# VERIFY General Assembly

## *WP4: Global $CH_4$ inversions using TROPOMI data*

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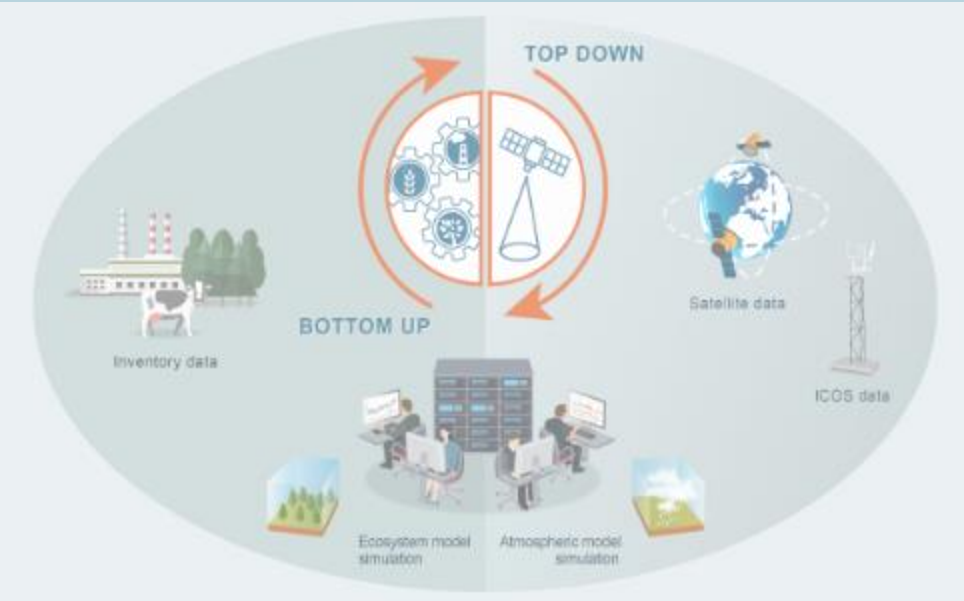



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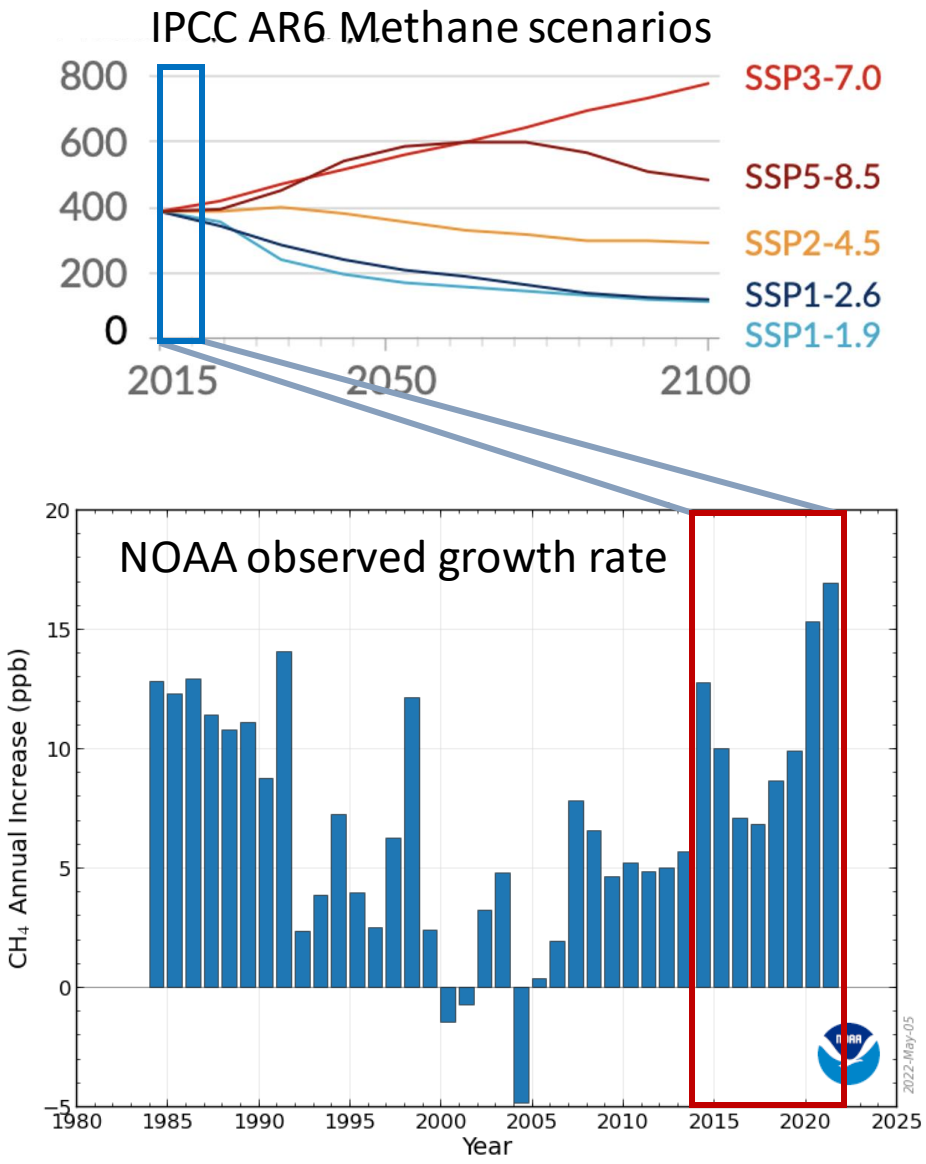
# GLOBAL $CH_4$ GROWTH RATE

