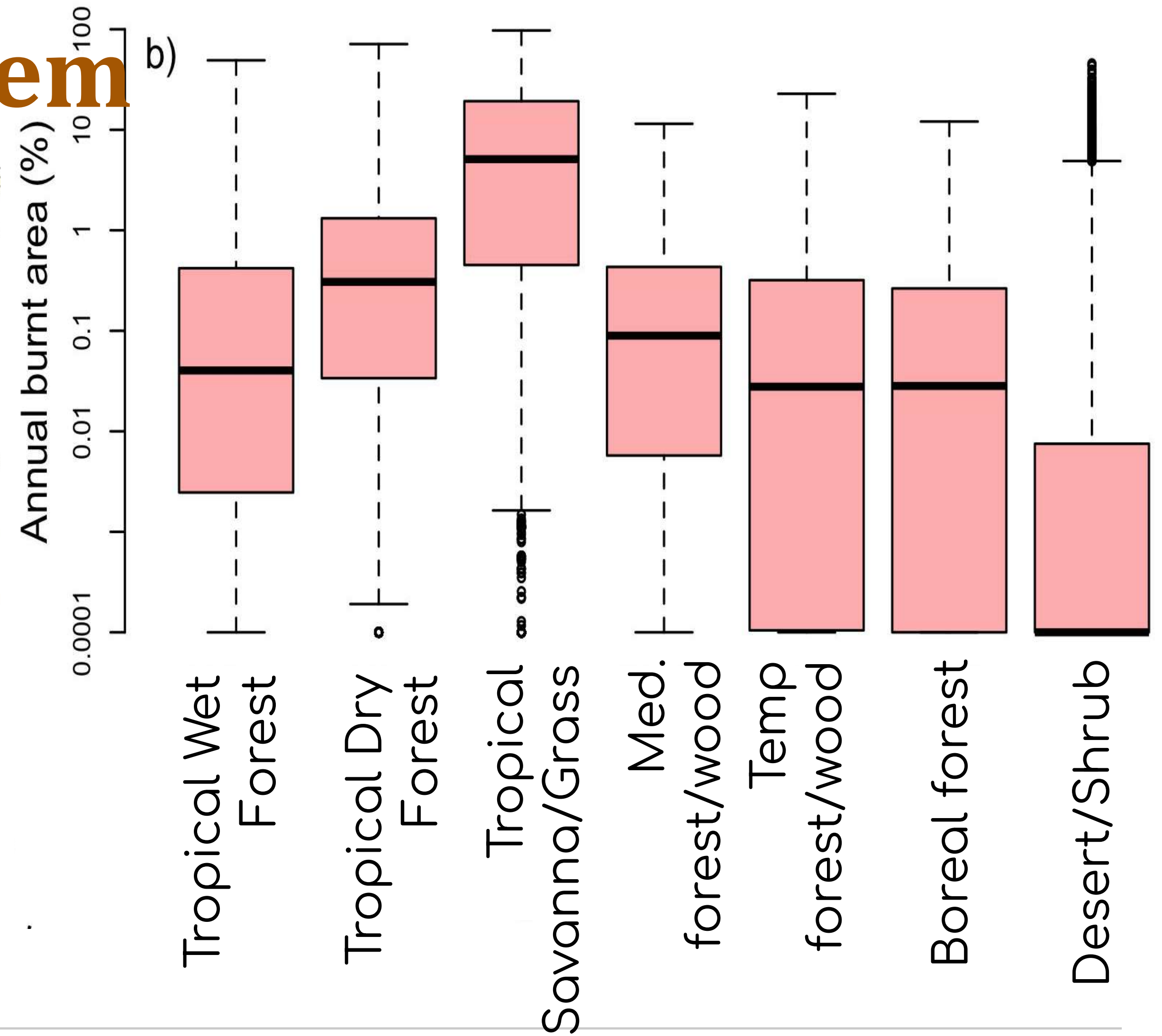
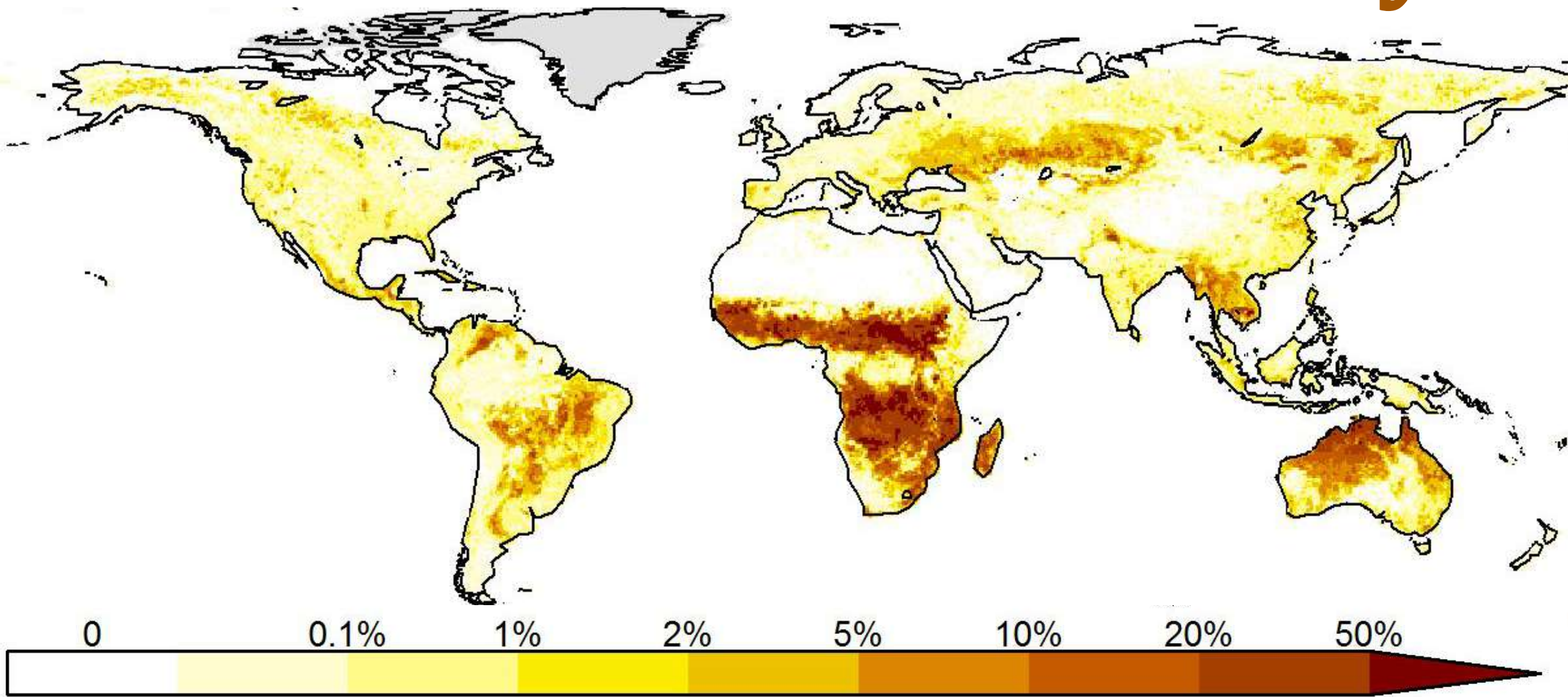


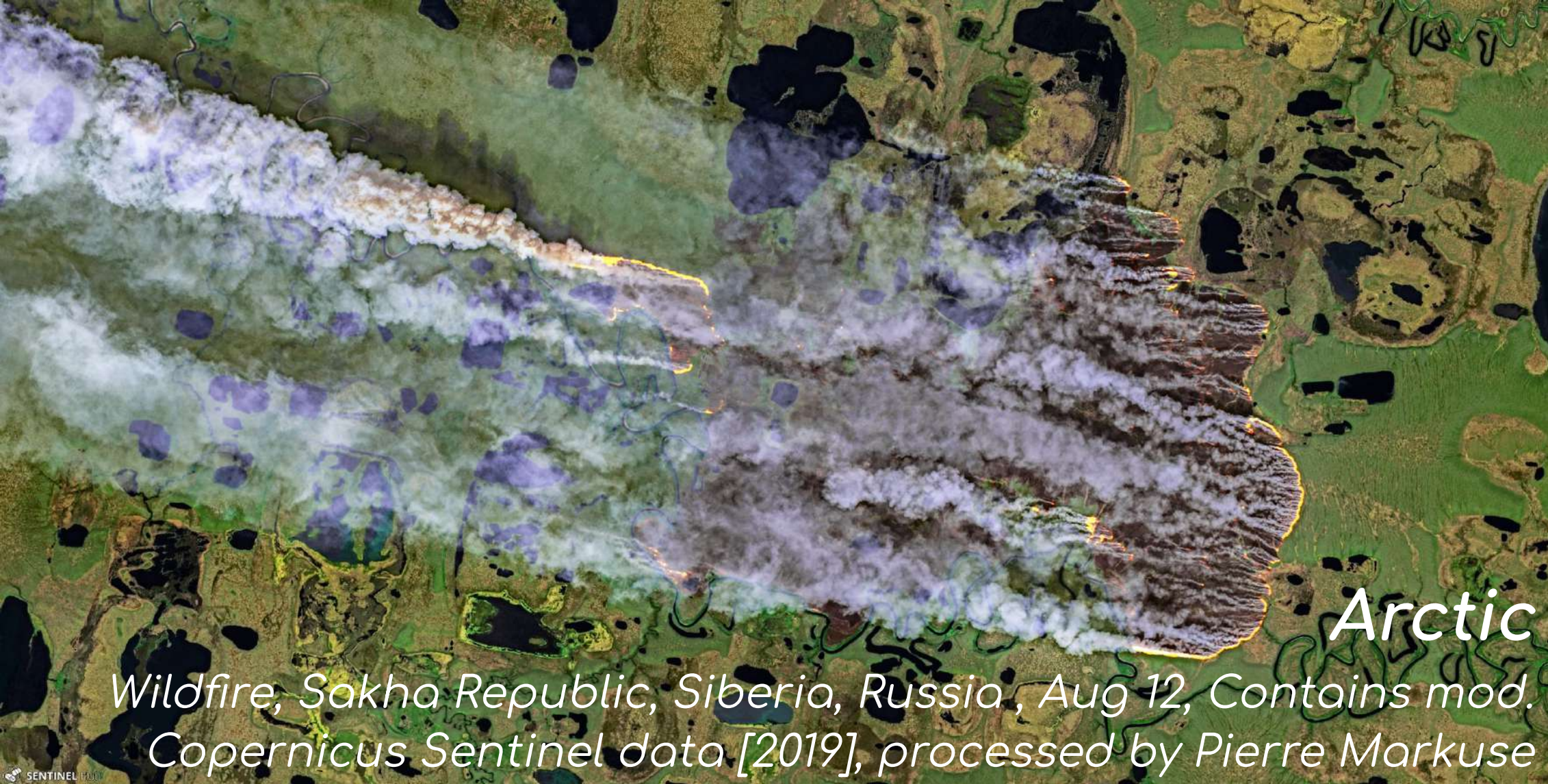
(de-) attributing meteorological drivers of unusual fire season - A Bayesian approach

Douglas Kelley, Rhys Whitley,
Ioannis Bistinas, Chantelle
Burton, Dong Ning, Chris
Huntingford, Megan Brown,
Toby Marthews, João Teixeira,
Rob Parker, Rich Ellis,

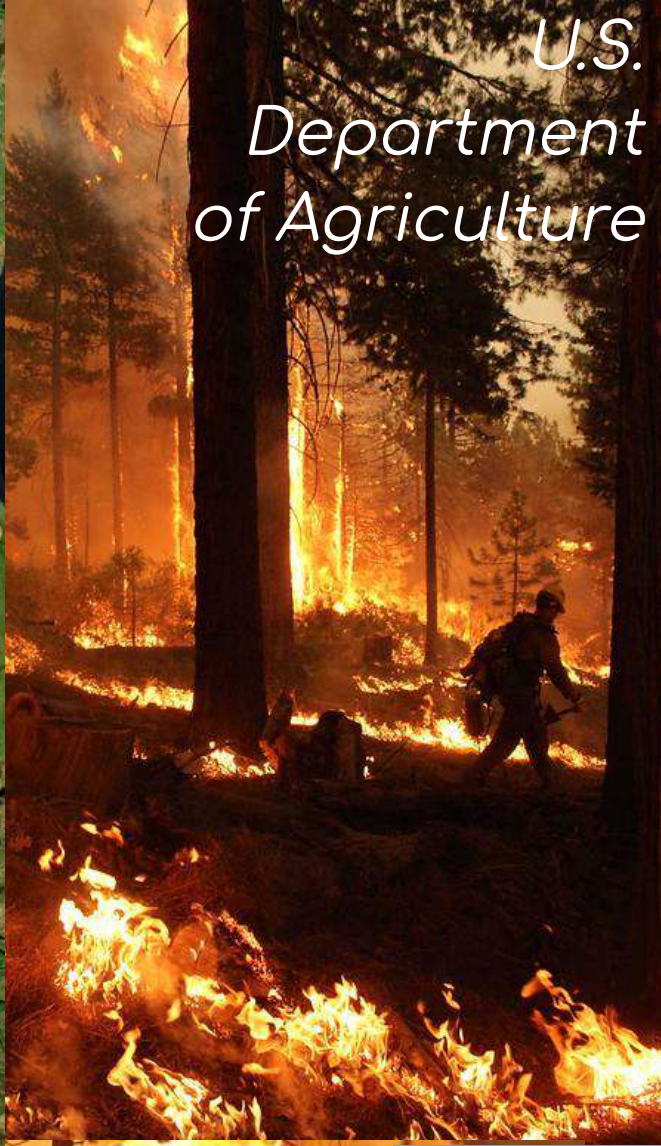
and many more...

Fire in the Earth System





Arctic
Wildfire, Sakha Republic, Siberia, Russia, Aug 12, Contains mod.
Copernicus Sentinel data [2019], processed by Pierre Markuse



U.S.
Department
of Agriculture



NSW/Queensland
NSW RFS Mathoura 1B by Russell Perry



Amazon
Fires in the Amazon rainforest by
ESAs Luca Parmitano on the ISS



U.S. Department
of Agriculture



NSW Rural Fire Service



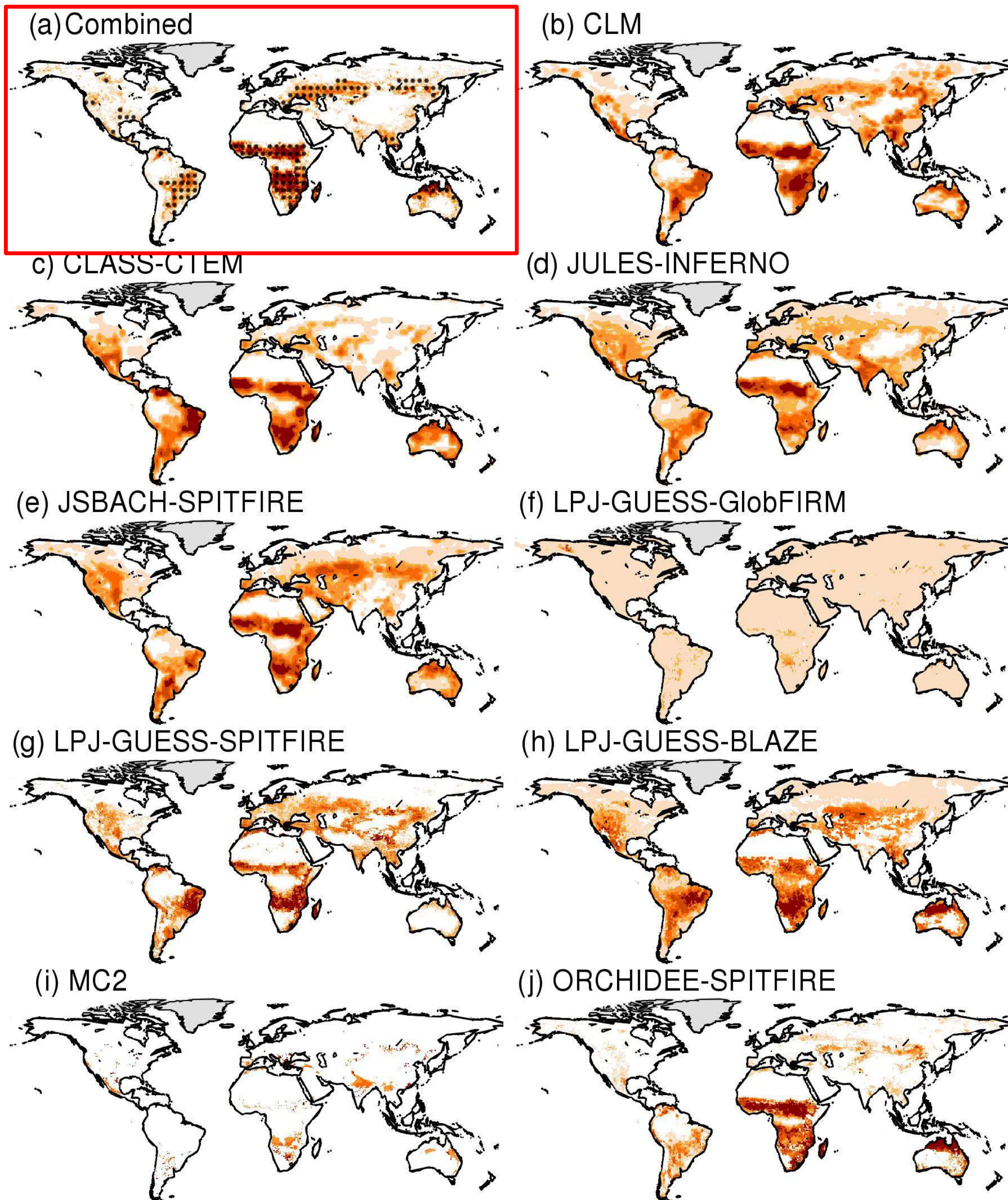
Slash and burn agriculture in the Amazon,
Mott Zimmerman



