First methane retrievals and hotspot identification with TROPOMI

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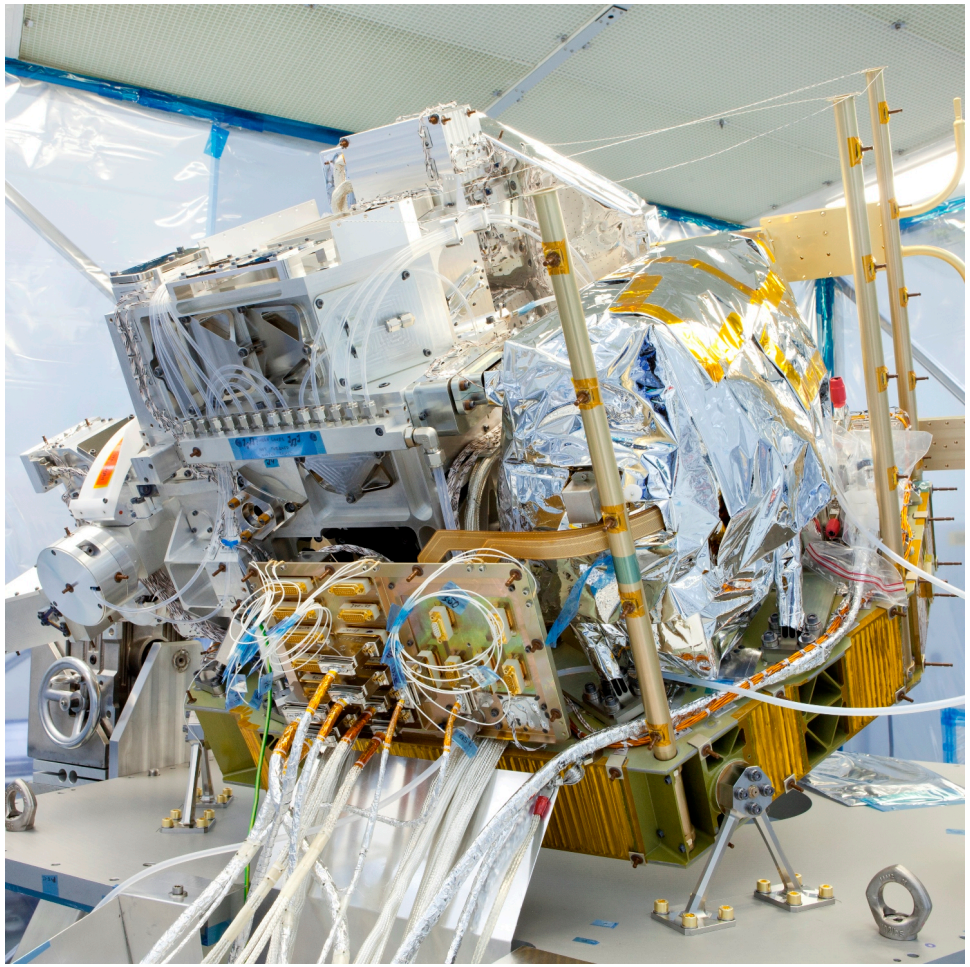
SRON

Netherlands Institute for Space Research

Netherlands Organisation for Scientific Research (NWO)

TROPOMI Instrument

Assembled TROPOMI instrument



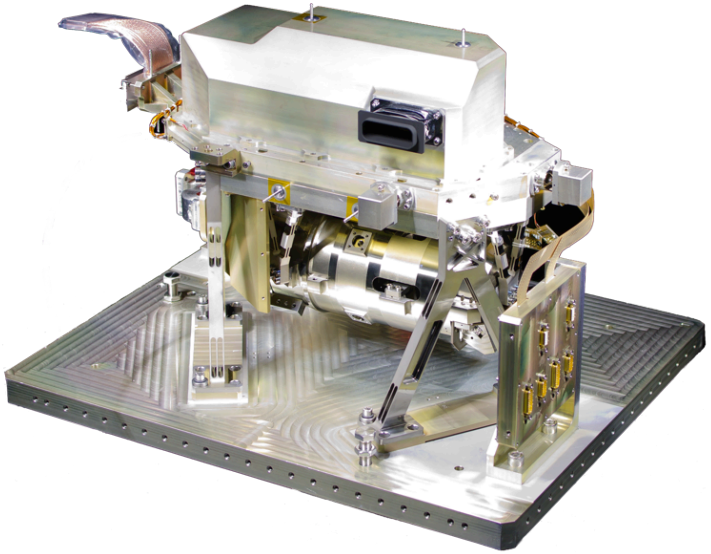
SWIR channel

band: 2305-2385 nm

resolution: 0.25 nm

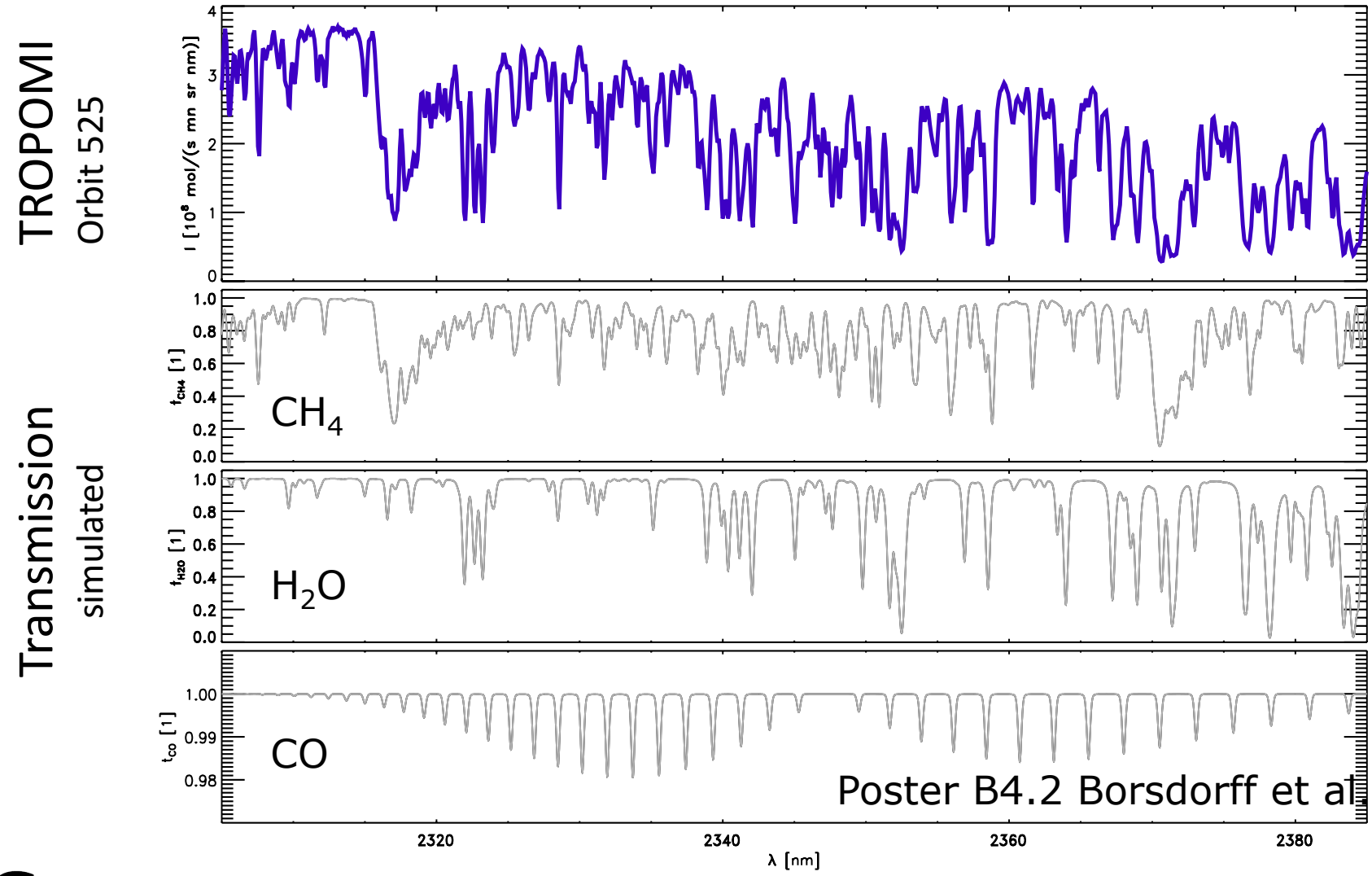
sampling at sub-satellite point: 7x7 km^2