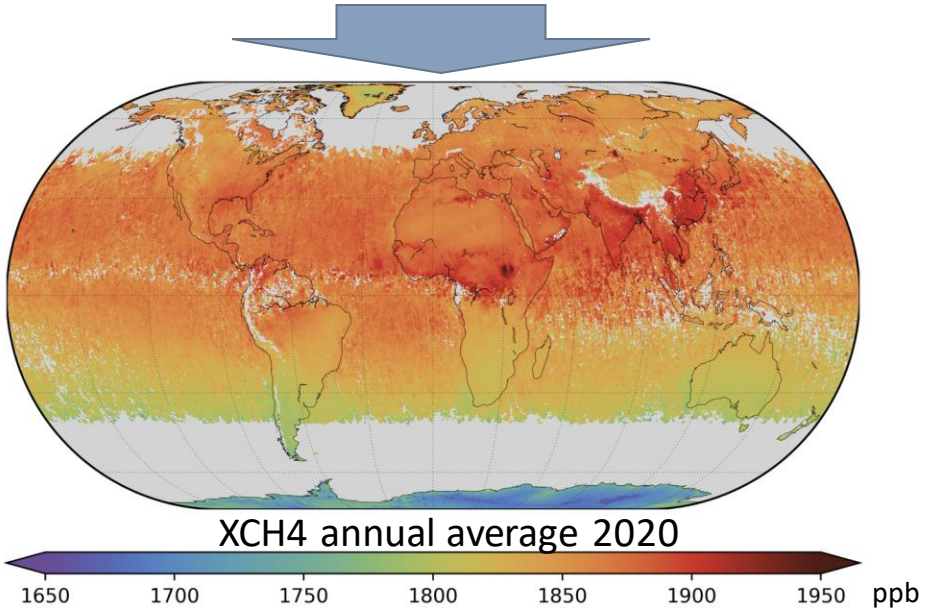



- Observed growth rates divert strongly from the sustainable AR6 SSP scenarios
- Poor understanding of $CH_4$ growth rate variations of the past decades
- Monitoring capacity needs further development

