Global XCO_2 retrievals from TanSat: A detailed intercomparison between UoL-FP and IAPCAS

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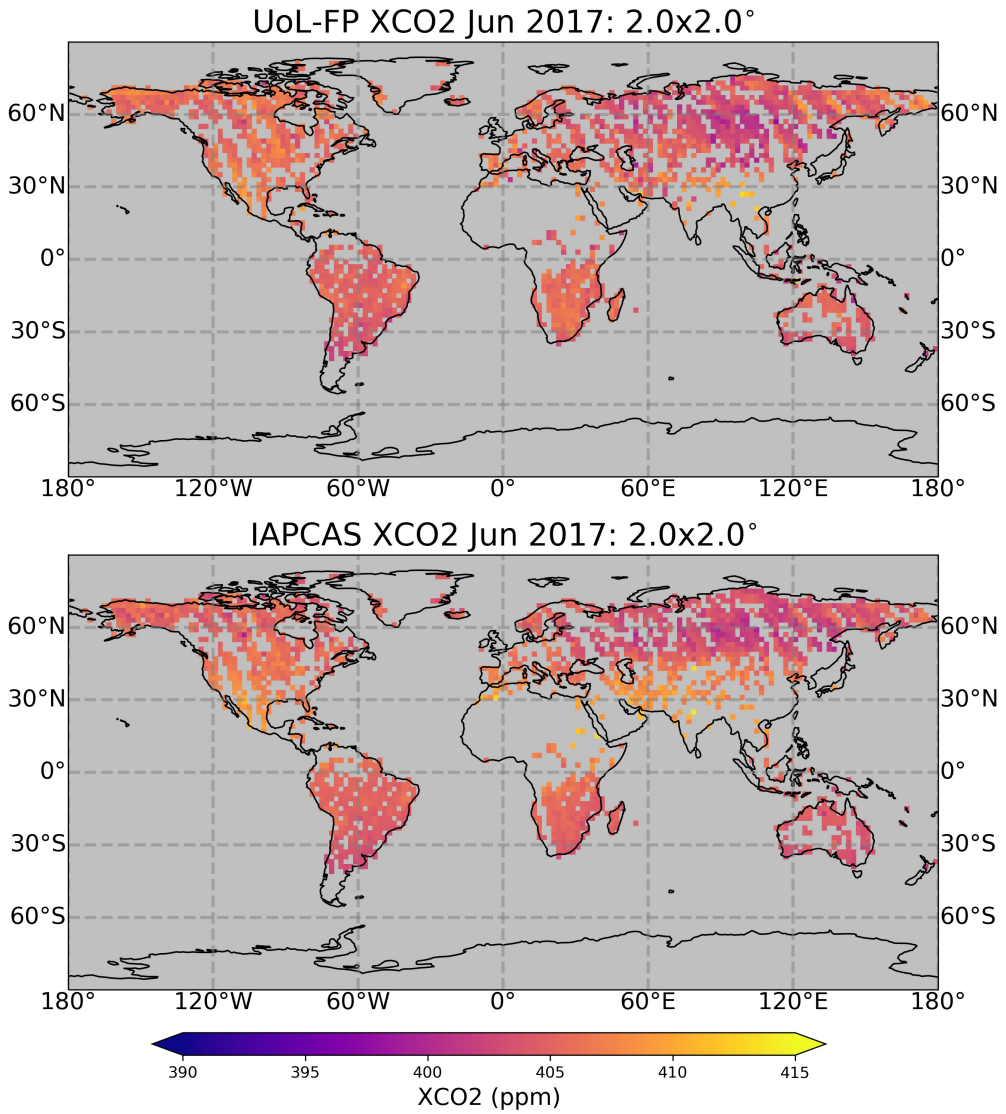

Global XCO_2 products have now been generated for UoL-FP, allowing us to compare to the global products from IAPCAS.

Why compare retrievals from two algorithms and the filters used?

- Provides a means of benchmarking XCO_2 retrievals
- Algorithm performance check
- Sensitivity of retrieved quantities to input physics

In this poster, we will provide an overview of comparisons between TanSat retrievals as processed by UoL-FP/IAPCAS.

