Comparison and validation of fire emissions models for the Amazon

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1 BeZero

2 Koninklijk Nederlands Meteorologisch Instituut
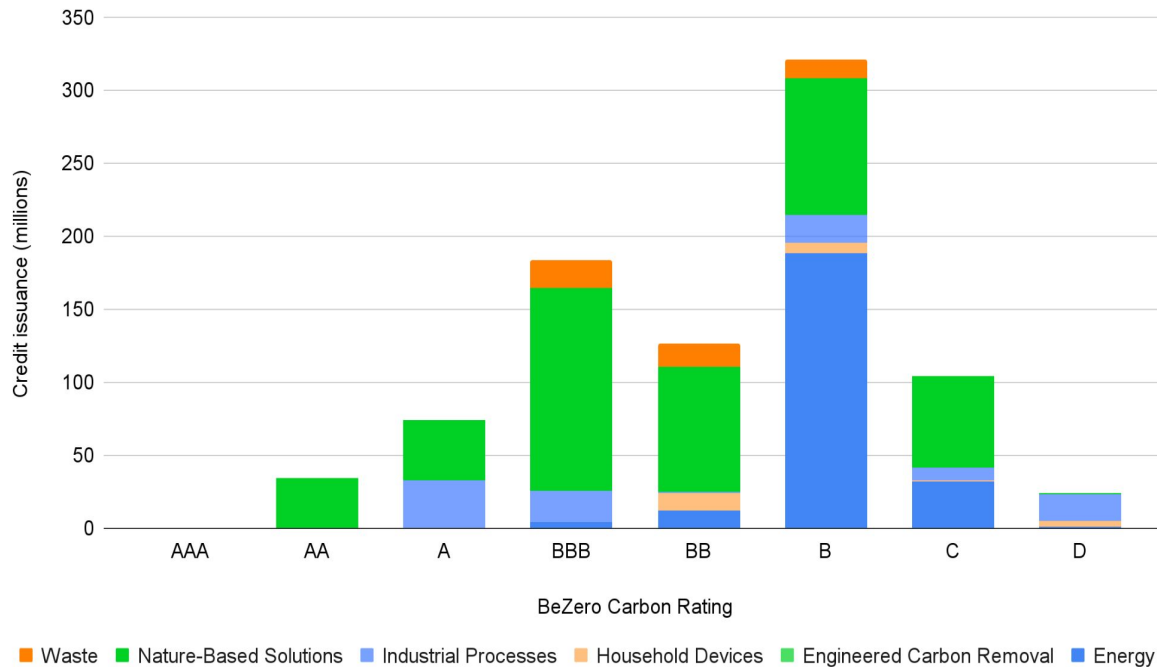Ministerie van Infrastructuur en Waterstaat

