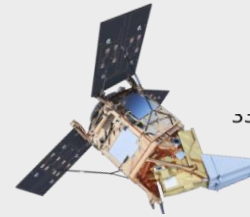


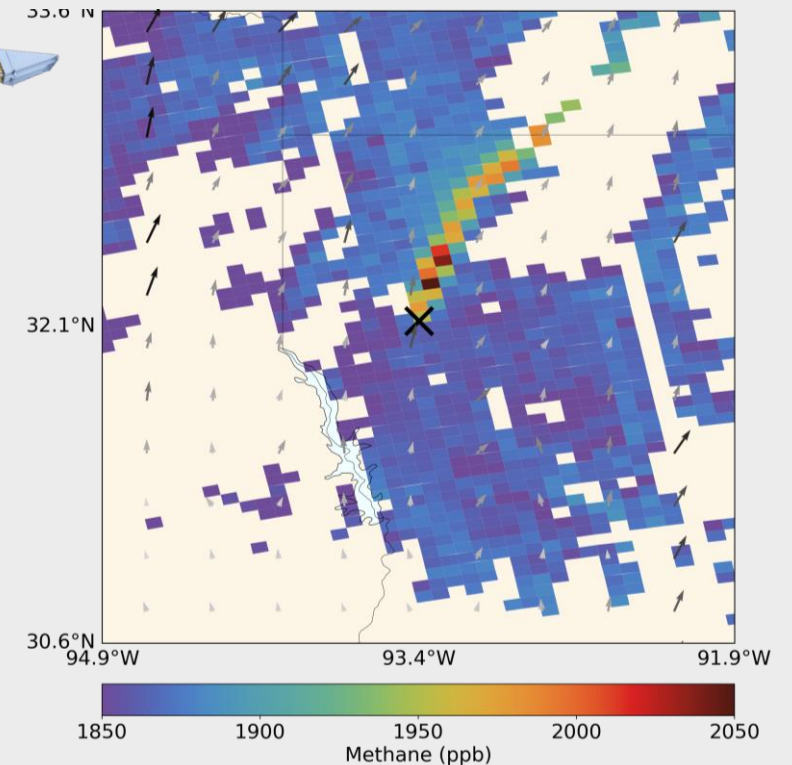
TROPOMI's SWIR channel measuring CH₄ and CO

Ilse Aben

On behalf of the TROPOMI SRON team and collaborators

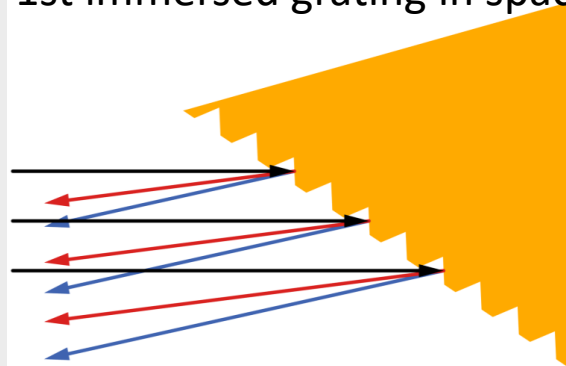


TROPOMI on September 25, 2019

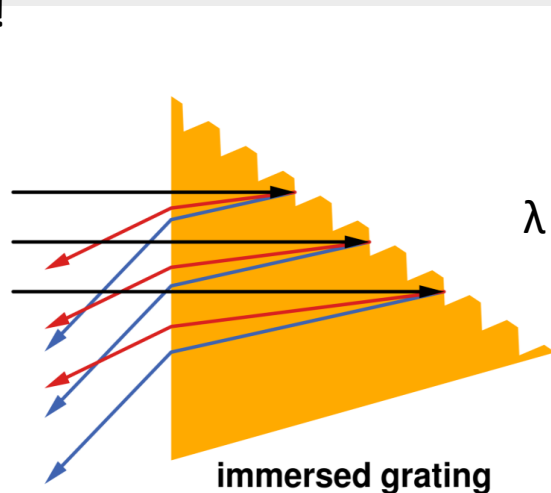


Key technology SWIR channel : immersed grating

1st immersed grating in space !!



normal grating



$\lambda \rightarrow \lambda/n$

$n_{\text{vacuum}} = 1.0$
 $n_{\text{silicon}} = 3.5$

30x smaller !! (120 → 3.5 L)

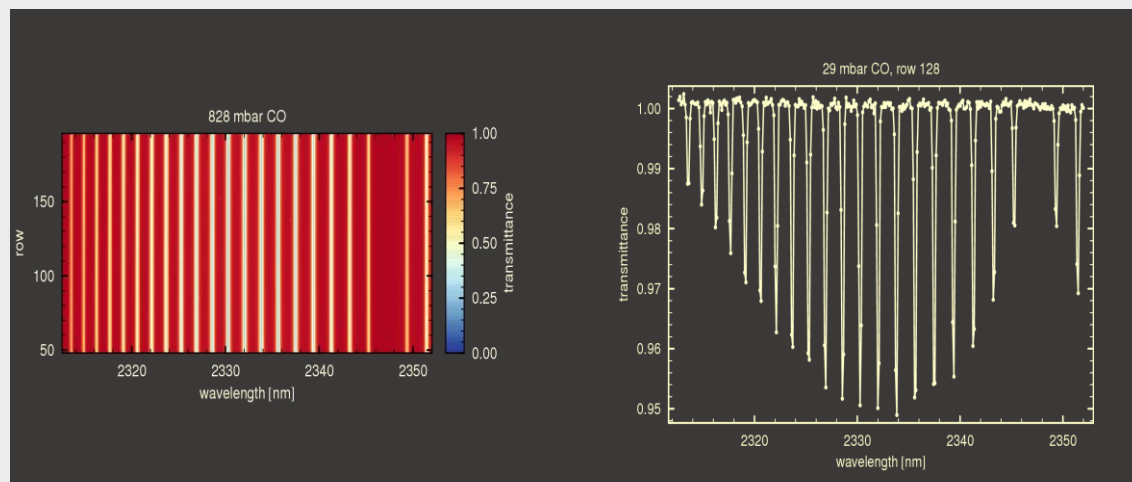
Volume reduction

$$R = \lambda / \Delta\lambda = (2.N.a \sin\theta) / \lambda \approx D / \lambda$$