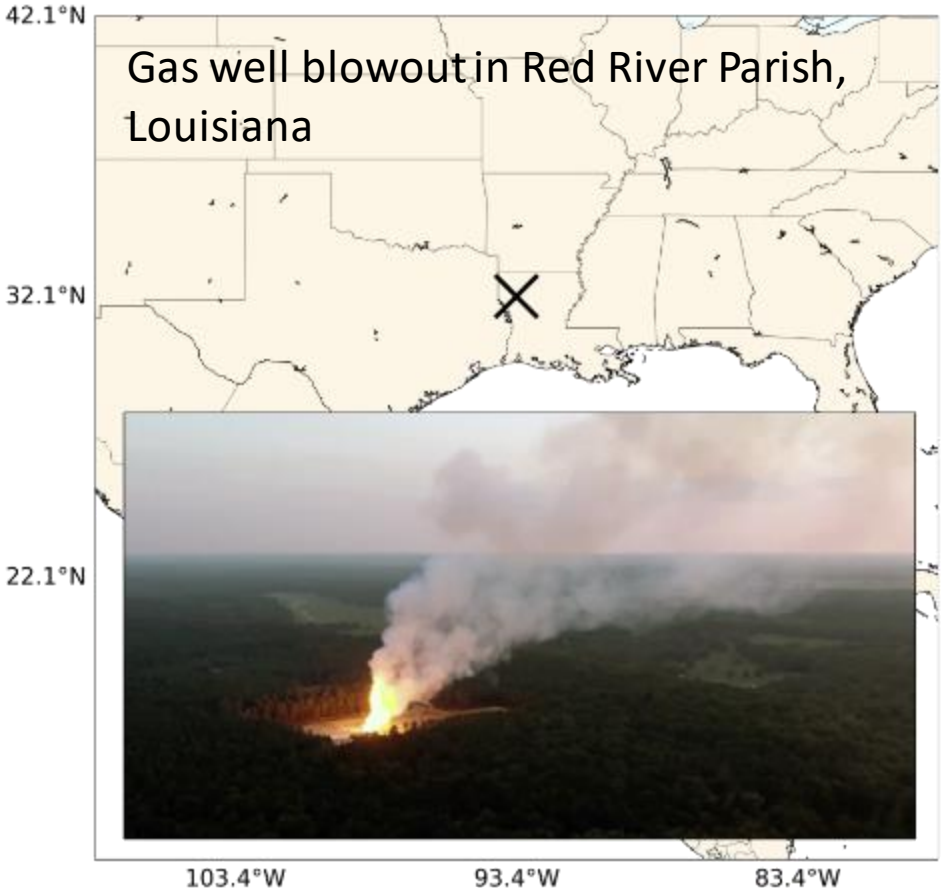
# VERIFY WP4 ACTIVITIES VUA

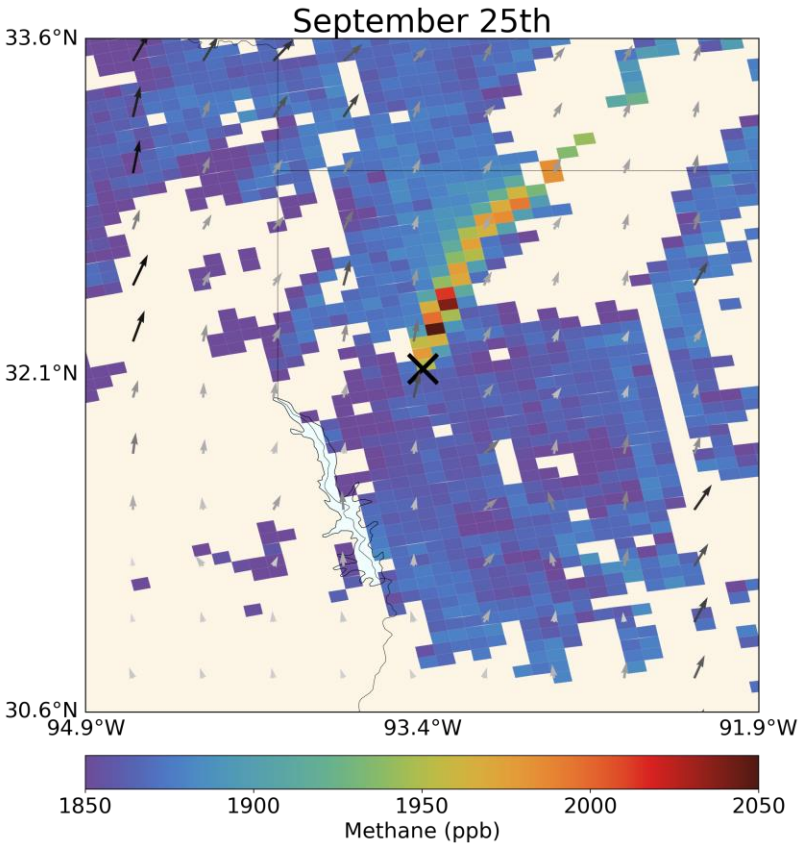
**TROPOMI Launch: Oct 2017**

- Investigate the use of the 2.3 $\mu$m XCH4 data
- Prepare TM5-4DVAR inverse modelling system for use of S5p data
- Check data quality and apply (bias) corrections where needed