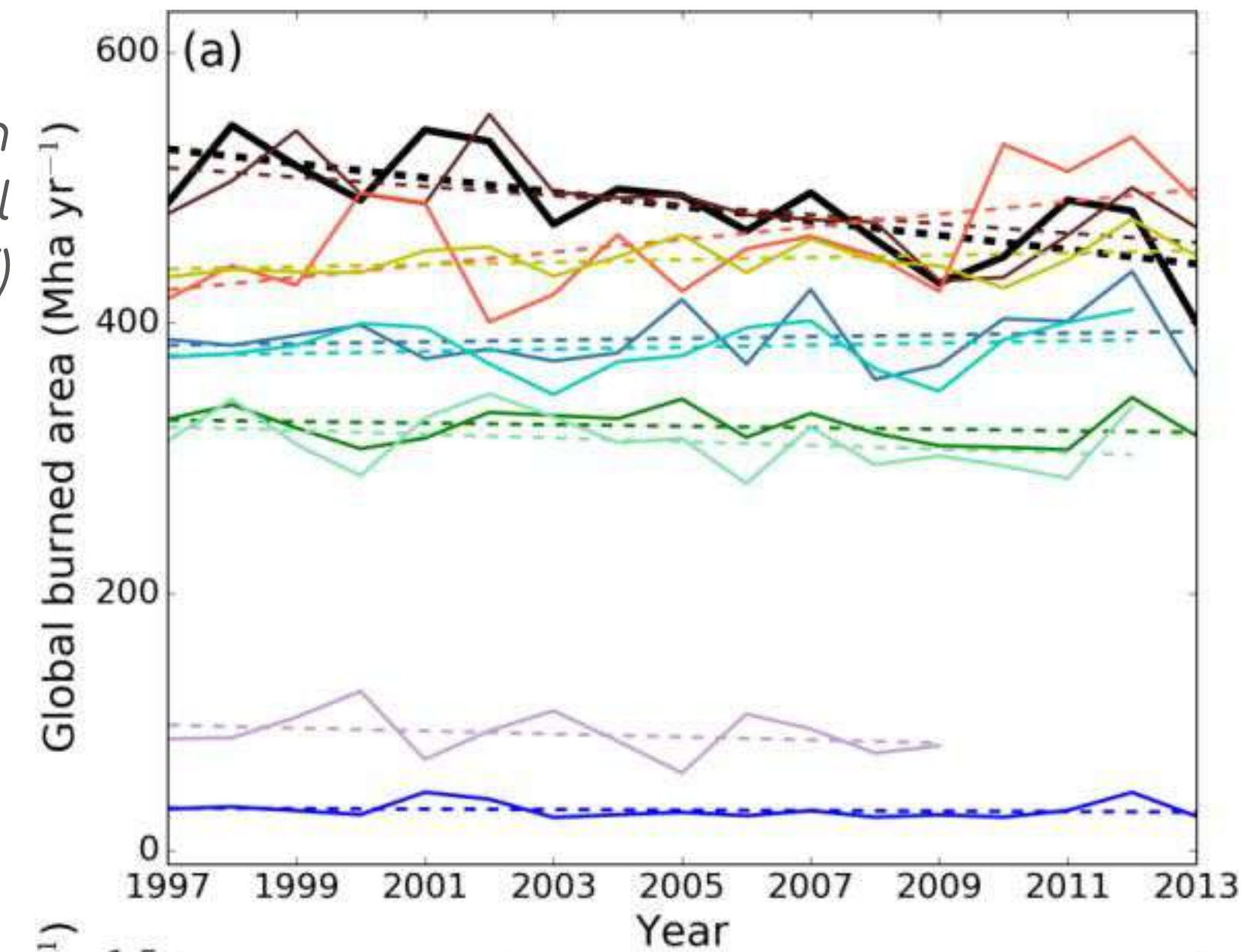
GREG MATTHEWS

California
Greg Matthews #DetectiveGreg

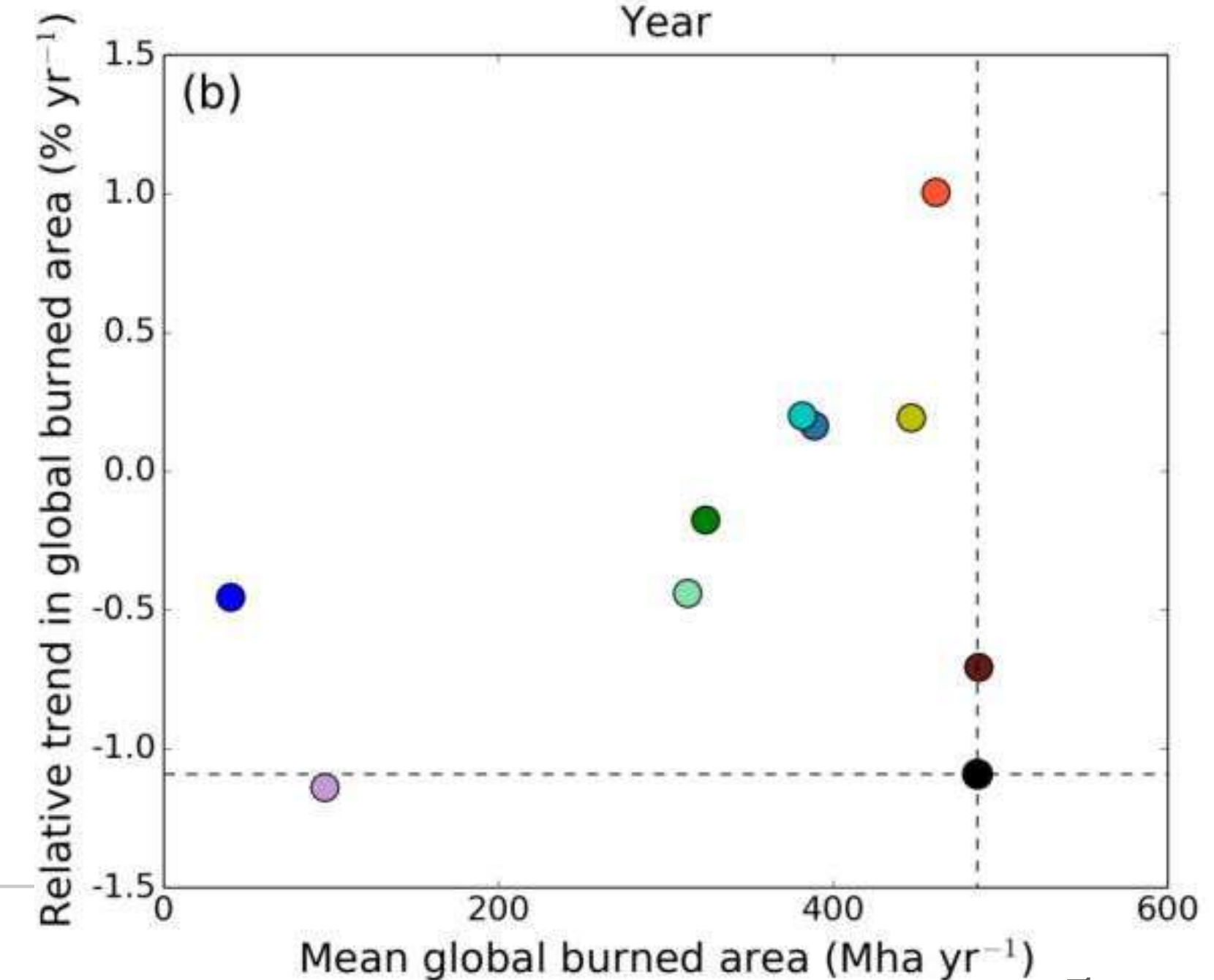
Fires in LSMs



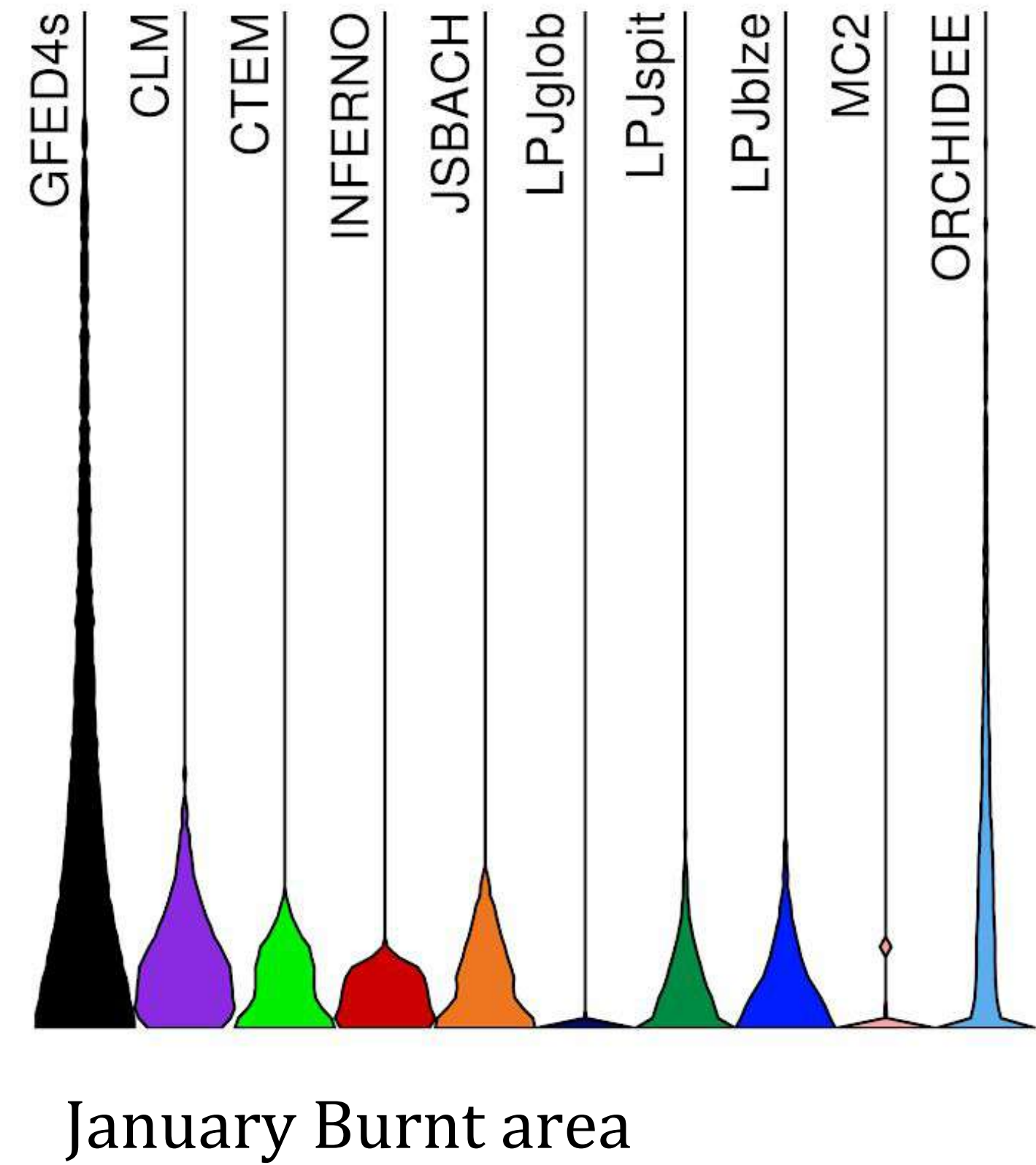
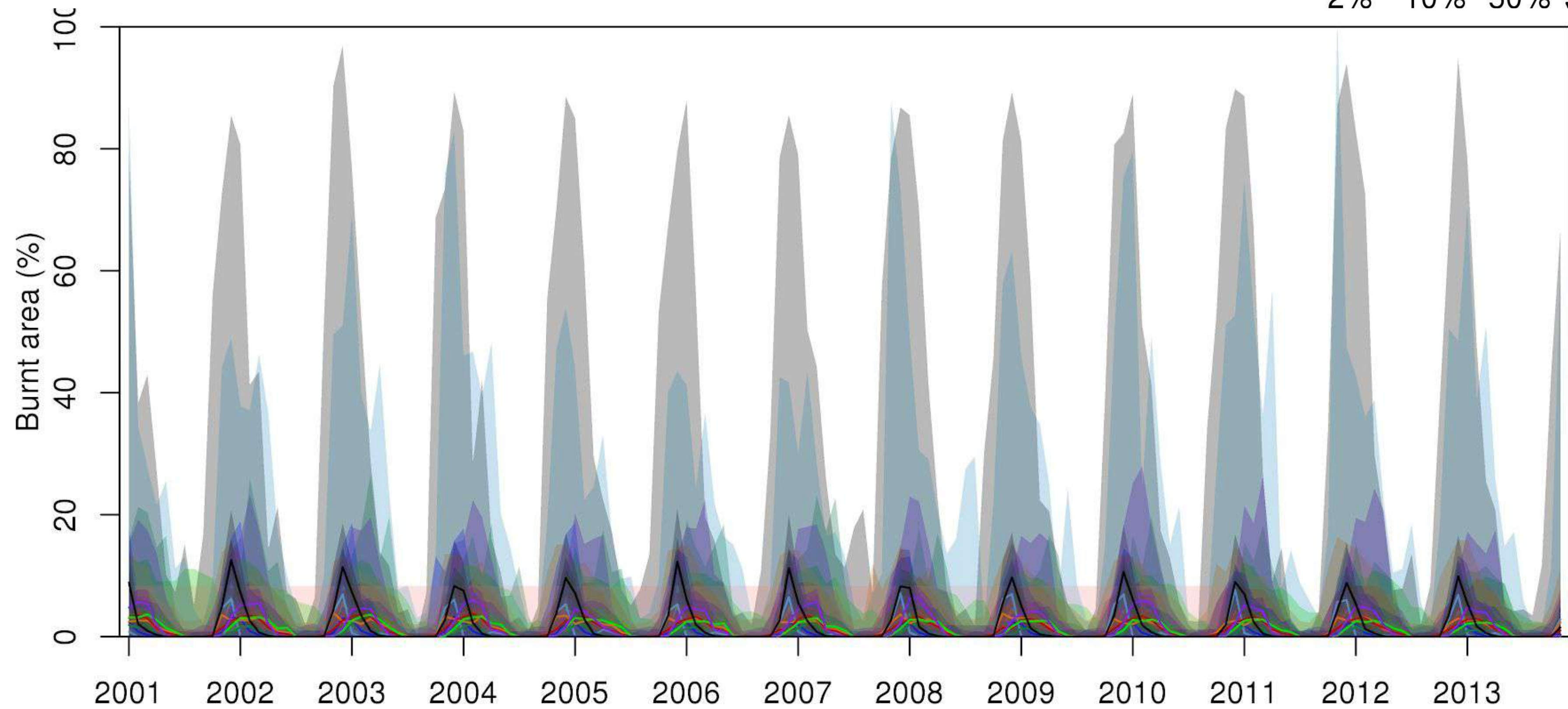
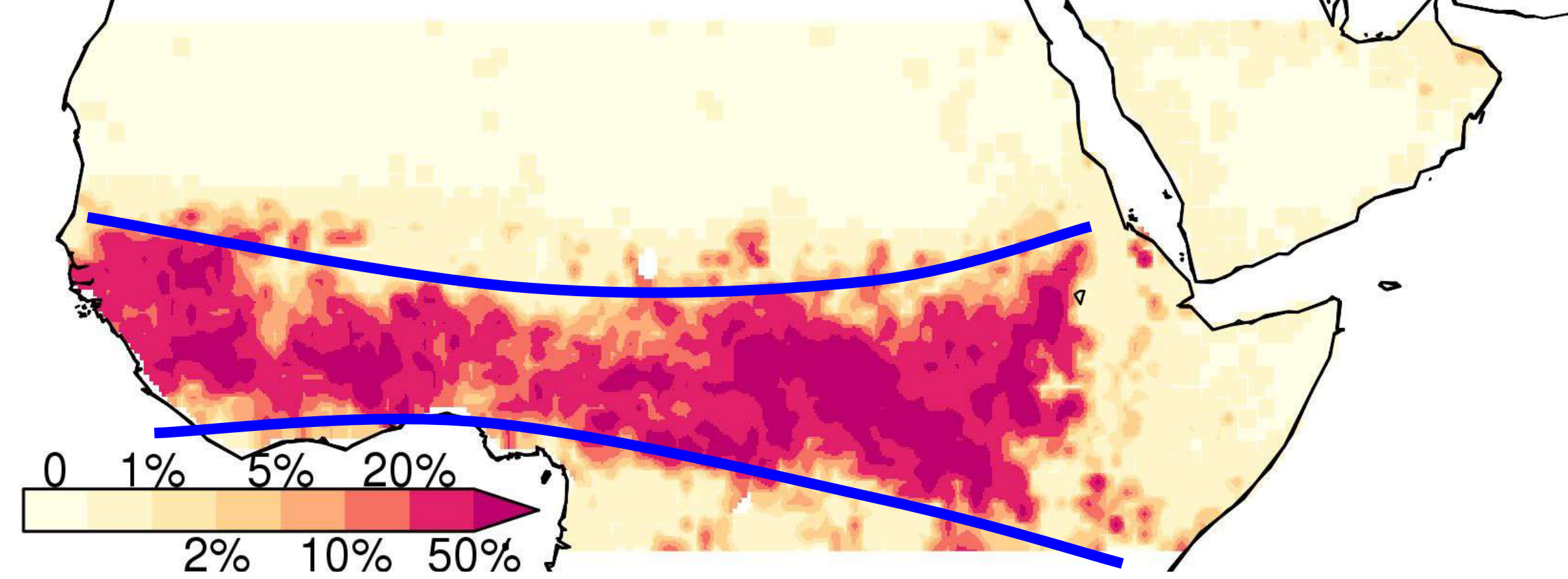
Andela et al., A human-driven decline in global burned area (2017)



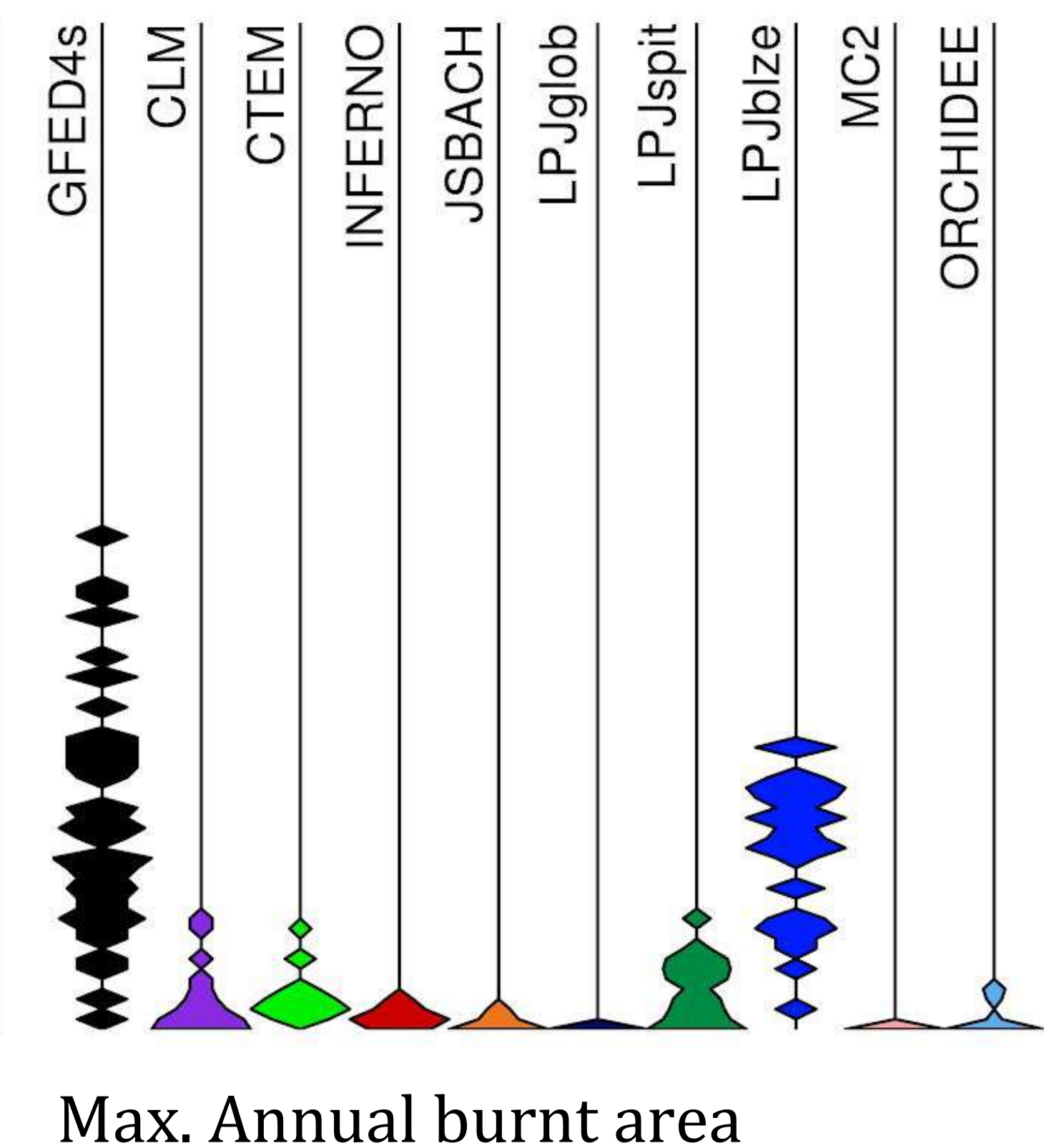
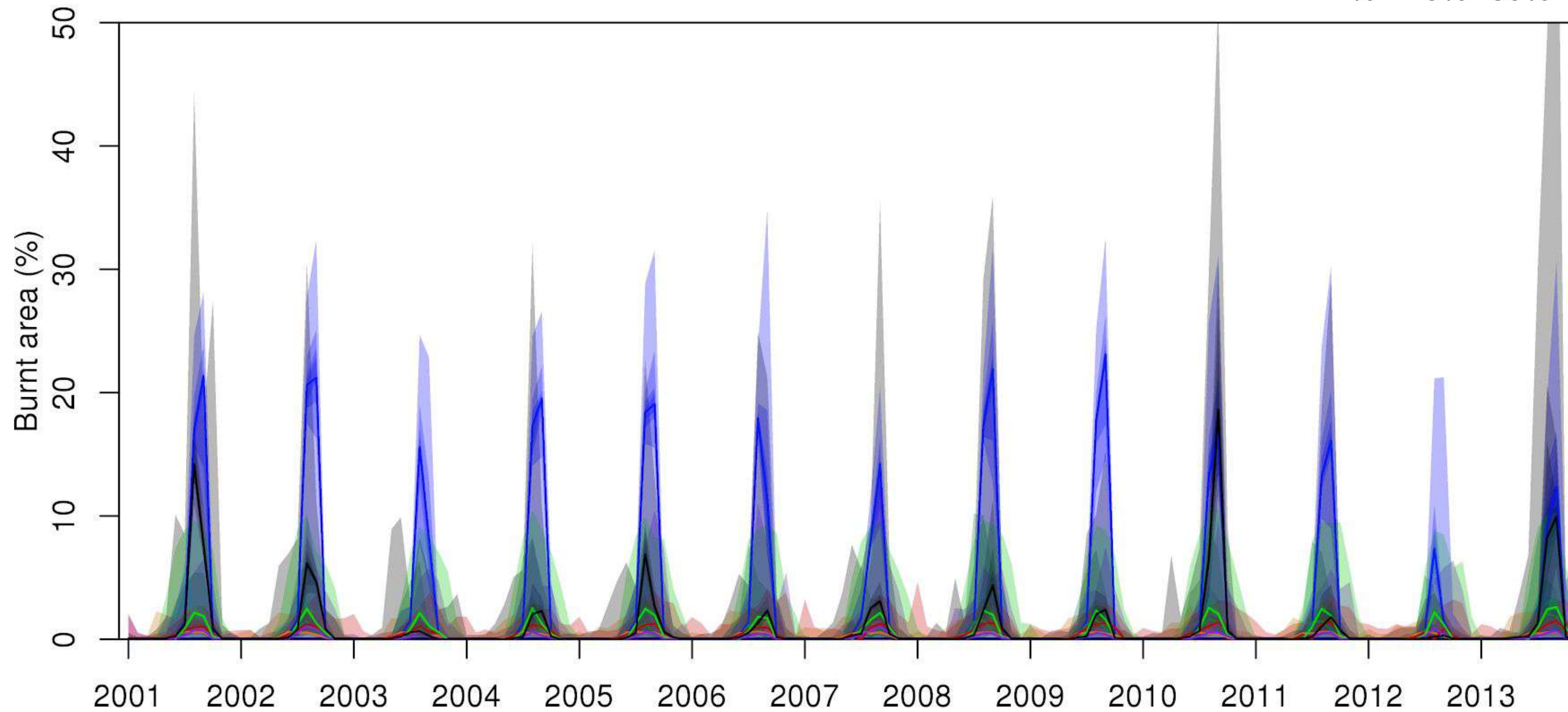
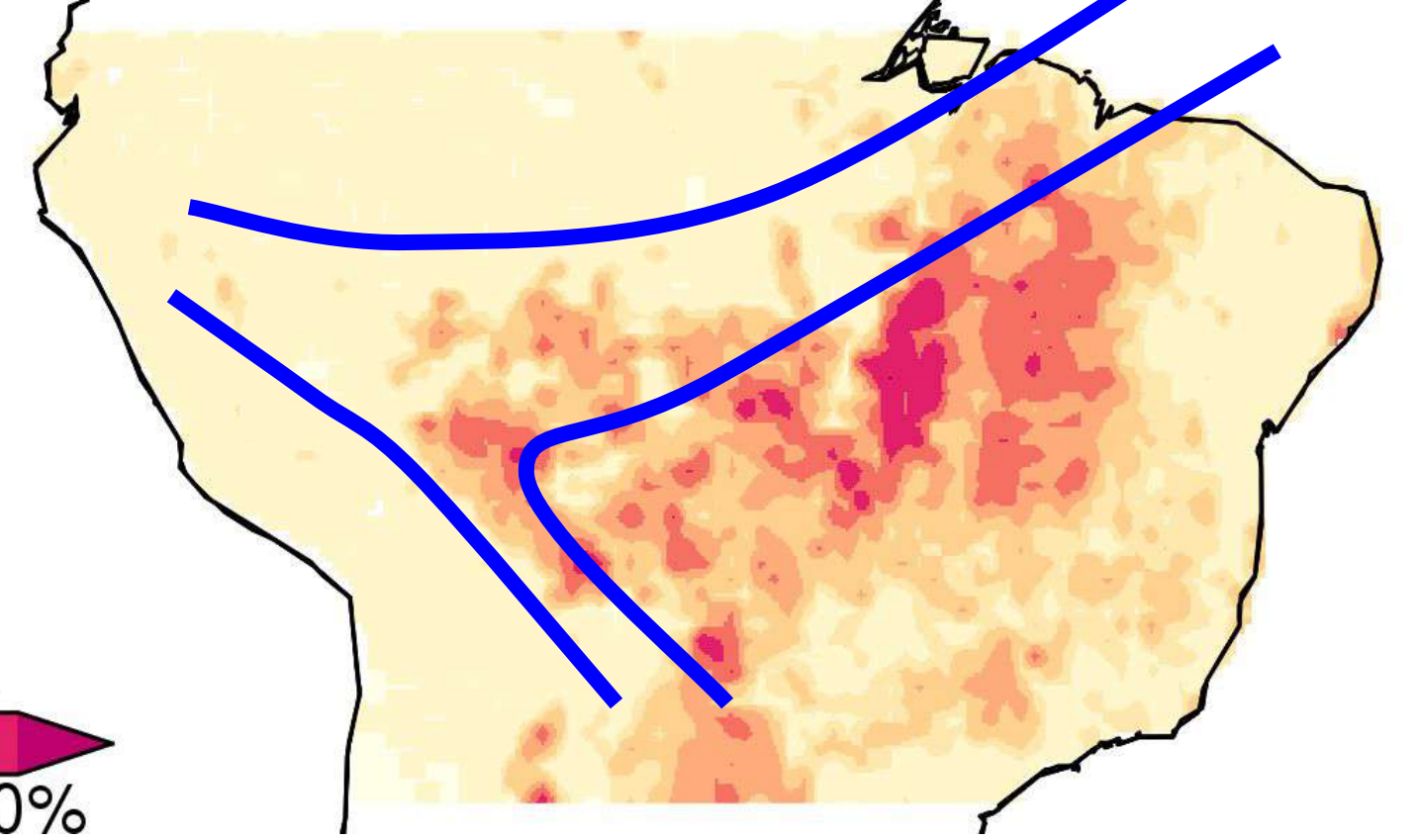
Hantson et al. Quantitative assessment of fire and vegetation properties in simulations with fire-enabled vegetation models from the Fire Model Intercomparison Project (2020).



