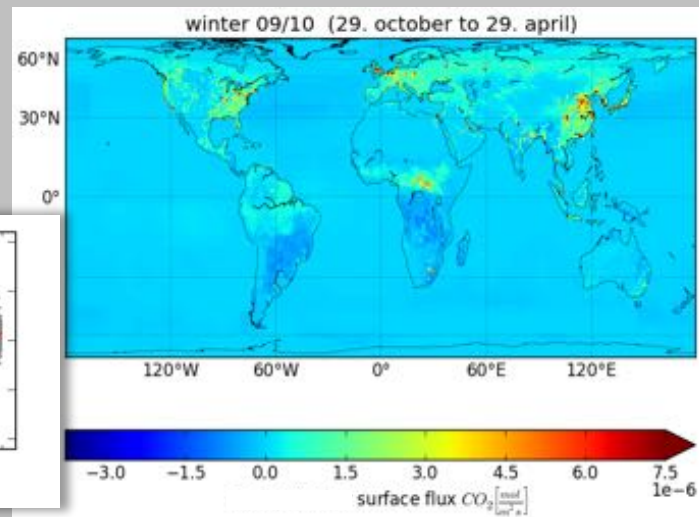
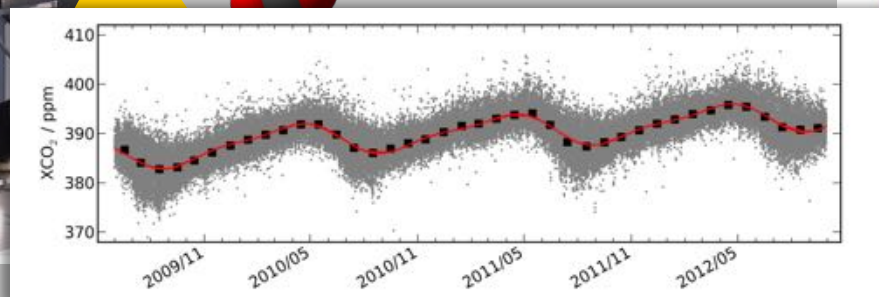
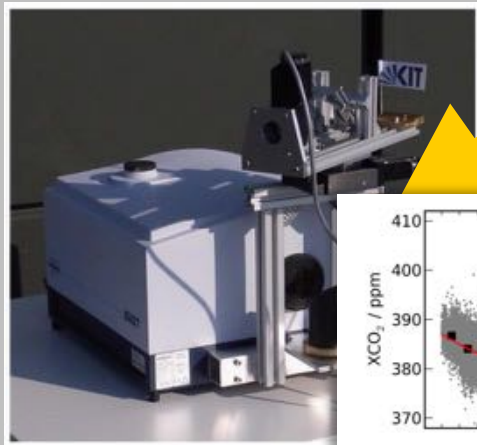
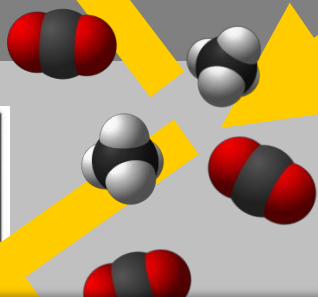


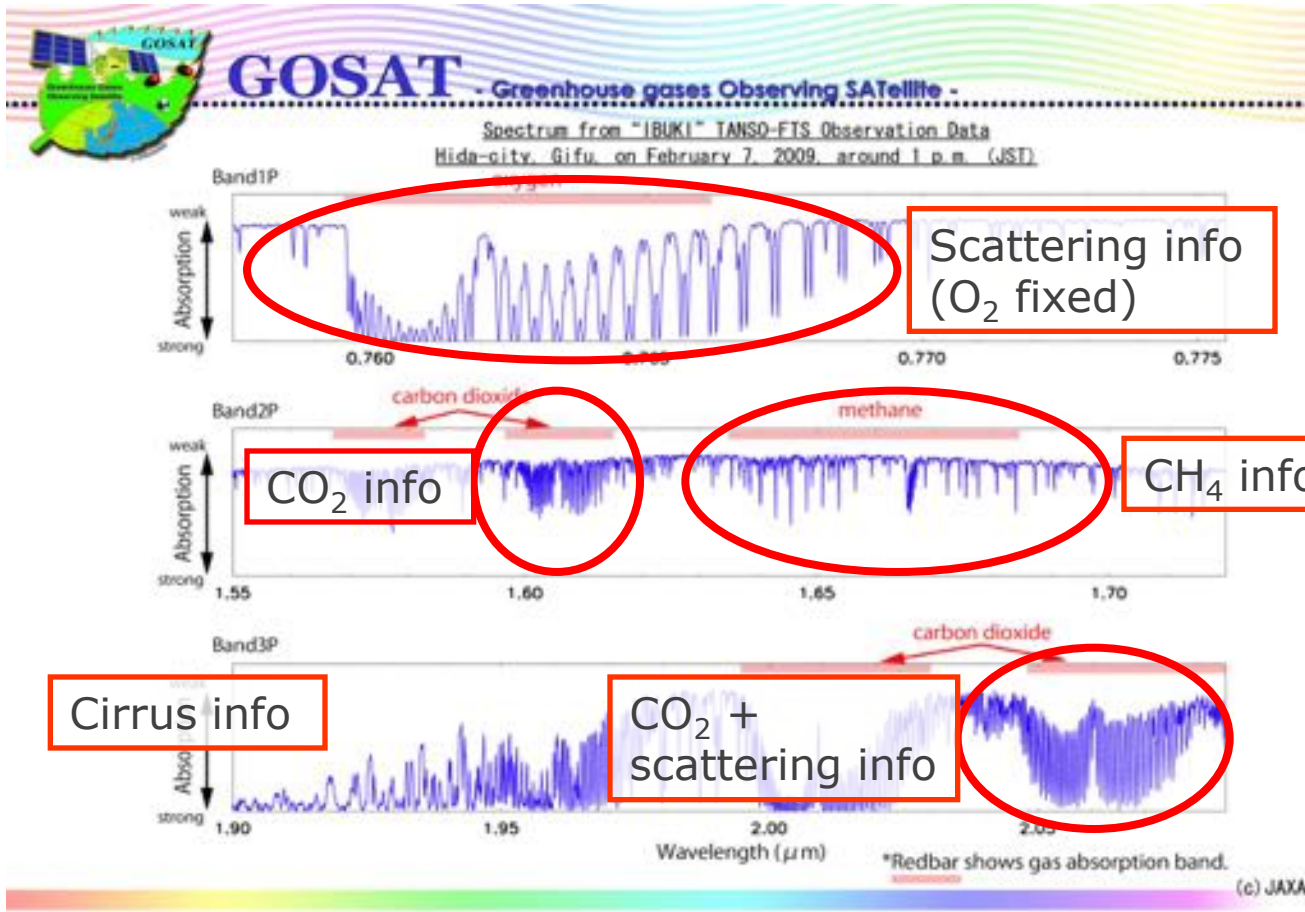
Seasonal carbon uptake as seen from an improved version of RemoTeC

A. Butz, A. Babenhauserheide, M. Bertleff, R. Checa-Garcia, K. Fischerkeller,
P. Hahne, F. Klappenbach, J. Kostinek, K. Stammberger
Karlsruhe Institute of Technology (KIT), IMK-ASF, Karlsruhe, Germany

