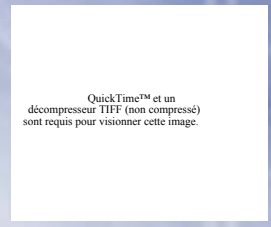


COMPARISONS BETWEEN GROUND-BASED AND SATELLITE RETRIEVALS IN THE UV RANGE.

Virginie Buchard, Colette Brogniez, Frédérique Auriol, Thierry Podvin, Luc Blarel and Jacqueline Lenoble

Laboratoire d'Optique Atmosphérique

(Villeneuve d'Ascq, France)

UV Spectroradiometers

Spectral irradiance measurements on a horizontal surface

Double monochromators JOBIN-YVON HD10

Resolution : ~ 0.75 nm – thermally regulated

λ range = 280-450 nm, step = 0.5nm

Scan **duration**: ~ 6 min – every 15 min
Alternately : **global** (diffuse + direct) and **diffuse**

Uncertainties : ~ 5% (400 nm) – ~8% (300 nm)

Sites : Villeneuve d'Ascq (50.61ºN, 3.14ºE) : located near an industrial city in the north of France.

Briançon (44.90ºN, 6.65ºE) : high altitude site - French Alps

OMI (Ozone Monitoring Instrument)

Launch : July 2004

Onboard the NASA EOS AURA spacecraft

Dedicated to the monitoring of the air quality and the components that influence the climate

Spectrometer that makes measurements in UV-visible

range : 270 - 500 nm

spatial resolution : 13 km * 24 km at nadir

Provides among other things :

✓total column of ozone,

✓UV surface irradiances at 305, 310, 324 and 380nm,

✓aerosol optical depths at 354, 388 and 500nm.

Comparison of the total column of ozone

Spectroradiometer :

- Differential absorption technique : (comparison between 2 ratios of irradiances at 2 wavelengths, one ratio simulated and stored in a LUT, the other calculated from UV measurements.
- All skies (clear sky and cloudy)·.
- Daily averages for zenith angles smaller than 75°

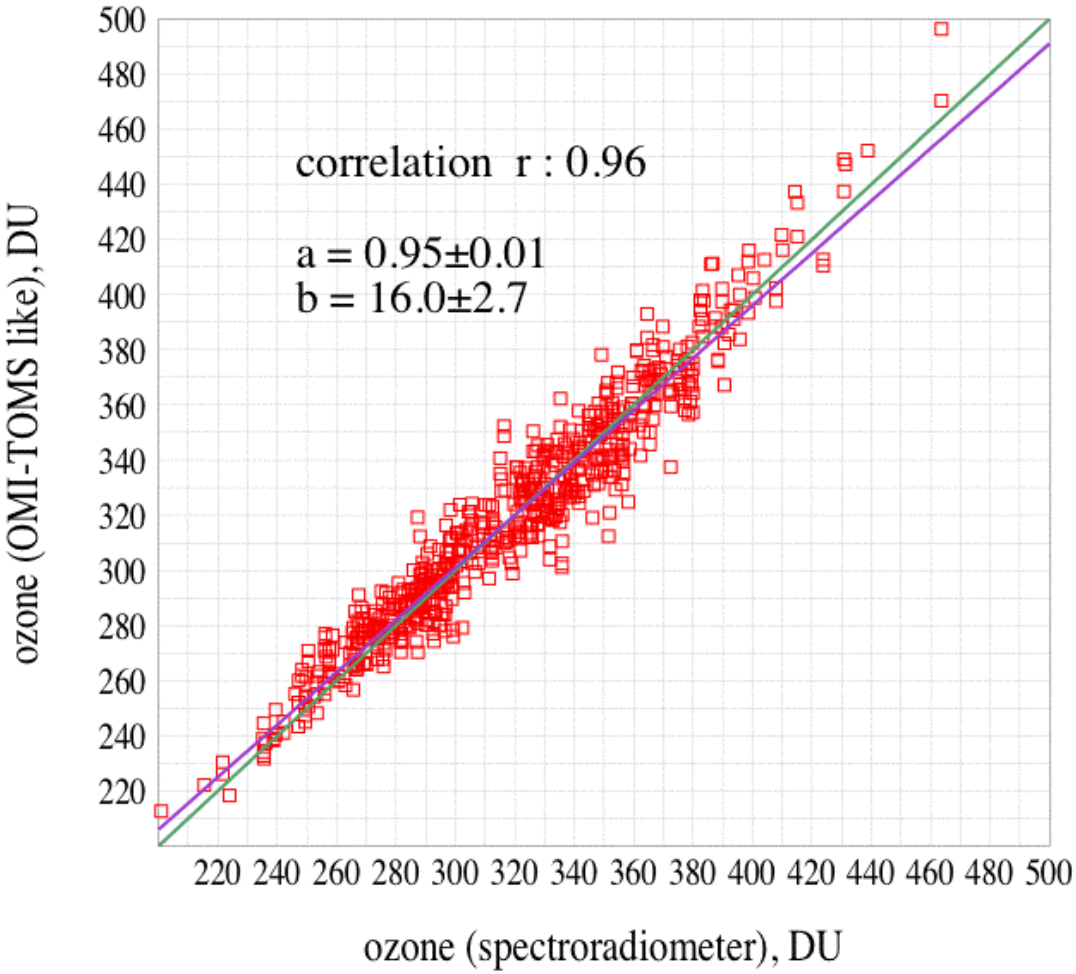
Uncertainties ~7%

OMI :