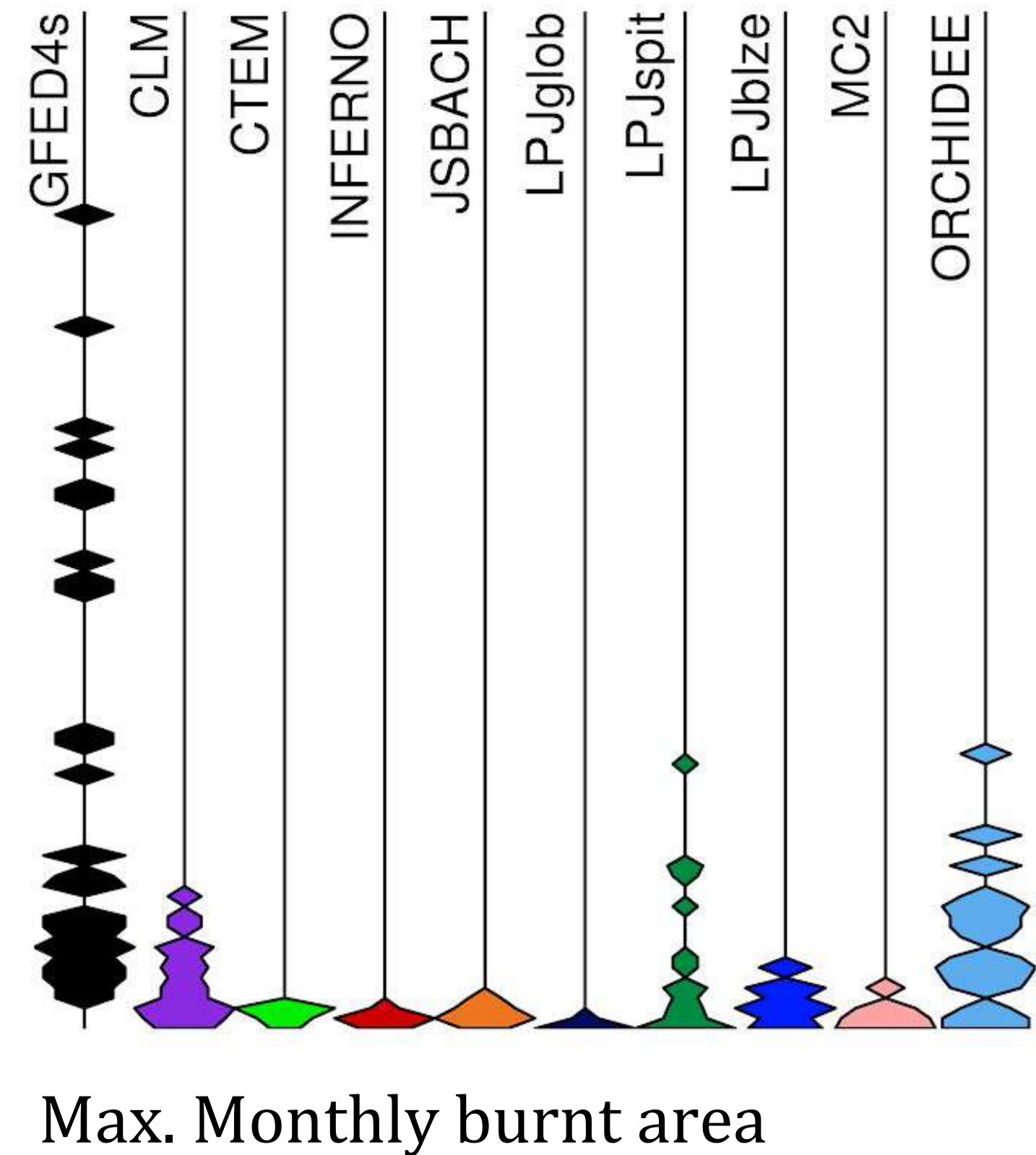
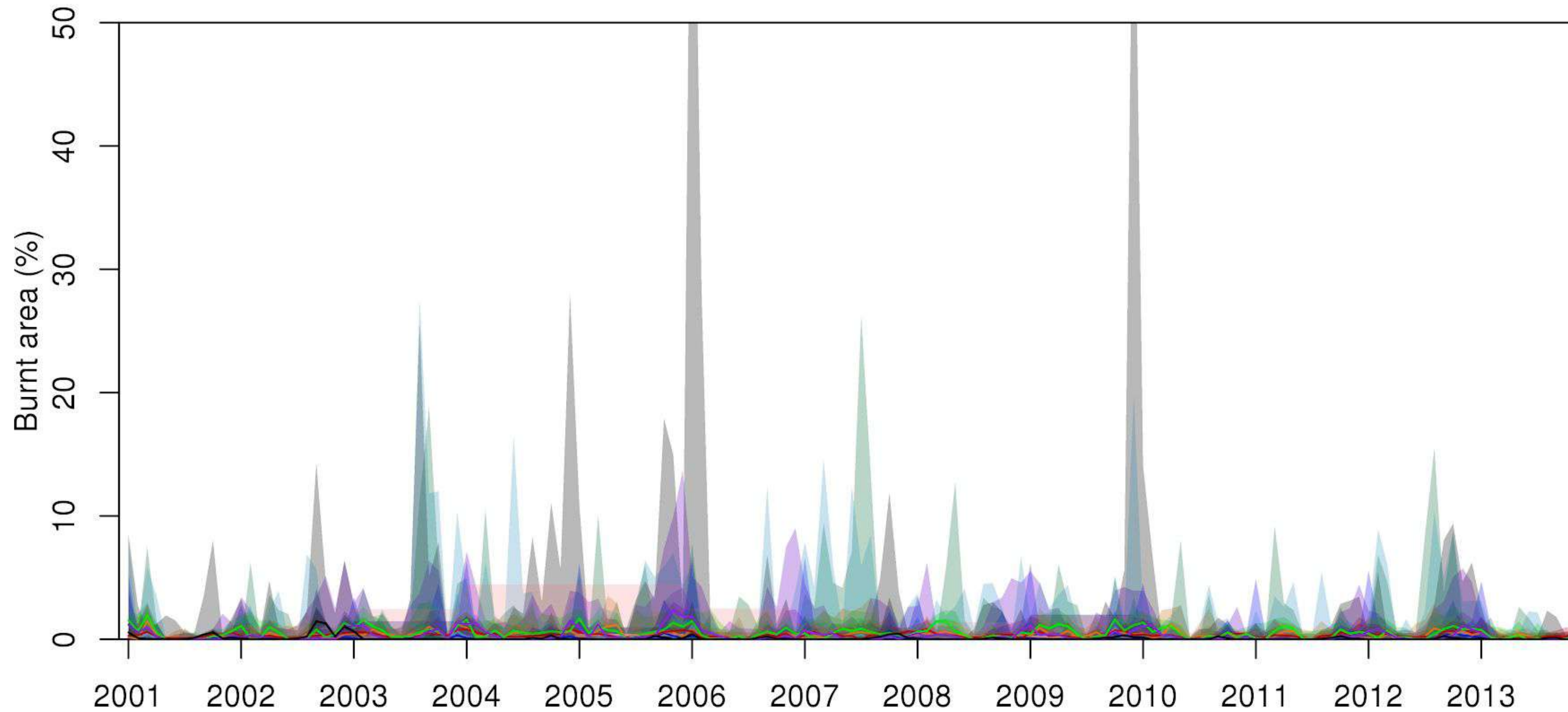
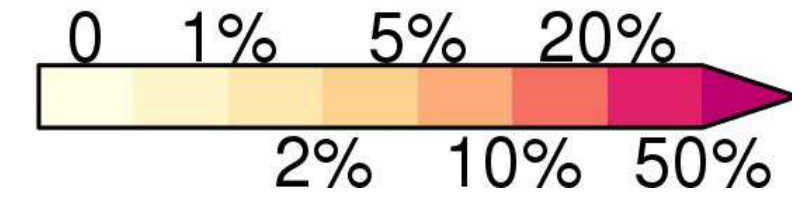
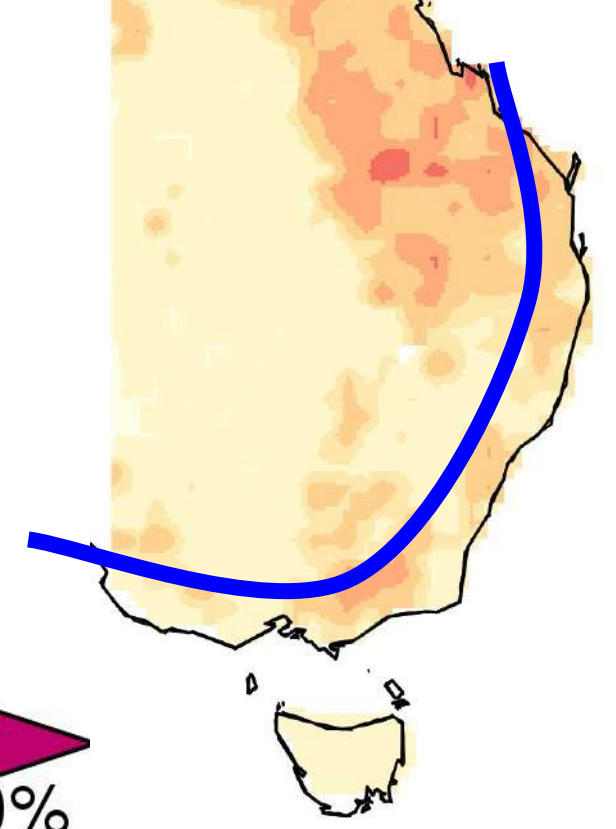
Problem 1: high burnt areas - Sahel



Problem 2: Human dominated fire regimes - Arc of deforestation



Problem 3: Inter-annual variability - South East Australia



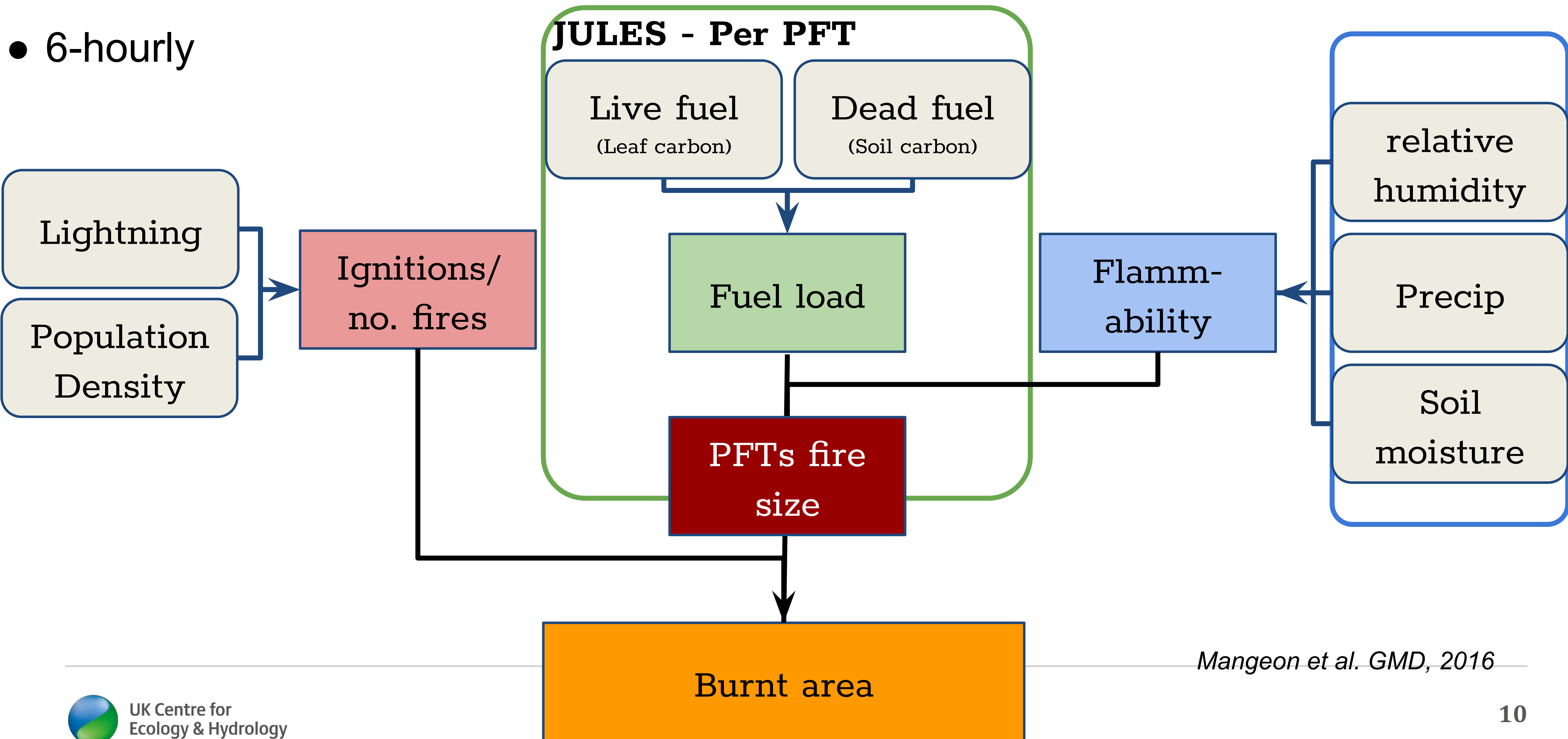
Some vague aims

fireMIP prioritiesformal sensitivity and analysis on the input parameters to determine if fire models include correct processes/parameterisation should be prioritised to improve, and provide confidence in, model performance..... **(2018 workshop)**

- Find a way to assess and constrain veg-fire models using observations
 - Simplify the simple INFERNO model
 - Constrain it using Bayesian inference
- Test this with a couple of recent big fire events from last year in:
 - Amazon
 - Southeastern Aus