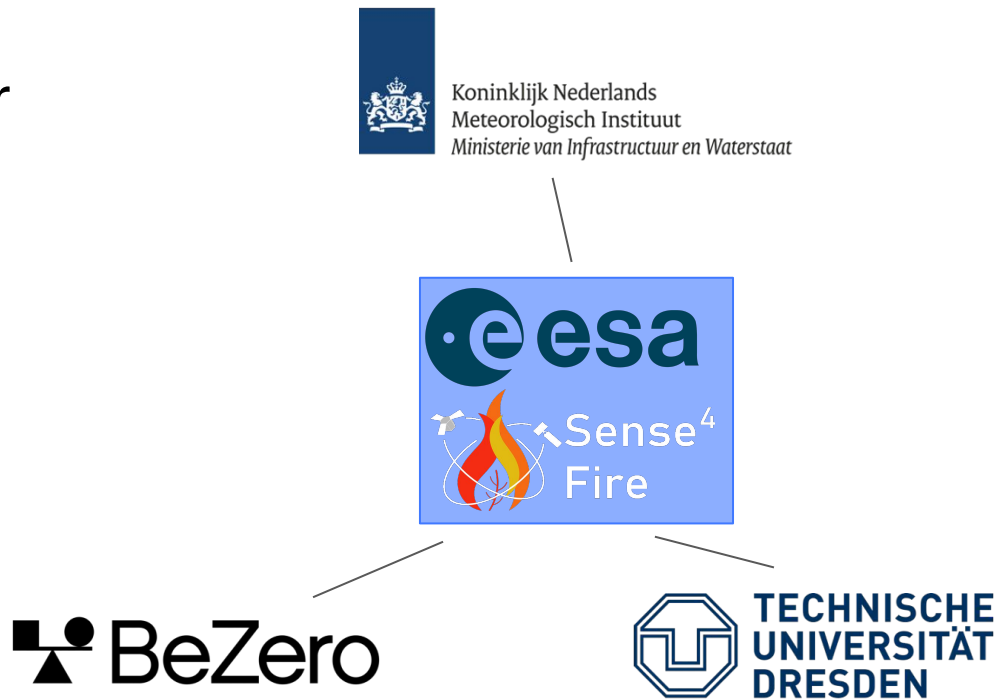3 TECHNISCHE UNIVERSITÄT DRESDEN

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BeZero Carbon

- Carbon ratings agency

- Independent ratings of carbon offsetting projects

- Key risk factors:
  - Additionality
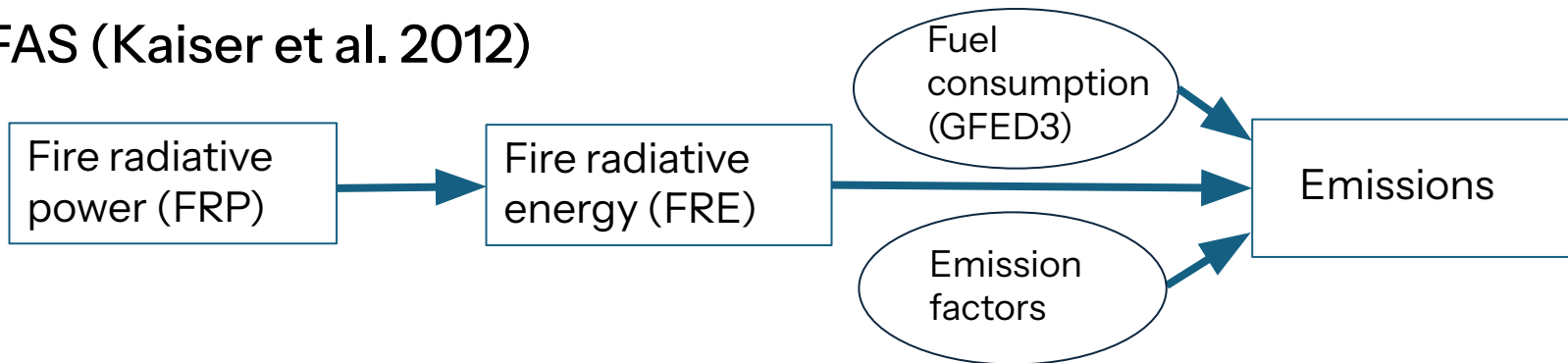 - Over-crediting
  - Non-permanence

ESA – Sense4Fire

- ESA Carbon Science Cluster

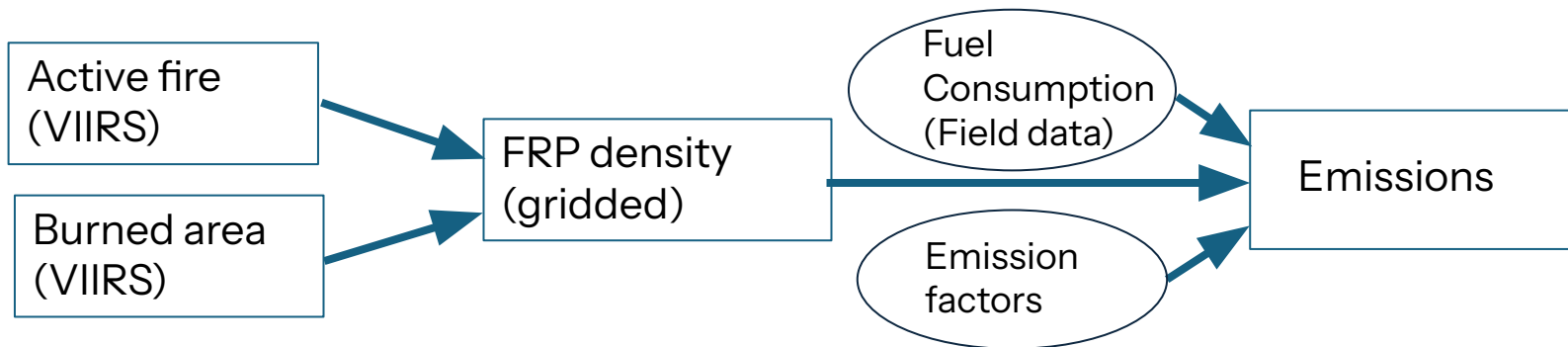- Fuel, fire & emissions products based on ESA data

