SCIAMACHY Level-2 V6 :
First look at Diagnostic Data Set

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Ozonesonde, lidar & FTIR PIs
ESA, BELSPO

Objectives

First look at Level-2 V6 Diagnostic Data Set : limb O3 and nadir CO

- Technical check of file contents
- Preliminary & incomplete comparison to ground-based data
- Preliminary & incomplete comparison between SGP 3.01, 5.02 and 6.00

→ Are there any critical issues in the V6 Diagnostic Data Set ?

Limb O3 profile

SCIAMACHY

- SGP 3.01/R complete data set (Aug 2002 – Jan 2010)
- SGP 5.02/W complete data set (Aug 2002 – Apr 2012)
- SGP 6.00/Y diagnostic data set (Aug 2002 – Apr 2012) delivered 24-28 Apr

Ground-based data

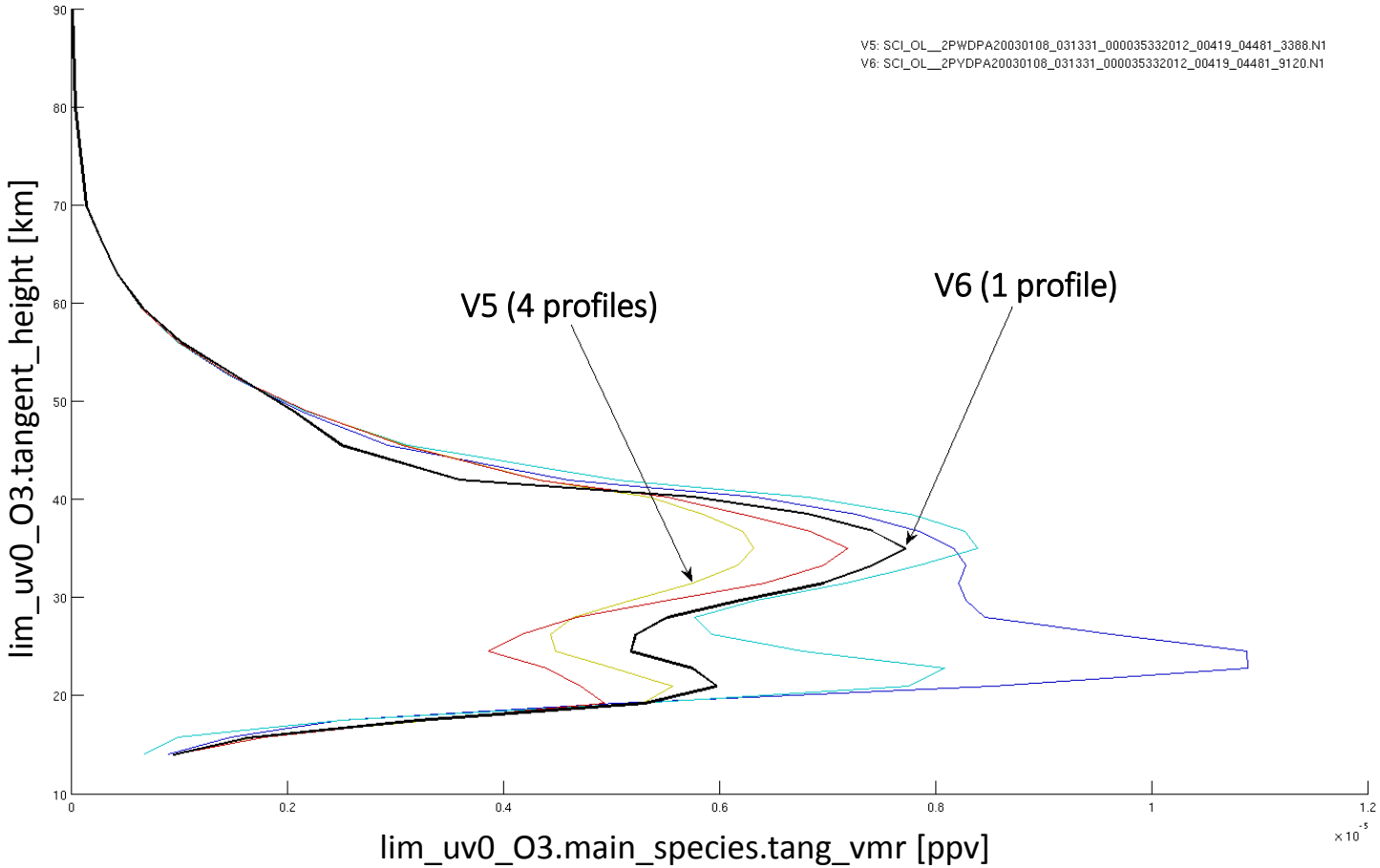
- Ozonesonde : ground to ~33km, NDACC/WOUDC/SHADOZ
- Stratospheric lidar : 17-45km, NDACC

