SAPIENZA
UNIVERSITÀ DI ROMA

Physics Department

Solar UV radiation monitoring at Rome (Italy) by means of ground- and satellite-based instruments

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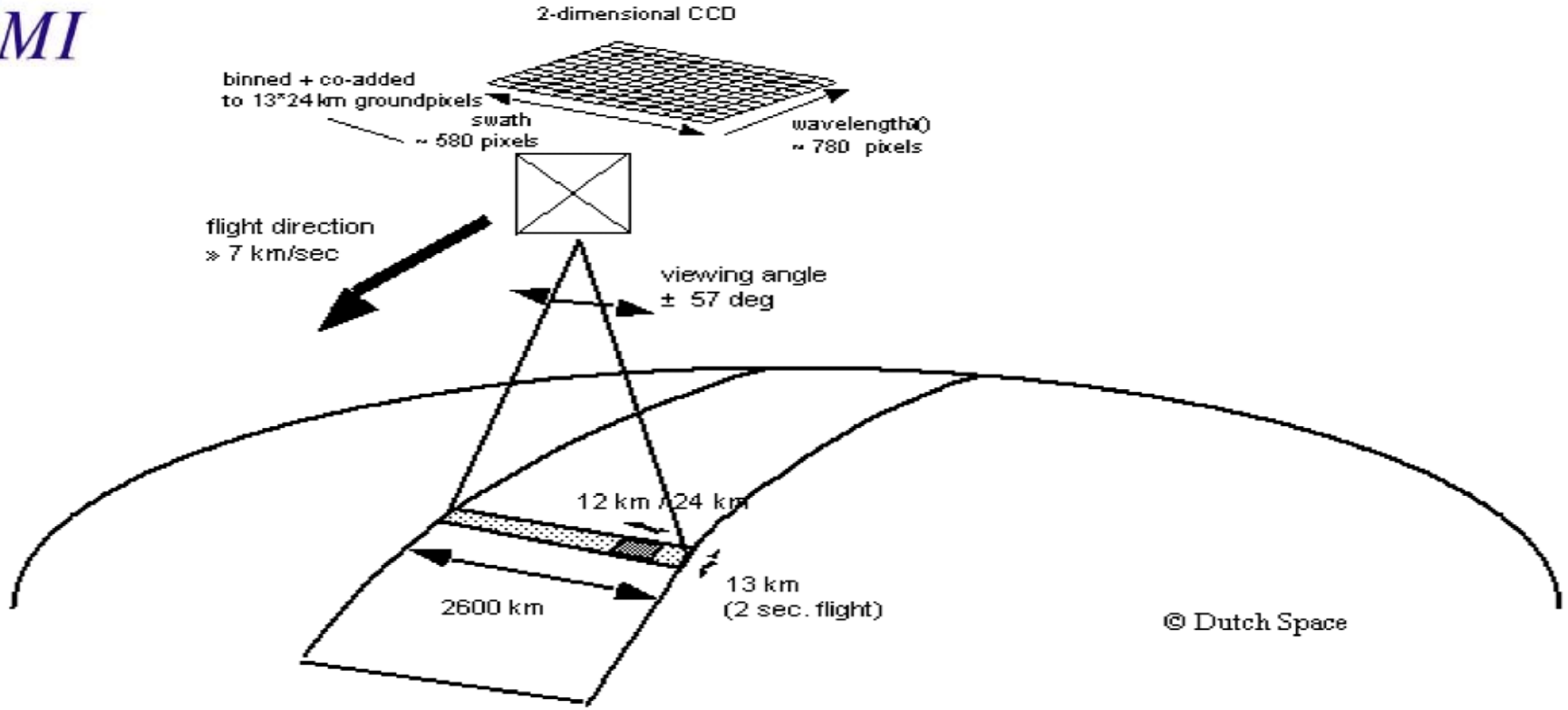
Ground-based station

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
(model MKIV)

Ozone Monitoring Instrument (OMI)



Operational on **NASA EOS-AURA** satellite from July 2004

spectral range 270-500 nm (0.5 nm step)

Sun-Synchronous **polar orbit** (overpass: 13:45 Local Time)

telescope viewing angle 114° (bandwidth: 2600 km)

spatial resolution 13km x 24km (nadir)

Dataset

BREWER:

- Daily Total Ozone
- Spectral Irradiance (290-325 nm)
- Erythemal Dose Rate, EDR (time sampling 30 min)
- AOD at 320.1 nm
- SSA at 320.1 nm: model+measurements

YES UVB-1RADIOMETER:

- EDR (time sampling 1 min)
- Erythemal Daily Dose, EDD

OMI satellite overpass data (collection 3):

- OMI-TOMS/OMI-DOAS total ozone
- UV irradiance at 305.1, 310.1, 324.1 nm and EDR at noon and at 13:45 LT
- EDD