Fire emissions estimates
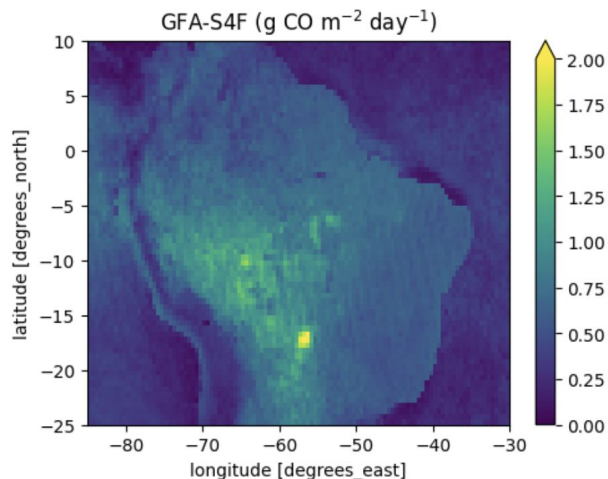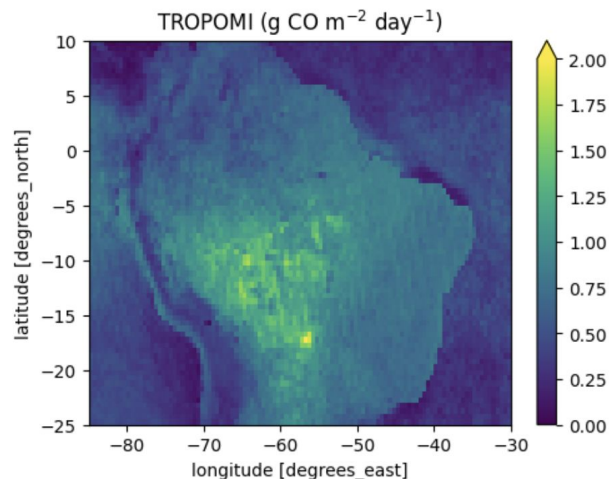
- ## GFAS (Kaiser et al. 2012)

```
Fire radiative      →    Fire radiative         Fuel
power (FRP)              energy (FRE)      consumption    →   Emissions
                                            (GFED3)

                                           Emission
                                            factors
```

- ## GFA–S4F (Andela et al. 2022)

```
Active fire                                  Fuel
(VIIRS)         →     FRP density        Consumption    →   Emissions
                      (gridded)          (Field data)
Burned area     →
(VIIRS)                                    Emission
                                           factors
```

Atmospheric transport model

- Emissions ingested into IFS–COMPO for atmospheric transport modelling

- Validated using TROPOMI CO column observations

TROPOMI (g CO m^{-2} day^{-1})
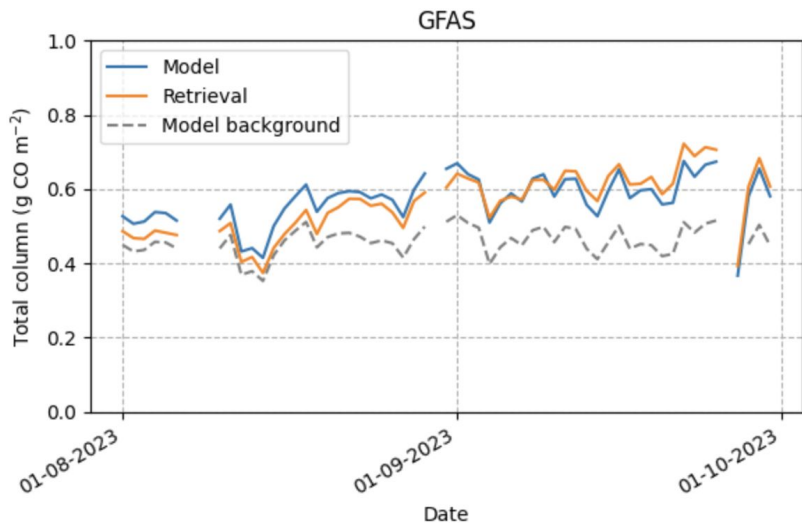
GFA-S4F (g CO m^{-2} day^{-1})

