Action 726

SAPIENZA
UNIVERSITÀ DI ROMA
Physics Department

Cost 726 Final Workshop
13-15 May 2009 - Warsaw, Poland

Solar UV radiation, total ozone and aerosol monitoring by means of satellite and ground-based instruments at Rome

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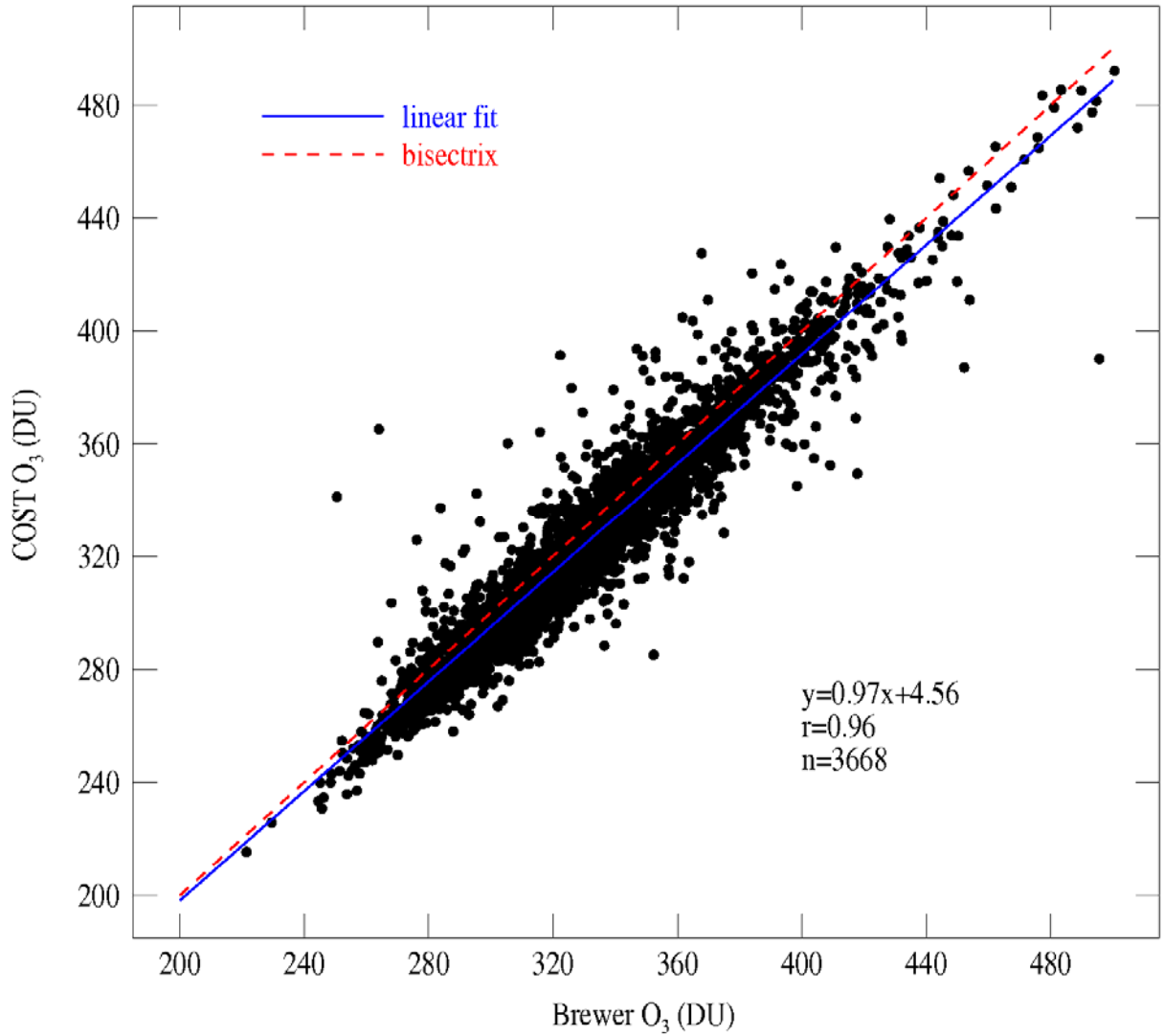
Ground-based station

Solar Radiometry Observatory
University of Rome - Sapienza
(41.9°N, 12.5°E, 75 m a.s.l.)

Broad-band radiometer (model YES UVB-1)

Brewer spectrophotometer #067 (MKIV)

Total Ozone



Rel. Difference
-1.8% ± 3.2%

Erythemal UV radiation

$$EDR = \int_{280\,nm}^{400\,nm} S(\lambda) I(\lambda) d\lambda$$ Erythemal Dose Rate (Brewer)

$$EDR = UCf_n(SZA, TO_3) Coscor(SZA)$$ Erythemal Dose Rate (YES)

U signal of the instrument (Volt)