Erythemal UV radiation

$$EDR = \int_{280nm}^{400nm} S(\lambda) I(\lambda) d\lambda$$

Erythemal Dose Rate

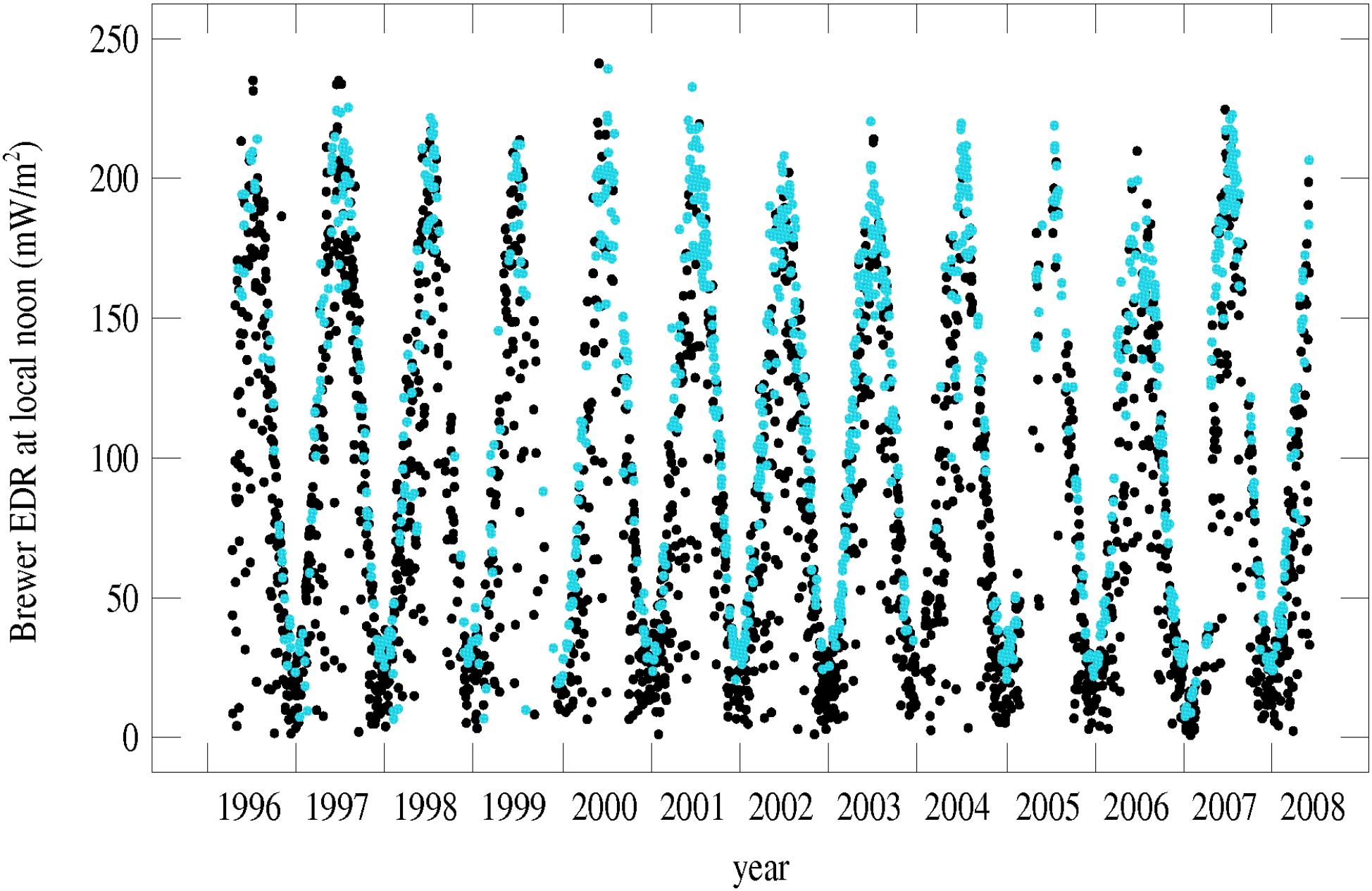
$$EDD = \int EDR\,(t)\,dt$$

Erythemal Daily Dose

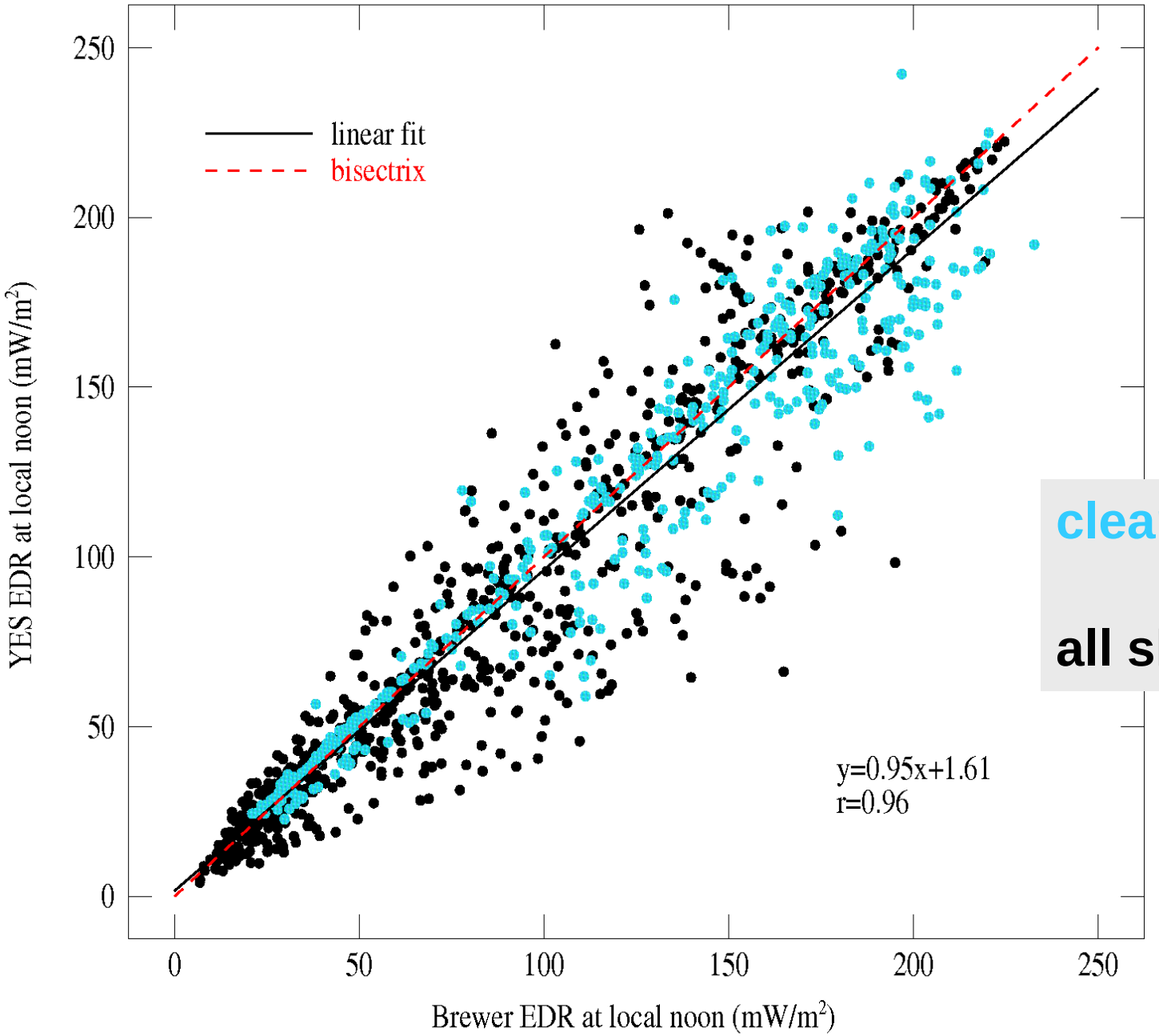
$$EDR = UCf_n(\Theta, TO_3)Coscor(\Theta, TO_3)$$

EDR: erythemal weighted irradiance or erythemal dose rate (Wm^{-2})
U*:* signal of the instrument (Volt)
C=0.1104 $Wm^{-2}V^{-1}$ (sza=40°, TO3=300 DU)**:** calibration coefficient
$f_n(\Theta,TO_3)$ function of the sza Θ and TO3 (spectral mismatch correction)
Coscor(Θ)**:** cosine correction function.