- Methods : - TOMS-like
  - DOAS-like
- Measurements : 1 or 2 overpasses·

Comparison of ozone at Villeneuve d'Ascq

OMI TOMS - like method



656 points

y = x

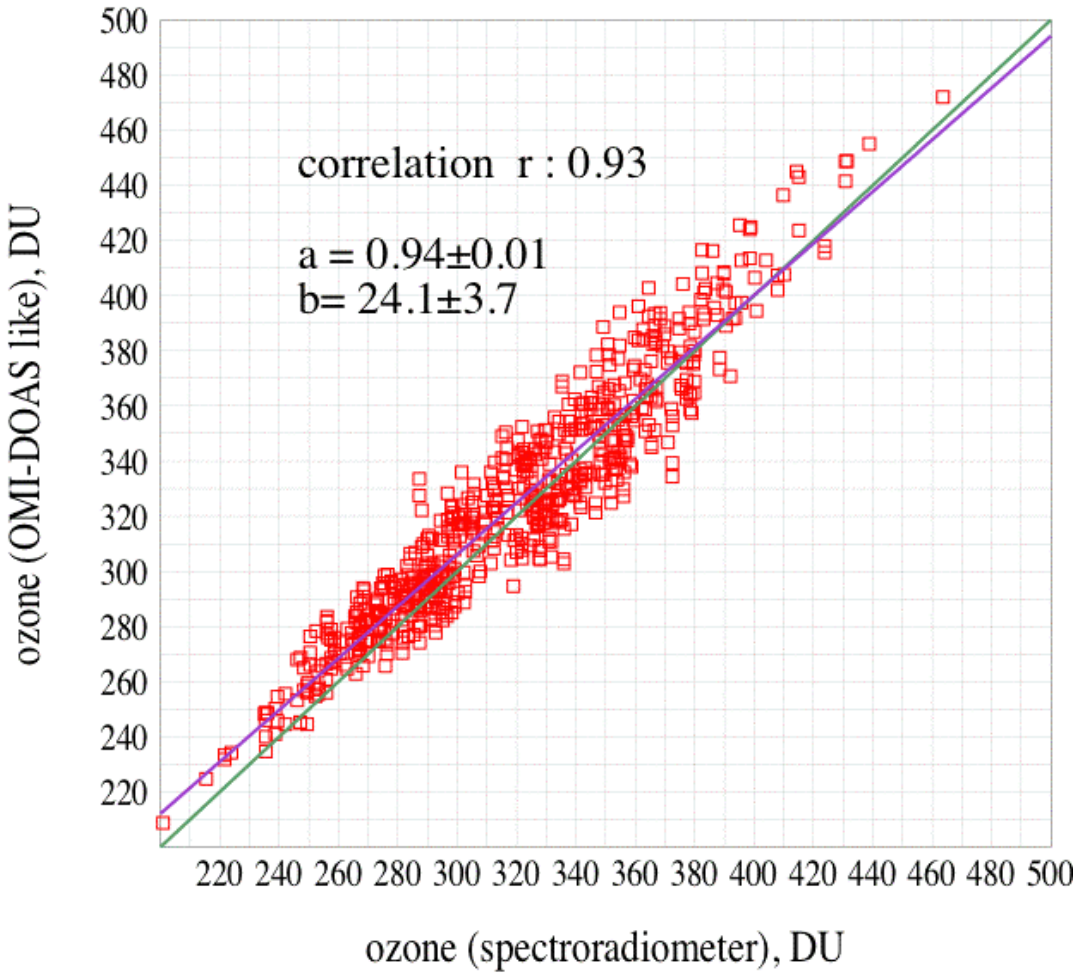
y = a*x+b

Period : October 2005 - January 2007

Good agreement

Comparison of ozone at Villeneuve d'Ascq

OMI DOAS - like method



669 points

y = x

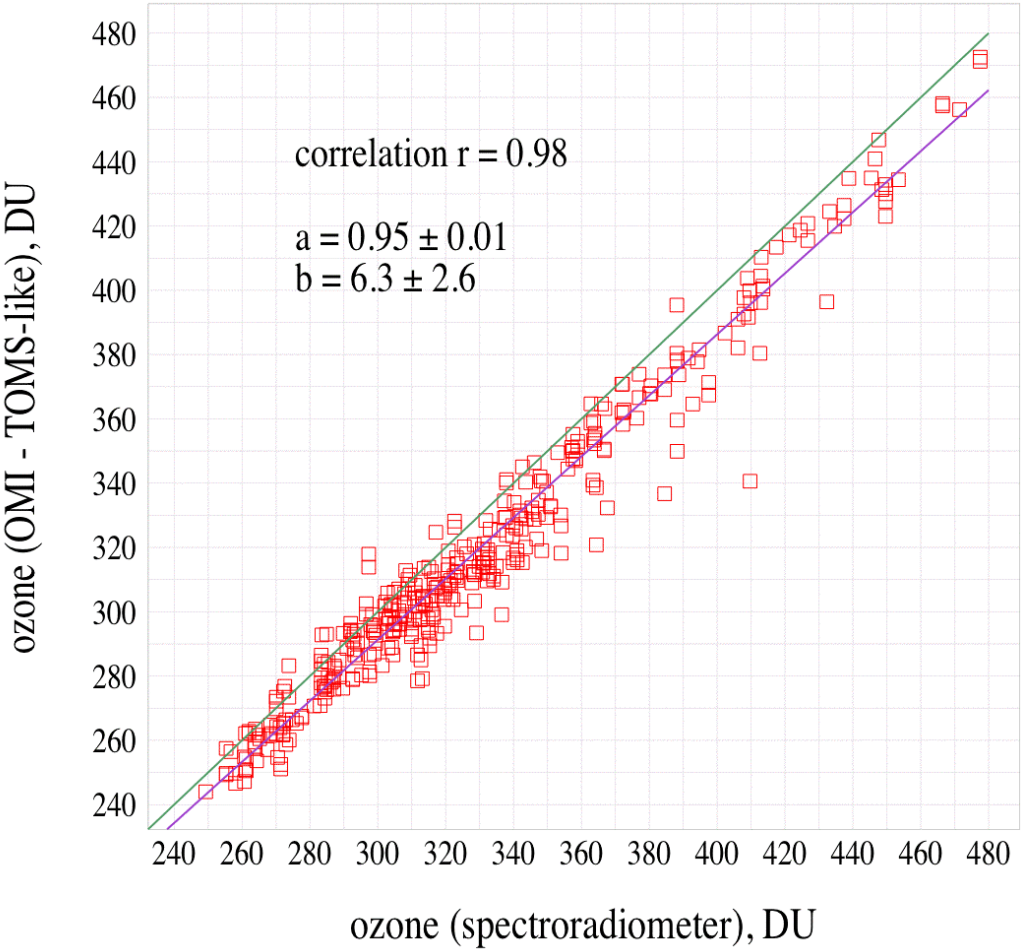
y = a*x+b

Period : October 2005 - January 2007

Agreement less good than TOMS method but correct

Comparison of ozone at Briançon

OMI TOMS - like method



