

Comparison of MLS and sonde time series over Europe and the tropics

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Thanks to the MLS team for providing V3.3 data prior to release,
and to the sonde station teams.

Objectives

- Use the dense sonde network over Europe to evaluate the capability of the Aura MLS data to extend profile time series down into the lowermost stratosphere
- Use the SHADOZ sonde network to check out the MLS time series in the inner tropics.

Sonde data

- European stations: 2-3 soundings per week
 - Hohenpeissenberg is the only station using Brewer Mast sondes. Revised data shown here from WOUDC.
 - Payerne and Uccle use ECC sondes
 - All sonde profiles are scaled to the overhead ozone column at the station (ground based)
- SHADOZ stations: at most weekly, some stations only 2/month, and gaps at some stations
 - Kuala Lumpur, Nairobi, San Cristobal, Ascension, and Natal
 - Sonde data are not scaled to overhead ozone column, but comparisons to TOMS data reveal some systematic differences (see Thompson et al. JGR, 2007)

MLS data

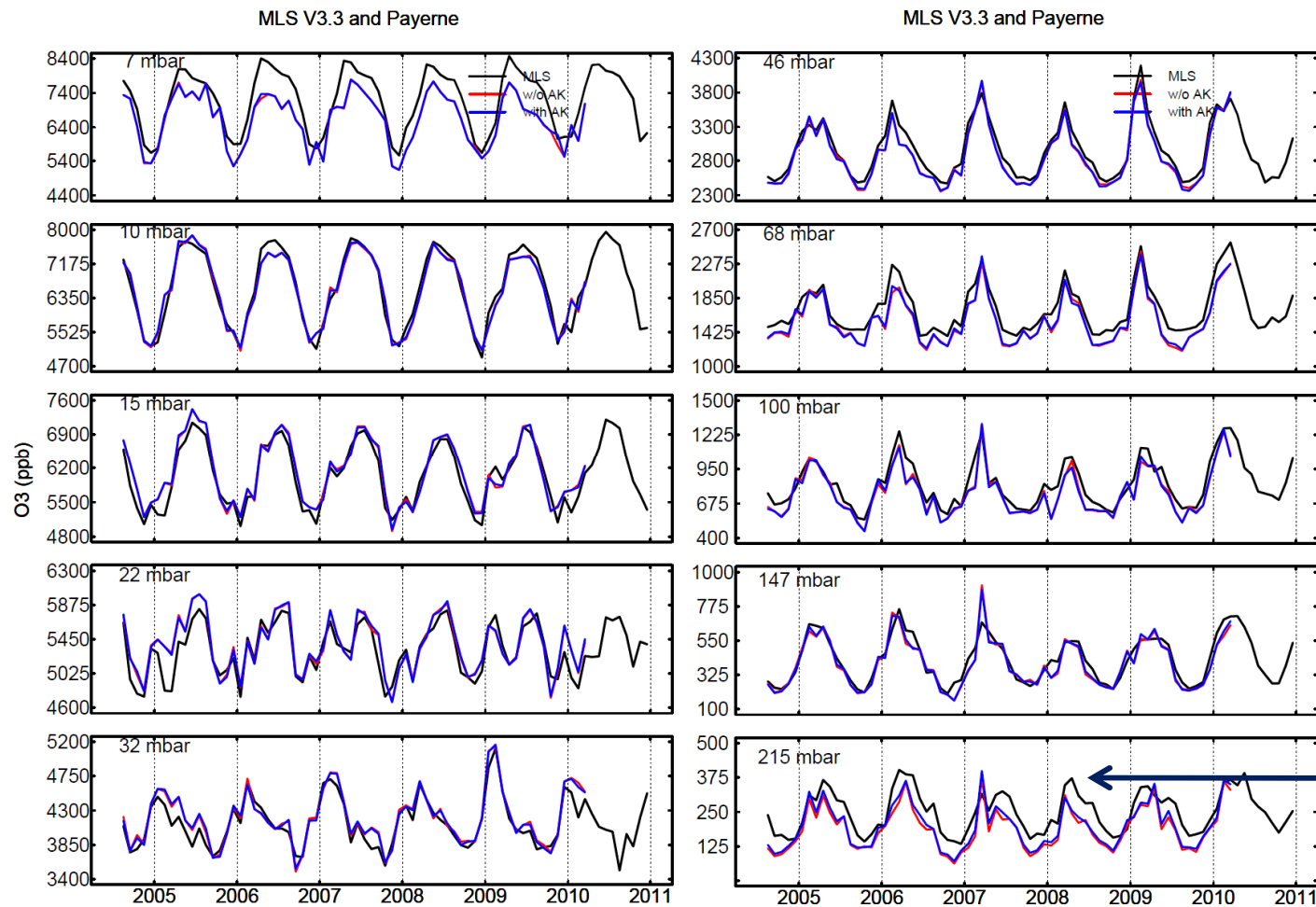
- MLS launched on the Aura satellite in July 2004. Data available for August 2004-present.
- Results shown for V3.3, supplemental plots shown for V2.2.
- MLS data are provided on a pressure grid.
- Vertical resolution for ozone is ~2.5 km
- Data selected following the recommendations in the Users' Guides.
- The MLS vertical averaging kernel was applied to the sonde data, but this makes very little difference.