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The TanSat observatory and data products

TanSat Product Specification	
Launch date	21st Dec 2016
Data span	1st Mar 2017 – 25th May 2018
Footprint	2x2km
Swath	18km
Orbital Altitude	700km
Bands	O_2A, CO_2 Weak, CO_2 Strong (not used)
Product	XCO_2
Precision	1-4ppm
Product level	Level 2

- UoL-FP algorithm is used to process the entire TanSat dataset spanning 1st Mar 2017 – 25th May 2018 (land only).
- The data products have been produced as part of the ESA CCI+ project.
- L1 data products available at https://fy4.nsmc.org.cn/data/en/code/TANSAT.html
- L2 data products for colocated observations over TCCON sites, and global data for Jun/Aug 2017 available at https://climate.esa.int/en/projects/ghgs/Data/

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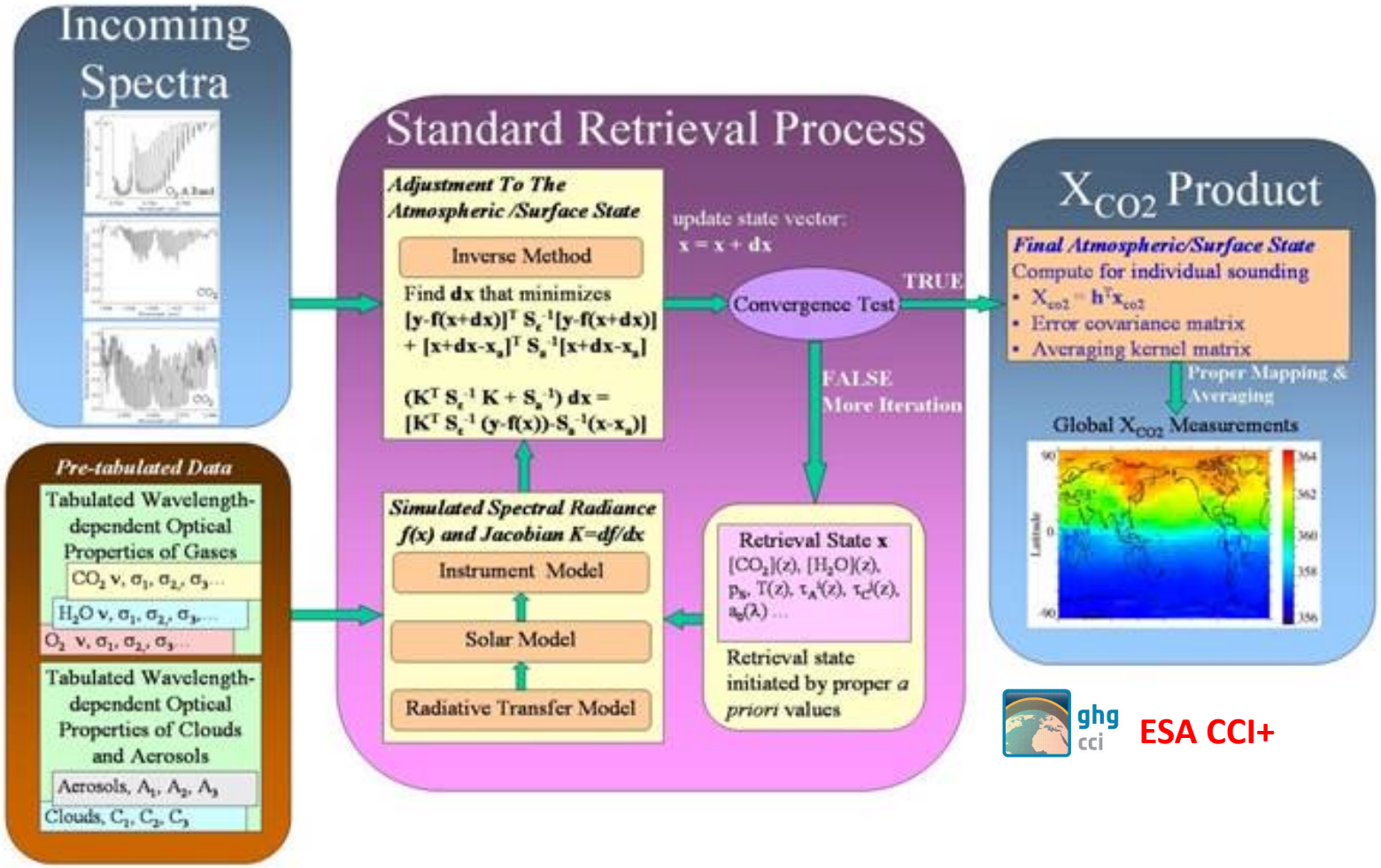
UoL-FP Retrieval Algorithm



- Algorithm originally developed for processing OCO retrievals using the optimal estimation method, and radiative transfer scheme LIDORT, with aerosol information taken from CAMS.
- Adapted to process TanSat retrievals, UoL-FP uses O_2A and weak CO_2 bands only as there are calibration issues with the strong CO_2 band.
- Algorithm performs radiometric corrections using 8th-order Fourier series to improve calibration of operational data*.