378 points

y = x

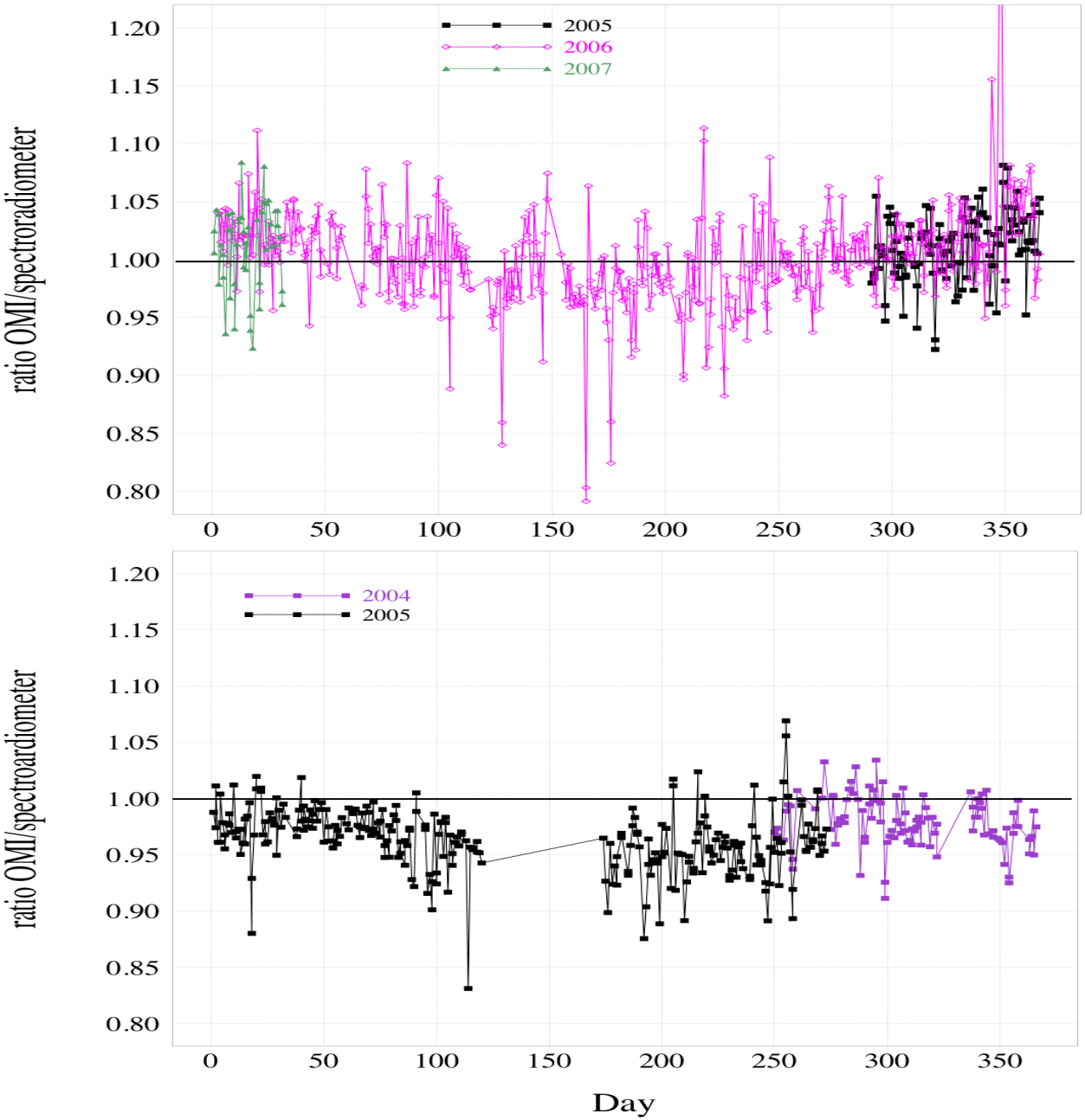
y = a*x+b

Period : September 2004 - September 2005

Good agreement but a little bias (spectro > OMI)

Study with an other spectroradiometer (Bentham) in progress.

Time series of ozone ratio OMI/spectroradiometer



At V. d'Ascq

656 points

OMI : TOMS-like method

At Briançon

378 points

Small <0 Bias

Difference larger in summer

Comparison of UV surface irradiances at V. d'Ascq

For clear skies (flags OMI and spectro)

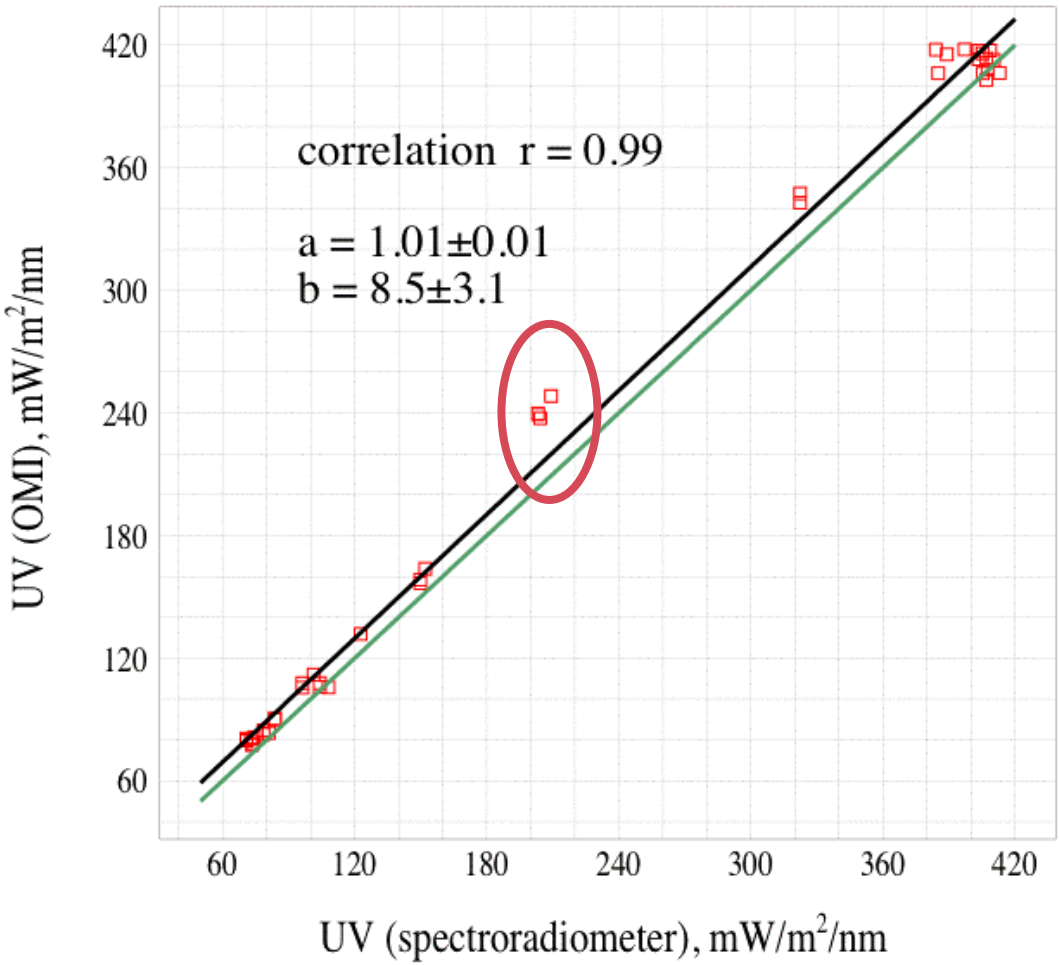
Spectroradiometer :