Details

- MLS data over Europe selected for 45° - 55° N, 10° W – 30° E (the same box used in Terao and Logan (2007) to compare SAGE II, HALOE, SBUV and sondes)
- Tropical MLS data selected for 4° N- 8° S, zonal mean
- Sonde data are shown on the MLS V2.2 retrieval levels
 - 6 levels per decade of pressure
- Monthly mean time series are compared
- Applying the MLS averaging kernels makes very little difference to the sonde data
 - Shown for Payerne
- MLS and sonde data are on pressure levels, so no issue of changing units between pressure and altitude

MLS (V3.3) and Payerne sonde data, 2004-2010.

Excellent agreement for 146-10 hPa, for both interannual variability (IAV) and absolute amounts.

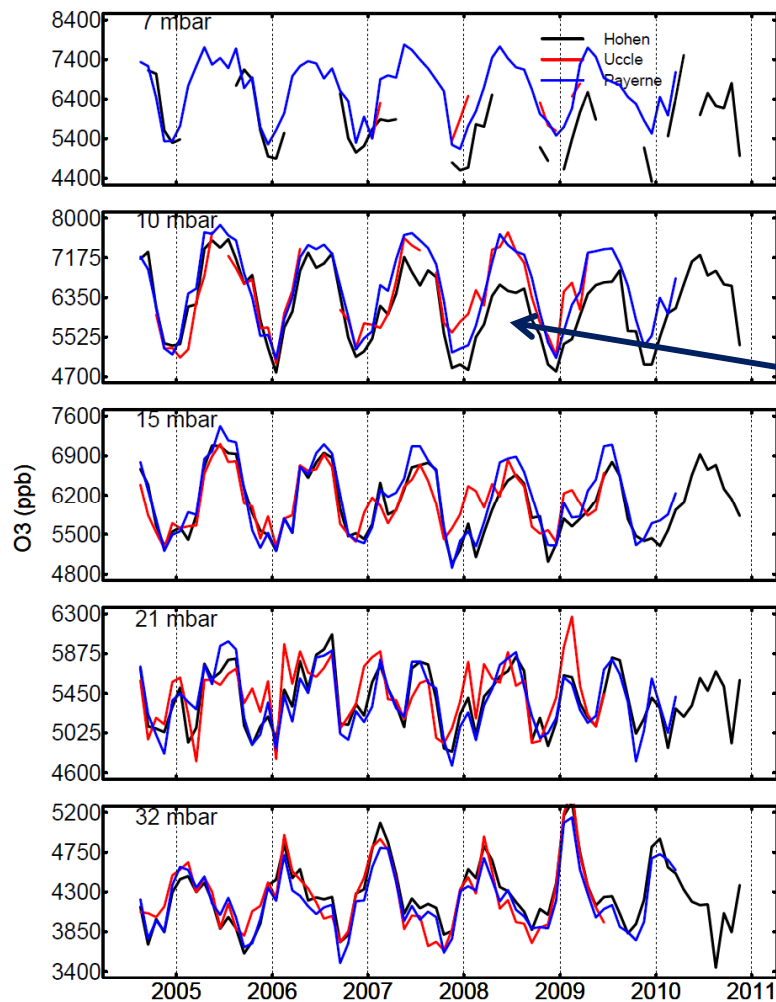


MLS
Sonde
Sonde with AK

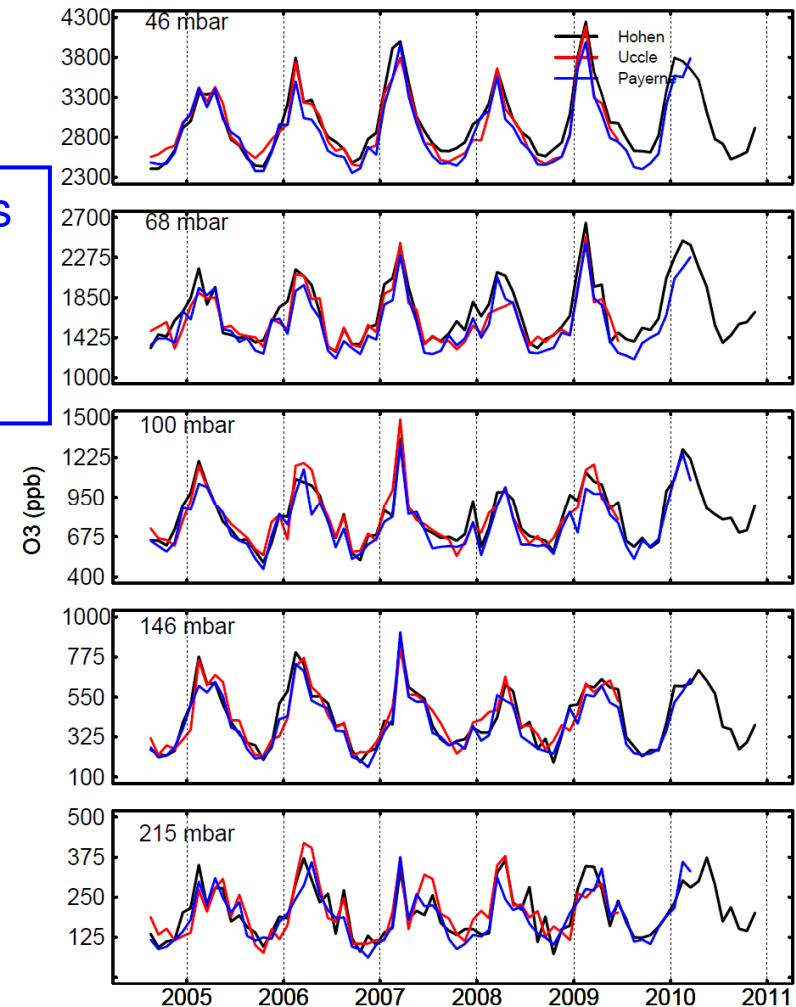
MLS biased
high at 215 hPa

Payerne, Hohen., and Uccle (on MLS levels)

