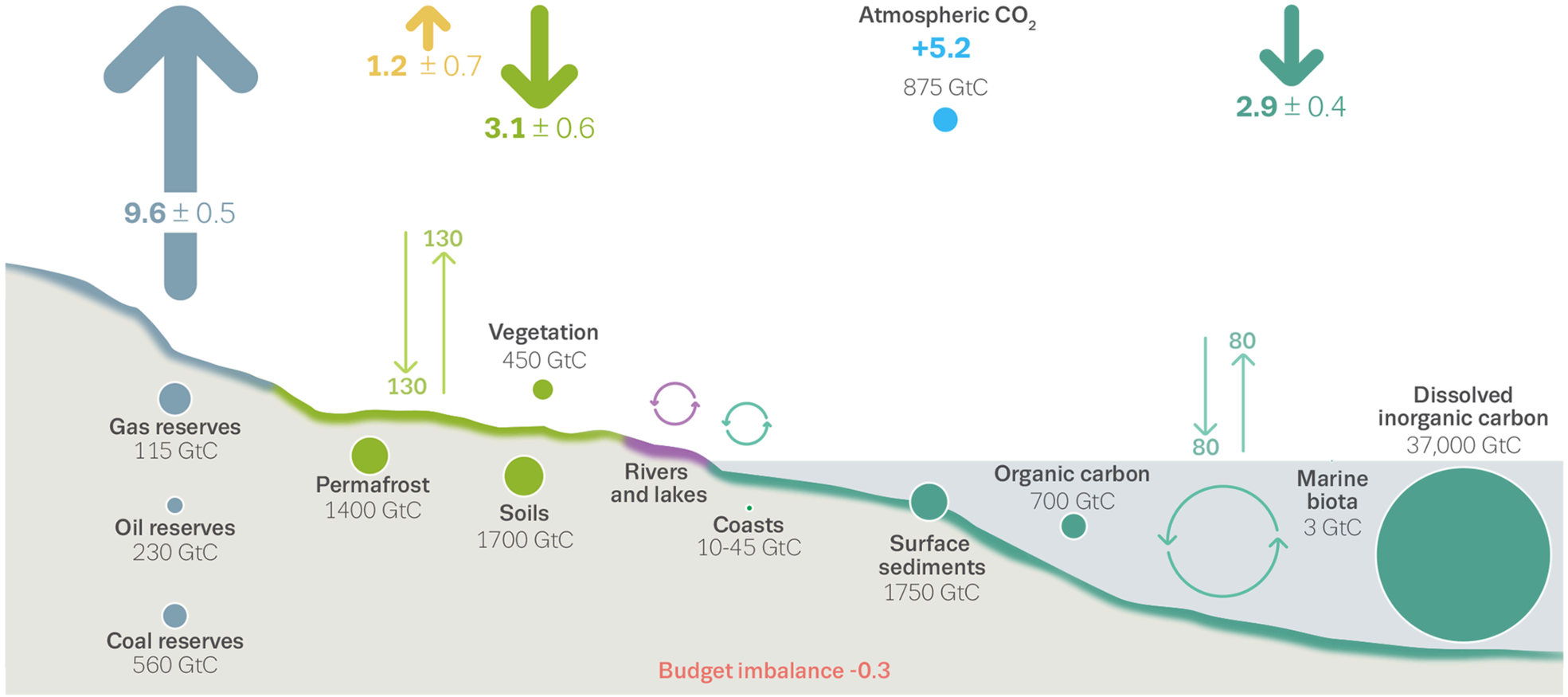
TM5-MP/COCO$_2$ developments

Preparations for a global joint CO/CO$_2$ inversion system to optimise fire carbon emissions

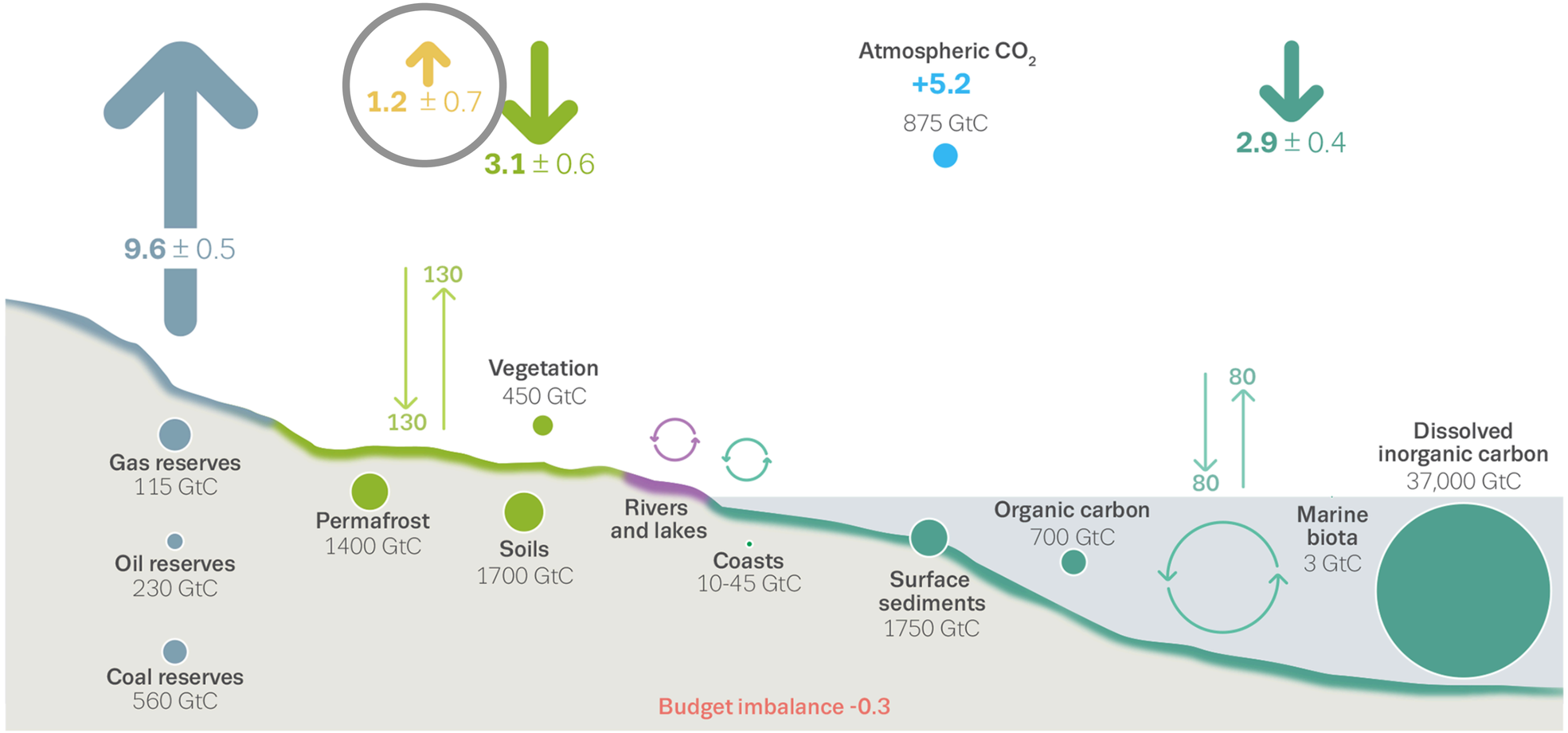
a case study on 2019 Amazonian fire season