- Deconvolution of the measurements from the instrument's slit function (FWHM ≈ 0.75 nm) and reconvolution by the FWHM of OMI ≈ 0.55 nm (use of SCHICrivm)
- Choice of best coincidence with solar noon.

OMI :

- Determination of UV surface irradiances: radiance measurements + radiative transfer model (input data : ozone, surface albedo, P, T profiles…).
- One or two data per day (at solar noon).

Comparison of UV at 324 nm at Villeneuve d'Ascq



43 points

y = x

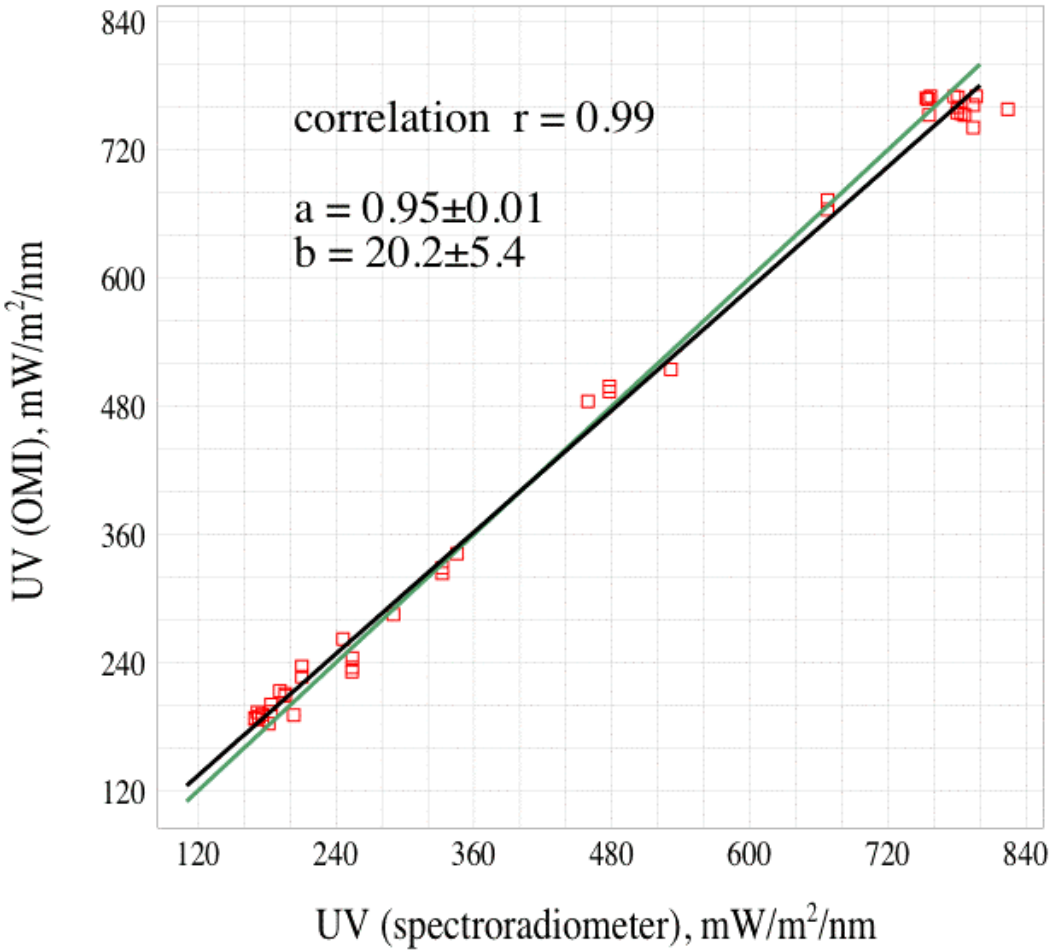
y = a*x+b

Period : October 2005 - July 2006

Satisfying agreement - small bias

(important to use the same slit function).