EDR at noon (Brewer)



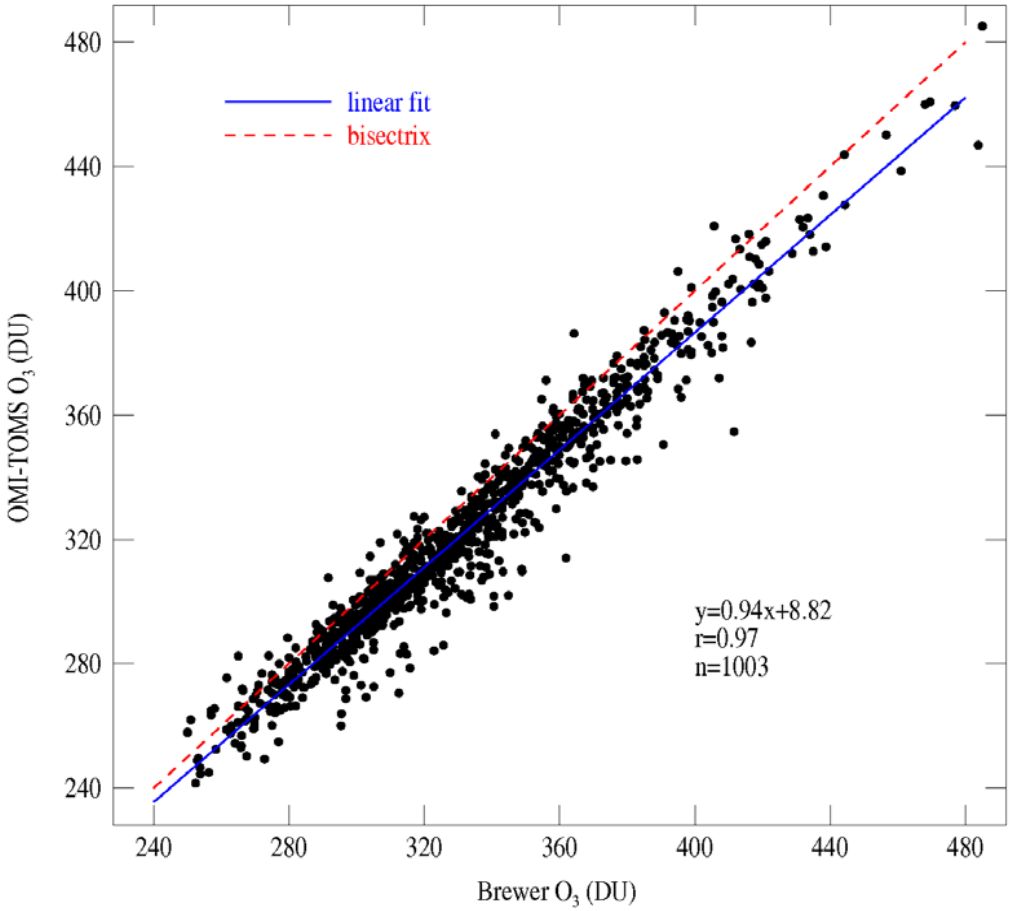
Brewer vs YES EDR at noon

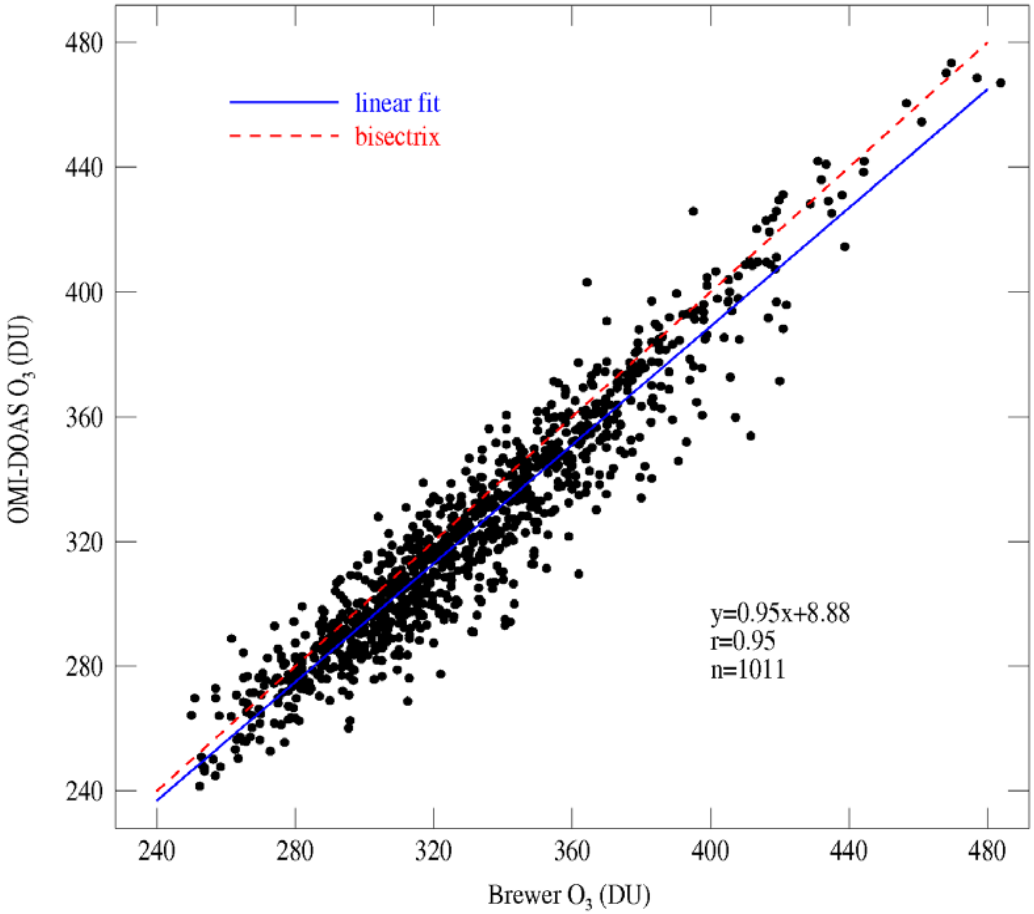


clear skies: -2% ± 12%

all skies: -3% ± 19%

OMI validation: ozone data



