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An innovative compact lidar for atmospheric aerosol, water vapour and transmissivity measurements

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The Naples observation station serves as a National Facility for the ACTRIS European network. In this frame, an innovative lidar system was recently made operational as part of the transportable atmospheric analysis equipment at the University of Naples "Federico II", located at CeSMA (Advanced Metrological and Technological Services Center).
The system is compact and transportable, using two wavelengths to retrieve both elastic and Raman backscattered light, and also providing depolarization analysis. Its emitter is a solid-state Nd:YAG laser source with a repetition-rate of 2 kHz, sending the second (532 nm) and third harmonic (355 nm) of the fundamental wavelength (1064 nm) into the atmosphere. The receiver operates in a monostatic configuration and employees a Ritchey-Chretien telescope with a 20 cm diameter and a 50 cm focal length. Moreover, the advanced scanning systems permits measurements at desired angle with respect to the zenith and azimuth angles.
The spectral selection box splits the light into the various wavelength and polarization components, and in particular into channels for the acquisition of backscattered light of the same wavelength sent in the atmosphere, analysing elastic scattering, and also channels for the acquisition of wavelengths from anelastic, or Raman, scattering. In particular, Raman echoes for the 355 nm initial wavelengths are acquired, 386 nm for N2 and 407 nm for H2O. This last channel is fundamental to obtain information on the water vapour presence in atmosphere, which is one of the most variable in concentration component.
This system allows to carry out measurements of atmospheric transmissivity in the UV region. A special interest for this spectral region comes also from the development of new methods to detect very high-energy cosmic rays through the UV Cherenkov light emitted by the electromagnetic showers generated in the atmosphere, few kilometres above surface level. The transmissivity depends on scattering and absorption processes at the various wavelengths from molecules and aerosol in atmosphere, with the latter term being the most difficult term to estimate. Measurements made by this lidar will be reported, showing off how this instrument can conduct in-depth analysis of atmospheric particulate matter, obtaining optical properties of the particles and transmissivity of the atmosphere.

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