Very stable SWIR performance and instrument in excellent condition.



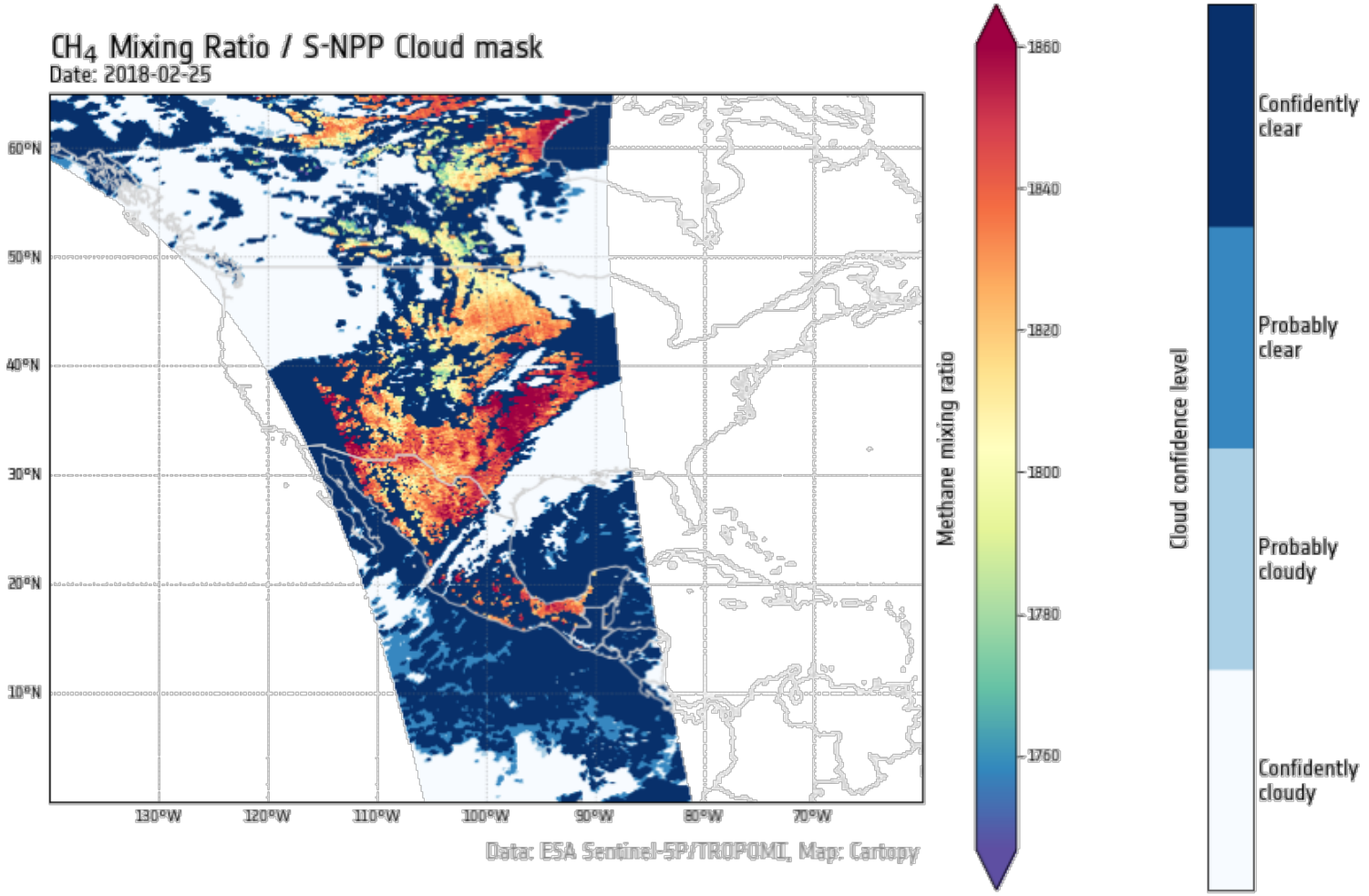
https://www.sron.nl/tropomi-swir-monitoring

Measured Spectrum (November 2017)