S. Basu, **S. Guerlet**, R. Detmers, O. Hasekamp, J. Landgraf, S. Houweling
SRON – Netherlands Institute of Space Research, Utrecht, The Netherlands

Data download: ssh_remotec@imkwww1.imk.kit.edu



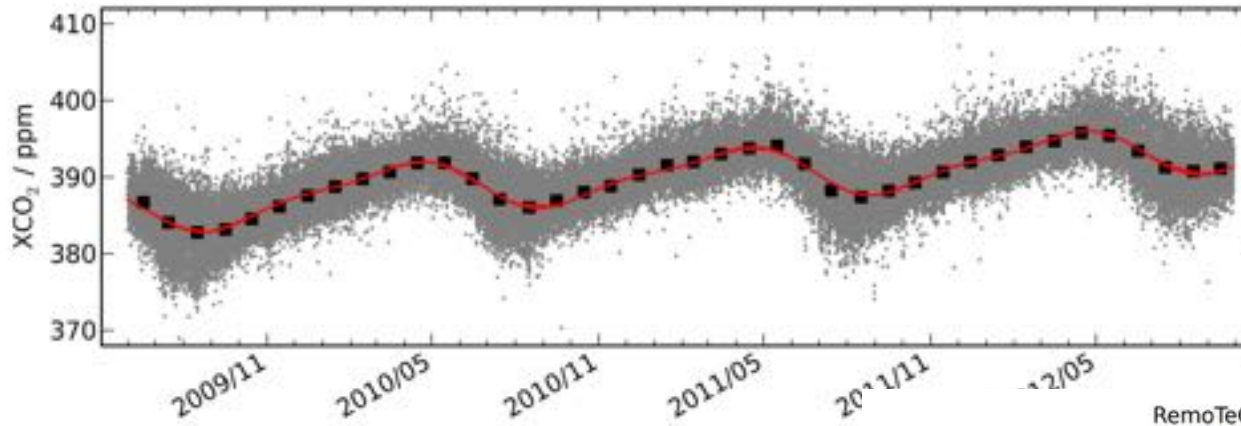


RemoTeC retrieves:

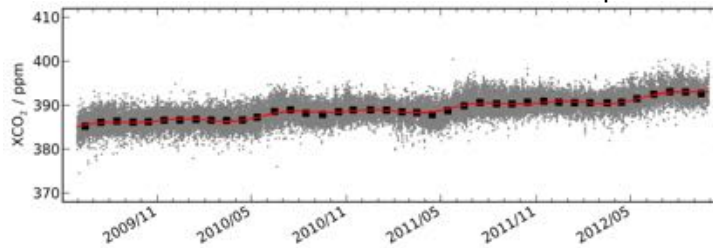
- XCO₂,
- XCH₄,
- Particle amount N_s,
- Particle size a_s,
- Particle height z_s,
- Surface parameters,
- Instrument parameters.

http://www.jaxa.jp/press/2009/02/20090209_ibuki_e.html#at1

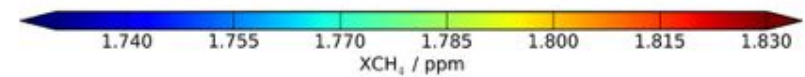
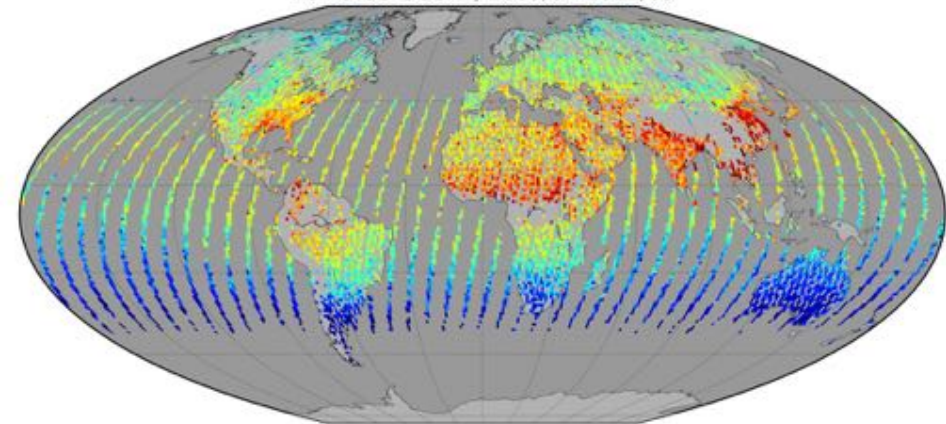
RemoTeC – GOSAT: northern hemisphere