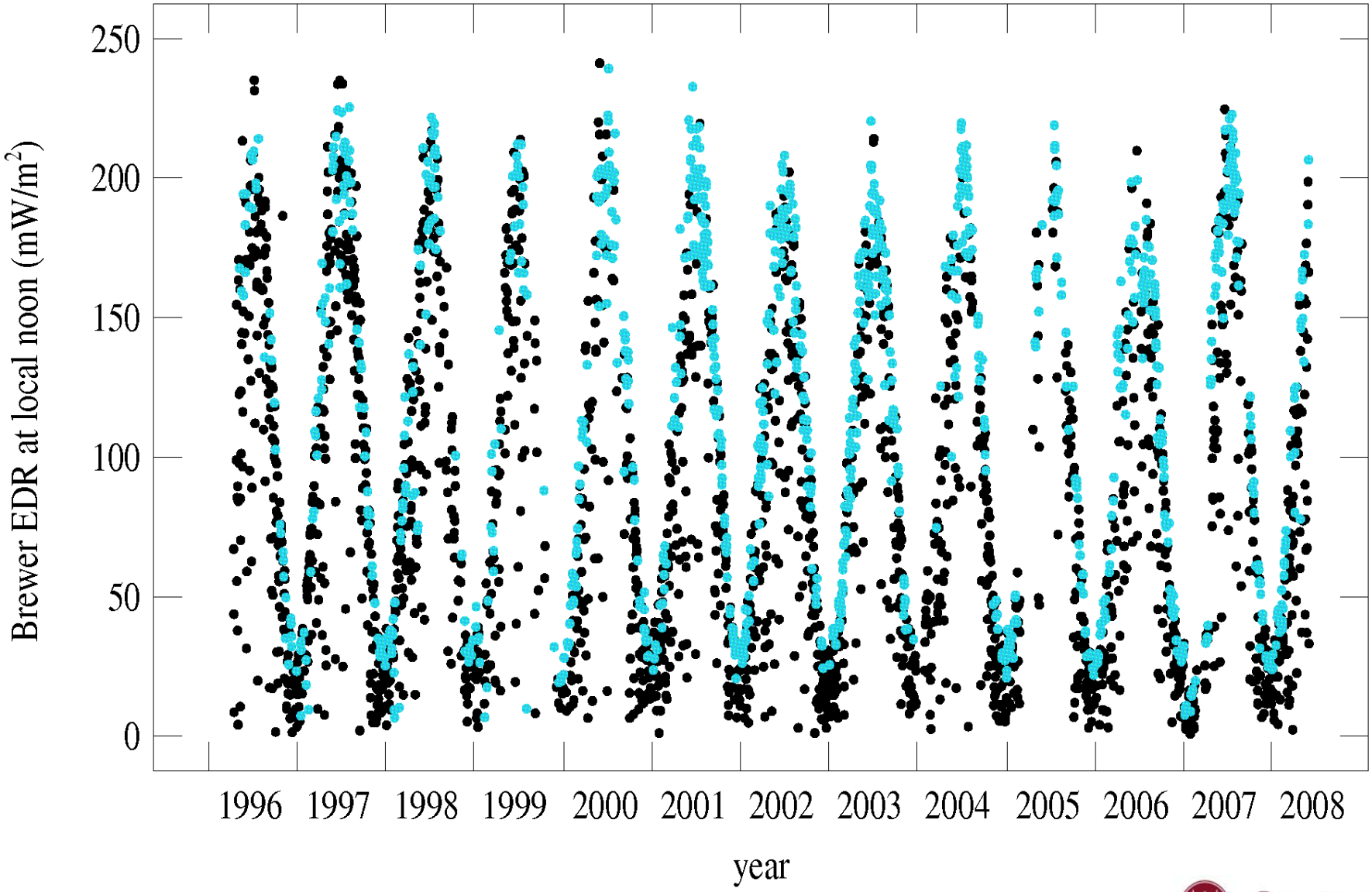
$C = 0.1104\ Wm^{-2}V^{-1}$ (SZA=40°, TO_3=300 DU) calibration coefficient

$f_n(SZA, TO_3)$ function of SZA and TO_3 (spectral mismatch correction)

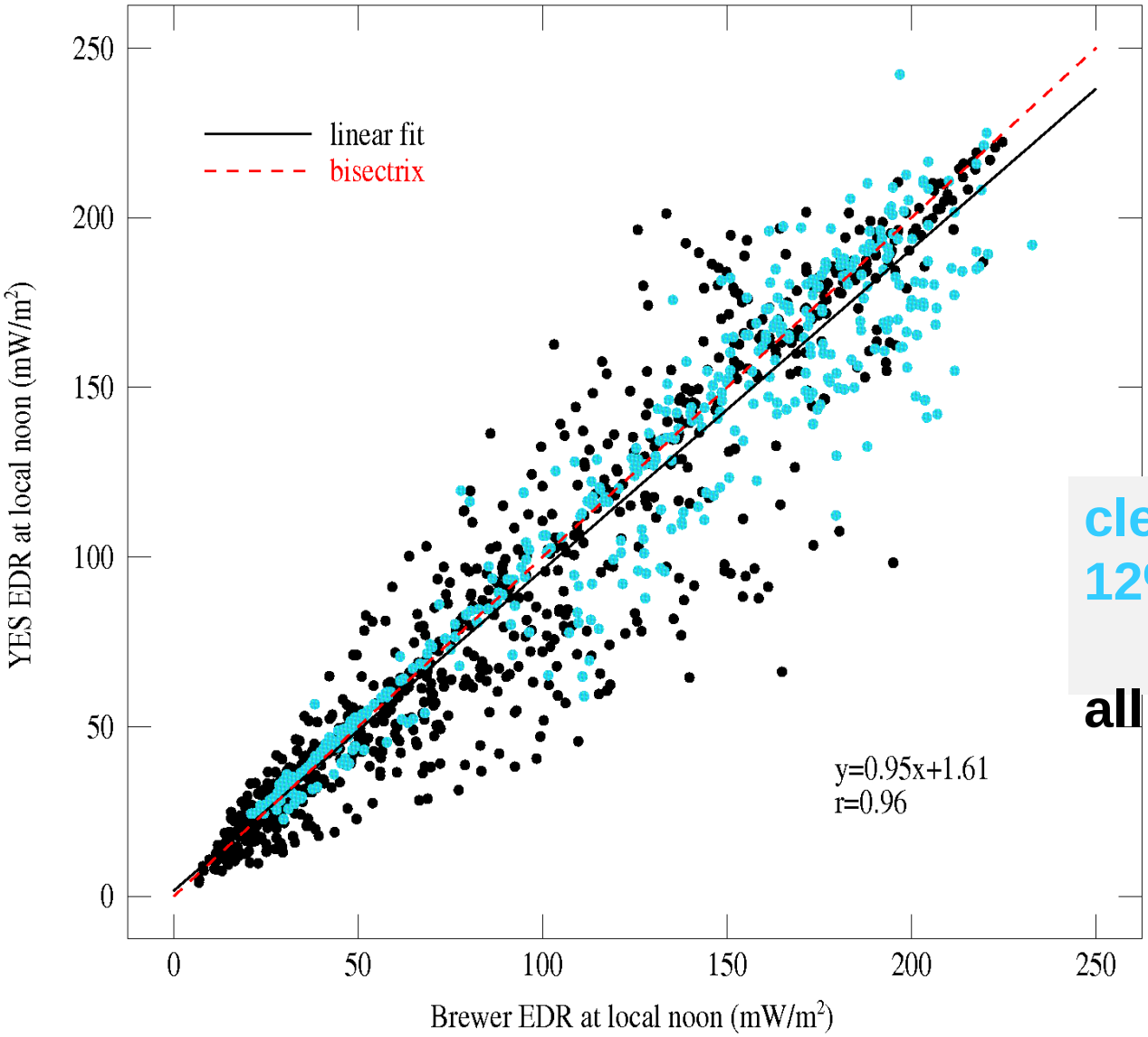
$Coscor(SZA)$ cosine correction function

$$EDD = \int EDR(t)dt = \sum EDR(t)\Delta t$$ Erythemal Daily Dose

EDR at noon (Brewer)