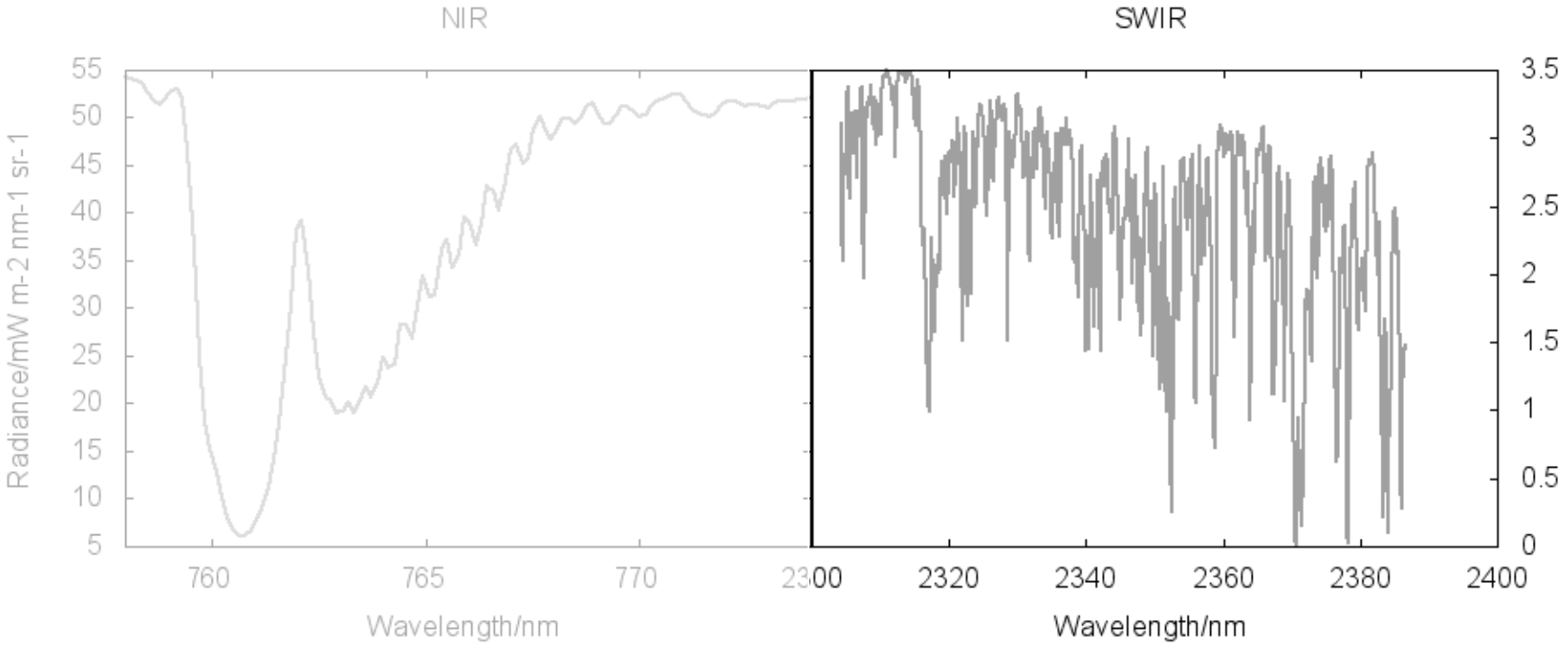
S5P - Suomi NPP loose formation

- Time difference within ≦5 min
- VIIRS data are used as cloud filter, TROPOMI requires 'confidently clear-sky' observations.



Methane Retrieval Concept

SWIR and SWIR+NIR processing options

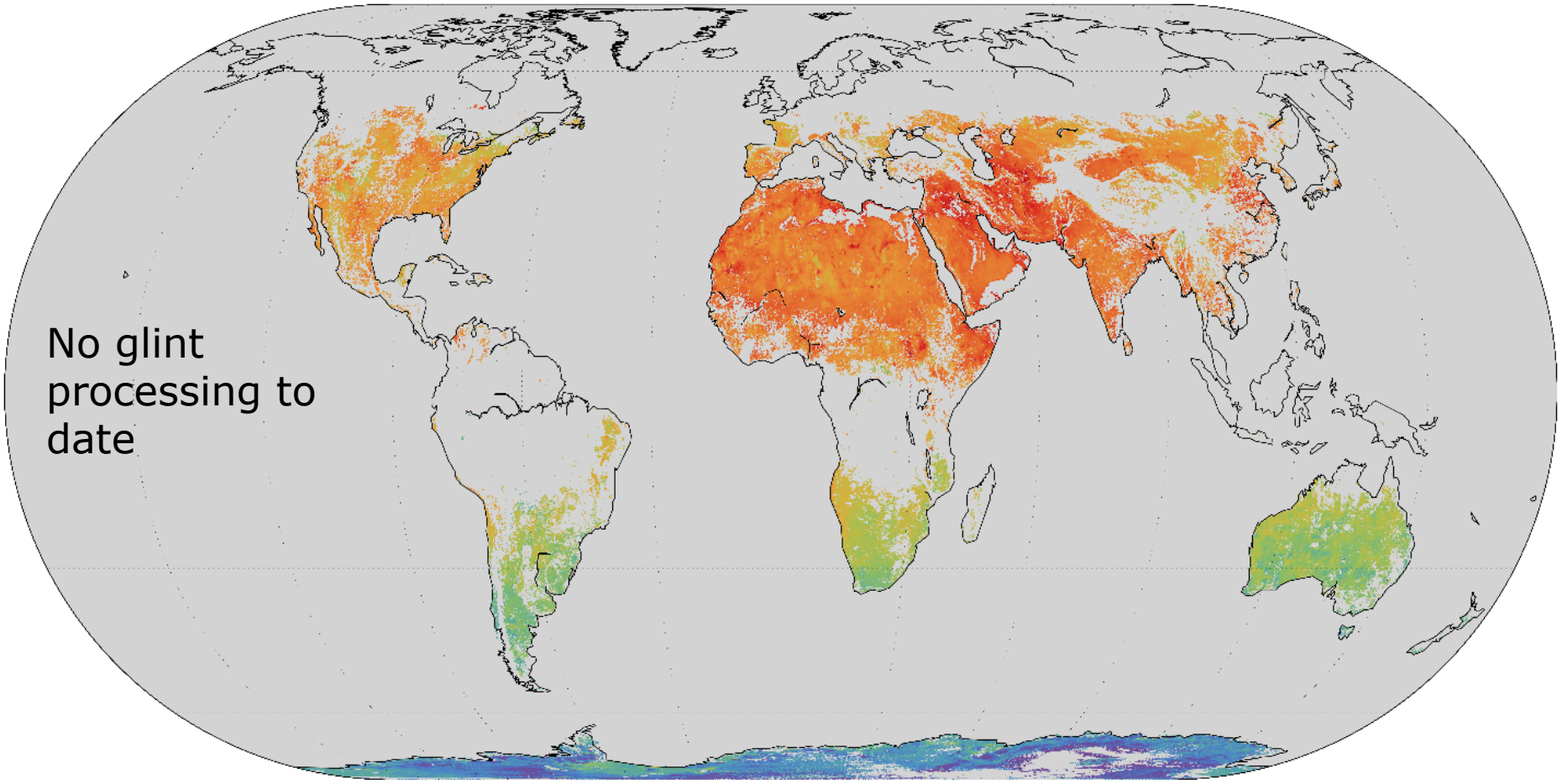


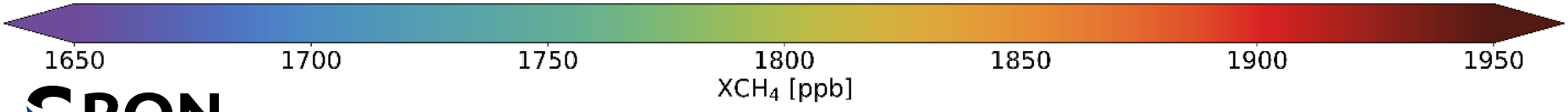
Currently, the NIR does not add significant information to the SWIR one-band retrieval. All presented results for one-band approach.

