

Review of Aerosol Optical Depth comparison between GAW-PFR and AERONET-1 Cimel radiometers from long-term (2005-2015) 1-minute synchronous measurements

General comments:

The structure and content of the main manuscript has improved significantly from the first submission. However, several new portions of the manuscript and supplement need correction and further clarification. After these revisions are implemented, then the manuscript should be publication ready.

Manuscript:

Abstract: "fairly good agreement at 380nm"; please provide a phrase or sentence discussing improving UV traceability as discussed in conclusions.

Page 2, Line 10: "https"?

Page 2, Lines 19-23: Is this a separate paragraph or does it belong to the previous one?

Page 3, Line 37: "is based on:", why does the sentence end with a colon? The following paragraphs are not enumerated.

Page 4, Line 25: Perhaps the Supplement should be described in one or two sentences.

Page 4, Line 27: Check formatting of degree symbols

Page 6, Lines 29-30: "and depends on the optical mass"; The optical air mass has a dependence for all channels and not only UV. Please use "optical air mass" and not "optical mass"

Page 7: Line 20: change "lineal" to "linear"

Page 8: Lines 29-31: This reference (Holben et al., 2006) is for the sky inversion QA (Dubovik and King 2000, Dubovik et al. 2000, 2002, 2006) and not for Version 2 AOD.

Page 9, Table 1:

"AOD uncertainty": Do these values vary by wavelength for PFR and Cimel?

"Temperature control": Is this applied to all wavelengths for both instruments and AERONET versions?

Page 11, Line 20: How do 5000 more points for Cimel compare to PFR at air mass greater than 5?

Page 11, Line 21: Only Supplement S.1 exists (not S.1.1)

Page 12, Line 10: 870nm AOD has better agreement due to less trace gas contribution or is it related to the Cimel staying the same since 2011 as shown in Figure 2? Please make a statement in regards to the Cimel/PFR agreement at 870nm.

Page 21, Lines 22-28: These lines need to be revised based on Supplement comments below.

Page 26, Line 9: Is the NO<sub>2</sub> spatial resolution “0.25 x 0.2”? Is this the same NO<sub>2</sub> for both AERONET versions?

Page 26, Line 12: The optical depth of O<sub>3</sub> and NO<sub>2</sub> for each measurement should be available from AERONET. Please state why they are not used.

Page 28, Table 9: “870” should be “870 nm”

Page 28, Lines 12-13: PFR is corrected or Cimel corrections are removed?

Page 33, Line 3: What is the total traceability percentage for 380nm and 500nm with the adjustment factor applied? Does it bring 380nm into compliance with PFR standard?

Page 33, Lines 13-14: These lines need to be revised based on Supplement comments below.

Page 33, Line 17: “very high AOD retention” is based on Angstrom Exponent >1.2 (675-1020nm); it seems highly unlikely that measurements would be contaminated by altostratus and dust with such a high AE required for the retention.

Page 37: Lines 4-16: The AE can be greater than 0.6 and not be “Pristine” conditions. This conditional logic conflicts with supplement case 10.1 where locally generated smoke affects the measurements. Also, it is not impossible that smoke can be transported from sub-Saharan Africa. These AE conditions were applied in Cuevas et al. 2015 for comparing satellite with ground-based observations as a “first approach to discriminate when mineral dust is the main aerosol component.” However, this technique is not very appropriate in considering synchronous 1-minute data from ground based AERONET and PFR, which are measuring the same aerosols (unlike satellite, which uses a spatially distributed algorithm) at much higher temporal resolution than satellite. Only using AE for characterizing the aerosol condition is very problematic.

Page 38, Lines 17-20: The cases presented do not support these conclusions; see supplement comments.

Page 39, Lines 13-21: Discuss how the total traceability changed (not just the increment change) when applying the correction for FOV.

Page 39, Lines 22-29: Is this a separate conclusion paragraph?

Supplement Comments:

Are captions needed for these figures in the supplement? It would be useful to have them.

S1: Why is it that the high anomalies stop for the AOD 870nm after the last change of Cimel in 2011?