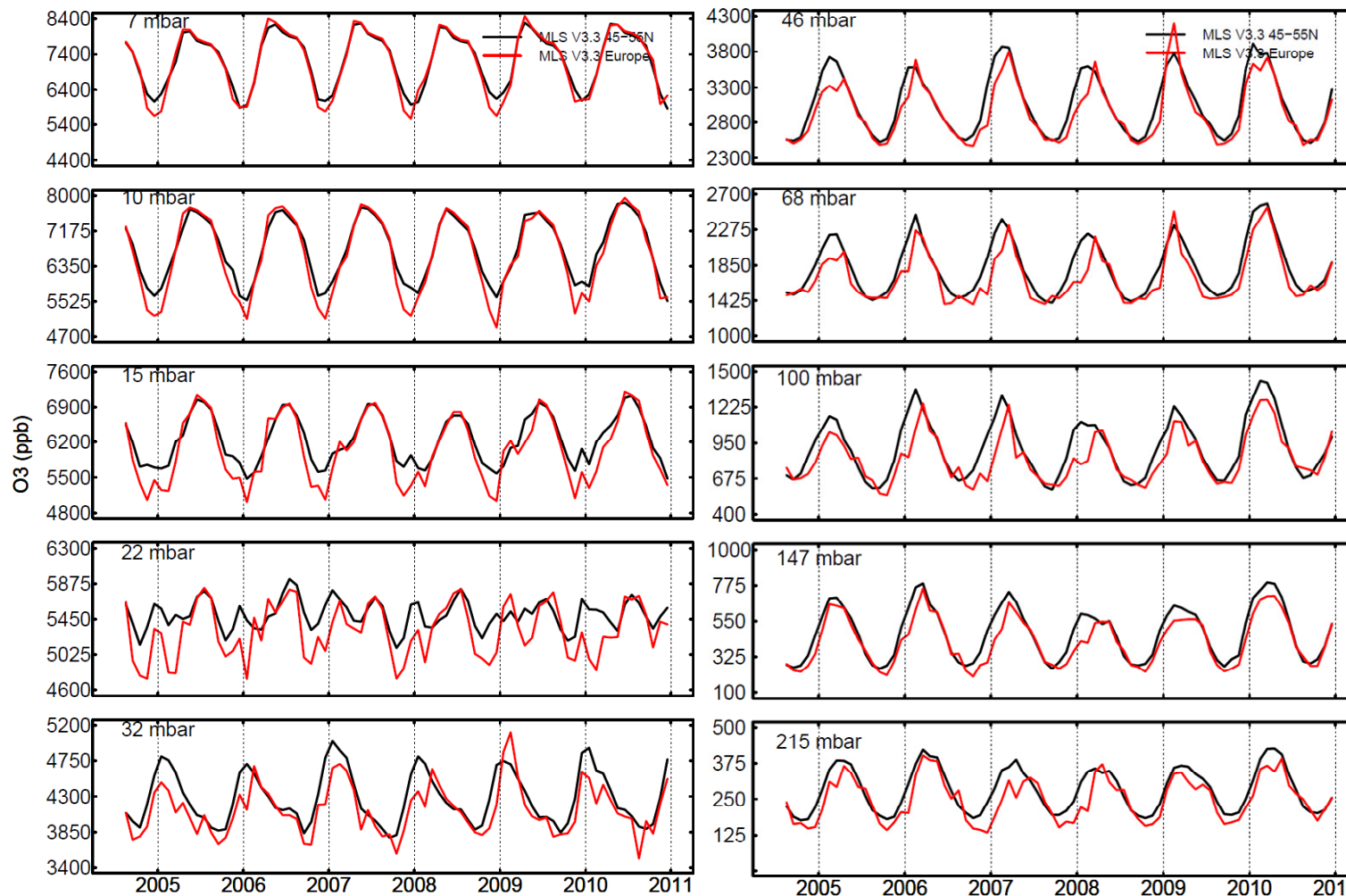
Three sonde records are coherent except near 10 hPa, 7 hPa (sparse) and some winters at 15 and 21 hPa (geophysical?).



Why does Hohen. differ in 07-09?