Comparison of UV at 380nm



43 points

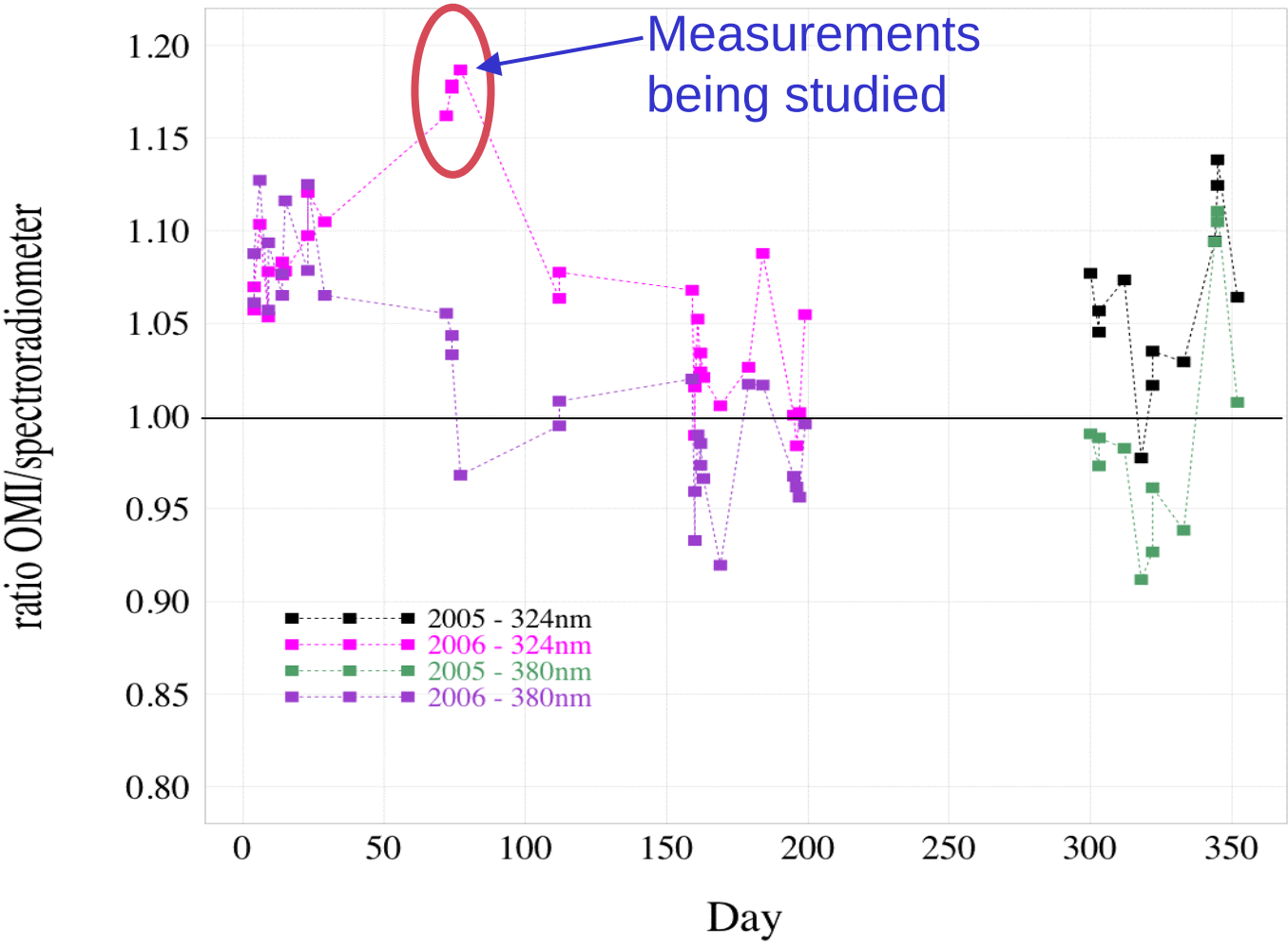
y = x

y = a*x+b

Period : October 2005 - July 2006

Satisfying agreement

Time series of irradiance ratio OMI / spectroradiometer



at 324 nm

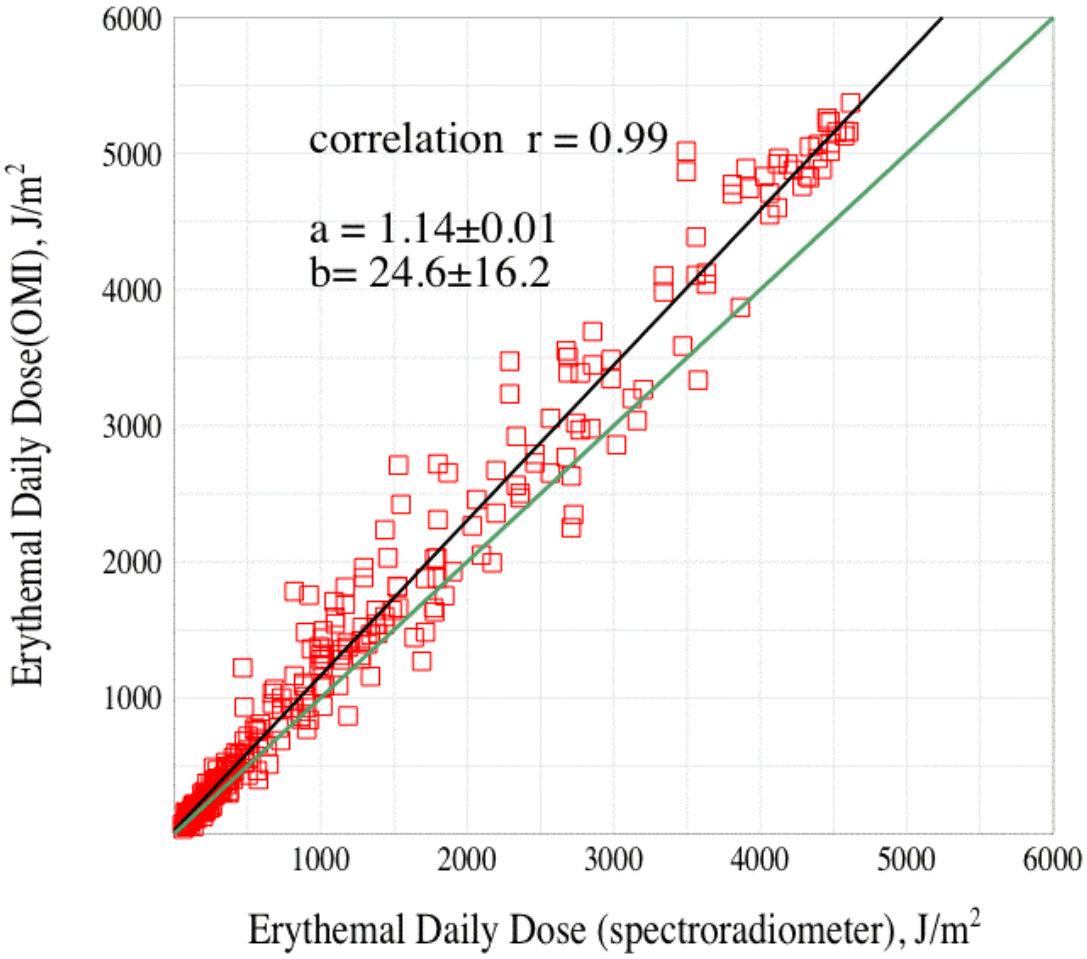
bias ~ 5-10 %

at 380 nm

~ 5-10 %
in winter

~ - 5-10 %
in other
seasons

Comparison of the erythemal daily doses at V. d'Ascq