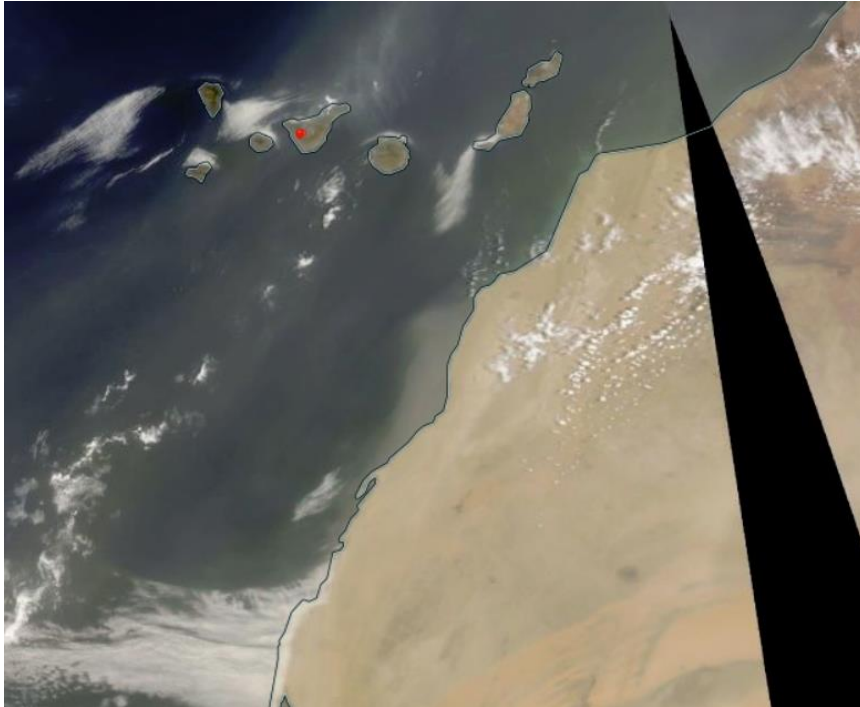
S4: The y-axis title is missing in plot V3 d). “Optical mass” should be “optical air mass”

S6. For example, why are data missing for V3 AOD 870nm (f) compared to plot (e) of V2 in the first part of 2007 and last part of 2009 but these periods are available in Figure 3 of the manuscript?

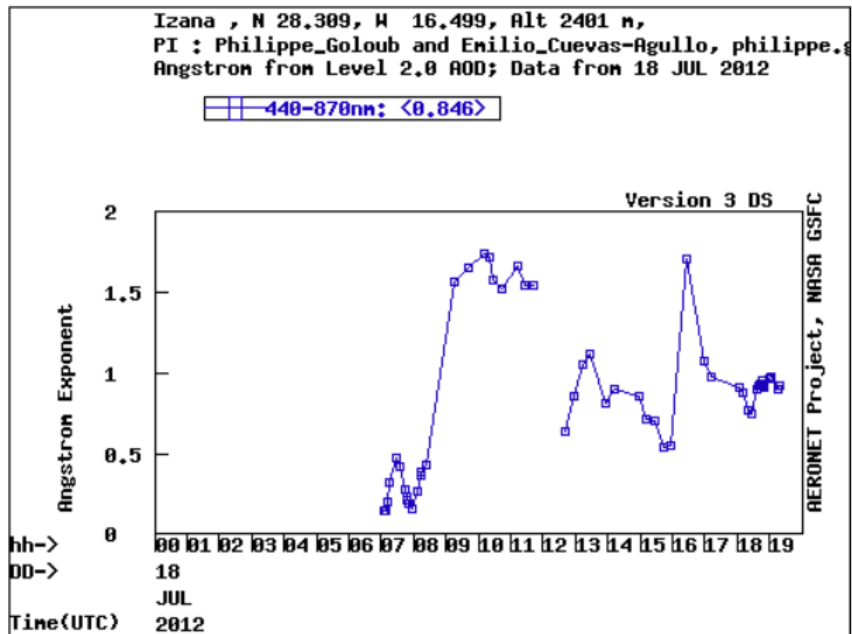
S10.1: This case appears to be mostly if not all dust and smoke. The sky camera images look inconclusive for clouds. MODIS satellite visible imagery indicates much more aerosol than clouds. MODIS hot spots (in red) indicate fires near Guía de Isora and Teide National Park to the southwest of Izaña Observatory on Tenerife. Also, MPL suggests aerosol rather than cloud due to weak backscatter (not

strong like for clouds). Further, the Angstrom Exponent is very high for Izana (see plot from <https://aeronet.gsfc.nasa.gov>; last accessed 20 May 2019) indicating smoke and dust aerosols.