Model optimization

- Multiple linear regression

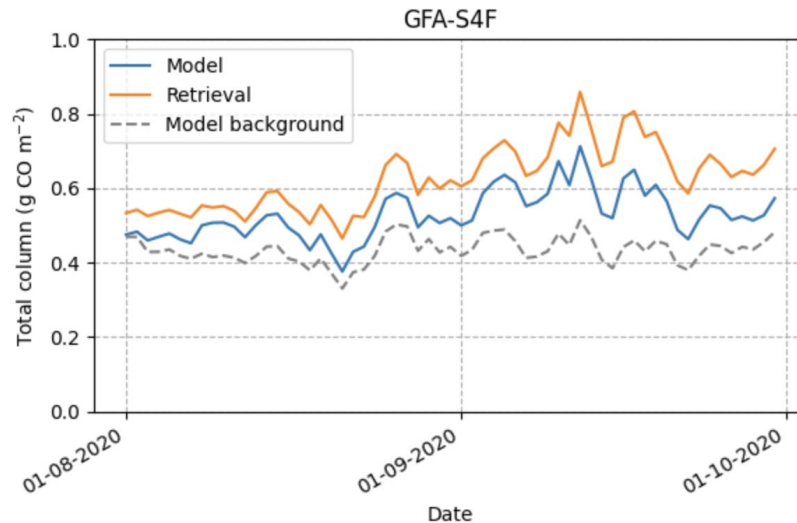- Optimizing per fire type / biome

- Distribution matching

$$Optimized = a \cdot DEFO + b \cdot SAVA + c \cdot FOREST + d \cdot SMALL + e \cdot Background$$
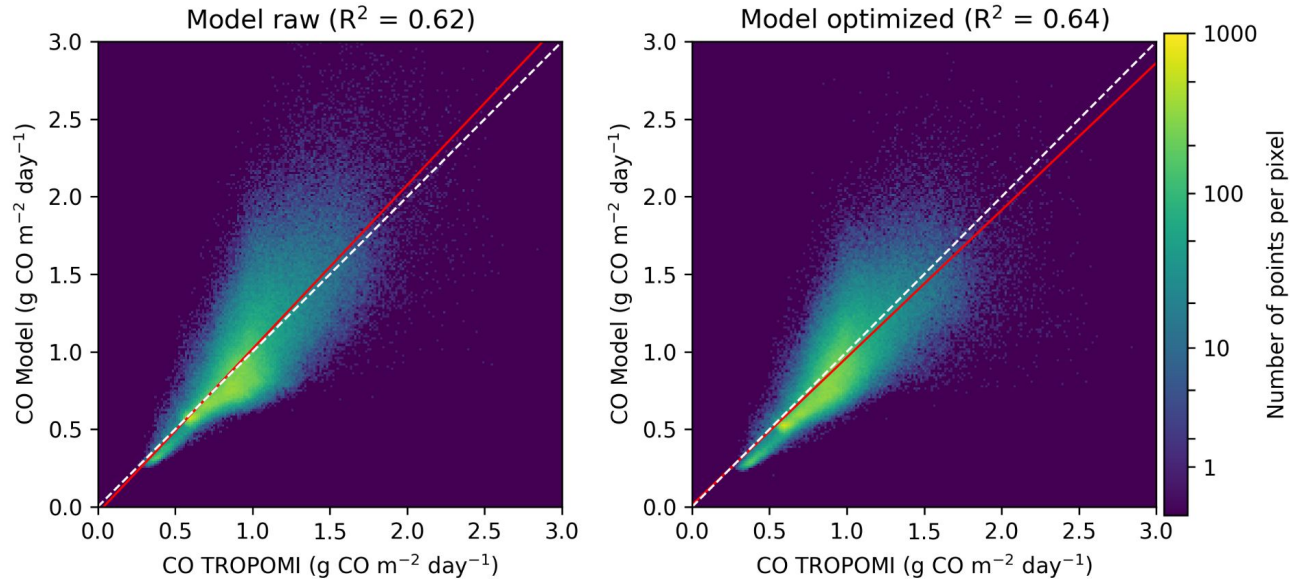
CO column time series

