

# Estimation of total ozone column using different pairs of channels of a NILU-UV multifilter instrument



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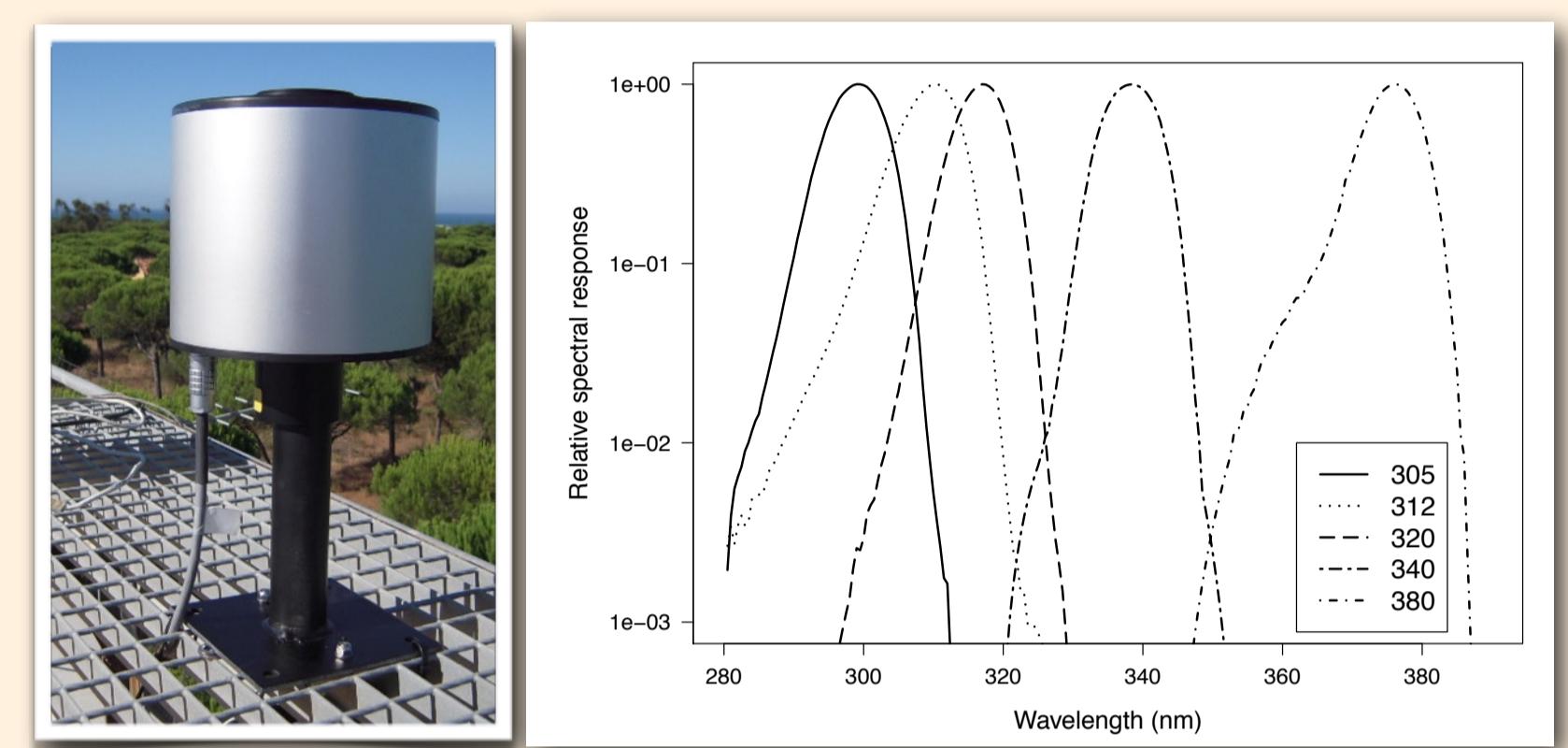
## INSTRUMENTATION

Brewer spectroradiometer  
MKIII #150 (Kipp & Zonen)