Brewer vs YES EDR at noon



clear skies: -2% ± 12%

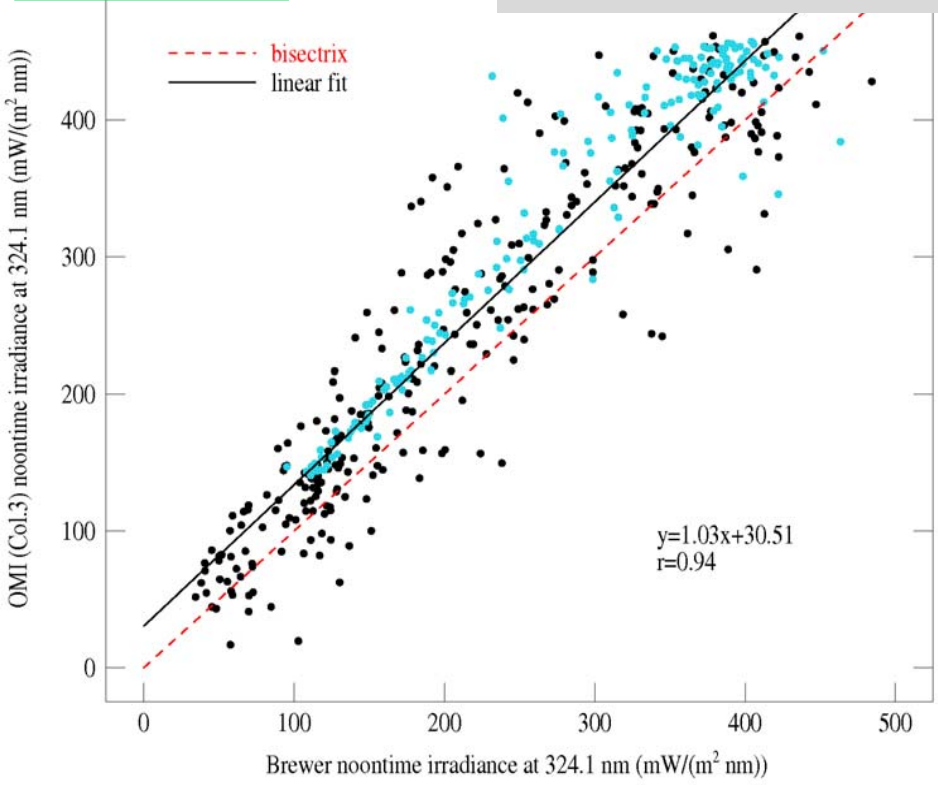
all skies: -3% ± 19%

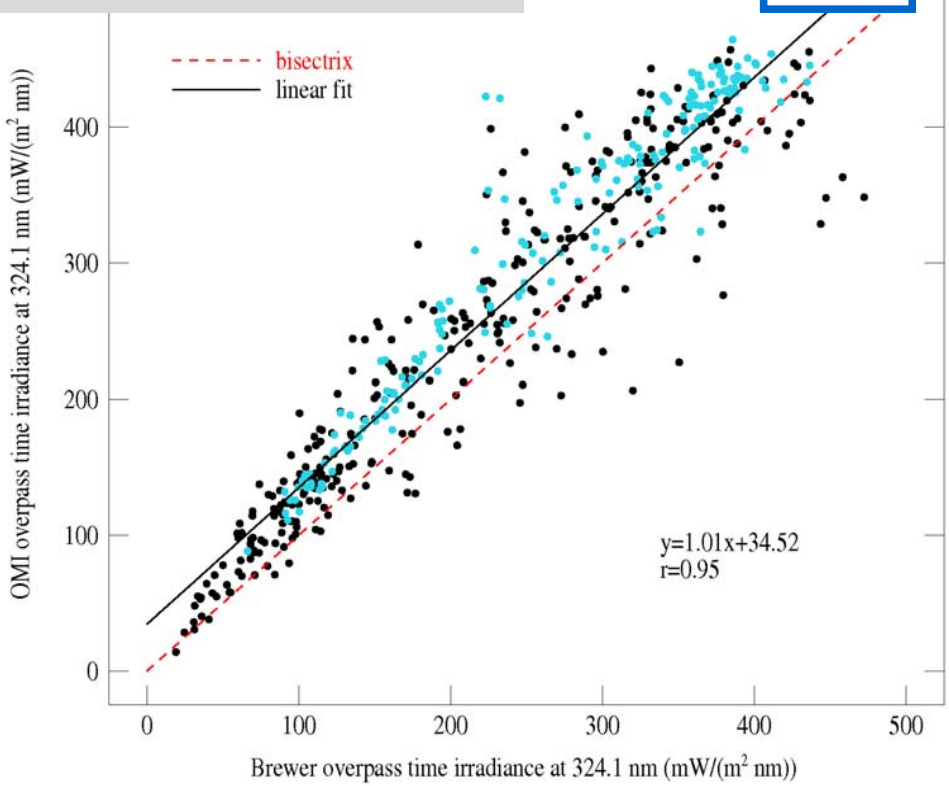
OMI validation: spectral irradiance

12:00 LT

SHIC-RIVM model for slit function correction
Brewer 067 FWHM=0.63 to OMI FWHM=0.55