INFERNO

- 6-hourly

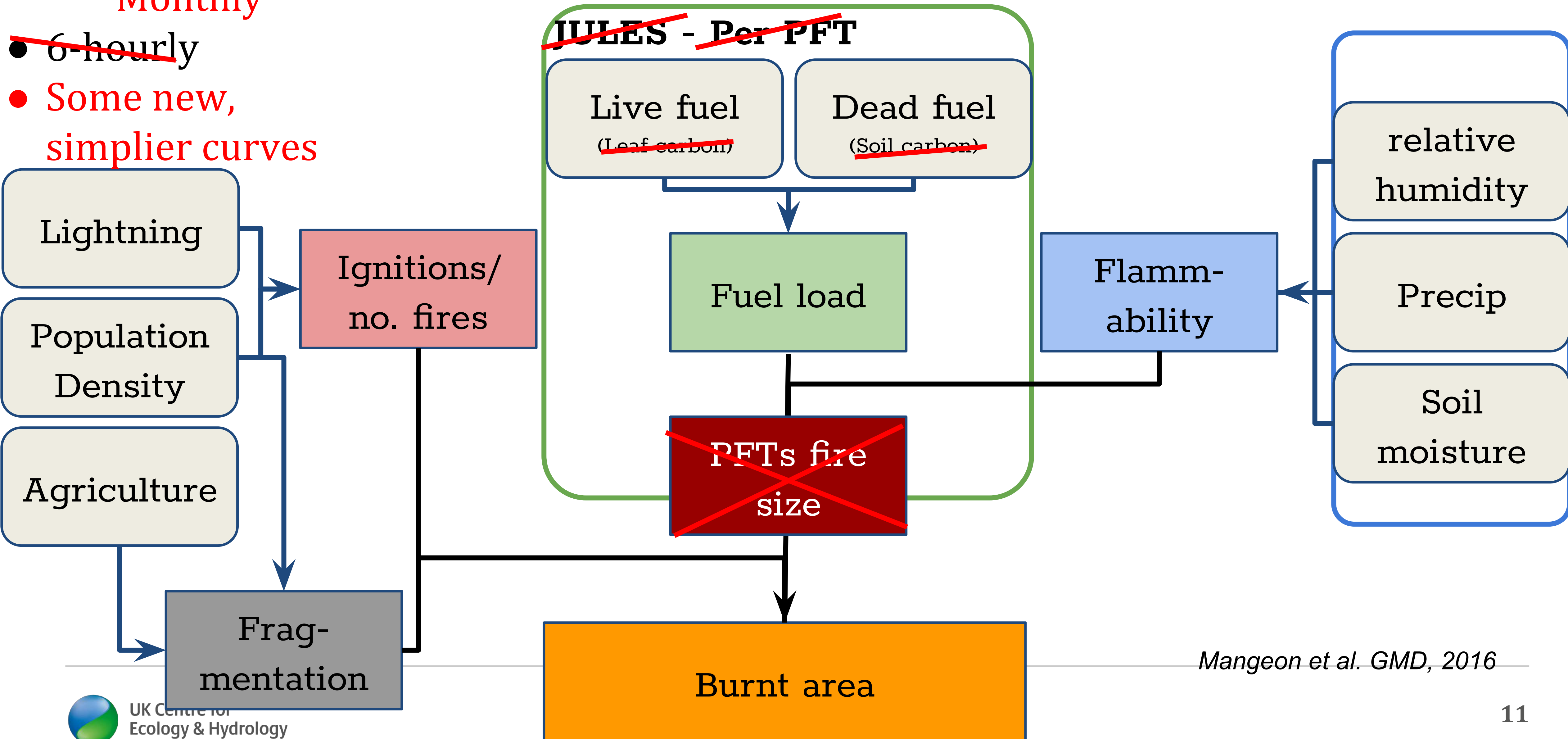


Mangeon et al. GMD, 2016

INFERNO stripped down

Monthly

- ~~6-hourly~~
- Some new, simpler curves

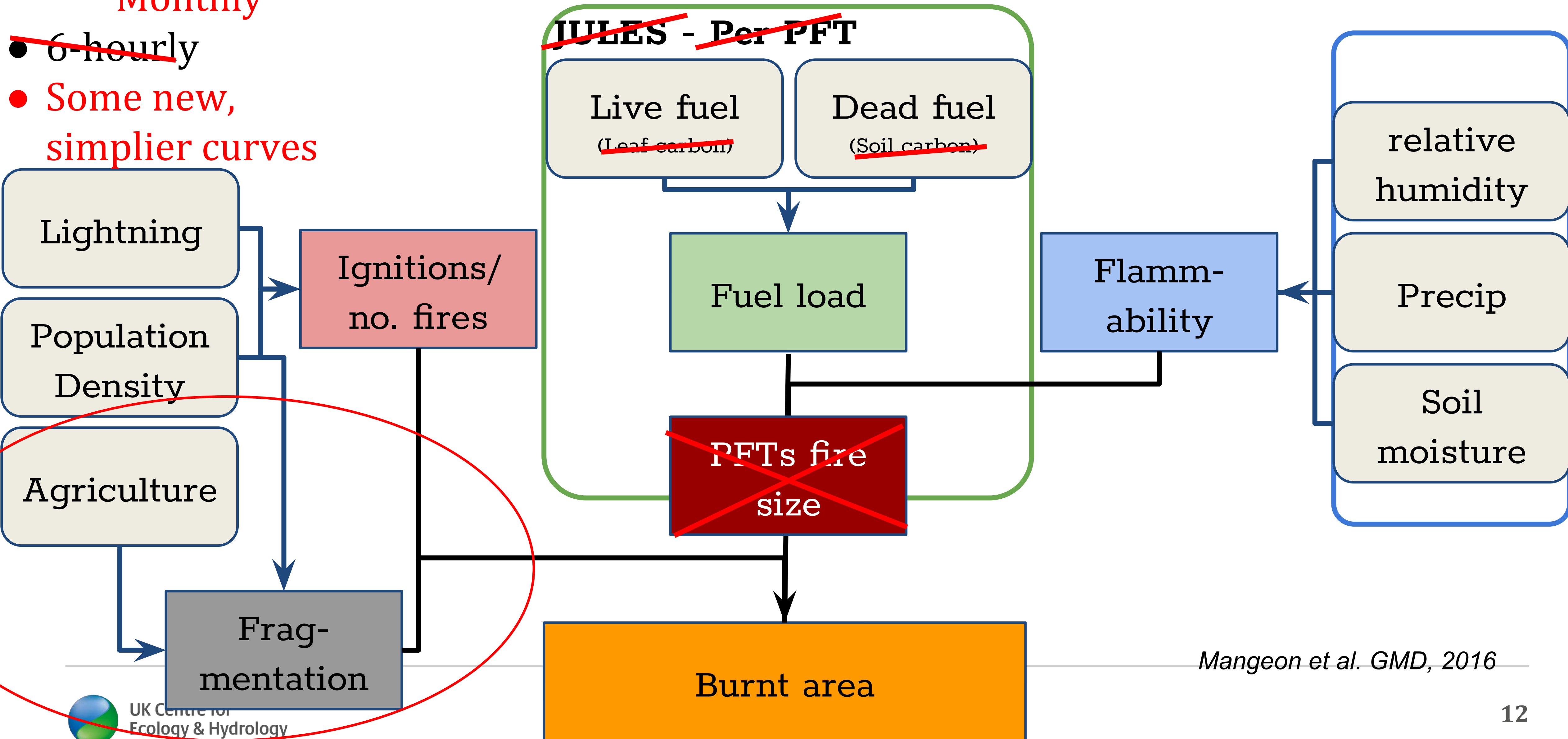


Mangeon et al. GMD, 2016

INFERNO stripped down

Monthly

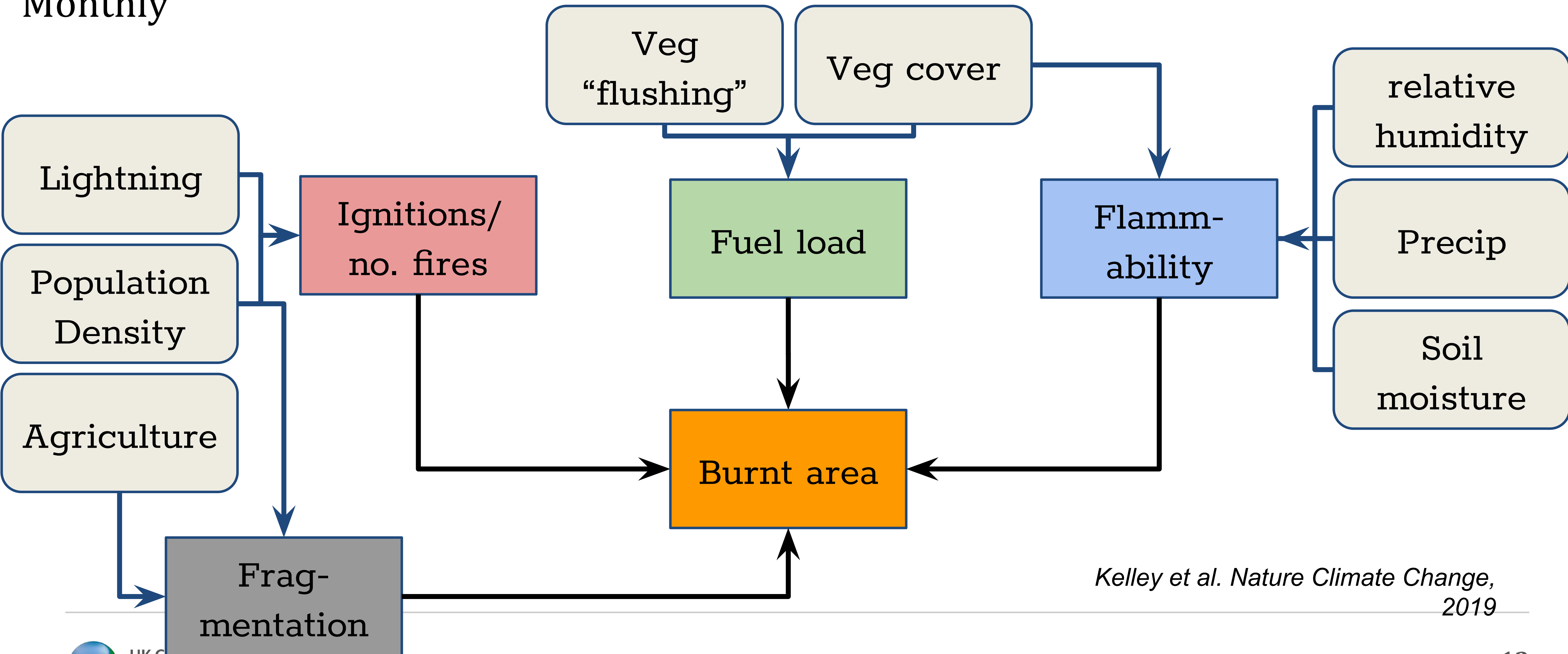
- ~~6-hourly~~
- Some new, simpler curves



Mangeon et al. GMD, 2016

“ConFIRE”

Monthly

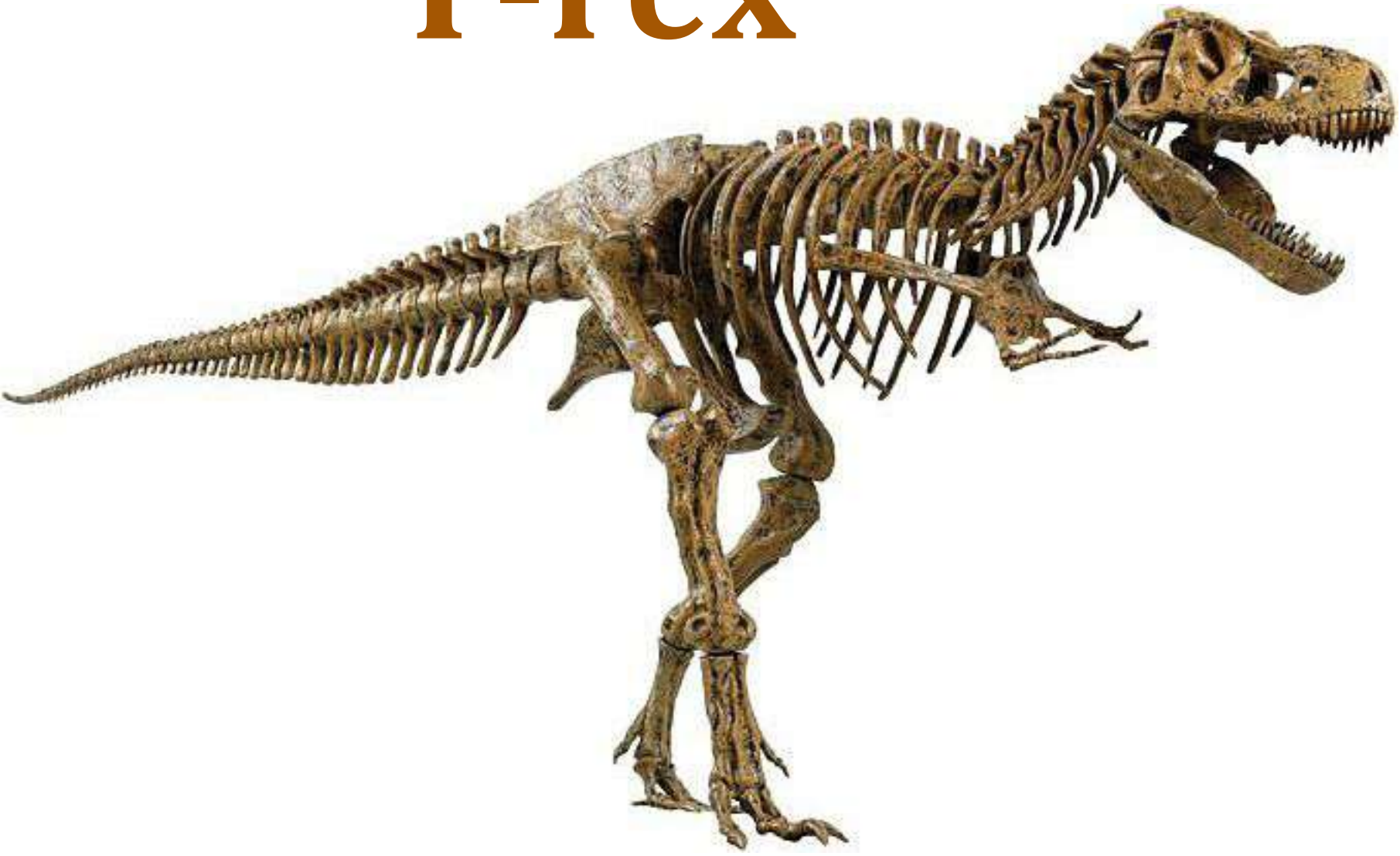


Kelley et al. Nature Climate Change, 2019

Bayes Theorem

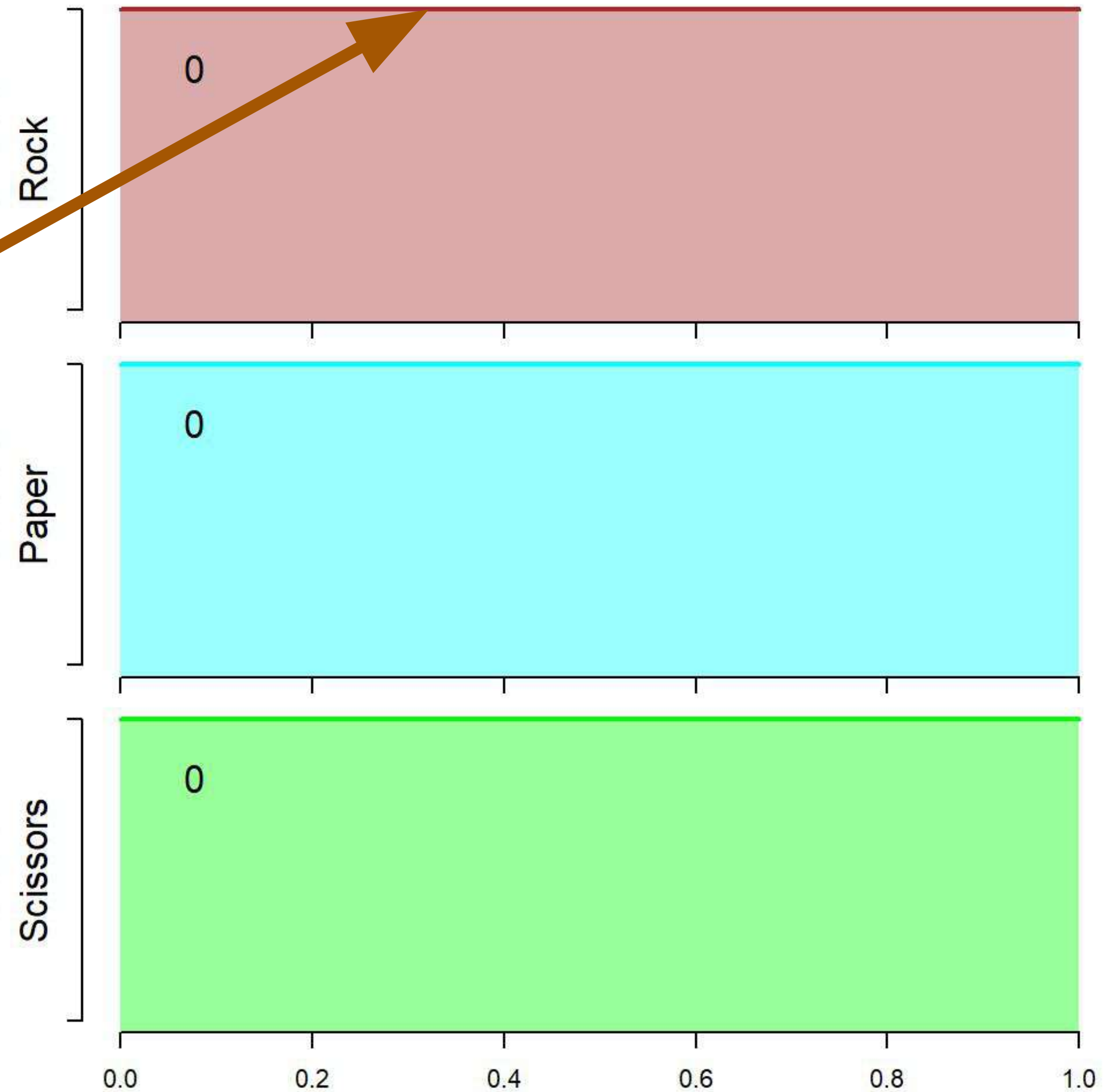
$$P(\beta|Obs) \propto P(\beta) \times P(Obs|\beta)$$

Bayes Theorem - Rock paper scissors vs T-rex

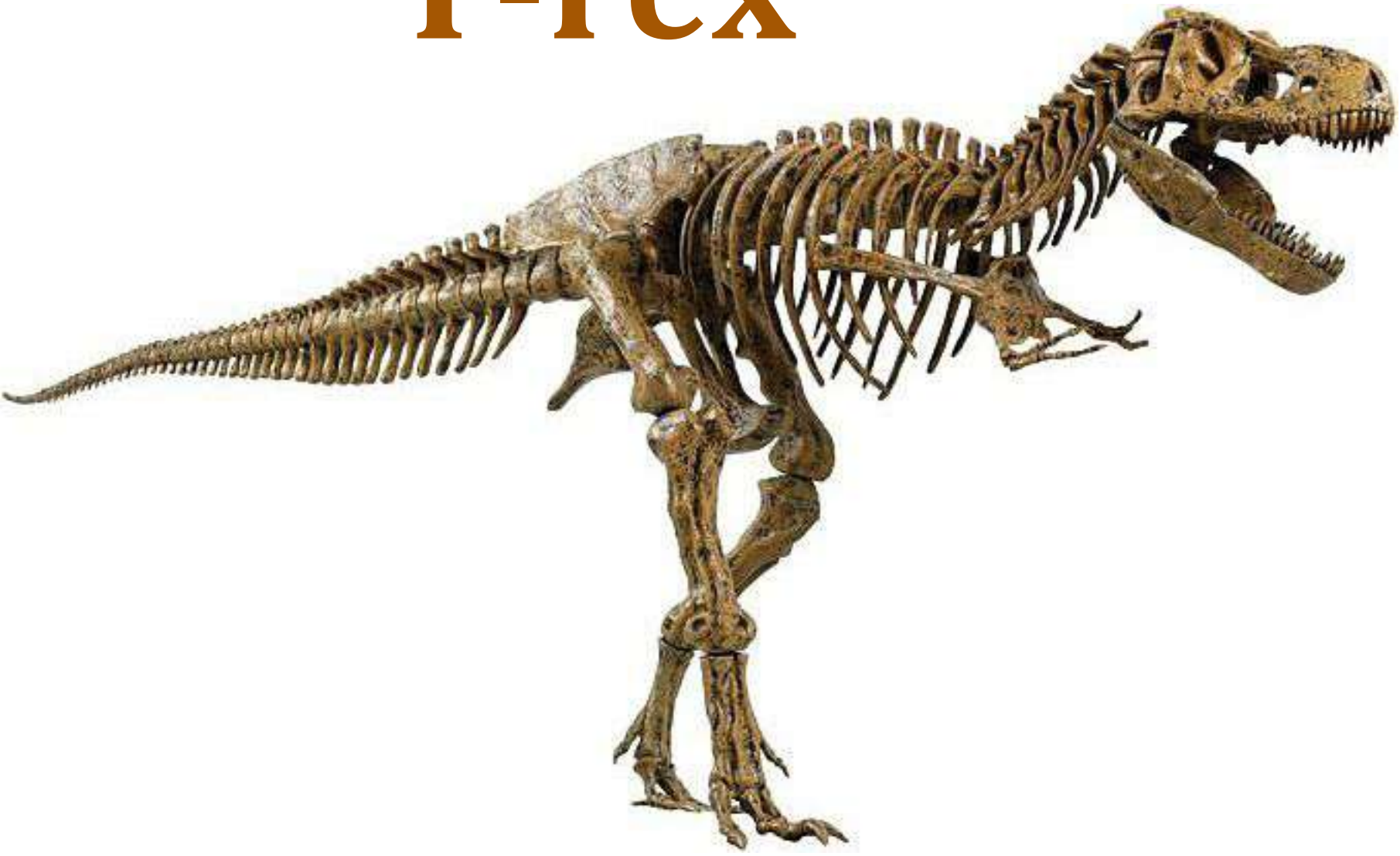


VERY
uninformed
priors

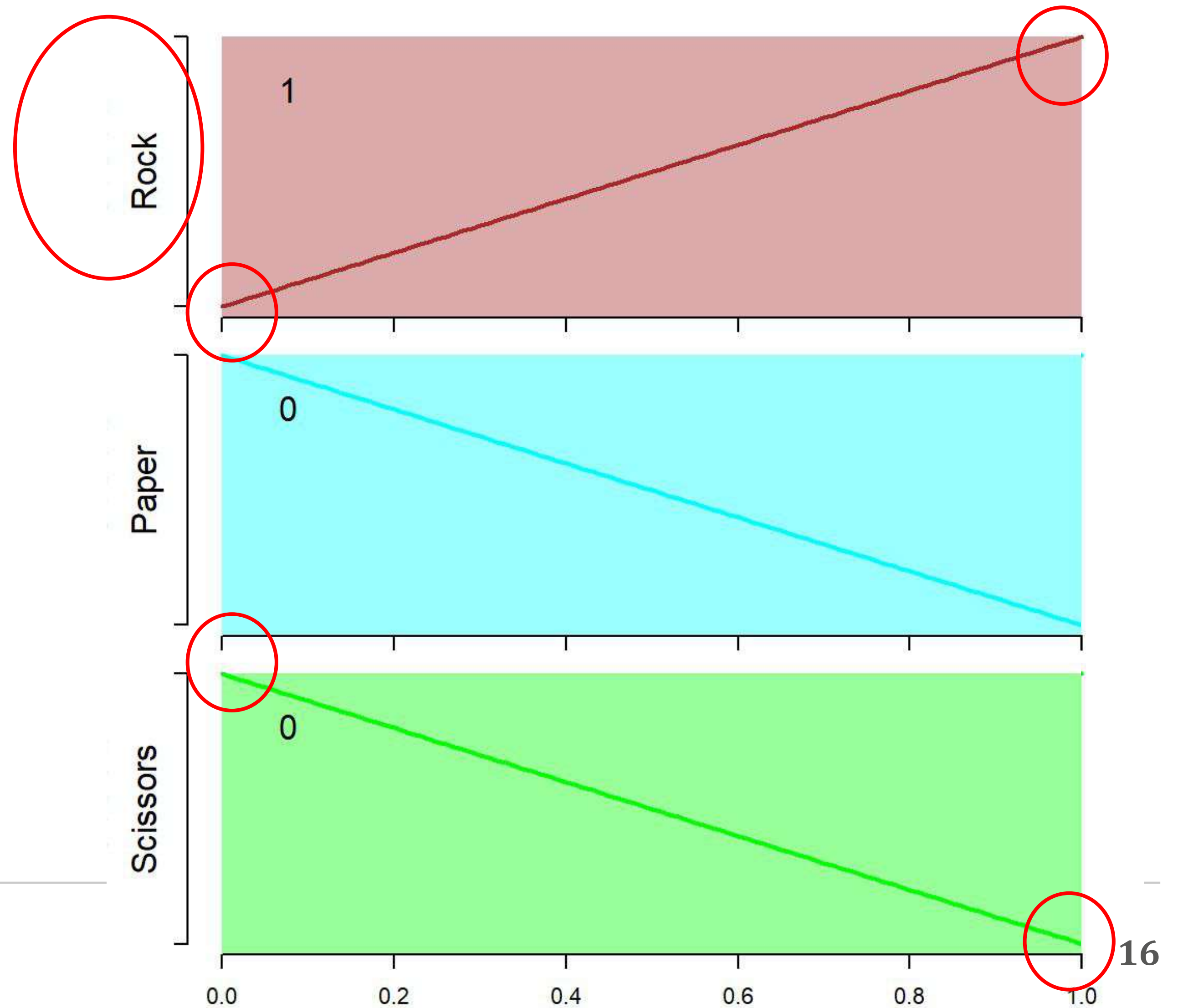
What is the frequency with which the T-rex chooses rock, paper, or scissors?



