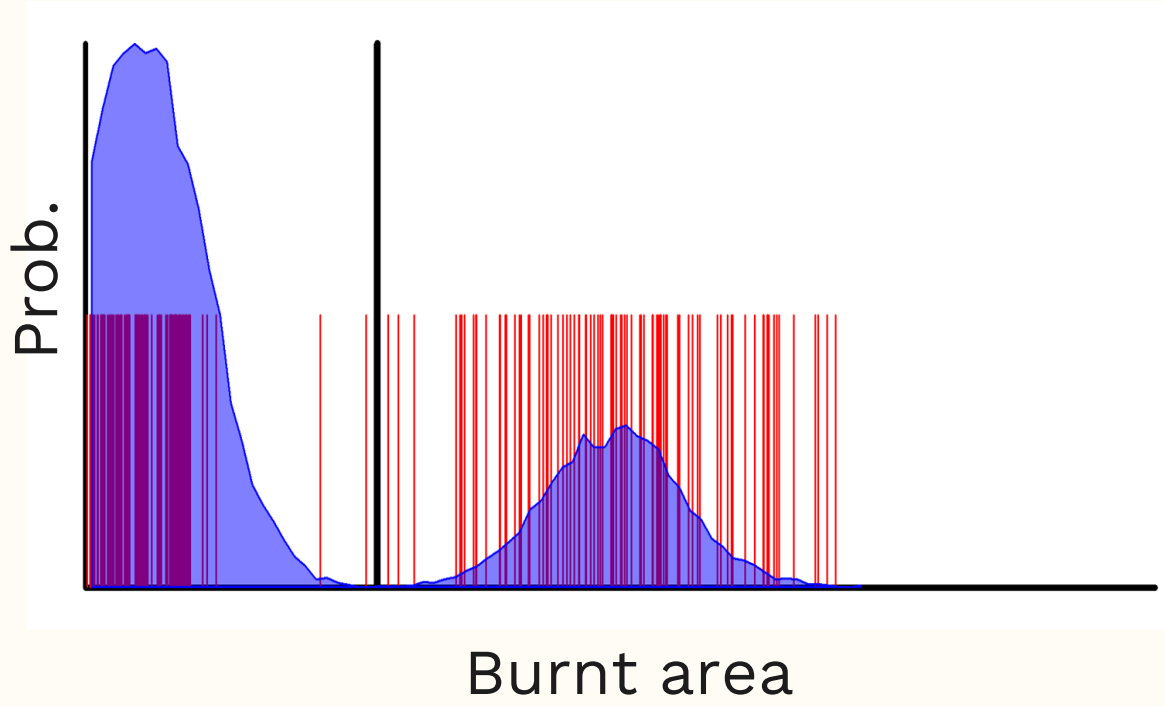
Stochastic nature



Point about why we wouldn’t expect a couple model like INFERNO to do extremes

Varying scales (& impacts)

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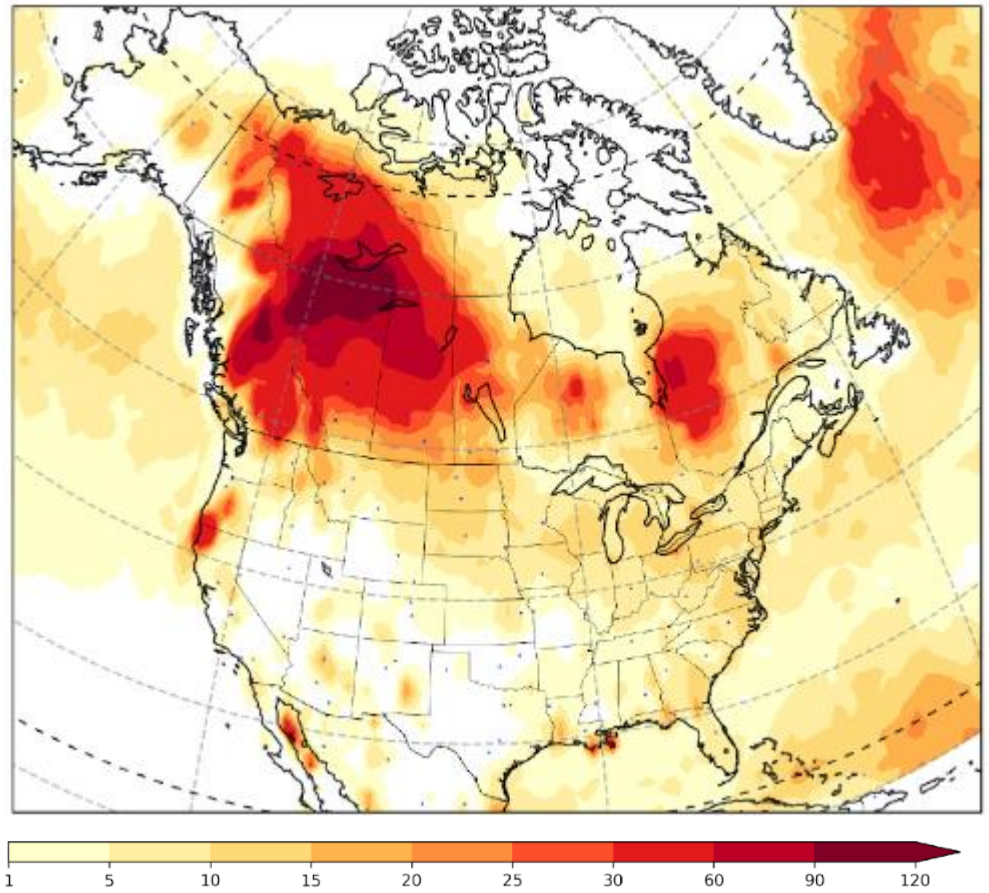
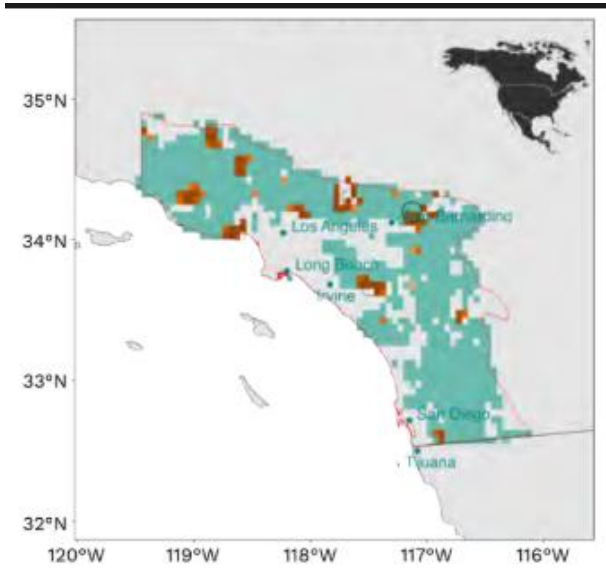


