ALINE/LALINET NETWORK STATUS

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ABSTRACT

The Latin American Lidar Network, ALINE a.k.a LALINET is a federation lidar network established in 2008 which became a member of GALION/GAW program in 2013. Currently the network consists of 9 operational stations with the perspective of two more stations to be included. The network today covers more than 18 million square Km and spans in Latitude from -52° to 21°

and in Longitude from -78° to -47° and it should cover a larger area in the future as planed inclusion of more active stations is on going.

1. INTRODUCTION

The Latin American Lidar Network, ALINE a.k.a LALINET is a federation lidar network established in 2013 as a member of GALION for 4D aerosol observation engaged in observing long-term climatic trends, identification of aerosols in the atmosphere and their optical properties and monitoring of long range transport, such as dust, volcanic ashes and biomass burning over South America. The scientific drives for the network are those connected to characterize the temporal-spatial distribution of aerosols and their variations on a regional and continental scale. On a local scale the aerosol plumes are used to study the atmospheric dynamics and these plumes act as planetary boundary layer tracers and also to help validating models and satellite observation products [1]. LALINET's most recent efforts are focusing in establishing a standard measurement protocol and improving a common algorithm for data processing to be shared among all participating stations and adding more stations to the present network.

Table 1.

Lidar system	City/Country	Coordinates
ba-BA-AR	Bariloche / Argentina	41.15°S 71.16°W
not applicable	Camagüey / Cuba	21.4°N 77.8°W
co-CEFOP-UDEC	Concepción/Chile	36.84°S 73.02°W
cr-CR-AR	Comodoro Rivadavia/ Argentina	43.24°S 65.33°W
ma-MA	Manaus / Brazil	2.89°S 59.97°W
me-LOA-UNAL	Medellin/ Colombia	6.26°N 75.58°W
ne-NE-AR	Neuquén/ Argentina	38.59°S 68.15°W
pa-LIPAZ	La Paz / Bolivia	16.54°S 68.07°W
sp-CLA-IPEN- MSP-LIDAR-I	São Paulo / Brazil	23.56°S 46.74°W
sp-CLA-IPEN- MSP-LIDAR-II	São Paulo / Brazil	Variable– Transportable System

2. NETWORK WORKSHOPS

The biennial meetings that have been taking place every two years since 2001, were initially created to nucleate the laser remote sensing groups in South and Central America. To achieve such goal, experts and observers from other groups in the world were invited at each edition. With the engagement of the groups and informal agreements being made new insights and scientific activities have been implemented, as pre-workshop introductory courses on atmospheric science and lidar fundamentals.

The network workshops have been held at most of the sites of the original teams (except Arecibo). Altogether 7 editions of this meeting have happened – Cuba (2001, 2003); Colombia (2005); Brazil (2007); Argentina (2009); Bolivia (2011); Chile (2013) – with a scheduled workshop to happen in Cuba, in April 2015. These meetings have steered most of the LALINET activities until the last edition when additional technical workshops were created to help in establishing measurement and data analysis protocols.

The I Workshop on Lidar Inversion Algorithms for LaLinet were held in Concepción, Chile, from 10 to 13 March 2014. The main goal of this first workshop was to compare the inversion algorithms for elastic backscatter lidars from each Latin-American Lidar group in order to develop a uniform, unified and improved algorithm.

The algorithm evaluation and improvement was based on the analysis of three simulated lidar datasets and comparison with the expected results. The first dataset was provided by the Institute for Tropospheric Research (iFT), Leipzig – Germany, and corresponds to the data used in the EARLINET paper Boeckmann et al., Appl. Opt. (2004). The second dataset was a modification of the first one, to include different levels of noise. The third dataset was another modification to include a cloud. As a result of the comparison, a standard for the retrieval of the particle backscatter from elastic lidar data was defined. Matlab and Mathematica routines for doing these calculations were prepared, which are not being used by all stations in the network.

3. INSTRUMENTAL INVENTORY

Most of the LALINET systems are not series-produced instruments and, therefore, present large differences in configuration and capabilities. For this reason there is a continuous attempt to improve network harmonization and optimization. To accomplish that a review of the current instrumental status of all LALINET systems was reviewed and analyzed in detail in order to assess the potential performance of the network and to detect networking weaknesses. In this process it was detected that efforts must be done to achieve as much as possible unattended systems to improve temporal coverage and to reduce the manpower needed, which in turn should have repercussions on the manpower devoted on data analysis. The number of emitted wavelengths should increase in order to achieve the triad 355+532+1064 nm, with the aim to improve the spectral capabilities of LALINET and be able to detect these channels that are the minimum lidar wavelengths to derive particle microphysical properties by combination with sunphotometer data. Besides, no 3+2 systems are available to extract microphysical properties by inversion method with regularization.



4. PILOT CAMPAIGN

A pilot campaign was carried out during Sep 10-14th 2012, which was representative as many biomass-burning activities occur during this period of the year. This pilot campaign was the first coordinated effort to perform simultaneous lidar measurements in Latin America. The difficulties involved in the coordination of such simultaneous measurements were mainly due to (1) reduced manpower, (2) manually operated lidar stations, and (3) weather permitting conditions. This effort allowed us to establish some common network standards such as molecular cross-section and the same methodology for retrieving particle backscatter from elastic lidar data.



Fig. Fires (dark blue) detected by INPE algorithm (http://www.inpe.br/queimadas/) using AQUA/MODIS satellite data from September 10th to 14th 2012 are shown. Lines correspond to 48 h HYSPLIT back trajectories (http://ready.arl.noaa.gov/HYSPLIT.php) starting at the time selected for each station and altitude of maximum backscatter (Fig. 3). Trajectories were calculated in ensemble mode using GDAS meteorological data.



Fig. Particle backscatter coefficients (Mm-1 sr-1) obtained by each group participating in the analysis of data from the Pilot Campaign. Left: São Paulo and right: Manaus. No overlap correction was applied at this stage.





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