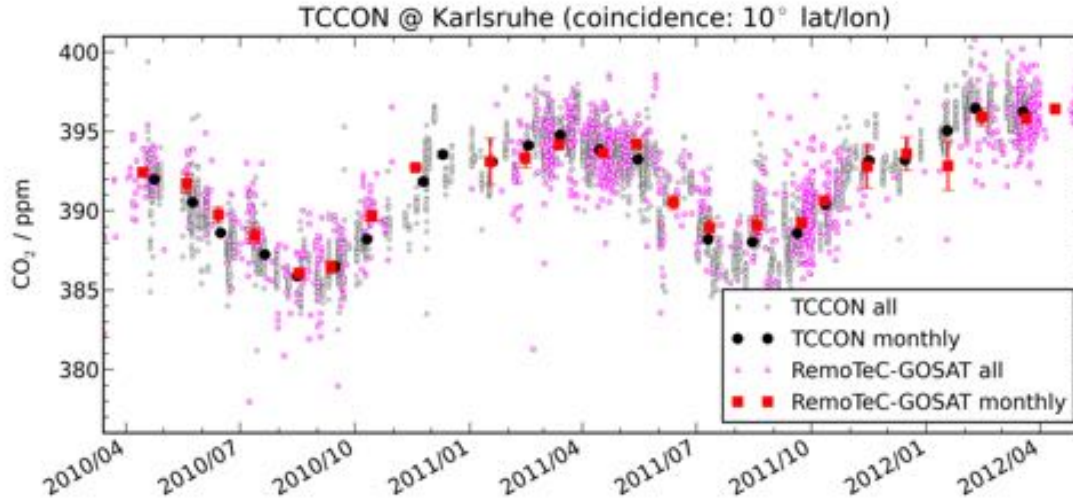
RemoTeC – GOSAT: southern hemisphere



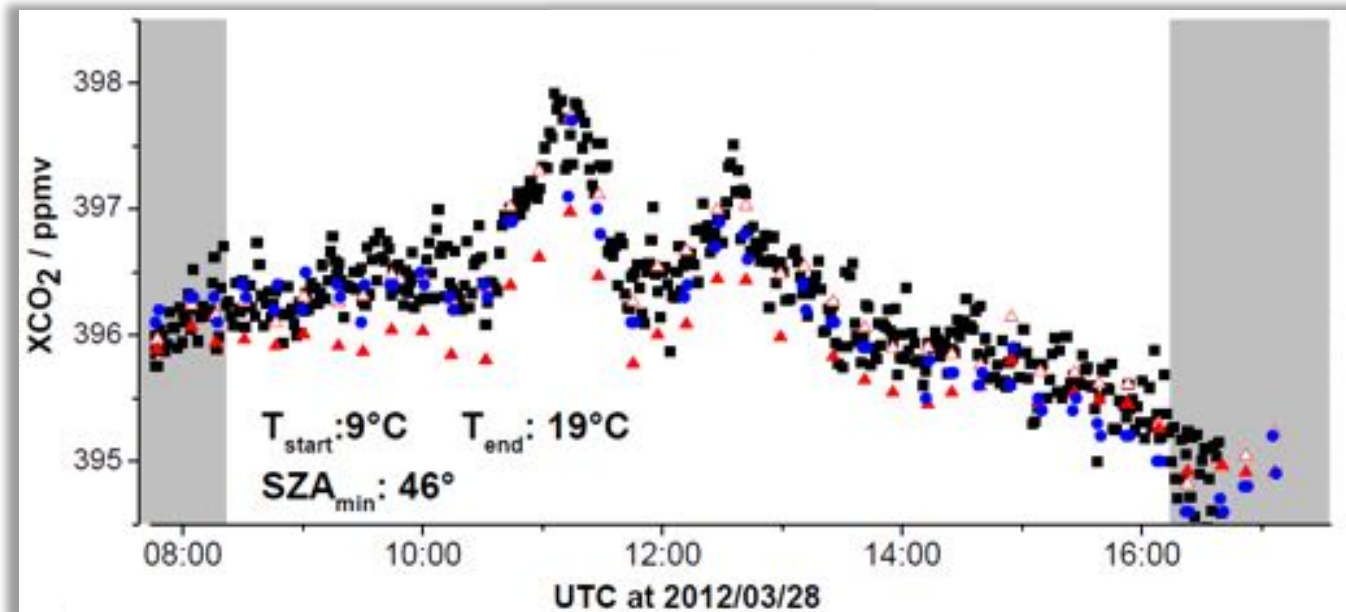
RemoTeC-GOSAT, 2009/04-2012/09



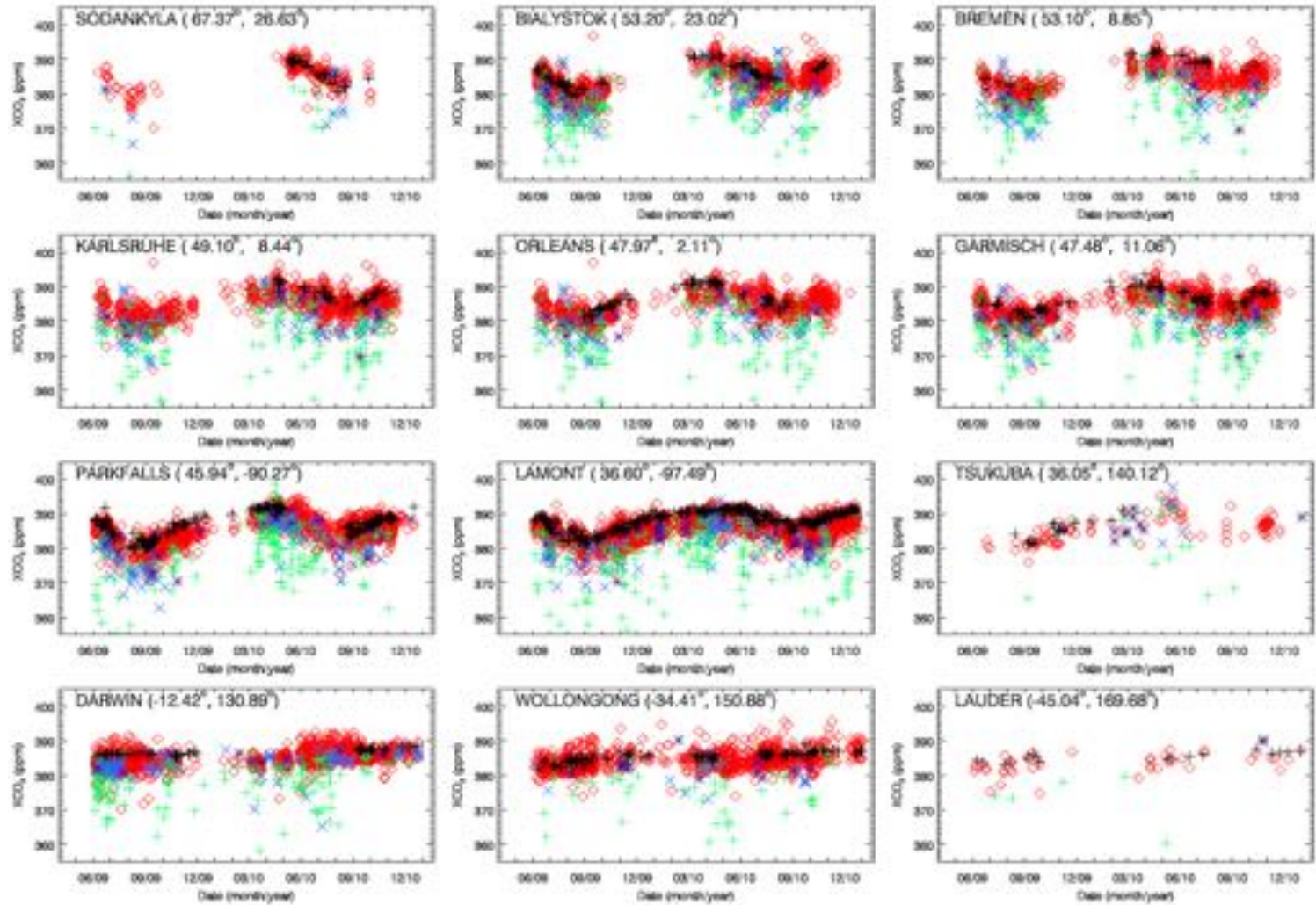
L2 data download: ssh remotec@imkwww1.imk.kit.edu



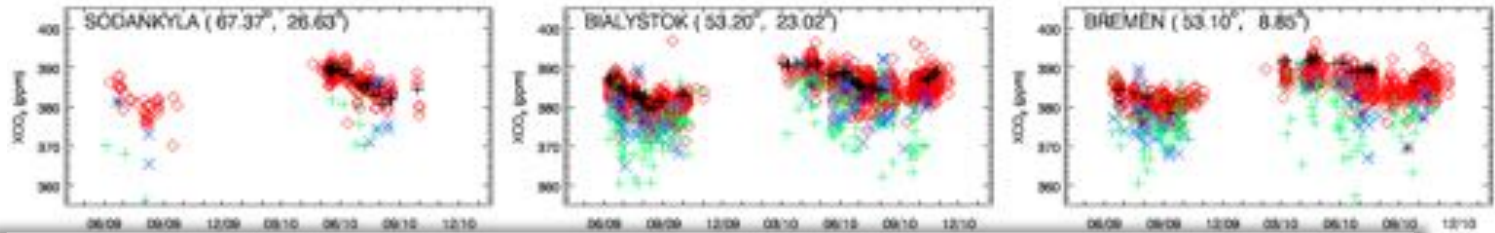
Updated from
Butz et al., GRL, 2011



Gisi et al., AMT, 2012



Guerlet et al., JGR, 2013;



RemoTeC-GOSAT v2.1:

Station-to-station standard deviation of bias wrt. TCCON,

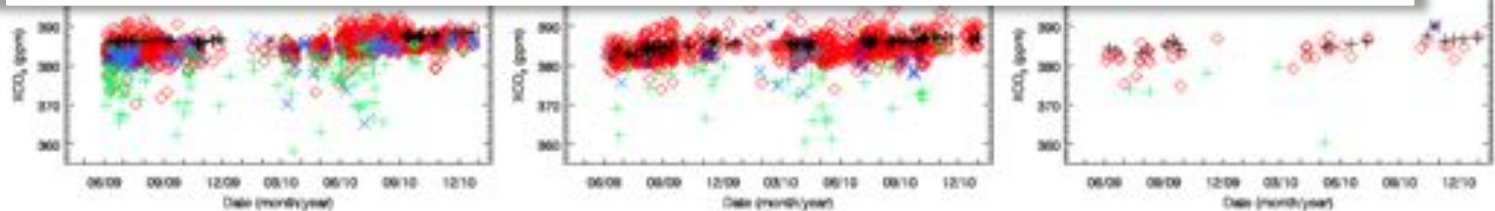
XCO_2 : 0.16% \sim 0.63 ppm

XCH_4 : 0.23% \sim 0.004 ppm

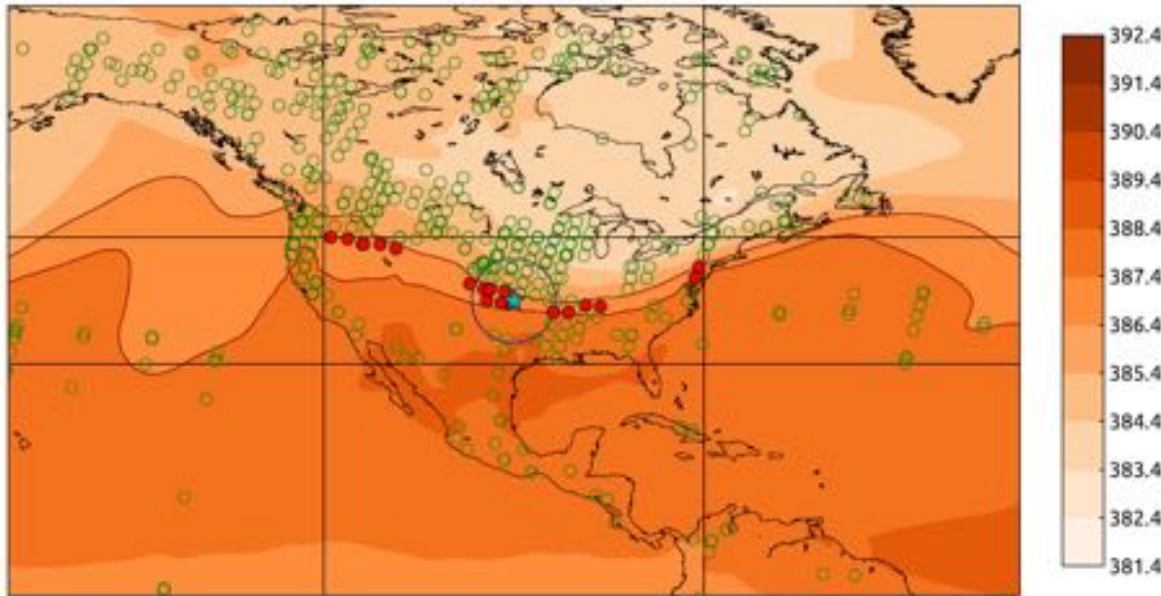
Scatter, root mean square difference to TCCON,

XCO_2 : 2.05 ppm \sim 0.53%

XCH_4 : 0.014 ppm \sim 0.76%

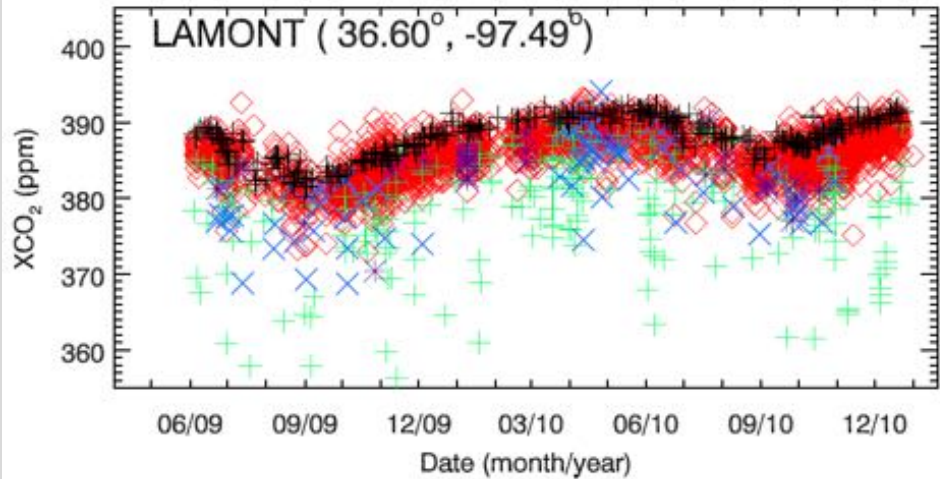


Guerlet et al., JGR, 2013;



Guerlet et al., JGR, 2013;

- Model XCO₂ field on 1°x1° with TM5 for weekly averages
- Select lat/lon box around TCCON station: $\pm 7.5^\circ$ lat, $\pm 22.5^\circ$ lon
- Coincidence if GOSAT sounding in lat/lon box and modelled XCO₂ (at GOSAT) = modelled XCO₂ (at Lamont) ± 0.5 ppm



Black : TCCON
Red : RemoTeC
Green : RemoTeC cirrus + aerosol flagged
Blue : RemoTeC only aerosol flagged

Aerosol filter:

„Difficulty of scattering scene“ =

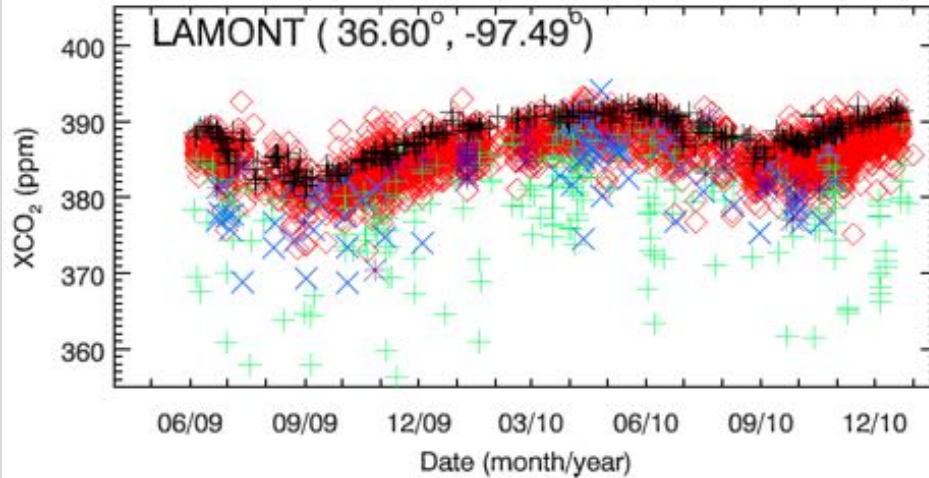
= Retrieved particle amount ($SOT \sim N_s$)

x height (z_s)

x size ($\sim 1/\alpha_s$) =

= $SOT \times z_s \text{ [m]} / \alpha_s > 300$

Guerlet et al., JGR, 2013;



