

# JULES Fire Module Update

Module leads:

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This work was presented by Doug Kelley

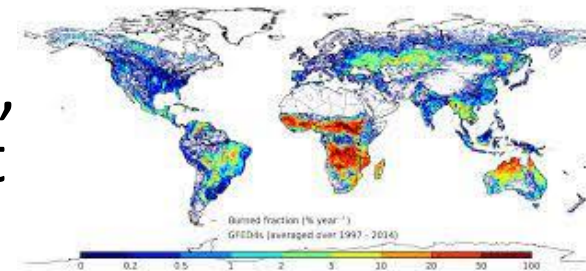


# Running JULES-INFERNO with prescribed fire



Exeter University: Stephen Sitch, Jefferson Goncalves De Souza, Mike O'Sullivan, Dominic Fawcett, Thais Rosan

- So far have run standard prognostic using INFERNO. Planning to run 2000-2020 with monthly burnt area from satellite data
- Will help constrain the carbon budget, and inform understanding of burnt



# WHAM!

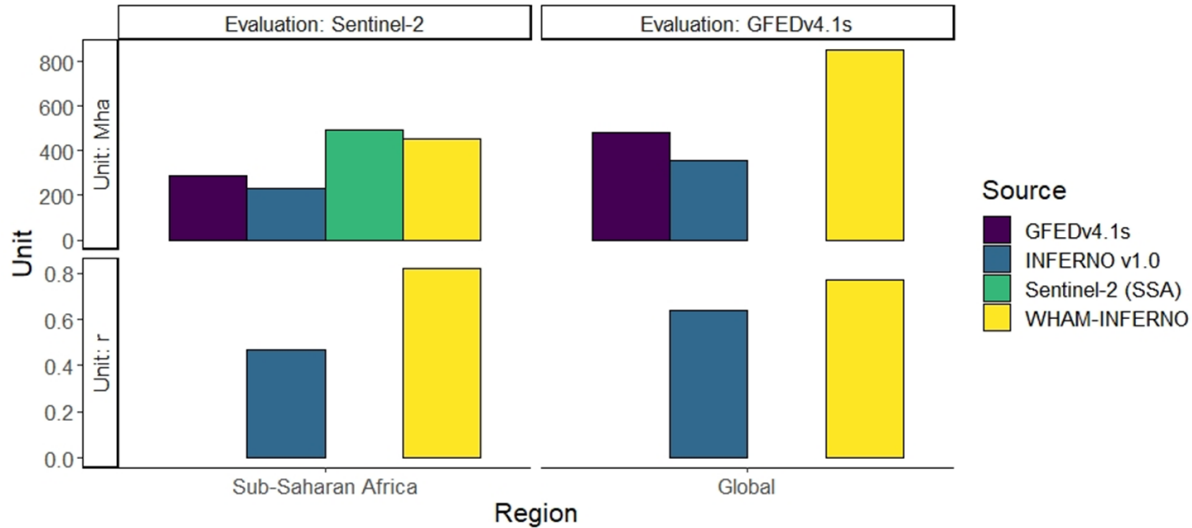
## Wildfire Human Agency Model



Ol Perkins, James Millington, Sarah Matej, Karl-Heinz Erb, Matt Kasoar, Apostolos Voulgarakis

- WHAM! is an agent-based model that represents human fire use & management strategies across different land systems (cropland, forestry, livestock farming etc). Current outputs are for managed and unmanaged anthropogenic fires, and fire suppression
- Coupling outputs from WHAM! with JULES, starting with replacing crop and pasture fires in INFERNO with prescribed inputs from WHAM!
- Hopefully full coupling at some point in future (outputs from JULES are passed to WHAM! online and then feedback on the WHAM! inputs to JULES)
- Writing up loosely coupled WHAM-INFERNO ensemble - replaces the parameterisations of human impacts on fires in INFERNO with outputs from WHAM!

# WHAM! Wildfire Human Agency Model



Increases INFERNO's ability to reproduce remote sensing data

Nearly doubles INFERNO's projected burned area - likely to be closer to the amount projected by GFED5 (headline number of 780 Mha presented at EGU)

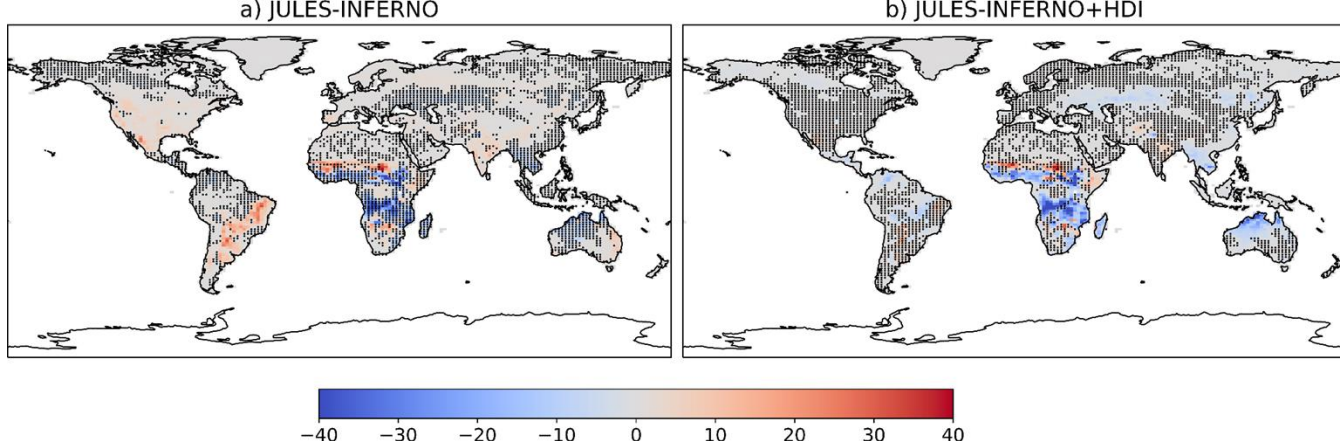
The coupled model suggests about 50% of all global burned area is from small, managed anthropogenic fire