- 2023

- 2020

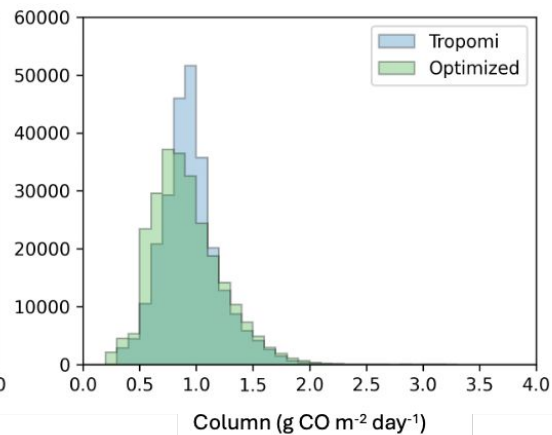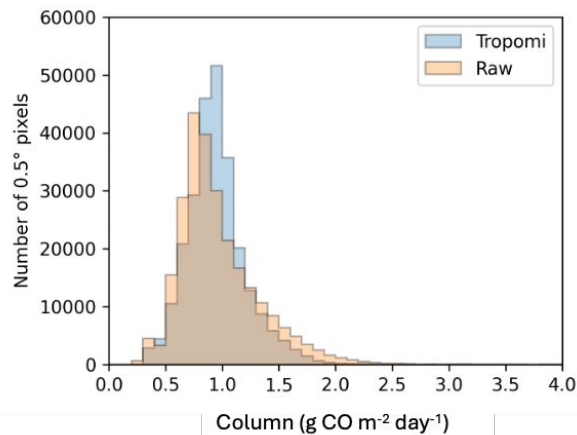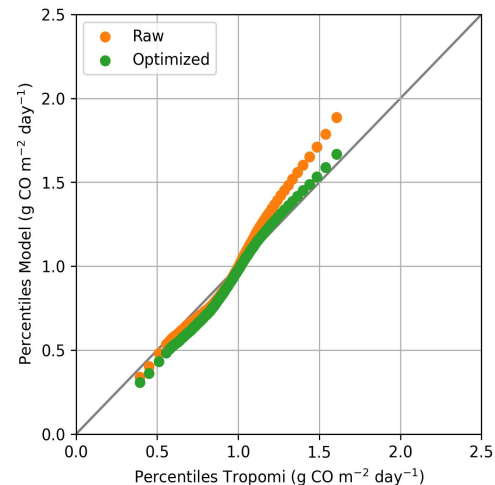# Optimization results
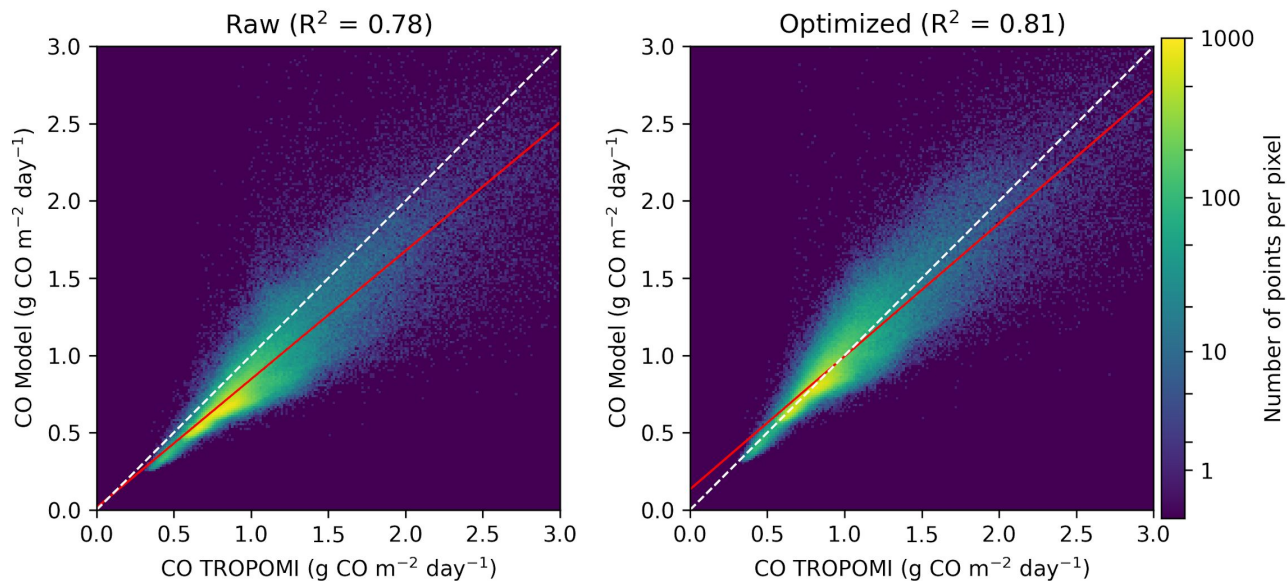
- GFAS. 2023-08-01 <> 2023-09-30

