Matthias Forkel[1], Christine Wessollek[1], Niels Andela[2], Jos de Laat[3], Vincent Huijnen[3], Daniel Kinalczyk[1], Christopher Marrs[1], Dave van Wees[2], Ana Bastos, Philippe Ciais, Dominic Fawcett, Johannes Kaiser, Erico Kutchartt, Carine Klauberg, Rodrigo Vieira Leite, Wei Li, Carlos Silva, Stephen Sitch, Jefferson Goncalves De Souza, and Stephen Plummer

Multiple approaches for quantifying fuels, combustion dynamics, and regional fire emissions in the Amazon and Cerrado

EGU 2024, Session BG 1.3

TECHNISCHE UNIVERSITÄT DRESDEN

BeZero

Royal Netherlands Meteorological Institute
Ministry of Infrastructure and Water Management

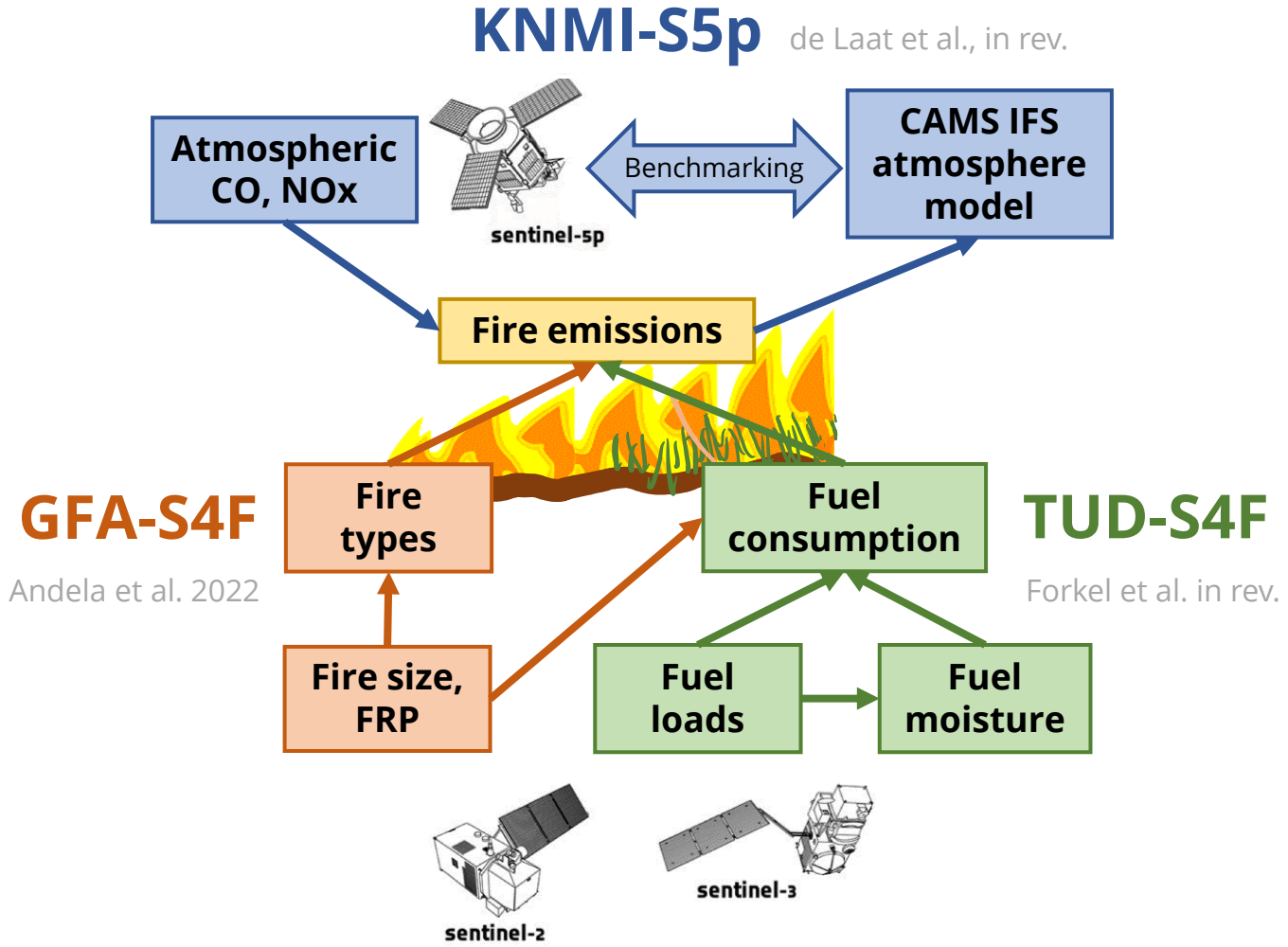
Fuels and fire emissions

Fire emissions

- Fuel types / composition
- Fuel loads
- Fuel moisture
- Fuel chemistry (e.g cellulose, lignin, volatiles)
- Oxygen availability
- Burning behaviour (flaming, smouldering)
- Temperature, humidity


Brazil, 2020

Sense4Fire approaches



Data available at
https://sense4fire.eu/database/
User: s4f_user
Pwd: sentinel_1235

