

## Report on the outcomes of a Virtual Mobility<sup>1</sup>

Action number: CA21119

Grantee name: Angelos Karanikolas

### **Virtual Mobility Details**

Title: Contribution to WG1 Deliverable D1.1. about photometry campaigns (deadline: October 2023).  
Redaction work, literature study, dataset analysis

Start and end date: 04/10/2023 to 14/10/2023

### **Description of the work carried out during the VM**

Description of the virtual collaboration and activities carried out during the VM, with focus on the work carried out by the grantee. Any deviations from the initial working plan shall also be described in this section.

(max. 500 words)

*During the VM there was significant contribution to the WG1 Deliverable D1.1. report and collaboration with the other authors. The grantee's contributed mainly to 3 parts.*

- 1. The QUATRAM campaigns: The QUALity and TRaceability of Atmospheric aerosol Measurements (QUATRAM 1,2 and 3) campaigns were focused on the evaluation of the Improved Langley Plot (ILP) method, which is the calibration method used by the instrument network SKYNET using the PREDE-POM sun and sky radiometers. The campaigns included co-location of Precision Filter Radiometers (PFR) and POMs in Rome and Davos to investigate the effect of different conditions on ILP. Through the data from the 3 campaigns it became evident that ILP produces systematically significantly lower calibration factor. The effect is stronger in Rome and the causes are under investigation.*
- 2. The MAPP campaign: The Metrology of Aerosol Optical Properties (MAPP) campaign was carried out in Izaña and included several spectroradiometers (QASUME, PSR, BTS, EKO) and the sun photometers of the 3 main networks used for AOD retrieval (PFR, CIMEL and POM). The goal was to assess the accuracy of the AOD retrieval from such instruments using solar and lunar direct irradiance when calibrated at the SI units ( $W/m^2$ ). Some of the results are summarised below at point 3. Additional already existing, but not published work concerns the comparison of different calibration methods of POMs for both the extraterrestrial irradiance and the solid view angle.*

<sup>1</sup> This report is submitted by the grantee to the Action MC for approval and for claiming payment of the awarded grant. The Grant Awarding Coordinator coordinates the evaluation of this report on behalf of the Action MC and instructs the GH for payment of the Grant.

3. *Relevant literature overview: This part includes the addition of summaries from 3 published papers:*

- a. *Cuevas et al. 2019: This paper includes a long-term comparison of AOD in Izaña between a PFR and a CIMEL for the period 2005-2015. The measurements satisfy the traceability criteria except at 380 nm. The study investigates potential explanations for the points outside the World Meteorological Organisation limits and the worse performance at 380 nm. The conclusions were that the field of view difference between the instruments has a significant effect under large dust concentrations, especially at 380 nm. Also, at 380 nm the calibration uncertainty is higher.*
- b. *Karanikolas et al. 2022: This paper includes a PFR-CIMEL comparison in Davos for the period 2007-2019. The comparison shows traceability between the instruments. However, there were long-term trend differences larger than the trend uncertainties showing that AOD differences considered small conventionally can be significant for trend analysis. Finally, it investigates the effect of measurement uncertainty, temporal resolution, AOD averaging method and trend estimation method on the trend comparison. All these factors had smaller effect than the trend uncertainty.*
- c. *Gröbner et al. 2023: This paper aims to investigate whether spectroradiometers calibrated to SI units ( $W/m^2$ ) can provide accurate AOD according to WMO standards. It uses the data from the MAPP campaign to compare the extraterrestrial solar irradiance retrieved from selected spectroradiometers at Izaña (2373 m) with a satellite-based reference spectrum. The extraterrestrial spectrum agreed better than 1-2% depending on the wavelength and instrument (excluding wavelengths with significant gas absorption). The AOD differences with reference instruments satisfied the WMO traceability criteria.*

References:

Cuevas, E., Romero-Campos, P. M., Kouremeti, N., Kazadzis, S., Räisänen, P., García, R. D., Barreto, A., Guirado-Fuentes, C., Ramos, R., Toledano, C., Almansa, F., and Gröbner, J.: Aerosol optical depth comparison between GAW-PFR and AERONET-Cimel radiometers from long-term (2005–2015) 1 min synchronous measurements, *Atmos. Meas. Tech.*, 12, 4309–4337, <https://doi.org/10.5194/amt-12-4309-2019>, 2019.

Gröbner, J., Kouremeti, N., Hülsen, G., Zuber, R., Ribnitzky, M., Nevas, S., Sperfeld, P., Schwind, K., Schneider, P., Kazadzis, S., Barreto, Á., Gardiner, T., Mottungan, K., Medland, D., and Coleman, M.: Spectral aerosol optical depth from SI-traceable spectral solar irradiance measurements, *Atmos. Meas. Tech.*, 16, 4667–4680, <https://doi.org/10.5194/amt-16-4667-2023>, 2023.

Karanikolas, A., Kouremeti, N., Gröbner, J., Egli, L., and Kazadzis, S.: Sensitivity of aerosol optical depth trends using long-term measurements of different sun photometers, *Atmos. Meas. Tech.*, 15, 5667–5680, <https://doi.org/10.5194/amt-15-5667-2022>, 2022.

### **Description of the VM main achievements and planned follow-up activities**

Description and assessment of whether the VM achieved its planned goals and expected outcomes, including specific contribution to Action objective and deliverables, or publications resulting from the VM. Agreed plans for future follow-up collaborations shall also be described in this section.

*(max. 500 words)*

*The VM achieved its planned goals. The output is a complete first draft of the contributions to the report and the process of minor corrections and improvements has already started. There were changes in comparison to the initial plan concerning the visualisation part of the campaigns' content. For the purpose of the report it was considered necessary to limit the visualisation to tables containing an overview of the campaigns without adding graphical visualisation of the comparisons' results.*

*The VM outcome contributes significantly to the deliverable D1.1. "Create a list of existing and foreseen campaigns or experiments needed for night and day aerosol measurements and report on the data collection and analysis of the data/measurements" of WG1 of COST action Harmonia.*