OVP



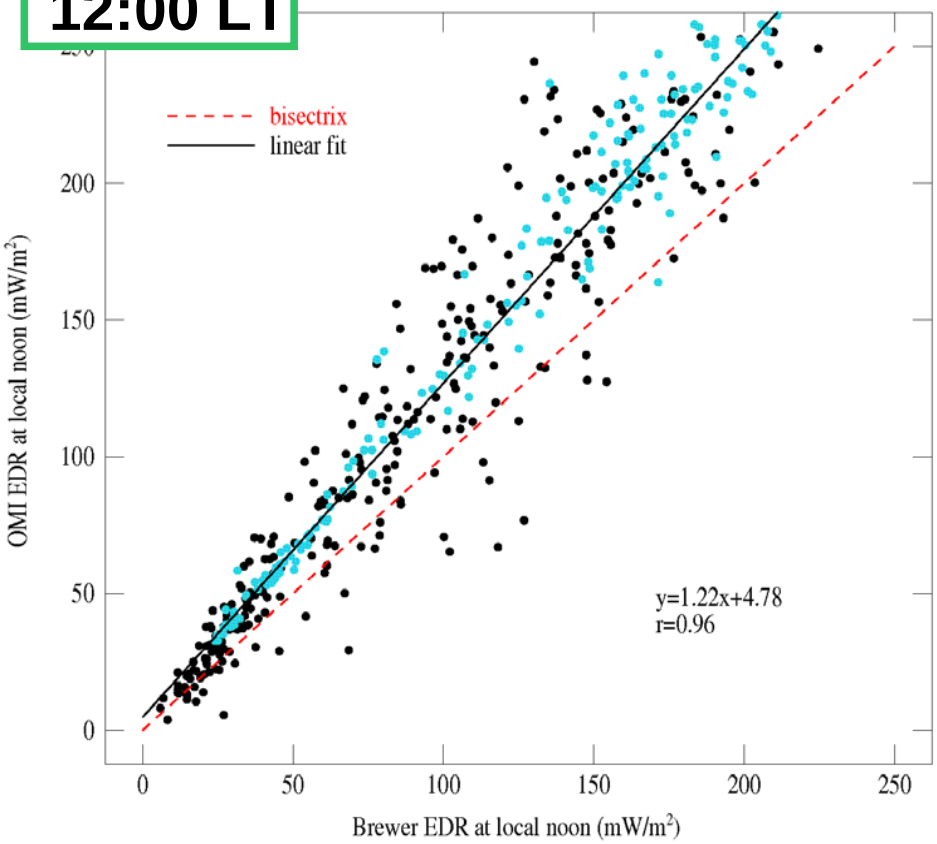


	bias%		r	
	cs	as	cs	as
Irradiance at 305 nm	25	21	0.98	0.97
Irradiance at 310 nm	11	10	0.97	0.95
Irradiance at 324 nm	21	18	0.96	0.94

	bias%		r	
	cs	as	cs	as
Irradiance at 305 nm	24	22	0.99	0.97
Irradiance at 310 nm	11	10	0.97	0.95
Irradiance at 324 nm	20	19	0.97	0.95