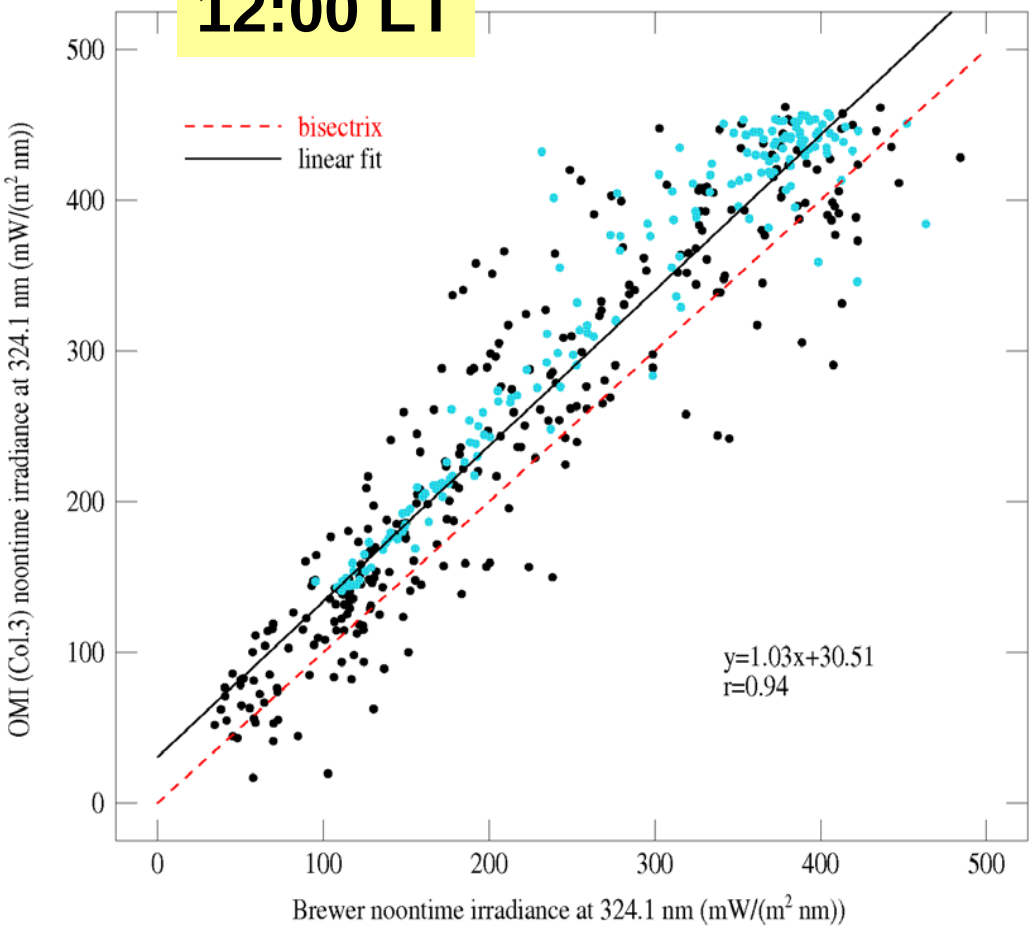


OMI-TOMS
all skies: -2.8% ± 2.4%

OMI-DOAS
all skies: -2.2% ± 3.6%

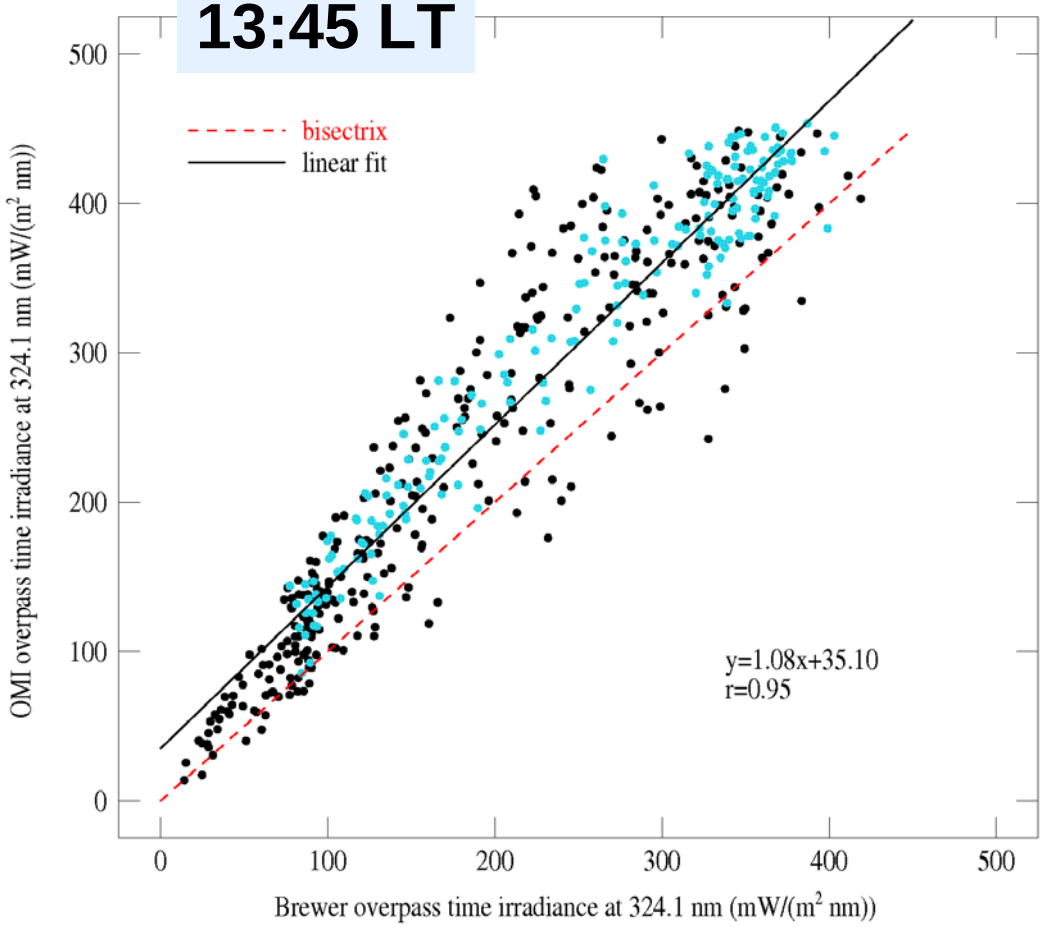
OMI validation: spectral irradiance

12:00 LT