Anne-Wil van den Berg | TM5 meeting at the University of Crete | 16-17/10/2023

Land Use Change Emission [Uncertainties]



Land Use Change Emission [Uncertainties]



Land Use Change Emission [Uncertainties]

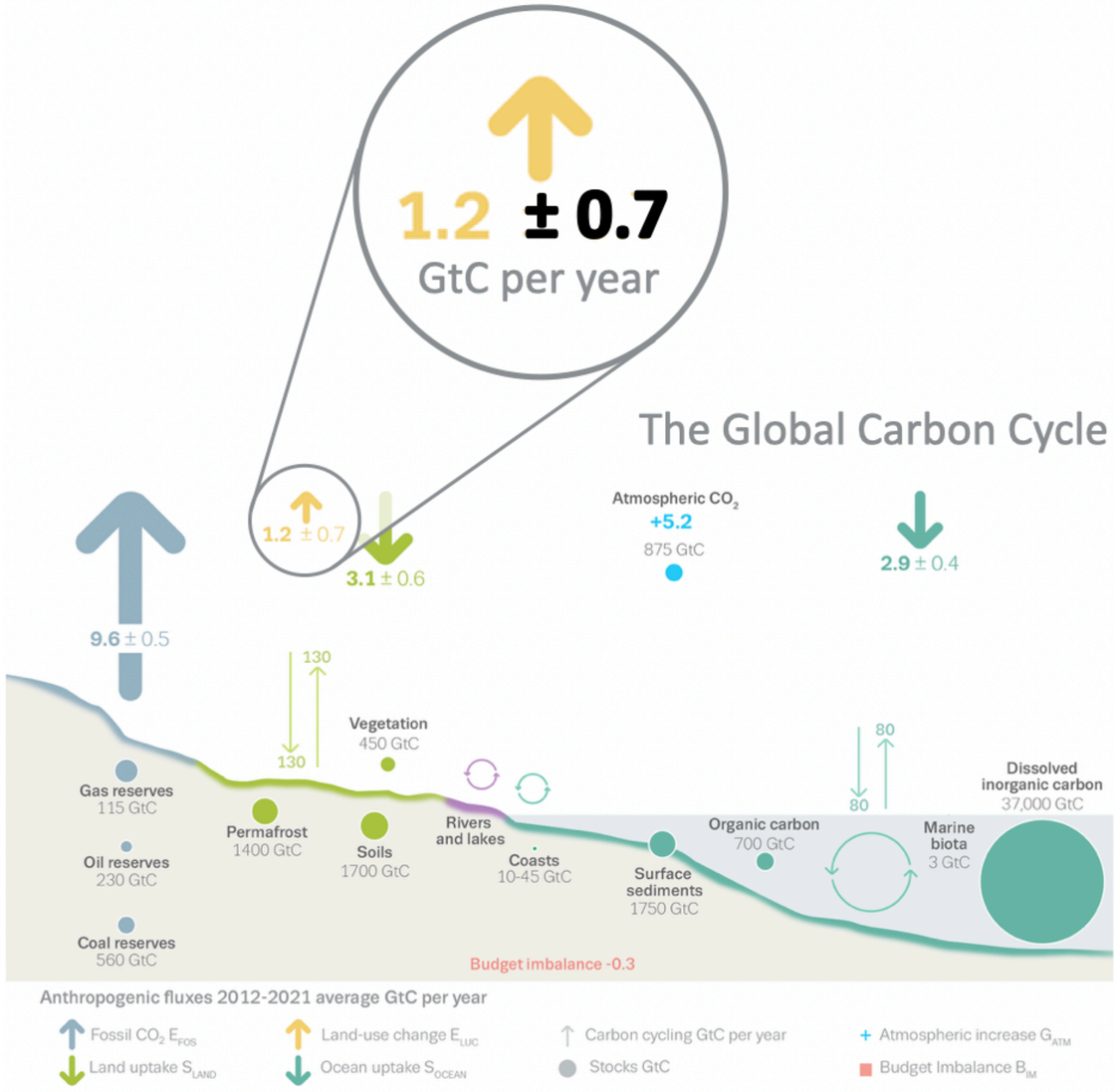
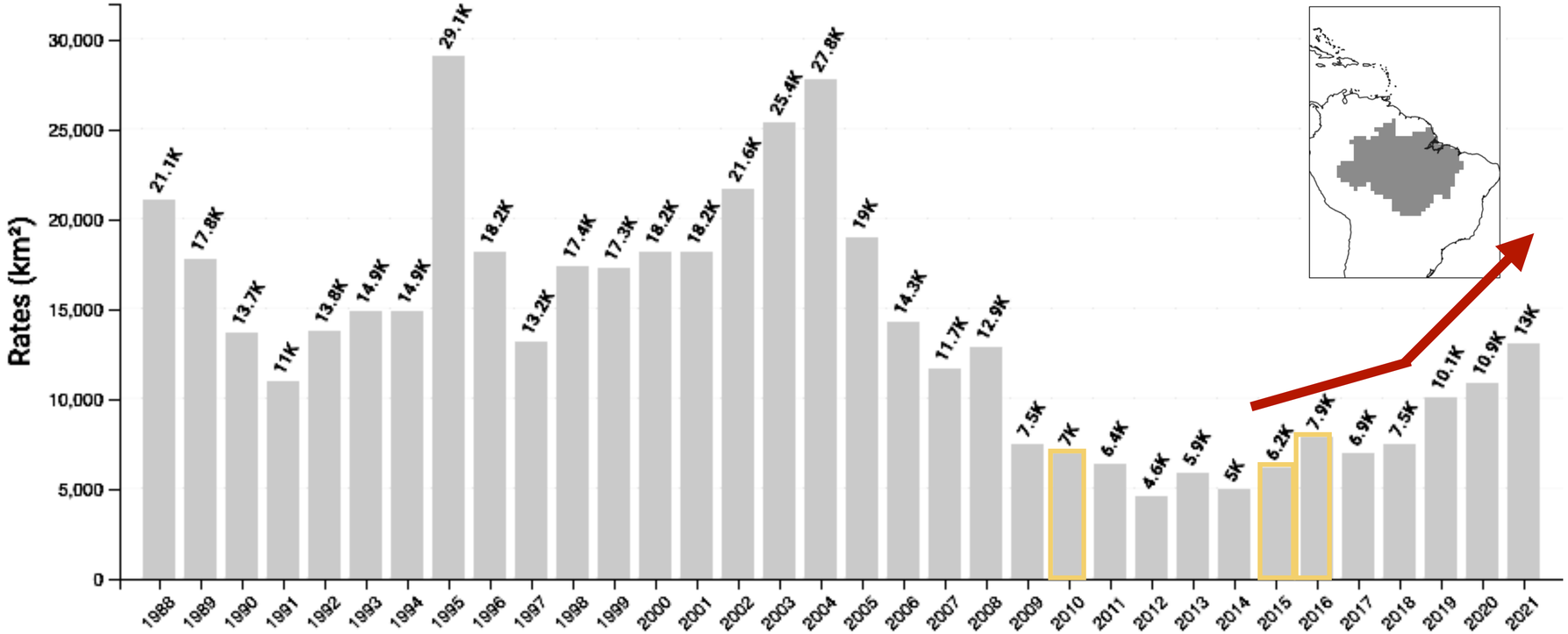