Methodology

- SCIA screening : none (no recommendation by QWG)
- Co-location : <500km, <±12h, closest pair
- Comparison grid : 14.875 – 42.875km (step=1.75km) + final level at 47.25km
- Coordinate system : altitude, O3 number density
- Vertical smoothing : none

Change in Level-2 processor for Limb ozone

Addition of UV spectral window leads to 1 retrieved V6 O3 limb profile per E-W scan, instead of 4 profiles for V3 and V5.

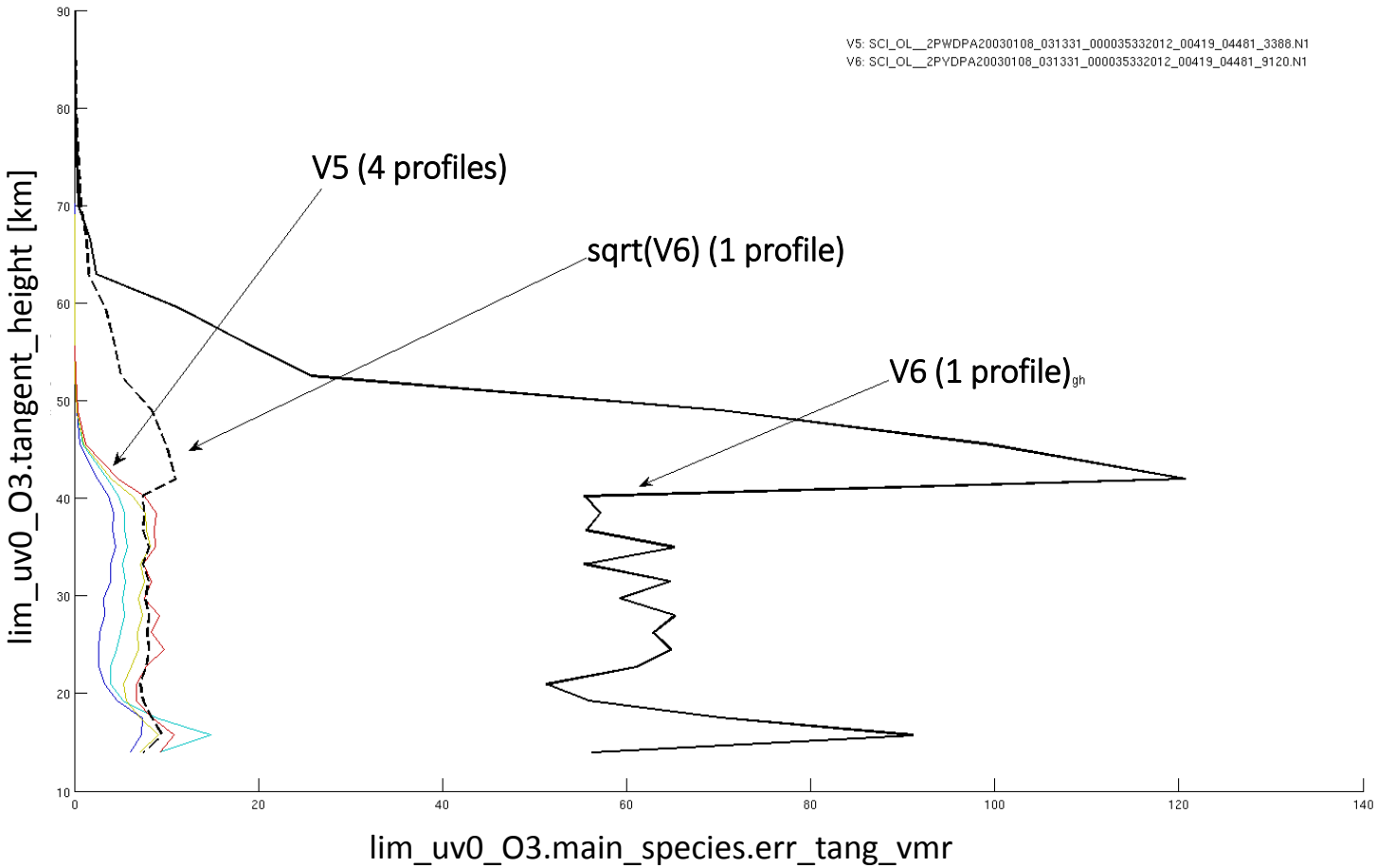


This impacts delta-validation : there is no unique one-to-one match between V5-V6.