Number of Days in 2023 with Air Quality Worse than WHO Guideline



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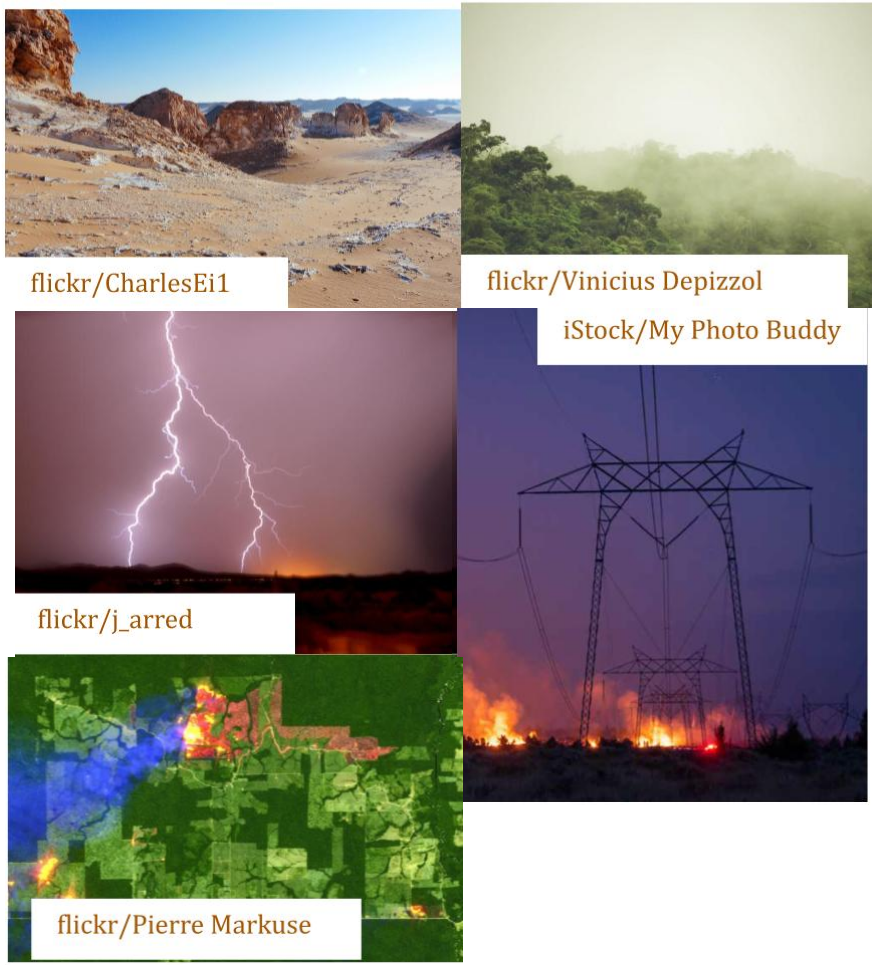
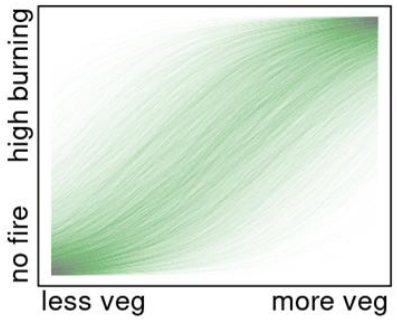
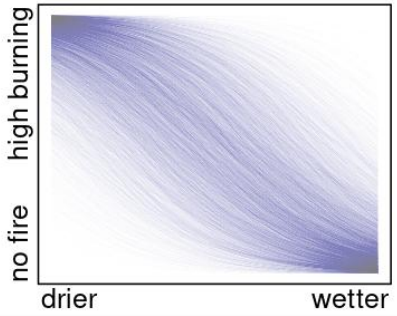
Interactions between controls

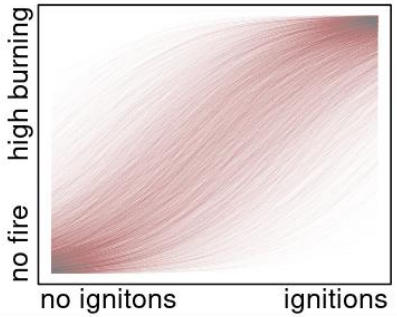




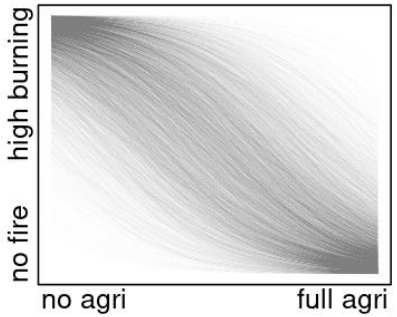
No vegetation → no fuel → no fire
Lots of veg → lots of fuel → fire
Unknown relationship between the two extremes