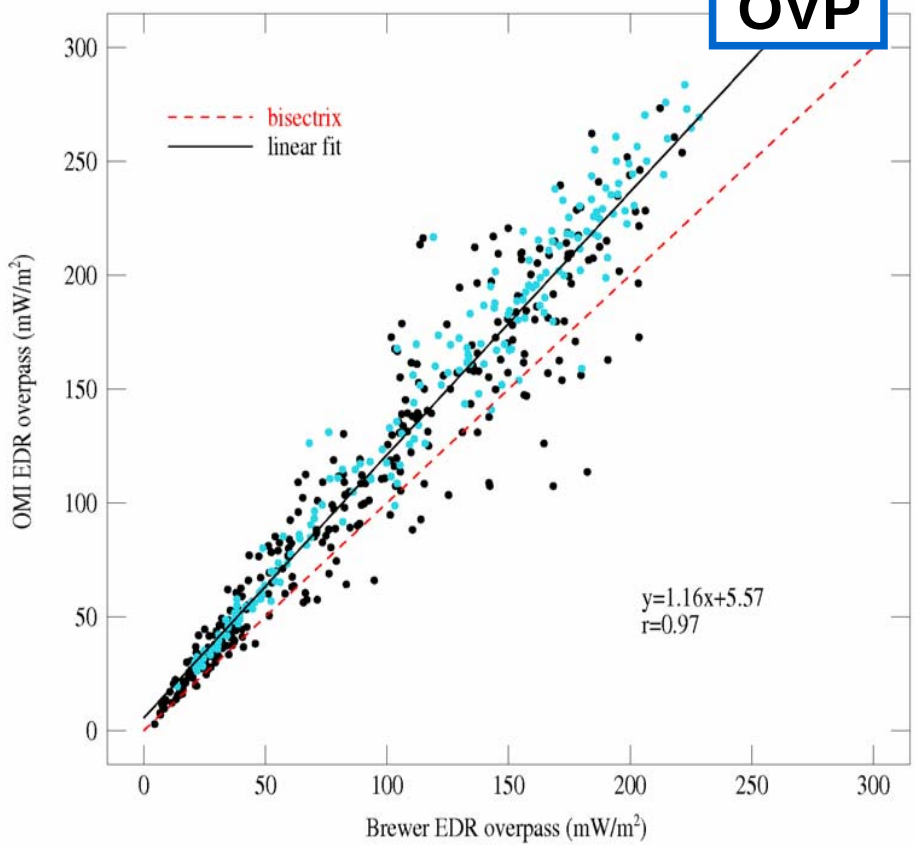
OMI validation: EDR

12:00 LT



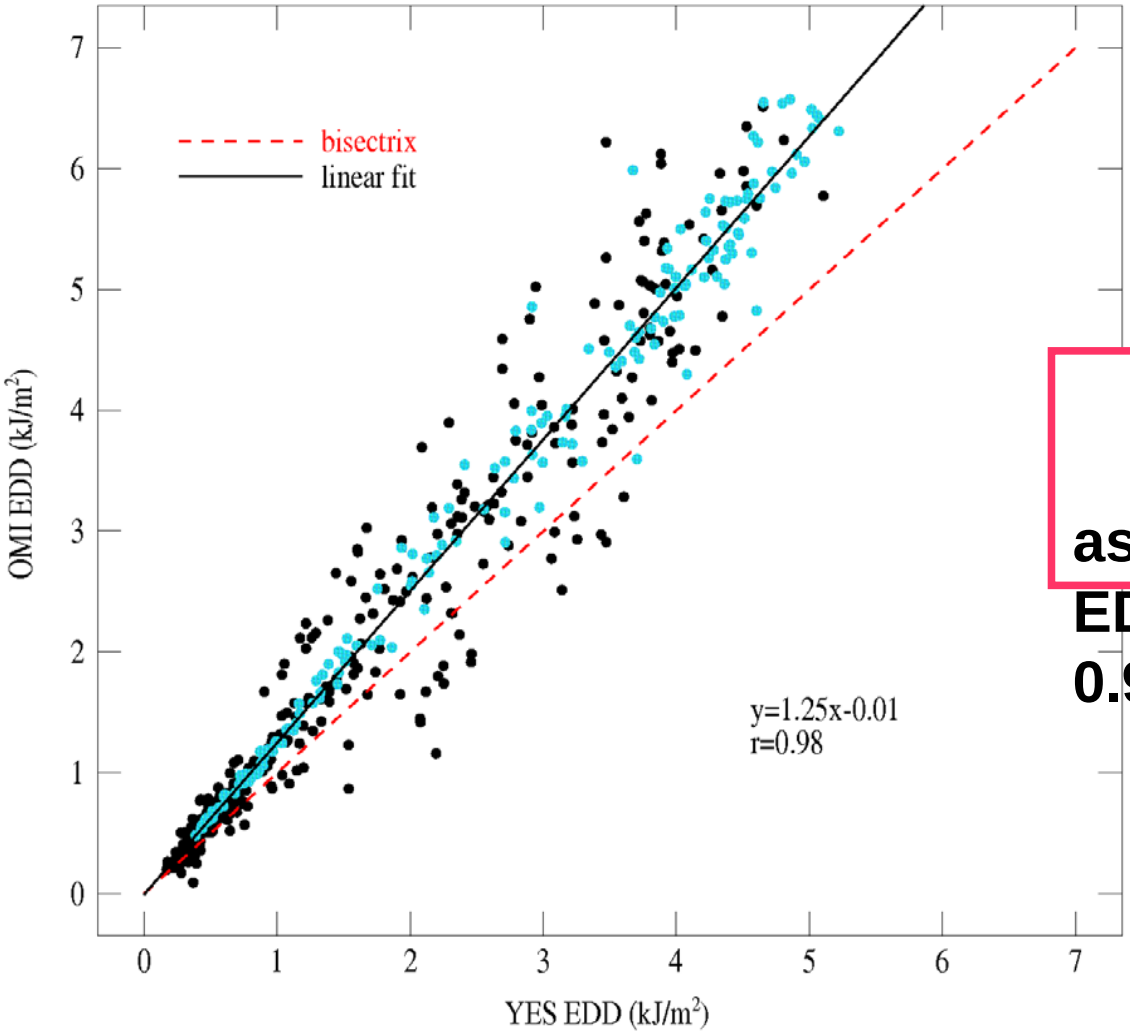
	bias%		r	
	cs	as	cs	as
EDR Brewer	30	28	0.98	0.96
EDR YES	28	22	0.98	0.96

OVP



	bias%		r	
	cs	as	cs	as
EDR Brewer	26	24	0.98	0.97
EDR YES	29	27	0.98	0.96

OMI validation: EDD



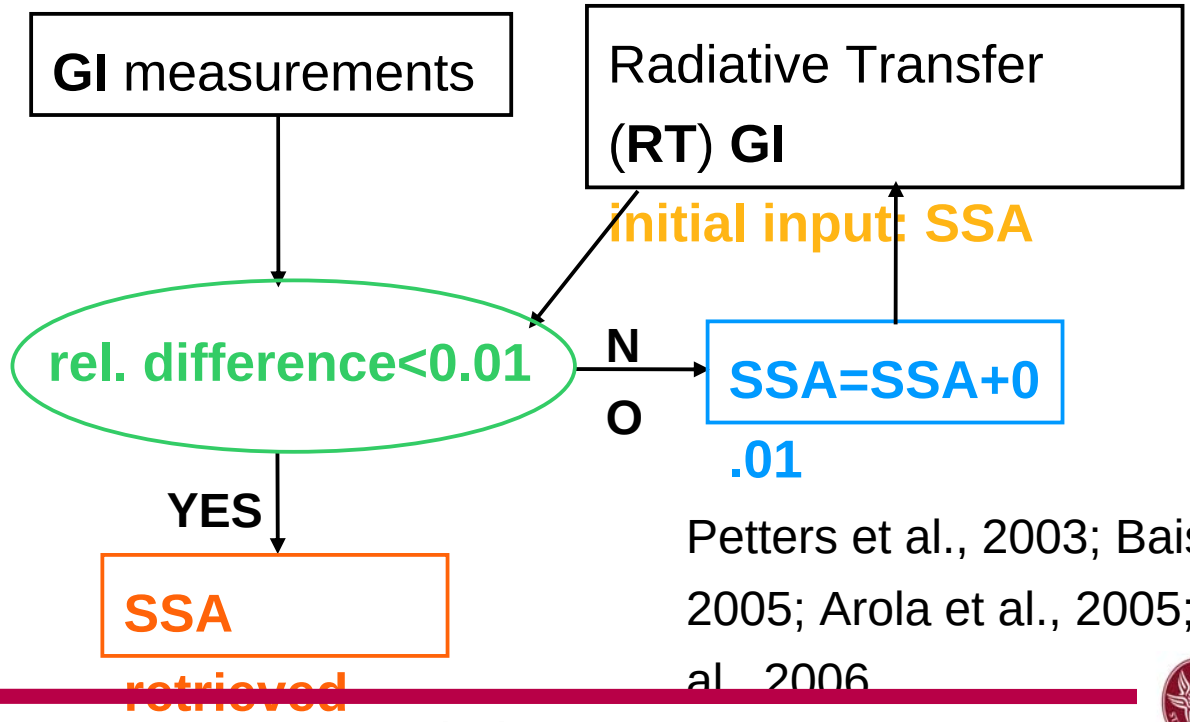
	bias%		r	
	cs	as	cs	as
EDD YES	26	25	0.99	0.98