**Perkins, O.,** Matej, S., Erb, K.-H., & Millington, J.D.A. 2022. Towards a global behavioural model of anthropogenic fire: The spatiotemporal distribution of land-fire systems. *Socio-Environmental Systems Modelling*, vol. 4, 18130, 2022, doi:10.18174/sesmo.18130

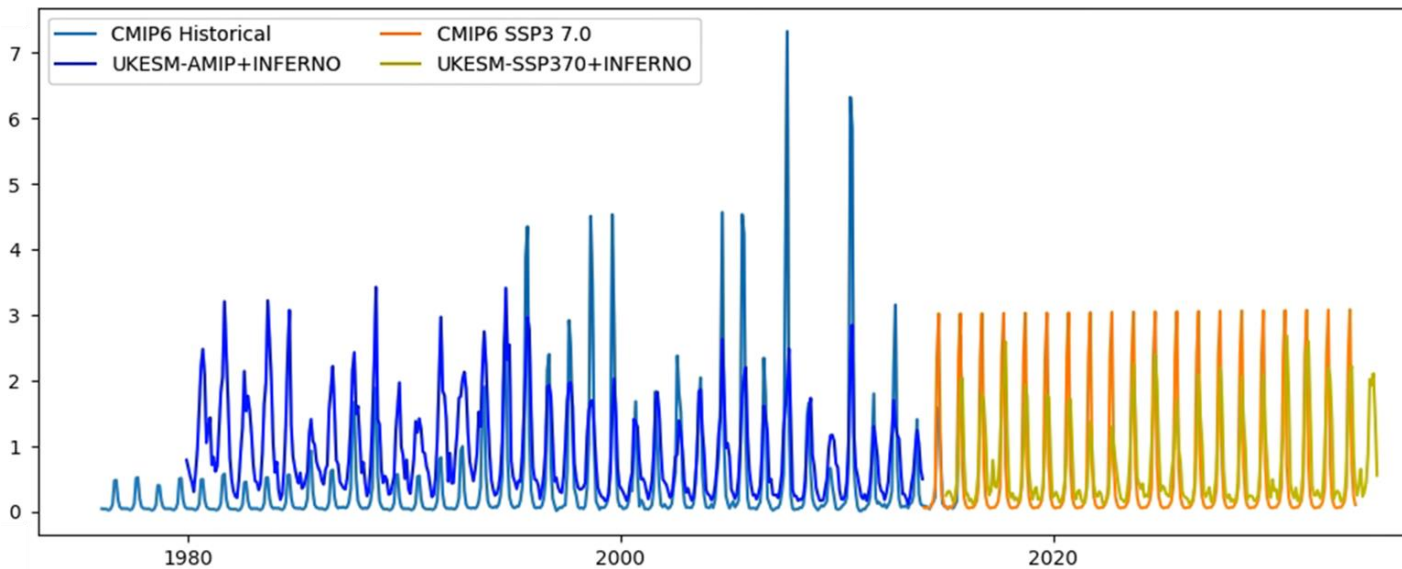
**Smith, C.,** Perkins, O. & Mistry, J. Global decline in subsistence-oriented and smallholder fire use. *Nature Sustainability*. 2022. <https://doi.org/10.1038/s41893-022-00867-y>

# João Teixeira

## HDI



## Emissions





# Other developments

- Alex Kuhn-Regnier (Imperial) - working on an alternative, empirical parametrisation for INFERNO based on previous work (<https://bg.copernicus.org/articles/18/3861/2021/bg-18-3861-2021.html>); supervised by Apostolos, Colin, and Sandy. Hoping to be able to do away with the PFT-specific typical burnt areas by taking advantage of pre-season productivity (proxies)
- Fire & optimisation for UKESM 2.0 - Chantelle Burton, João Teixeira, Doug Kelley
- Katie Blackford - developing peat fire capability (as presented yesterday)
- Olivia Haas and co - Use work on empirical fire size, intensity modelling to inform future model dev

# Highlights/conferences this year

- Fire workshop planned for early January (hosted by Leverhulme Centre for Wildfires, Environment and society)
- Galileo Fire Conference in Germany (March 2022) “Fire impacts at the Earth surface across space and time: perspectives for future fire management”

# FireMIP

- Ongoing work with last round of FireMIP (TRENDY)
- ISIMIP2b with fire: Mathison et al. (2022) submitted to JAMES
- ISIMIP3a - FireMIP simulations planned across CLASSIC, CLM, JULES-INFERNO, JULES-ConFire, LPJ-GUESS-SIMFIRE-BLAZE, LPJ-GUESS-SPITFIRE, LPJml-SPITFIRE, ORCHIDEE-SPITFIRE, SSiB4-TRIFFID
- 3 attribution papers planned for fire using ISIMIP3a: Burnt area, Impact of climate change on Fire PM2.5 mortality around the world, fire-induced change on the global water cycle in the 21st century
- Also running FireMIP LGM experiments (LGM, LGM-WWF, LGM-piCO2) - work in progress (Matt Kasoar)



# Wish list

Is anyone working on this, and what is the status?

- Pyro-convection (possibly in the pipeline)
- Deposition of black carbon on ice (and changes to albedo, melting ice etc) and ocean
- Deforestation fires / fragmentation?
- PFT adaptation to fire
- Offline INFERNO/prescribed fire in JULES.