Figure from Friedlingstein et al. (2022)

Deforestation in Amazonia



INPE (2022): http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates

Deforestation in Amazonia

Article

Amazonia as a carbon source linked to deforestation and climate change

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Article

Increased Amazon carbon emissions mainly from decline in law enforcement

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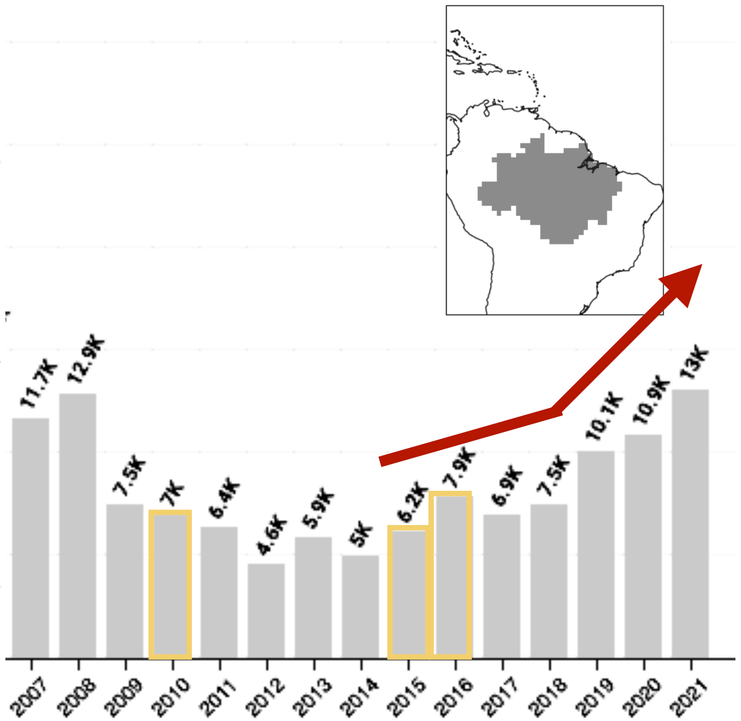

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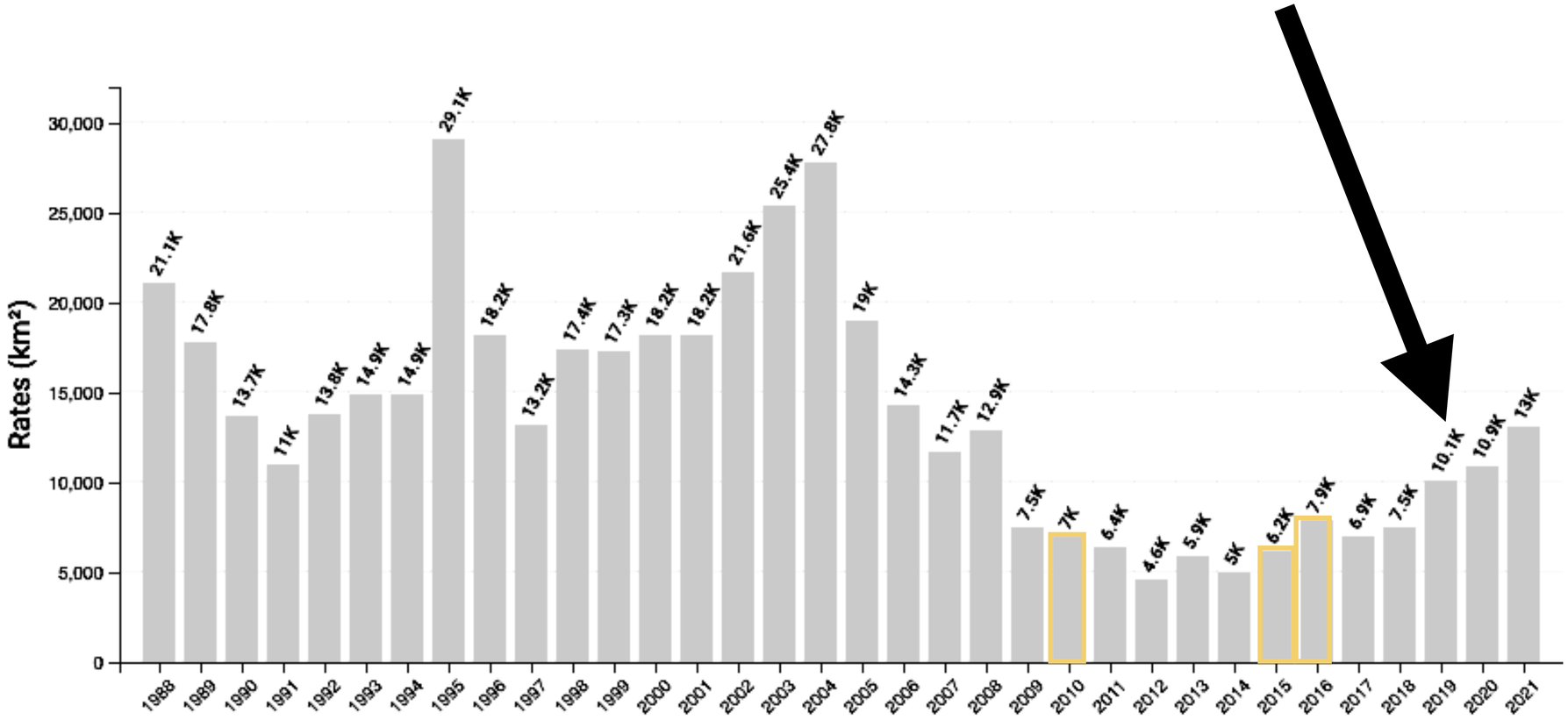
Deforestation in Amazonia