Index of /database/Amazon-reg/S4F.CCILC_S4Fba_dynEF

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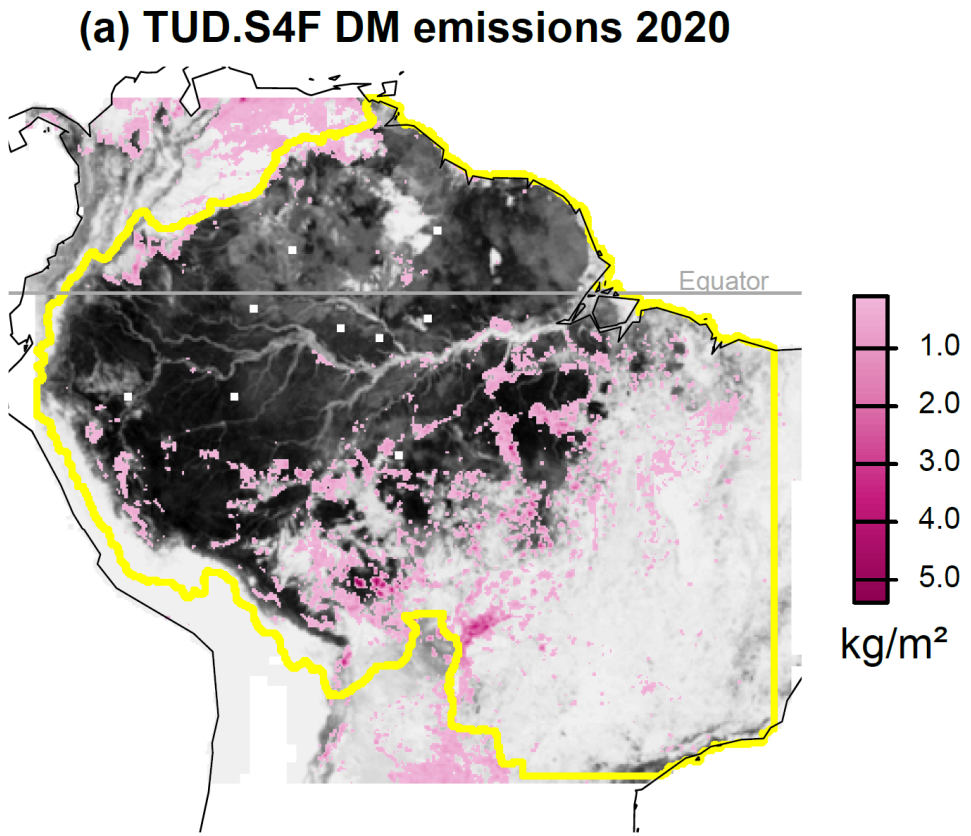
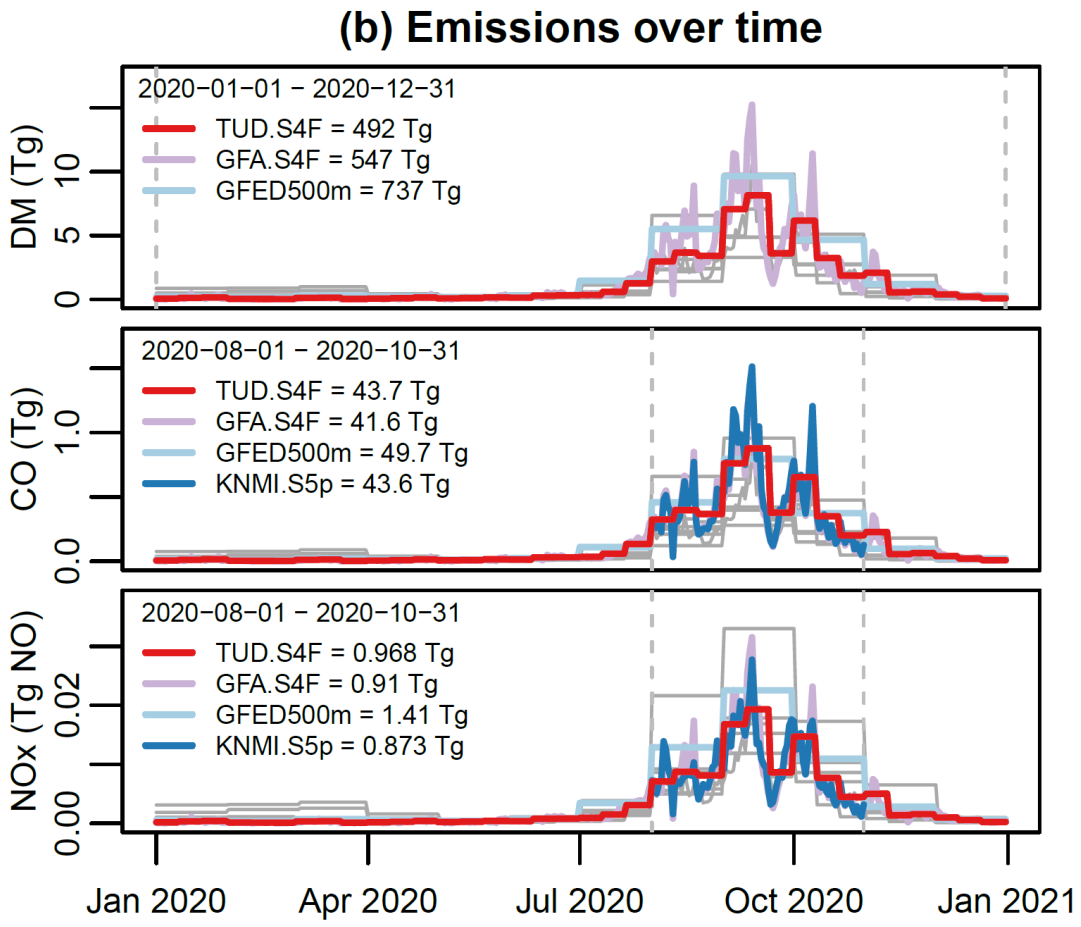
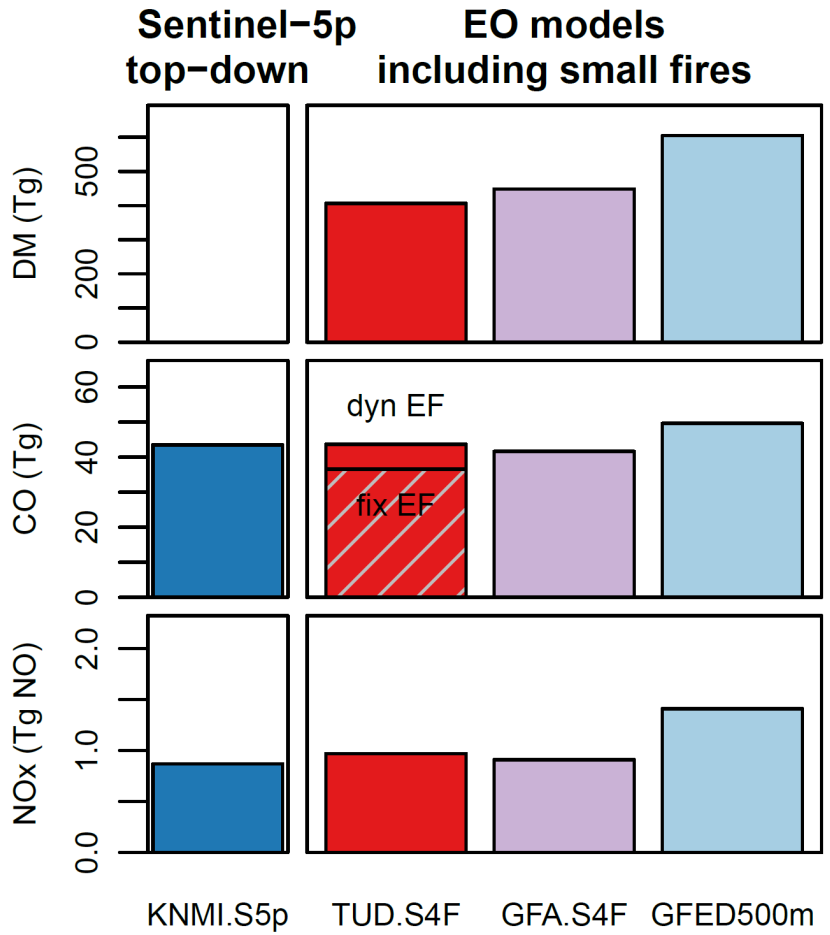
Fire emissions 2020