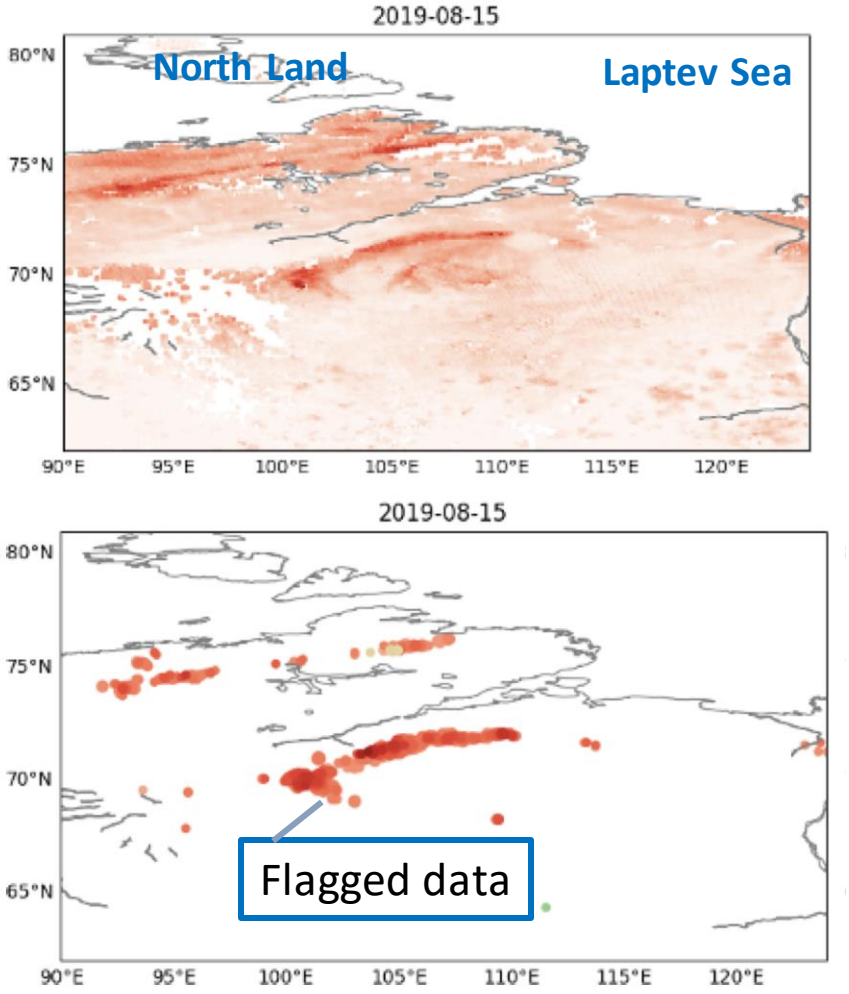
# TROPOMI & LOCAL EMISSIONS




Maasakkers et al. (2021), Drone footage: Phin Percy Jr., Image Credit: ESA

# TROPOMI: LOCAL => REGIONAL SCALE

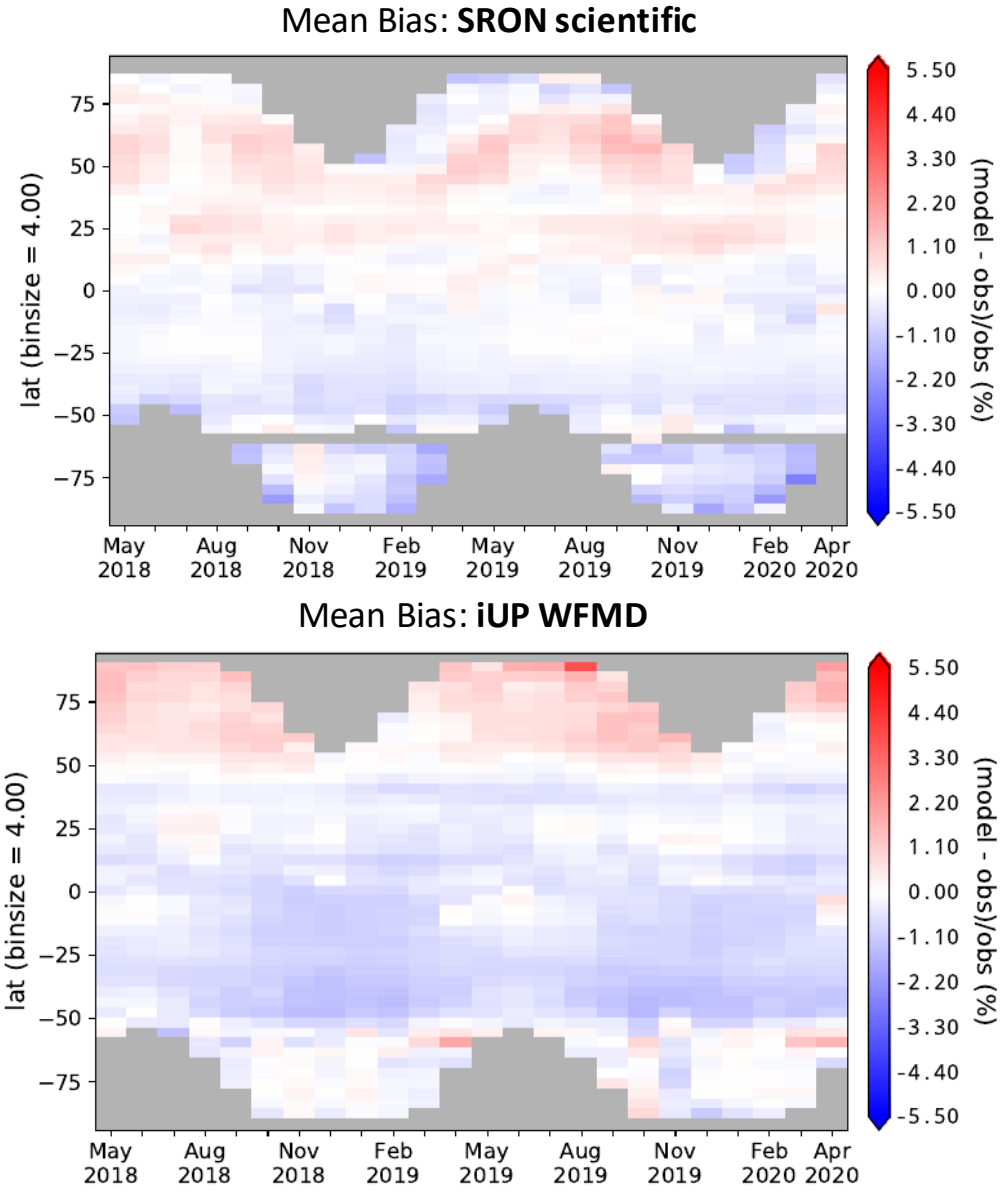



- Surface albedo influences on XCH4 corrected in the retrieval (Lorente et al, 2020)
- Regional varying influences remain
- SRON: Modified version of the polynomial to fit the spectral continuum has improved the retrieval