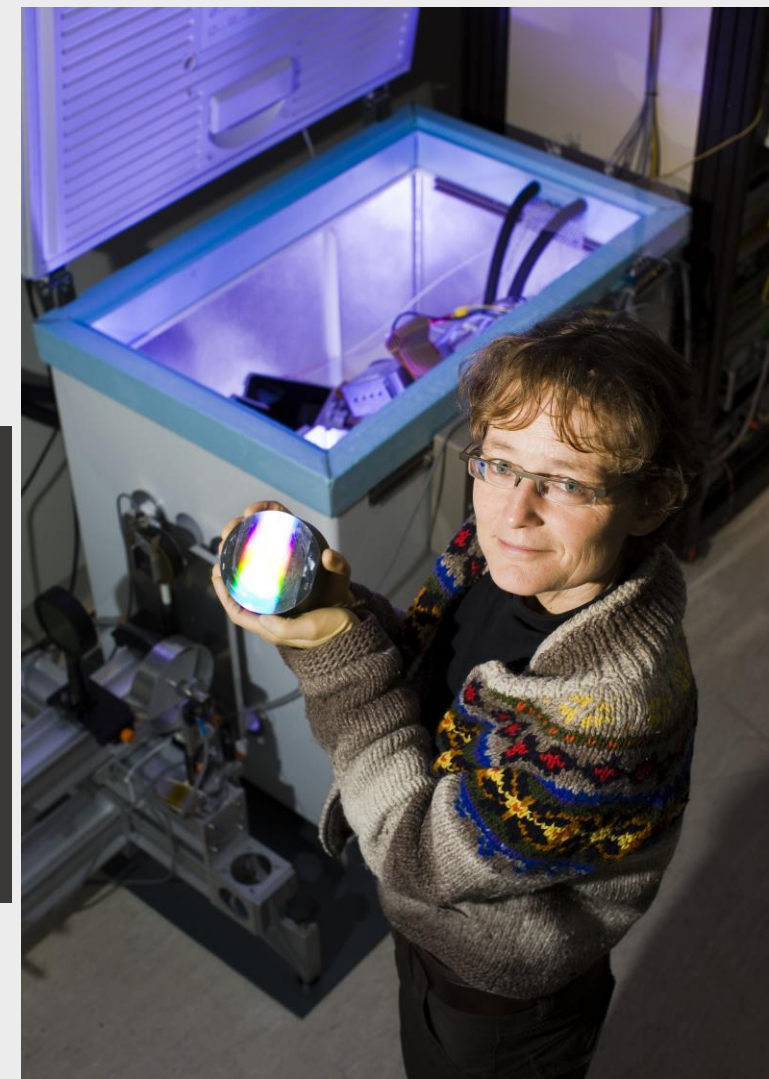


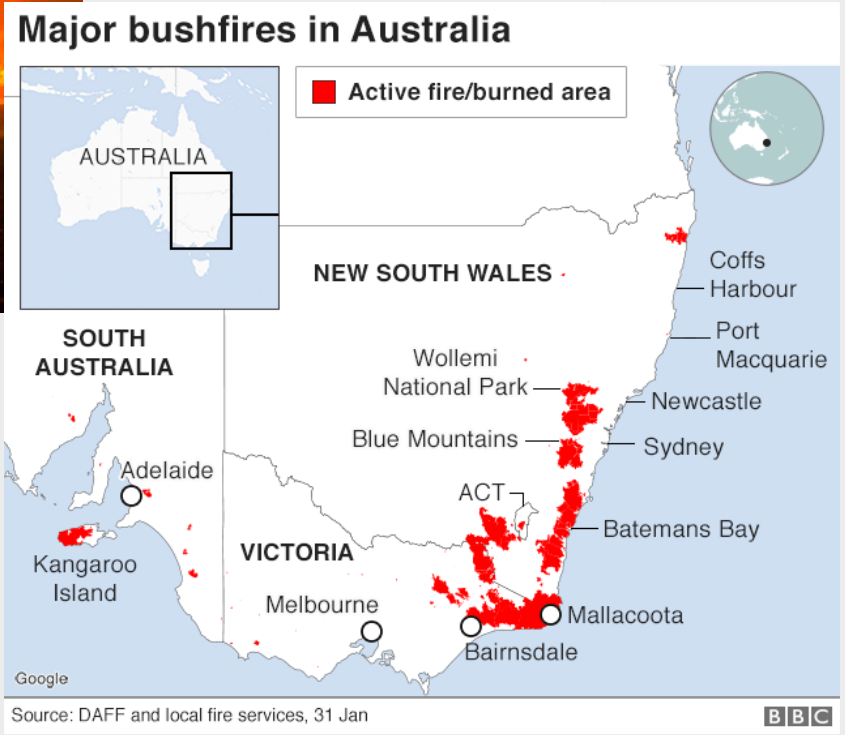
2008

SWIR breadboard at SRON

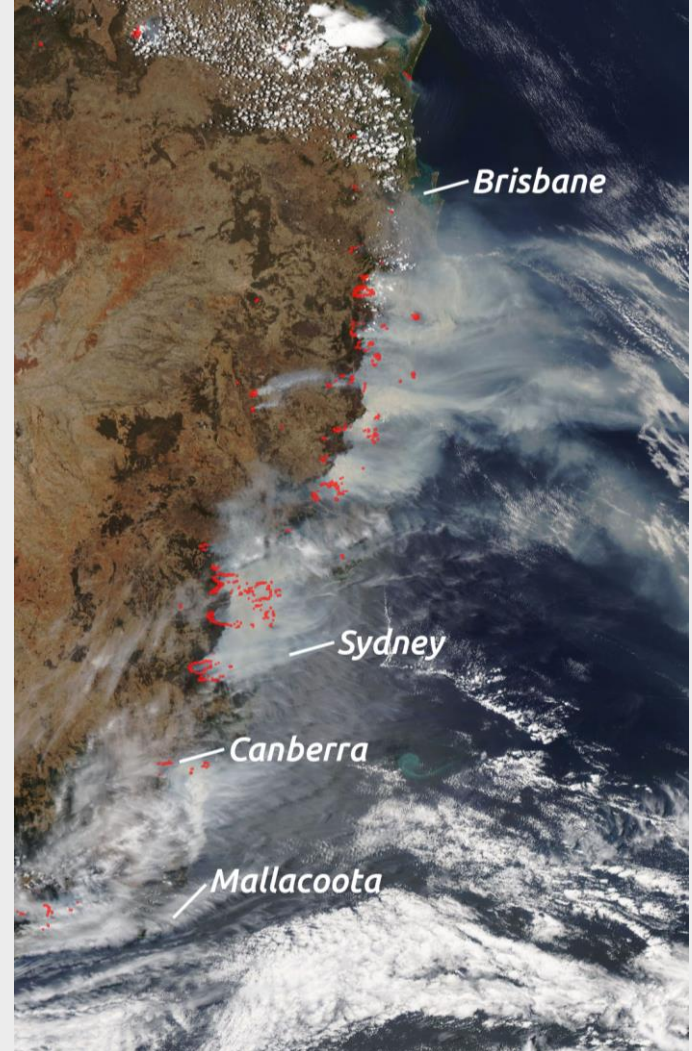


It works !!!!





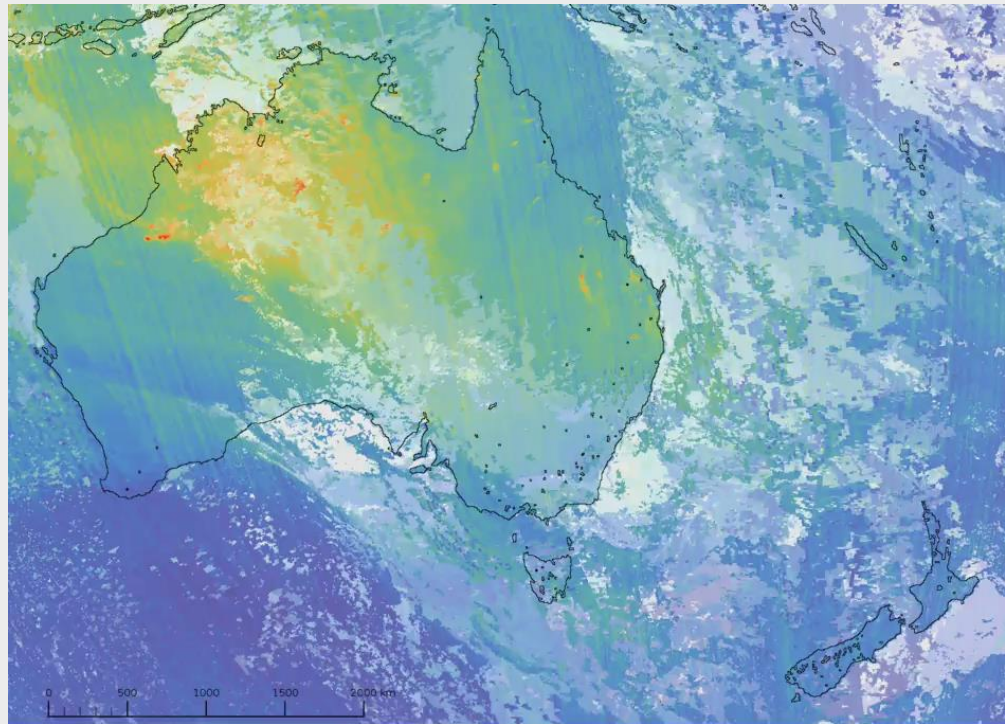
Extreme 2019-2020 'black summer' wildfires in Southeast Australia