INPE (2022): http://terrabrasilis.dpi.inpe.br/app/dashboard/deforestation/biomes/legal_amazon/rates

Def

World Meteorological Organization
@WMO

From the other side of Earth, here's the latest on the Amazonia fires

Produced by @CopernicusEU's atmosph service, it shows the smoke reachir and São Paulo

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Raging rainforest fires darken skies in Brazil, inspire #prayforamazonia

Brazil's National Institute for Space Research said the country has seen a record number of wildfires this year, an 84 [illegible] compared t

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By Angela Barnes with Reuters • Updated: 23/08/2019

The New York Times

Fires in Amazon Rain Forest Have Surged This Year

The fires, most of which have been set by farmers clearing their land, are raging in uninhabited areas of rain forest and intruding on populated areas in the country's north.

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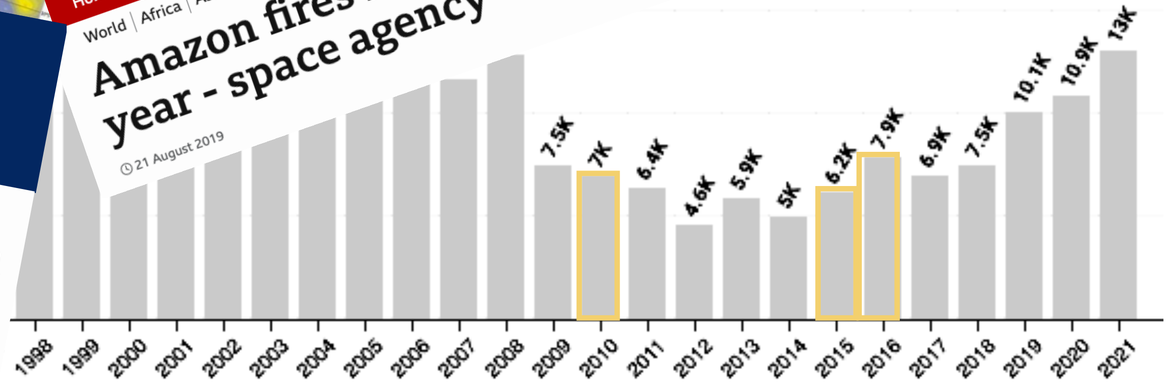
Amazon fires increase by 84% in one year - space agency

21 August 2019



INPE [illegible]oard/deforestation/biomes/legal_amazon/rates

Observational datasets

- Satellite instruments, OCO-2, MOPITT, TROPOMI
- Aircraft profiles L. Gatti, LaGEE, INPE

- NOAA CO_2, CO obspacks
- ATTO tower, Lavric & Walter, MPI
- Manaus aircraft profiles, Miller et al., 2021
- TCCON, Wunch et al. (2010) Laughner et al. (in prep)

Multi-tracer CO/CO_2 inversions

Until now:

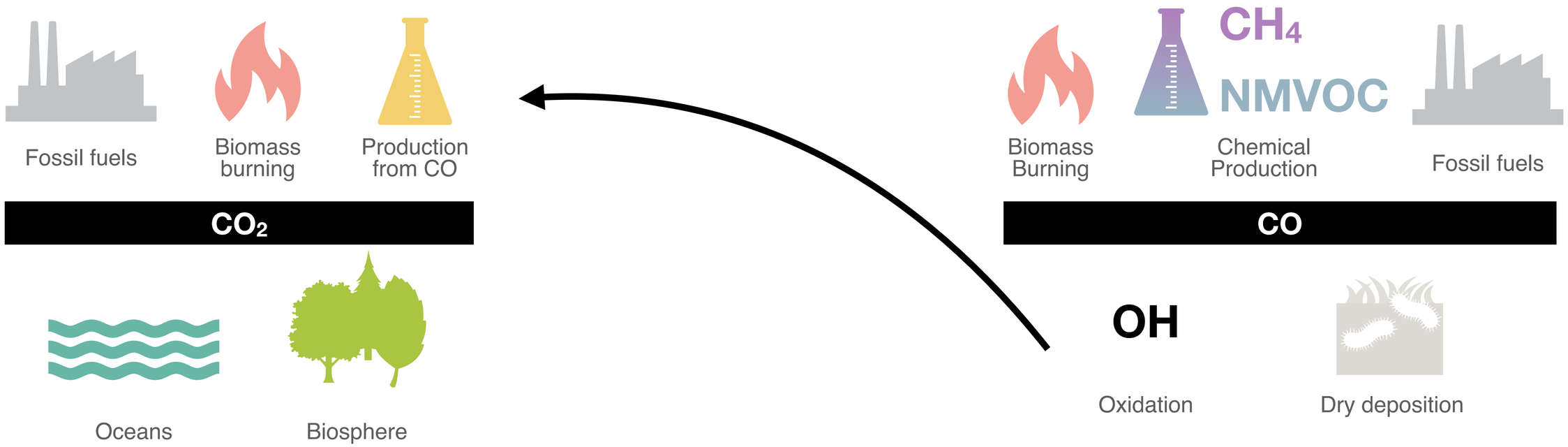
2 step approach

- CO only inversion to optimise fire emissions
- Convert posterior fire fluxes with predetermined (fixed) CO/CO_2 *emission ratios*
- Optimised fire fluxes as prior in CO_2 inversion

