Identification of long-range transport of aerosols over Austria using EARLINET lidar measurements

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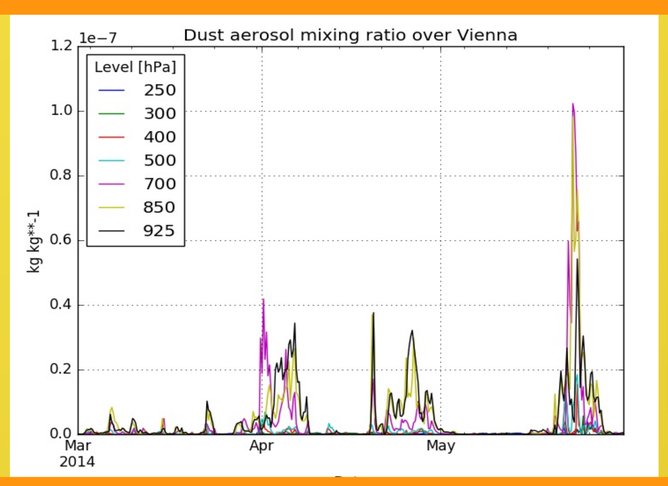
INTRODUCTION

The aims of the study is to identify the paths of the long-range transported aerosols over Austria and their potential origin, and to estimate their properties, using lidar measurements from EARLINET stations closest to Austria from Germany and Romania and aerosol transport models. As of now, there is no lidar station in Austria.

METHODOLOGY

The analysis has been performed for Vienna (48.21°N, 16.36°E) as receptor site, using MACC re-analysis data [1] from the period March - May 2014 for the vertical distributions of aerosols. A cluster analysis of back-trajectories from FLEXPART aerosol dispersion model [2-3] was used to associate measurements from EARLINET lidar stations [4] closest to Austria to the trajectories. For the lidar stations, the aerosol layers have been determined using a wavelet analysis, and the aerosol type was identified with NATALI algorithm [5].
For Austria, the aerosol classification was obtained from Calipso satellite data.

EVENTS OF LONG-RANGE TRANSPORT OF AEROSOLS

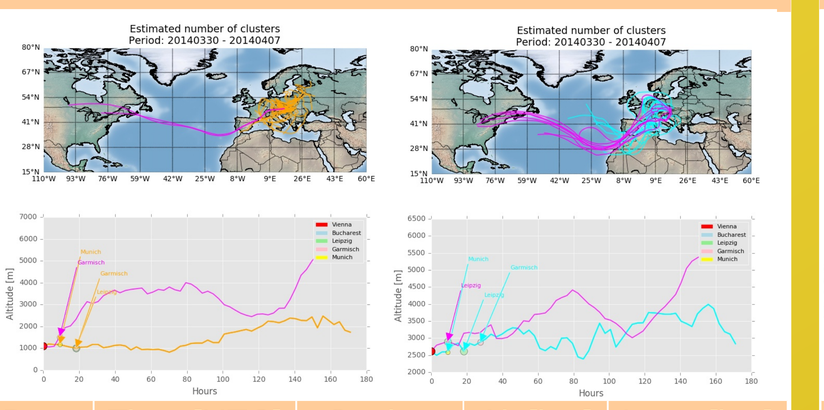


Events of dust aerosol over Austria, and data selected correlated with lidar measurements

Case	Event period	Selected data	850 hPa	Type	700 hPa	Type
1	30.03.2014 – 07.04.2014	01.04.2014, 04.04.2014	1115 m	Polluted continental	2615 m	Polluted dust
2	20.04-2014 – 29.04.2014	25.04.2014, 27.04.2014	1115 m	Polluted Continental	2615 m	Dust
3	20.05.2014 – 26.05.2014	23.05.2014	1115 m	Dust	2615 m	Dust

RESULTS

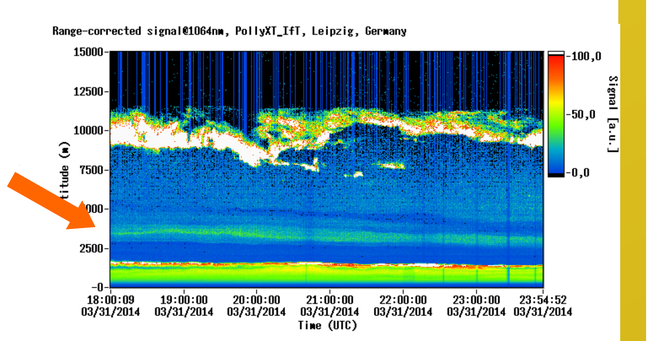
Case 1



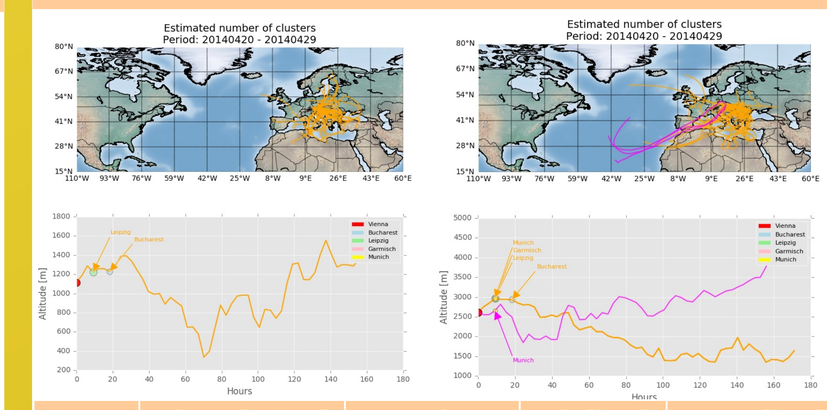
Date	Time [UTC]	Station	Alt.[km]	Layer[km]
01.04	12:00	Vienna	1.12	
31.03	11:30	Leipzig	1.12	1.20
01.04	00:00	Vienna	1.12	
31.03	11:30	Garmisch	1.85	2.00
04.04	12:00	Vienna	1.12	
03.04	11:30	Garmisch	1.10	1.20
01.04	06:00	Vienna	2.62	
31.03	18:00	Leipzig	2.90	3.10
04.04	12:00	Vienna	2.62	
03.04	18:30	Leipzig	2.80	3.00