SRON Single band retrieval applied to OCO-2 data ⇒Poster A2.7 Hu et al.

Methane TROPOMI (not bias corrected)

November 12th to December 30th, 2017





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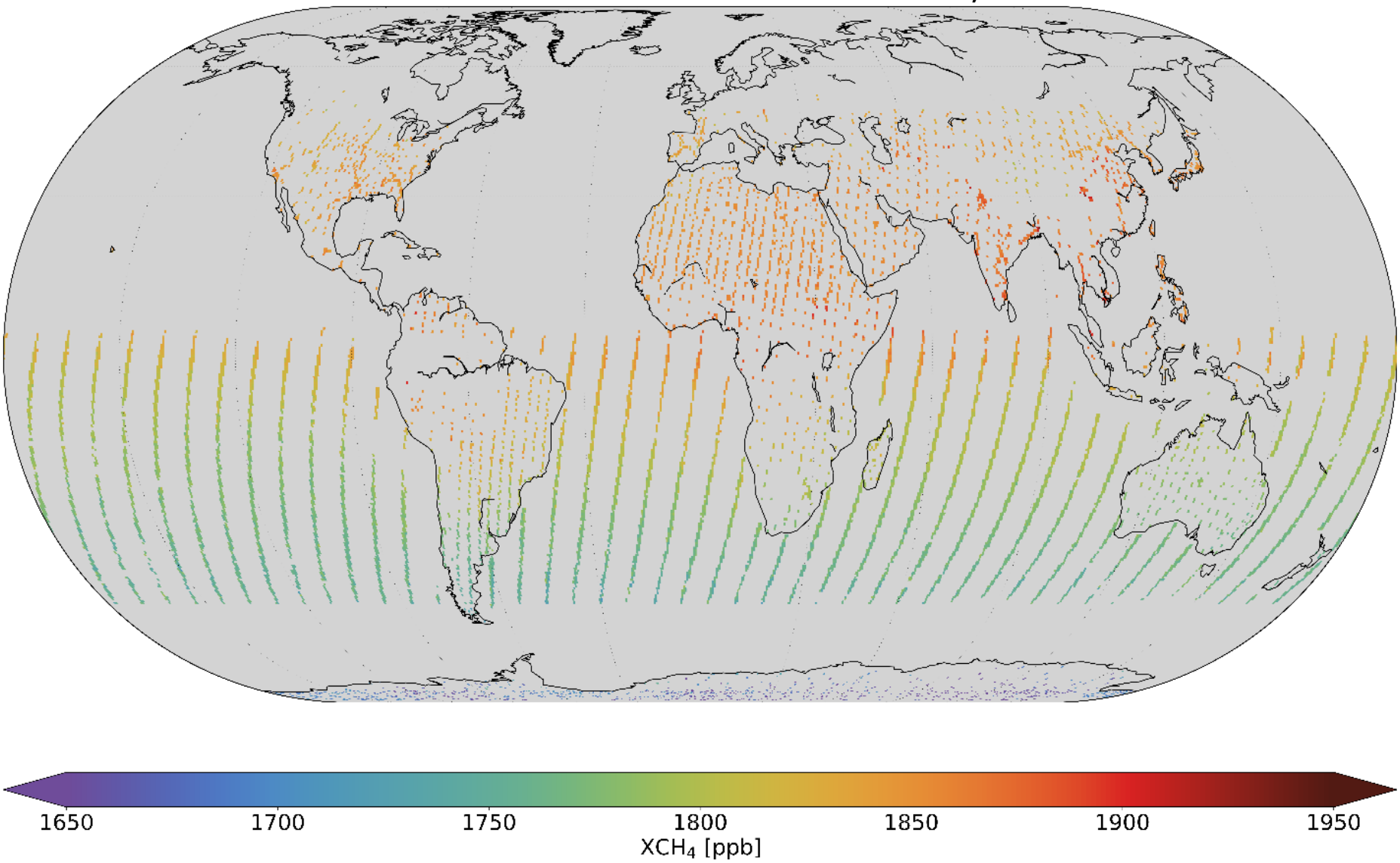
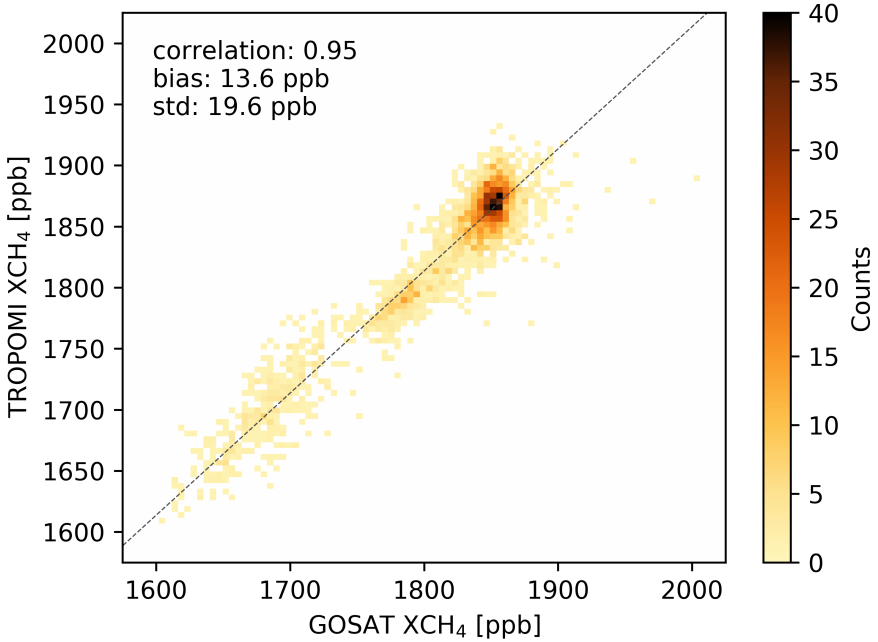
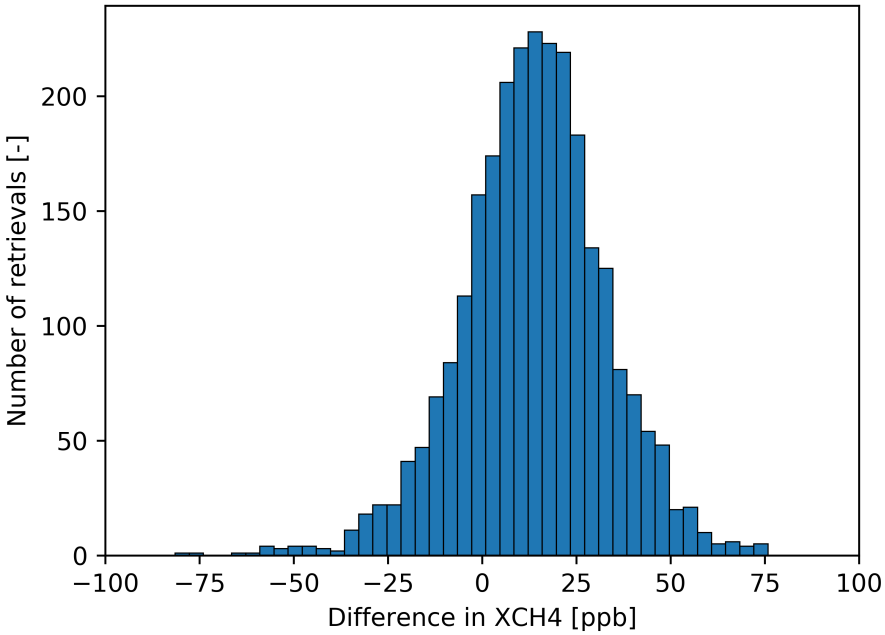
Methane GOSAT (proxy, bias corrected)