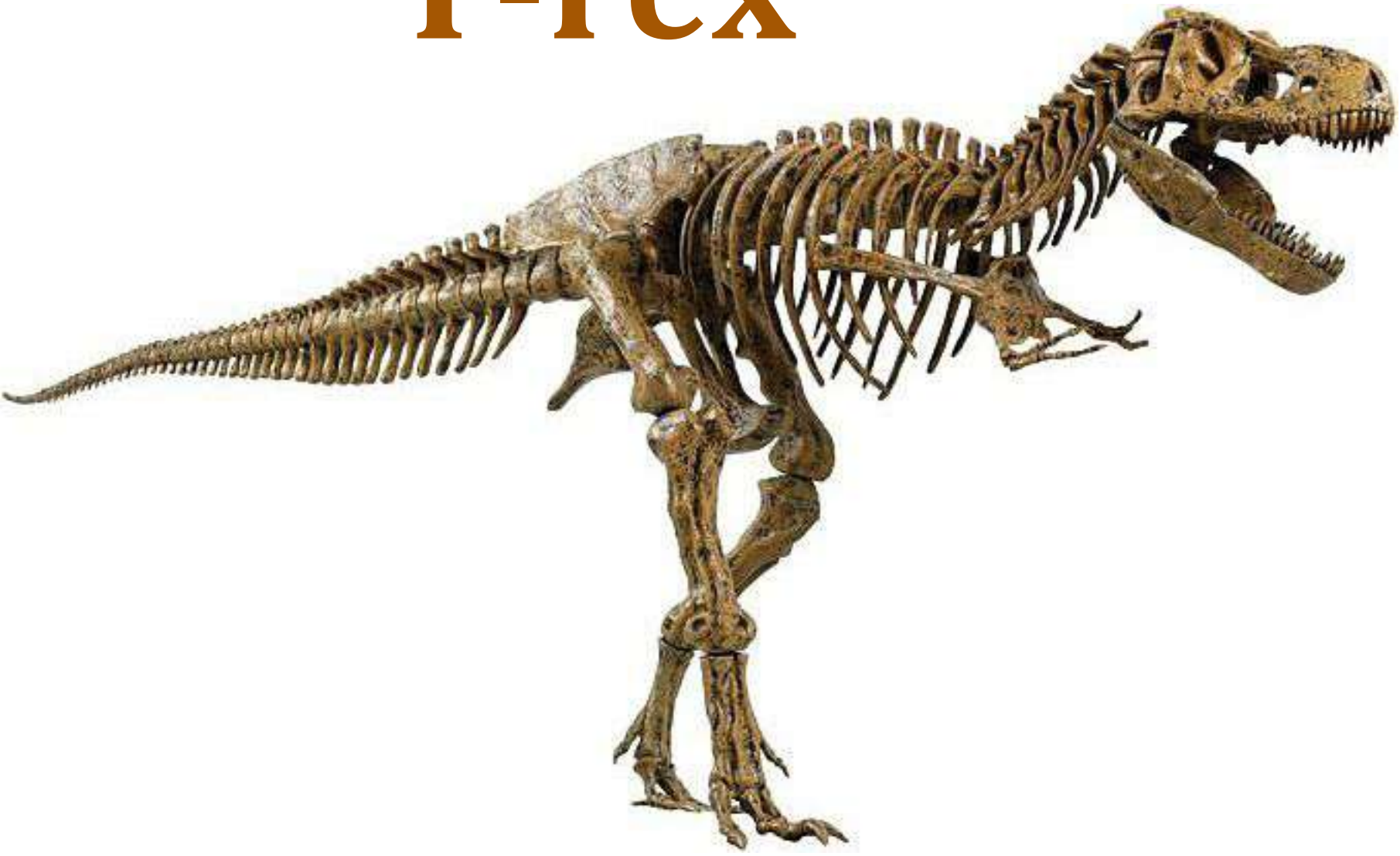
Bayes Theorem - Rock paper scissors vs T-rex



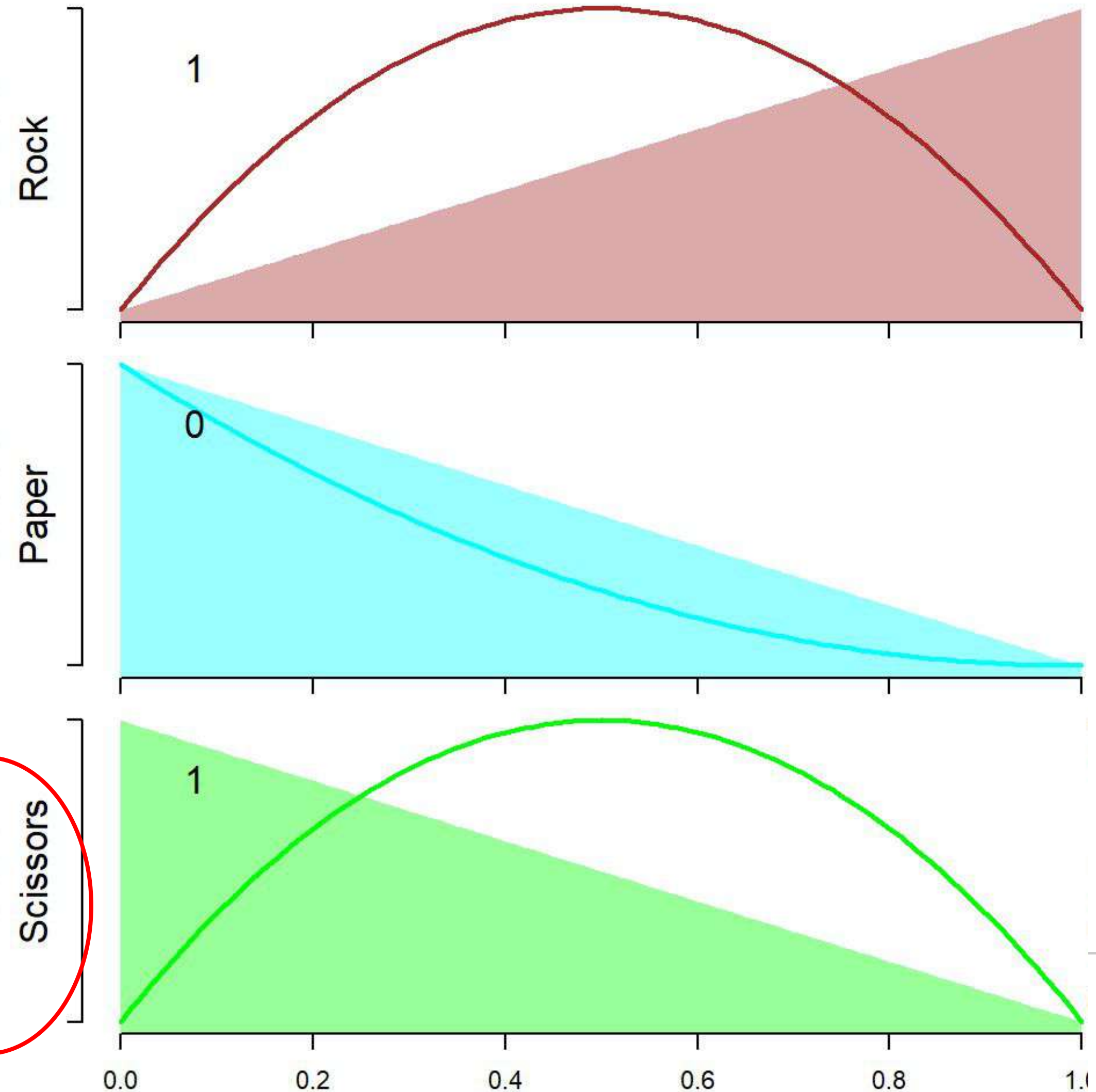
What is the frequency with which the T-rex chooses rock, paper, or scissors?



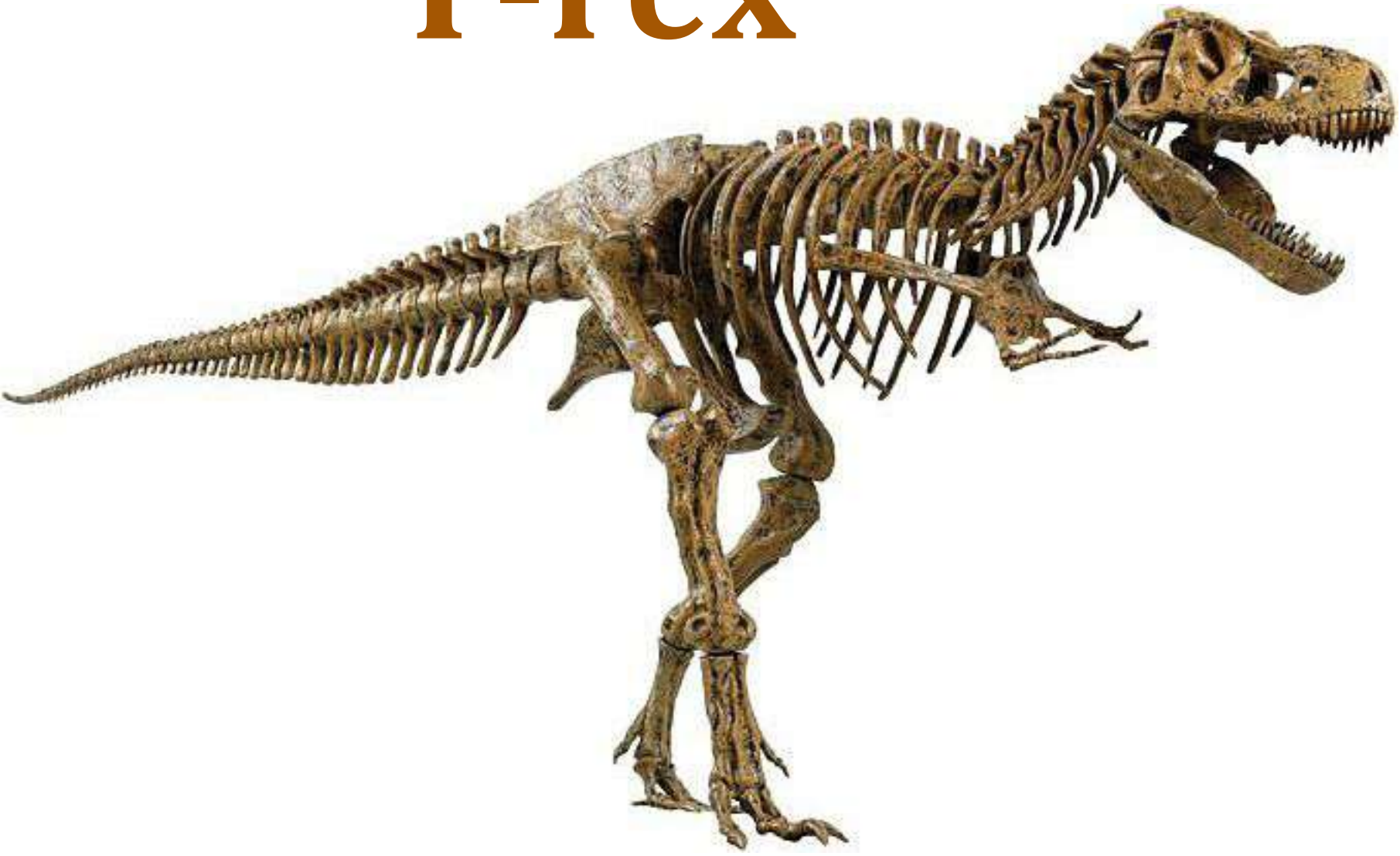
Bayes Theorem - Rock paper scissors vs T-rex



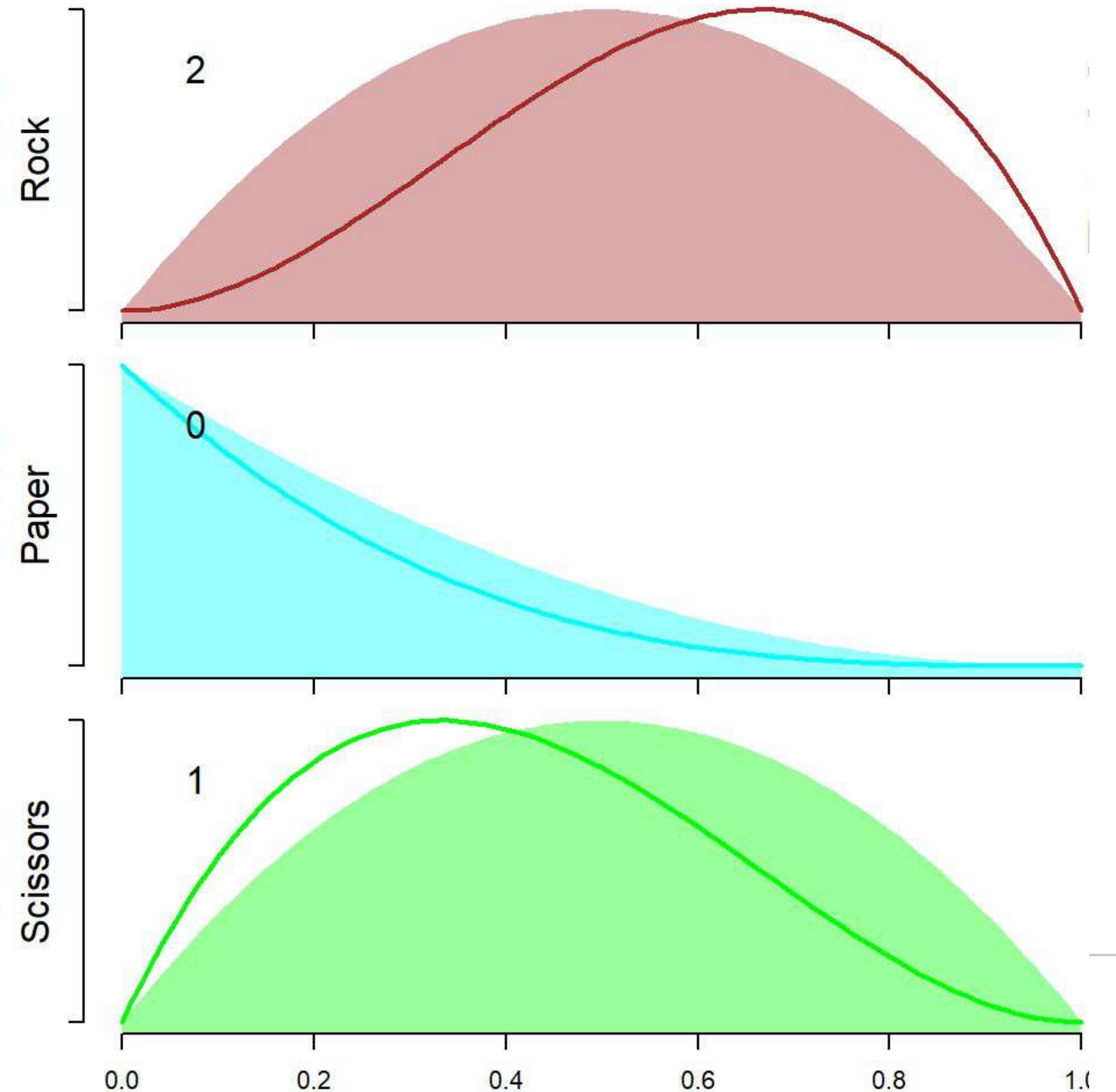
What is the frequency with which the T-rex chooses rock, paper, or scissors?



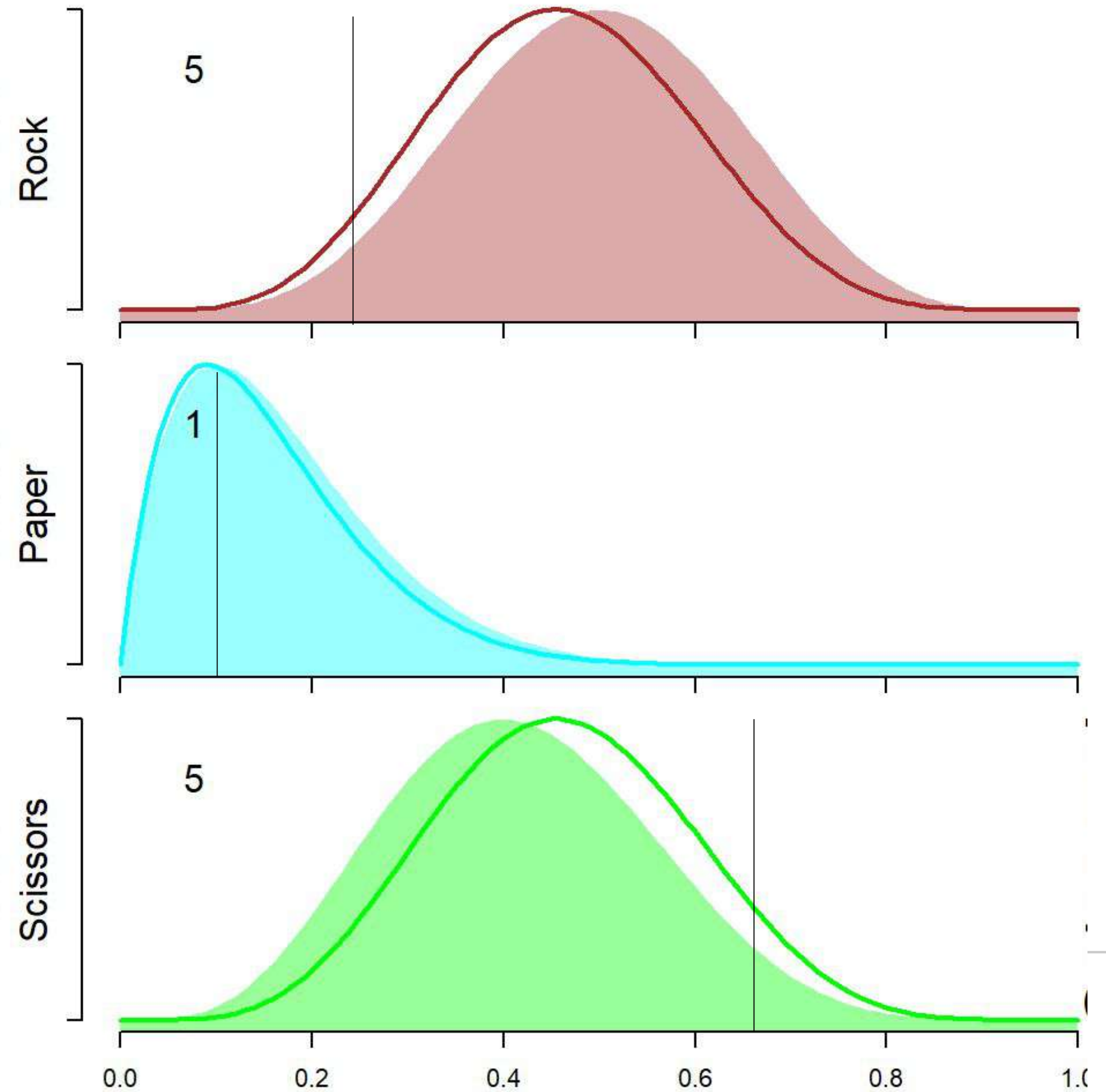
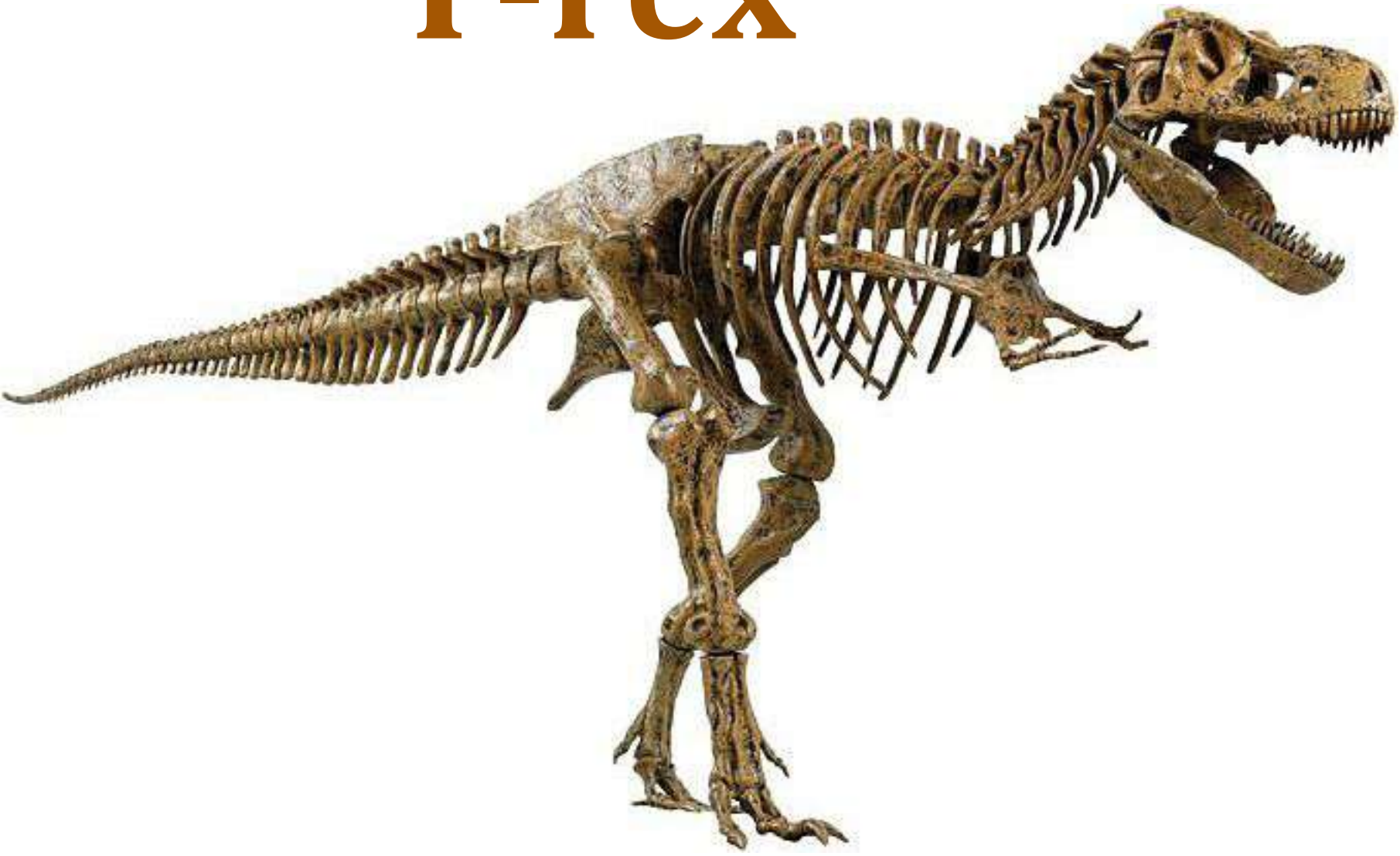
Bayes Theorem - Rock paper scissors vs T-rex



What is the frequency with which the T-rex chooses rock, paper, or scissors?