Barré et al, ACP, 2021

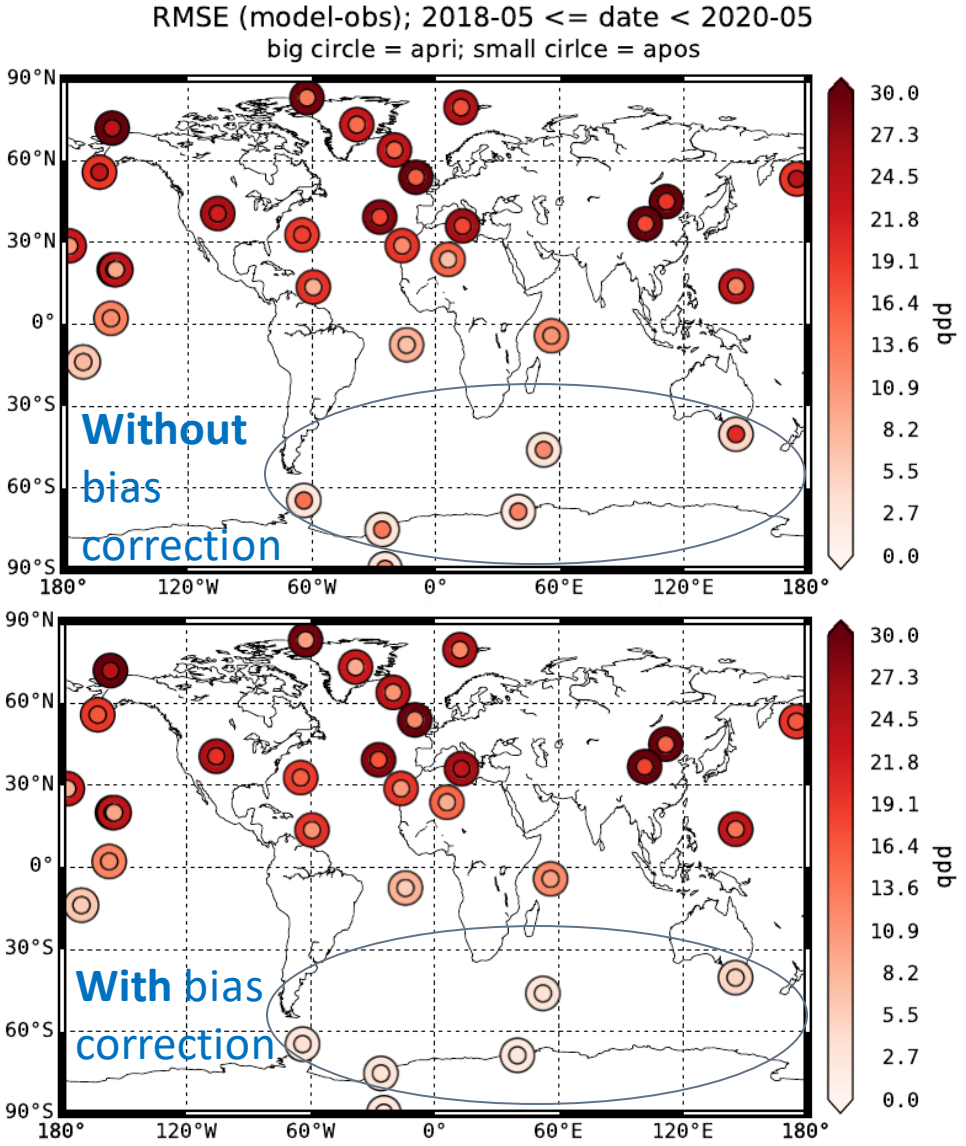
# TM5 4DVAR IMPLEMENTATION

- Latitudinal bias between TROPOMI and TM5-4DVAR optimized using surface measurements
- Known problem in offline models (treatment of stratospheric $CH_4$)
- But looks different for different retrievals also …