Leipzig,
Lidar PolyXT
31.03.2014, 6h

Aerosol layer:
3.0 – 5.0 Km



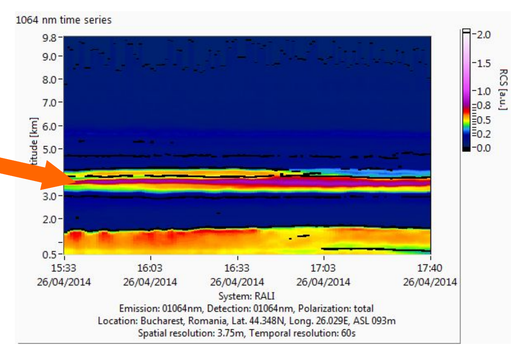
Case 2



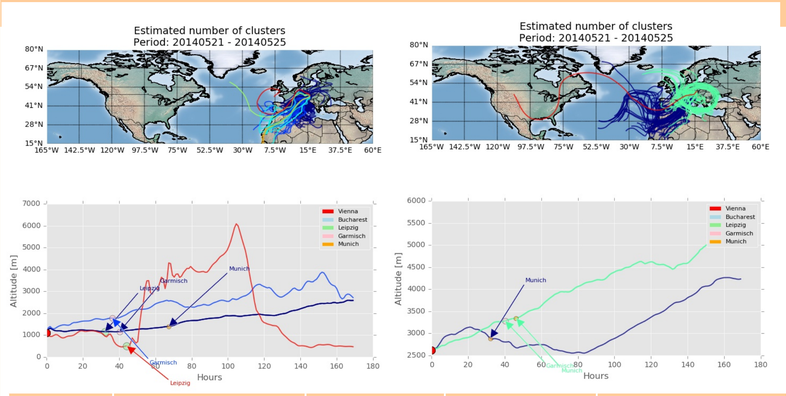
Date	Time [UTC]	Station	Alt.[km]	Layer[km]
25.04	06:00	Vienna	1.12	
24.04	18:00	Leipzig	1.30	1.20
25.04	00:00	Vienna	2.62	
24.04	13:00	Munich	2.80	2.90
24.04	14:00	Garmisch	2.65	2.80
24.04	11:00	Leipzig	3.00	3.20
27.04	12:00	Vienna	2.62	
26.04	16:00	Bucharest	3.10	3.20

Bucharest,
Lidar RALI
26.04.2014, 2h

Aerosol layer:
3.0 – 4.0 Km

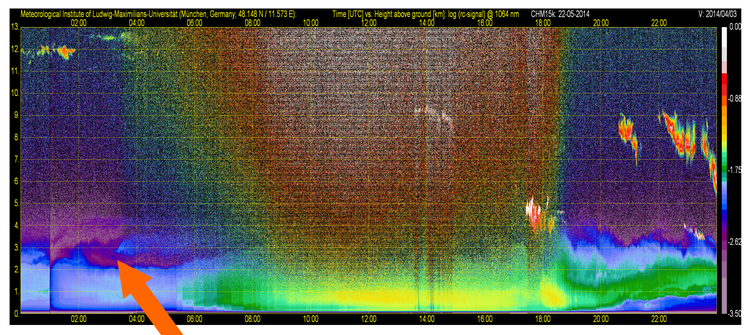


Case 3



Date	Time [UTC]	Station	Alt.[km]	Layer[km]
23.05	12:00	Vienna	1.12	
22.05	05:00	Leipzig	1.15	1.30
23.05	12:00	Vienna	2.62	
22.05	04:00	Munich	2.72	2.60

Munich, 22.05.2014, Ceilometer YALIS, 24h,
log(range corrected signal) at 1064 nm



Aerosol layer: 2.6 – 4.0 Km

CONCLUSIONS

Aerosols layers from lidar measurements associated by cluster analysis with layers from the FLEXPART model revealed an influence of long-range transport (combined or alternated) of Saharan dust and smoke from North America over Austria.
One case of mixture of dust from Sahara and smoke from North America and two cases of dust were identified for Spring 2014
Analysis of aerosols optical parameters computed from lidar measurements confirms the presence of the dust aerosols mixed with smoke for first case, the dust mixed with polluted continental for the second case and the dust aerosols for the third case.

REFERENCES

[1] MACC Project, http://www.gmes-atmosphere.eu/
[2] P. Seibert and A. Frank: Atmos. Chem. Phys., 4, 51–63, 2004
[3] Stohl, A. et al: Atmos. Chem. Phys., 5, 2461–2474, 2005.
[4] Pappalardo, G. et al.: Atmos. Meas. Tech., 7, 2389–2409, 2014
[5] Nicolae, D. et al: EPJ Web of Conferences, 27th ILRC Conference 2015, New York, USA

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