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**Reading**

## ***INFERNO module update***

Ol Perkins, Doug Kelley, Chantelle Burton (co-leads)

In association with the Doug Kelley honorary dinosaur 2025



[www.centreforwildfires.org](http://www.centreforwildfires.org)



@centrewildfires

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# Lots of activity!

- **Peat**
- **UKESM & emissions**
- **Attribution [State of wildfires report 2024/5]**
- **Emulation**

-> Model developments covered in next talk

# Peat: Getting INFERNO-peat into the trunk

- Community meeting to coordinate activity summer 2025
  - Burned area should be relatively easy
  - Emissions could be quite tricky
  - Integration with endogenous peat within JULES is a medium-term ambition
- > OP to add burned area by end of 2025

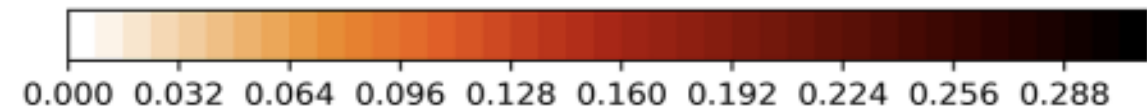
## INFERNO-peat v1.0.0: a representation of northern high-latitude peat fires in the JULES-INFERNO global fire model

Katie R. Blackford<sup>1,2</sup>, Matthew Kosoar<sup>1,2</sup>, Chantelle Burton<sup>3</sup>, Eleanor Burke<sup>3</sup>, Iain Colin Prentice<sup>1,4</sup>, and Apostolos Voulgarakis<sup>1,2,5</sup>

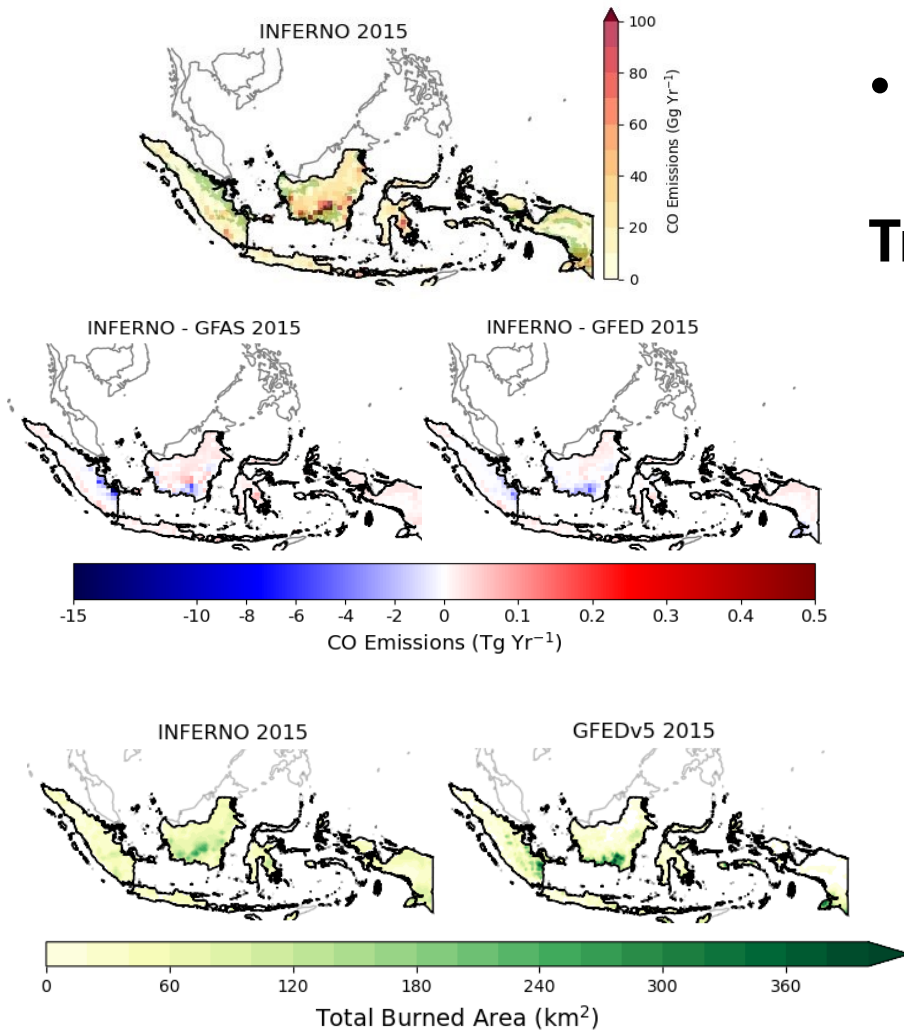
(a) INFERNO



(b) INFERNO-peat LIS-OTD



## INFERNO without peat



- Extension/adaption of Blackford *et al.* (2024) to Tropical Peat
- Using Indonesia as case study location first
- The expanding to include Africa and South America

