Geophysical Research Abstracts
Vol. 20, EGU2018-14646, 2018
EGU General Assembly 2018

Study of aerosol hygroscopicity using continuous Raman lidar measurements

Francisco Navas-Guzmán (1), Giovanni Martucci (1), Maxime Hervo (1), Martine Collaud Cohen (1), Dominique Ruffieux (1), Bertrand Calpini (1), Valentin Simeonov (2), and Alexander Haefele (1)

(1) Federal Office of Meteorology and Climatology MeteoSwiss, Payerne, Switzerland (francisco.navas@meteoswiss.ch), (2) Ecole Polytechnique Fédérale de Lausanne - EPFL, Lausanne, Switzerland

An important factor that can modify the role of aerosols in the global energy budget is the relative humidity (RH). Under high relative humidity conditions, aerosol particles size may increase due to water uptake (hygroscopic growth) altering their size distribution and their optical and microphysical properties. Therefore, hygroscopic growth affects the direct scattering of radiation and especially the indirect effects, as the affinity of atmospheric aerosols for water vapour is highly related to their ability to act as cloud condensation nuclei (CCN). Thus, understanding aerosol hygroscopic growth is of high importance to quantify the influence of atmospheric aerosol in climate models. Despite its importance, aerosol hygroscopic properties have not been properly characterized yet using remote sensing (RS) techniques (non-invasive method) and it is a quite open issue that needs to be addressed. The number of aerosol hygroscopic studies using RS techniques is modest and most of them were limited to few case studies during specific field campaigns. The major limitation of most of these studies is due to the lack of simultaneous observations of vertically resolved profiles of relative humidity and aerosol properties.

The Swiss RAman Lidar for Meteorological Observations (RALMO) can overcome these difficulties since it is able to provide continuous daytime and nighttime profiles of aerosol properties (backscatter and extinction) and relative humidity. RALMO is a state-of-art humidity, temperature and aerosol profiler capable to measure the rotational-vibrational Raman signals of nitrogen and water vapour (wavelengths of 386.7 and 407.5 nm, respectively) along with the pure rotational Raman (PRR) signal around the Rayleigh line at 355 nm during day and night-time. RALMO is operated at the aerological station of MeteoSwiss at Payerne (46º48' N, 6º56' E, 491 m asl) since beginning 2008 and provides one of the longest time-series of vertical profiles of humidity, temperature and aerosol properties in Europe. The presented study shows several case studies where the capability of this lidar system to detect vertically and temporally resolved aerosol hygroscopicity is proved. The RH profiles from the lidar have been evaluated by comparing co-located radiosonde measurements. The results show the potential of RALMO dataset for future statistical analysis of hygroscopic properties for a large variety of particles that reach our station (e.g. volcanic particles, Saharan dust, pollution, biomass burning aerosols, etc).