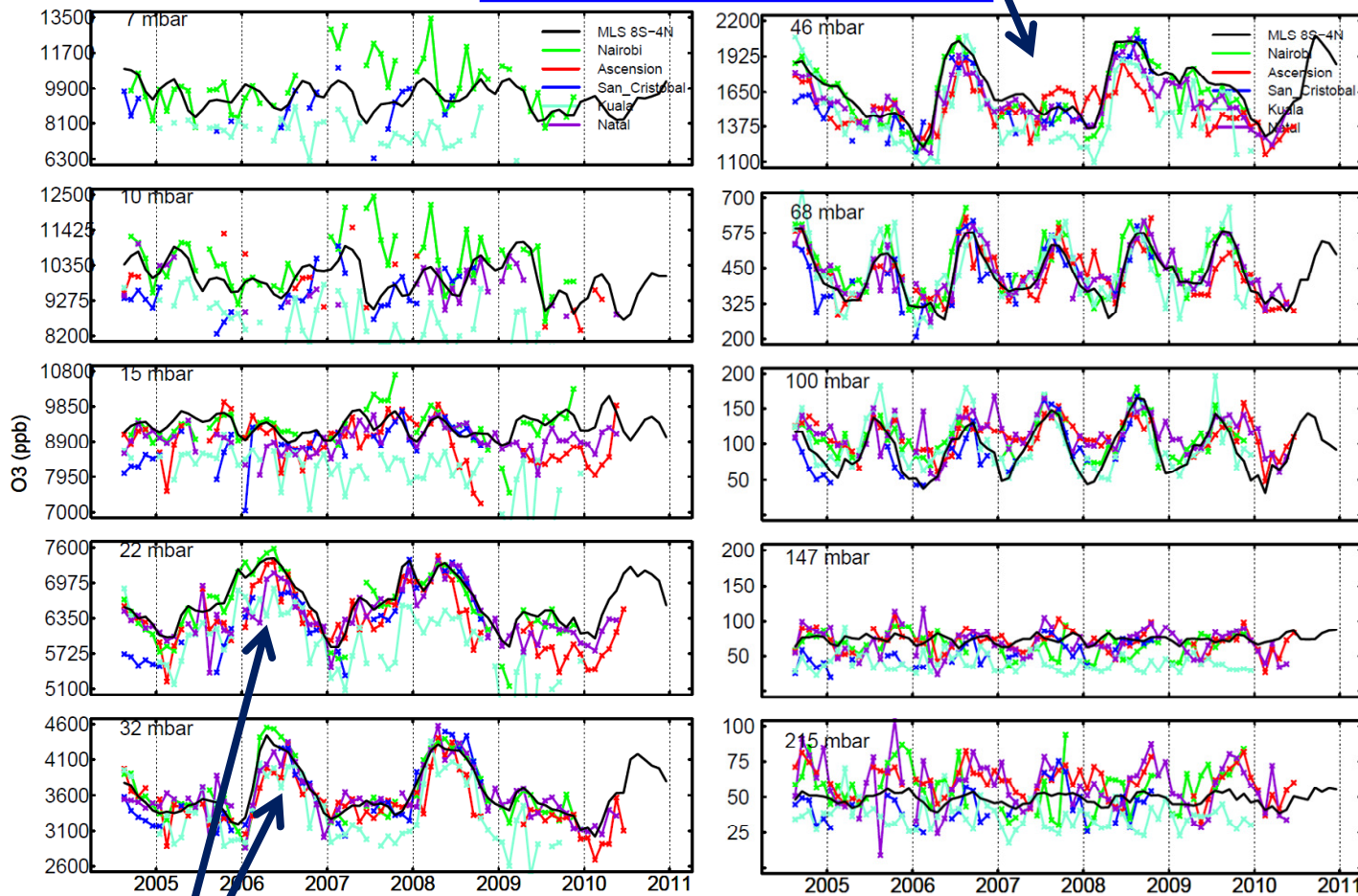
MLS zonal mean (45°-55°N) shows similar IAV to MLS over Europe (10°W-30°E, 45°-55°N)



Zonal mean
Europe
(All are MLS)

MLS (V3.3) zonal mean (4°N-8°S) and SHADOZ sonde data (3°N-8°S)