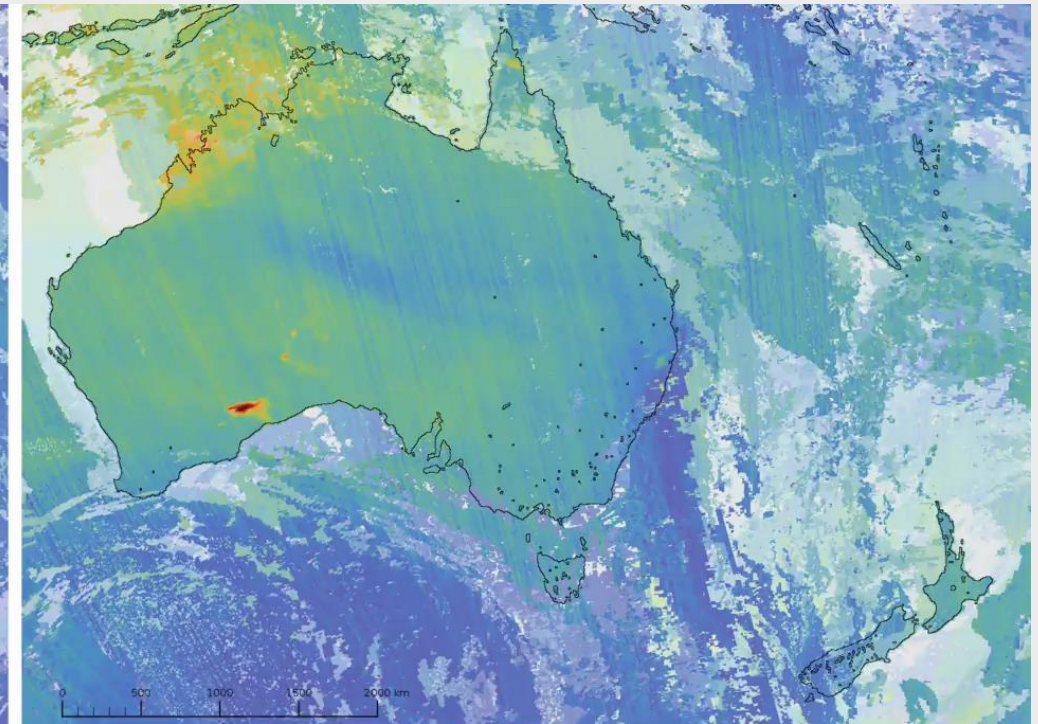
TROPOMI measuring CO from wildfires → CO₂

2018/2019

2019/2020

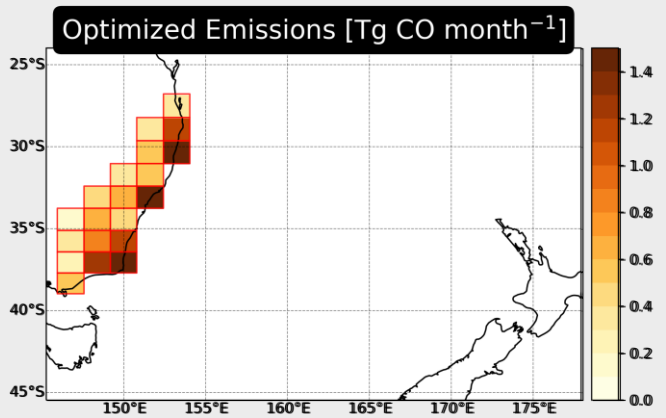
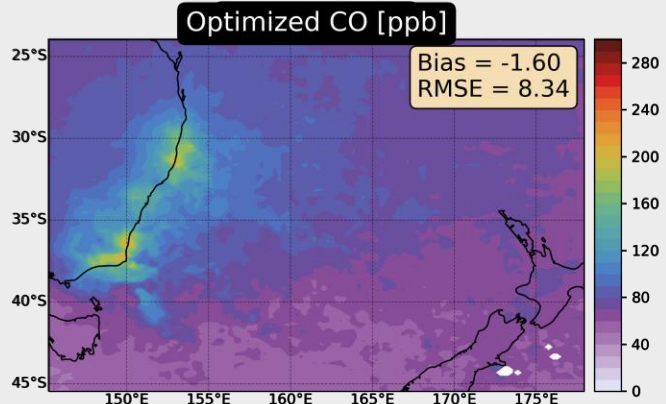
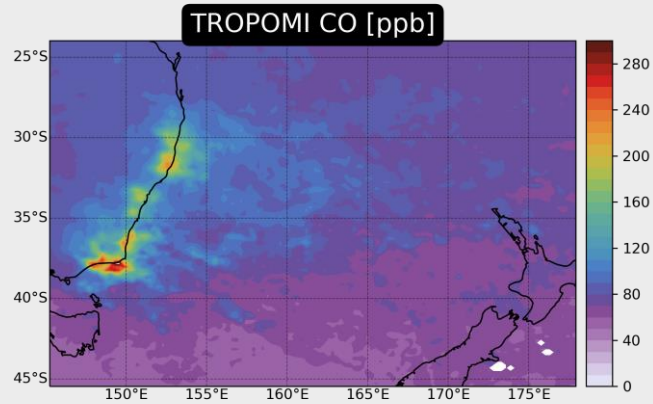
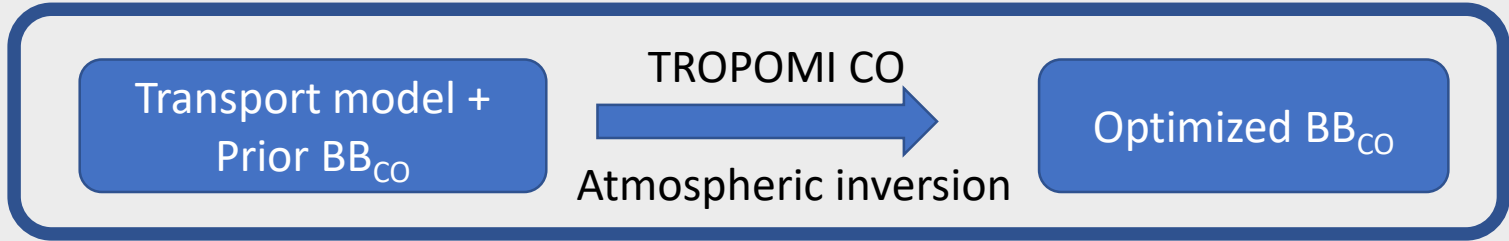