- Black** : TCCON
- Red** : RemoTeC
- Green** : RemoTeC cirrus + aerosol flagged
- Blue** : RemoTeC only aerosol flagged

Aerosol filter:

„Difficulty of scattering scene“ =

= Retrieved particle amount ($SOT \sim N_s$)

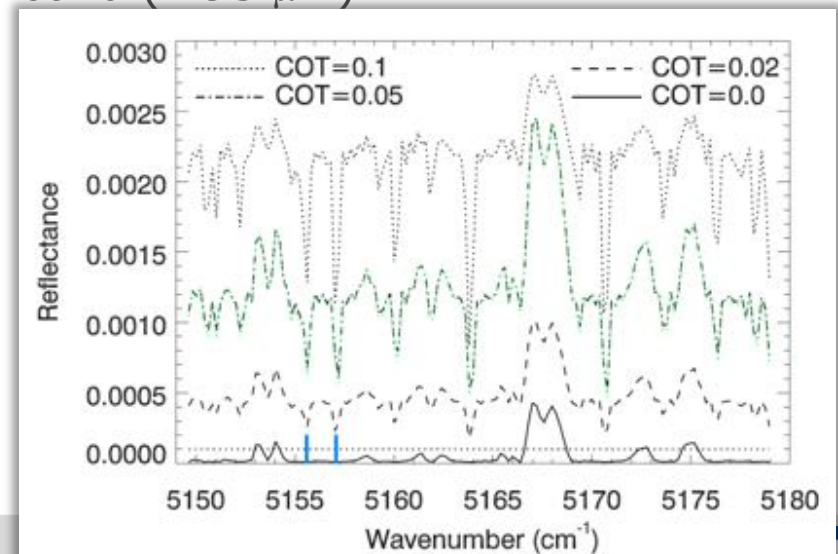
x height (z_s)

x size ($\sim 1/\alpha_s$) =

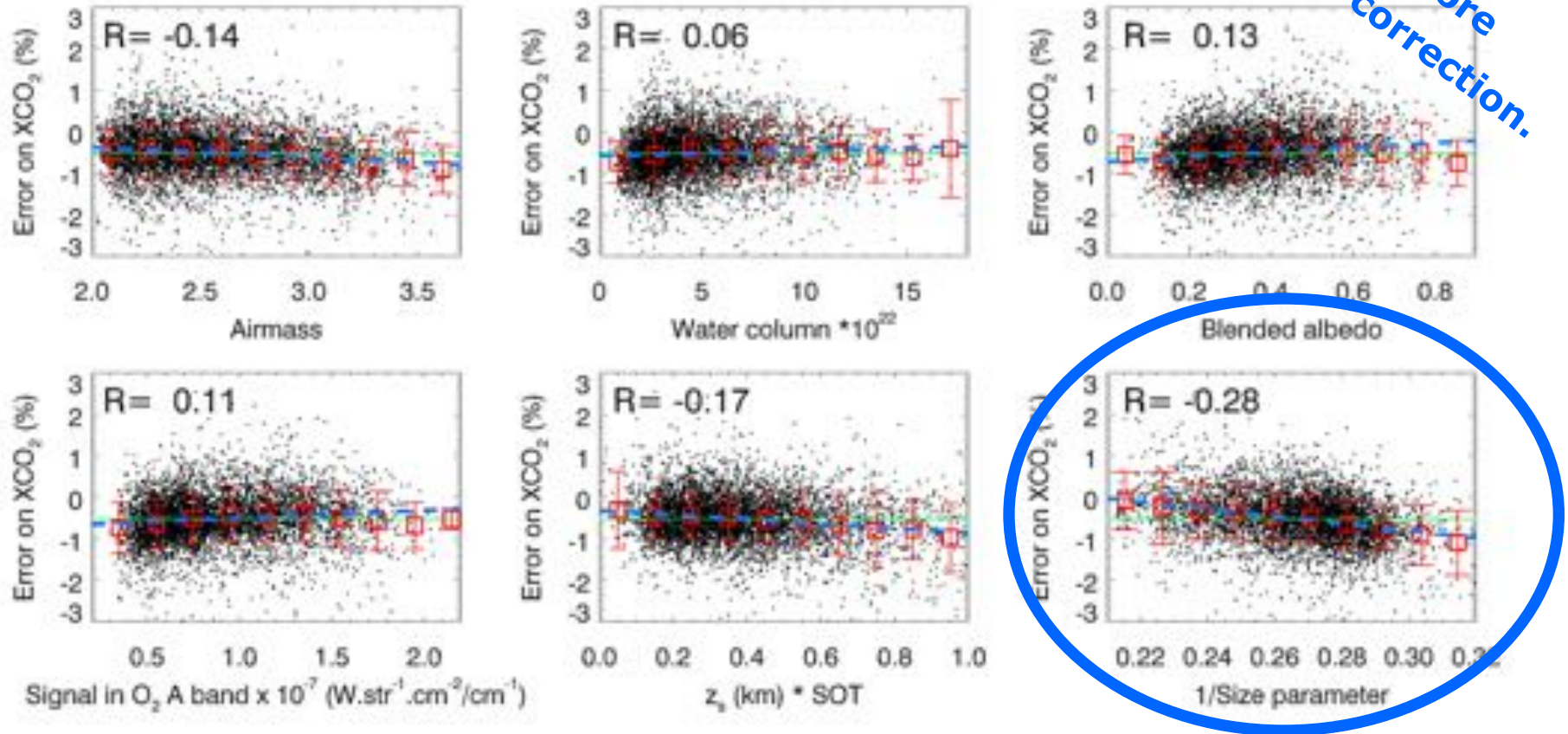
= $SOT \times z_s \text{ [m]} / \alpha_s > 300$

Guerlet et al., JGR, 2013;

Cirrus filter @ highly saturated water band ($1.95 \mu\text{m}$)



Correlation of **RemoTeC-vs-TCCON difference** with geophysical, instrumental parameters