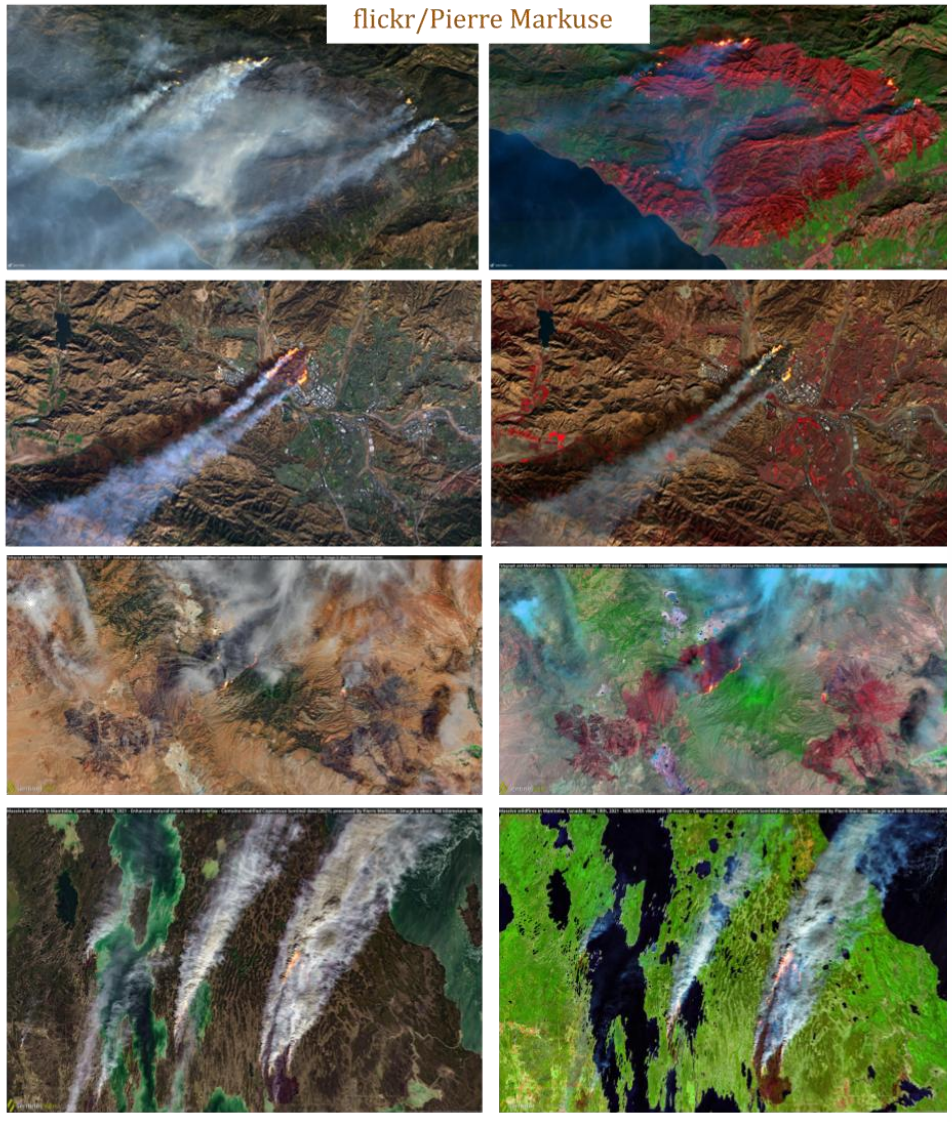
Dry → fire
Wet → no fire

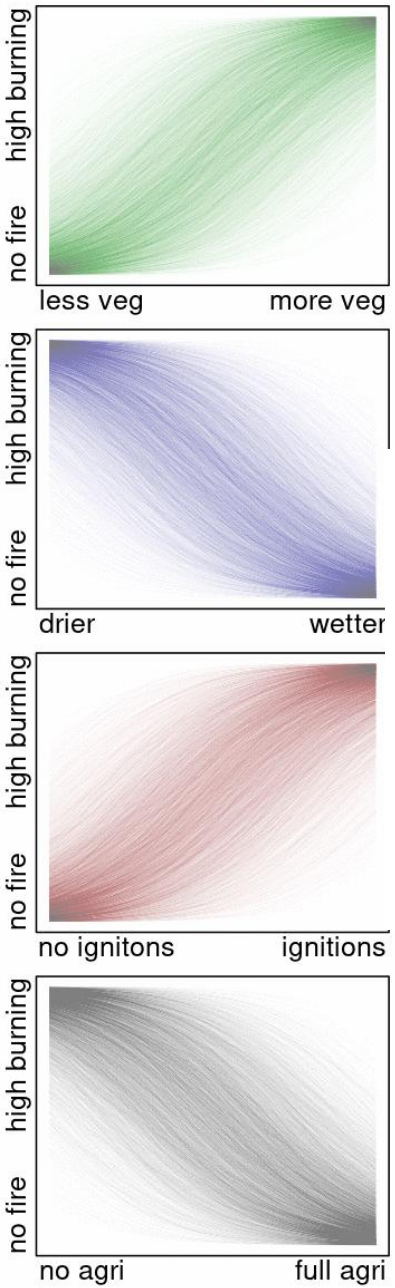


Lightning & people → ignitions
→ fire

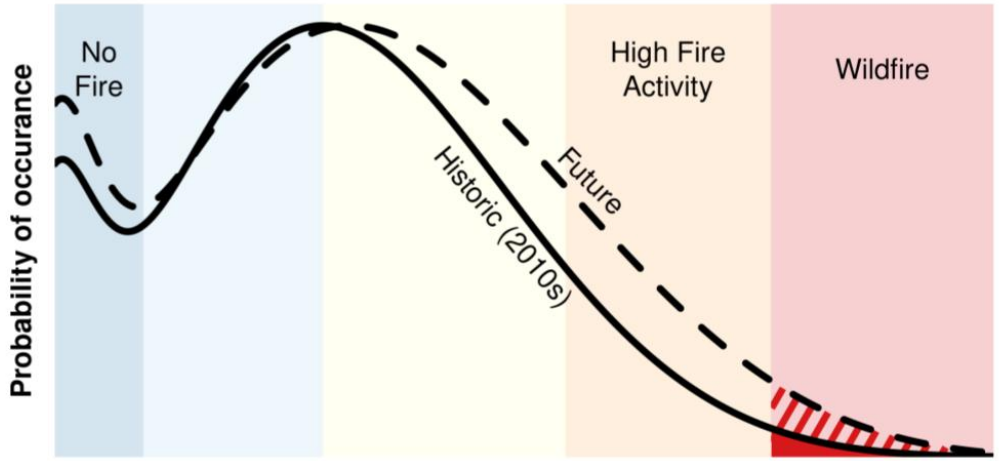


Agriculture → fragmentation
→ no fire





+ a counterfactual



Fire season anomaly

Factual: ERA5

Counterfactual: ERA5 Climatology

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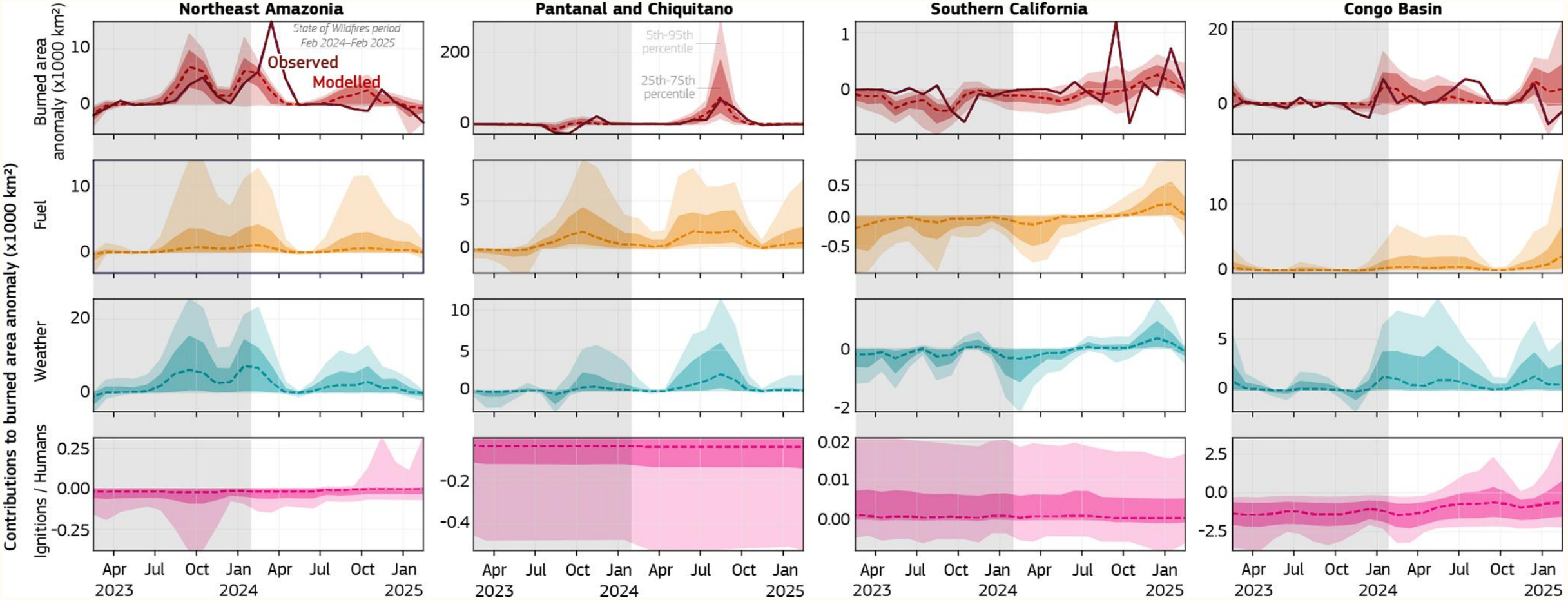