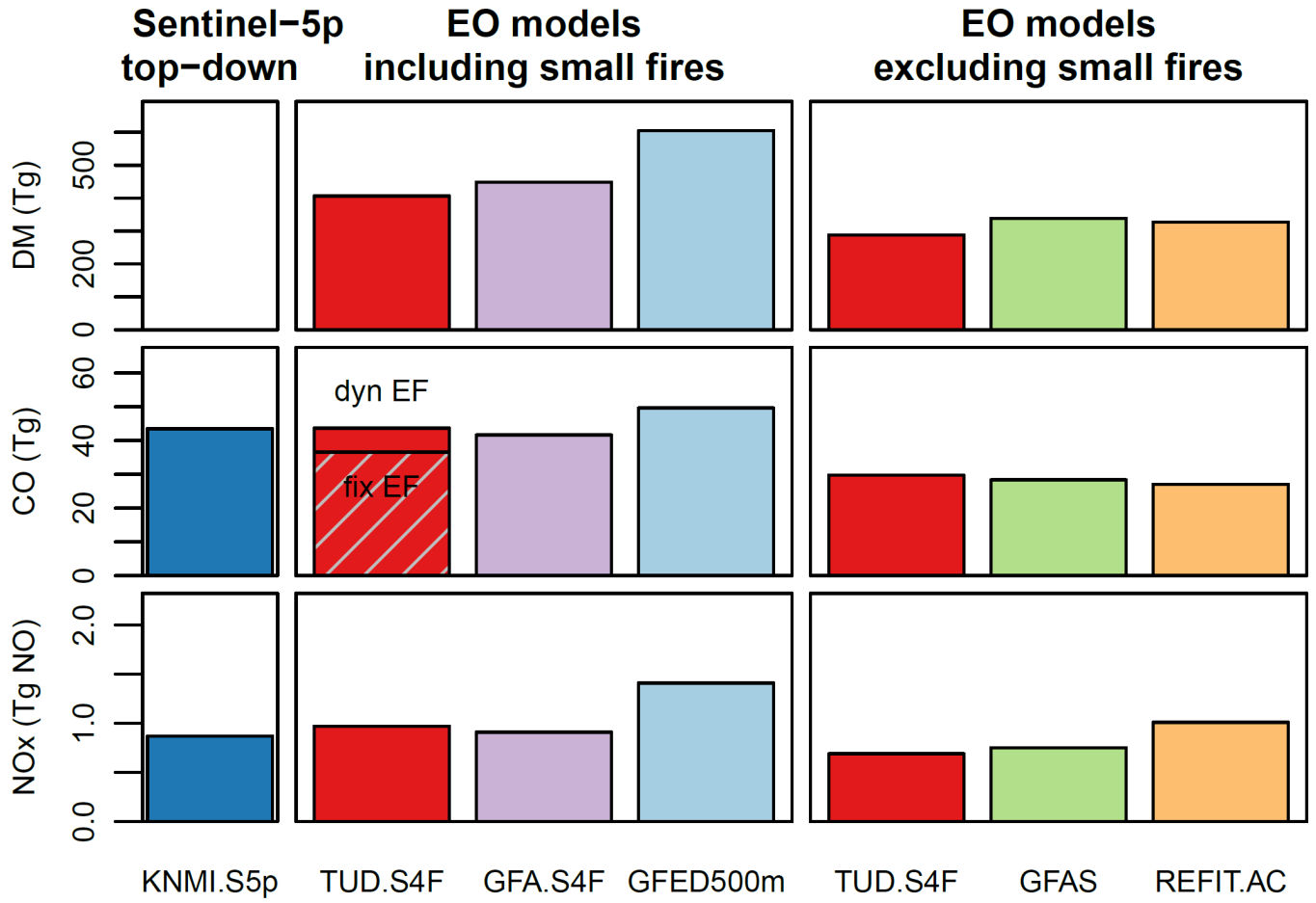


Fire emissions August-October 2020

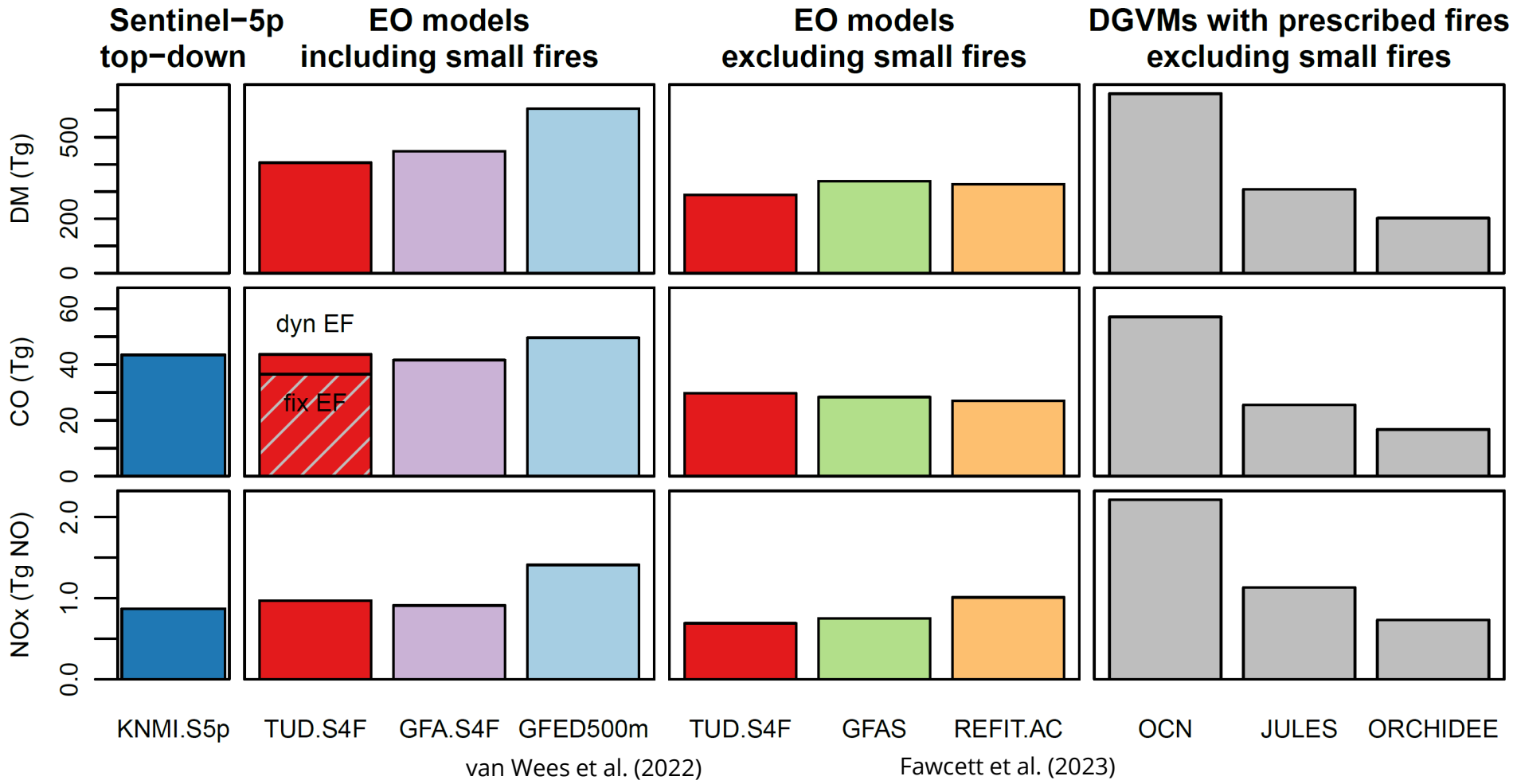


van Wees et al. (2022)