SSA and AAOD retrieval in UV range

SSA=$k_s/(k_s+k_a)$ Single Scattering Albedo

AAOD=(1-SSA)·AOD Absorbing Aerosol Optical Depth

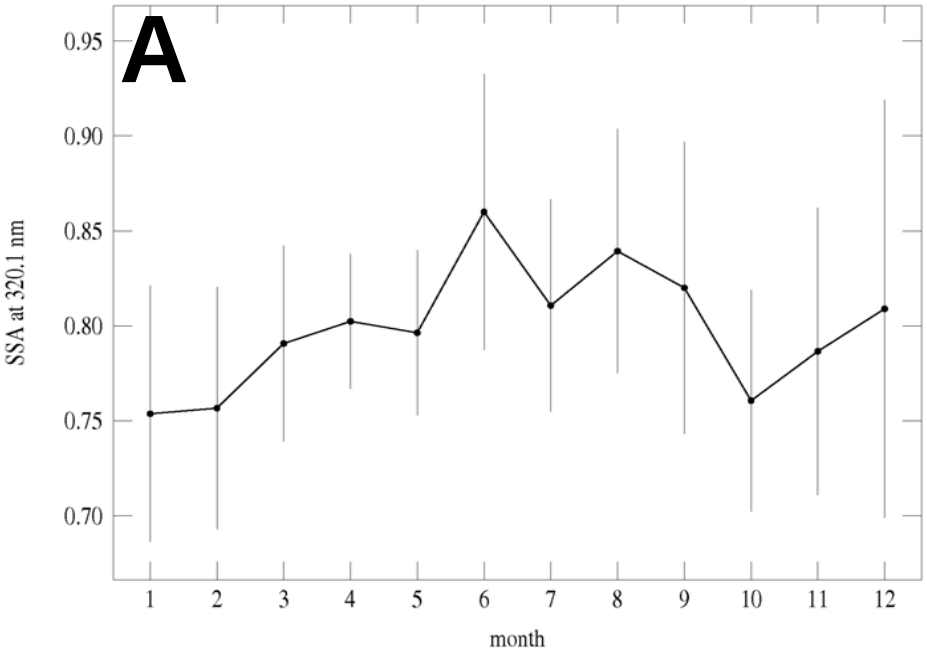
GI global irradiance



Petters et al., 2003; Bais et al., 2005; Arola et al., 2005; Meloni et al., 2006

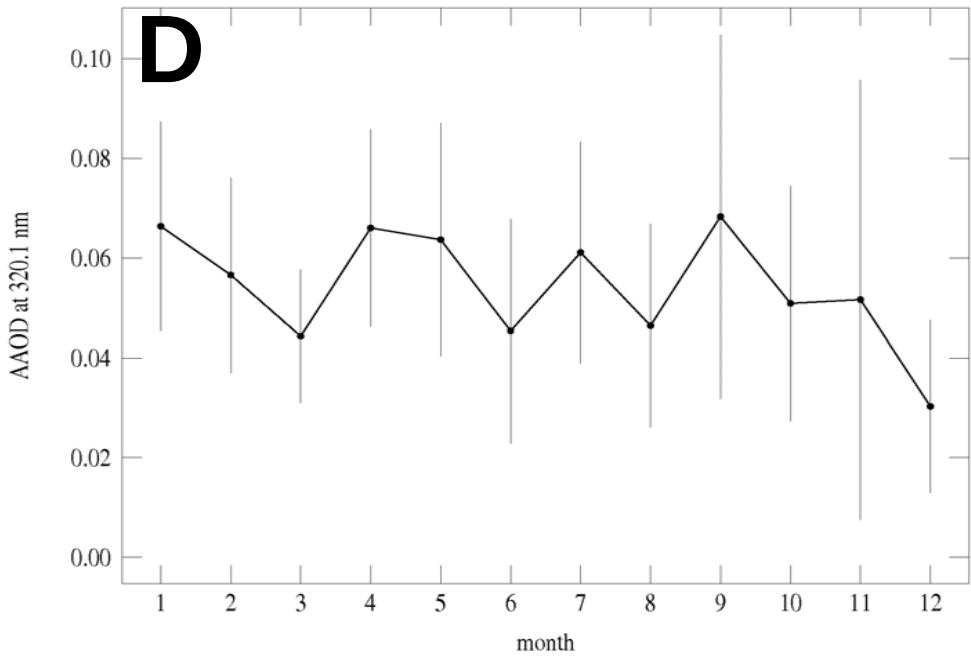
Monthly means

SSA



mean SSA=0.80 ± 0.08

AAOD

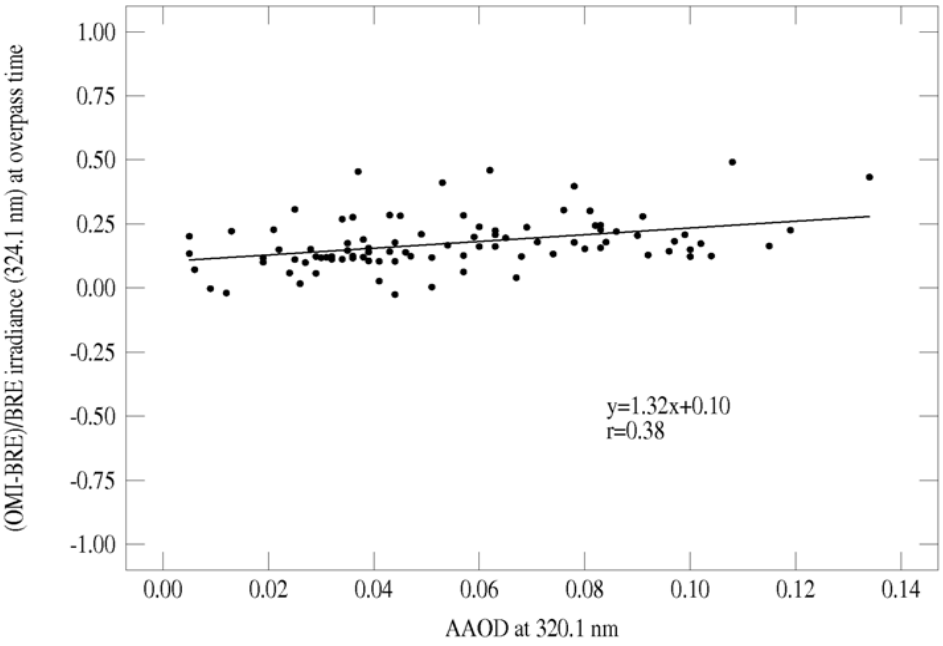


mean AAOD=0.056 ± 0.028

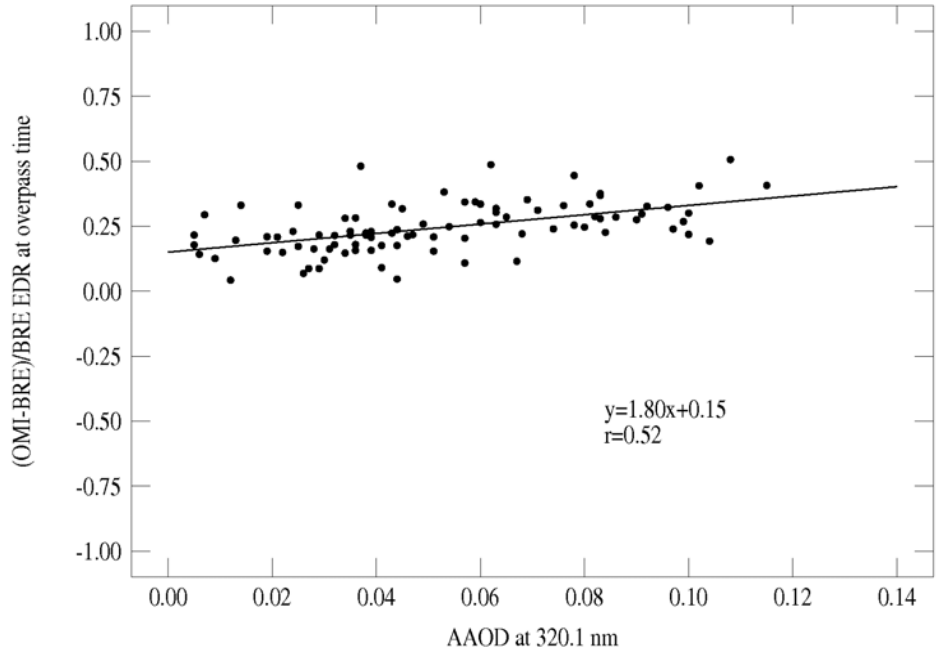