Todo : investigate how to best inter-compare V3/V5/V6.

Critical : ex-ante uncertainties unrealistically high

V6 ex-ante uncertainties for number density, VMR and partial columns are similar/identical.
But V6 values are much larger (~60-100%) than those of V5 (~10%).



DLR (5 May): cause of bug found, O3 errors are ~8x too high

Median bias of SCIA relative to (unsmoothed) sonde and lidar

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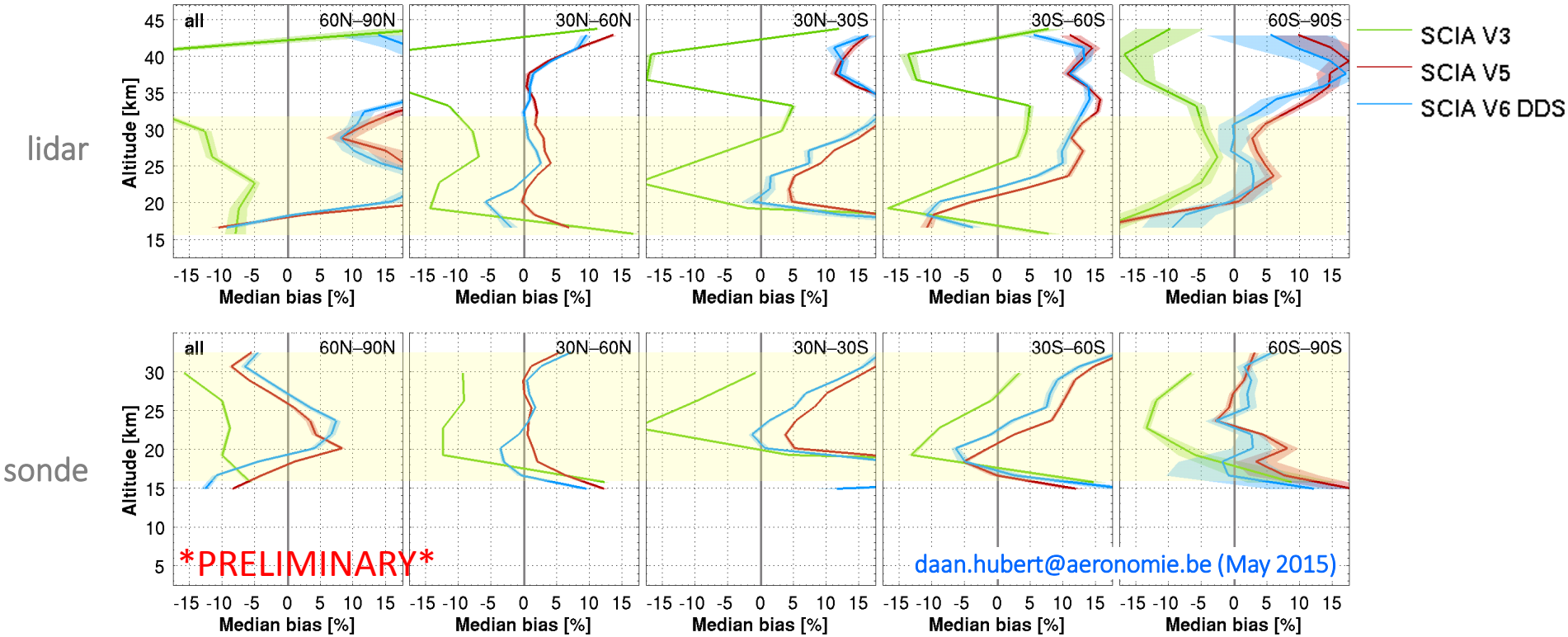