# Improving the calculation of peat ignition probability in INFERNO-peat

## Dimitra Tarasi with Voulgarakis, Rein, et al.

How is the probability of peat ignition simulated in INFERNO-peat?

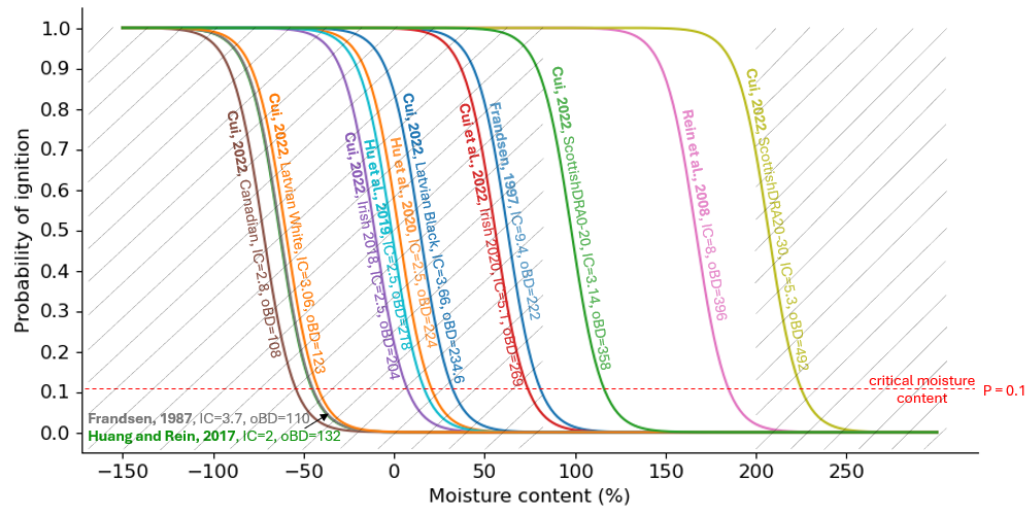
Frandsen (1997) empirical model:

$$P = \frac{1}{1 + \exp[-(B_0 + B_1 \times MC + B_2 \times IC + B_3 \times BD)]}$$

MC: Moisture Content, IC: Inorganic Content, BD: Bulk Density

### Limitations of Frandsen's model

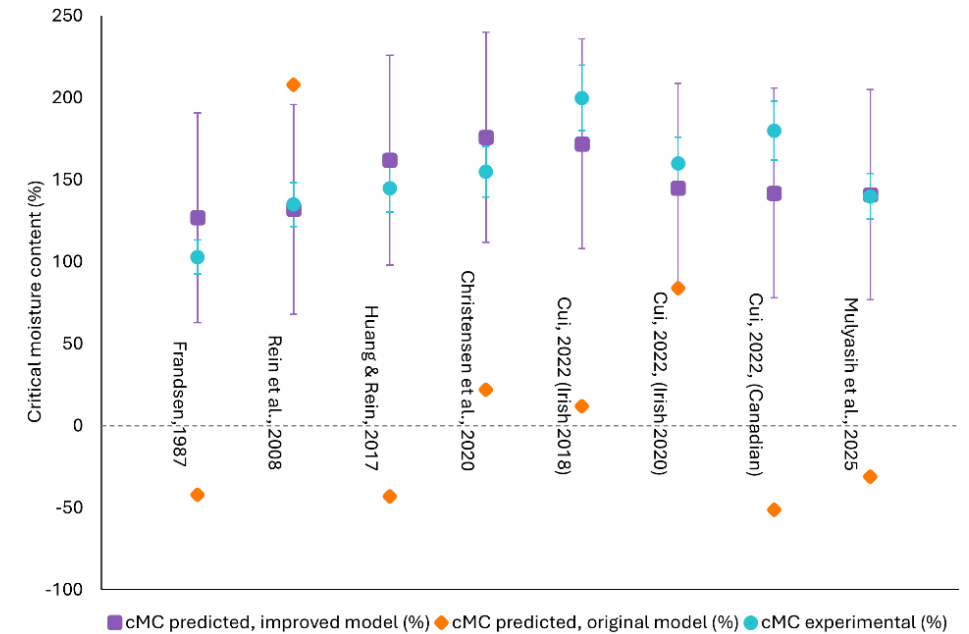
- ✓ Based on 1 single peat type → **FIXED** values of IC and BD
- ✓ Non-physical results when applied to peat samples of different properties