	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

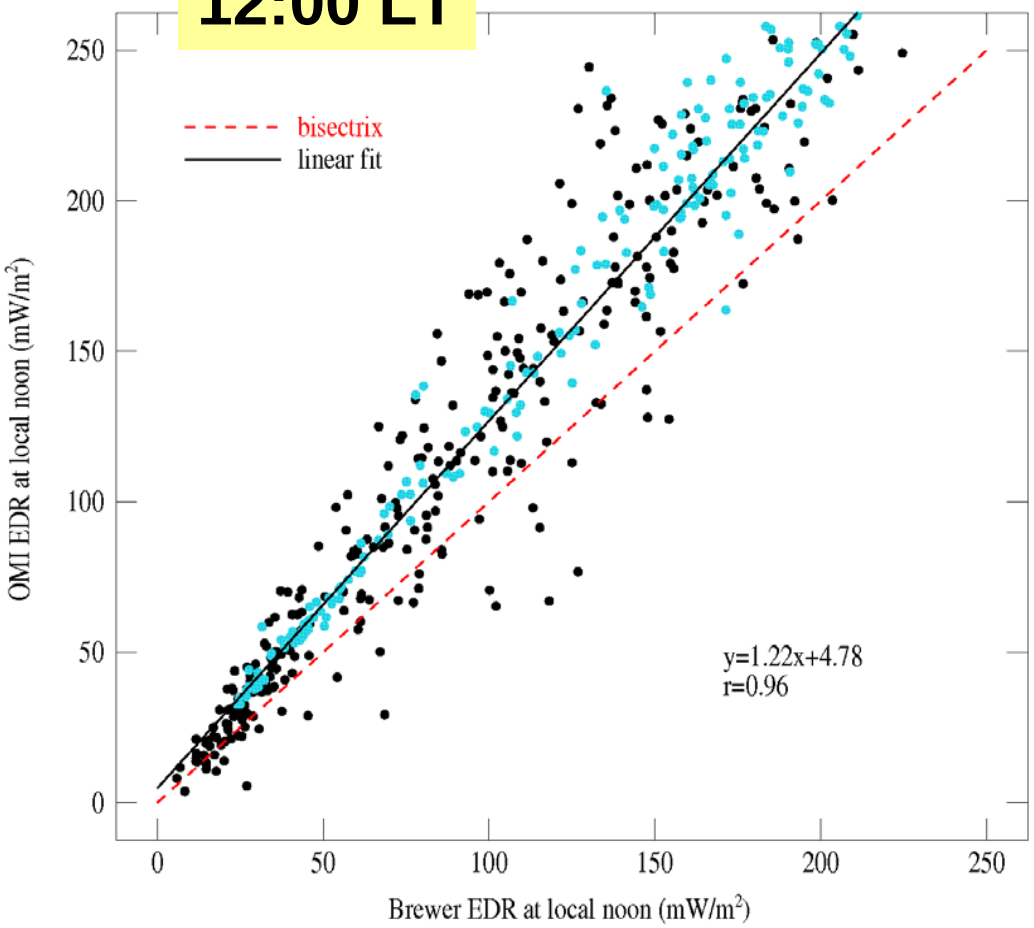
13:45 LT



	bias(%)		r	
	cs	as	cs	as
Irradiance at 305 nm	37	35	0.97	0.97
Irradiance at 310 nm	28	25	0.97	0.96
Irradiance at 324 nm	30	30	0.97	0.95