orbit 5504
2018-11-05 08:35

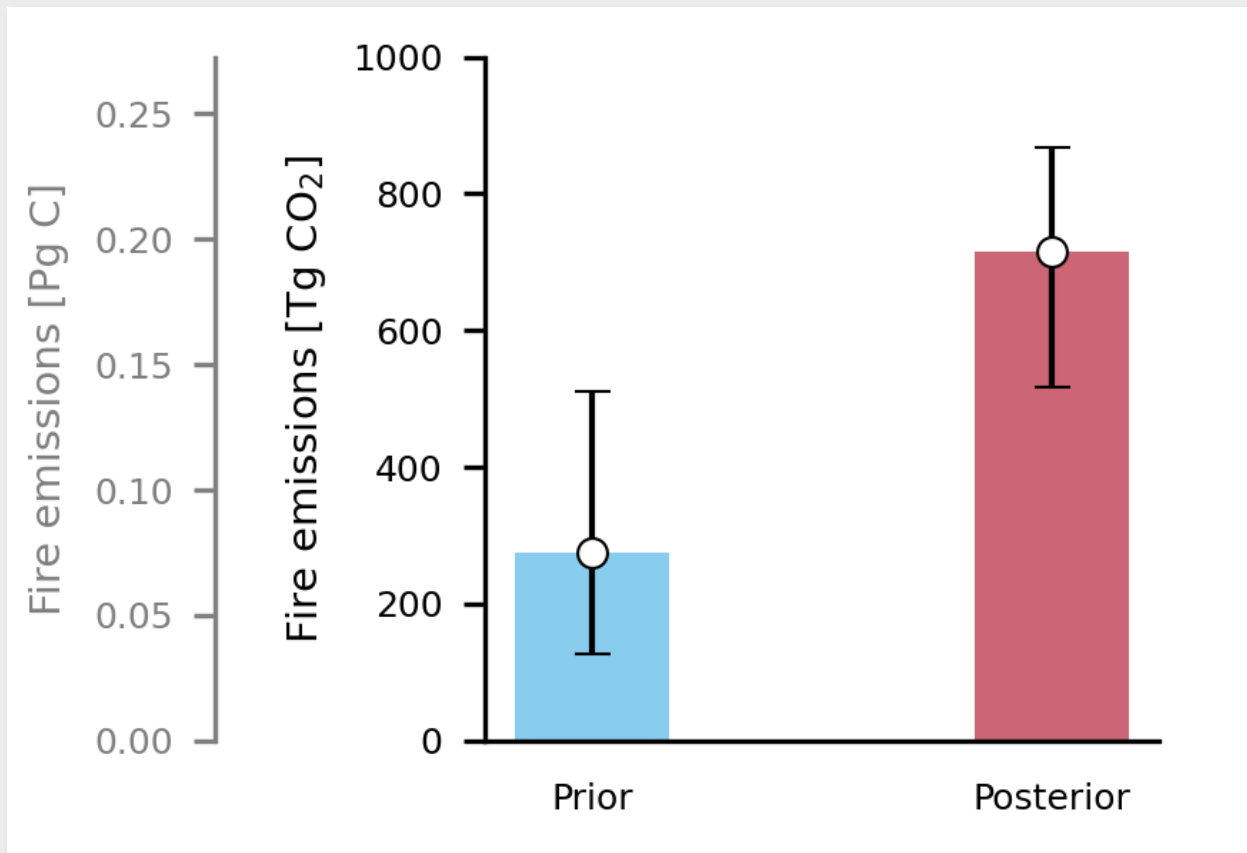
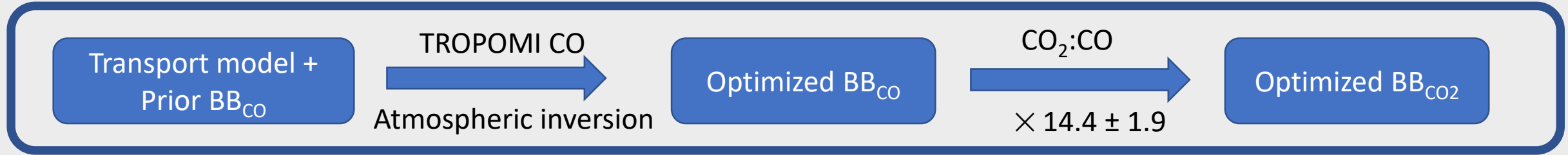


orbit 10682
2019-11-05 07:51

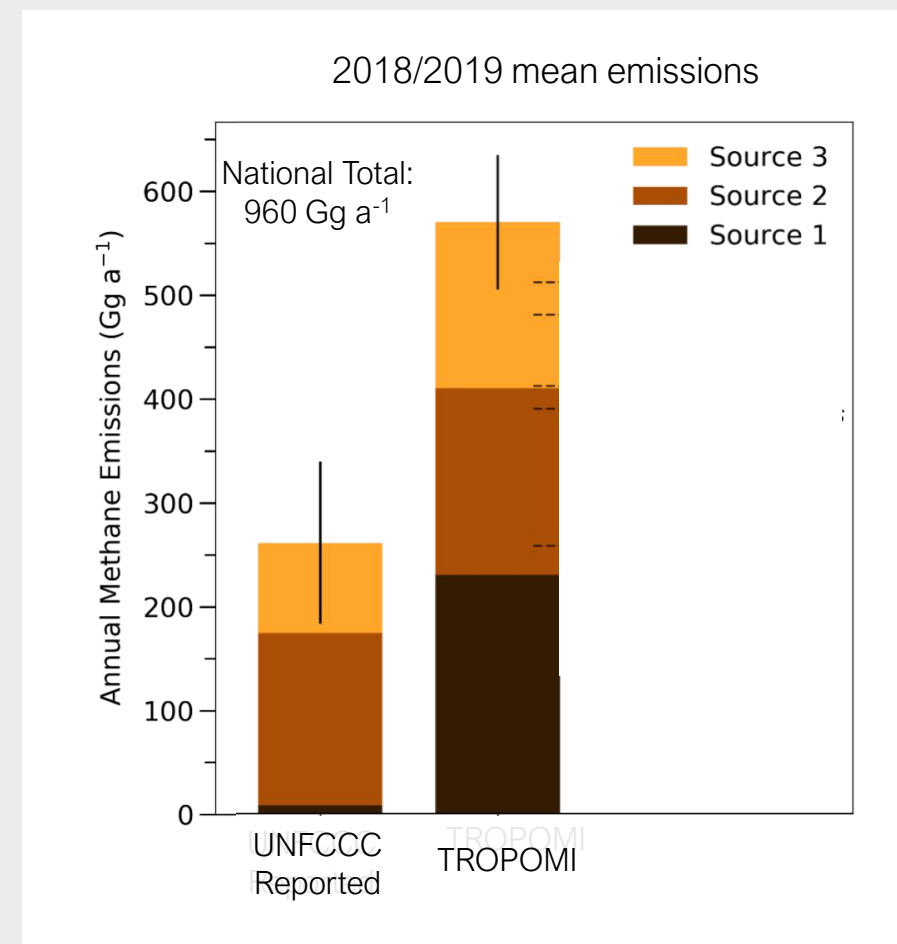
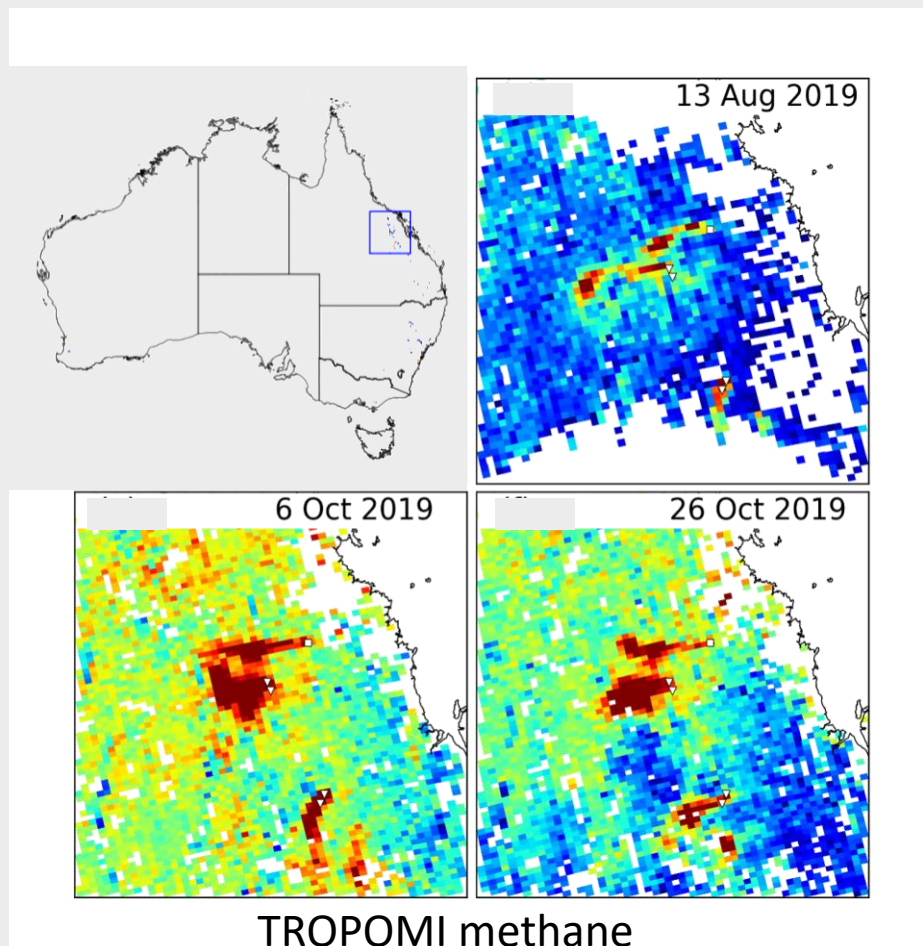