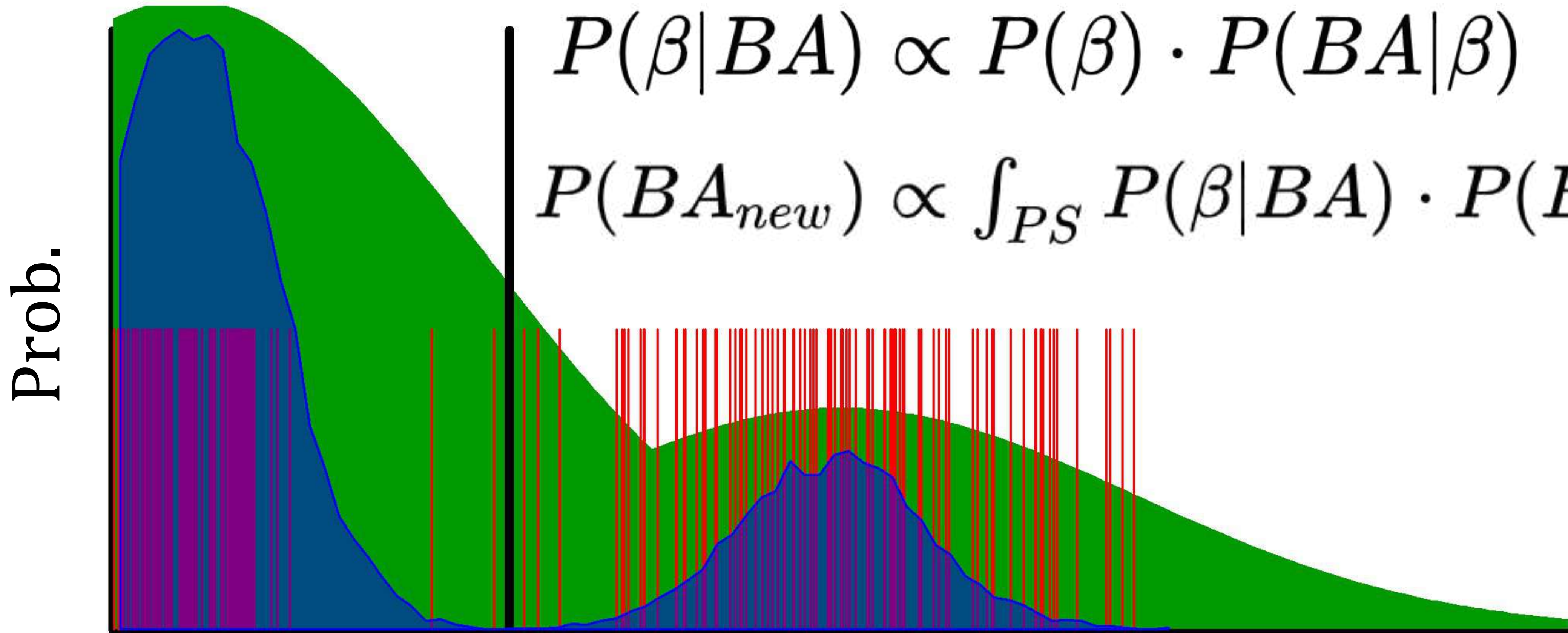
Bayes Theorem - Rock paper scissors vs T-rex



Same climate conditions...

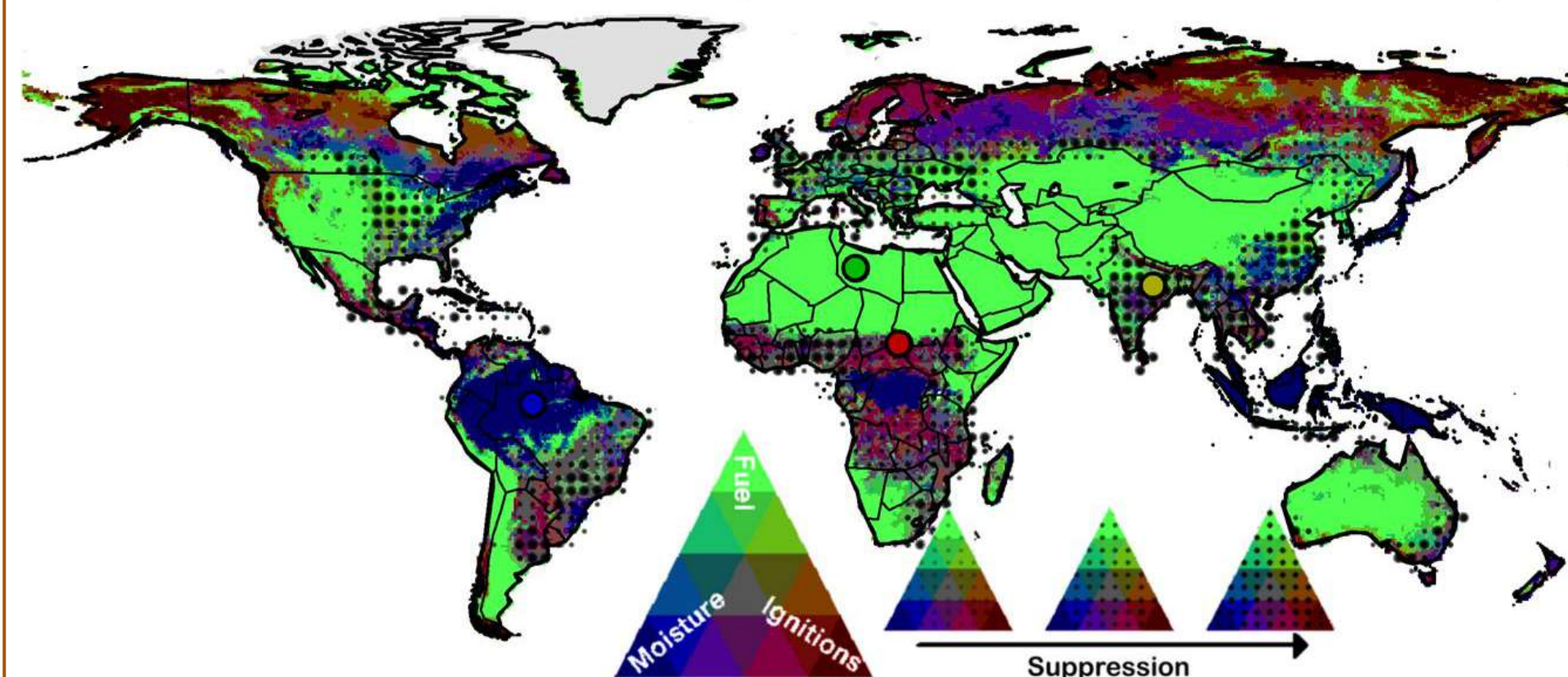
$$P(\beta|BA) \propto P(\beta) \cdot P(BA|\beta)$$

$$P(BA_{new}) \propto \int_{PS} P(\beta|BA) \cdot P(BA_{new}|\beta)$$

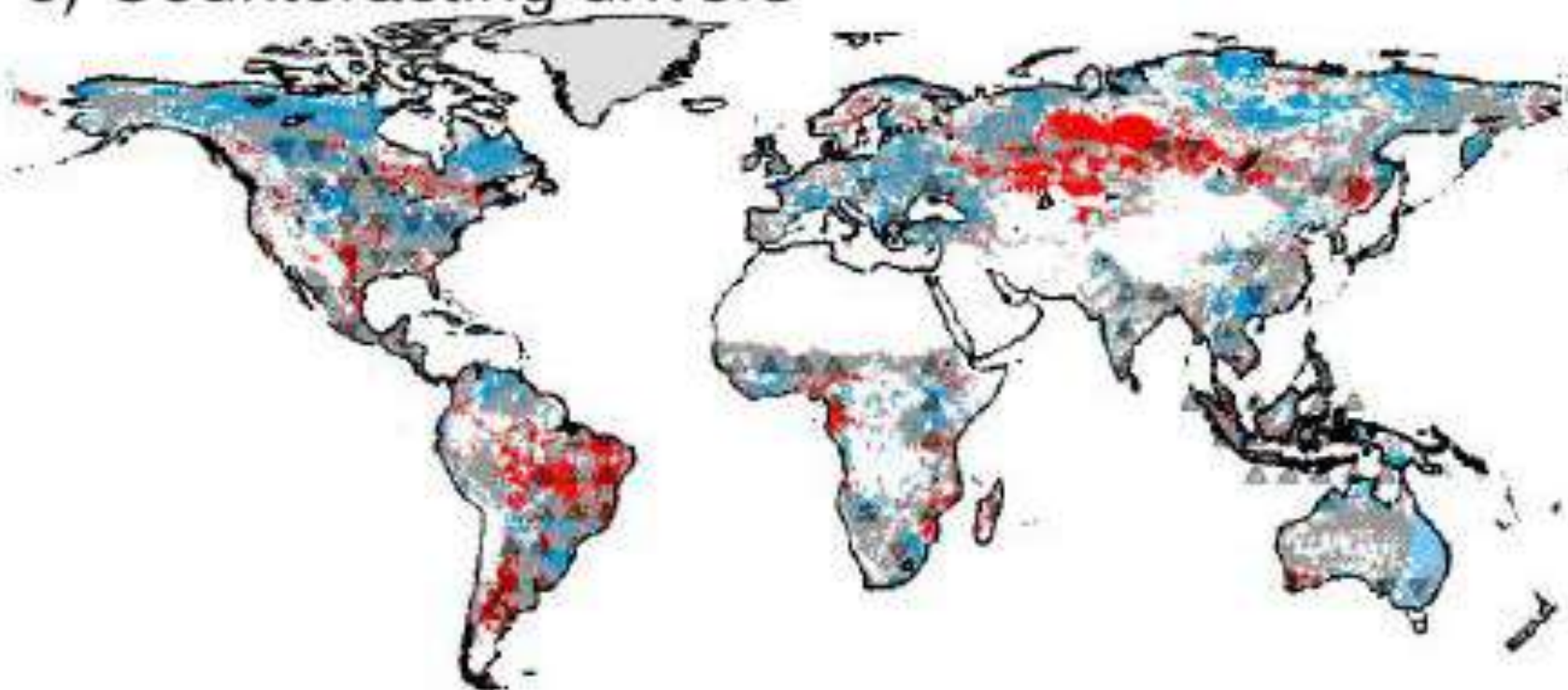


How contemporary bioclimatic and human controls change global fire regimes

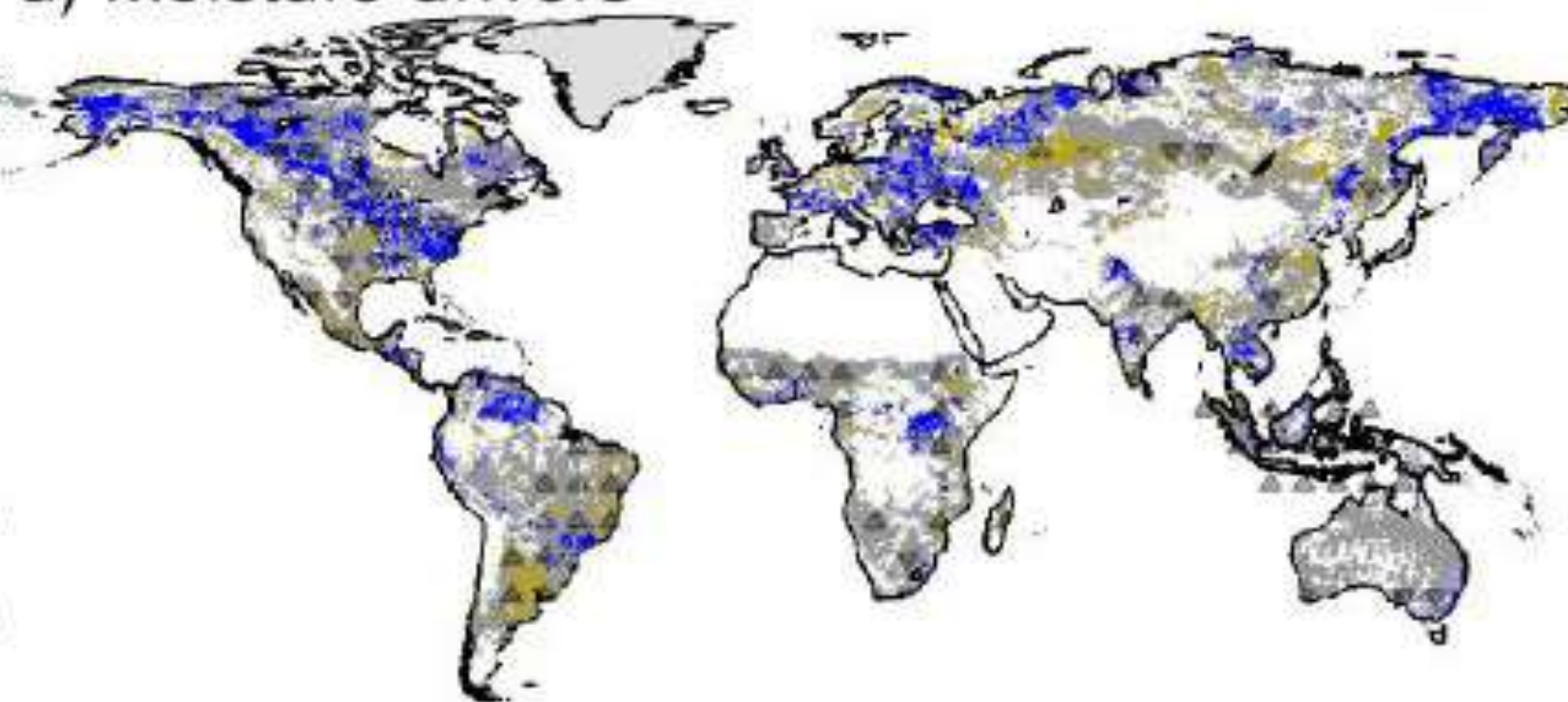
Douglas I. Kelley^{1*}, Ioannis Bistinas^{2,3}, Rhys Whitley⁴, Chantelle Burton⁵, Toby R. Marthews¹ and Ning Dong^{6,7}