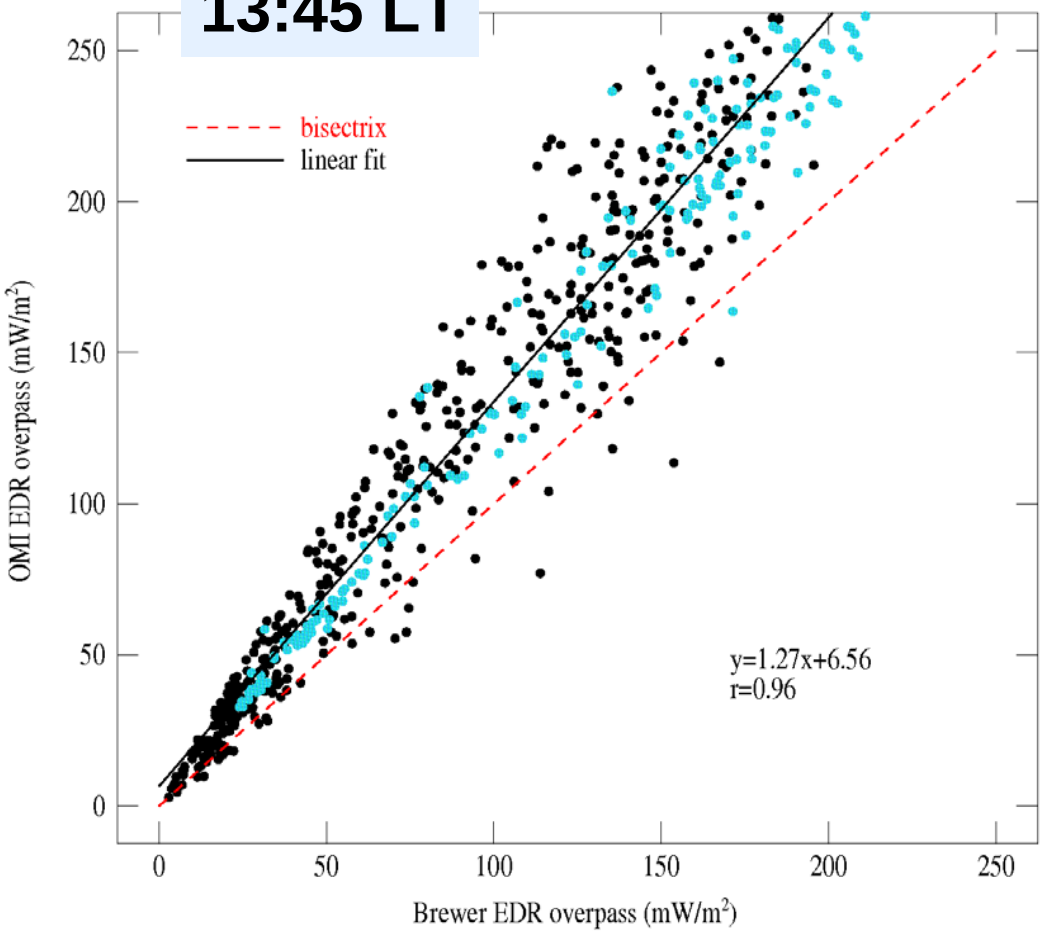
OMI validation: EDR

12:00 LT



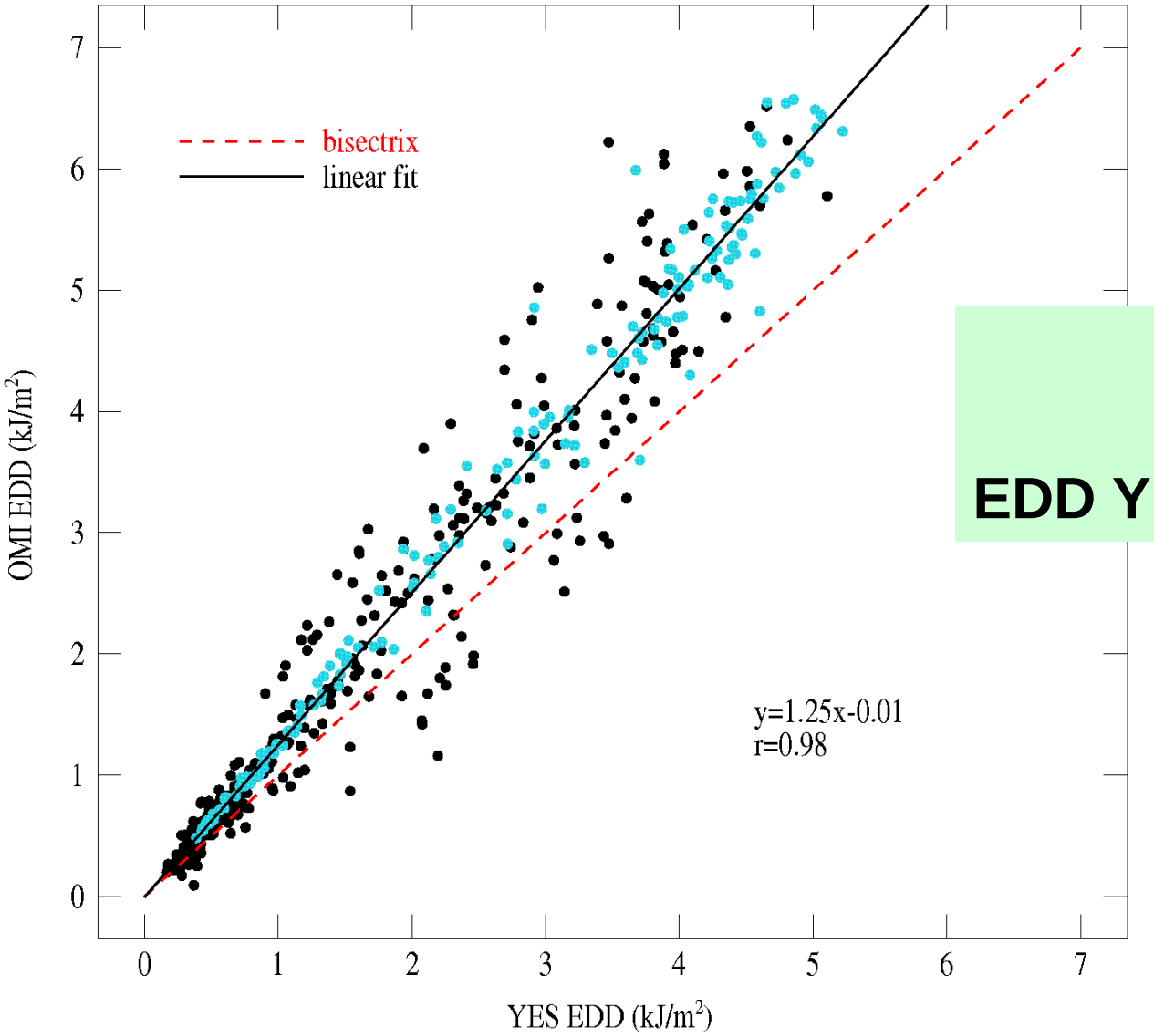
	bias(%)		r	
	cs	as	cs	as
EDR Brewer	30	28	0.98	0.96
EDR YES	28	22	0.98	0.96