1. Performed flux inversions for 20 180x180km regions over Australia between Nov 2019 – Jan 2020.
2. After optimization, a number of hotspots appear with much larger fires emissions



- 715 Tg CO₂ released to atmosphere for the 3-month period
- ~10% of global BB emissions per year
- ~2 times larger than Australia's total greenhouse gas emissions per year

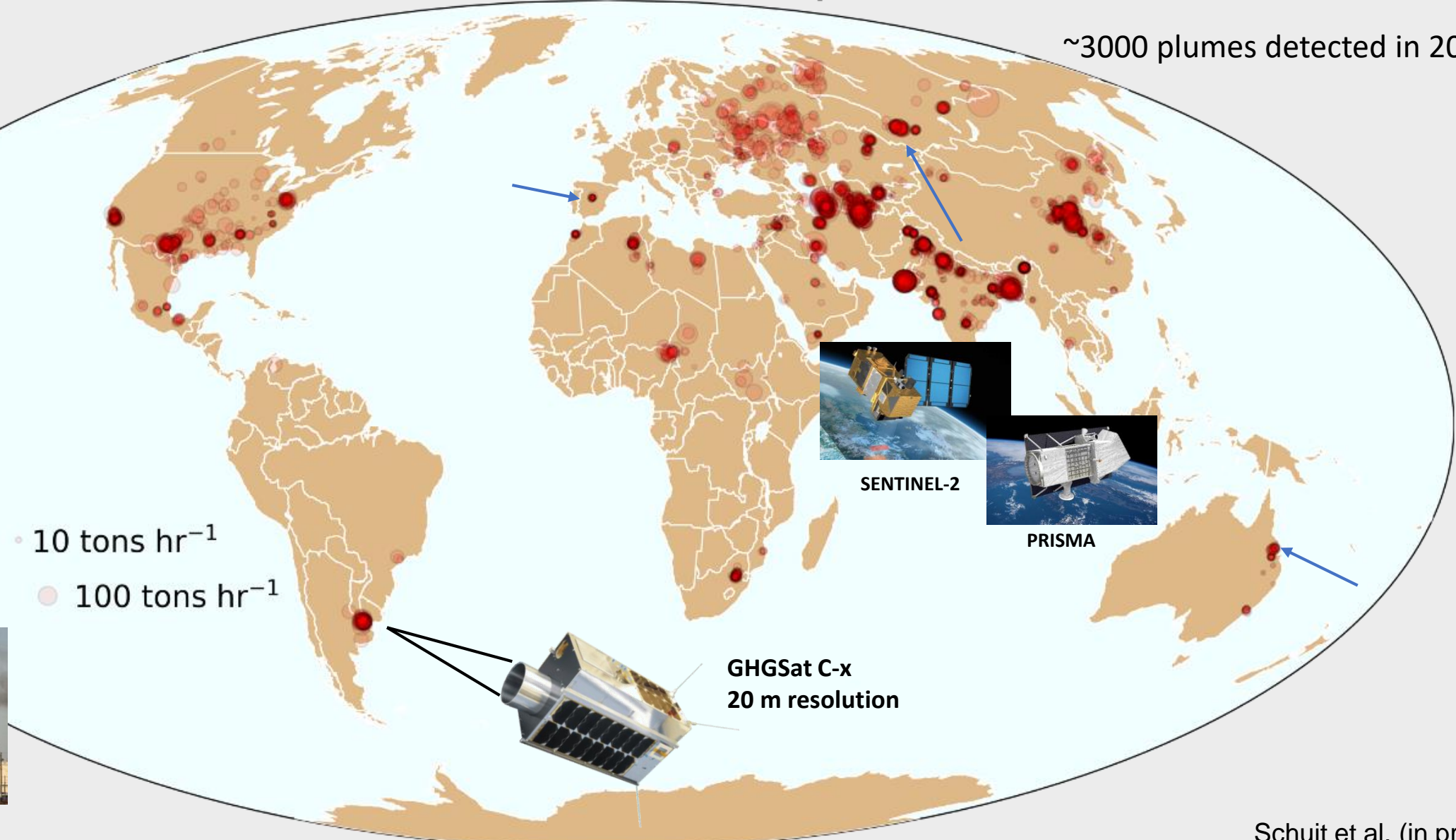


6 mines : 7% AUS coal production, 55% reported CH_4 coal emissions

1 mine (surface mine) : 1% AUS coal production, 24 % reported CH_4 coal emissions

