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New eye safe compact EZ LIDAR^{TM} for pollution and meteorological monitoring.

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As the lidars became commonly used on a routine basis by many atmospheric research groups in order to retrieve the optical properties, structure and layering of aerosols and clouds the networks have raised around these research issues (EARLINET, CLOUD-NET, AD-NET, MPLnet, Cis-LINET). The CEA/CNRS and the LEOSPHERE have gathered their competencies and jointly developed an eye safe, robust, unattended lidar "EASY_AEROSOL_LIDAR"^{TM} (www.lidar.fr) dedicated to remote observations of highly resolved structures of tropospheric aerosols and clouds (Fog, low clouds, sub-visible cirrus clouds), up to 15km/20km depending on detect4ion options. The system is a mature meteorological turnkey and unattended sensor and hence can well serve for operational meteorological networks and pollution agencies as a standardized tool, and hence it is a very good candidate to be integrated in a whole weather remote sensing platform.

The system is based on linearly polarised 355nm Nd:Yag pulsed laser wavelength operating at pulse energy of 16mJ with 20Hz repetition rate. The conceptual simplicity of the backscattering lidar scheme ensures easy and trouble free utilisation of the lidar during field campaigns even under tough conditions (e.g. highly polluted, desert). Light weight easy to transport system is designed to allow a fixed location measurements with vertical and horizontal scanning option (e.g. scanning of pollution within the city), as well as the operation from an available mobile platform, a car, ship, and/or an aircraft.

In automated vertical measurements configuration lidar is powerful enough to cover the range from full overlap at 100m (50m with post processing) up to the Tropopause level (15km/20km) even for tropical regions, i.e. providing the information on PBL structures and Cirrus clouds at the same time. As deliverable the profiles of the range and background corrected signals, backscatter and extinction coefficient (Klett-Fernald approach with height dependent lidar ratio assumption for locally representative aerosol type) are provided with very high resolution definition in space and time. The retrievals are usually obtained with 1.5m spatial resolution, and integrated for aerosol detection over 1s in PBL, 5-30s in troposphere below 5km, and between 30s to 1min above 5km. Additionally, the PBL height, the cloud bottom height and the particle optical depth are provided automatically.

The raw lidar data are acquired using analog and/or photon counting detection and processed for mentioned calculations by internal software, hence no additional software development is required. Retrieved results are displayed on the front panel of the acquisition system allowing for an immediate interpretation. Raw and processed data are accessed by TCP-IP protocol which allows using the system remotely from desired computer. During automated measurements several safety features are assuring full control over the system. They cover as simple functions as the control of the system's internal temperature and power, through the detection of photomultiplier saturation due to low clouds, high background and/or direct sun radiation, to as sophisticated as pulse repetition rate control for the purpose of serving as the laser flash-lamp life time saver.

One of the Easy Lidar's main benefits is the upgradeability of the standard system. The 355nm cross-polarisation detection is enabling the information on shape of the measured particles, e.g. spherical particles as aerosols from biomass burning or anthropogenic pollution, or non-spherical as silicate aerosols from Saharan dust or ice particles of Cirrus. Another important evolution of the system, currently under development, is the implementation of the Raman nitrogen and water vapour detection channels. The latter one will provide the mixing ratio profiles in PBL (up to 2km daytime / 10min integration).

Since May 2005 the system has been successfully used in several campaigns, e.g. for pollution tracking (LISAIR'05, Paris, France), African monsoon observations (AMMA'06, Niamey, Niger), long term air quality measurements (Beijing, China), as well as during validation campaigns (SIRTA, 2005, Palaiseau, France, ARM'06, Oklahoma, USA). Thus this instrument should be of great use in the next future in order to improve measurements for atmospheric research as well as for continuous networked standardized meteorological and pollution measurements.