*Workshop on "Recent advancements in remote sensing and modeling of aerosols, clouds and surfaces",*
*GRASP ACE Summer school,*
*Lille, France, May 22-26, 2023*

# Remote sensing solutions for mobile atmospheric observations

**I.E. Popovici[1,2*], P. Goloub[2], L. Blarel[2], G. Dubois[2], T. Podvin[2], M.F. Sanchez Barrero[1,2], F. Ducos[2], B. Patra[2], R. Loisil[2], C. Delegove[2], B. Torres[2] and S. Victori[1]**

[1] *CIMEL Electronique, Paris, France*
[2] *Univ. Lille, CNRS, UMR8518-LOA-Laboratoire d'Optique Atmosphérique, Lille, France*

***Corresponding author e-mail**: i-popovici@cimel.fr

The three main instruments that we developed for observations of the atmosphere during motion are: the shipborne CE318-T CIMEL photometer, a modified version of the standard CIMEL photometer, the fast sun-tracking PLASMA photometer [1], tested on car, aircraft, ship and the CIMEL CE370 (532 nm) and CE376 (532 nm, 808 nm, depolarization) compact, micro-pulse lidars that were already embarked on car for mobile campaigns. The lidar is used in synergy with the photometer to provide characterization of vertical and spatial variability of the scenes observed during movement. The shipborne CE318-T photometer is permanently installed since 2021 on the French research vessel Marion Dufresne in the frame of the MAP-IO (Marion Dufresne Atmospheric Program - Indian Ocean) research program, exploring Indian Ocean waters and sky. The PLASMA photometer has shown its capabilities to map aerosols loading and properties during several spatial variability campaigns in France using MAMS mobile system [2,3]. The CIMEL CE370 lidar allowed to explore the on-road vertical variability of aerosols in North China Plain and in industrial areas near Tianjin port [4]. First tests for mobile measurements with the dual-wavelength CE376 lidar were made during FIREX-AQ (Fire Influence on Regional to Global Environments and Air Quality) campaign [5] in north-western US in summer 2019, exploring fires close to the source. Since then, we improved the stability, robustness and modularity of the CE376 lidar, to be tested for new mobile campaigns. A first integration of the new CE376 lidar for mobile measurements will be on the Polar POD (https://www.polarpod.fr/), vertical vessel to circle the Antarctica and study the Southern Ocean and atmosphere above. Results from mobile photometer and lidar synergy during campaigns on land (France, China, USA) and on water (Marion Dufresne MAP-IO) will be presented, showing the capabilities of such synergy of instruments for atmospheric characterization (mapping of AOD, Angstrom Exponent, volume size distribution, extinction coefficient profiles, mass concentration profiles). This type of moving exploratory platform that allow measuring spatially the Essential Climate Variables (ECV) concerning aerosols properties (optical depth, single-scattering albedo, layer height, extinction profiles) are particularly of interest for satellite Cal/Val campaigns.

**Keywords**: photometer, lidar, mobile, aerosols, synergy

**References**

[1] Karol, Y., Tanré, D., Goloub, P., Vervaerde, C., Balois, J. Y., Blarel, L., Podvin, T., Mortier, A., and Chaikovsky, A. (2013). Airborne sun photometer PLASMA: concept, measurements, comparison of aerosol extinction vertical profile with lidar, Atmos. Meas. Tech., 6, 2383–2389.

[2] Popovici, I.E., Goloub, P., Podvin, T., Blarel, L., Loisil, R., Unga, F., Mortier, A., Deroo, C., Victori, S. Ducos, F., Torres, B., Delegove, C., Choël, M., Pujol-Söhne, N. and Pietras, C. (2018). Description and applications of a mobile system performing on-road aerosol remote sensing and in situ measurements, Atmos. Meas. Tech, 11, 4671–4691.

[3] Popovici, I.E. Aerosol Spatial and Temporal Variability as Seen by Mobile Aerosol Monitoring System (MAMS). 2018. Available online: http://www.theses.fr

[4] Popovici, I.E., Deng, Z., Goloub, P., Xia, X., Chen, H., Blarel, L., Podvin, T., Hao, Y., Chen, H., Torres, B., Victori, S. and Xuehua, F. (2022). Mobile On-Road Measurements of Aerosol Optical Properties during MOABAI Campaign in the North China Plain, Atmosphere, 13, 21.

[5] Warneke, C., Schwarz, J. P., Dibb, J., Kalashnikova, O., Frost, G., Al-Saad, J., et al. (2023). Fire influence on

regional to global environments and air quality (FIREX-AQ). Journal of Geophysical Research: Atmospheres, 128, e2022JD037758. https://doi.org/10.1029/2022JD037758