November 12th to December 30th, 2017



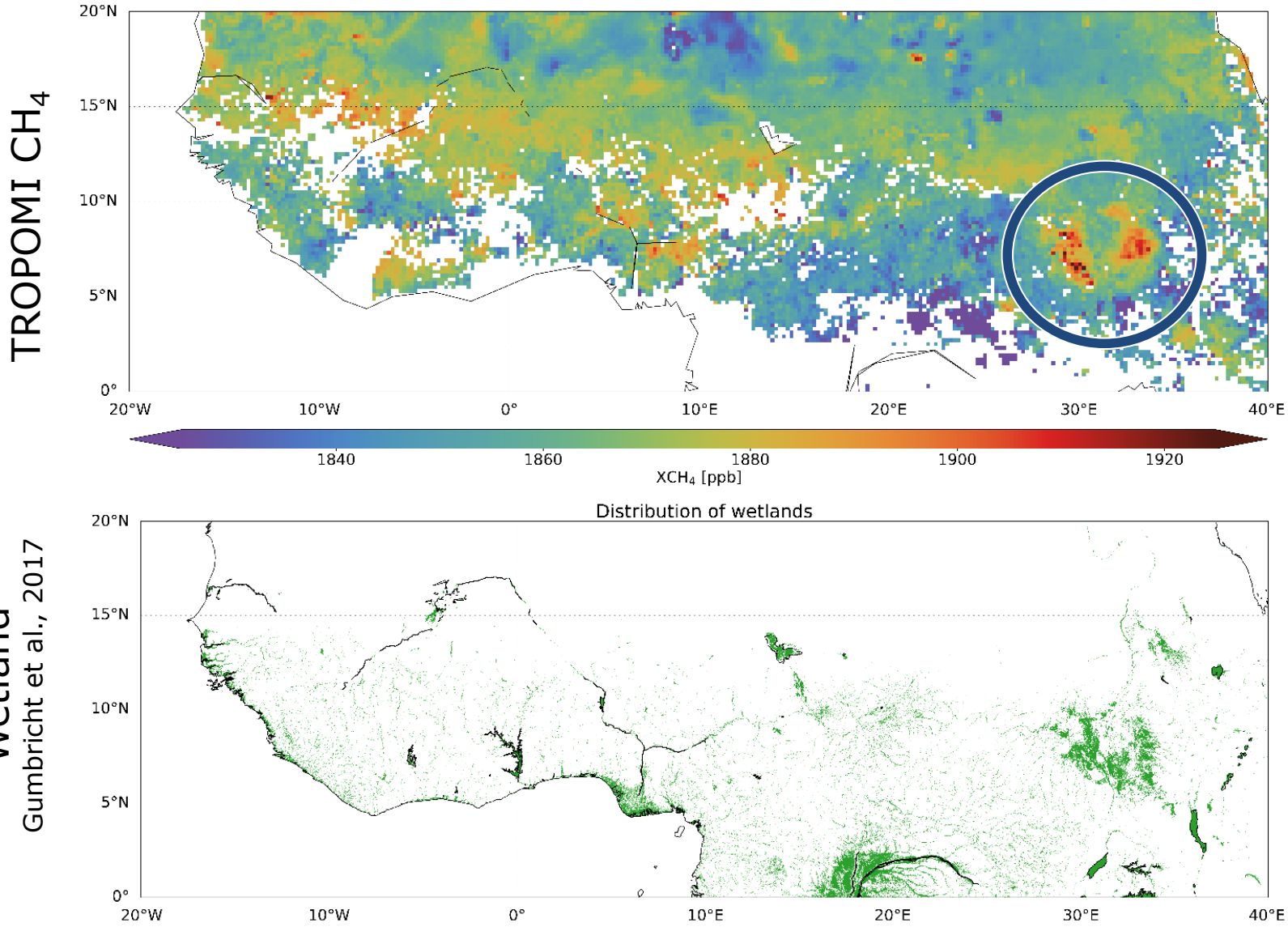
Methane: TROPOMI-GOSAT comparison





- GOSAT dataset bias-corrected, remaining bias of -6.6 ppb and a standard deviation of 15.5 ppb with respect to TCCON.
- A comparison with the GOSAT CH_4 proxy product shows good agreement with a bias of 13.6 ppb, standard deviation of 19.6 ppb

AFRICA wetlands



Methane Anomaly - US

- Discretize TROPOMI XCH_4 field on a 0.1x0.1º lat./lon. grid
- Consider region with radius of 1000 km for each grid point
- Elevation correction with respect to lowest point
- Subtract XCH_4 regional mean to get CH_4 anomaly for each grid point