2021 TROPOMI-detected Super-emitters

~3000 plumes detected in 2021



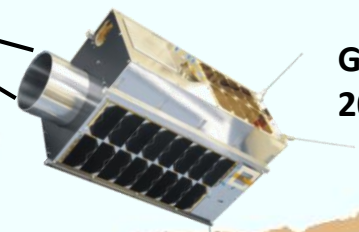
- 10 tons hr⁻¹
- 100 tons hr⁻¹



SENTINEL-2



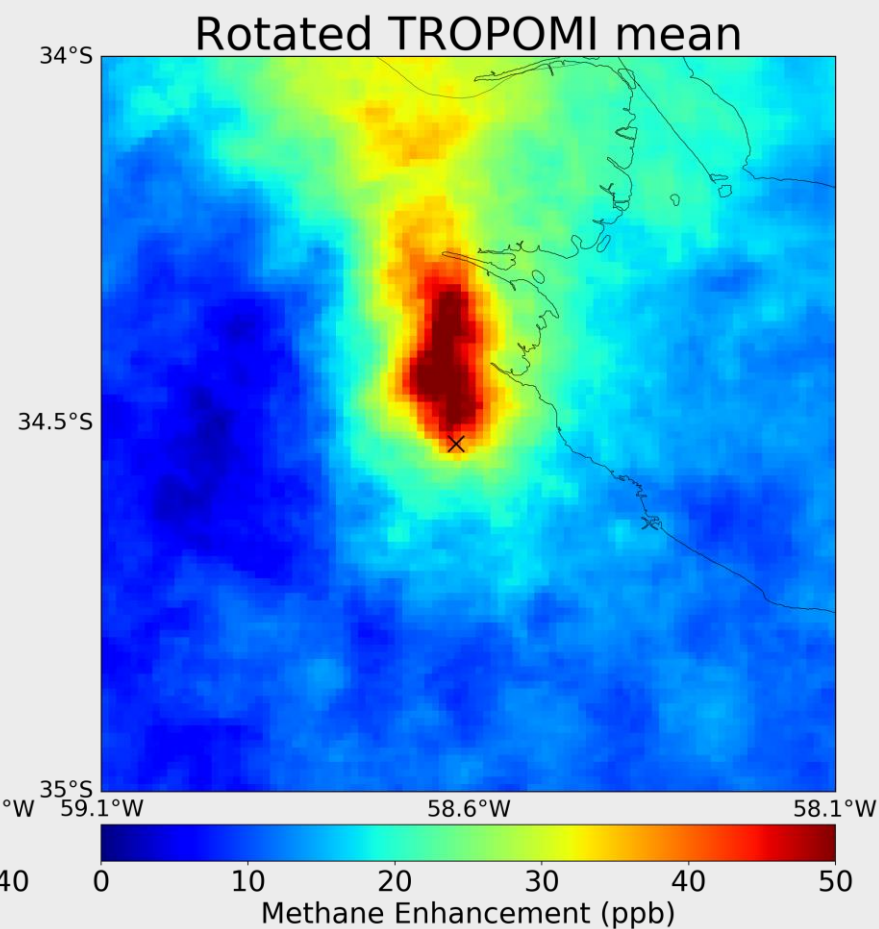
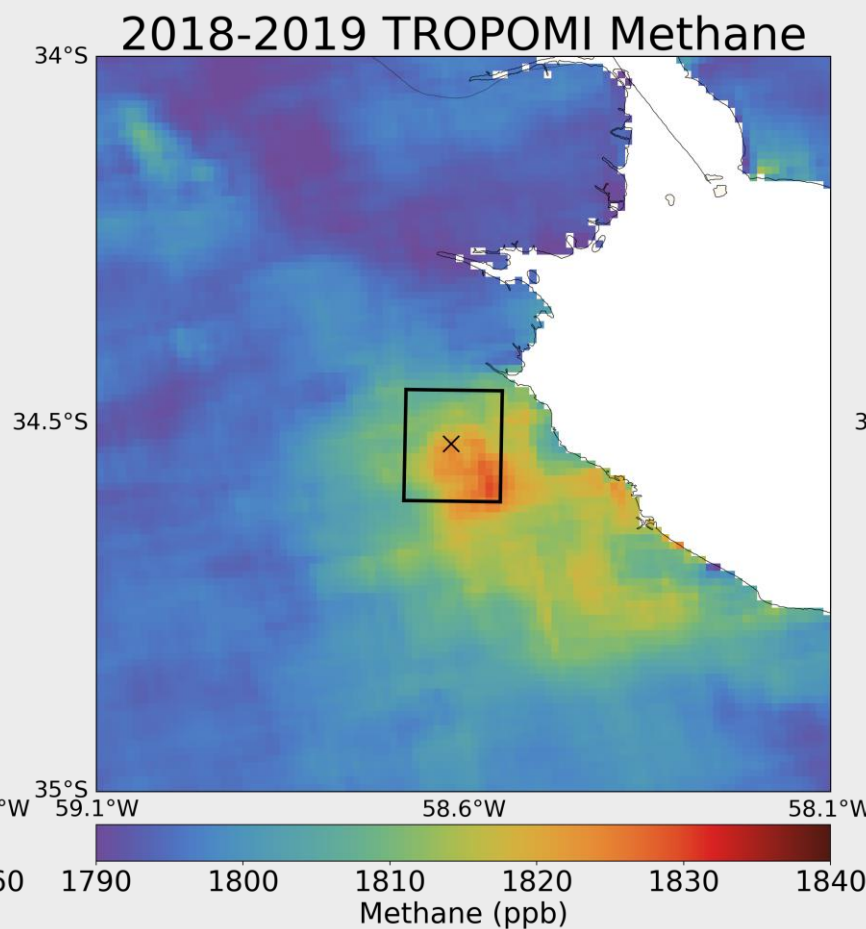
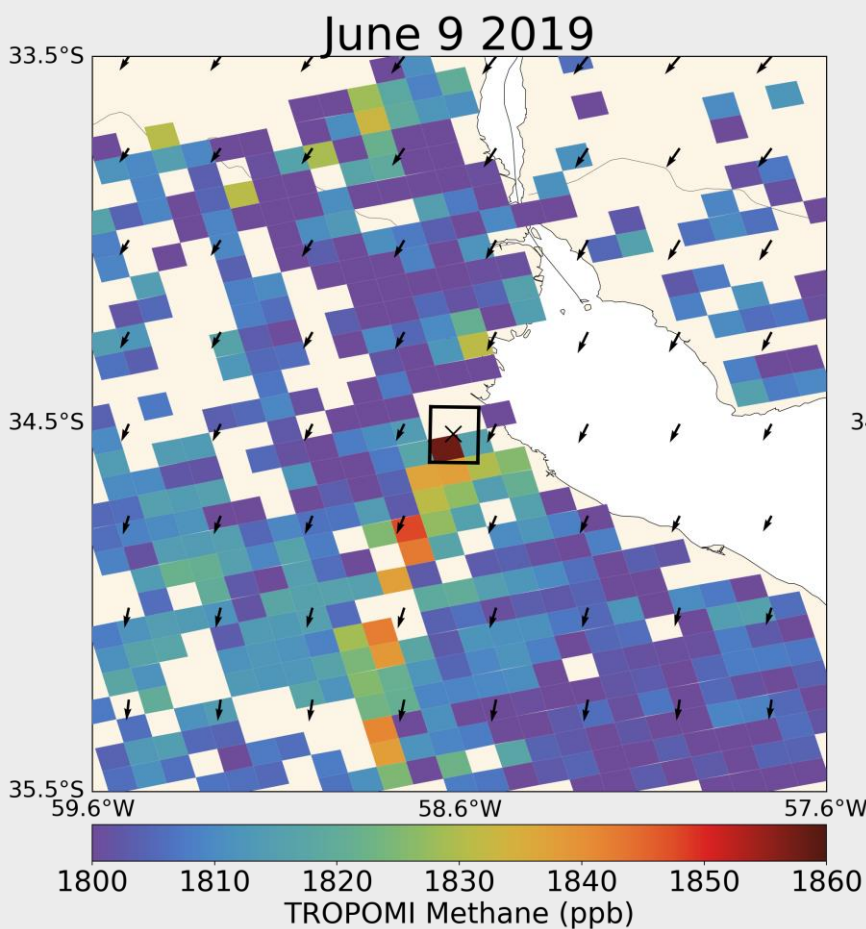
PRISMA