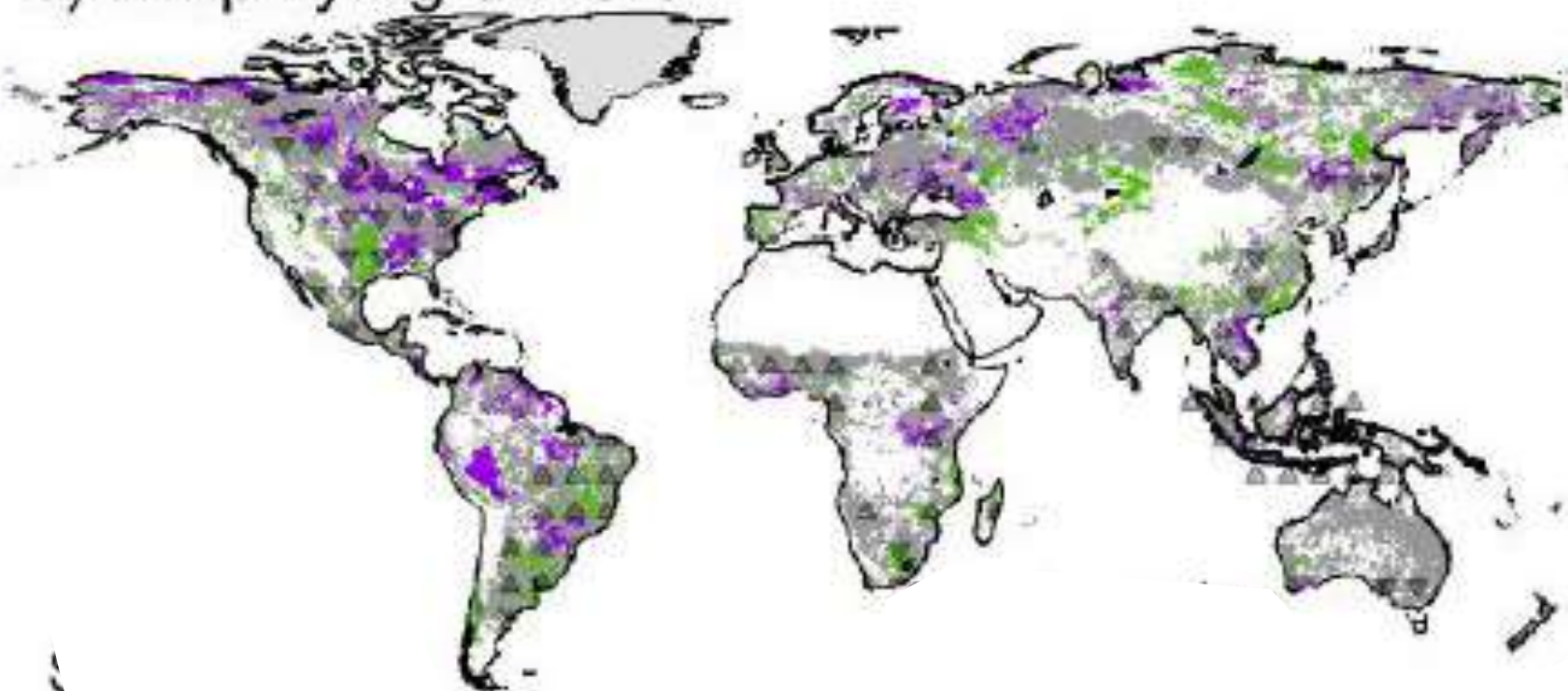
c) Counteracting drivers



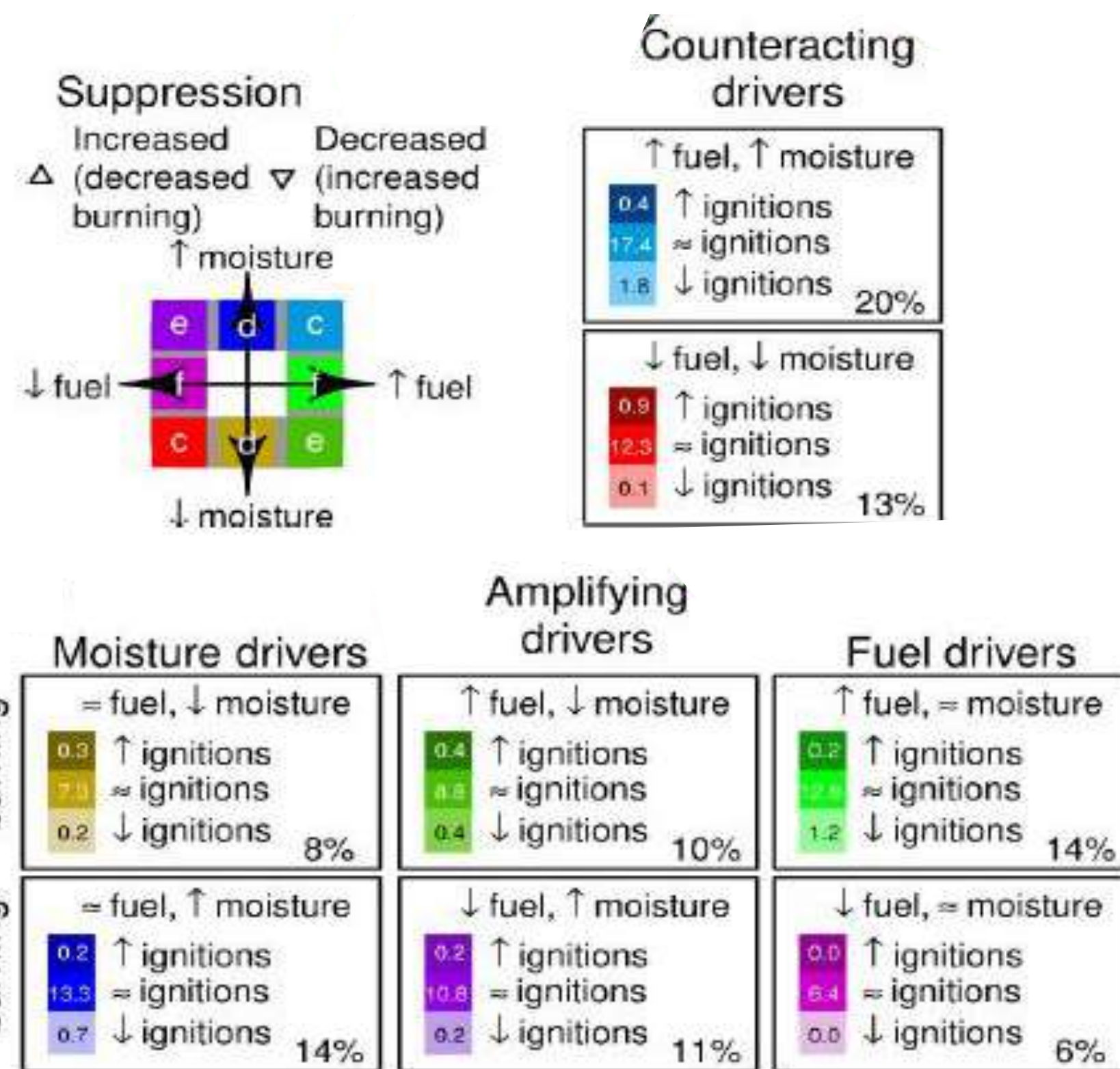
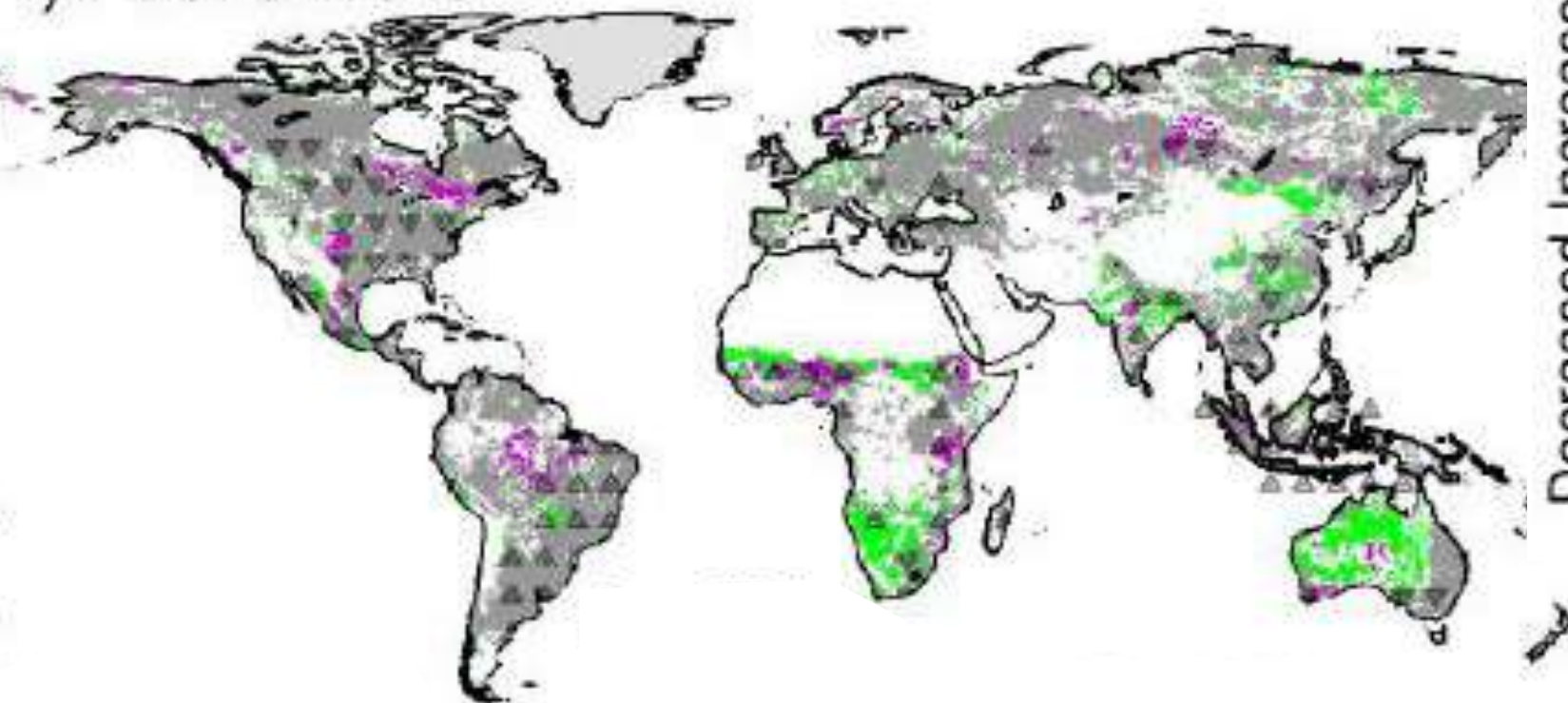
d) Moisture drivers



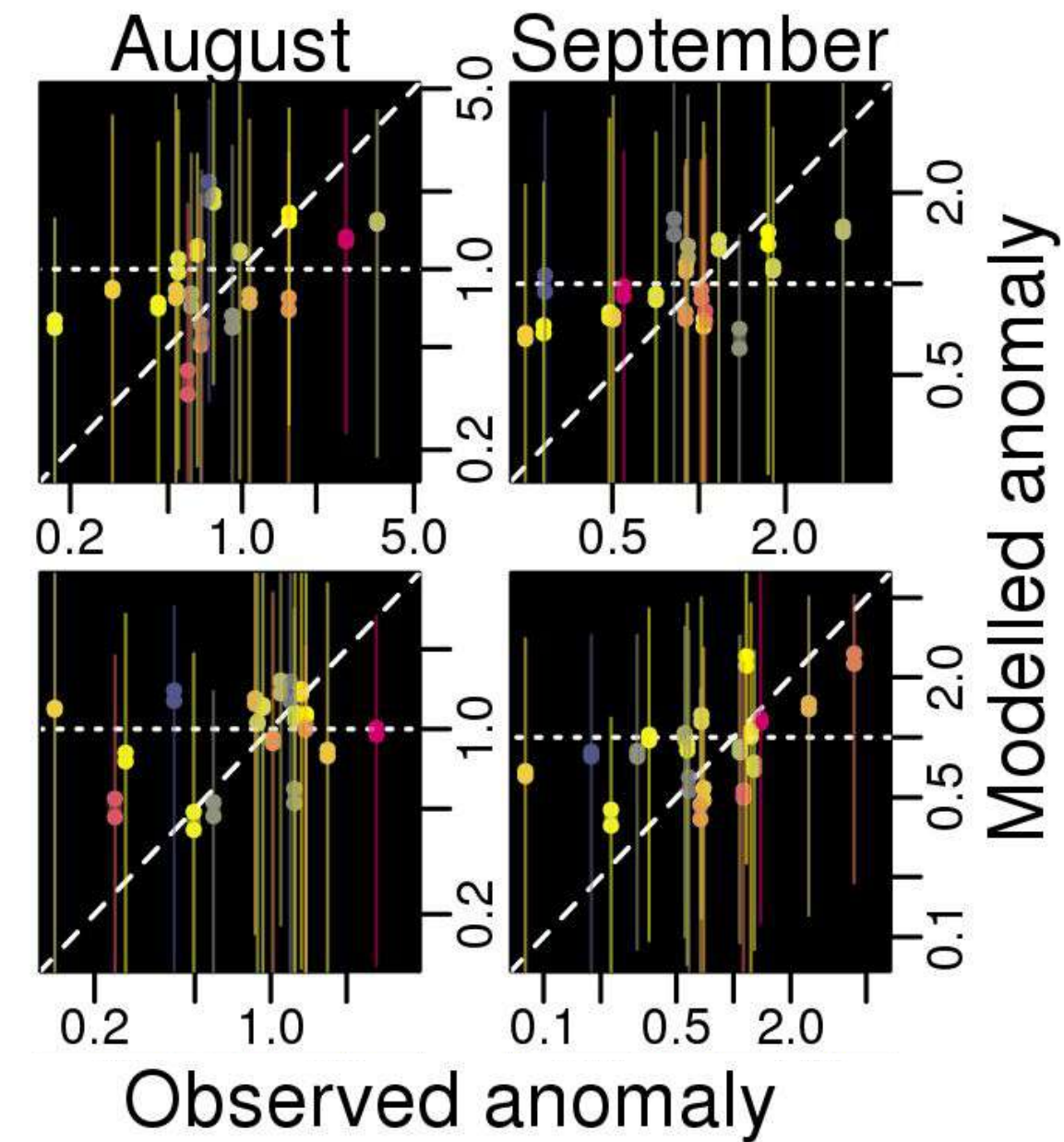
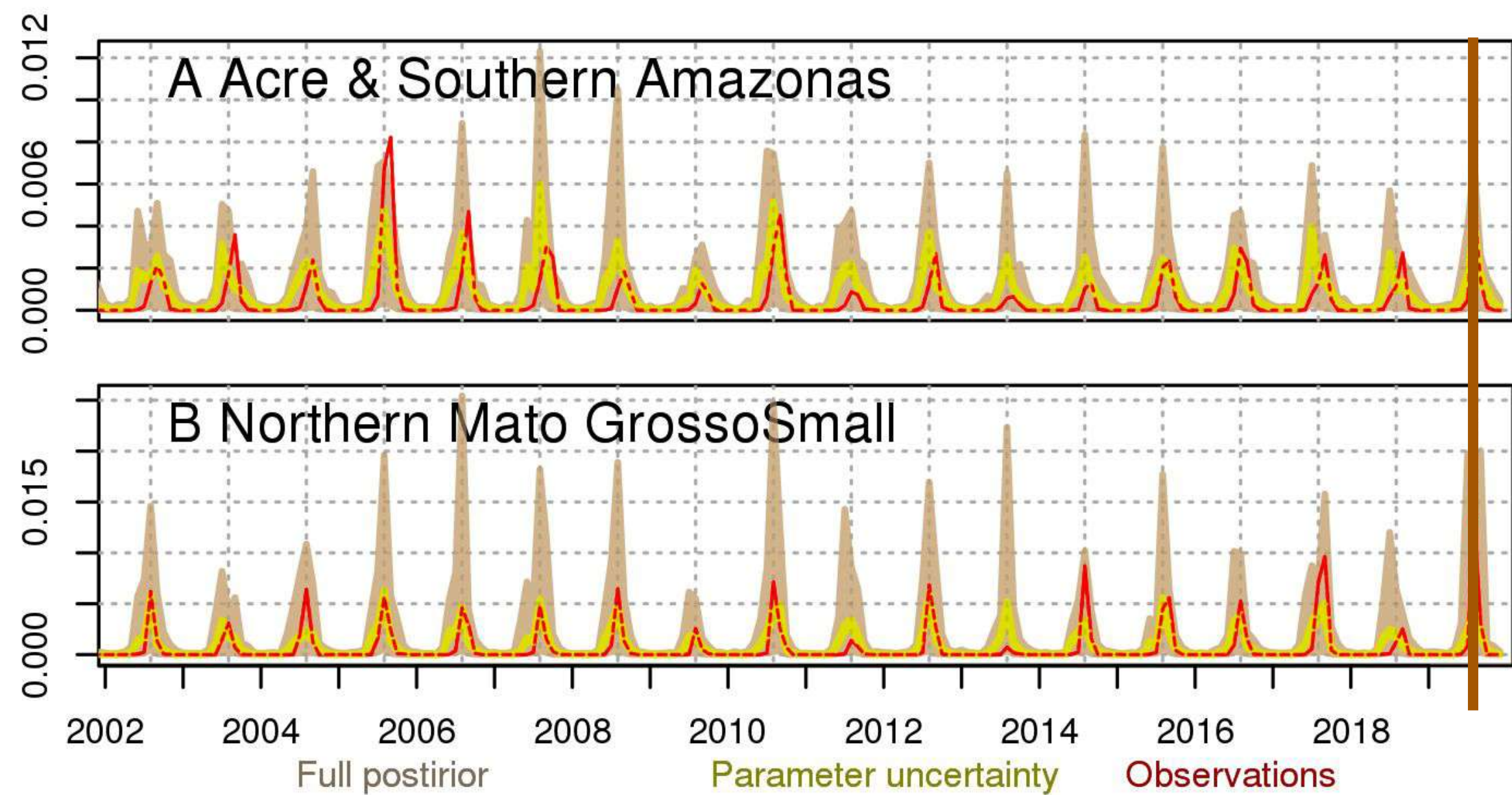
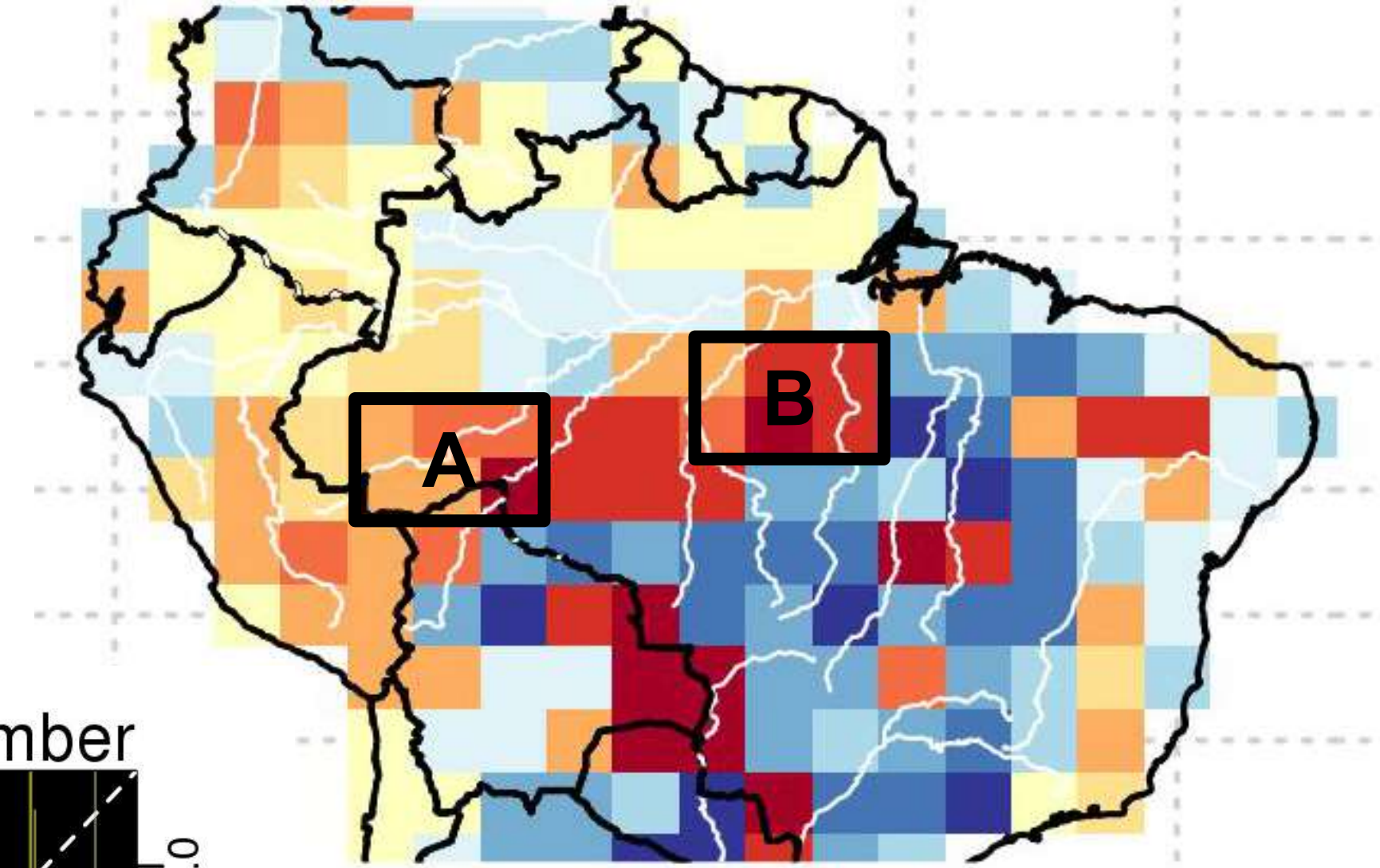
e) Amplifying drivers