Optimization results

- Deforestation & Forest scaled down
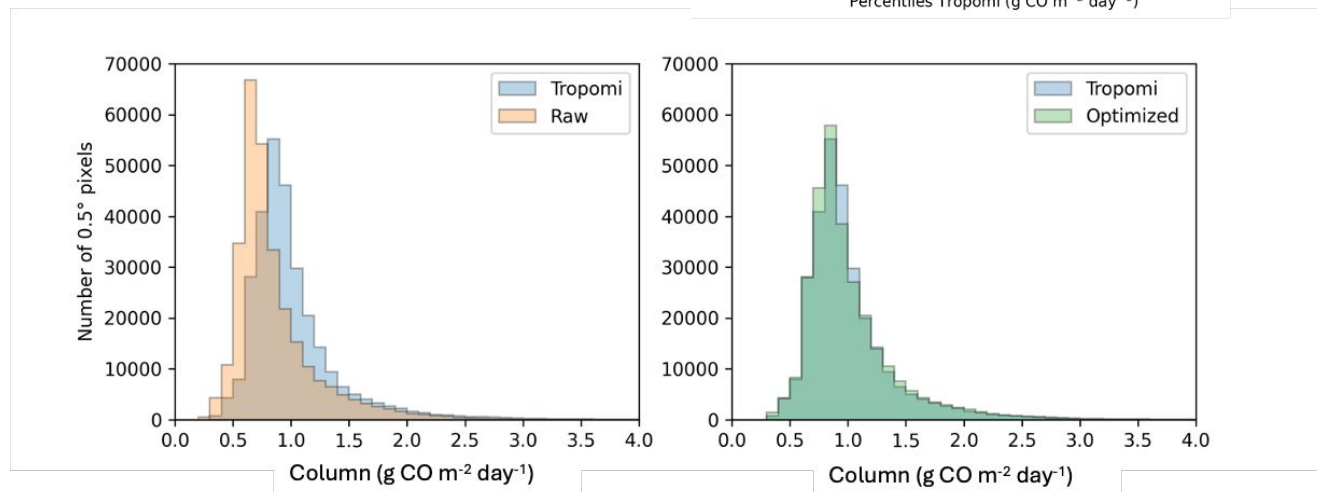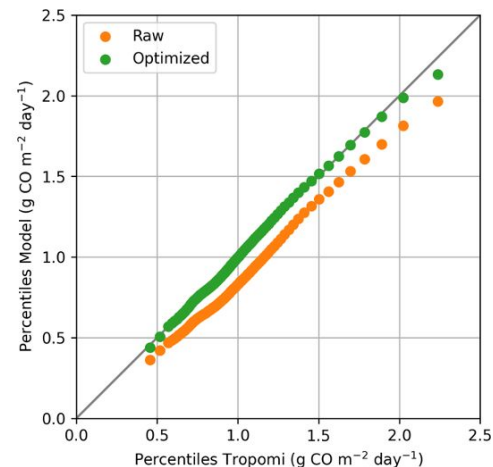
- Savanna scaled up

Optimization results

- GFA-S4F. 2020-08-01 <> 2020-09-30

Optimization results

- Again, forest down, savanna up

- Effective optimization for GFA-S4F

Conclusions

- GFA–S4F captures spatiotemporal patterns better (checked for 2020) but requires bias correction

- Overestimation of forest emissions and underestimation of savanna emissions in both models

Next steps

- Comparison for same and full year
- Validation using different year
- Gaussian regression to avoid spatial errors

Thank you.