OMI UV products validation: the role of absorbing aerosols

within ½ hour to OMI overpass

Irradiance 324nm



EDR



Medium-high correlation for AAOD (higher than for AOD)

Absorbing aerosols correction factor

$E_{CORR}=C_A \cdot E_{CLOUD}$

1. $C_A=1/(1+s \cdot AAOD)$ s=slope
2. $C_A=1/(1+s \cdot AAODS)$ AAODS=AAOD/cos(SZA)
3. $C_A=1/(1+3 \cdot AAOD)$ Krotkov et al., 2005

Irradiance 324nm

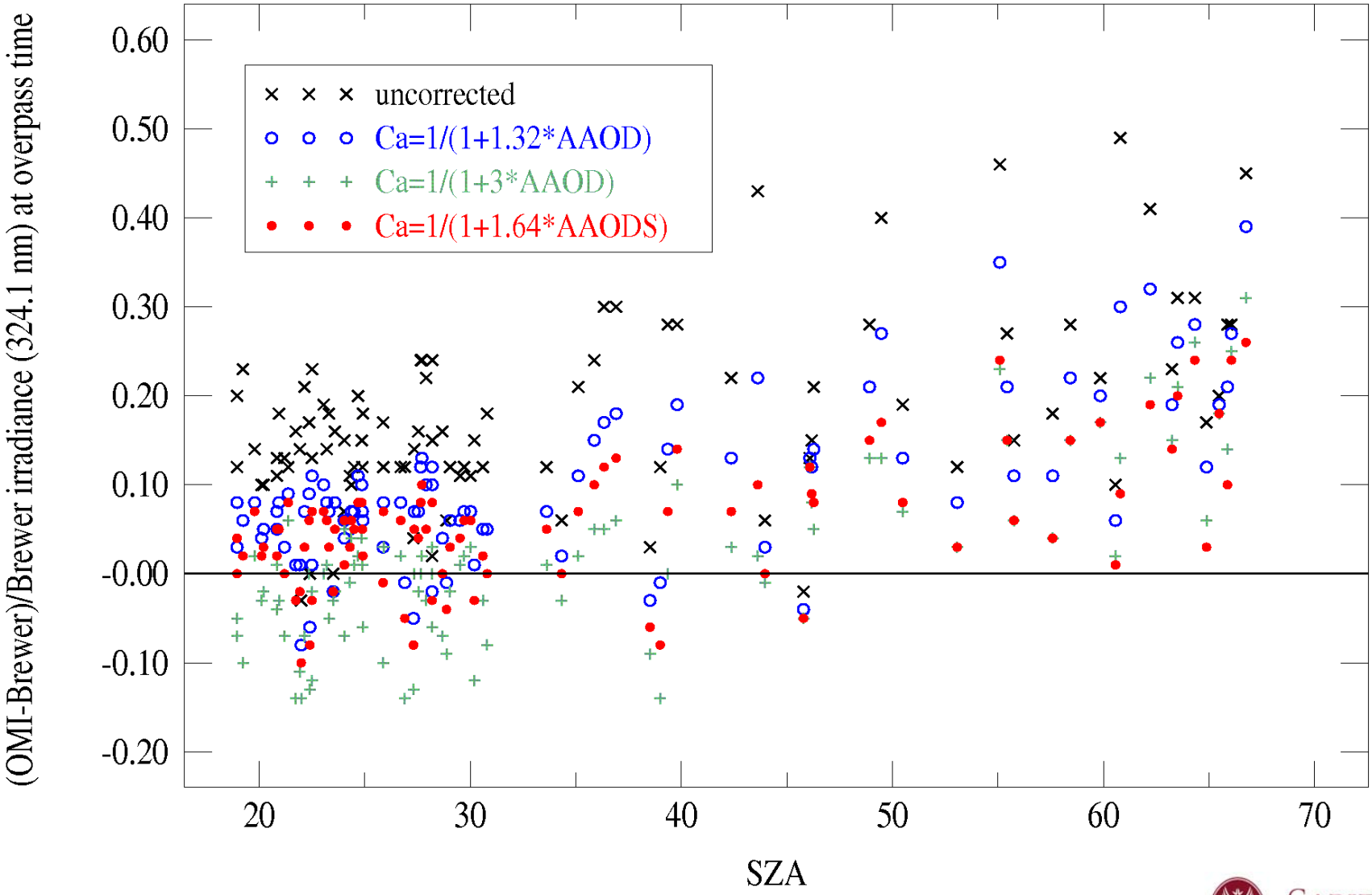
$1/C_A$	s	bias	SD
1	-	17.7	10.2
1+s·AAOD	1.32	9.9	9.1
1+s·AAODS	1.64	5.8	7.4
1+3·AAOD	3	1.6	9.7