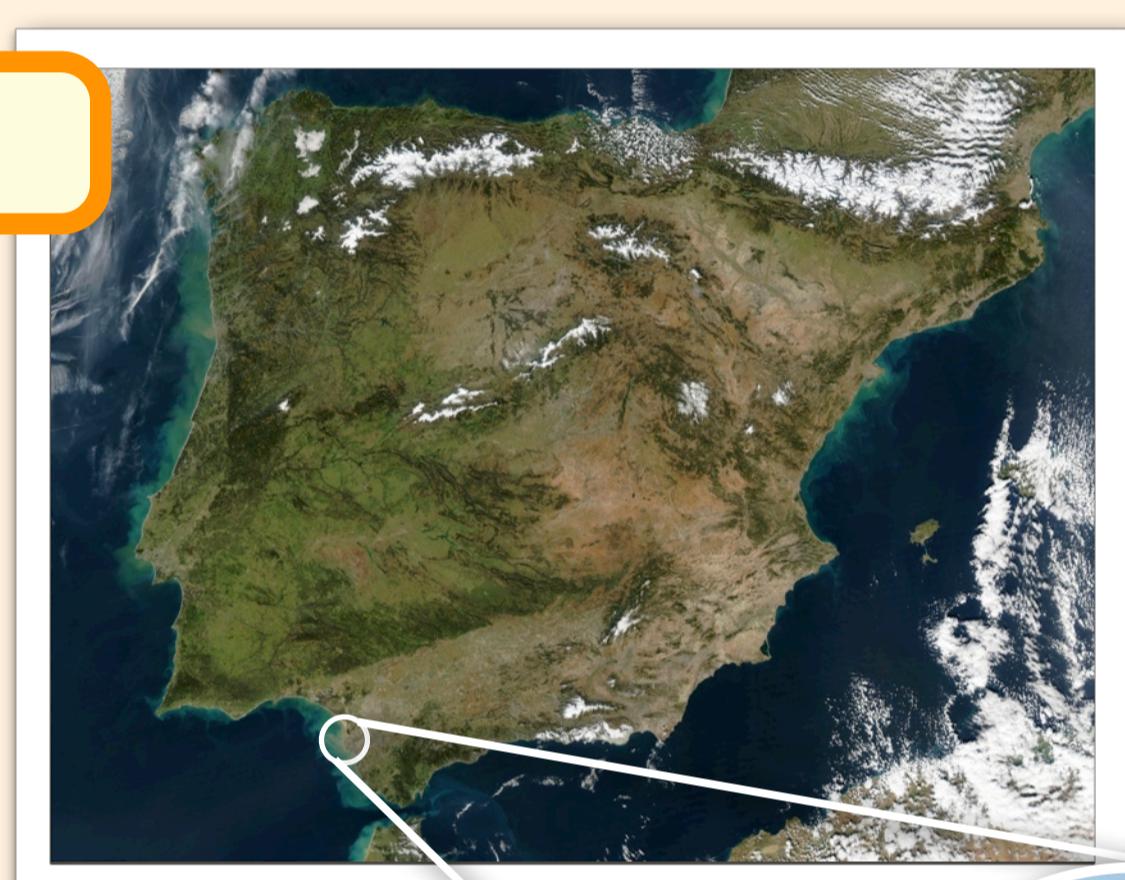


- Spectral global UV irradiances from 290 to 363 nm (0.5 nm step)
- Scans every 15 minutes approx
- Direct UV measurements for ozone estimation (Sun not blocked by clouds) (up to solar zenith angles -SZA- of 75°)