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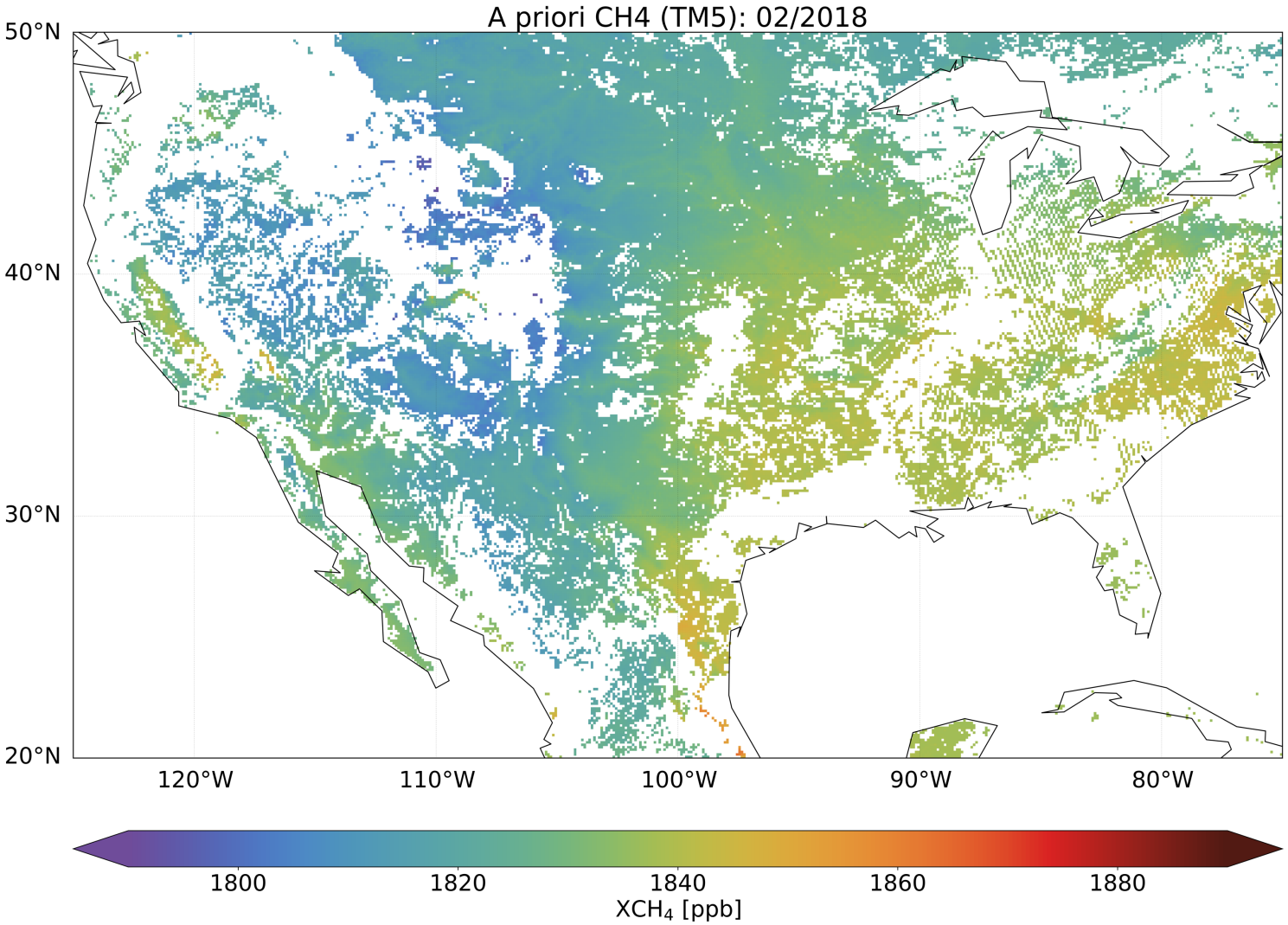