13:45 LT



	bias(%)		r	
	cs	as	cs	as
EDR Brewer	31	39	0.98	0.96
EDR YES	40	37	0.98	0.97

OMI validation: YES EDD



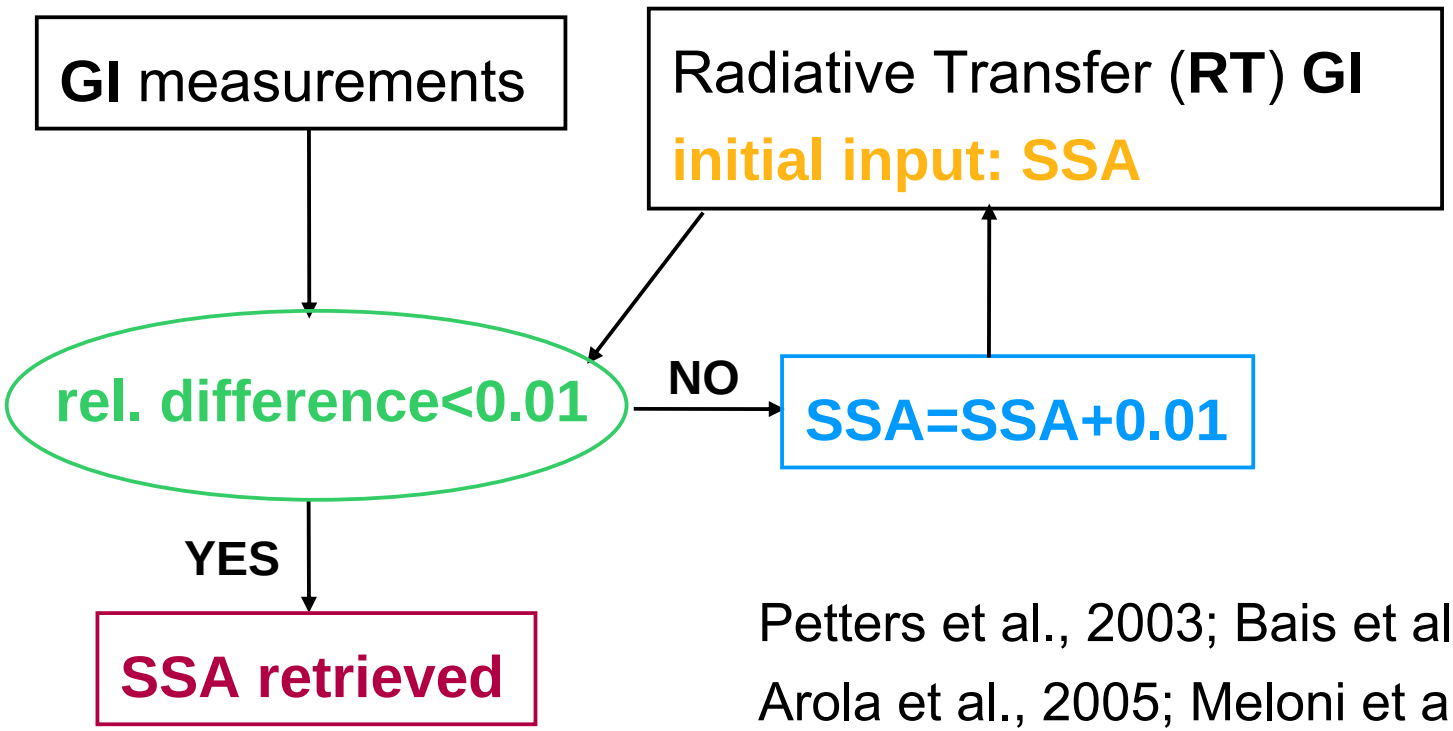
	bias(%)		r	
	cs	as	cs	as
EDD YES	26	25	0.99	0.98

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

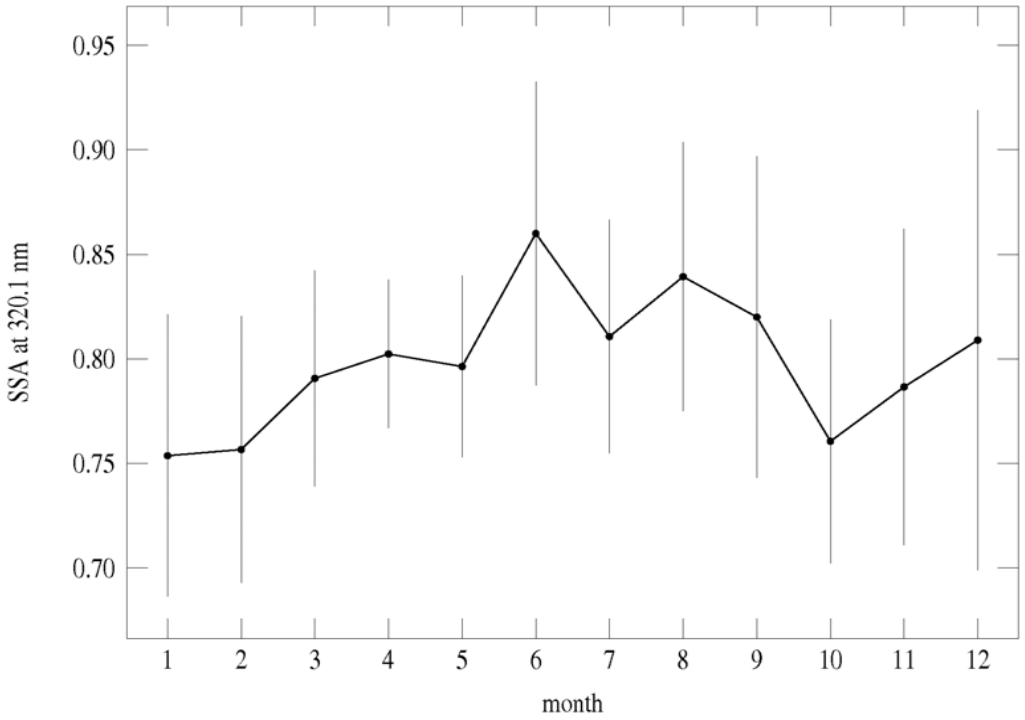
GI global irradiance



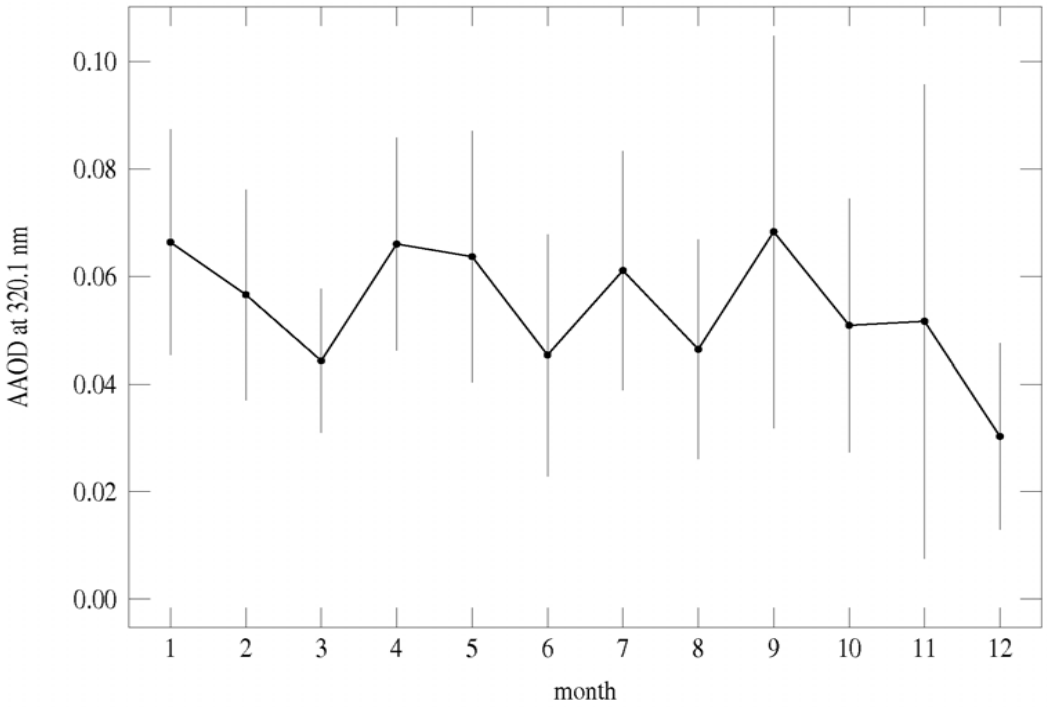
Petters et al., 2003; Bais et al., 2005;
Arola et al., 2005; Meloni et al., 2006