First, preliminary interpretation

- Bias of V5 and V6 ozone are quite similar, especially when compared to V3.
- V6 ozone is about 2-5% smaller than V5 below ~35km.
- V6 is perhaps a little less biased than V5, but no substantial improvement.

Comparison spread for SCIA and (unsmoothed) sonde and lidar

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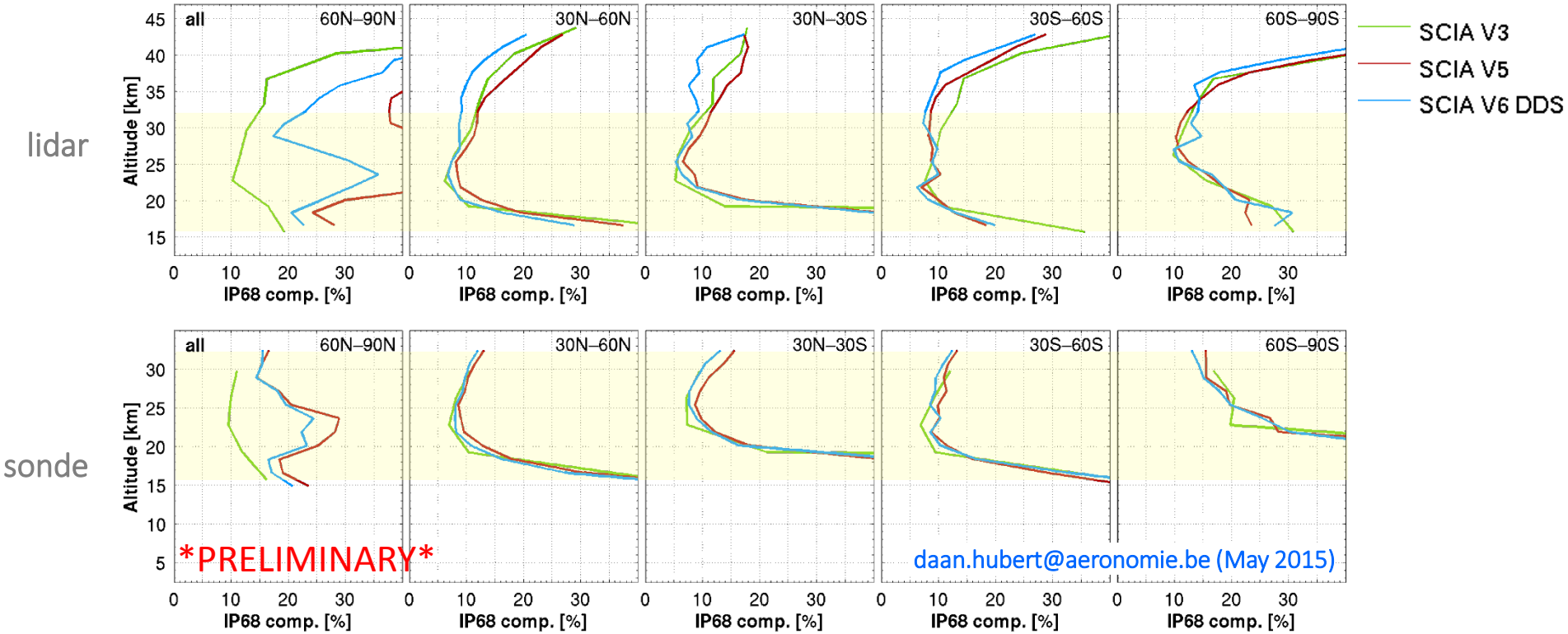