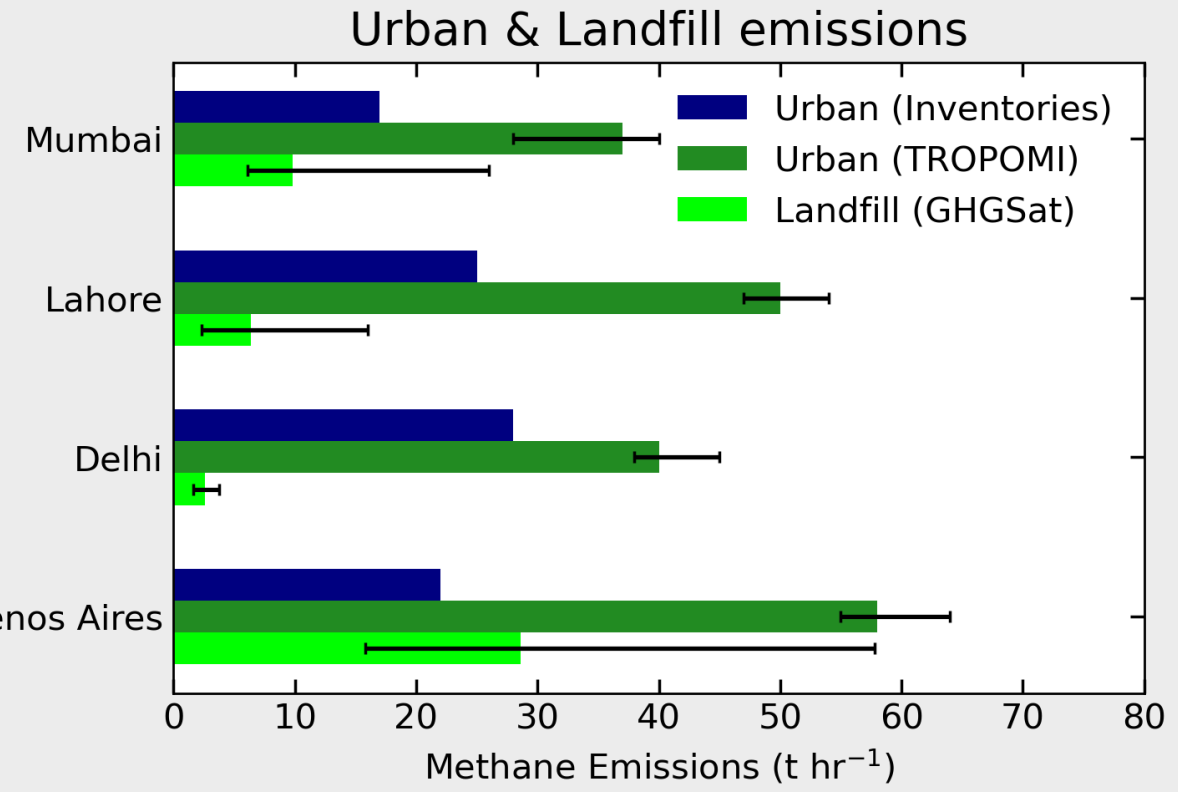
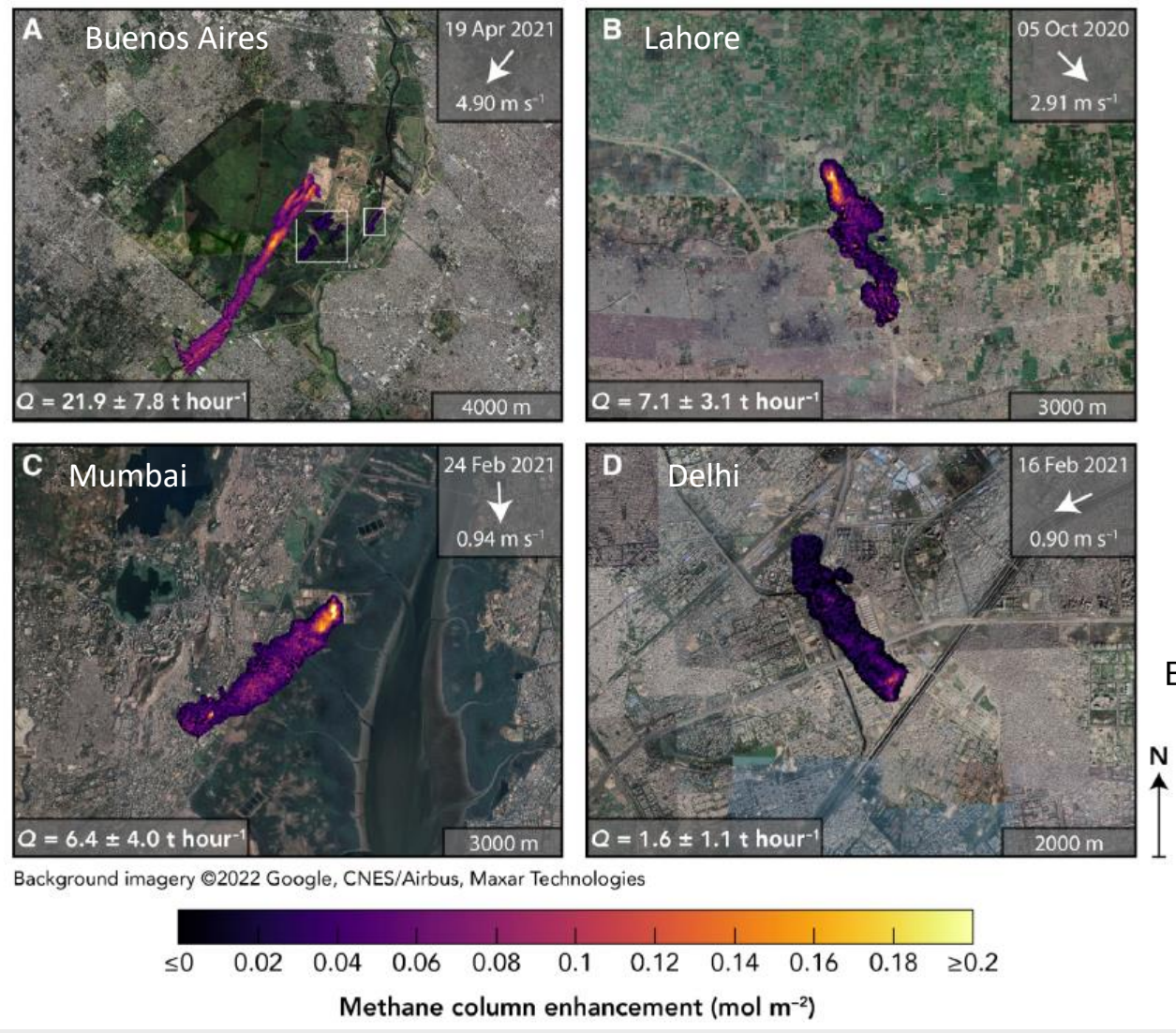


GHGSat C-x
20 m resolution

TROPOMI 'tip-and-cue' GHGSat : persistent emissions Buenos Aires (Argentina)