Monthly means

SSA



AAOD



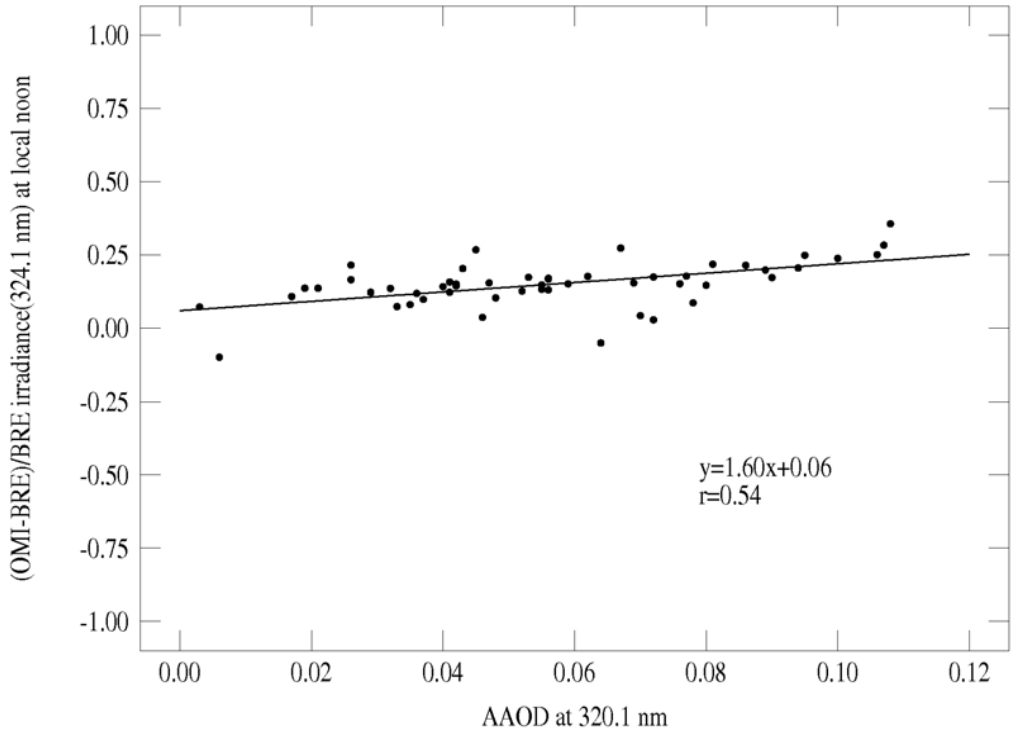
SOURCES OF UNCERTAINTY

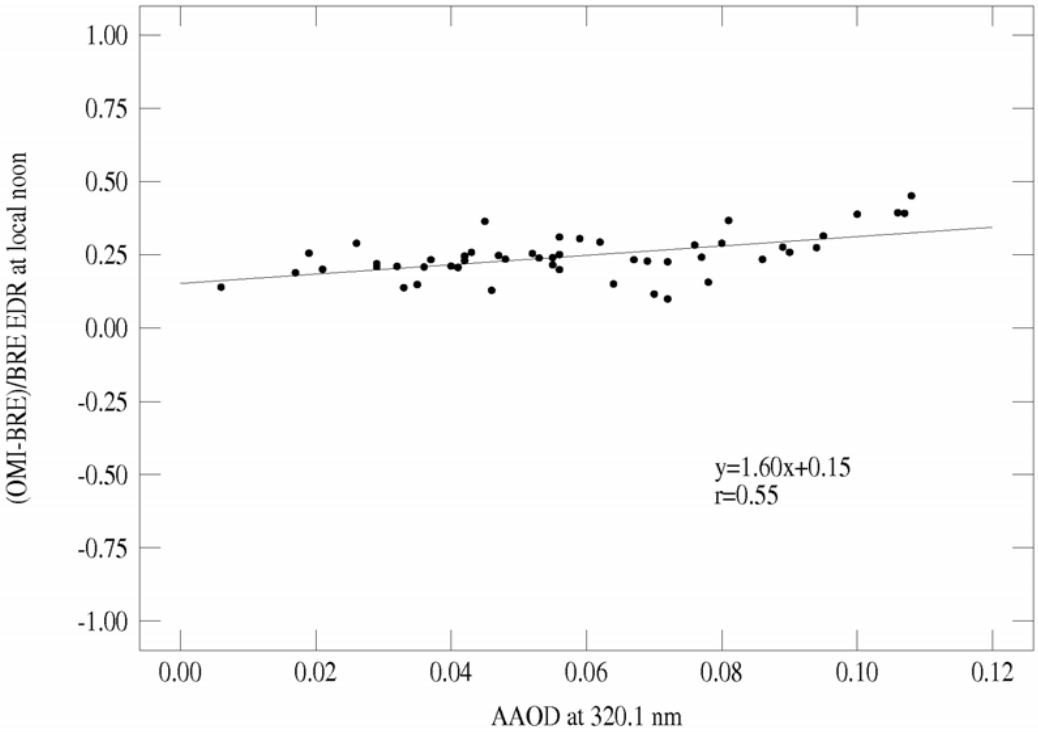
- model simulation: 5%
- spectral mesurements: 5%
- low SZA and AOD

ESTIMATED UNCERTAINTIES

SZA\AOD	0.2	0.4
30°	0.15	0.08
60°	0.13	0.05

OMI UV products validation: the role of absorbing aerosols





- Medium-high correlation for AAOD (higher than for AOD)
- 15% of the bias can be explained by the absorbing aerosols effect
- Overpass time data show lower dependence on aerosol optical properties (higher uncertainty on ground-based UV radiation, AOD and AAOD retrievals)

Thank you

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