QBO clearly evident



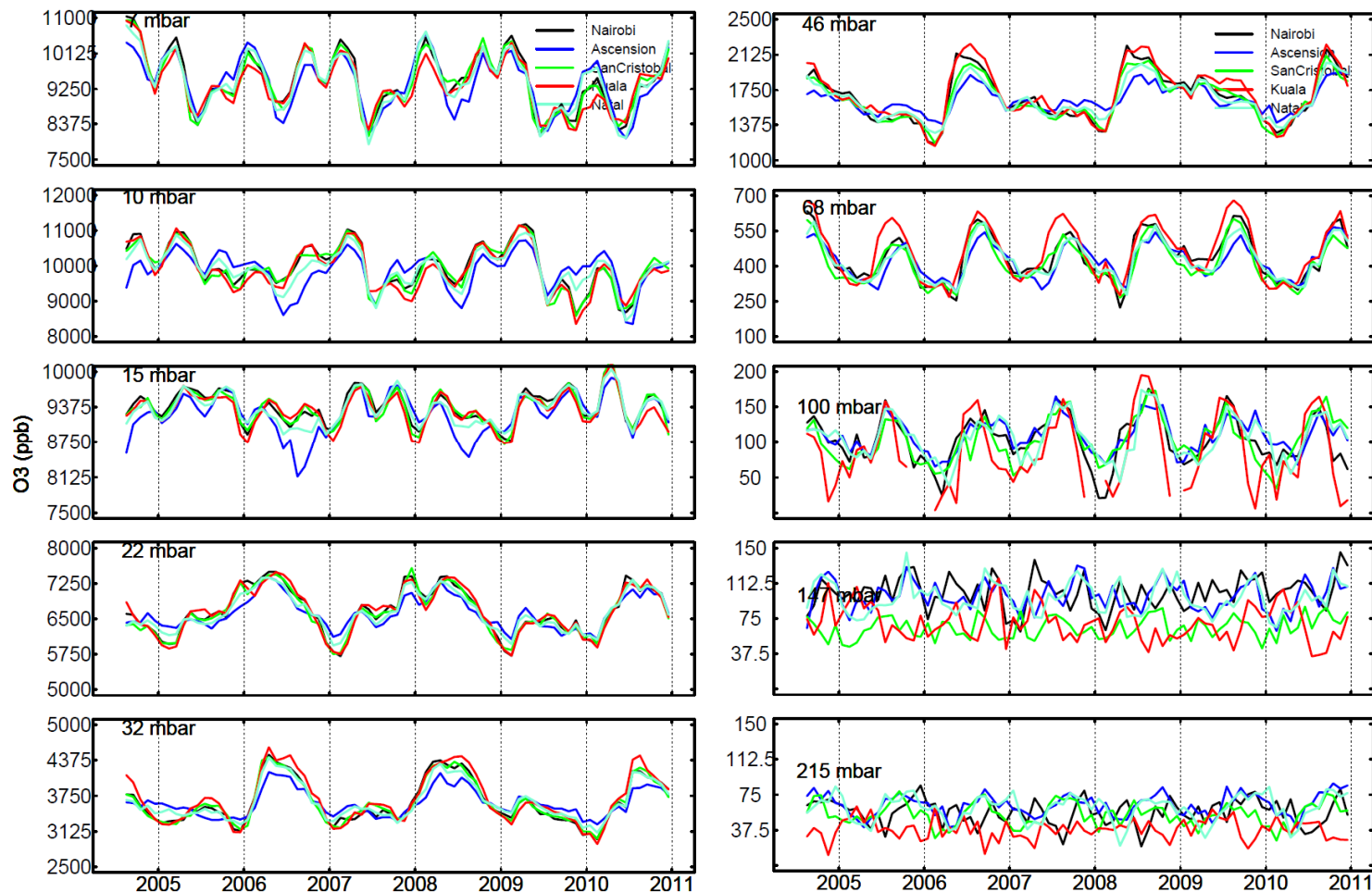
QBO clearly evident

Sonde time series are noisy, and divergent near the top of the profiles

Real spatial differences in ozone at 215 hPa (wave-one)

Spatial variations in the MLS data sampled at the location of the sonde stations (a box of 5° x 10° lat. x long.)

The MLS data imply that some sonde data have some problems at 10-25 hPa. The MLS data in the tropical UT require validation, ongoing at JPL.