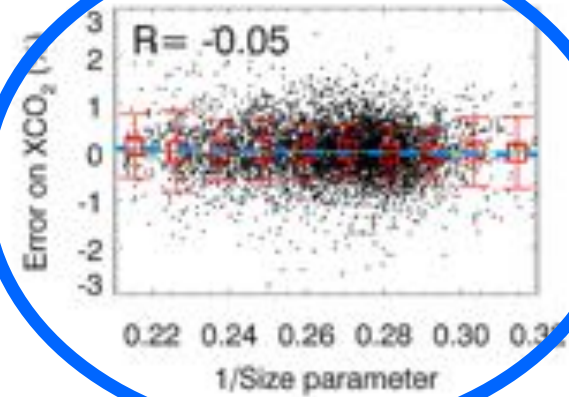
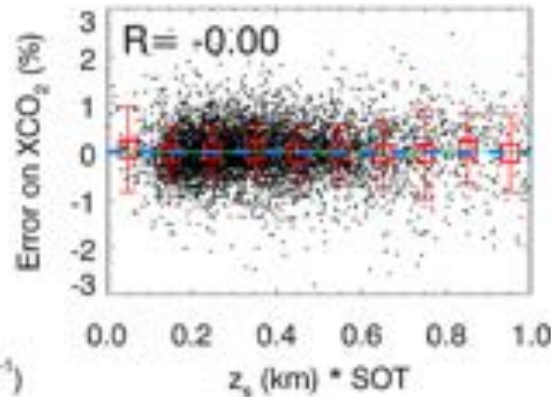
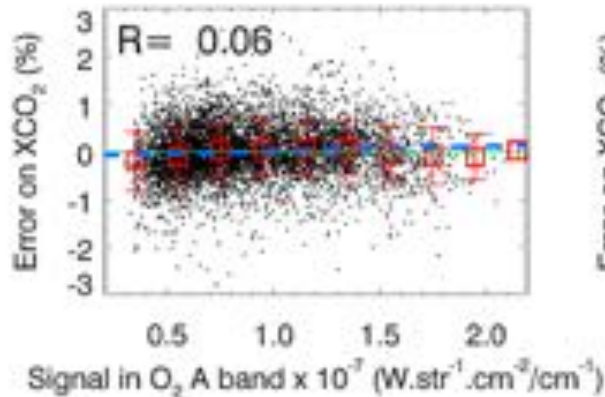
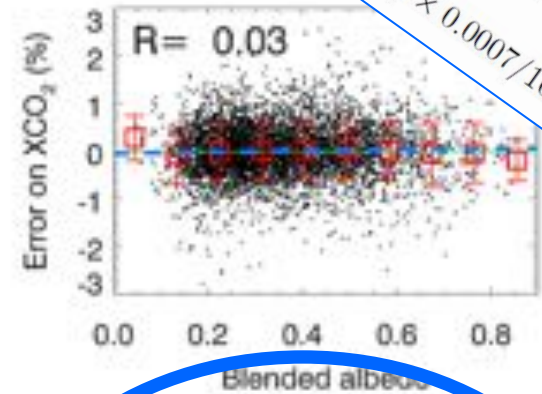
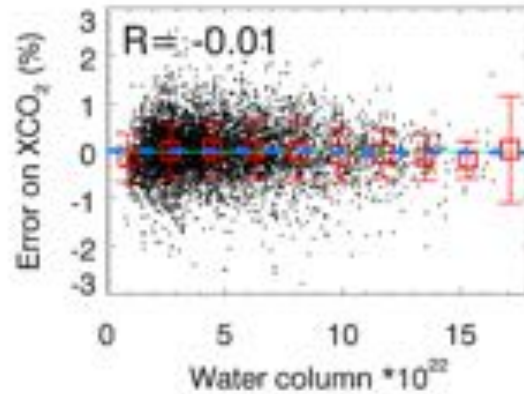
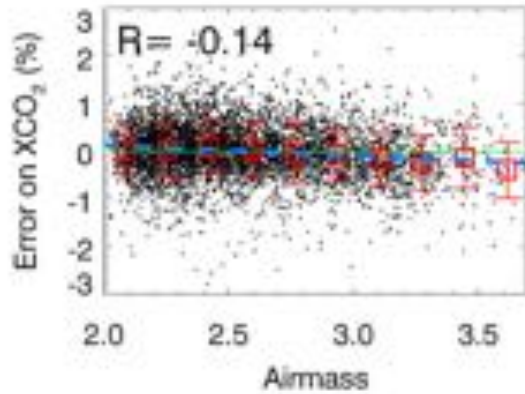


[Guerlet et al., JGR, 2013]

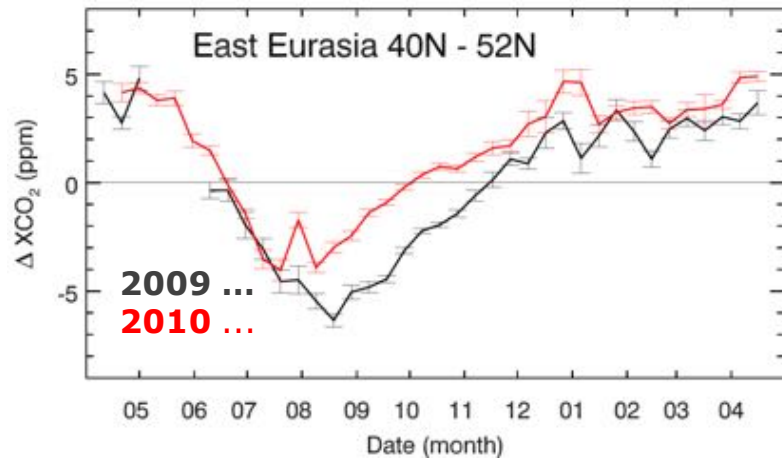
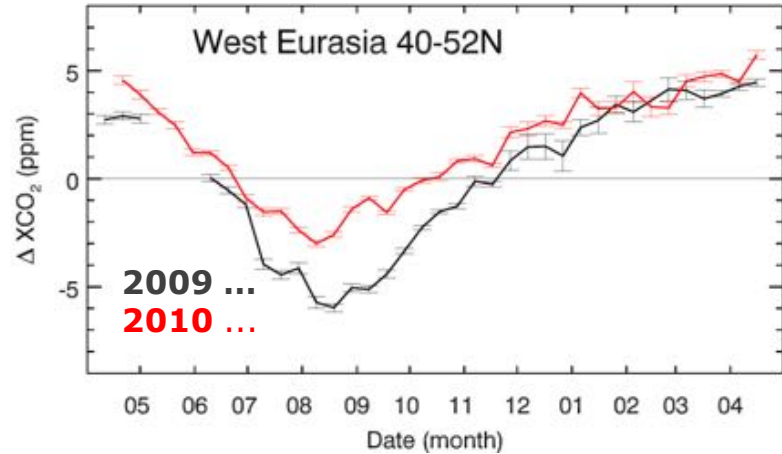
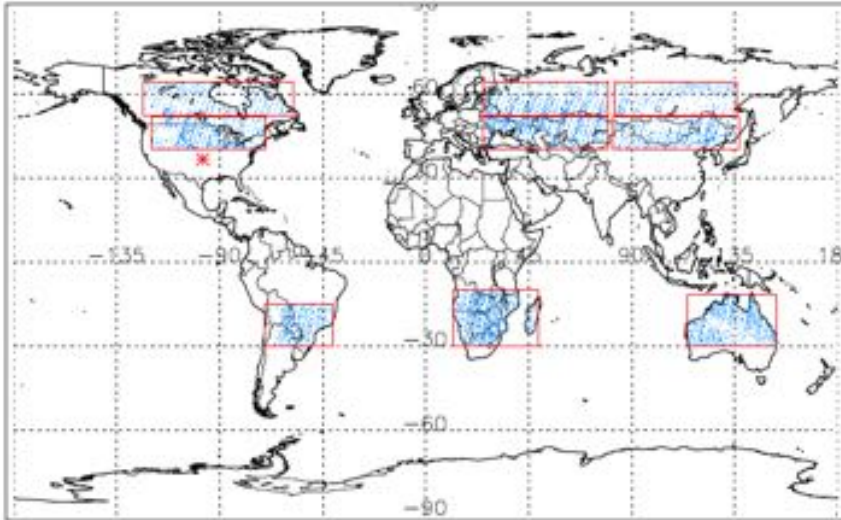
Correlation of **RemoTeC-vs-TCCON** difference with geophysical, instrumental parameters

After bias correction.