(e.g. work by: Stijn Naus & Gerbrand Koren, Helene Peiro, Luana Basso)

CO_2/CO in TM5-MP

Basis: CTE(-SAM)



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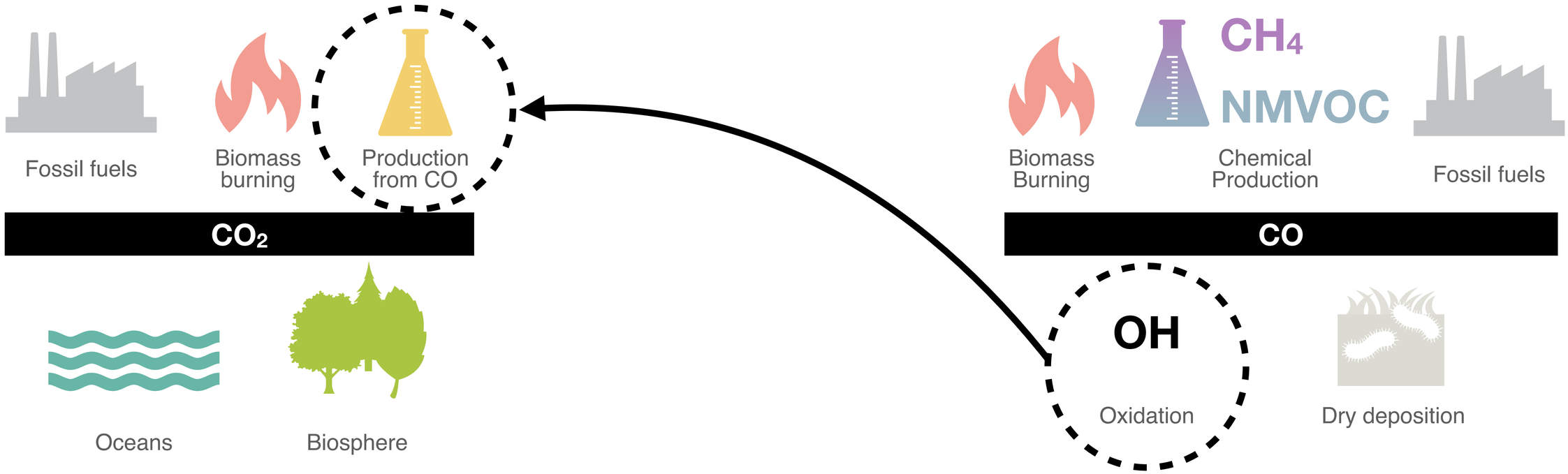