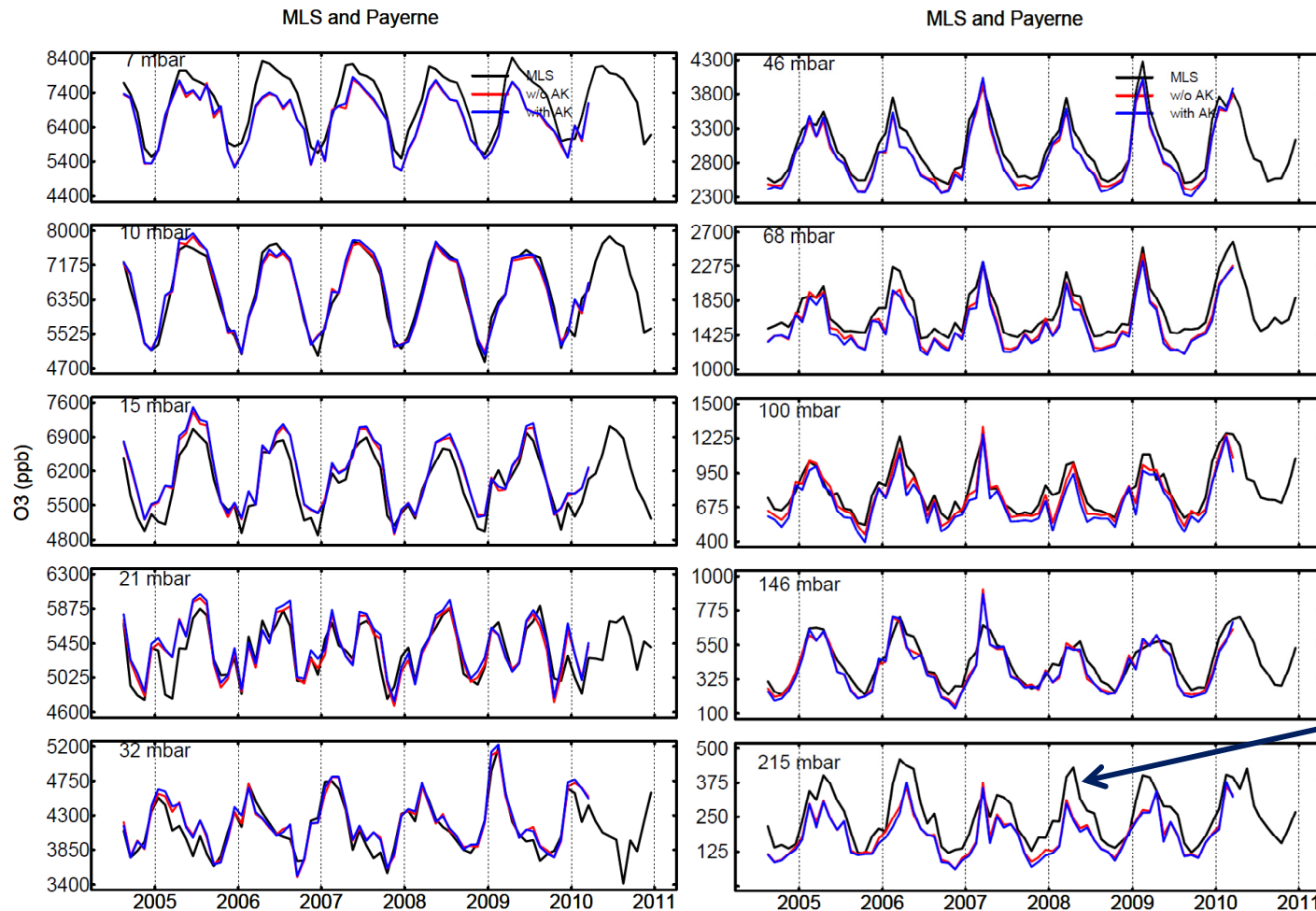
Conclusions

- The excellent agreement between the MLS and European sonde data shows the utility of the MLS data for extending satellite time series down as far as 147 hPa in the extratropics.
- The MLS data in the tropics look extremely promising down to 100 hPa, but there are known (but not solved) issues regarding consistency among the SHADOZ sonde stations at the 10% level.