Climate change attribution

Factual: ERA5

Counterfactual: From HadGEM3A

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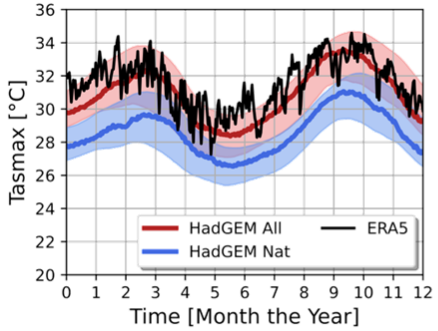
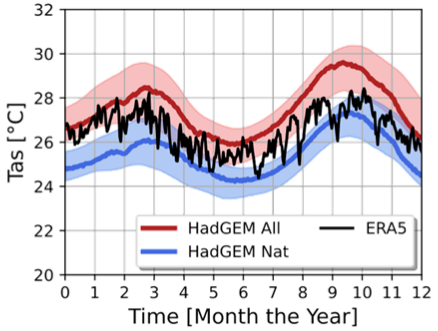
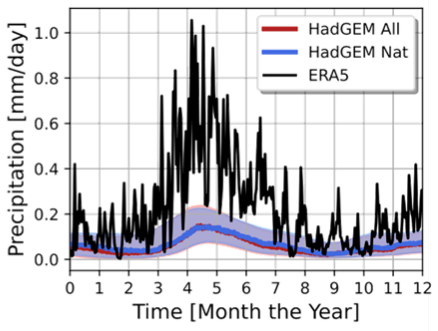
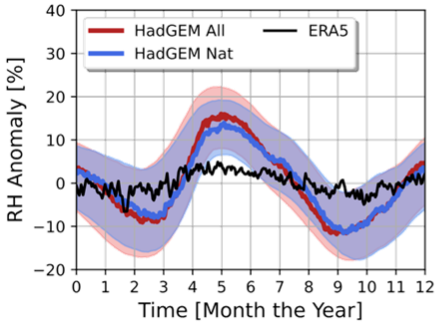
- All Greenhouse gases and aerosol emissions
- Land use
- Observed Sea Surface Temperatures and sea ice

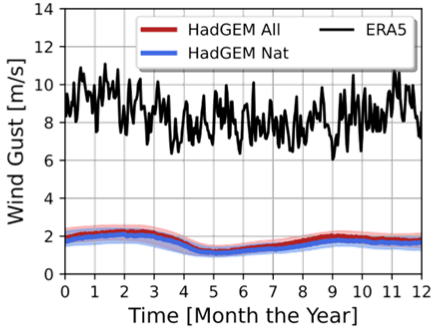
- Solar & volcanic forcings only
- 1850-level GHG & aerosols
- Anthropogenic SSTs removed