f) Fuel drivers

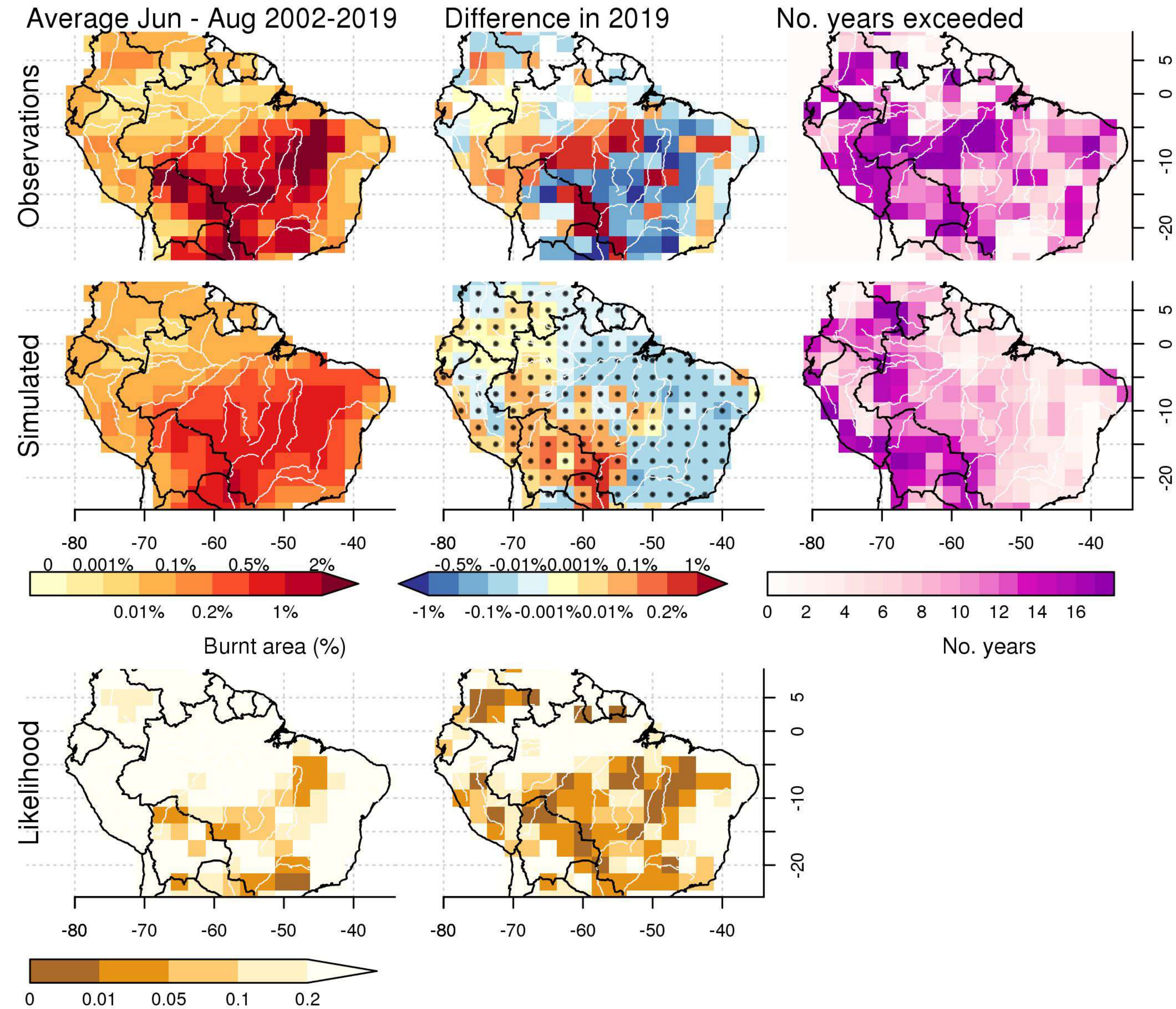


2019 Amazon fires



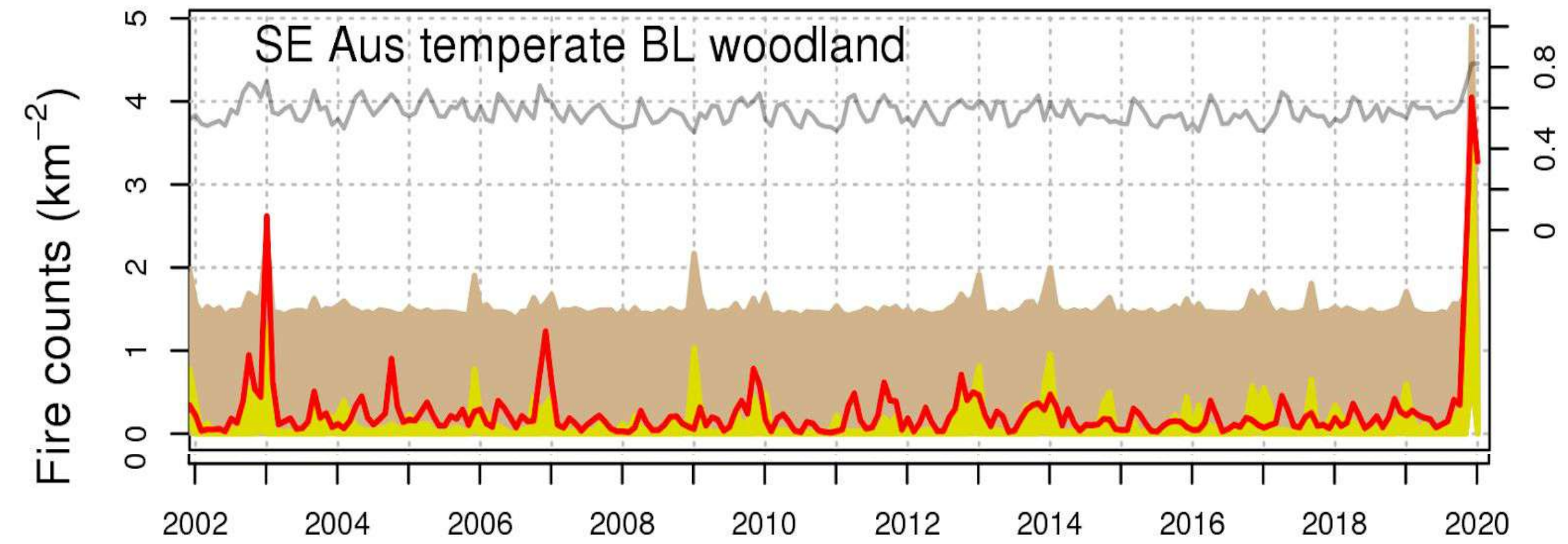
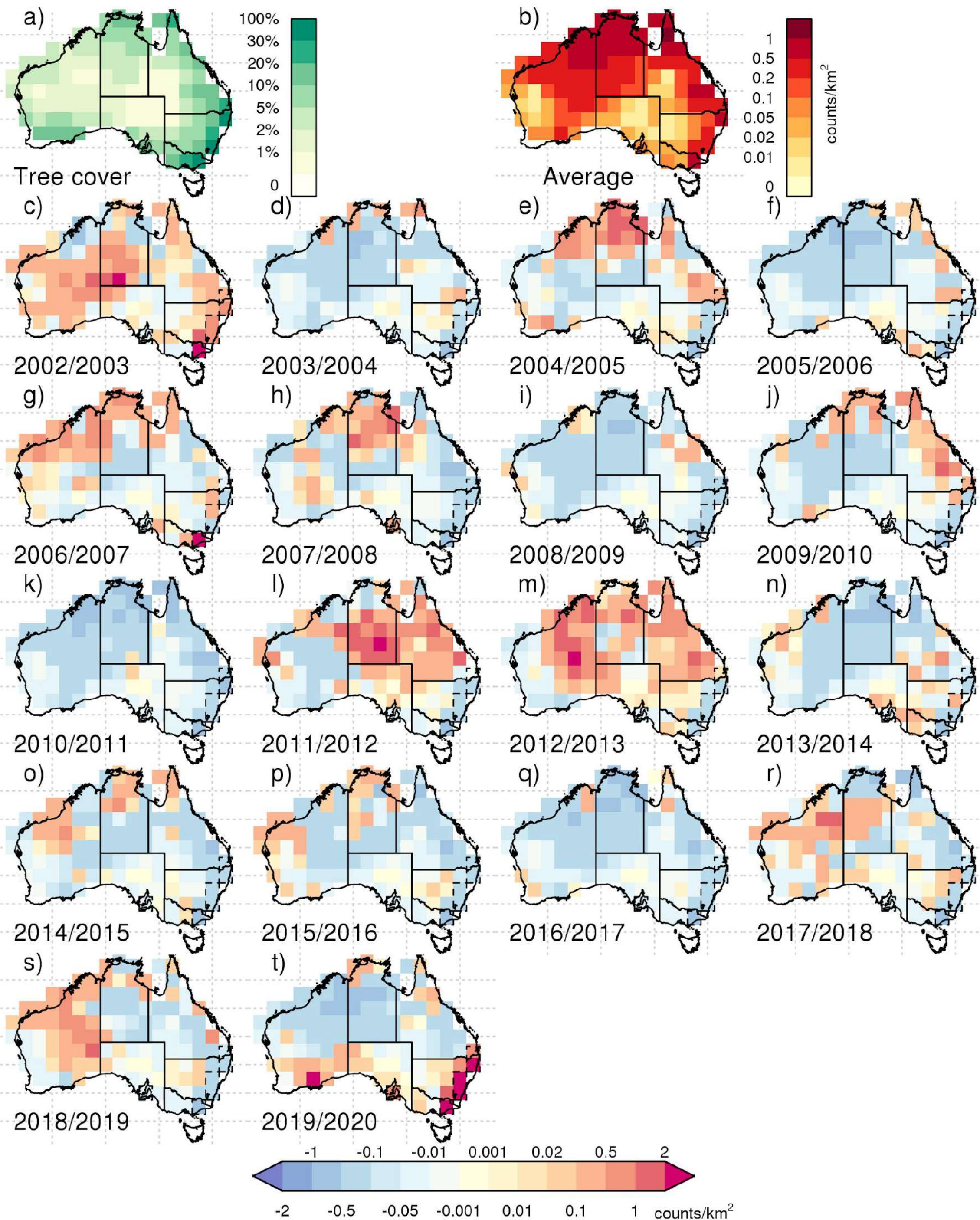
*Kelley et al.
Biogeosciences Discussions
(+plus some revisions)*

2019 Amazon fires



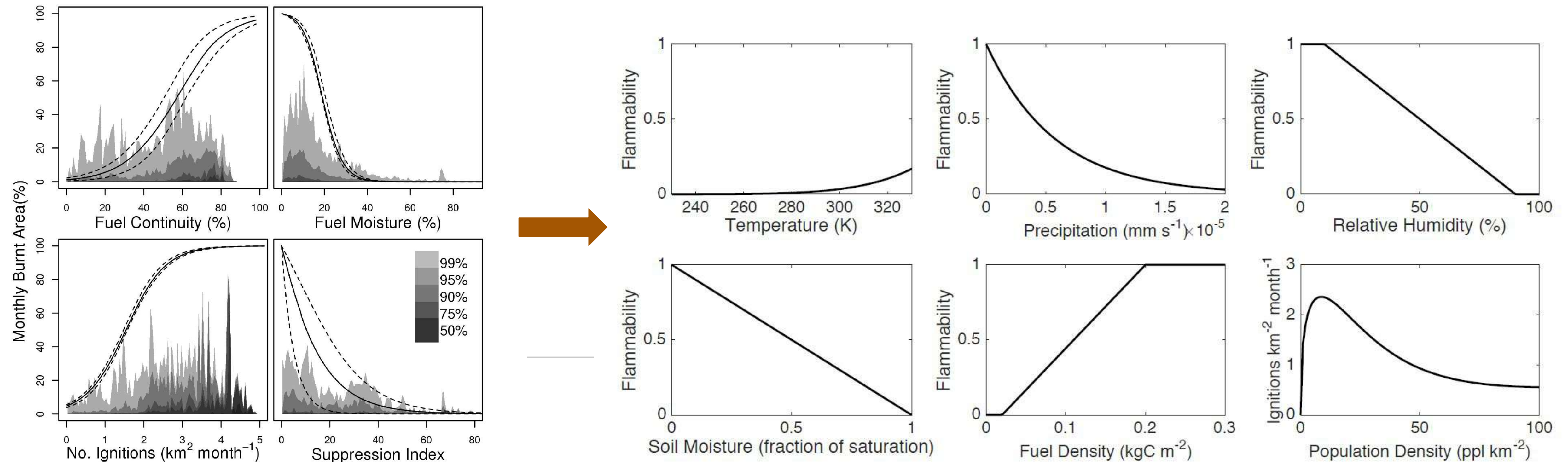
No meteorological influence found on Amazon burnt area in 2019

Australia 2019/2020 fires (initial results)



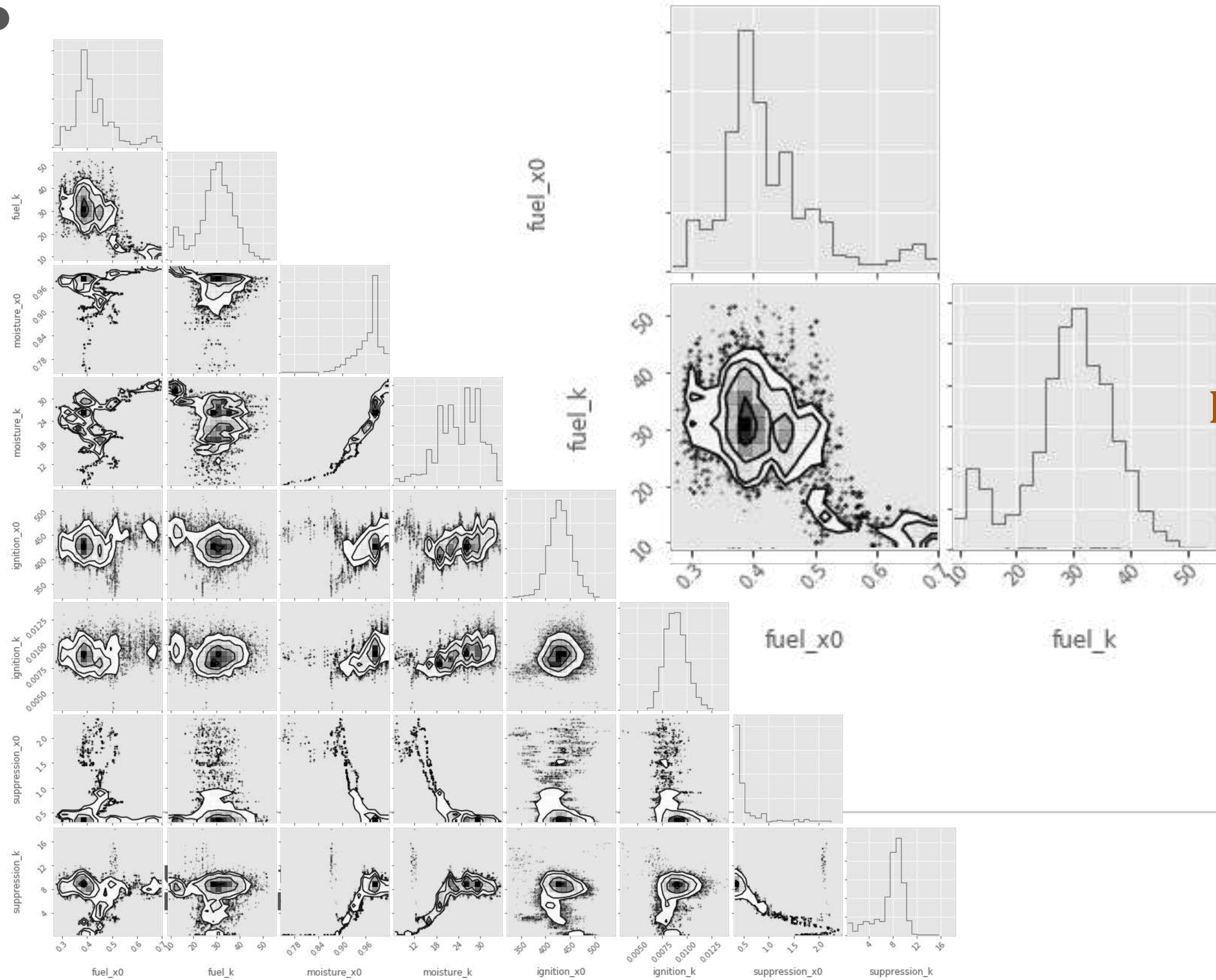
How we're gonna INFERNO-ise this

- 6-hourly timestep - sampling 1 day a month
- Tile based fire size & fuel
- Get rid of “pointy” curves in INFERNO

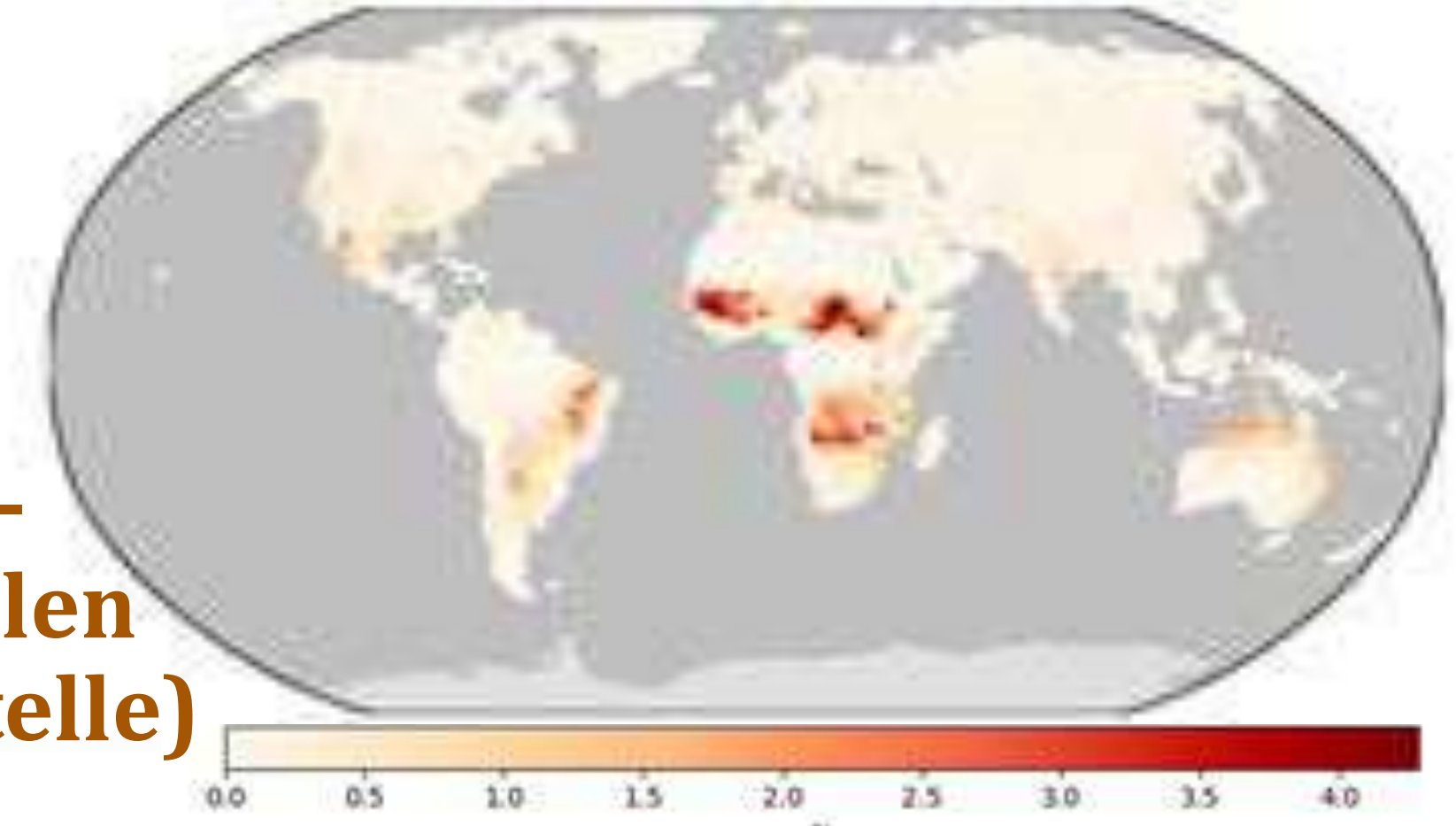


ESM-ise

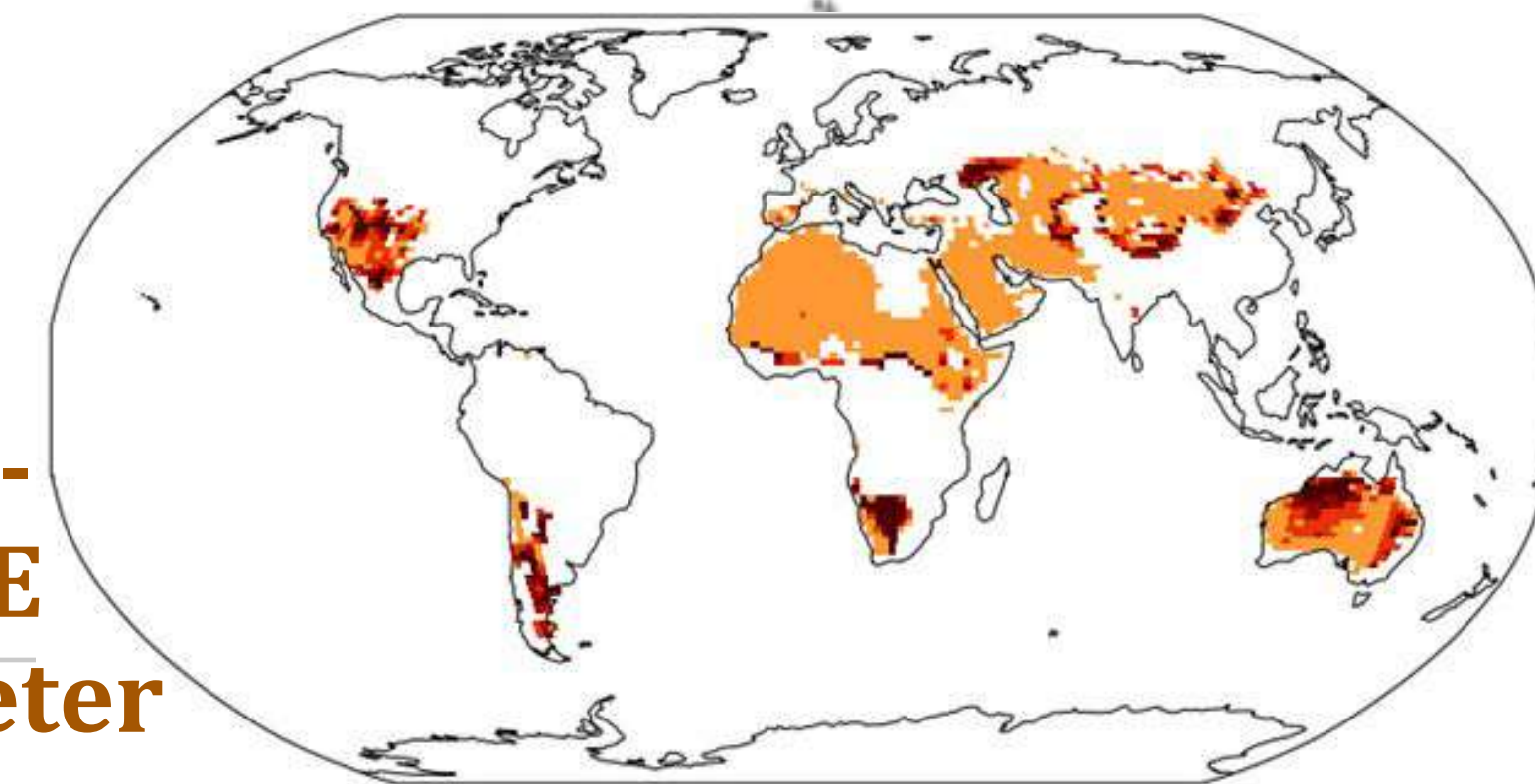
- Single or small number parameter selection
- Parameter selection under climate/veg biases
-



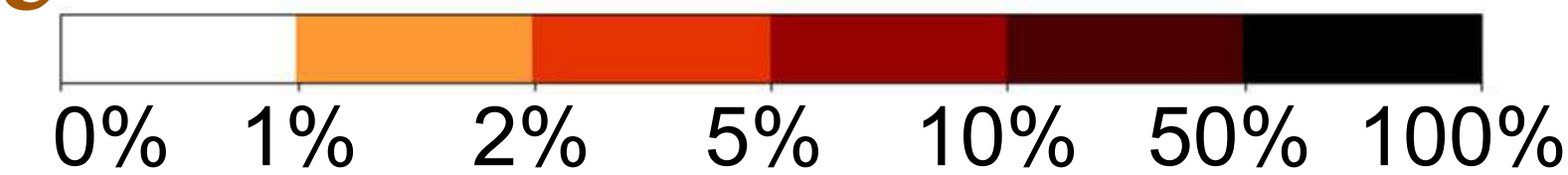
Obs -
GFED4s



UKESM-
INFERNO (stolen
from Chantelle)



UKESM-
ConFIRE
"Best" Parameter
value





Done!

Any questions?



See github.com/douglask3/amazon_fires/tree/EGU2020
or use QR code for to run Bayesian modelling framework