WP2- NA2: Remote sensing of the vertical aerosol distribution
Deliverable D2.1: Minutes of the 1st Joint WP2-20 Workshop

WP2 – NA2: Remote sensing of the vertical aerosol distribution

WP20 – JRA1: Lidar and sunphotometer

hosted by

Karlsruher Institut für Technologie (KIT)

Institute for Meteorology and Climate Research - Atmospheric Environmental Research (IMK - IFU), Garmisch-Partenkirchen (Germany)

29 November – 1 December, 2011

Agenda

29 Nov. 2011

9:00 – 18:00

WP2 NA2: Remote sensing of vertical aerosol distribution

Task 2.1 Exchange of expertise

ACTRIS overview

Interaction with other WPs

Open discussion

Task 2.2 Quality assurance

Task 2.2.2 Internal quality check-ups

Status

Discussion on procedures

Task 2.2.3 High-level quality check on the lidar data and products

Discussion and planned activities

Task 2.3 Improvement of lidar techniques and data analysis for aerosol characterization

Task 2.3.1 Definition of new aerosol parameters

Discussion on progress and needs

T2.3.2 SCC web graphic interface

Current status and future developments

T2.3.3 Documentation

Strategy

Miscellaneous

30 Nov. 2011

9:00-9:30

WP2 : Remote sensing of vertical aerosol distribution

Task 2.1 Exchange of expertise (cont'd.)

Interaction with other campaigns, programs and networks (EMEP, PEGASOS, etc.)

9:30-13:00

Technical discussions

14:00 – 18:00

WP20 JRA1: Lidar and sunphotometer – Improved instruments, integrated observations and combined algorithms

Task 20.1: Improved daytime capabilities of lidar instruments

Review of current status of Raman lidar techniques for daytime extinction measurements

Discussion on future developments

Task 20.2: Integrated observation strategies

Discussion of the structure of a database with combined lidar and sunphotometer observations

Discussion on integrated observations

Task 20.3: Integrated retrieval schemes for aerosol microphysical properties

Presentation of the current status of algorithm development and first results

1 Dec. 2011

9:00 – 13:00

WP2 NA2: Remote sensing of vertical aerosol distribution (cont'd)

Scientific presentations

End of the workshop

Minutes

The 1st joint workshop of ACTRIS WP2 (NA2: Remote sensing of vertical aerosol distribution) and WP20 (JRA1: Lidar and sunphotometer – Improved instruments, integrated observations and combined algorithms) took place at the Karlsruher Institute für Technologie's (KIT) Institute for Meteorology and Climate Research – Atmospheric Environmental Research (IMK-IFU), in Garmisch-Partenkirchen (Germany), from 29 November to 1 December 2011 (see agenda). This was a way to achieve a much more effective impact on the exchange of expertise since, although not all the participants in WP2 are carrying out the joint research activity of WP20, all of them are interested in its outcomes; the concurrence of both workshops allowed the attendees of the WP2 workshop to participate in the discussion of the WP20 one. The workshop was attended by 60 people.

The focus of the WP2 workshop was on instrument quality assurance, with special attention to depolarization calibration, since linear particle (or aerosol) depolarization ratio is one of the new quality-assured parameters whose profiles are to be included in the EARLINET extended standard set of parameters as one of the outcomes of ACTRIS activities, and a good calibration of the lidar instruments is critical to achieve reasonable uncertainty limits for these profiles to be meaningful.

In addition to the workshop main theme, which included parts of WP2 tasks 2.2 and 2.3, progress in the rest of tasks and subtasks was also tracked and fostered.

The focus of the WP20 workshop was on the review of the current status of instrument and algorithm developments and a discussion of common activities and observation strategies during ACTRIS.

All the presentations listed in the following are available on the *ACTRIS website*.

Note that you must be logged in to the ACTRIS intranet
first in order to use the interactive links below!