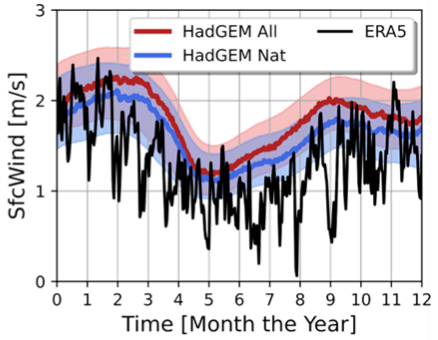


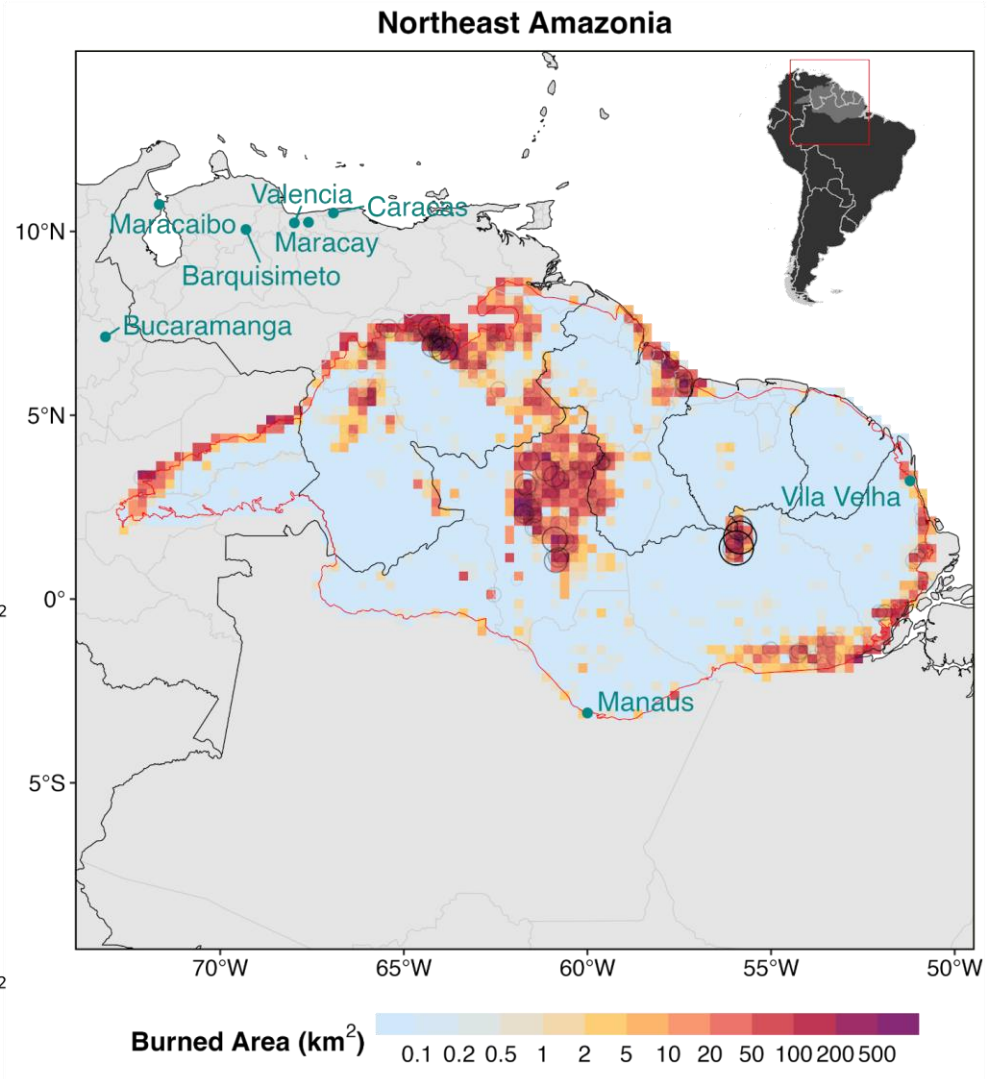




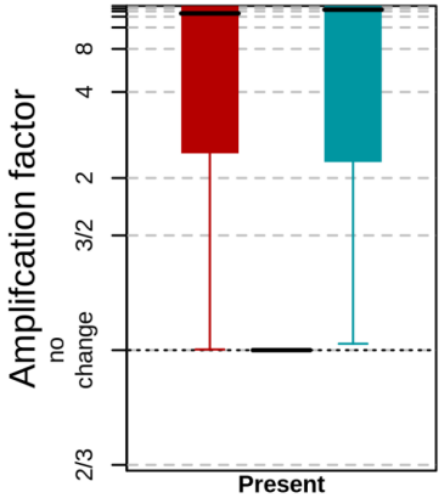


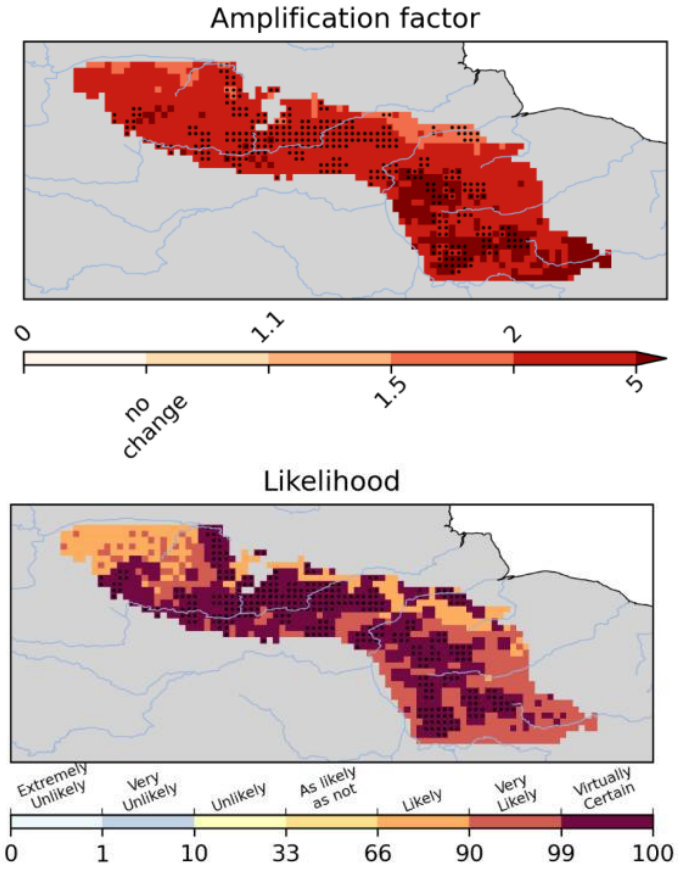




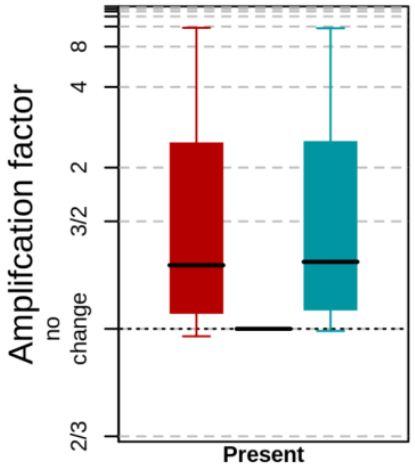


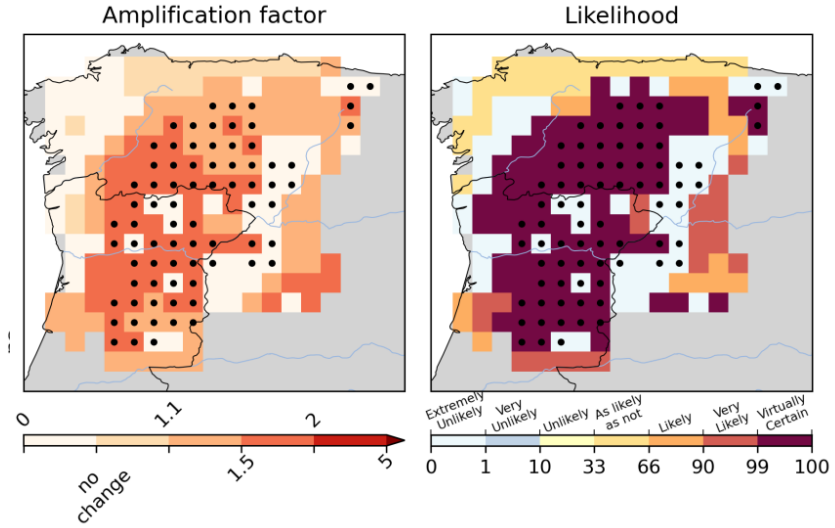
Midwestern Canadian Shield Forests





Northwest Iberia





Burton et al. (in review)

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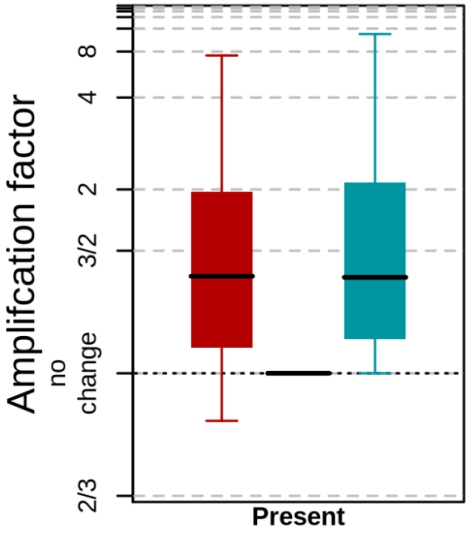
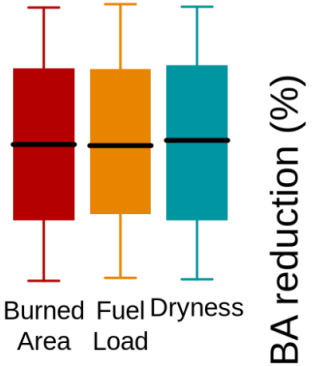
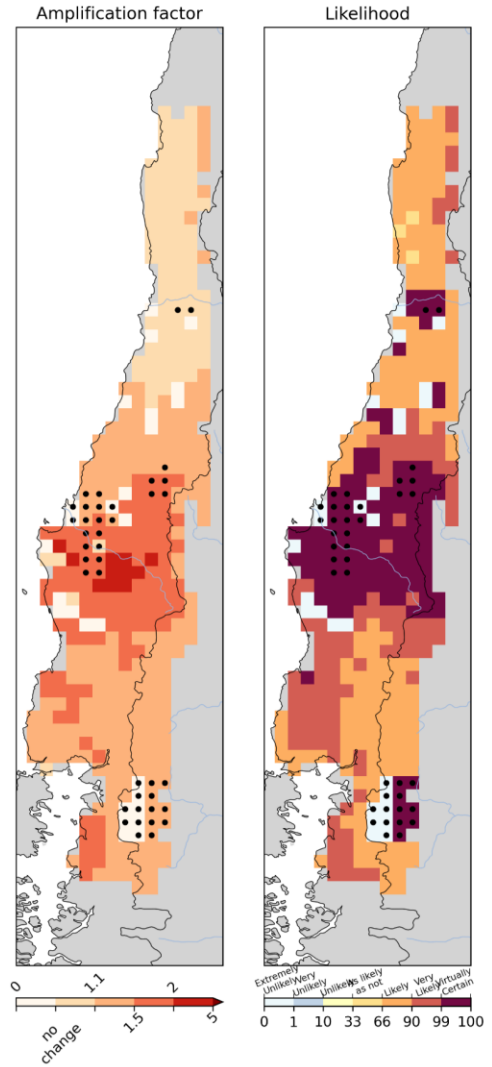
Chilean Temperate Forests & Matorral