# TROPOMI INVERSION VALIDATION

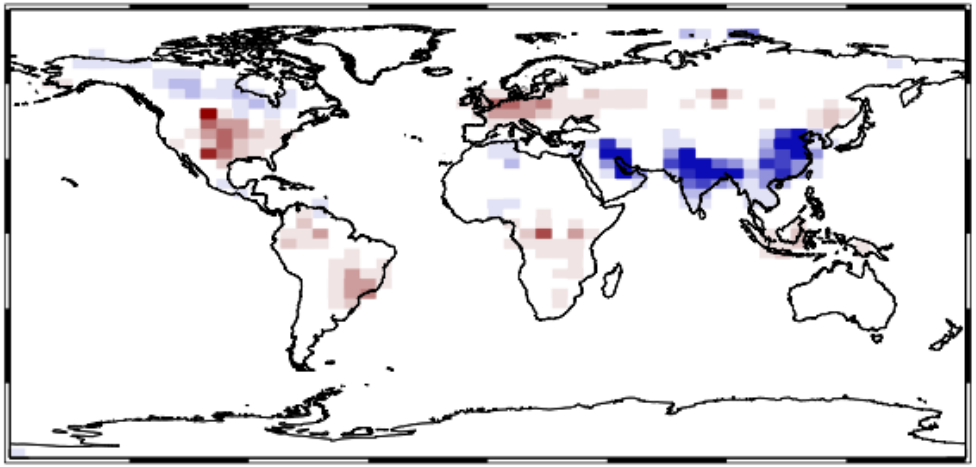
- Latitudinal bias correction improves the fit to independent surface data
- Visible mostly in the Southern Hemisphere



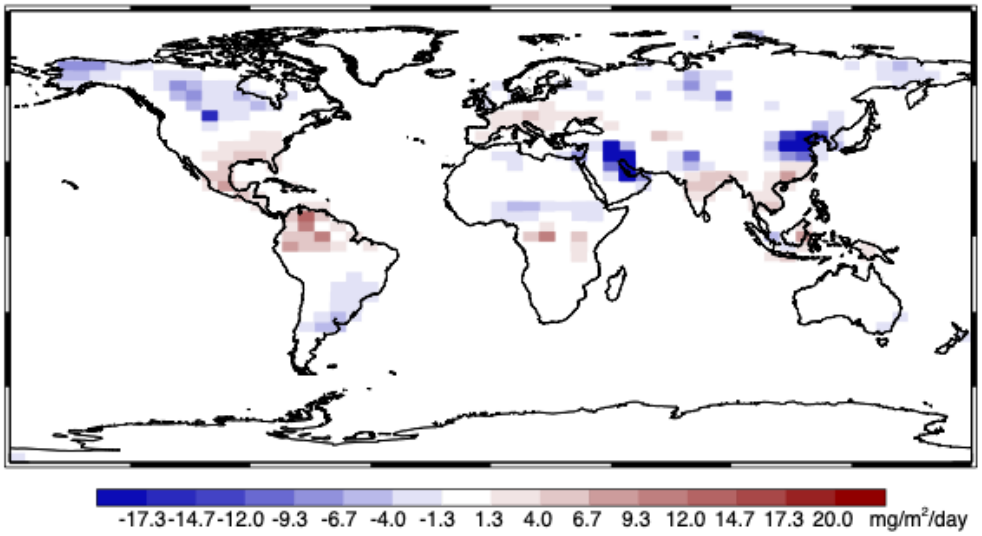
# $CH_4$ FLUXES; POSTERIOR - PRIOR

- Inversions tends to reduce emissions substantially over Southeast Asia
- But less so using satellite data
- Adjustments over EU and US also less using TROPOMI

Surface data (mean 2019 – 2020)



TROPOMI SRON Scientific (mean 2019 – 2020)



# 2020 - 2019 FLUX DIFFERENCE

- Surface inversion follows largely the a priori pattern of emission change
- TROPOMI inversion shows a strong change in the Tropics