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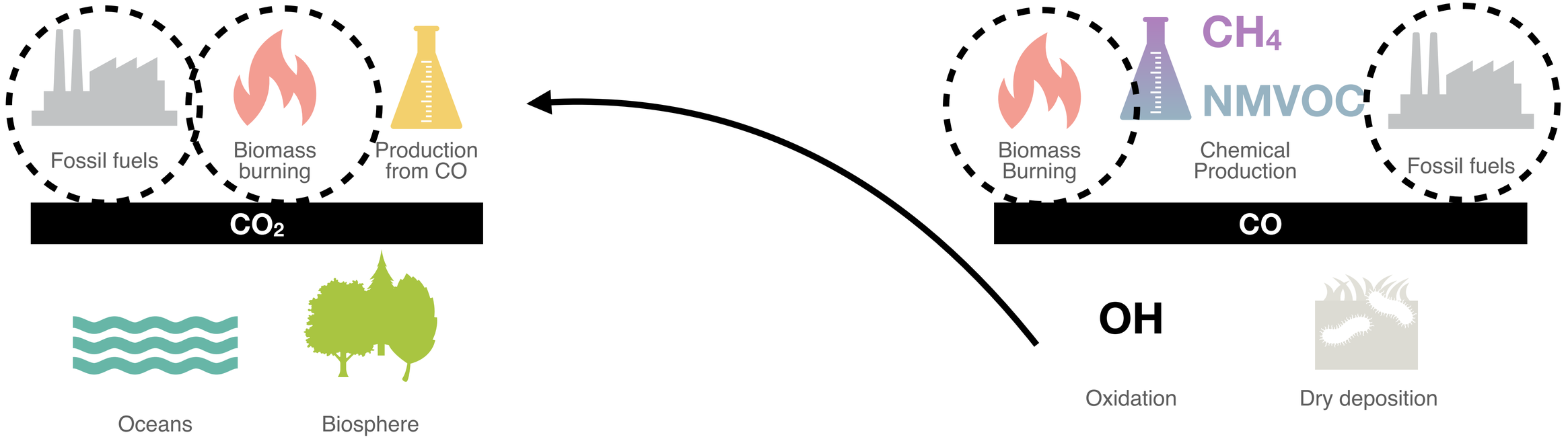
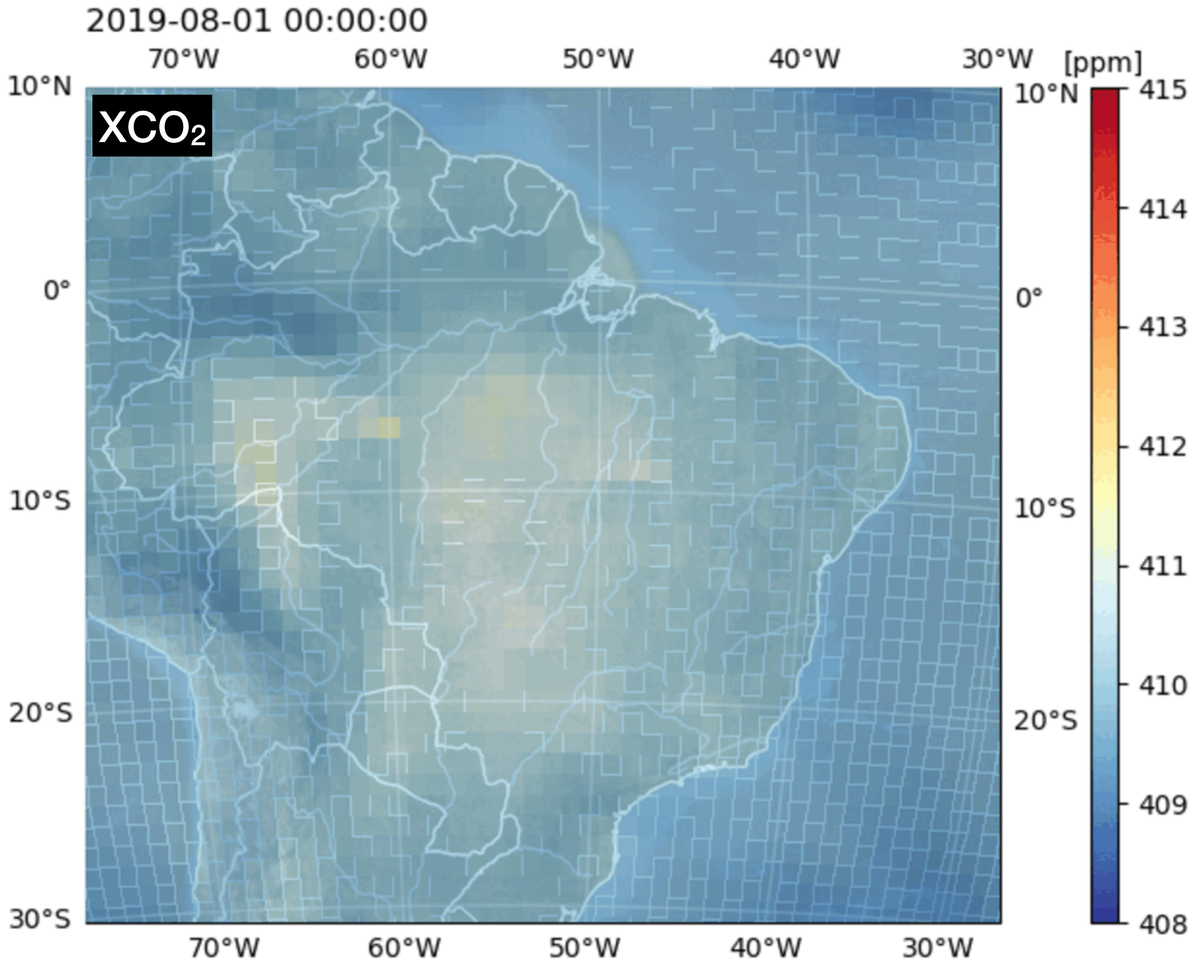
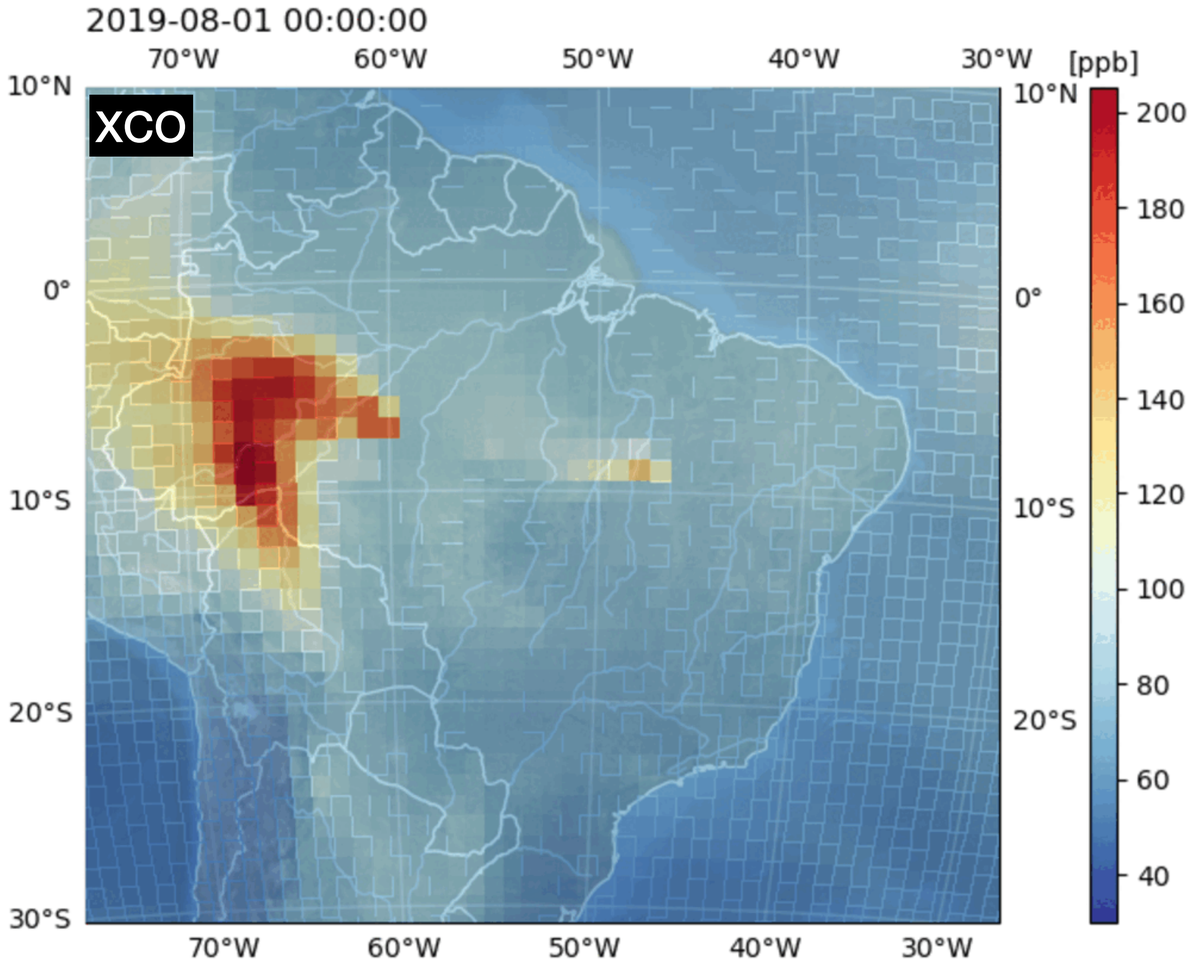