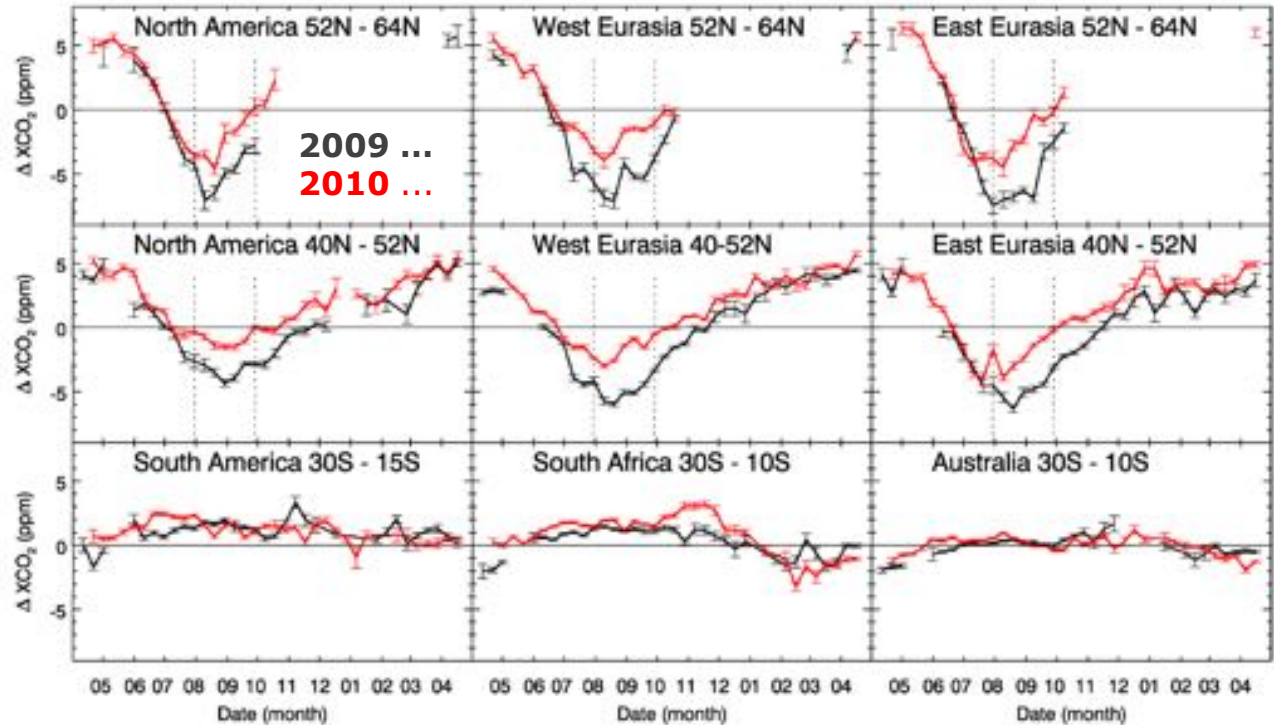
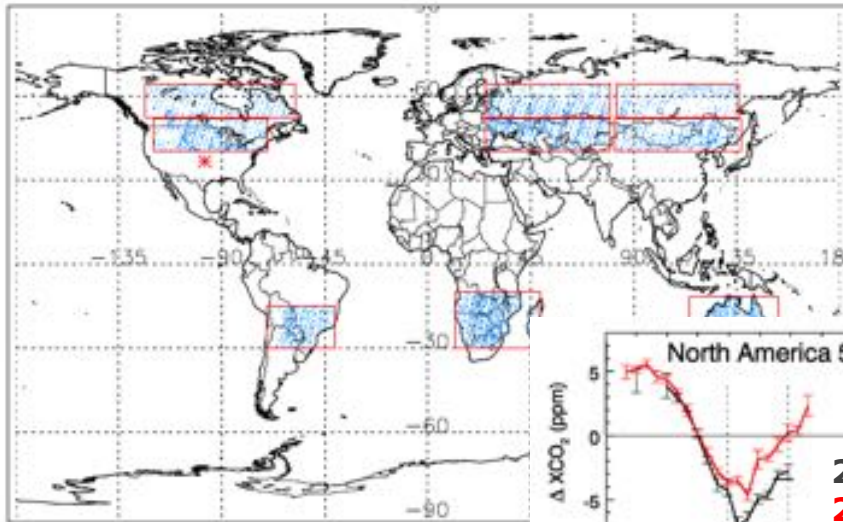
$$XCO_2^{corr2} = XCO_2 \times (0.979 + 1/a_s \times 8.74/100) + SOT \times z_s(m) \times 0.0007/100.$$



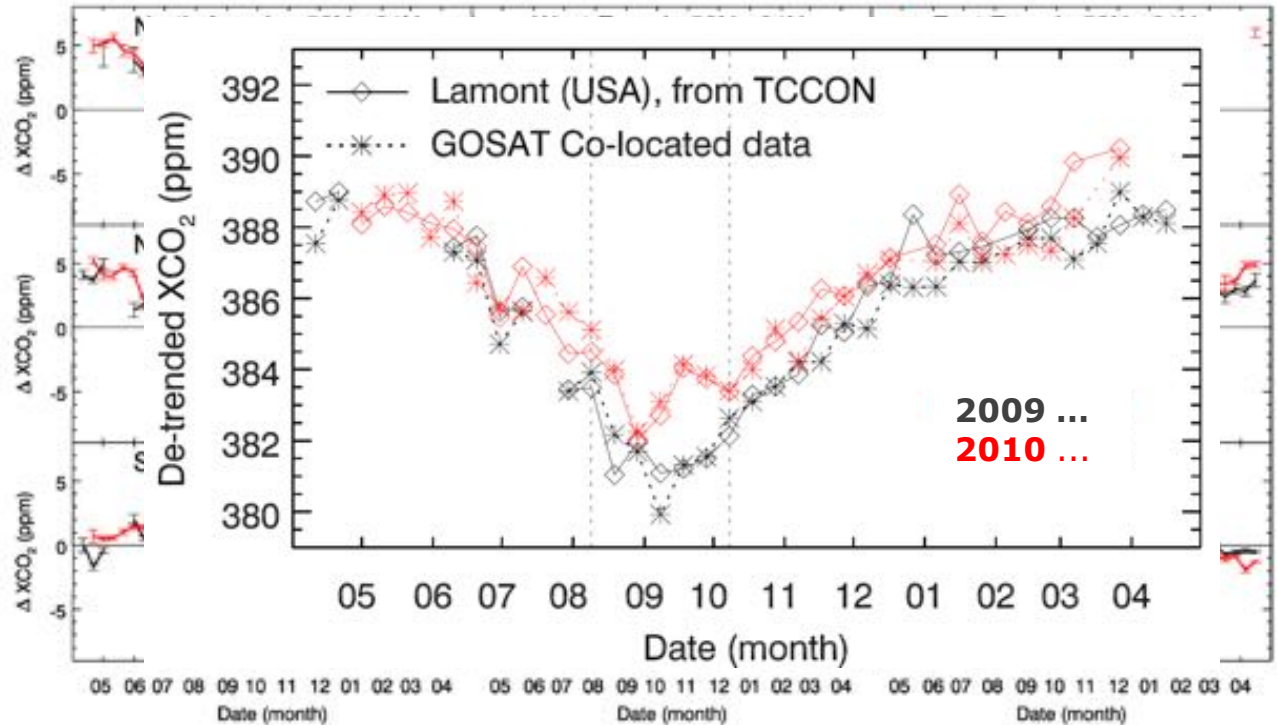
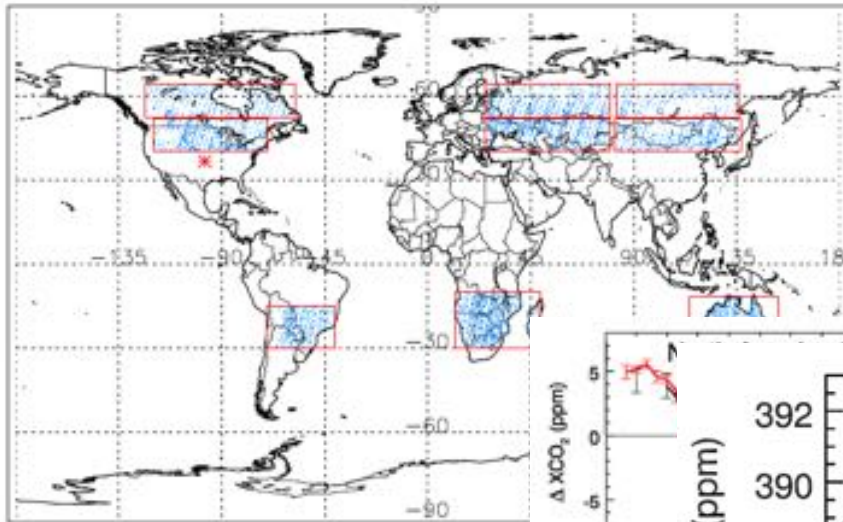
[Guerlet et al., JGR, 2013]