Aqua MODIS 18 July 2012 at 14:55 UTC

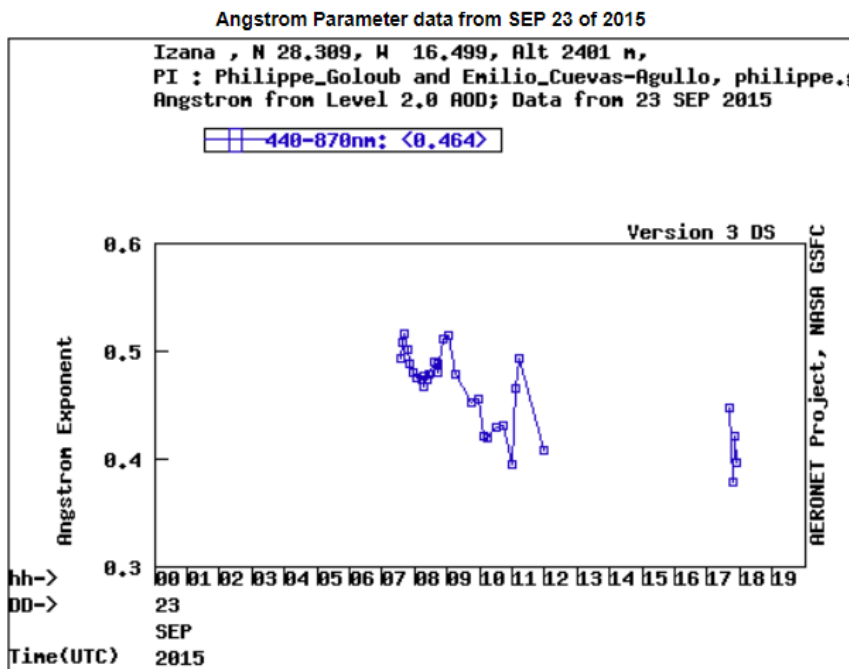


Angstrom Parameter data from JUL 18 of 2012



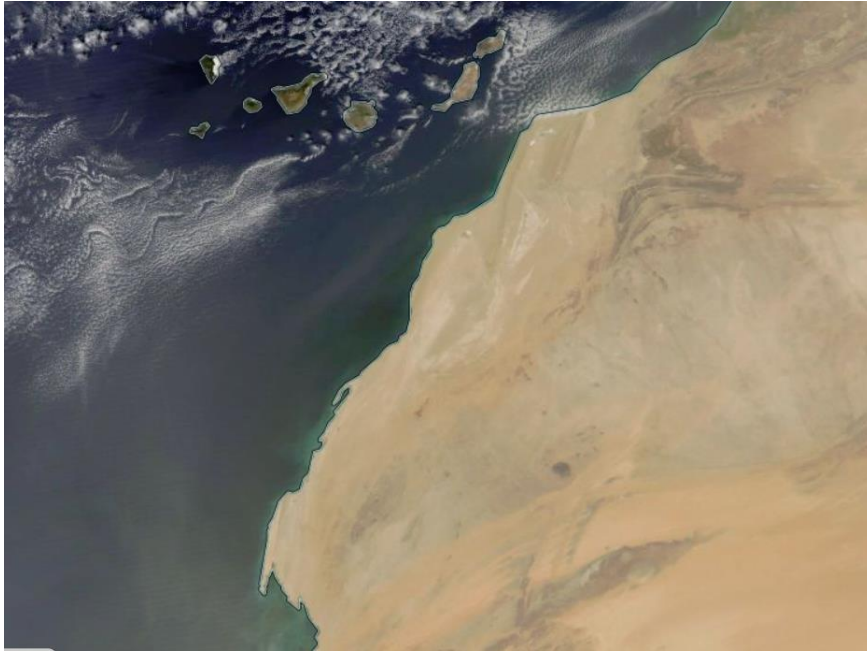
S10.2: MPL shows altostratus ending around 15:50UTC and Cimel is not pointing to the same portion of the sky as the lidar (zenith). Sky camera does not show stratus on the solar disk. The impact of Altostratus appears inconclusive in this case.

S11.1: In this case, the cloud appears to be present in the mpl but the backscatter does show an apparent increase between 2km and 4 km. The sun photometers can measure between clouds so it is possible it found a gap. The AE does tend to decrease increasing the chance of cloud contamination but this distinction becomes more difficult in a dust transport region.