BA reduction (%)



Future projections

Factual: ISIMIP3b (CMIP6) SSP126, 370, 585)

Counterfactual: ISIMIP3b historical

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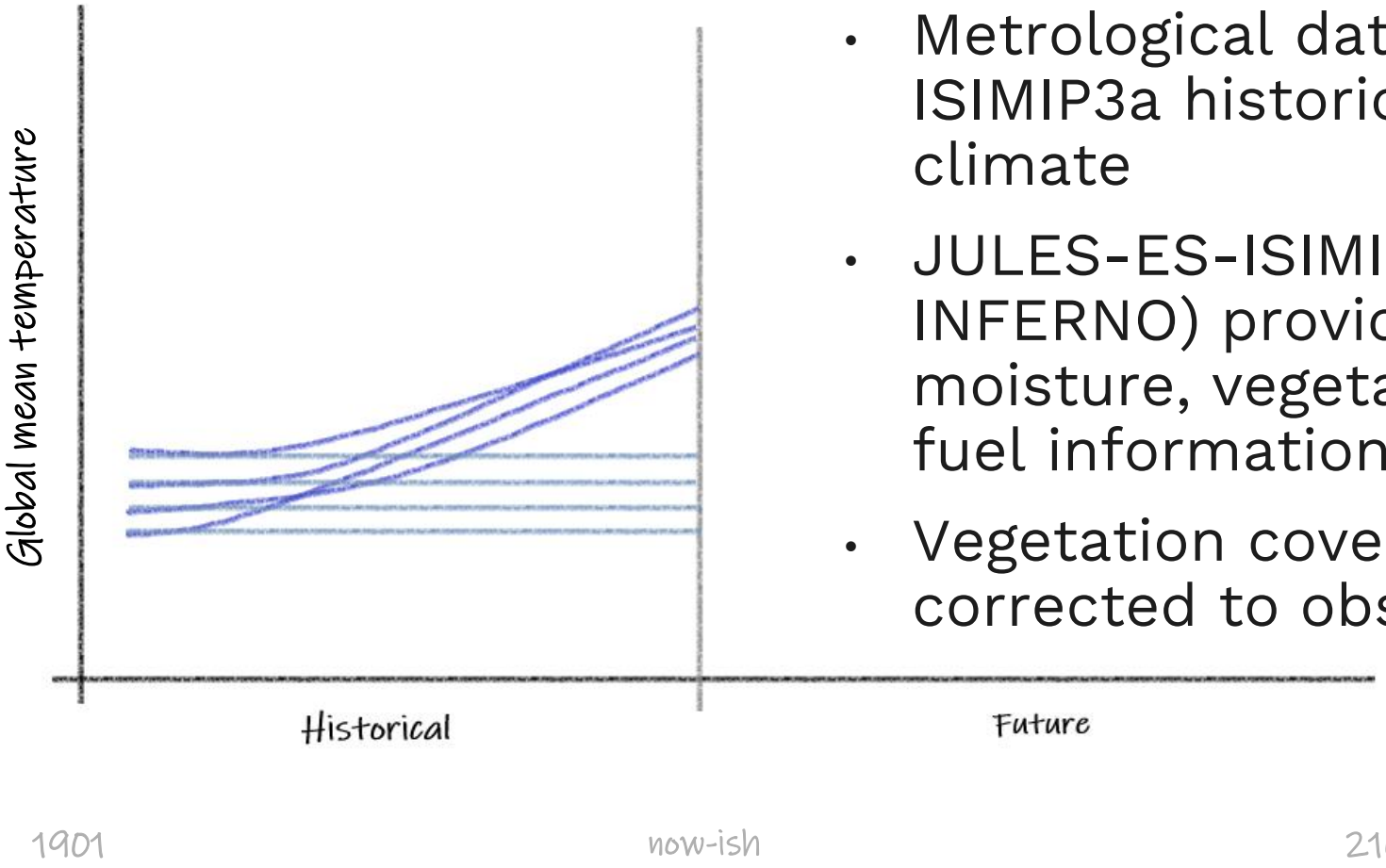
A cool diagram from Emma Robinson

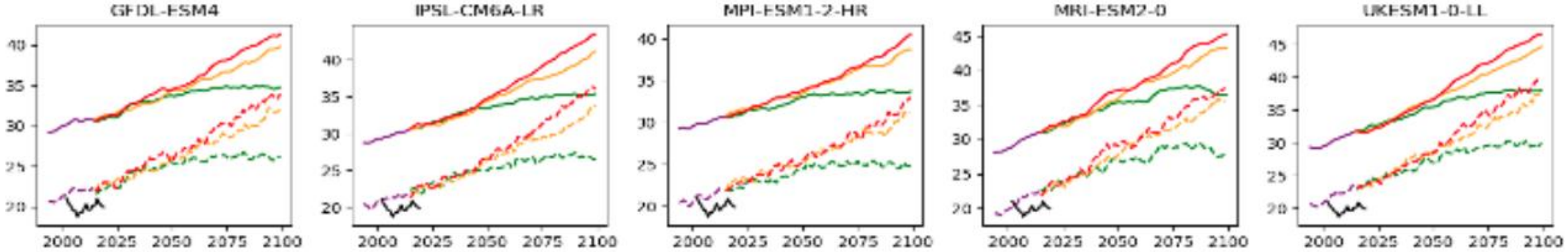


Historical climate

Counter climate

ISIMIP3a

- Metrological data from ISIMIP3a historical and counter climate
- JULES-ES-ISIMIP (without INFERNO) provides soil moisture, vegetation cover & fuel information
- Vegetation cover bias-corrected to observation