353 points

y = x

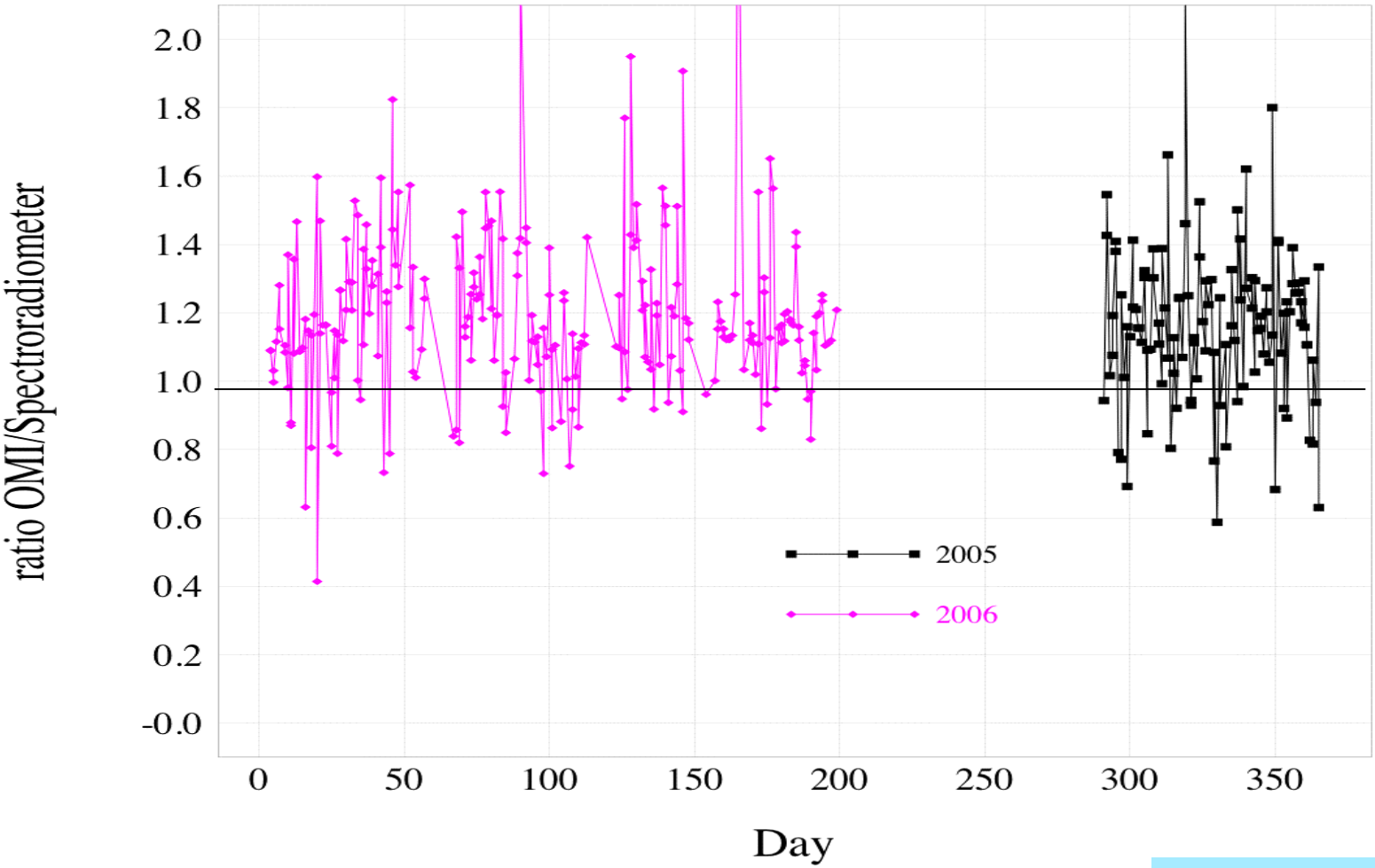
y = a*x+b

Period : October 2005 - July 2006

∃ Bias (OMI > spectro)

Similar results as others teams

Time series of the EDD ratio OMI /spectro at V. d'Ascq



Bias ≈ 20%

Comparison of aerosols at Villeneuve d'Ascq

Clear sky

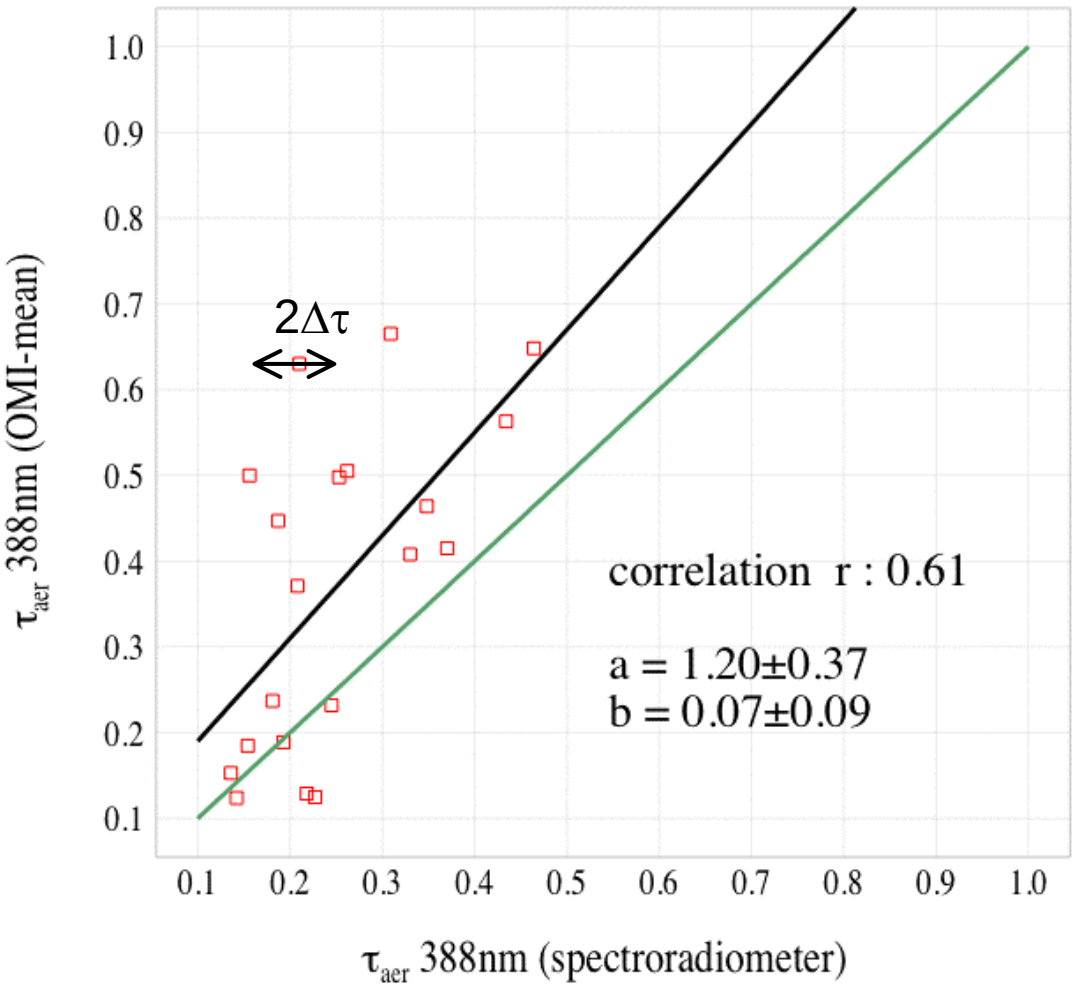
Spectroradiometer :