First, preliminary interpretation

- Comparison spread V3, V5 and V6 are generally similar, except…
  - Upper stratosphere : V6 up to 5% smaller than V3/V5.
  - Arctic : V6 possibly impacted by strong season-dependence (like V5).
- V6 seems slightly less variable than V5, but need to redo with similar subset.

Nadir CO column

Ideal situation

Due to the large variability of SCIAMACHY CO column data, users are advised to average at least on monthly scales. An ideal delta-validation should thus be based on the relative difference of monthly mean SCIA and FTIR data.

But…

Such an approach is not justified with only ~10 % of the data for one of the products.

Practical solution (2014/11)

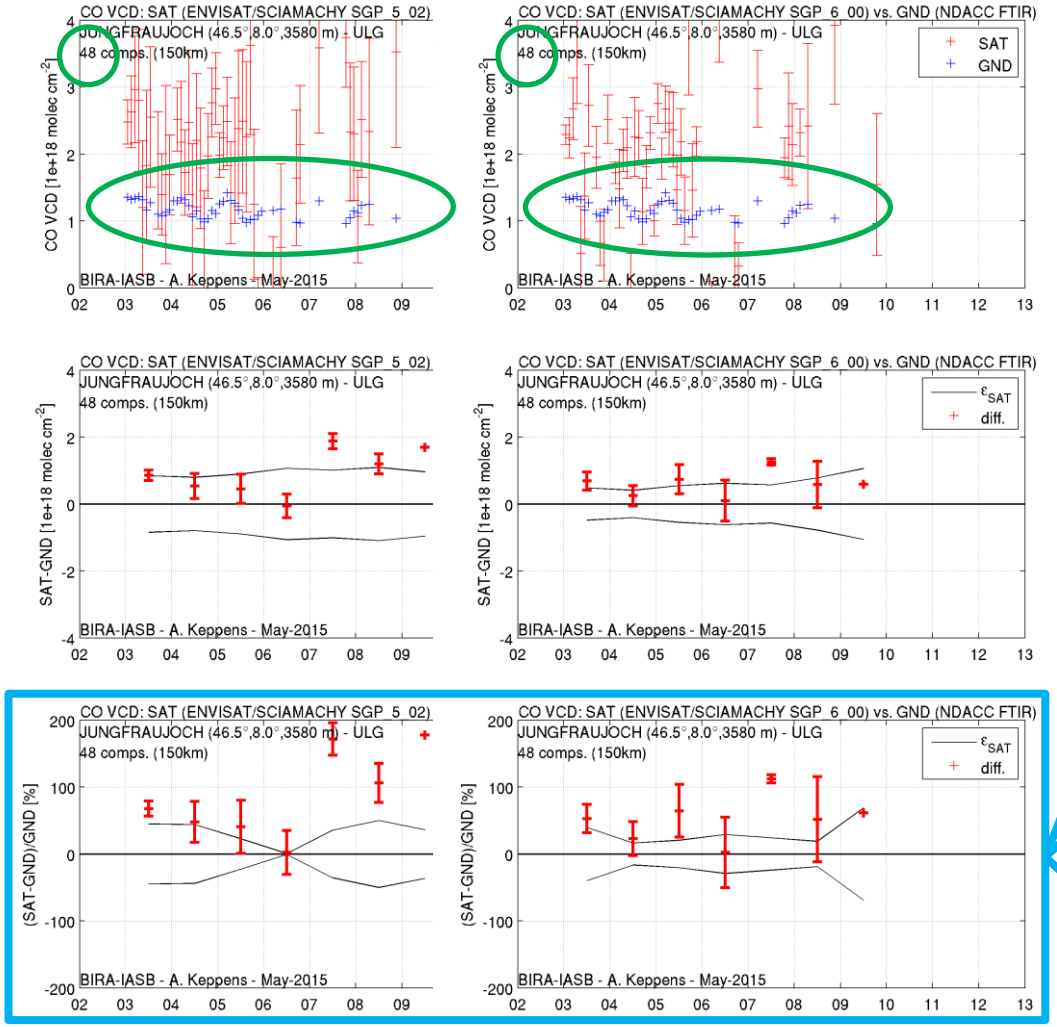
Instead, we propose to base the V6 delta-validation analysis on the relative difference of monthly means, for pairs within 300 km *and* within ±3 h.