*See Yang et al. (2020),

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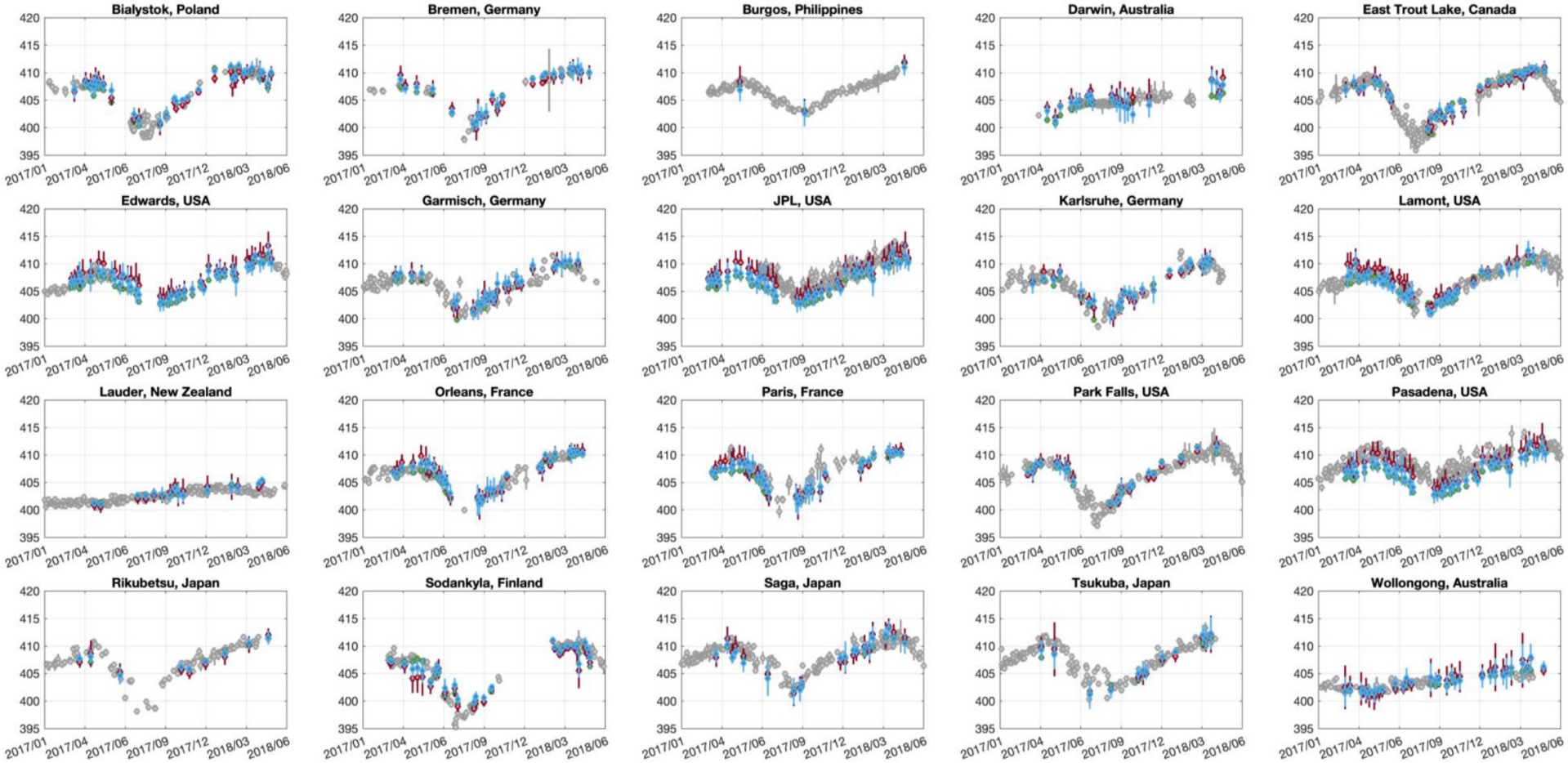
TCCON validation and bias correction