Extras – MLS v2.2 comparisons

MLS (V2.2) and Payerne sonde data

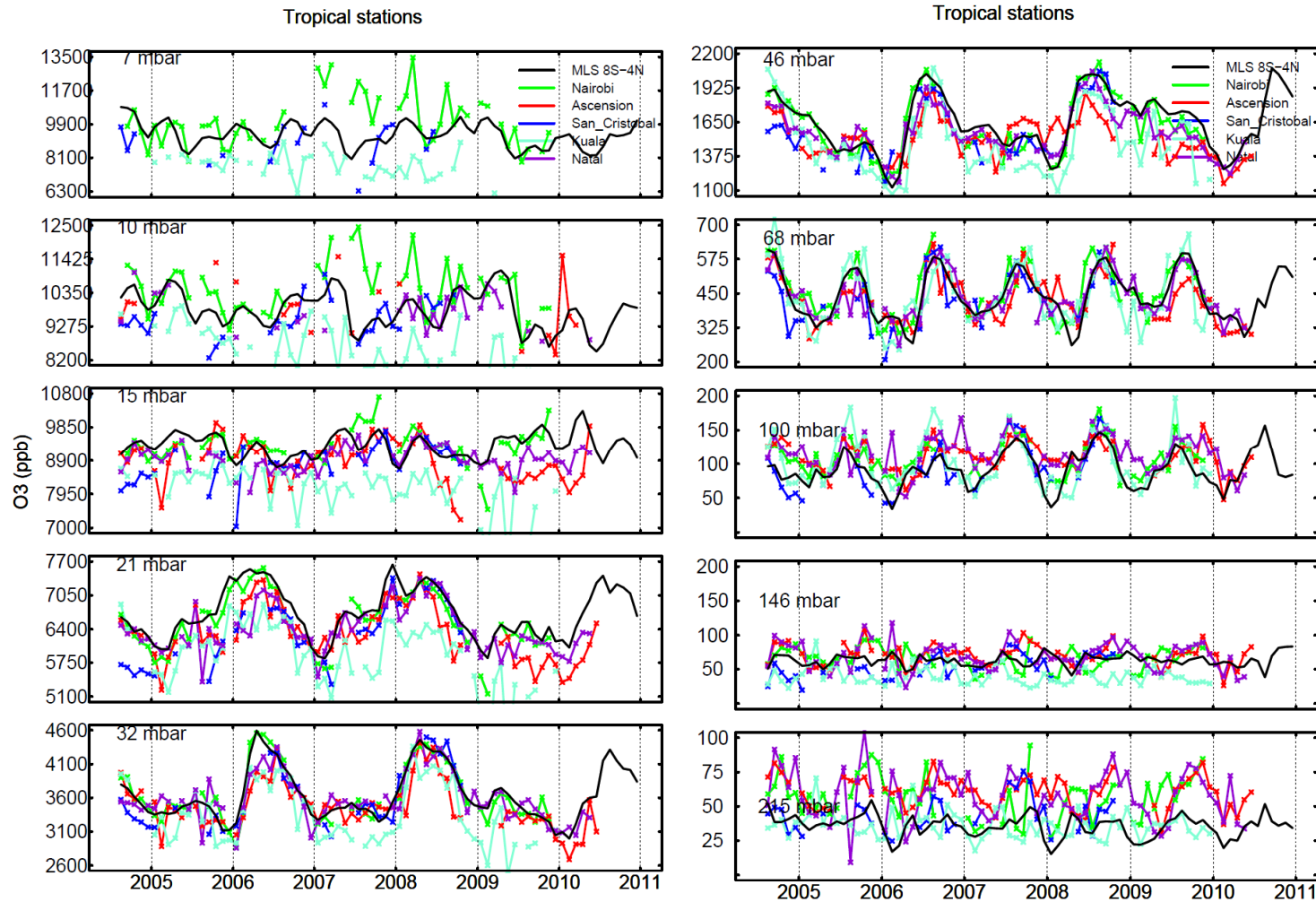
Excellent agreement for 146-10 hPa, for both interannual variability and absolute amounts



MLS
Sonde (no AK)
Sonde with AK

MLS biased high at 215 hPa, better in V3.3

MLS (V2.2) zonal mean (4°N-8°S) and SHADOZ time series (3°N-8°S)



Sonde time series are noisy. Sondes are not scaled to ozone column (they are in Europe)

Real spatial differences in ozone at 215 hPa (wave-one)