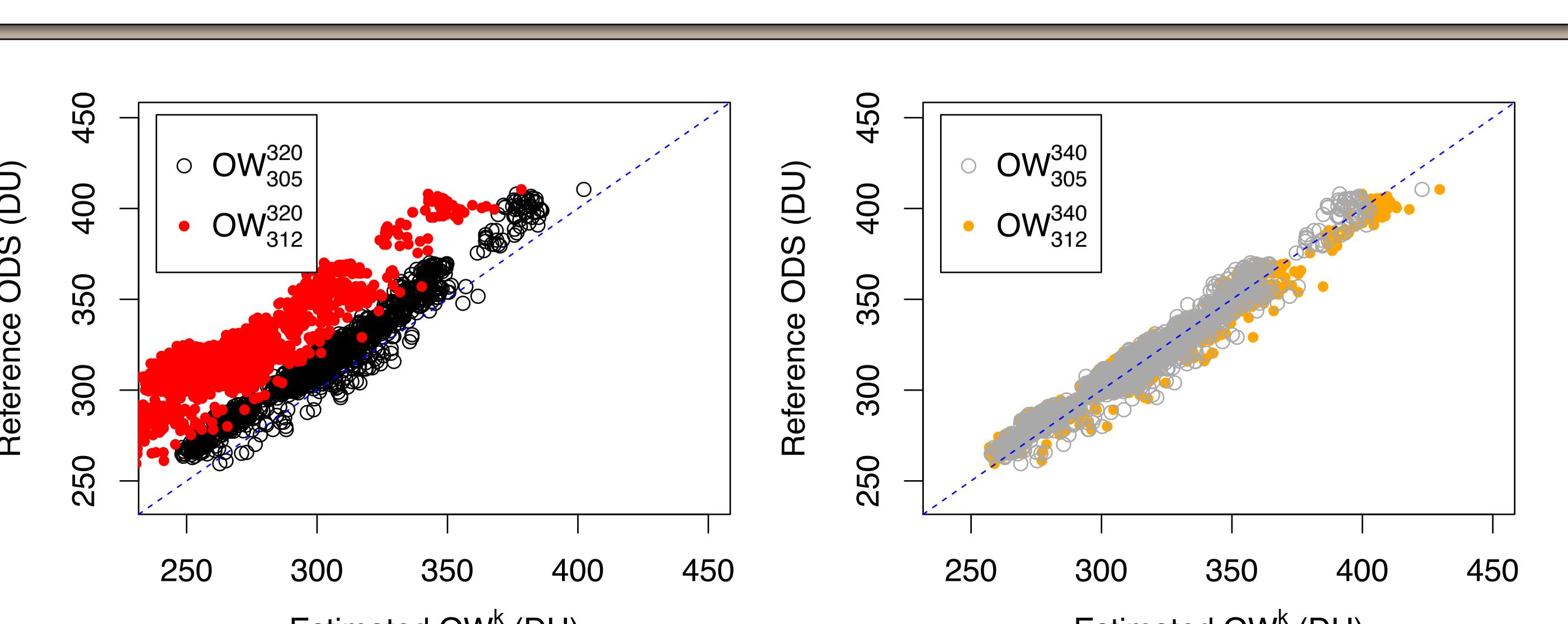
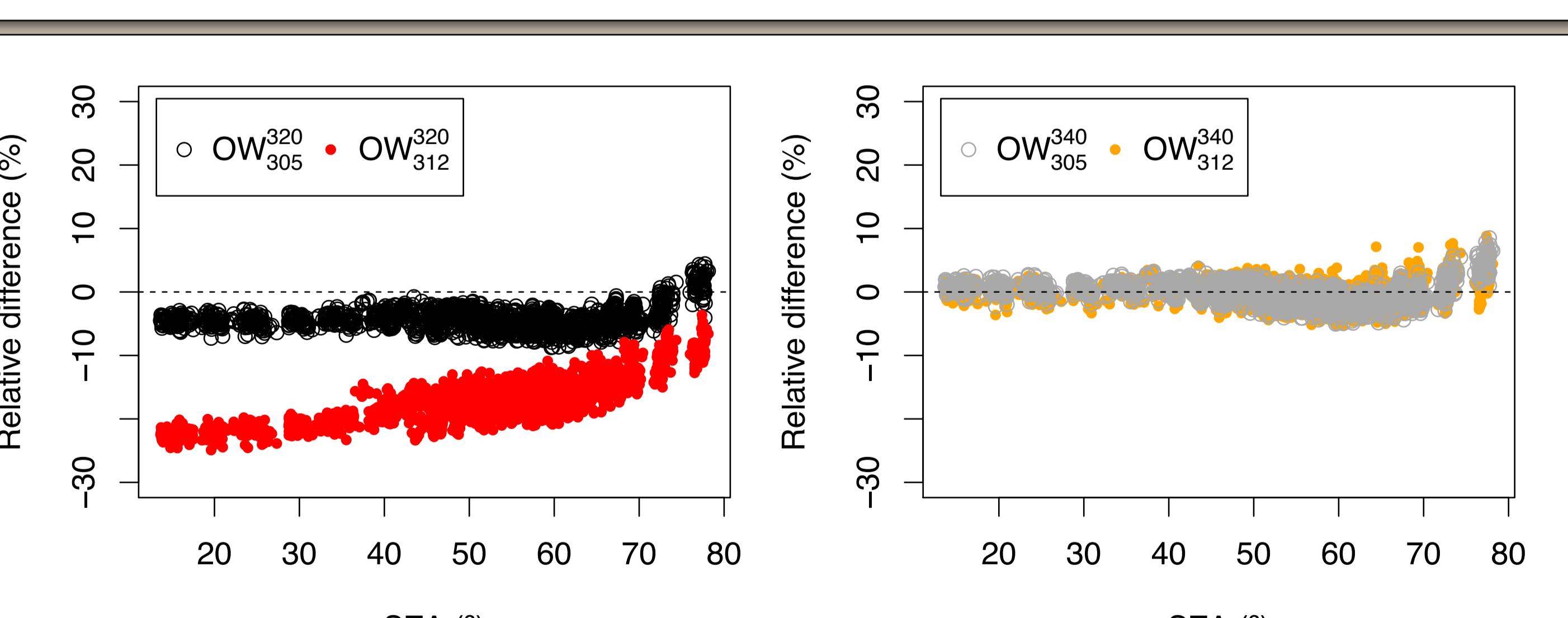