Use data from different days with different winds to find rough location

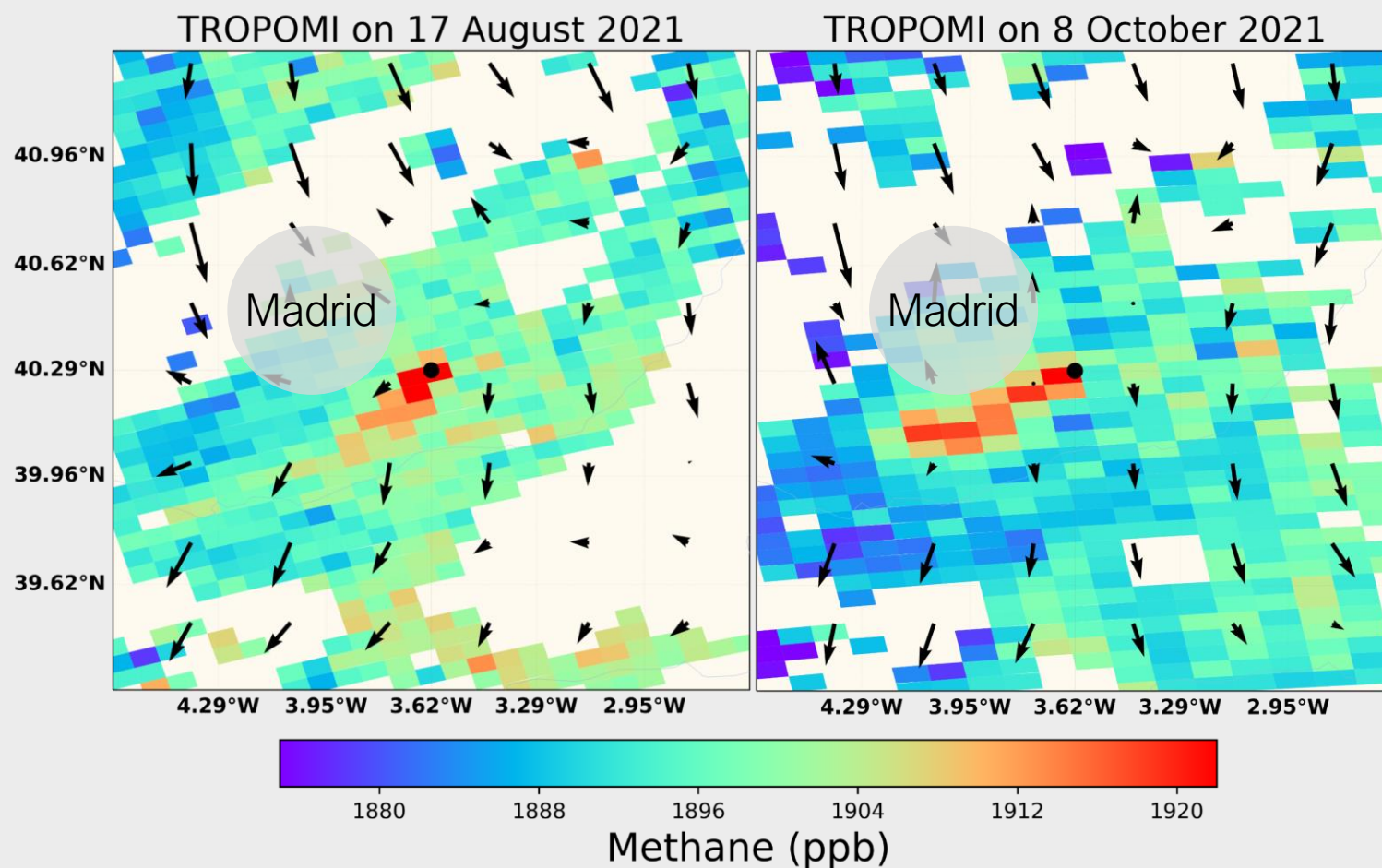




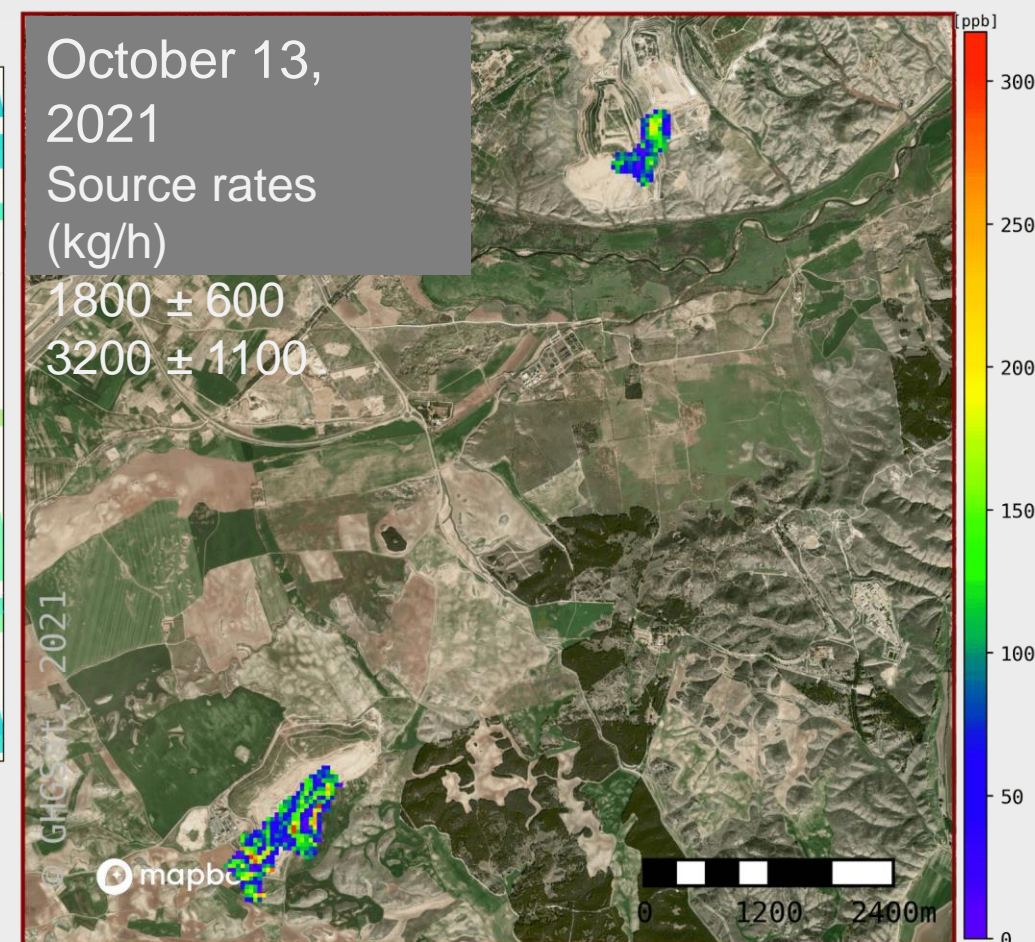
First space-based detections of methane emissions from landfills !
 By now detected methane emissions from **many more landfills**

Landfill emissions are also detected in Europe

Guided by long-term TROPOMI data, GHGSat detected large emissions from landfills near Madrid on multiple days in 2021.



Landfill - Madrid, Spain CH₄ Concentration Map



Background Image:
© Mapbox: <https://www.mapbox.com/about/maps>
© OpenStreetMap: <http://www.openstreetmap.org/copyright>
© Maxar: <https://www.maxar.com>

ESA coordinated a ground-based, aircraft, satellite campaign summer 2022 (EDAP)

Figure Credit: Gourav Mahapatra. ESA web story from November 11.



International Methane Emissions Observatory (IMEO)

Methane Alert and Response System (MARS)



IMEO will support governments and companies to reduce their emissions as agreed in the Methane Pledge at COP26

MARS :

1. detection, 2. notification and 3. mitigation

1st element of the MARS detection system is the Super Emitter detection system using TROPOMI and other satellites to pin-point exact facilities leaking/emitting.

(IMEO/UNEP, Kayrros, EDF, Univ. Valenc., SRON)



‘TROPOMI is a real game changer

producing exciting research

with direct societal impact’

THANK YOU
TROPOMI-team

How satellites are challenging Australia's official greenhouse gas emission figures

By Europe bureau chief Steve Cannane
Posted Thu 2 Dec 2021 at 7:38pm, updated Fri 3 Dec 2021 at 2:14am

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These Australian Coal Mines Are Methane Super-Emitters

Je ziet het niet zonder satelliet

Er worden steeds meer afspraken gemaakt om klimaatverandering tegen te gaan. Maar hoe meet je nou of landen zich daaraan houden?

HANS NIJENHUIS

Hot Tropic

dS De Standaard

bloomberg.com
Satellite Data Reveals How to Fix a Glot
Repairing 29 pieces of oil and gas equip
significantly reduce the region's climate

15 Sep 2021

News

Australian wildfires released more CO2 than annual emissions of Germany, say scientists