EDR

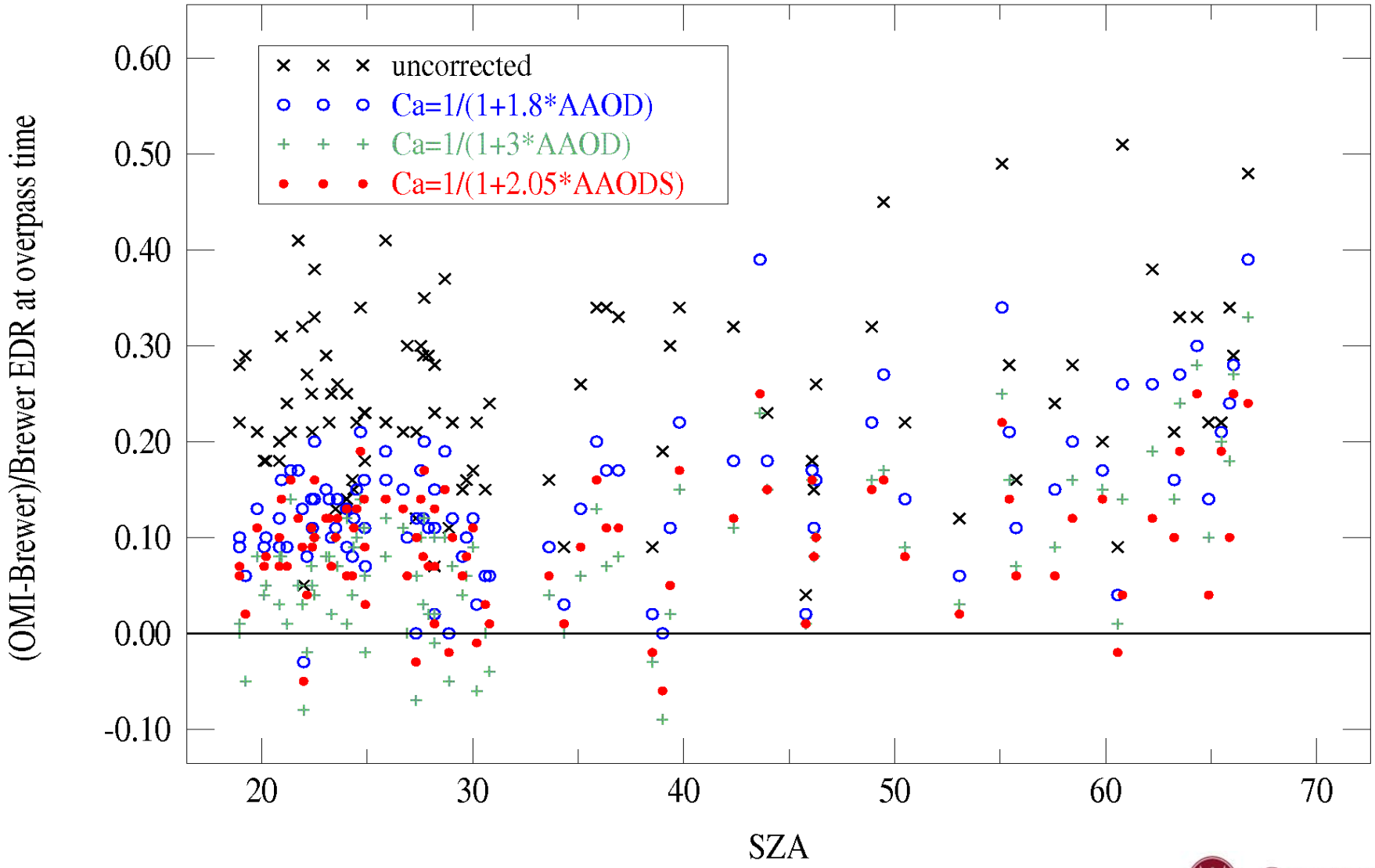
$1/C_A$	s	Bias	SD
1	-	25.0	10.7
1+s·AAOD	1.80	14.3	8.1
1+s·AAODS	2.05	9.6	6.5
1+3·AAOD	3	7.8	8.1

bias reduced by 10-15%
smaller bias for method 3; smaller SD for method 2

OMI correction: irradiance 324nm



OMI correction: EDR



Acknowledgments

COST Action 726: Long term changes and climatology of UV radiation over Europe for supporting the STSM at the lab LOA (Université des Sciences et Technologies de Lille, France)

Publications

Ialongo I.: **Surface UV radiation, total ozone and aerosol monitoring by means of satellite and ground-based instruments at Rome**, PhD Thesis, Sapienza University of Rome, 2009.

Ialongo I., Siani A.M., Casale G.R. and Cacciani M.: **Comparison between Erythemal Daily Dose retrievals from YES broadband radiometer and OMI data at Rome station,** Proceedings of the UV Conference One Century of UV Radiation Research, Davos, Switzerland, 18-20 September 2007, 189-190, Ed. by J. Groebner, 2007.

Ialongo I., G. R. Casale, and A. M. Siani: **Comparison of total ozone and erythemal UV data from OMI with ground-based measurements at Rome station**, Atmos. Chem. Phys., 8, 3283-3289, 2008.