Task 2.1. Exchange of expertise

Interaction with other work packages and integration

Interaction with other ACTRIS work packages was discussed following the presentations given by leaders of other work packages, or by participants in WP2 who also participate in other work packages or who had attended other work package workshops. Presentations by ACTRIS partners involved in several work packages and by ACTRIS co-coordinator, Paolo Laj, on the interaction with other programs and networks through specific campaigns, further underlined the importance of integration aspects. The challenges posed by the integration and the actions to be taken to achieve it were emphasized. The following presentations were given:

- *ACTRIS overview* (Adolfo Comerón, UPC)
- *WP6 –NA6: Integration, outreach and sustainability* (Adolfo Comerón, UPC): WP6 overview and report on WP6 ACTRIS vision report in Helsinki, 22-23 August 2011.
- *Interaction with WP5 and WP22. Summary of Joint Workshop, Delft, 12–14 September 2011* (Ulla Wandinger, IfT)
- *WP3-WP4: In-situ chemical, physical and optical properties of aerosols (NA) - Trace gases networking: Volatile organic carbon and nitrogen oxides (NA)* (Lucas Alados-Arboledas, CEAMA-UGR): WP3 and WP4 overview and report of WP3-WP4 in Ispra, 24-28 October 2011.
- *WP19: The ACTRIS Service Centre: Access to observations and service products of the infrastructure* (Cathrine Lund Myhre, NILU; Aasmund Fahre Vik, NILU; et al. MPI-HH, FMI, University of Reading, NILU)
- *Aerosol lidar activities at Finnish Meteorological Institute* (Mika Komppula, FMI; and Ewan O'Connor,University of Reading and FMI)
- *Discussions for ACTRIS support to EMEP/PEGASOS intensive observation periods* (Paolo Laj, CNRS-LaMP / UBP)
- *The Chemistry-Aerosol Mediterranean Experiment (ChArMEx) project: Overview and update* (Michaël Sicard, UPC)

It is outlined that the collocation of sunphotometers with most of the aerosol in-situ measurement stations and with most of the lidar stations provides a connection between both that should be exploited in search of integration.

It is agreed that no distinction between EARLINET finalized data and ACTRIS aerosol lidar data will be made and that the EARLINET data base will be accessed through the ACTRIS data center.

It is agreed that the EARLINET network will be partially activated beyond the climatology and CALIPSO correlative measurements to add value, together with the other components of ACTRIS infrastructure, to the EMEP/PEGASOS campaign taking place between 8 June and 17 July, 2012 and to the ChArMEx campaign between 15 June and 15 July, 2012. The extent and degree of that activation will be determined before the end of February 2012.

Technical presentations session

A broad range of technical issues and solutions affecting the performance of lidars and the quality of the data provided by them were openly presented and discussed in this session, with the aim to improve the overall quality of the lidar products. Discussion was brought up through the following presentations:

- *The influence of calibration range on lidar products: backscatter coefficient and volume depolarization. Results from RALI* (Livio Belgante et al., INOE)
- *Quest for MARTHA's UV-problem II* (Jörg Schmidt, IfT)
- *Auto-collimation with a custom-made fiber bundle to find the focus of a telescope / Comparison of telecover tests and the overlap function before and after realignments of Polly^{XT}* (Ronny Engelmann, IfT)
- *Usage of the Rayleigh-fit technique to improve removal of background noise from lidar data* (Ivan Grigorov, IE-BAS)
- *Telecover with systems using a fiber bundle + field lens* (Michaël Sicard, Diego Lange, and Adolfo Comerón, UPC)
- *Dark-measurement study on PCI digitizers at Madrid lidar station* (Francisco Molero, Alfonso Fernández, and Manuel Pujadas, CIEMAT)

Scientific presentations

The following presentations of stations and their capabilities, and of elaborated results from the exploitation of data provided by lidars, stressing the interaction with other instruments or with models, were put forward for discussion:

- *Lidar Investigation of Troposphere Aerosols in Georgia* (Giorgi Veshapidze et al., Ilia State University)
- *Quantitative evaluation of dust modeled profiles with EARLINET database: first results* (Lucia Mona, CNR-IMAA)
- *ACEMED experimental campaign - "Evaluation of CALIPSO's aerosol classification scheme over Eastern Mediterranean"* (V. Amiridis et al., NOA, AUTH, NTUA, University of Crete)
- *First results from the upgraded Athens EOLE & AIAS Lidar Systems during the EUFAR airborne campaign* (Alexandros Papayannis et al., NTUA, NOA)
- *2011 Activity of TUBITAK's multi-wavelength combined Raman/backscatter lidar. CALIPSO correlative measurements during the ACEMED campaign* (Kerim Allahverdiyev, TÜBITAK-MRC-ME)
- *Aerosol climatology over Maisach/Munich using CALIPSO L2 data* (Franziska Schnell, LMU)
- *Aerosol typing over Europe within the ESA-CALIPSO project based on EARLINET data* (Ulla Wandinger, IfT, et al. (IfT, CNR-IMAA), presented by Anja Hiebsch, IfT)
- *One year of aerosol lidar observations in Amazonia* (Holger Baars, IfT)
- *Preliminary results for microphysical properties of biomass burning aerosol transported from Ukraine* (Doina Nicolae, INOE; Detlef Müller, IfT / GIST; et al.)
- *Impact of aerosols on heterogeneous ice formation from EARLINET measurements in the northern hemisphere and PollyXT measurements in the southern hemisphere* (Thomas Kanitz, IfT)
- *Dual-field-of-view Raman lidar measurements of cloud microphysical properties* (Jörg Schmidt, IfT; Ulla Wandinger, IfT; and Aleksey Malinka, IPNASB)

Task 2.2. Quality assurance

This task partially included the central topic of the workshop, in particular in what respects depolarization calibration, which affects the linear particle depolarization ratio that will be included in the EARLINET standard set of parameters (see also section on Task 2.3 in these minutes). The subtasks structure, the reminder of basic internal check-up procedures and its current status, and the new ± 45º procedure for depolarization calibration are reported in the following presentation, where links can be found to detailed documentation:

- *WP2 Task 2.2 Quality Assurance* (Volker Freudenthaler, LMU)

Proposed system-oriented lidar quality levels are proposed in the following document:

- *WP2 Task 2.2 Lidar Quality levels* (Volker Freudenthaler, LMU)

No lidar intercomparison campaigns were due in the first year of ACTRIS, but they are foreseen in the 2nd and 4th years. The 2nd year campaigns will be defined in early 2012.

Progress on high-level quality checks on lidar data and products, including the single-calculus chain check on raw data and proposed limits of physical plausibility of the inversions is reported in the following presentation:

- *Task 2.2.3 High-level quality check on the lidar data and products* (Giuseppe d'Amico, CNR-IMAA)

The following contributed presentations promoted discussions on the quality assurance topic and in particular on the depolarization calibration issue:

- *New setup of UniLe lidar* (Ferdinando de Tomasi, CNISM-Università del Salento)
- *Characterization of the polarization-dependent receiver transmission of a lidar* (Jörg Schmidt, IfT)
- *Problems with depolarization measurements - Results of different calibration methods* (Jörg Schmidt, IfT)
- *Depolarization calibration measurements with +/-45° sheet polarizer in Polly^{XT}* (Ronny Engelmann, IfT)

It is to be noted that a device for the characterization of the polarization dependent receiver transmission can be borrowed from IfT and that advice can be requested from that institution by the participants in the work package to build their own.

