Dual Polarization LIDAR (DPL)

Rising level of airborne particles (aerosols), particularly those arising from industrial and automobile smoke, is a major concern, in terms of both human health and global warming. The compact Dual Polarization Lidar (DPL) developed by ISRO provides an insight in locating the presence of aerosol particles and clouds in the atmosphere which plays a major role in regulating earth's climate and air quality.

Specifications:

- Laser : Nd-YAG laser
- Wavelength : 532 nm
- Laser energy per pulse : 30 mJ max, 10 mJ typical
- Repetition rate : 1Hz to 20 Hz
- Beam-divergence : 0.69 mrad
- Telescope :Schmidst-Cassegrain, 150 mm, F ratio-10
- Field of View :Variable from 0.5 to 8 mrad, 2.0 mrad typical
- No. of receivers :2
- Polarization diversity accuracy :0.1%
- Vertical resolution :7.5 m max, 30 m typical
- Range :30m to tropopause height (240 m for 2 mrad) in daytime at 30 m range resolution and beyond 30 km in night time
- Operation :Zenith or at any slant path direction

Principal of Operation

The lidar system uses a single wavelength laser for excitation of the atmosphere and performs polarization diversity measurement in receiver for detection and discrimination of various suspended particles/aerosols of interest. In the simpler form, a laser transmitter generates a monochromatic spectrum of light beam having a predetermined state of

polarization. Light scattered from the lower atmospheric aerosol / particles is detected using a polarization sensitive receiver and thereby the degree of change in polarization of the scattered light is determined. The ratio of the depolarization at the exciting wavelength is then calculated and used to discriminate between the various particles/aerosols.

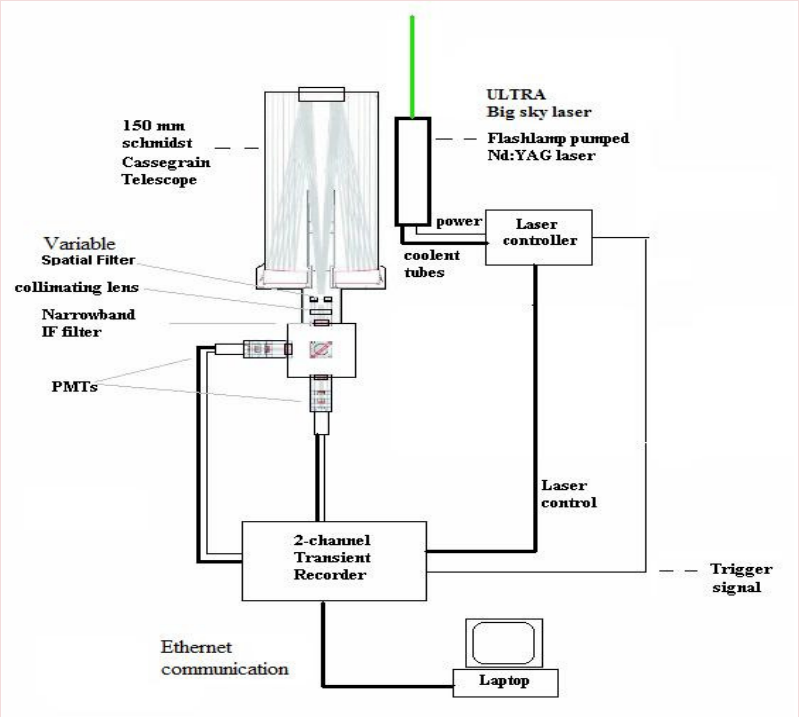

Fig: Schematic Block Diagram – Dual Polarization LIDAR

The DPL is an independent lidar system that contains a pulsed laser transmitter, a receiver telescope, optics, dual detectors, signal digitizers, timing and power supply electronics and a computer for control and data recording. The lidar system employs biaxial configuration.

Salient features

a. DPL is a compact, Ethernet operated fully remote controlled system.
b. If operated in shaded region, DPL system works in day and night without pause.
c. Data in analog and photon counting mode.
d. 7.5 m range resolution or in integer multiples of 7.5m.
e. Lidar system operation in any angle between 0 and 90 deg. elevation.