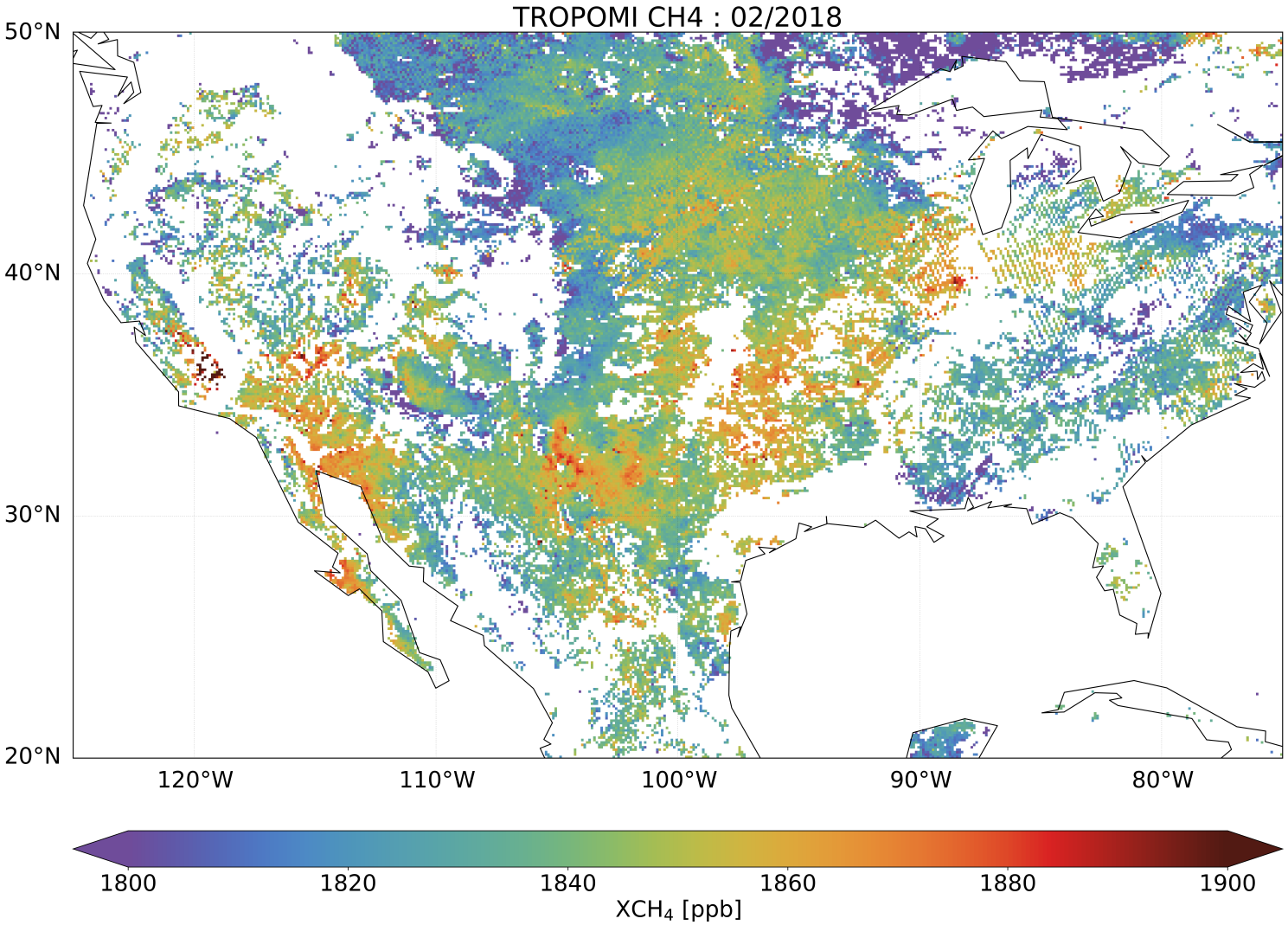
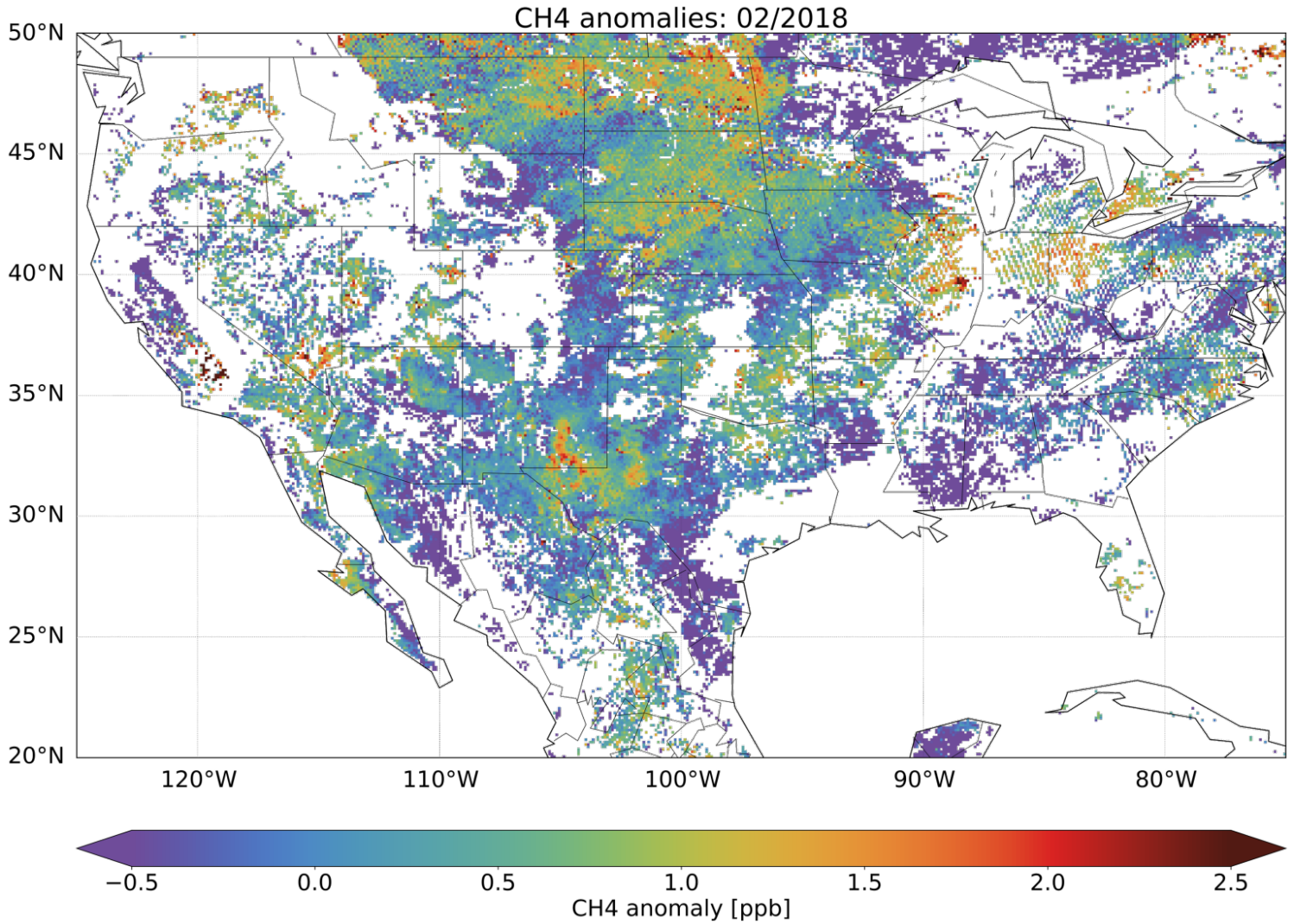
A priori (TM5)