How it looks like so far…

Animations of Simulated CO_2 and CO columns over Amazonia, August 2019
FWD simulation TM5-MP/$COCO_2$, 1x1 degrees, 25lvls





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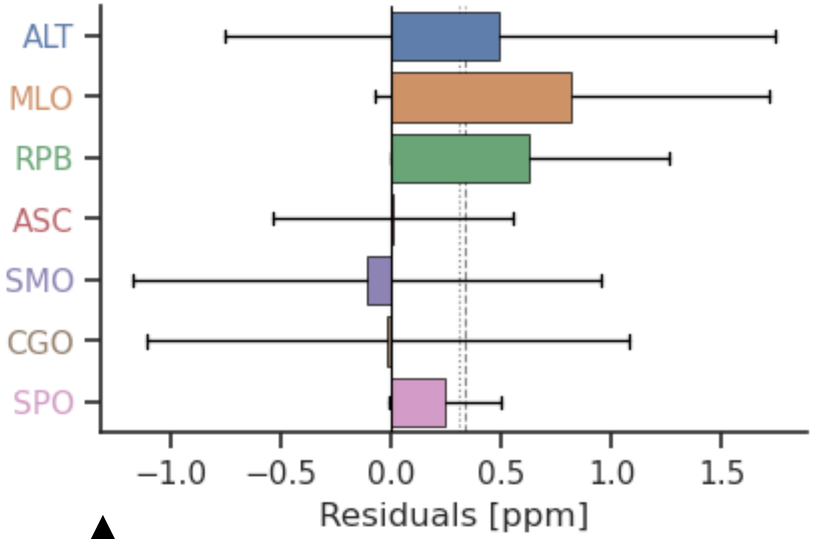
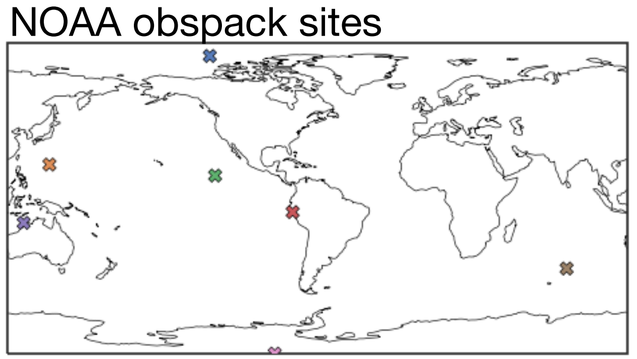
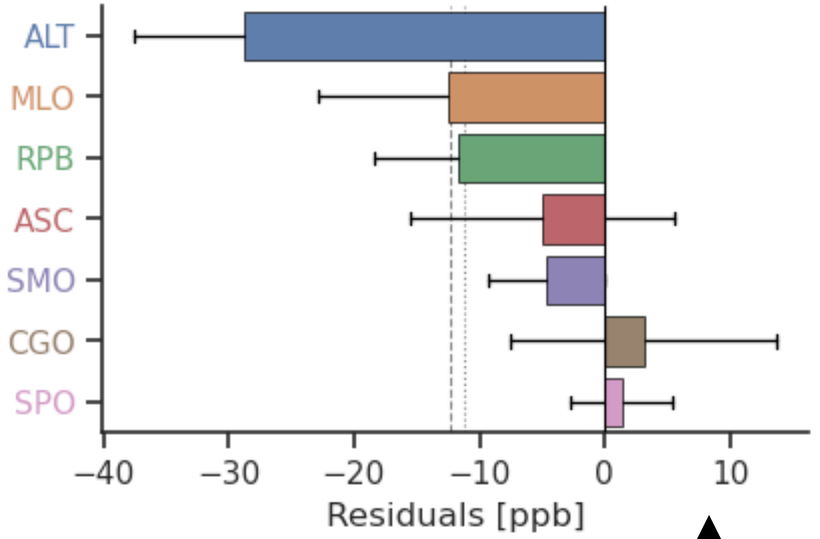
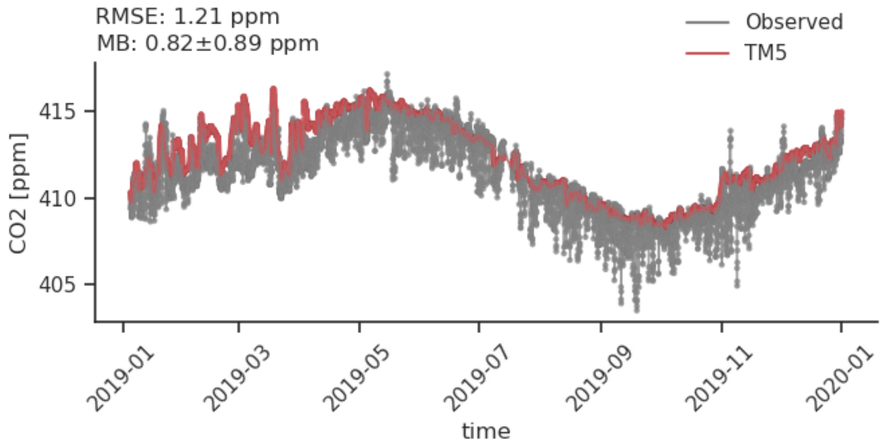