Plot of the Frandsen equation using the original coefficient for various combinations of inorganic content and organic bulk density. Hatched areas illustrate **non-physical results**, such as unrealistically low cMC (below 80%), excessively high cMC (above 200%), or negative moisture content values.

### Improvements in INFERNO-peat

- ✓ Optimization of the Frandsen's coefficients using experimental data (**completed**, collaboration with Hazelab and Prof. Rein)



Comparison of experimentally determined with predictions from the original and improved Frandsen model for different peat samples. The optimized model demonstrates substantial improvement in predictive performance.

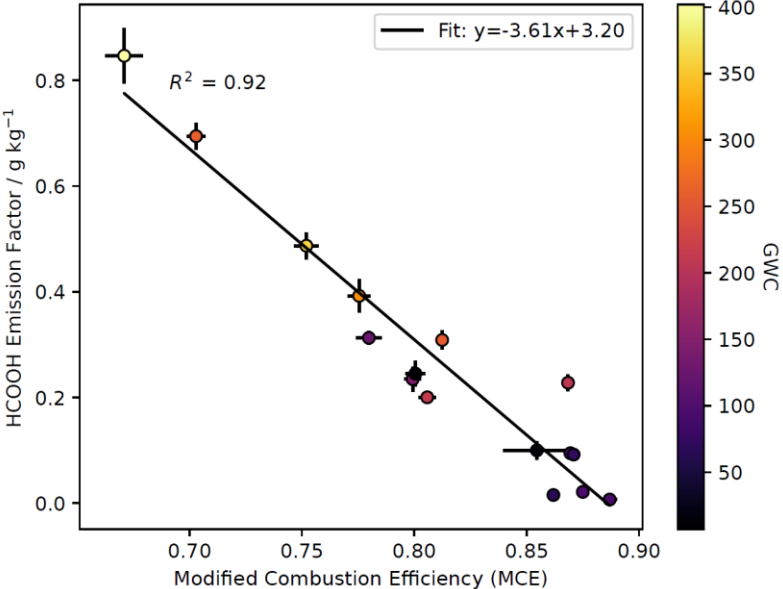
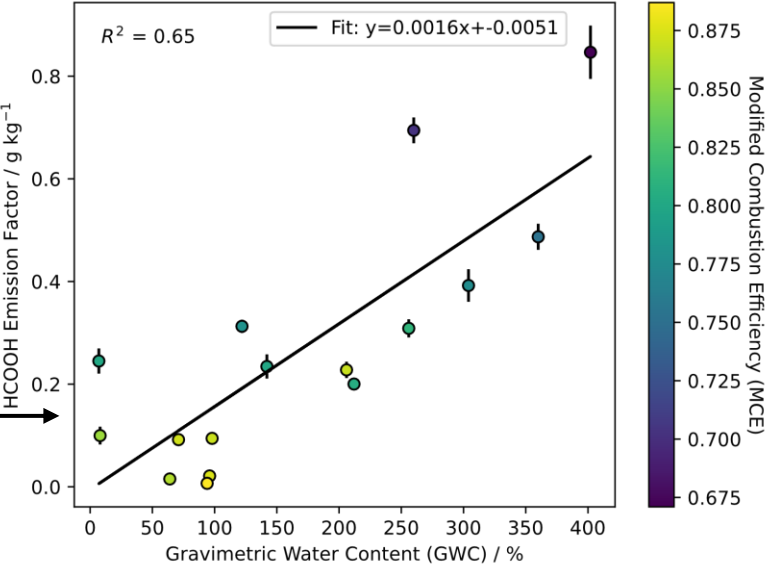
- ✓ Integration in the model spatially **varying BD and IC** datasets (**ongoing**)

Using for BD the global dataset from PEATGRIDS  
(we are now performing the first simulations with INFERNO-peat)