Task 2.3. Improvement of lidar techniques and data analysis for aerosol characterization

Status and progress in this task were presented and discussed, in particular in what respects the inclusion of particle depolarization ratio in the standard set of lidar parameters and the associated calibration methods. A summary of this is contained in the following presentation:

- *Task 2.3 Improvement of lidar techniques and data analysis for aerosol characterization* (CNR, IfT, LMU, CNISM, presented by Giuseppe d'Amico (CNR-IMAA)

For documentation purposes, Giuseppe d'Amico will send around a request form to all the lidar stations to provide information on the depolarization channel configuration, specifications, calibration method and error (random and systematic) analysis, to be returned before 29 February 2012.

Discussion is prompted by the following contributed presentations concerning subtask 2.3.1 (definition of new aerosol parameters):

- *Layer boundary detection - Review of candidate algorithms* (Ulla Wandinger, IfT)
- *The wavelet covariance transform technique for PBL detection* (Holger Baars, IfT)
- *Wavelet-covariance-transform technique - Detection of cloud top height and aerosol layers from space-borne lidar data* (Ulla Wandinger, IfT)
- *Boundary layer: a crucial parameter* (Fabio Madonna, and Lucia Mona, CNR-IMAA)
- *Layer-mean optical properties* (Anja Hiebsch, IfT)
- *Cloud masking* (Ilya Serikov, Holger Linné, Jens Bösenberg, MPI-HH)

- *Lidar/ceilometer target classification using the STRAT/STRAT2D algorithm* (Y. Morille, et al., CNRS-SIRTA, presented by Christophe Pietras, CNRS-SIRTA)
- *Lidar product uncertainties* (Aldo Amodeo, CNR-IMAA)

It is agreed that the wavelet covariance transform technique will be taken as the baseline algorithm to detect boundaries, because of the advantage given by its adaptive features.

The difference between the planetary boundary layer (PBL) height and the variable DustLayerHeight of the EARLINET current standard set is underlined.

The STRAT software for layer detection and classification can be freely downloaded from http://www.lmd.polytechnique.fr/~strat/

Progress on the single-calculus chain (SCC) web graphic interface (subtask 2.3.2) is reported in the following presentation:

- *SCC Web interface* (Ioannis Binietoglou, CNR-IMAA)

The deadline for having the SCC in testing mode is 29 February 2012. From that date on, all the EARLINET stations can test the SCC with raw data in the NetCDF structure accepted by the SCC.

The following presentation is contributed in connection with subtask 2.3.2 and the SCC capability of performing microphysical inversions:

- *Microphysics Inversion of Data from Multiwavelength Raman Lidar* (D. Müller et al. (IfT, GIST), presented by Ulla Wandinger (IfT)

Miscellaneous

The CALIPSO EARLINET subsets from 7 June 2006 to 31 October 2011 have been transferred from a server at MPG Hamburg to a new storage server at CNR-IMAA. NASA will upload the new subsets after October 2011 to the new server as soon as possible. For further details see the presentation:

- *CALIPSO EARLINET subsets* (presented by Giuseppe d'Amico, CNR-IMAA)

A proposal for a possible method to enhance the synergy between lidars and collocated ceilometers is discussed in the following presentation:

- *Examination of possible synergy between lidar and ceilometer for the monitoring of atmospheric aerosols* (Ioannis Binietoglu et al., CNR-IMAA; presented by Fabio Madonna, CNR-IMAA) (18 Mb!)

Task 20.1. Improved daytime capabilities of lidar instruments

The current status of instrument developments for daytime lidar extinction measurements was discussed. Theoretical background and technical requirements for optimized solutions were presented, see:

- *ACTRIS WP20 – JRA1: Lidar and sunphotometer* (Ulla Wandinger, IfT)

The following contributed presentations provide an overview on the two major technologies used for daytime extinction measurements based on the rotational Raman lidar technique:

- *Grating spectrometer technique for rotational Raman measurements* (Ilya Serikov, MPI-HH)
- *Interference-filter techniques for rotational Raman measurements* (Jörg Schmidt and Ulla Wandinger, IfT)

The outcome of the review will be summarized in a report (Deliverable 20.2, due date 31 March 2012).