Practical solution (2015/05)

Instead, we propose to base the V6 delta-validation analysis on the relative difference of monthly means, for pairs within 150 km *and* for the same subset of SCIA pixels for both versions.

(300 km co-locations are in the making, but take more time.)

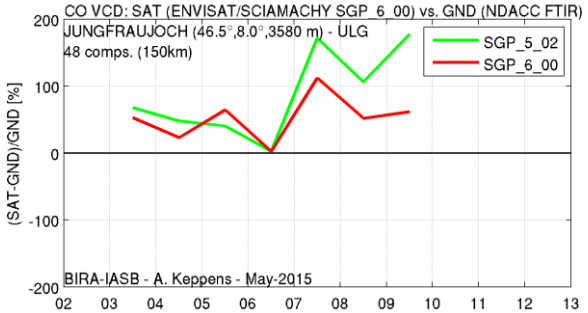
Data and plotting approach

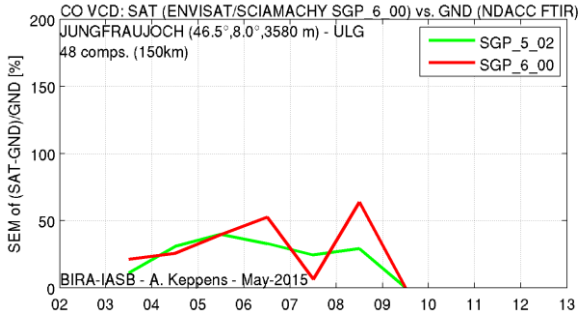


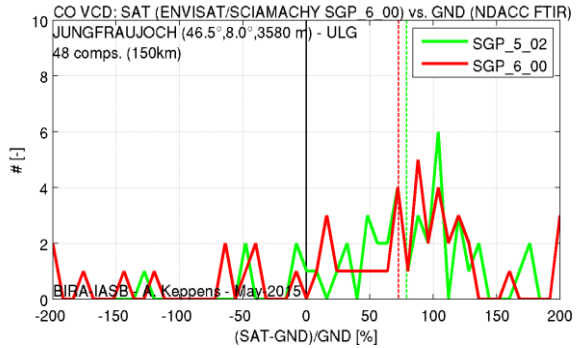
yearly bias

yearly SEM

full hist.