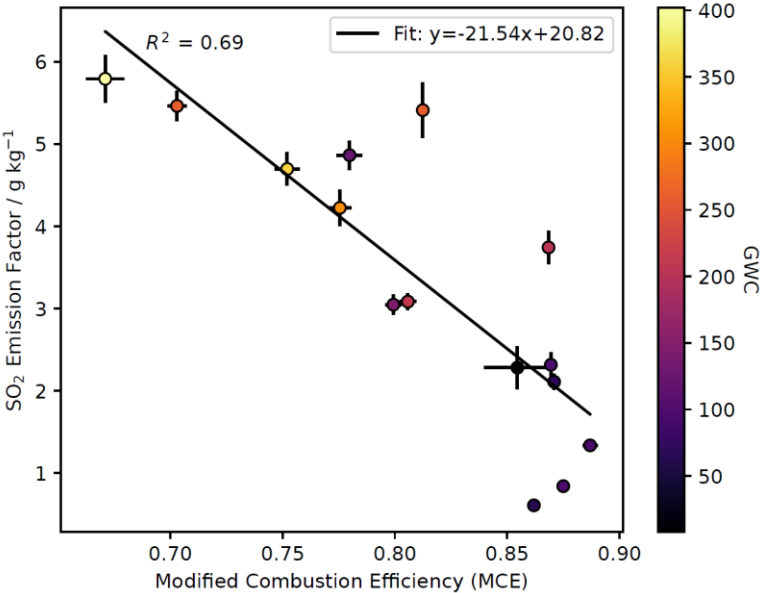
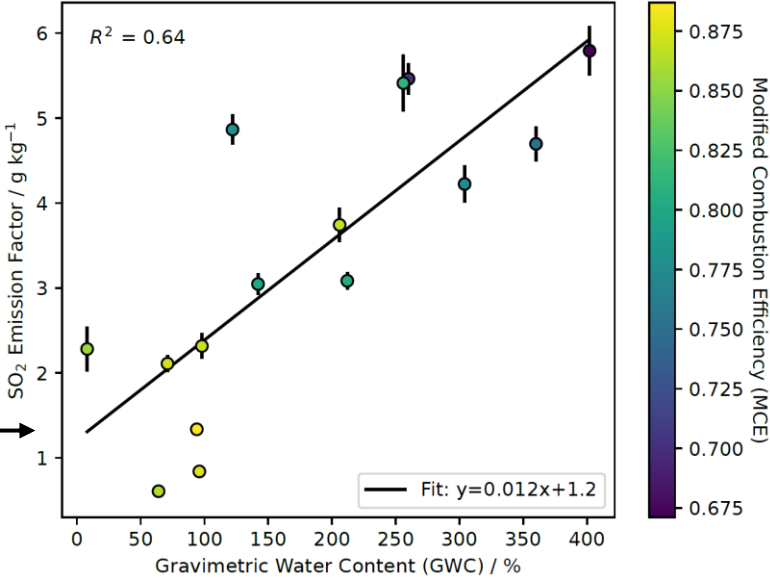
# Dynamic Emission Factors Dependent on Peat Condition

Luke Richardson-Foulger, with Wooster et al.