An outline of the optimization studies to be performed during ACTRIS is contained in the following contribution:

- *Improved daytime capabilities of lidar instruments* (Fabio Madonna, CNR-IMAA)

Task 20.2: Integrated observation strategies

An overview of input and output datasets used in different inversion algorithms was provided. The requirements which follow for the integrated observation strategies and the establishment of an observational database were discussed. Summarizing slides are available in the WP20 overview presentation:

- *ACTRIS WP20 – JRA1: Lidar and sunphotometer* (Ulla Wandinger, IfT)

A documentation on the database structure for combined lidar and sunphotometer observations will be drafted and sent around for discussion (Deliverable 20.1, due date 31 December 2011).

Task 20.3: Integrated retrieval schemes for aerosol microphysical properties

Combined lidar and sunphotometer algorithms are under development and investigation by different institutions. The following presentations give an overview on the status of development, dissemination, and application in the network:

- *Lidar/Sun-radiometer Remote Sensing Technique* (Anatoli Chaikovsky et al., IPNASB, LOA)
- *Results of combined lidar and sunphotometer retrievals obtained with the IPNASB algorithm* (Janet Wagner, IfT)
- *Combination of passive and active observations in aerosol retrievals* (Anton Lopatin et al., LOA, IPNASB)

Three further contributed presentations deal with combined micro-lidar and sunphotometer observations, with the influence of errors in sunphotometer observations on inversion products, and with the use of combined lidar and sunphotometer data for the development of atmospheric models for space-borne applications:

- *Real time monitoring of aerosol combining simple Lidar and CIMEL Sun-photometer* (Augustin Mortier et al., LOA)
- *Influence of radiance measurement errors on the inversion of sunphotometer data* (Benjamín Torres and Carlos Toledano, GOA-Univ. Valladolid)
- *Combined lidar-sunphotometer retrievals – experience from the VRAME project* (Detlef Müller et al., IfT, GIST, DWD, AUTH, , Brockmann Consult GmbH; presented by Dimitris Balis, AUTH)

AGREEMENTS AND ACTIONS

No.	Agreement	Task	Work packages involved
1	There is not distinction between EARLINET finalized data and ACTRIS aerosol lidar data	2.1	WP2, WP19
2	The EARLINET data base will be accessed through the ACTRIS data center	2.1	WP2, WP19
3	The ± 45º depolarization calibration method, as described in V. Freundethaler et al., "Depolarization ratio profiling at several wavelengths in pure Saharan dust during SAMUM 2006", Tellus B, 61B, pp. 165-179, 2009, is taken as the default one. The 45º method is also accepted for SCC quality assured products. Other methods may be allowed but should be fully documented.	2.2	WP2
4	The wavelet covariance transform method will be taken as the default one for boundary layer detection	2.3.1	WP2

Table 1. Agreements table

No.	Action	Task	Work packages involved	Deadline
1	Define the degree of partial activation of the EARLINET stations to support the EMEP/PEGASOS and ChArMEx campaigns in June-July 2011	2.1	WP2	29 February 2012
2	Perform mandatory internal check-up tests and send them to Volker Freudenthaler (stations not having done so yet)	2.2.2	WP2	31 January 2012
3	Define priorities for the lidar intercomparison campaigns of ACTRIS 2nd year.	2.2.1	WP2	31 January 2012
4	Send request form for information on particle linear depolarization measurement, specifications, calibration and error analysis	2.3.1 2.3.3	WP2	9 December 2011
5	Response from stations to action No. 4	2.3.1 2.3.3	WP2	29 February 2012
6	SCC web graphic interface in testing mode	2.3.2	WP2	29 February 2012
7	Draft of documentation on the database structure for combined lidar and sunphotometer observations	20.2	WP20	31 December 2011
8	Draft the report on evaluation of Raman lidar techniques for daytime extinction measurements	20.1	WP20	31 March 2012

Table 2. Actions table

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