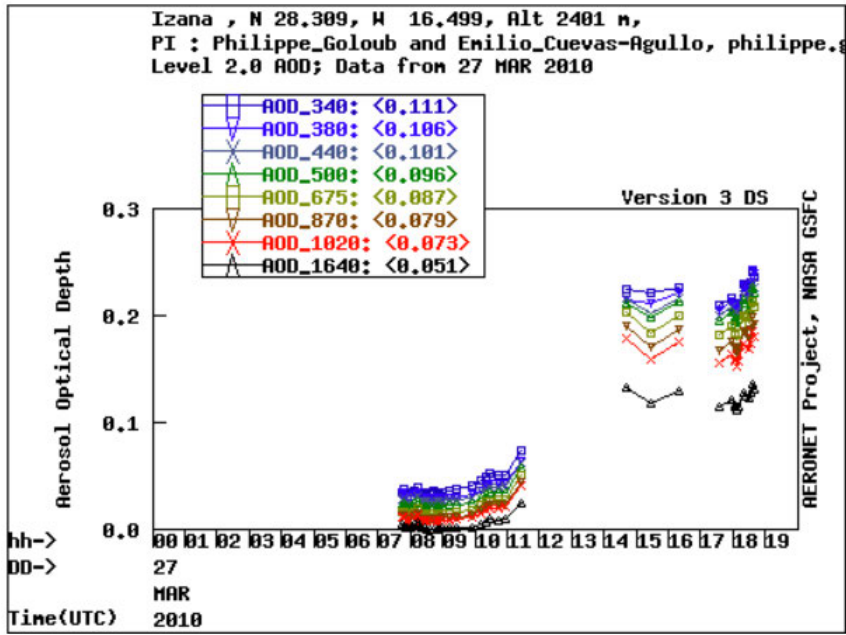


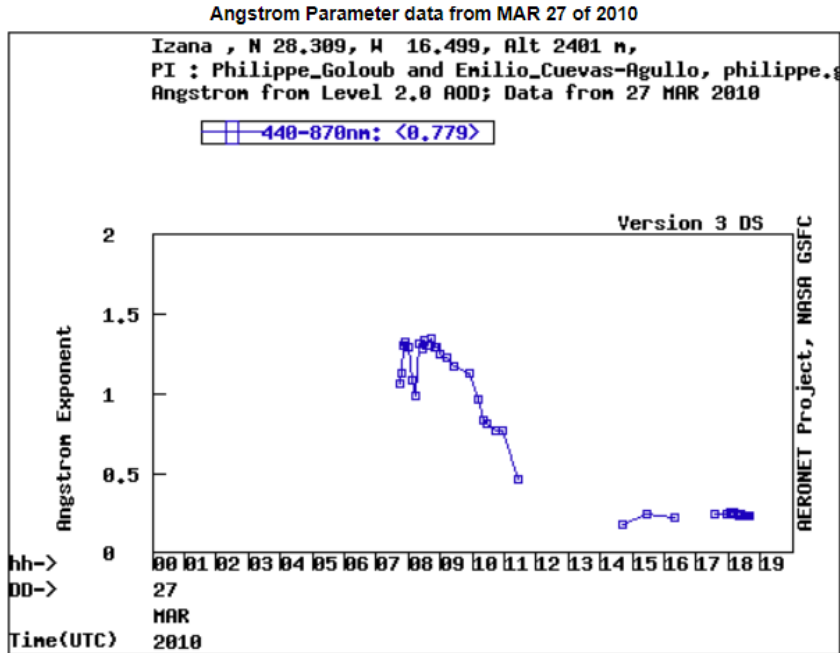
S11.3: It is difficult to "see" cirrus in the sky camera visible image. Do you have a processed whole sky cloud image indicating clouds? AE from 14UTC to 18UTC looks like dust. MODIS visible images show dust plume transported from the Sahara desert.

Aqua MODIS at 14:30 UTC on 27 March 2010



AOD Level 2.0 data from MAR 27 of 2010





S12, Case analysis 12 February 2015:

Note again the photometers and Lidar do not point in the same direction. Why is PFR affected and not AERONET, it is not clear why they have such different AOD? Did ice freeze on PFR external lens like whole sky imager?

S18. More explanation is needed here or in the manuscript text.