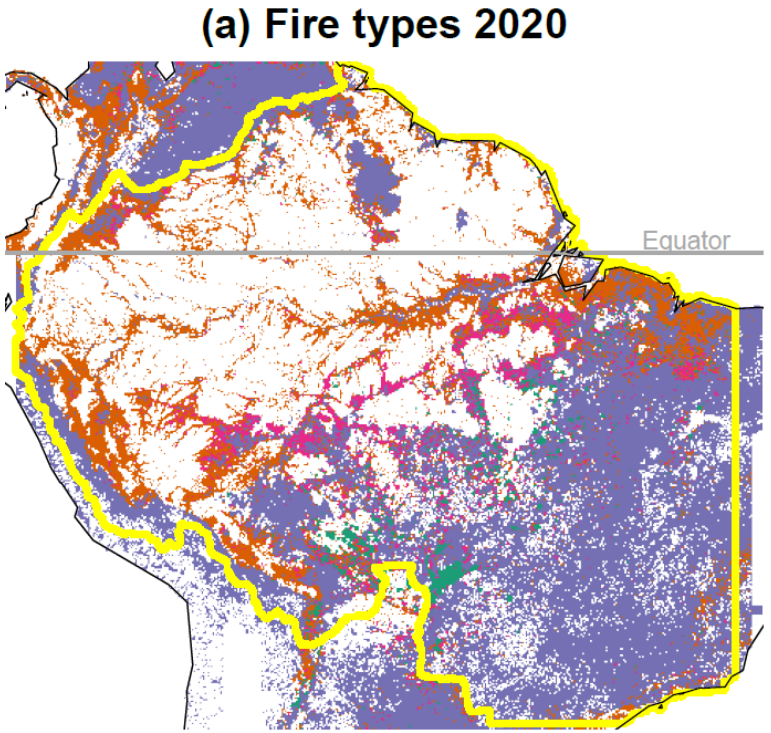
Fire emissions August-October 2020

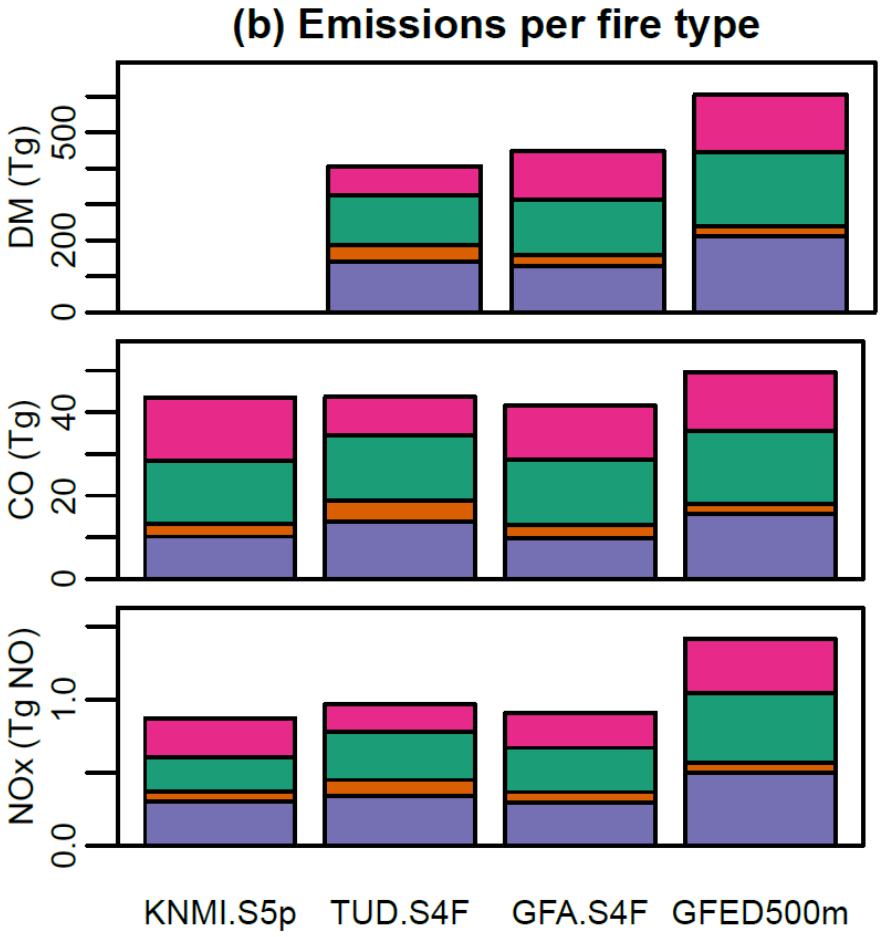


Fire emissions August-October 2020



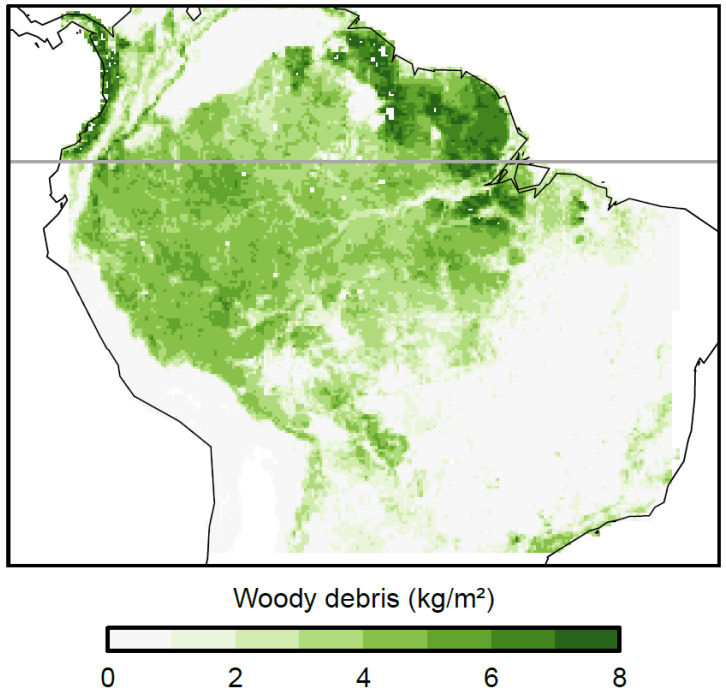