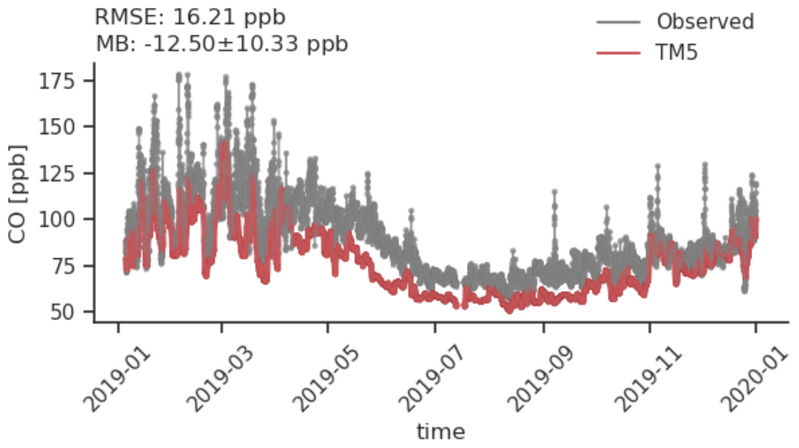


Mauna Loa

CO_2

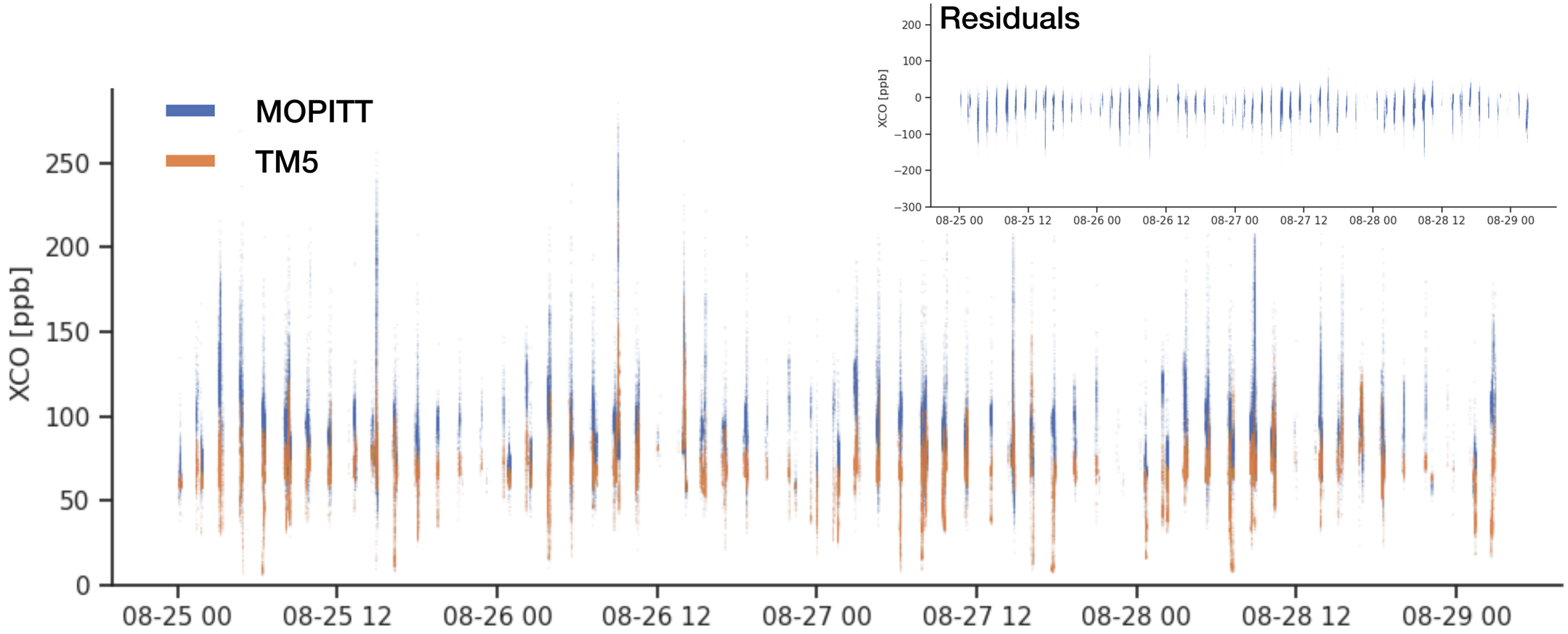


CO



How it looks so far…

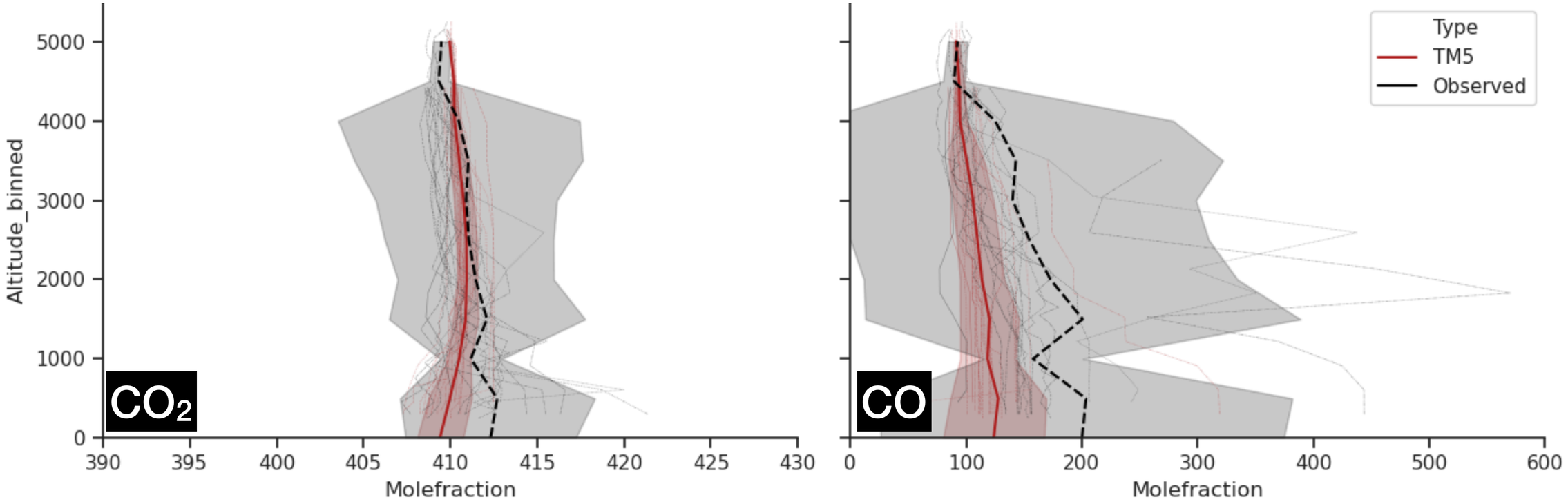
MOPITT V9 TIR product - some days in late august 2019



How it looks so far …

Aug/sep mean vertical profiles over Amazonia

Work in progress….



VP measurements courtesy from Luciana Gatti, La GEE, INPE

Thank you

TM5-MP code: https://ci.tno.nl/gitlab/tm5/tm5-mp.git

—> WUR/CTECC branch

CTDAS code: https://git.wur.nl/ctdas/CTDAS.git

—> CTECC branch

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UNIVERSITY & RESEARCH

CoCO2
Prototype system for a
Copernicus CO_2 service

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 958927.