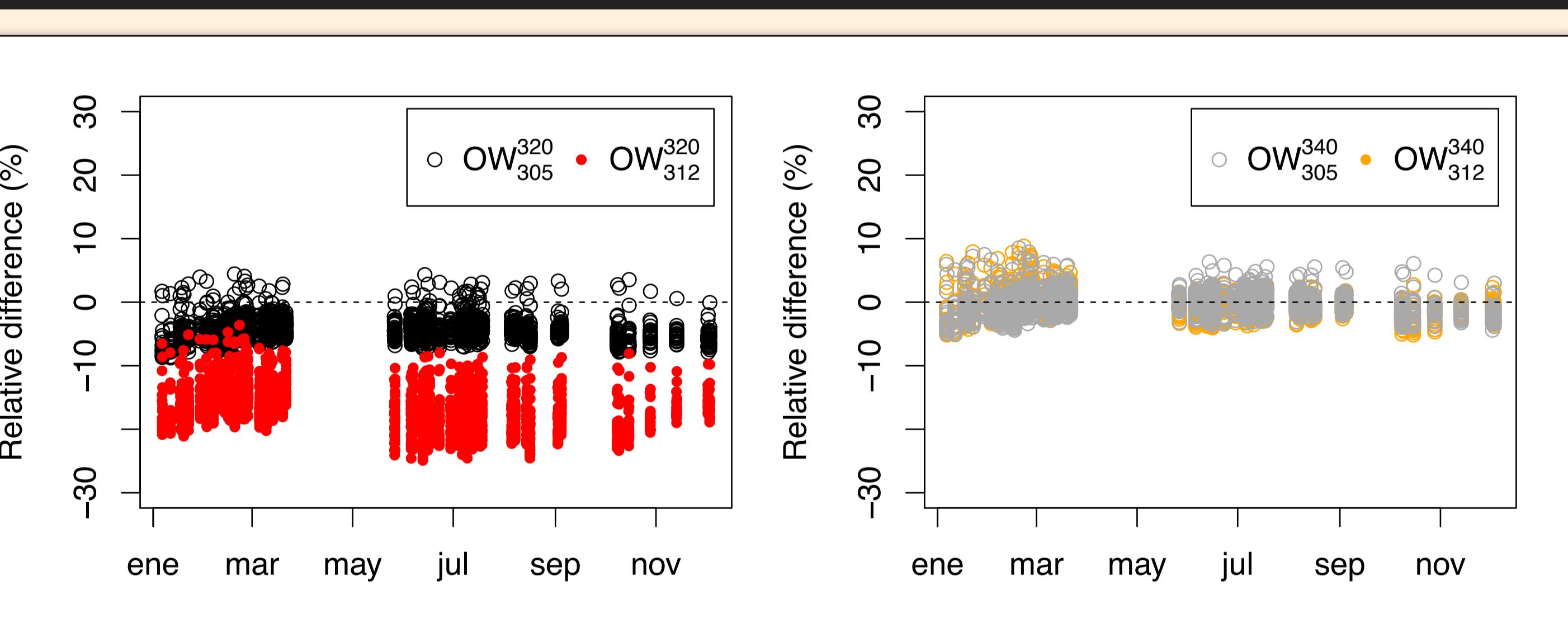
NILU-UV #119 multifilter radiometer spectral response functions