Emissions from different fire types



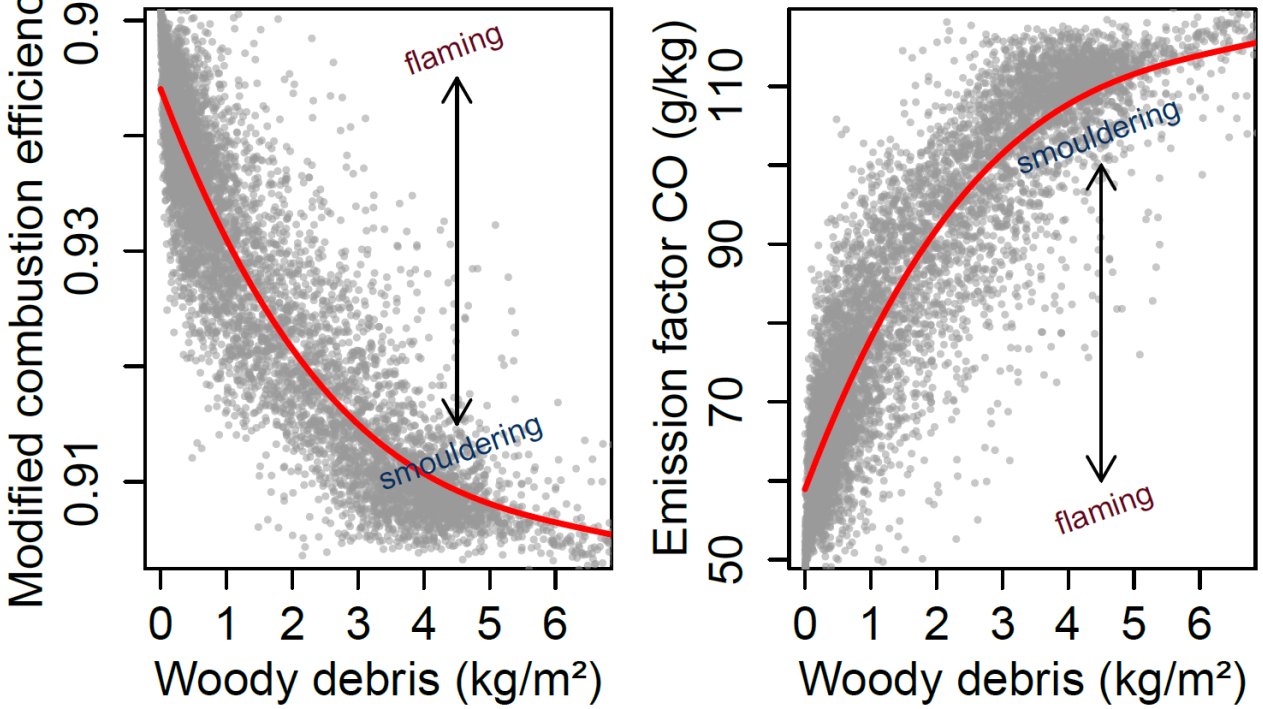


Fuel loads and combustion

TUD-S4F woody debris



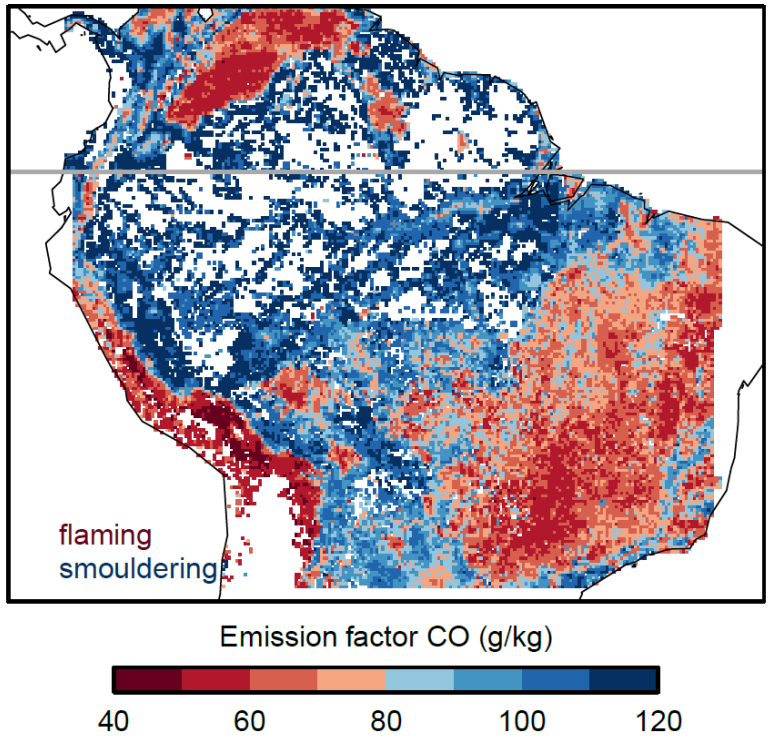
Combustion efficiency and emission factor