Yearly weighted rel. diff. from monthly averages

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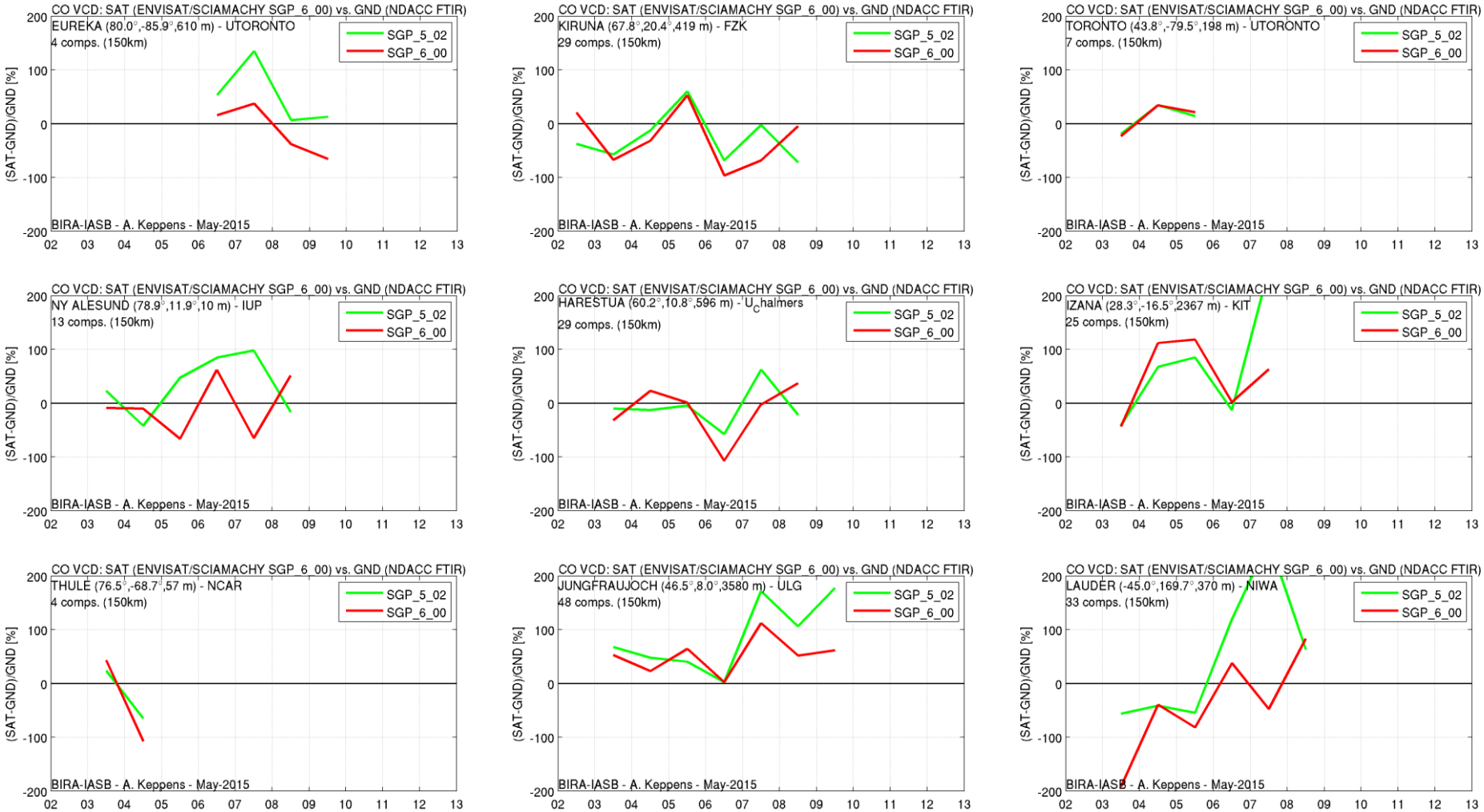

Preliminary observations:

- Yearly bias: Comparable (~100 %) or slightly reduced (up to few 10 % per station)
- Yearly spread (not shown): Comparable (~20-50 %)

First look results*

Technical check

- O3 errors clearly too large, bug identified by DLR
- Other fields seem reasonable at first sight

Limb O3 profile

- Bias: very likely no substantial improvements of V6 w.r.t. V5 bias
- Comparison spread: V6 & V5 very similar

Nadir CO column

- Yearly bias: V6 & V5 comparable, likely slightly reduced for V6
- Yearly spread: V6 & V5 comparable

*All results shown are preliminary

Focus of delta-validation exercise

Verify whether “data quality features” of SGP 5.02 also appear in SGP 6.00 (or not)…

Limb O3 profile

- Large positive bias in most of middle stratosphere
- Hemispheric asymmetry in bias
- Strong seasonal dependence of bias & spread in Arctic and Antarctic
- Vertical oscillations in bias & spread profiles of AK-smoothed results
- Long-term, negative drift in middle stratosphere

Nadir CO column

- Large bias
- Large comparison spread

…