Typical value  
from literature

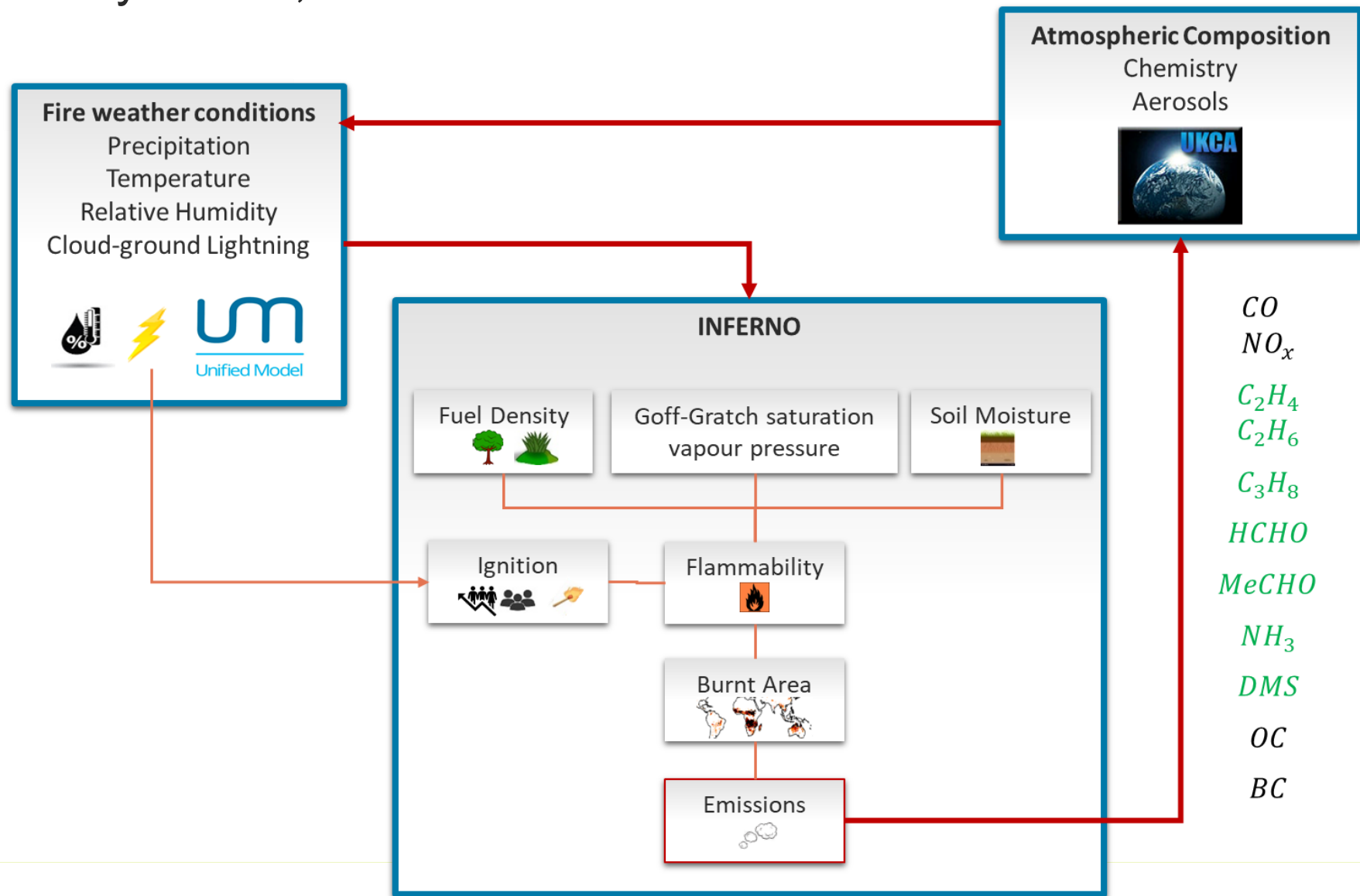


Typical value  
from literature



# UKESM: new emissions factors

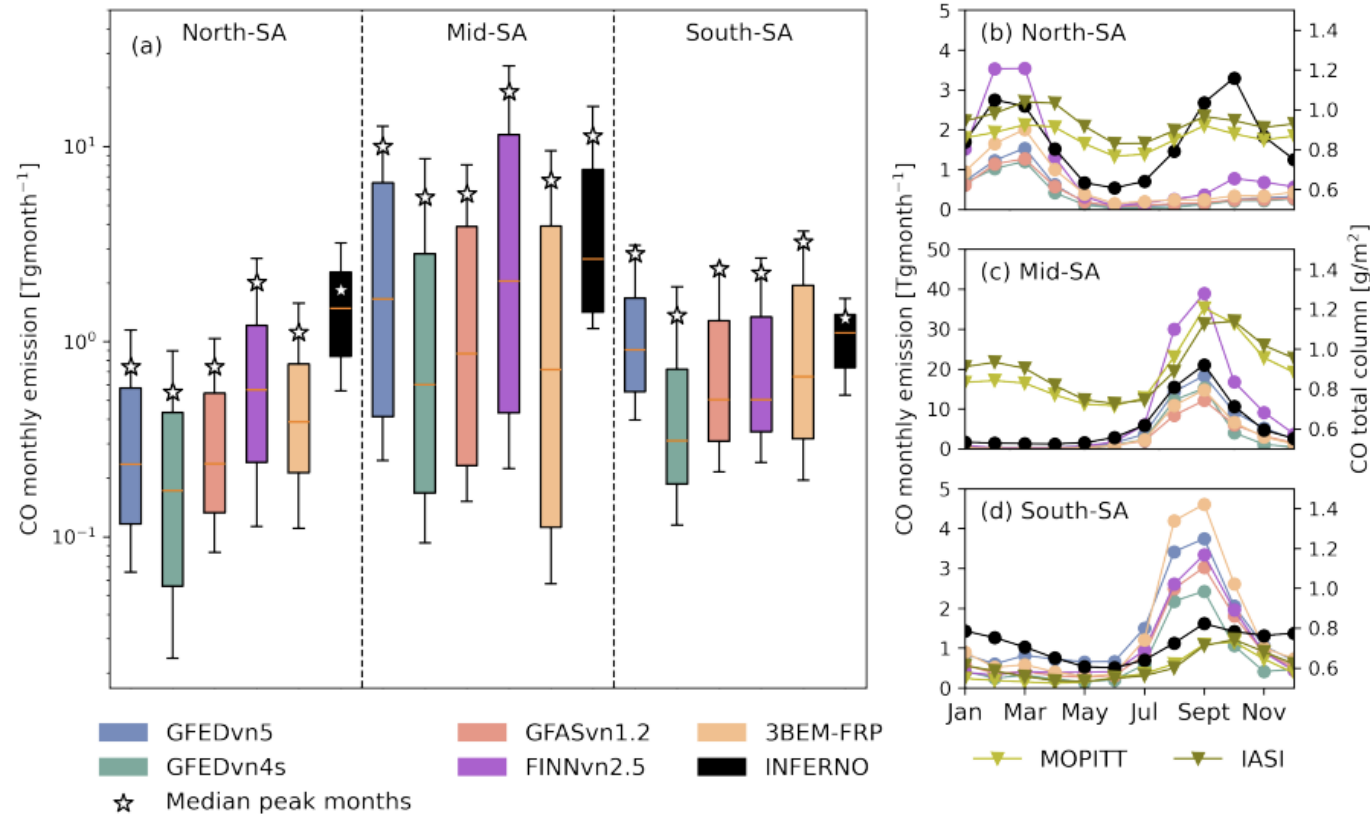
Amy Peace, João Teixeira



# Evaluating CO emissions: Maria P. Velázquez-García

## Understanding drivers and biases of simulated CO emissions by the INFERNO fire model over South America

Maria P. Velázquez-García<sup>1,2</sup>, Richard J. Pope<sup>1,2</sup>, Steven T. Turnock<sup>3,4</sup>, Chetan Deva<sup>1</sup>, David P. Moore<sup>5,6</sup>, Guilherme Mataveli<sup>7,8</sup>, Steve R. Arnold<sup>1</sup>, Ruth M. Doherty<sup>9</sup>, and Martyn P. Chipperfield<sup>1,2</sup>





# THE STATE OF WILDFIRES PROJECT

stateofwildfires.com

## An annual review of fire activity & extreme events



*Matthew W Jones, Douglas I Kelley, Chantelle Burton, Francesca Di Giuseppe,  
Maria L.F. Barbosa, Joe McNorton & the State of Wildfires Report Co-authors*

Finding answers to the questions we get asked every year...

Was this the worse fire season?    Is this the “new normal”?    Will it get worse?    Was this predictable?    Is climate change to blame? Was it people?    Will delivering on climate commitments help to avoid a repeat?    How can land use or land management policy help?    Can firefighters be better prepared and resourced?    How should governments invest to tackle the problem?

### 2023/24 report

#### Canada



Almost a decade's fire emissions in one fire season. 230,000 evacuations.

#### Amazonas



Manaus temporarily had among the worst air quality on the planet.

#### Greece



Largest wildfire ever recorded in Europe.

## 2024/25 report

### Northeast Amazonia



Transnational extreme fire event across Brazil, Venezuela, the Guianas

### Pantanal and Chiquitano



Air quality up to 60 times above the WHO standard.

### Southern California



>\$200 bn in damages caused by just two fires affecting LA.

### Congo Basin



Record-breaking fire extent & emissions drive record tree-cover loss

### Nepal / Northeast India



Over 100 fatalities in Nepal & record-breaking fire extent

### Greece



Strong boreal fire emissions continue into 2024.

# Emulation [Rob Parker & Chantelle Burton]

- PhD Student Limeng Zheng is starting PhD at Leicester with Rob/Doug/Chantelle to develop emulators of JULES-INFERNO
- Plan is to explore reversibility and early warning of potential tipping points