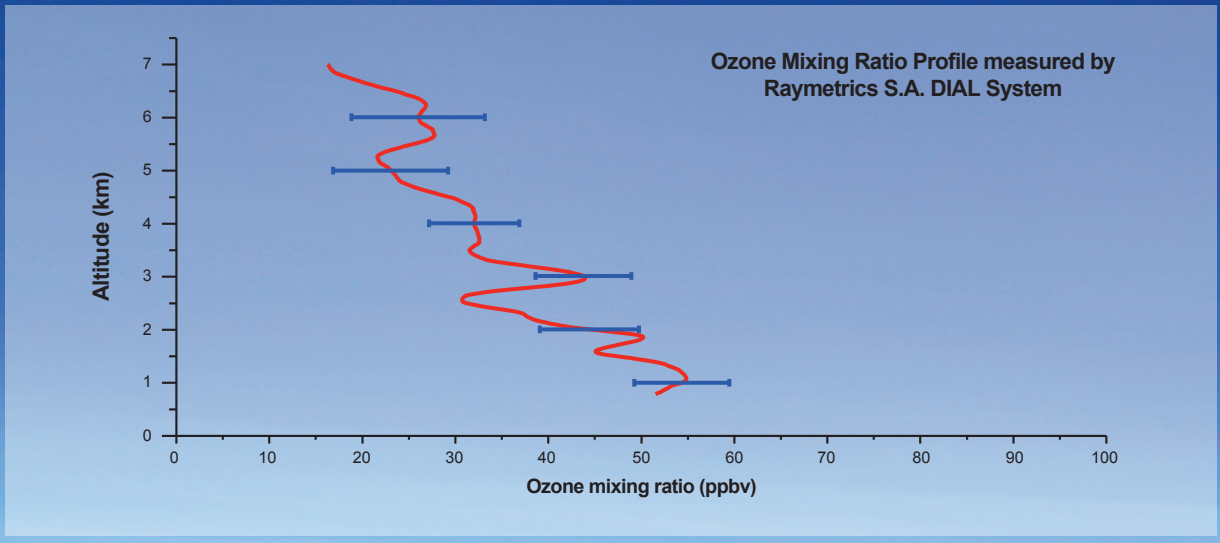
Ozone Profiler

raymetrics
lidar systems

The importance of Ozone on Earth climate and Atmospheric radiation balance

In Atmospheric Science, Ozone is considered to be one of the most significant trace gasses. Stratospheric ozone prevents UV solar radiation from reaching the earth's surface protecting flora and fauna from its harmful effects. Moreover, it contributes to stratospheric warming. On the other hand, tropospheric ozone is considered as anthropogenic greenhouse gas and secondary air pollutant. It is formed by photo-chemical reactions involving Nitrogen Oxides (NOX) and Volatile Organic Compounds (VOCs).



Impacts of high tropospheric Ozone concentrations

- Tropospheric Ozone is an important greenhouse gas, pollutant, and source of OH radicals. It is regarded as the third most important contributor to global warming following Carbon Dioxide and Methane [IPCC 2007].
- Tropospheric ozone is known to damage plants, reducing plant primary productivity and crop yield.
- It is related to the concentration of Methane and other hydrocarbons in the atmosphere through chemical processes assisted by absorption of UV solar radiation.
- Ozone is also toxic to humans and vegetation because it begins oxidizing biological tissue and causes harmful respiratory effects in cases of long exposure at high concentrations.
- Ozone contributes to deterioration of materials and buildings affecting monuments of invaluable cultural heritage.

Tropospheric Ozone Monitoring

- Global long-term measurements of Ozone indicate an apparent increase within the past hundred years.
- Key factors that determine the abundance of O3 in the lower troposphere are:
  - Emissions of the precursors NOx and reactive VOCs,
  - Atmospheric production and destruction of O3 (lightning),
  - Turbulent transport (Stratospheric-Tropospheric exchange),
  - Advection from upwind sources,
  - Deposition onto surfaces.
- O_3 monitors, in the measurement networks, are mainly point monitors at ground level that yield no information about the vertical distribution of ozone.
- Vertical profiling measurements are conventionally obtained with balloon-borne sensors. However, this method provides very poor temporal (in most cases 2 measurements/day) and spatial resolution.

Raymetrics solution for accurate ozone concentration-vertical profiling

- Raymetrics incorporates in its products one of the most efficient remote sensing technique for Ozone concentration vertical profiling. Differential Absorption Lidar (DIAL) technique.
- Such configuration provides the ability of measuring ozone concentration within the PBL and simultaneously detect Stratospheric Ozone intrusions into the upper and mid Troposphere.
- Thus, such a system could be used for Ozone pollution detection in daily and long-term basis (establishment of a database with ozone concentration profiles over each territory), along with tropospheric climatology studies.

Advantages of DIAL remote sensing Technique

- Continuous monitoring of the vertical distribution of Ozone (24/7 configuration).
- Increased raw signal spatial resolution (3.5m – 15m) along with very high temporal resolution (few minutes).
- Increased range of measurements typically from 50m up to 12km.

Raymetrics DIAL System

The system is equipped with a small sized diameter telescope i.e. 200-300mm (having low full overlap altitude with the laser pulse approx. 100m). A powerful laser source emitting @ 266nm. The Stimulated Raman Shifting technique is used to produce 289, 299, 316nm laser beams.

Wavelength pairs for DIAL measurements are:

266-289nm, O_3 measurements within the PBL, (Altitudes<2km).
289-299nm, O_3 measurements over the PBL, (Altitudes 2km – 6km).
299-316nm, O_3 measurements, (Altitudes 6km – 12km).
Typically, the systematic error in ozone concentration vertical profiles remains lower than 5% (nighttime) and 10% (daytime).

- Data acquisition/analysis supported by Raymetrics software:
  - Safe operation even if the user is not familiar to laser technology.
  - Fully automated, user friendly, operation and remote control of the system for 24/7 data acquisition.
  - Live data processing and display of the retrievals in 2D and 3D imaging.
- Total after sales hardware and software support.

The system is addressed to:

- Meteorological services.
- Atmospheric research Laboratories.
- Environmental institutes.
- Observational Laboratories.

CERTIFICATES

Raymetrics is the first atmospheric LIDAR manufacturer able to offer certifications for its products, and for their systematic uncertainties, from LiCAL/ACTRIS, according to document doi:10.5194/amt-9-4181-2016.

The company is ISO 9001:2008 certified.

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Since 2002 Raymetrics has been designing and manufacturing atmospheric remote sensing systems for meteorological and other similar applications.

Today we are the world leader in the rising wave of remote sensing technology in operational and commercial sectors such as Meteorology, Aviation, Environmental Protection, Mining, Oil & Gas and Heavy Industry.

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