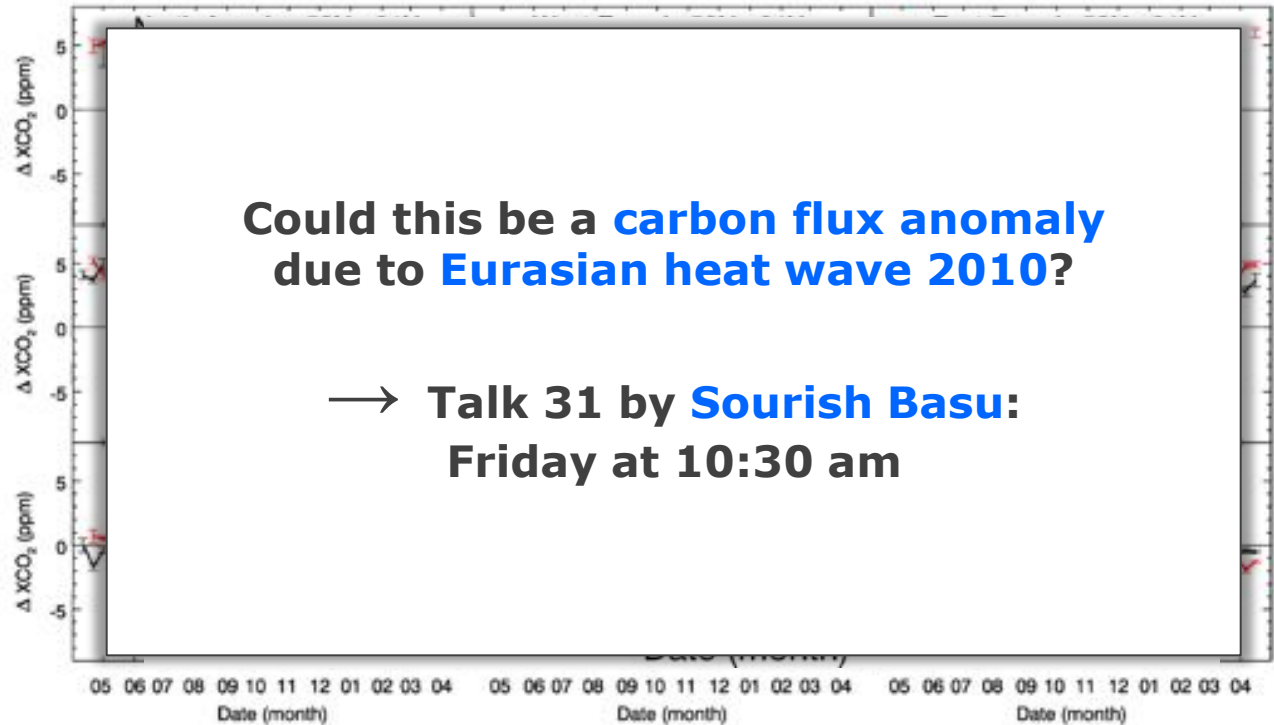
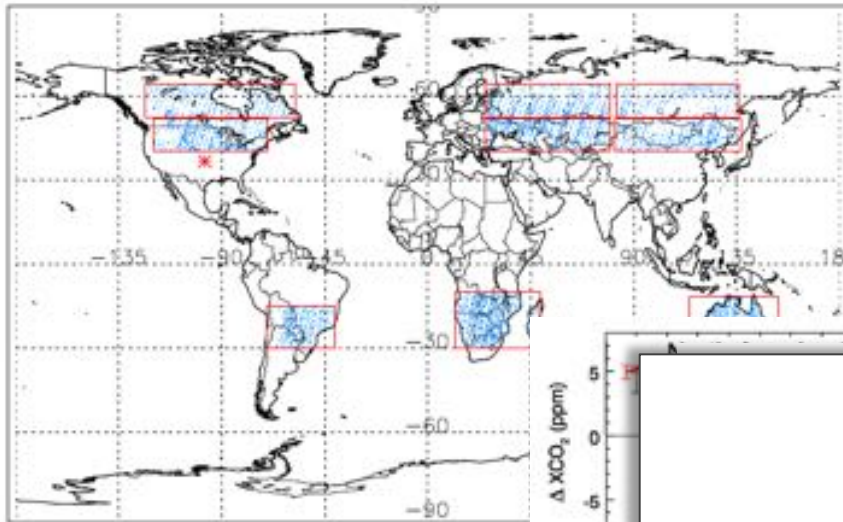
Guerlet et al., GRL, 2013



Guerlet et al., GRL, 2013



Guerlet et al., GRL, 2013



Guerlet et al., GRL, 2013

RemoTeC: algorithm for routine processing of satellite-based solar backscatter measurements in the SWIR (**GOSAT**, OCO-2, Sentinel-5 Precursor, S5, ...)

- **V2.1**: available for download via
ssh_remotec@imkwww1.imk.kit.edu
Password request: andre.butz@kit.edu, o.hasekamp@sron.nl
- **Validation**: improved coincidence criteria, efficient filtering, bias correction
- **Seasonal cycle of XCO₂** in 2010 substantially shallower than in 2009: carbon flux anomaly due **Eurasian heat wave**?

→ **Talk 31 by Sourish Basu:**
Friday at 10:30 am