Red – TanSat/IAPCAS
Blue – TanSat/UoL-FP
Grey – TCCON data
Green – CAMS data

Colocation Criterion:

- ±3° of TCCON site
- ±1h of observation time
- $N_{TCCON} > 20$, $N_{TanSat} > 50$

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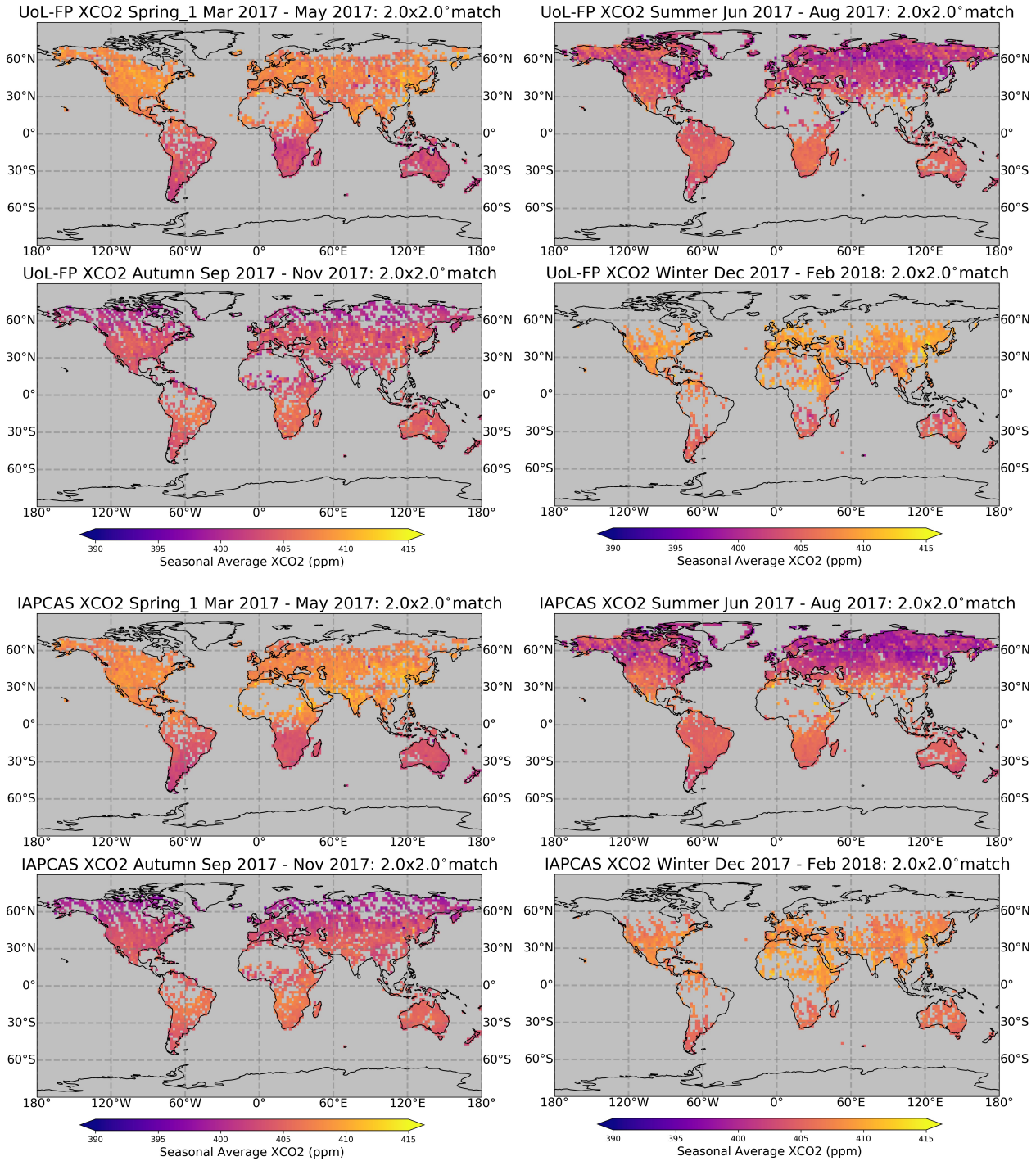

Seasonal plots

- The UoL-FP and IAPCAS products use different quality filters when selecting XCO_2 values to include.
- This results in the UoL-FP data having ~ factor 2 more data points per day than the corresponding IAPCAS dataset.
- Therefore, for this seasonal comparison we match up common soundings in the UoL-FP/IAPCAS datasets.

