

Multiwavelength Raman lidar observations in Eastern Europe for long-range transported aerosols originating from North American biomass burning episodes

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The extremely strong wildfires occurred on the North American continent in the past few years produced large amounts of smoke, which was lifted into the free troposphere and/or lower stratosphere. Depending on the atmospheric circulation conditions, these biomass-burning-aerosol (BBA) layers were transported from the US or Canada towards Europe. These long-range transport (LRT) events, originating from fires in North America, have been observed and characterized by ground-based and satellite measurements in multiple locations in Europe (see: Baars et al., 2021; Hu et al., 2019; Ansmann et al., 2018; Ancellet et al., 2016, etc.).

The present study aims to provide an analysis of a complex episode of long range transported biomass burning aerosol over Cluj-Napoca, Romania using a multiwavelength Raman lidar observations within the framework of the European Aerosol Research Lidar Network (EARLINET).

The Cluj-Napoca lidar system (CLOP) emission is based on a Nd-YAG laser Continuum INLITE II-30, which has a repetition rate of 30 Hz and is equipped with second and third harmonics. The radiation at 1064, 532, and 355 nm is simultaneously emitted into atmosphere. The backscattered radiation is collected by a Cassegrain type telescope (D300, Raymetrics S.A., Athens, Greece) with a focal length of 1500 mm. The signal detection unit has a total of 6 detection channels, 4 channels for the elastically backscattered radiation at 1064, 532 (cross and parallel), and 355 nm and 2 channels for the Raman radiation backscattered by nitrogen molecules at 607 and 387 nm. The raw data vertical resolution is 3.75 m.

Following the detailed analysis of an initial eight cases with potential presence of long-range transported aerosols from North American biomass burning episodes, only one case was confirmed as meeting the conditions to support the hypothesis of such an intrusion over Eastern Europe. Thus, the lidar observations of September 21, 2020 indicate the presence of several layers with different physical and optical characteristics in the atmosphere. From the analysis of these properties and based on the back trajectory data provided by the Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model it was concluded that in addition to the presence of smoke (in the lower layers), there was also an intrusion of Saharan dust in a layer located at a higher altitude.