- Aerosol optical depth (AOD) is obtained from the gound-based direct irradiance (global - diffuse).
- Uncertainties : ~ 0.05

OMI :

- Method : adjustement of the radiance measured at 388 nm.
- The OMI's AOD at 388 nm is averaged within 50 km around V. d'Ascq (reduces the influence of clouds).

Comparison OMI - spectroradiometer at V. d'Ascq



20 points

y = x

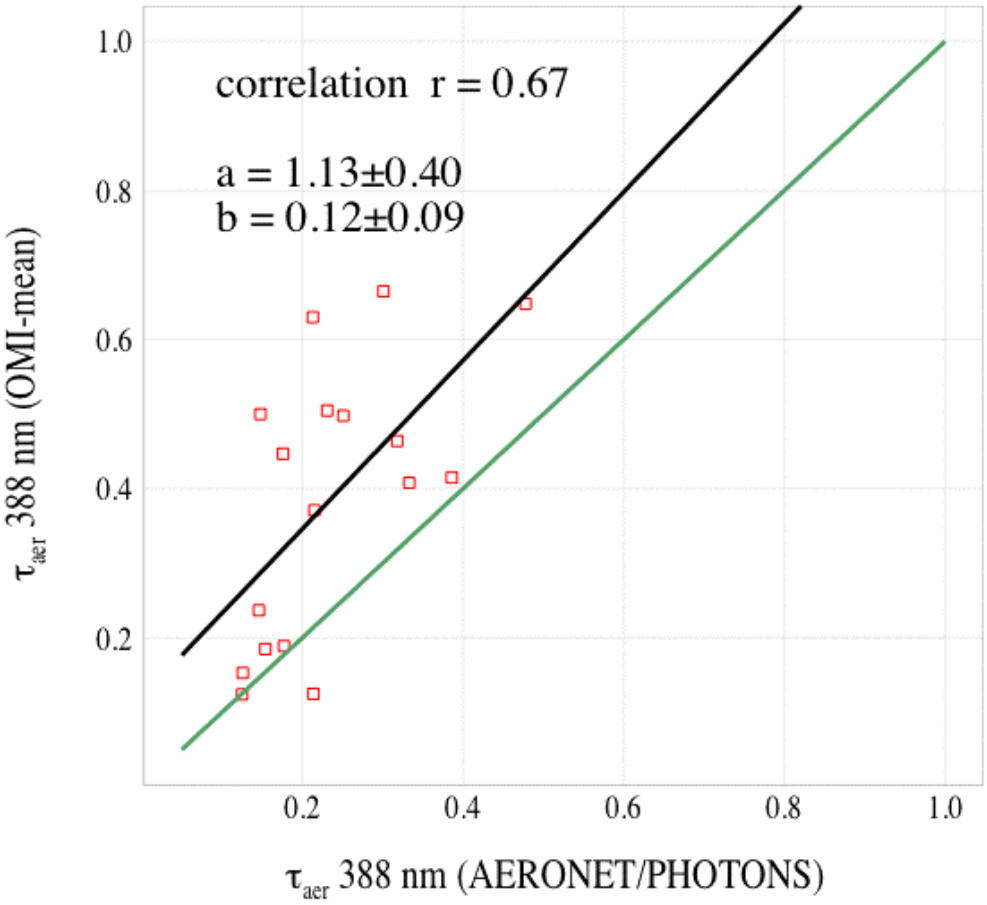
y = a*x+b

Period : March - September 2006

Preliminary results disappointing

Comparison OMI - AERONET/PHOTONS at V. d'Ascq

AERONET/PHOTONS : interpolation



17 points

y = x

y = a*x+b

Period : March - September 2006

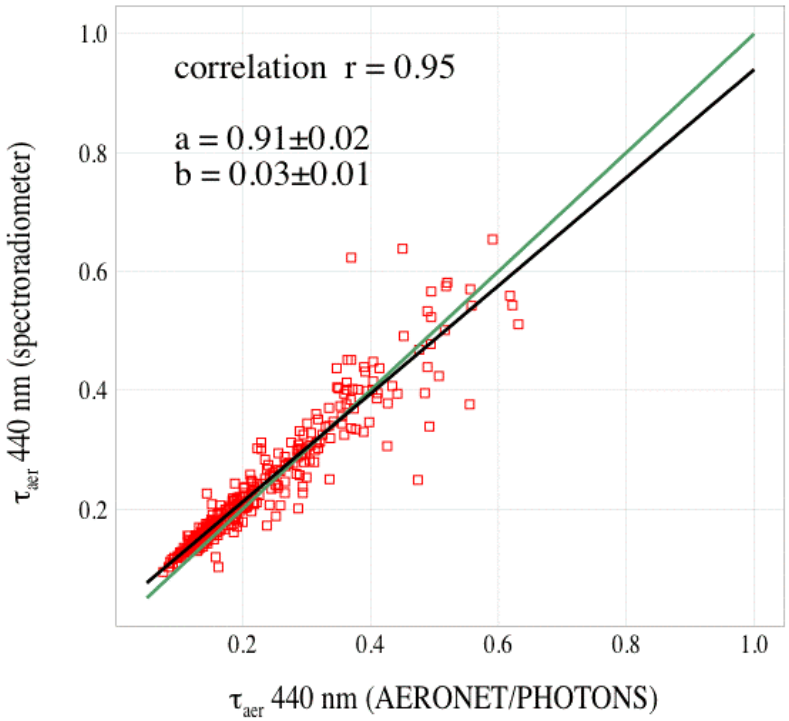
Similar results : OMI's AOD > spectroradiometer's AOD and > AERONET's AOD.