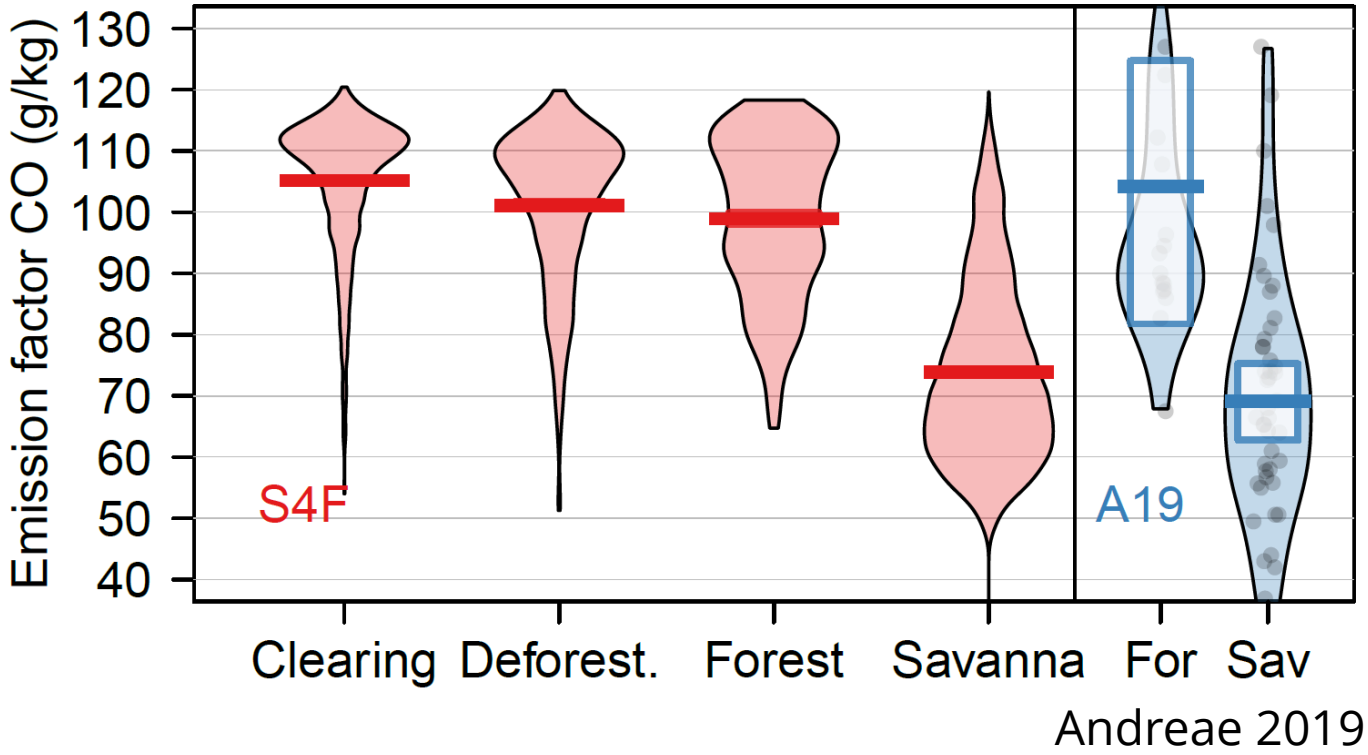
Dynamic emission factors

Sense^4 Fire

(a) TUD.S4F emission factor CO

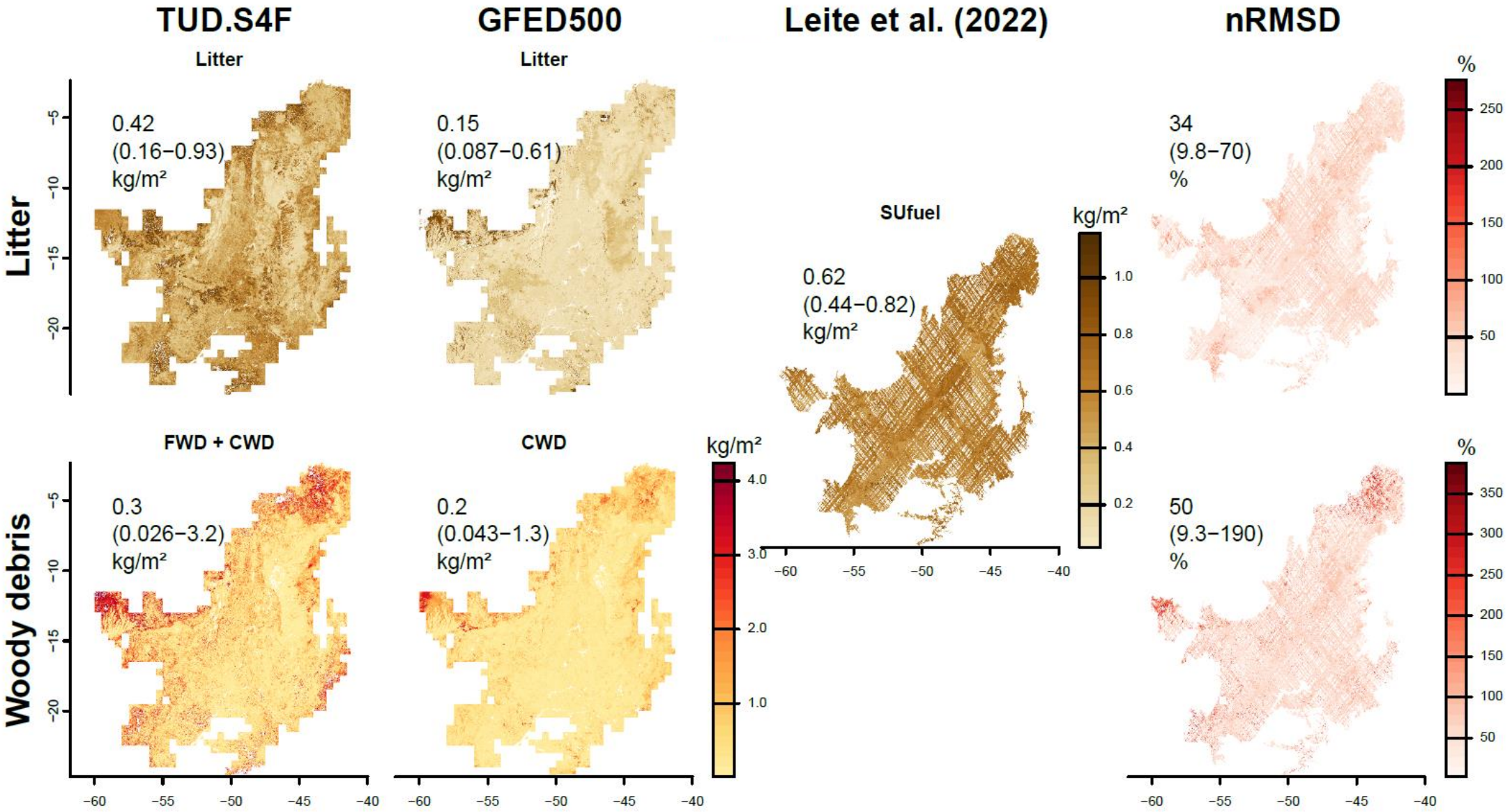


(b) CO emission factor per fire type



Andreae 2019

Benchmarking fuel loads



Conclusions

Other Sense4Fire presentations:
Daniel Kinalczyk: Emission plumes from Sentinel-5p, Fri 8:30, X5.147
Niels Andela: Global Fire Atlas, Fri 16:20, room 2.23

- Total fire emissions dominated by smouldering combustion of woody debris
- Emissions in Amazon and Cerrado, 1st August-31st October 2020
  - Total dry matter emissions 338^{661}_{202} Tg DM (9 estimates)
  - Carbon monoxide 36.6^{57}_{17} Tg CO (11 estimates)
  - Nitrogen oxide $0.94^{2.21}_{0.69}$ Tg NO (10 estimates)
- Forest and deforestation fires contribute to 53^{64}_{42}% of dry matter emissions
- Dynamic emission factors: combustion efficiency decreases and CO emissions increase with higher loads of woody debris
- Need for ground measurements to better quantify fuels and combustion dynamics
- Sense4Fire provides 3 complementary approaches – data at sense4fire.eu
- Developments: extend to southern Africa, Europe and Yakutia + going near-real time