

# CIS-LINET - LIDAR NETWORK FOR MONITORING AEROSOL AND OZONE IN CIS REGIONS

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## ABSTRACT

A lidar network CIS-LiNet was established in 2005 by lidar teams from Belarus, Russia and Kyrgyz Republic. Its objective is carrying out coordinated lidar observation of the atmospheric aerosol and ozone over the territory of CIS (former Soviet Union countries) from Minsk to Vladivostok.

Remote atmosphere monitoring with active and passive optical systems forms the main part of the CIS-LiNet working program activities. Complex lidar and radiometric stations are developed for aerosol investigation. A unified methodology for lidar data processing and corresponding software is being worked out for all the network stations. Routine measurements have been started and a common data base for the observation results is currently developed within the CIS-LiNet network.

## 1. INTRODUCTION

The CIS-LiNet lidar network has been developed to arrange coordinated observations of aerosol and stratospheric aerosol characteristics on the territory of the former Soviet Union countries. The concept of CIS-LiNet formation presupposed coordination of its activities with the EARLINET and AD-Net lidar networks to ensure facilities for joined atmosphere investigations on the Eurasian continent (Fig. 1).

CIS-LiNet includes (Fig.1):

- a stationary lidar stations in Minsk (53.917N, 27.383E), Moscow (55N, 37E), Surgut (61.25 N, 73.50E), Tomsk (56.48N, 85.05E), Vladivostok (43.01N, 131.9E).
- an Alpine stationary lidar station in Teplokluchka

- (42.5N, 78.4E) in Central Asia, Kyrgyz Republic.
- a seasonal lidar station on the base of a mobile lidar at the Lake Baikal (51.44 N, 105.06 E).
- a shipboard lidar in Vladivostok.



Fig. 1. Lidar networks at the Eurasian continent:

\* - EARLINET, ■ - AD-Net, ○ - CIS-LiNet

The main investigation tasks implemented within CIS-LiNet are the following:

- Routine and coordinated observations of the altitude troposphere aerosol parameters profiles to study large-scale spatial-temporal atmosphere aerosol component modifications and large-scale transport process.
- Investigation of aerosol fields dynamics in the atmosphere boundary layer on the temporal scale from diurnal to seasonal ones.
- Routine stratosphere aerosol and ozone observations to study factors influencing their modification and trends
- Studying regional changes in aerosol fields parameters, affected by phenomena characteristic of the region: anthropogenic atmosphere pollution, forest fires,

dust carry-outs from Sahara, North China and Mongolia, volcanic activity in the regions of Kamchatka and Kurile islands, aerosol characteristics transformation in vertical transport in the Alpine regions, stratosphere clouds.

## 2. LIDAR EQUIPMENT

A three-wavelength lidar (355, 532 and 1064 nm) with Raman channel (387 or 607 nm) is approved as a basic variant for tropospheric aerosol measurements in CIS-LiNet. The lidar stations in Minsk, Tomsk and Alpine stationary lidar station in Teplokluchenska are able to provide depolarization measurements.

The measurements of stratospheric aerosol are carried out at all stationary CIS-LiNet stations. In Minsk and Tomsk lidar systems include additional channels for sounding ozone.

The CIS-LiNet stations are being constructed as combined lidar and radiometer complexes. Three stations (Minsk, Tomsk, and Moscow) are capable to make correlated lidar and radiometer measurements. AERONET sun photometers will be further installed on other stations.

The program of equipment unification is step by step implemented to provide the data uniformity and quality in the CIS-LiNet network.

All the CIS-LiNet stations were provided the same type of laser transmitter - the YAG laser with second and third harmonic generator.

CIS-LiNet teams designed and produced pilot lot of uniform photo-receiving modules for record of sounding signals in the analog mode and the numerical data transfer to a control computer. The photo-receiving module comprises a photo receiver, a computer-controlled high power supply, a 14-bit ADC, a pulse energy recording channel, and an USB interface.

Intercalibration experiments are envisaged at the CIS-LiNet with using mobile lidars.

## 3. DATA PROCESSING

A multi-purpose software package was decided and installed at all stations.

An essential feature of the software designed is the storage and presentation of initial and processed data in ACCESS database. The package envisages performing the following data processing stages:

- Measurement and presentation of lidar signals to the database.
- Visualization and preliminary processing of lidar signals.
- Preliminary processing of additional information, including sun-photometer data.
- Retrieval of optical and microphysical aerosol parameters and of ozone concentration.
- Presentation of the processed data as an mdb-file of the ACCESS database.

The results of calculations are altitude profiles of aerosol backscatter coefficient and extinction (for Raman sounding), such as microstructure aerosol parameters in the case of combine lidar and sun photometer measurements.

## 4. MEASUREMENT PROCEDURE AND RESULTS

Routine lidar atmosphere observations at CIS-LiNet stations started in June 2005. Monday and Thursday are defined as observation days to measure tropospheric aerosol parameters. Under favorable weather conditions, two measurement series, namely near noon and sunset, are carried out each of the days.

Stratosphere aerosol and ozone sounding take place during nights with cloudless atmosphere. On average, 3 series of stratosphere sounding are scheduled per month.

Along with routine lidar observations CIS LiNet lidar groups carry out specific measuring programs to study features in the aerosol fields formation in the regions, where the stations are located, including:

- dust transport from continental Chinese and Mongolian regions to coastal Pacific Ocean area and from the Sahara desert to European region;
- features of aerosol field formation of the lower troposphere in the mountain hollow of the Baikal Lake with local and regional pollution sources;
- regional features in the stratosphere dynamics under autumn-spring rearrangement of the atmosphere.

The apparatus description, the measuring method, the software package for data processing, the data base and other CIS-LiNet activities results are available at the info-site : <http://www.cis-linet.basnet.by/>

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