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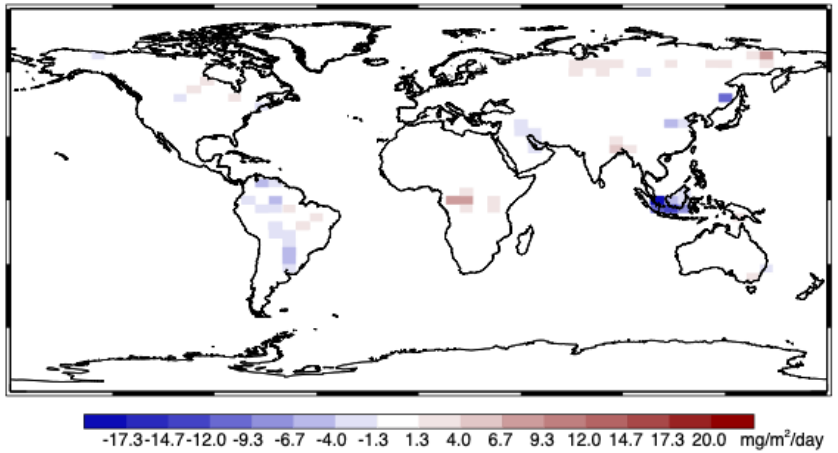
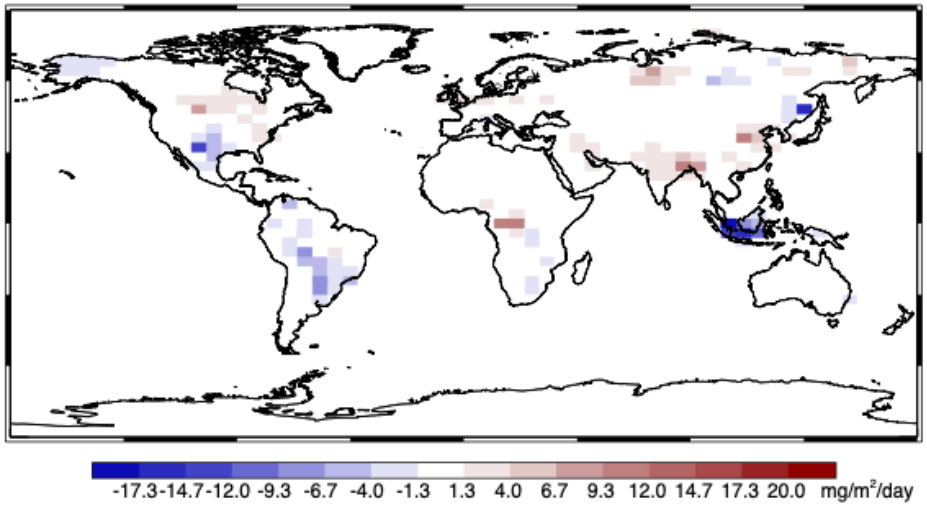
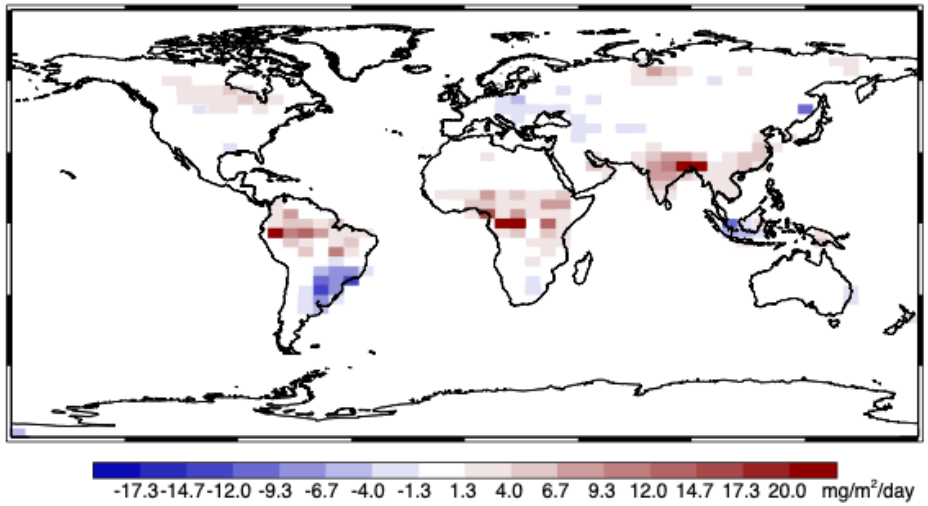



2020 - 2019

Surface data




TROPOMI SRON Scientific



# SUMMARY

- In VERIFY WP4 we implemented TROPOMI in TM5-4DVAR
- TROPOMI data look consistent with GOSAT (wrt bias correction), except for surface albedo dependence (work in progress)
- Inversion results using TROPOMI show the most important differences with the use of surface data in the Tropics
- The origin of the $CH_4$ increase between 2019 and 2020 is put largely in the Tropics (preliminary results for the full year of 2020!)

# Thank you for your attention.

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