

Report on the outcomes of a Short-Term Scientific Mission¹

Action number: CA21119

Grantee name: E-COST-GRANT-CA21119-6fba6a38

Details of the STSM

Title: CIMEL repair and calibration

Start and end date: 30/08/2023 to 13/09/2023

Description of the work carried out during the STSM

On the very first day after my arrival in Valladolid, we embarked on the essential task of registering the photometer in GOA's CAELIS software, assigning it a unique reference number, and meticulously inspecting all other components of the instrument. This comprehensive evaluation was carried out by the laboratory technician, who examined the biaxial robot, as well as the azimuthal and zenithal axes. Some components needed replacement due to breakage, such as the robot belt responsible for securing the photometer head and the drive belt of the robot, while others were replaced because they were missing altogether, like the fastening collar. After the completion of these critical tasks, the evaluation of the temperature response of the instrumentation within a thermal chamber is conducted in the Optical Laboratory. This evaluation spans a temperature range from -40°C to 60°C, utilizing a stepwise temperature increase approach, and meticulously recording data at each 0.5°C interval. To conclude the calibration process, the photometer is installed on the terrace of the Faculty of Science building. This rooftop platform serves as a dedicated location for solar calibration conducted by GOA. Specifically, it is used for comparing the field instrument's signal with those from two meticulously calibrated master instruments located at Izaña, Tenerife, Spain. During my stay in Valladolid, the GOA group encountered an issue with the heating system of one of their photometers installed in Ny-Ålesund. Consequently, the thermal chamber was occupied most of the time to address this problem. Furthermore, adverse weather conditions in Valladolid during that period slowed down these final operations. Upon the completion of all required tasks, the photometer will be meticulously packaged and transported back to Italy. In the upcoming season, it is scheduled for deployment at the "Ottavio Vittori" Climate Observatory located in the northern Italian Apennines.

¹ 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.

Description of the STSM main achievements and planned follow-up activities

The objective of this STSM, focused on the maintenance of the CIMEL photometer at the GOA group of the University of Valladolid, has been accomplished. The photometer required repair and calibration after prolonged period of inactivity, preparing it for a new measurement season at the Italian Climatic Observatory “Ottavio Vittori” located at Monte Cimone (44° 12' N, 10° 42' E, 2165 m.a.s.l.). This location stands as the highest peak in the Northern Apennines, situated between two distinct climatic regions: the continental Europe northwards and the Mediterranean Basin southwards. The calibration process conducted at GOA will enable participation in the AERONET network, providing data from this strategic site. Furthermore, this STSM provided an opportunity to become acquainted with the CAELIS software actively utilized by the GOA group for the control and management of the photometers in their inventory through period checks. It also offered insights into the scripts used within this software for the computation of various optical aerosol parameters. CAELIS facilitates real-time monitoring of photometer status, offers direct access to AERONET data, and provides a wealth of useful documentation for instruments, error resolution, and fault troubleshooting. Once the photometer is installed at the Vittori Observatory, the algorithm developed by the National Research Council of Italy – Institute of Polar Sciences (CNR-ISP) for AOD and alpha calculation will be compared with the algorithm employed by the AERONET network. Specifically, this comparison will extend beyond AOD values to include Rayleigh scattering values, the absorption values of various trace gases (i.e. carbon dioxide, ozone, nitrogen dioxide), and the cloud-screening procedure. This comparative work has the potential to evolve into a scientific article that put beside the two calculation methodologies at different polar sites. These objectives align with the predetermined deliverables of WG1 within this COST Action, particularly those related to optimizing and standardizing aerosol columnar products derived from direct and diffuse irradiance measurements.

During my doctoral studies, I am dedicating time to the development of the PolarAOD website, an international network aimed at collecting and providing the scientific community with photometry data from various polar research bases and stations, both in the Arctic and Antarctica. The STSM in Valladolid also provided an opportunity to discuss this project with colleagues from the GOA group, who have been actively involved in and committed to the project since its inception in 1999 under the leadership of Dr. Tomasi. Following the outbreak of the pandemic in 2020, all activities of this network experienced slowdowns, which continued until today. Therefore, there was a renewed interest in strengthening the collaboration of the GOA group within the PolarAOD network by adding the polar bases managed by the group (Andened and Ny-Ålesund in the Arctic; Marambio and BAE Juan Carlos I in Antarctica). Within PolarAOD, it will be possible to upload either the irradiance signals directly measured by the photometer or the AOD data directly. In cases where signals need to be uploaded, an algorithm developed by CNR-ISP capable of calculating AOD and alpha from various photometer models will be utilized. The involvement of the GOA group aligns with the deliverables of WG2, specifically focusing on the establishment of an international cooperation network, with a particular emphasis on polar regions.

Lastly, there was also a discussion regarding the overseas period foreseen by my PhD program at Ca' Foscari University of Venice. There is a possibility of installing a PREDE POM02 solar photometer on the roof of the Faculty of Sciences at the University of Valladolid. On the terrace, the GOA group hosts infrastructure for the calibration of CIMEL photometers (with two master photometers calibrated at the Izaña station) and a Precision Filter Radiometer (PFR). The intention is to initiate a brief measurement campaign lasting some months, followed by a comparison of the results and measurements obtained from these three different models of photometer.