AOD at V. d'Ascq small

=> Cloud contamination ? (pixel size)

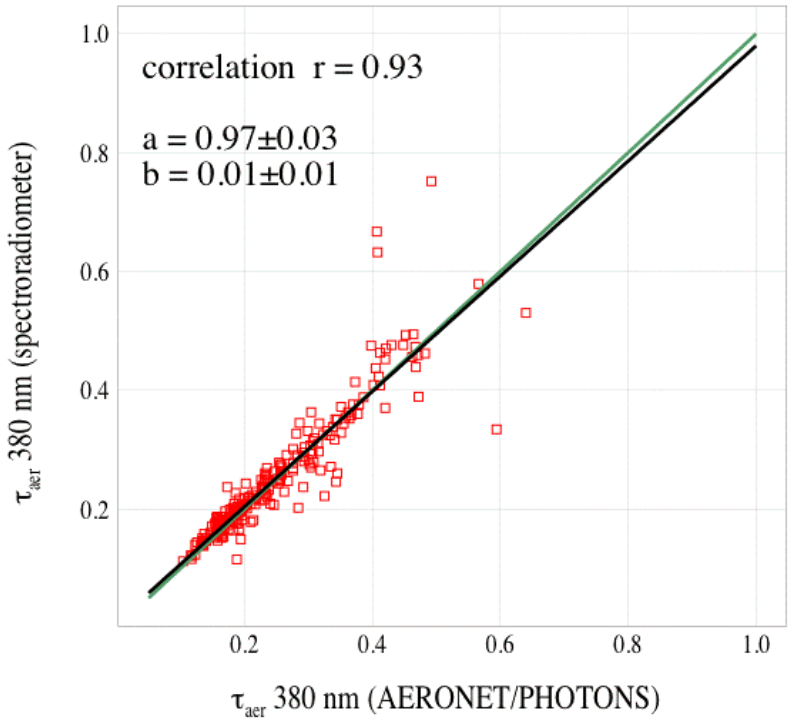
Comparison spectroradiometer - AERONET/PHOTONS

at 440nm



□ □ □ 349 points

at 380nm



□ □ □ 238 points

—— y = x

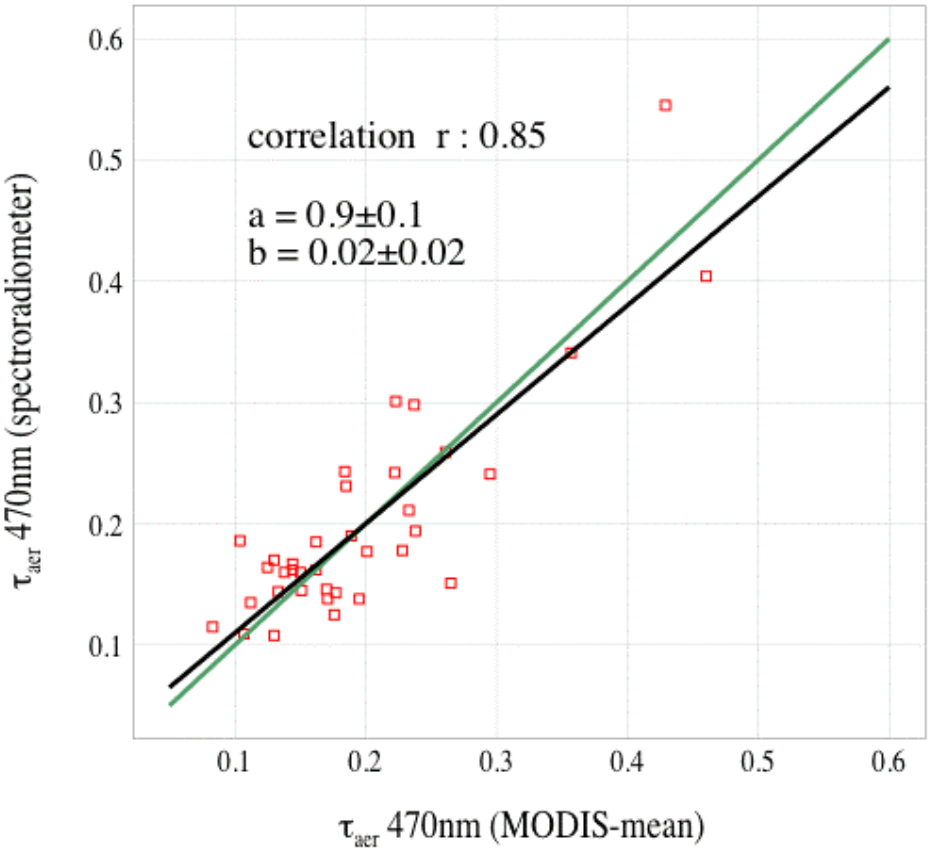
—— y = a*x+b

Period : January - September 2006

The results are quite satisfying

Comparison spectroradiometer - MODIS/Aqua

spectroradiometer : extrapolation at 470 nm



36 points

y = x

y = a*x+b

Period : January 2006 - October 2006

Results quite reasonable

Comparisons spectro/MODIS and spectro/AERONET ⇒ spectroradiometer's AOD is generally correct

CONCLUSIONS :

Ozone : good agreement for both methods (a little better for TOMS-like).

UV irradiance: reasonable agreement at 324 and 380 nm.

Erythemal daily doses : bias OMI>spectro.

Aerosols : preliminary comparisons with OMI disappointing.

Comparisons between MODIS and AERONET AOD with AOD from ground-based spectroradiometer in VdA are satisfying.

Prospect :

Comparisons of UV irradiances at Briançon.

Use of future version OMAERO of KNMI.