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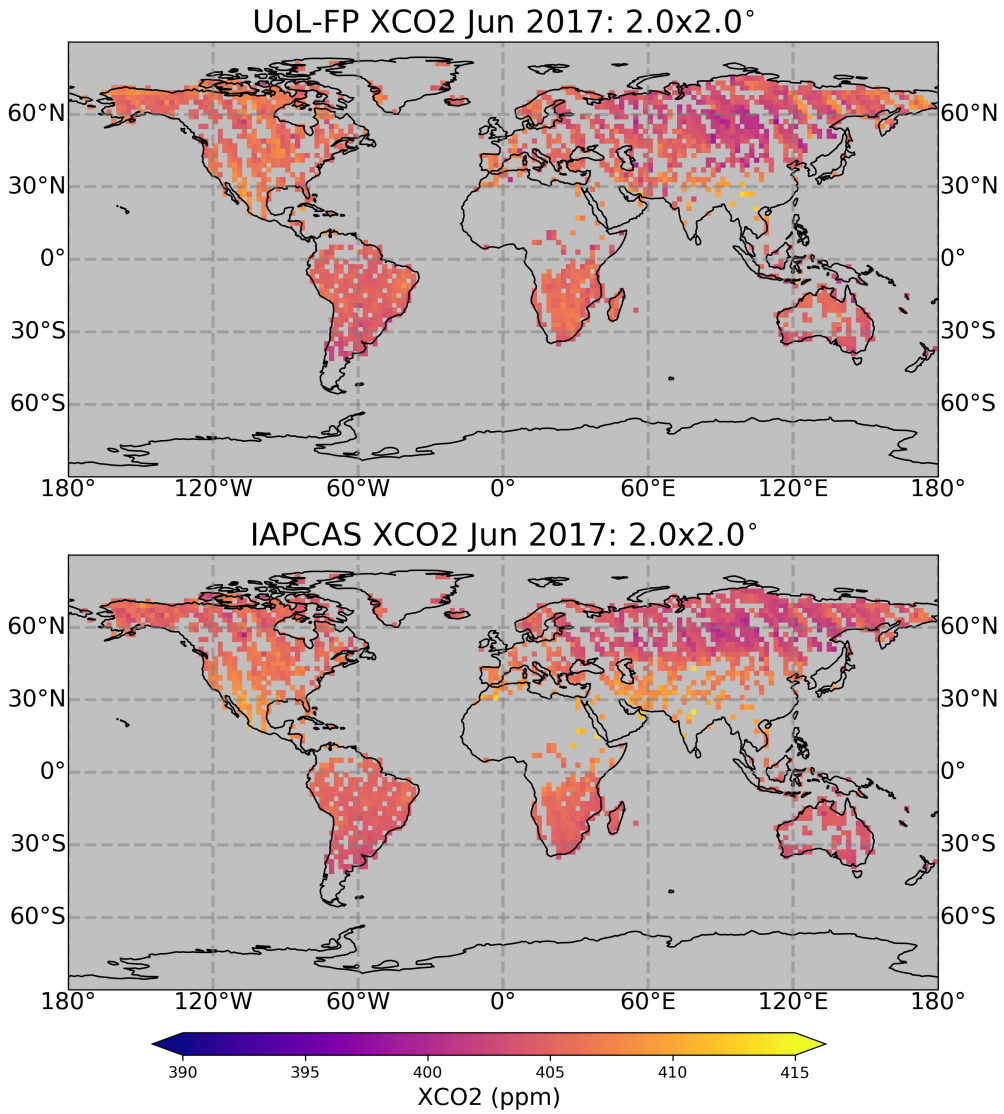
Conclusions/To-do next



Conclusions

- Generally good agreement between retrieved UoL-FP/IAPCAS XCO_2 values.
- Largest differences seen in the tropics where there are no TCCON validation stations.

To-do next:

- Investigation of other bias-correction methods using different truth proxies such as the Small Area Approximation, and model median.
- Reassessment of the UoL-FP quality filters in light of the global data.

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