A priori CH4 (TM5): 02/2018
50°N
40°N
30°N
20°N
120°W
110°W
100°W
90°W
80°W
1800
1820
1840
1860
1880
XCH4 [ppb]

A priori (TM5)→TROPOMI XCH_4



A priori (TM5)→TROPOMI XCH_4→CH_4 Anomaly



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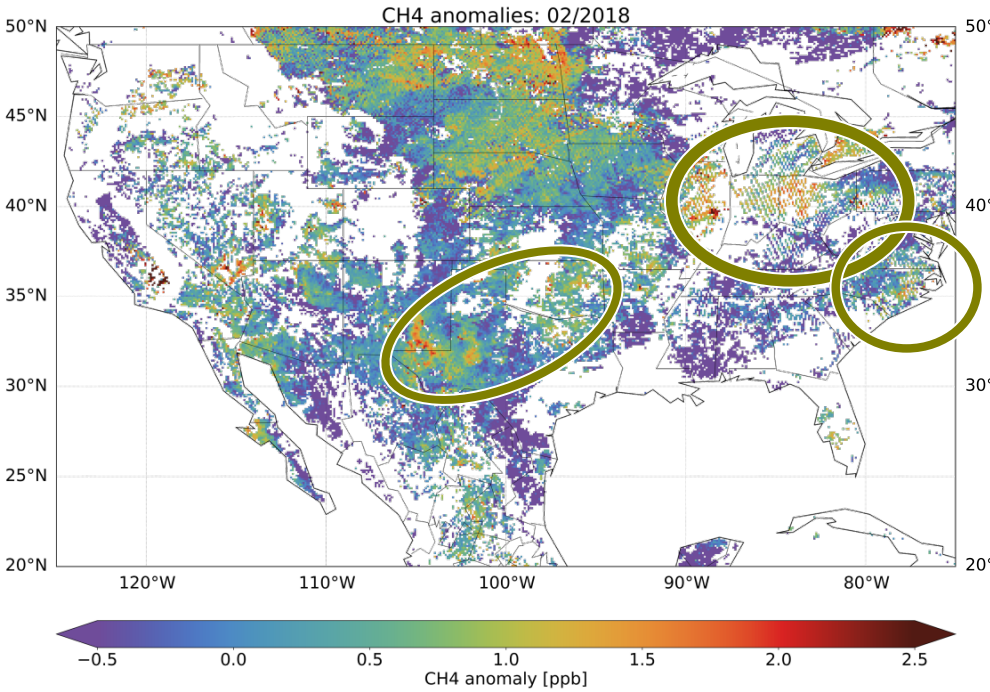
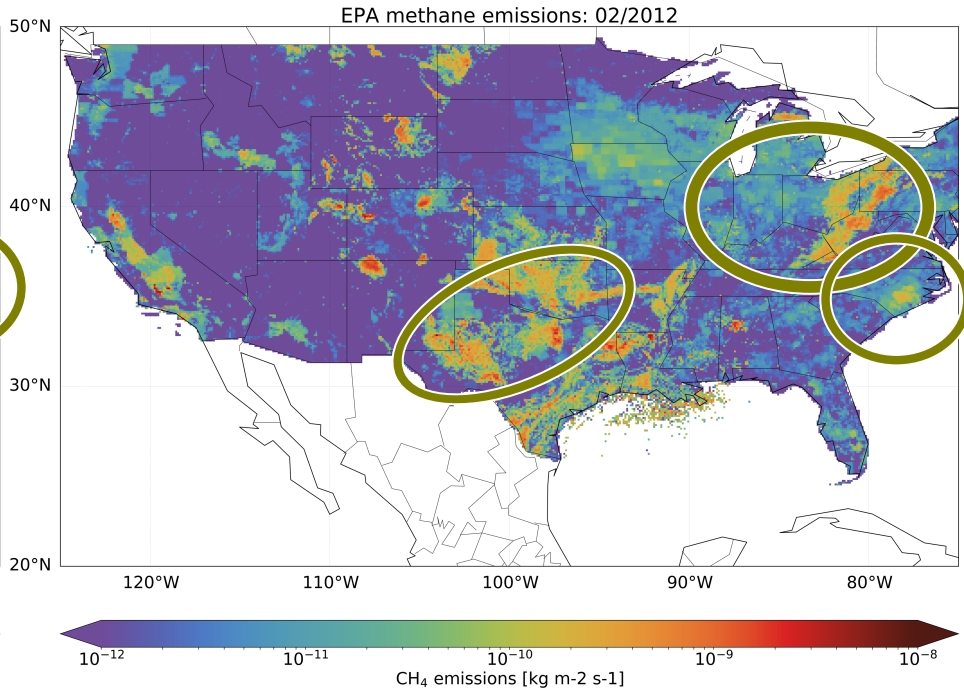
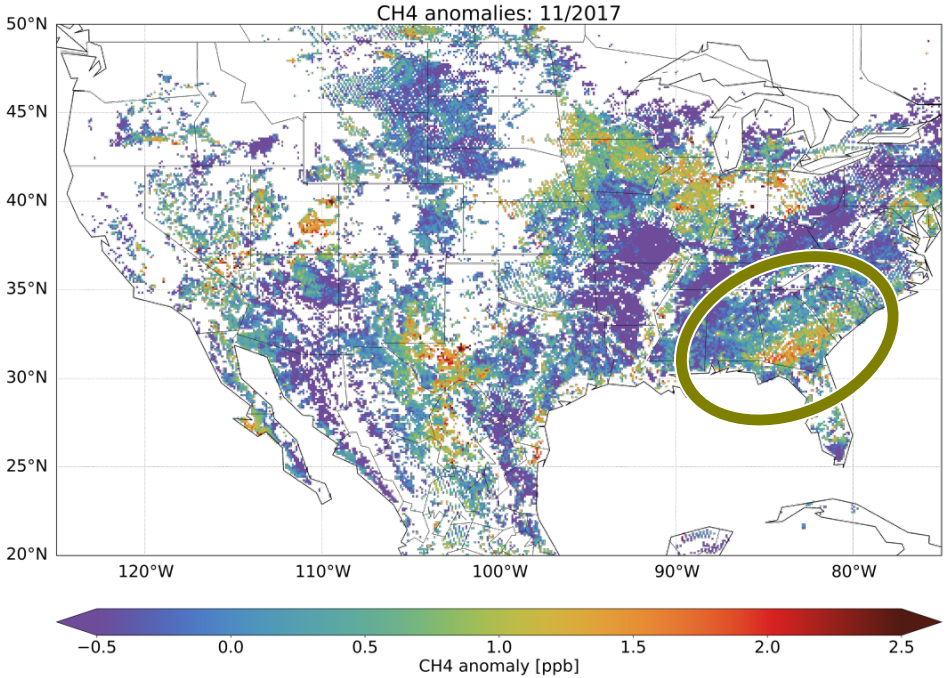
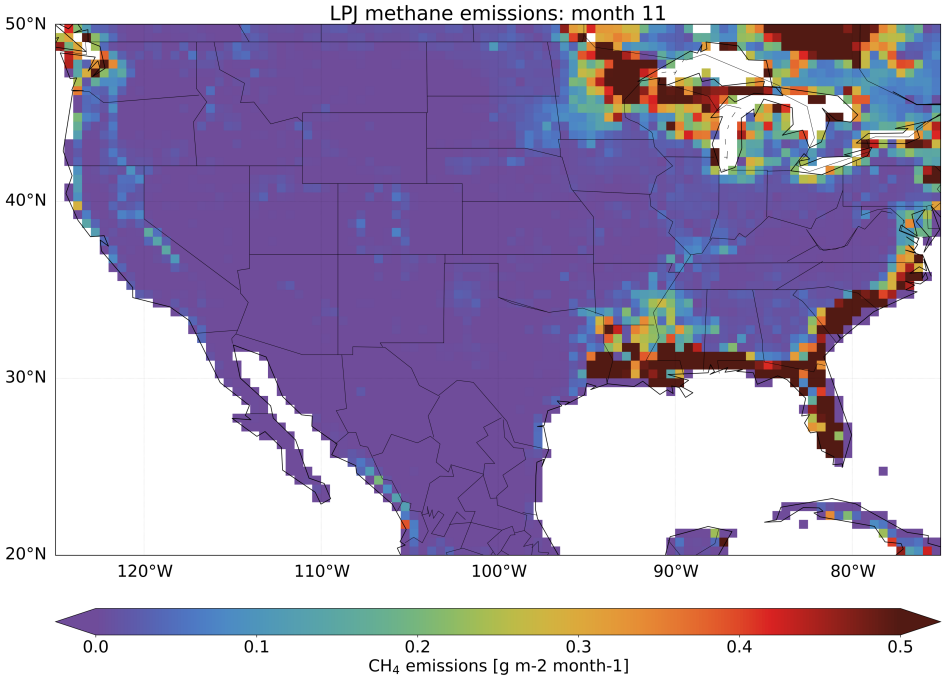
Comparison: Anomaly ↔EPA emissions





Comparison: Anomaly ↔LPJ wetland emissions





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CONCLUSIONS

- CH_4 TROPOMI-GOSAT comparison suggests similar quality of the data
- TROPOMI measures 'hot-spots' due to wetland emissions.
- XCH_4 anomaly over the US shows clear evidence for CH_4 enhancement due to anthropogenic and wetland emissions.

Future activities:

- New Spectroscopy, activity ongoing
- Validation with TCCON ground-based observations
- NIR stray light under investigation to improve data quality.

➢ *Hu et al., GRL, doi 10.1002/2018GL077259, 2018*

Disclaimer: The presented work has been performed in the frame of the Sentinel-5 Precursor Validation Team (S5PVT) or Level 1/Level 2 Product Working Group activities. Results are based on preliminary (not fully calibrated/validated) Sentinel-5 Precursor data that will still change.
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