GCM SSP126

ISIMIP3b

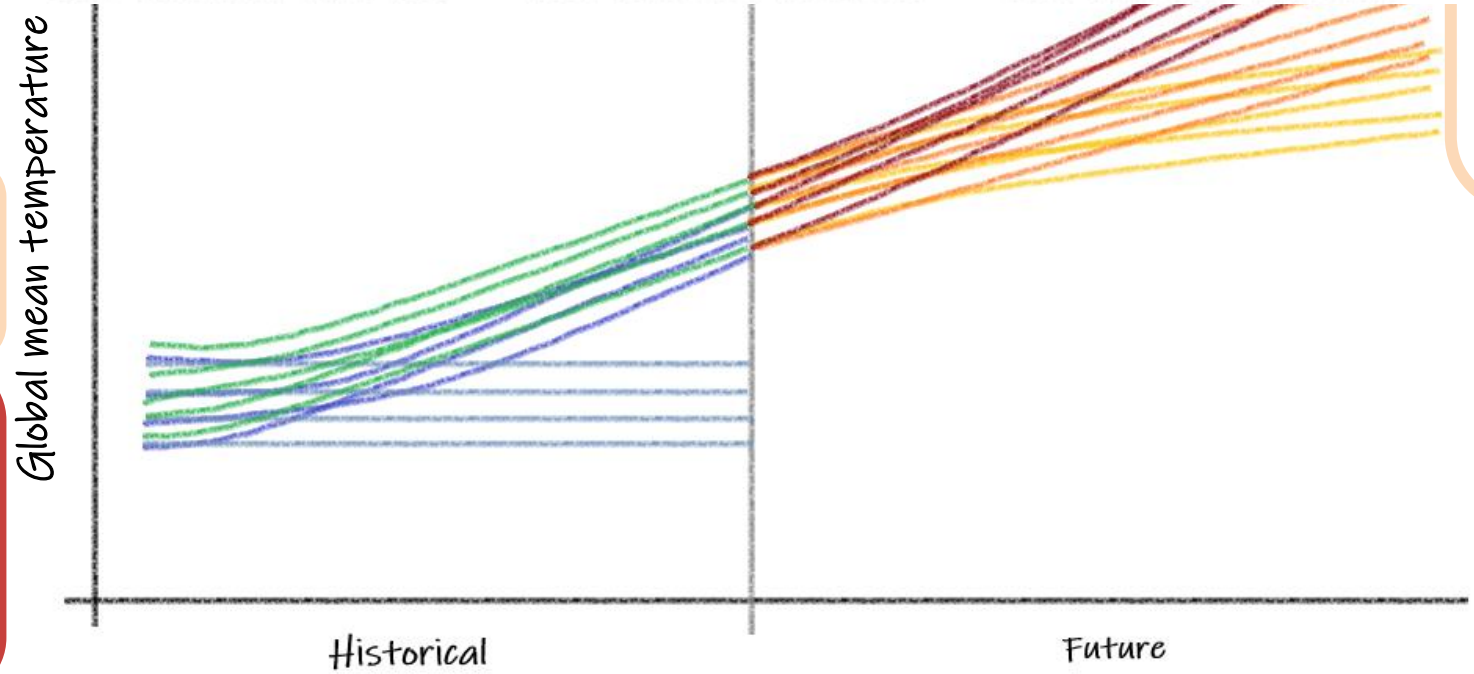
ISIMIP3b

GCM historical

Historical climate

Counter climate

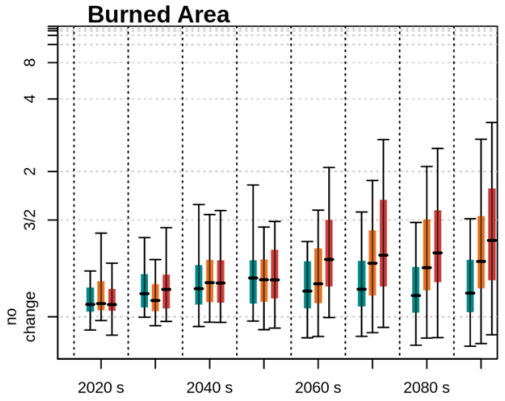
ISIMIP3a

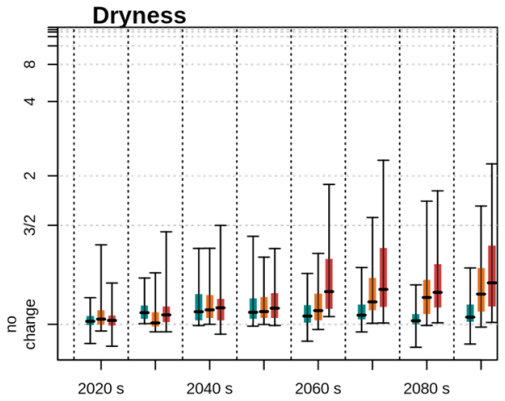


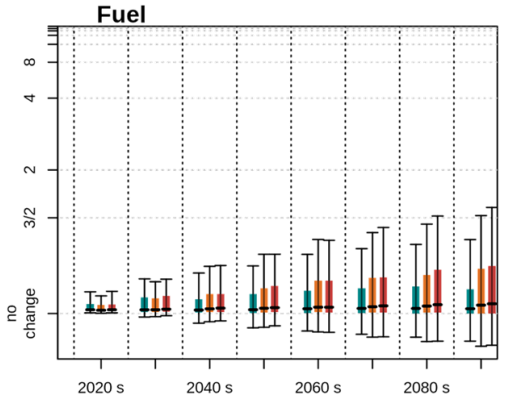
A cool diagram from Emma Robinson

1901 now-ish 2100

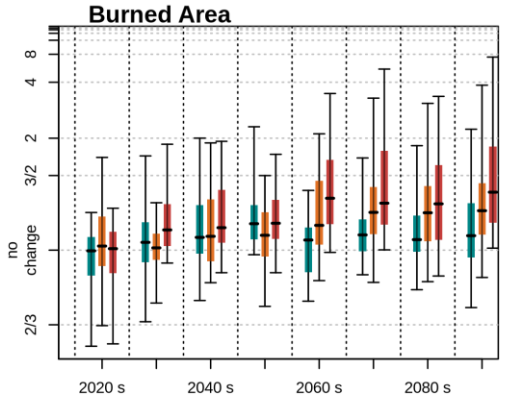
Annual average

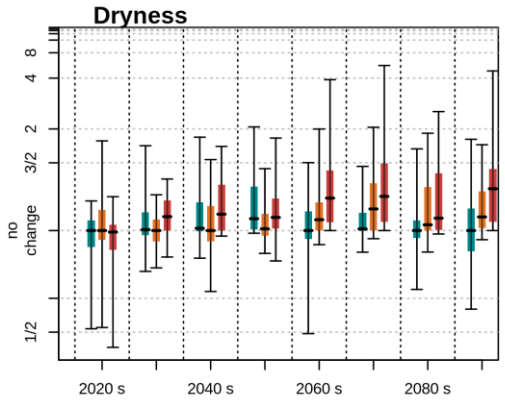


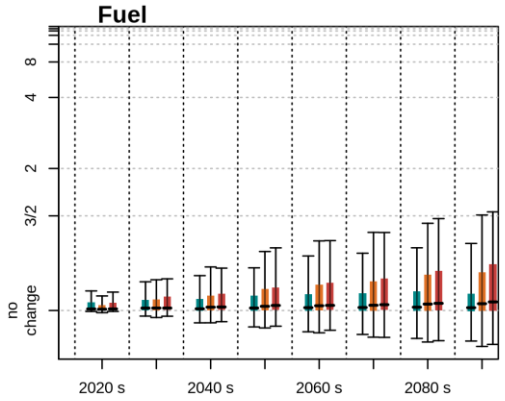


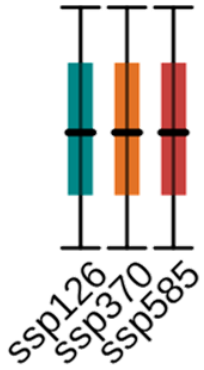


Extreme

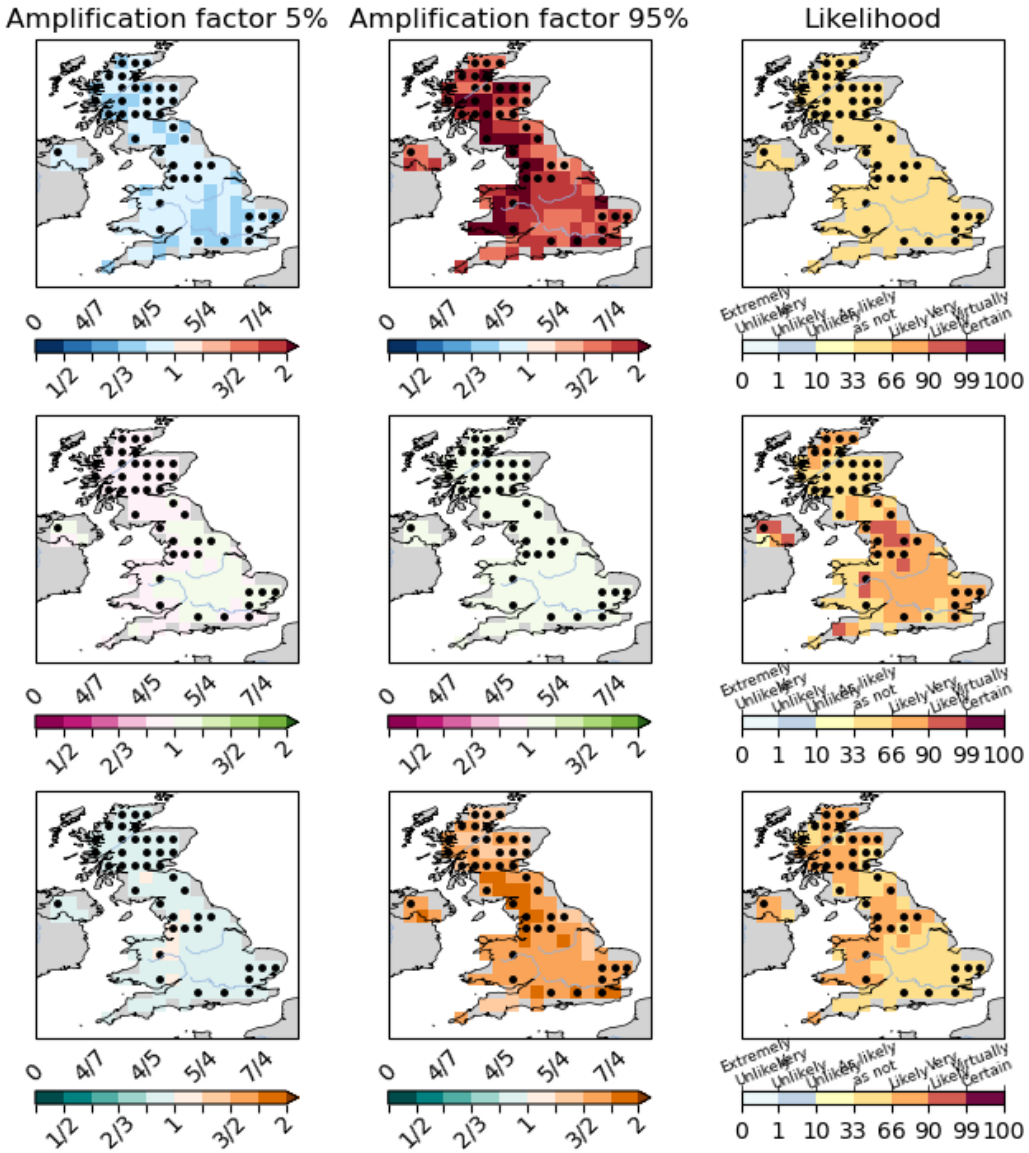








Extreme – SSP370 2090s



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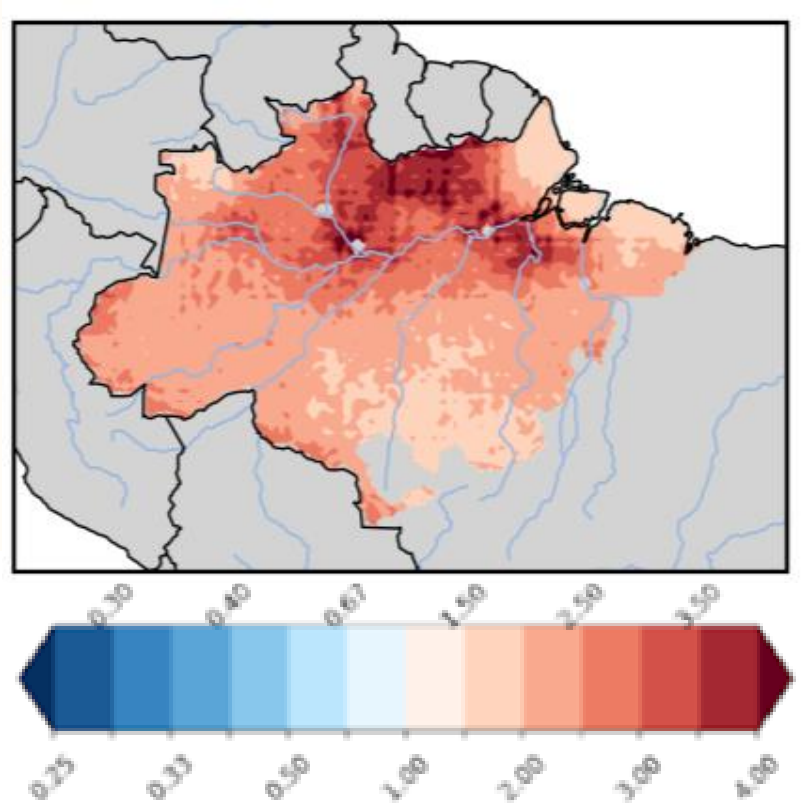
BASE Wildfire Loss & Damage

Maria LF Barbosa (marbar@creh.ac.uk)

Attribution science = ConFLAME-HadGEM/-ISIMIP

Communities knowledge = observations of the season + validation of model approach



UKCEH

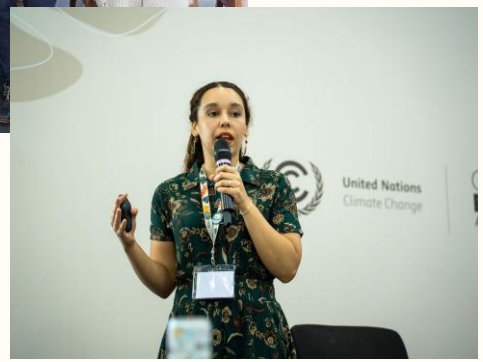
BASE
Building Approaches to fund local Solutions with climate Evidence

UK pavilion event

Wildfires: Science, Stories, and Strategies for Resilience in Amazonia

UNFCCC official side event

Building Resilience through Integrated Fire Management: Policies, Early Warning & Safeguards



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Next steps

THE STATE OF WILDFIRES PROJECT