Current Installation

National Atmospheric Research Laboratory (NARL), ISRO, Gadanki, AP.

Application(s)

DPL an active LIDAR instrument with inbuilt polarization capability probes the properties of thin clouds and air borne particles in the atmosphere. The LIDAR vertical profiles provide detailed structure and content of aerosol particles, evolution of atmospheric boundary layer height, cloud height, identification of aerosol plumes in urban and industrial areas etc.

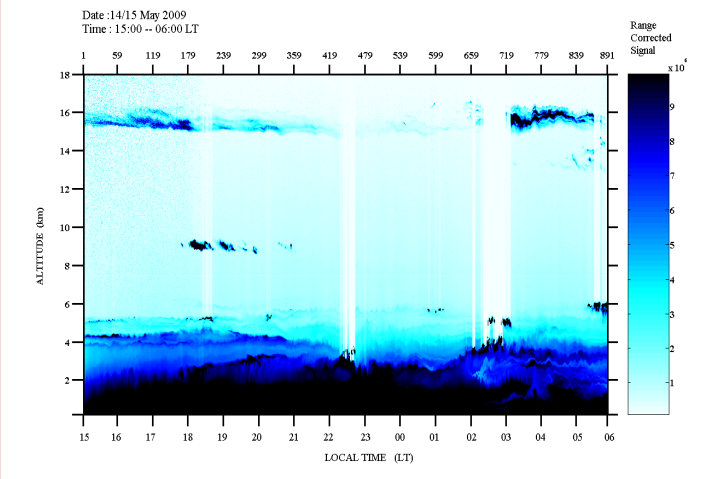

Fig: A typical lidar observation illustrating the location of high altitude sub visible ice clouds at 16 km during daytime

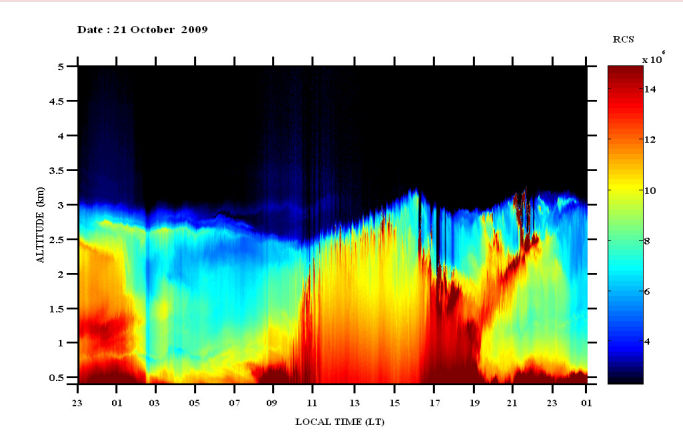

Fig : lidar observation of diurnal evolution of atmospheric boundary layer

Scientific application(s)

a. Lidar data provides dynamical structure of the atmosphere, which can be used for real-time detection of atmospheric boundary layer height (ABL)

and can provide continuous height information of planetary boundary layer.

b. Lidar data provides valuable information on presence of dust in the atmosphere .This information is vital for air quality requirements.
c. Time evolution of lidar data provides new insight in to the different types of cloud structure and its content.
d. Long-term climatology of lidar data provides how clouds and aerosols form, evolve and affect climate.

Commercial application(s)

a. Locating and ranging the gas leakage/pollutant emission areas in gas pipeline /industrial areas in horizontal direction.
b. Visibility determination at airports for aircraft landing and takeoff in slant path directions.
c. Aircraft Icing helps aircraft pilots for identifying the ice cloud regions and thereby protecting the icing of aircraft wings.

TECHNOLOGY TRANSFER FROM ISRO

ISRO is willing to offer the know-how of this technology to entrepreneurs / industries in India. Capable manufacturing industries interested in acquiring this know-how may write with details of their present activities, requirements and plans for implementation, infrastructure and technical expertise available with them, their own market assessment, if any, and plans for diversification to the address given below.

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