## LOCATION



INTA- El Arenosillo  
Observatory (Huelva,  
Spain)



## OBJECTIVES

- Analyze the Stamnes et al. (1991) method for retrieving TOC values from weighted irradiance data as measured by multifilter instruments.
- Simulate the performance of the NILU-UV #119 channels by using its spectral response functions, combined with UV global spectra measured by the Brewer #150.

## METHODS

### 1.- Weighted irradiance from UV spectra

$$\int_{\lambda} E(\lambda) \cdot SRF_i(\lambda) d\lambda = E_i^W$$

UV global spectra  
from Brewer #150  
Year 2012

Spectral Response  
Functions from  
NILU-UV #119

**Weighted irradiance  
as measured by  
NILU-UV #119**

Experimental irradiance  
ratios

k:j  
320:305  
320:312  
340:305  
340:312

### 2.- Radiative Transfer simulations

UV global spectra  
by  
SBDART Radiative  
Transfer Model

Model inputs  
SZA= 0° to 90° (steps 1°)  
TOC= 200 to 500 DU (steps 5 DU)  
AOD= 0.01 (rural)  
Albedo=3.5%

Weighted by  
Spectral Response  
Functions from  
NILU-UV #119

Simulated weighted  
irradiances  
Channel 305  $E_s^W_{305}$   
Channel 312  $E_s^W_{312}$   
Channel 320  $E_s^W_{320}$   
Channel 340  $E_s^W_{340}$

Simulated  
irradiance ratios  
k:j  
320:305  
320:312  
340:305  
340:312

**OZONE  
ESTIMATION**  
 $OW_j^k$

### 3.- Comparison with reference values

Direct-Sun TOC measurements  
Brewer #150

Estimated  
TOC values  
 $OW_j^k$

Reference  
TOC values  
ODS

Year 2012  
cloud free days  
simultaneous  
data

## RESULTS

ODS Direct-Sun reference measurements by Brewer #150.

$OW_j^k$  Estimations using different pairs of weighted irradiances.

$$\text{Relative diff}_n = \frac{OW_{nj}^k - ODS_n}{ODS_n} \cdot 100$$

$$MBE = \frac{100}{N} \sum_{n=1}^N \frac{OW_{nj}^k - ODS_n}{ODS_n}$$

Estimations	SZA total		13°<SZA<65°		65°<SZA<76°	
	MBE (%)	s (%)	MBE (%)	s (%)	MBE (%)	s (%)
$OW_{320}^{305}$	-4.3	1.8	-4.6	1.3	-2.6	2.6
$OW_{320}^{312}$	-17.0	3.6	-18.0	2.7	12.0	2.6
$OW_{340}^{305}$	-0.1	1.8	-0.3	1.5	0.7	2.6
$OW_{340}^{312}$	-0.1	1.8	-0.3	1.6	0.5	2.4

## CONCLUSIONS

- Most adequate pairs to estimate total ozone column are those based on channel 340.
- Estimations derived from pairs 340:305 and 340:312 have a very similar performance, with slightly worse agreement with the reference for large SZA.
- Relative differences show a dependence with SZA for all the pairs studied.
- Worst results are found for estimations based on 320:305 pair, subestimating reference values for the complete SZA range.

## Acknowledgements



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