preliminary data

please do not use these data for publications

please contact Gelsomina Pappalardo if you want to use some of these data or if you wish more information

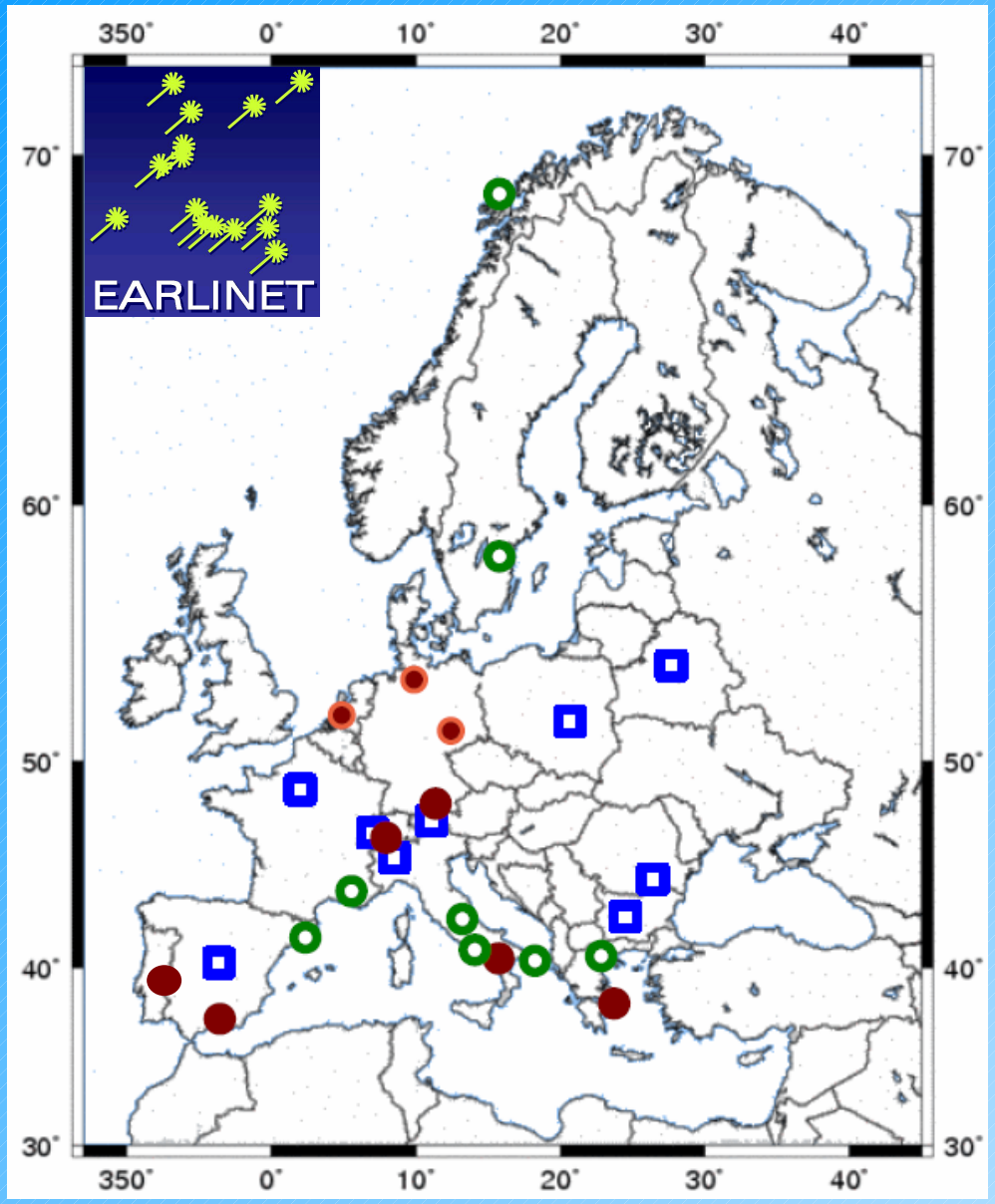
Dispersion and evolution of the Eyjafjallajökull ash plume over Europe: vertically resolved measurements with the European LIDAR network EARLINET

Gelsomina Pappalardo

and the EARLINET team (presented by Ina Mattis)

* What is EARLINET ?
* 4 dimensional distribution of the ash plume over Europe
* Sensitivity of lidars and ceilometers
* Estimation of mass profiles from lidar measurements

European Aerosol Research LIdar NETwork
EARLINET



- since 2000
- regular measurements 3times a week
  → avoid biases
- additional measurements to study long-range transport + special events
- Quality assurence of systems and algorythms
- Standardized data format
- Access to data via centralized data base
- 25 lidar stations
  → round-the-clock observations (3)
  → extinction profiles (16 Raman lidars)
  → 9 multi-wavelength Raman lidars
    → β(355, 532, 1064) + α(355 + 532)
    → wavelength dependence of α, β, S
    → differentiation of aerosol types
    → microphysical aerosol properties

www.earlinet.org

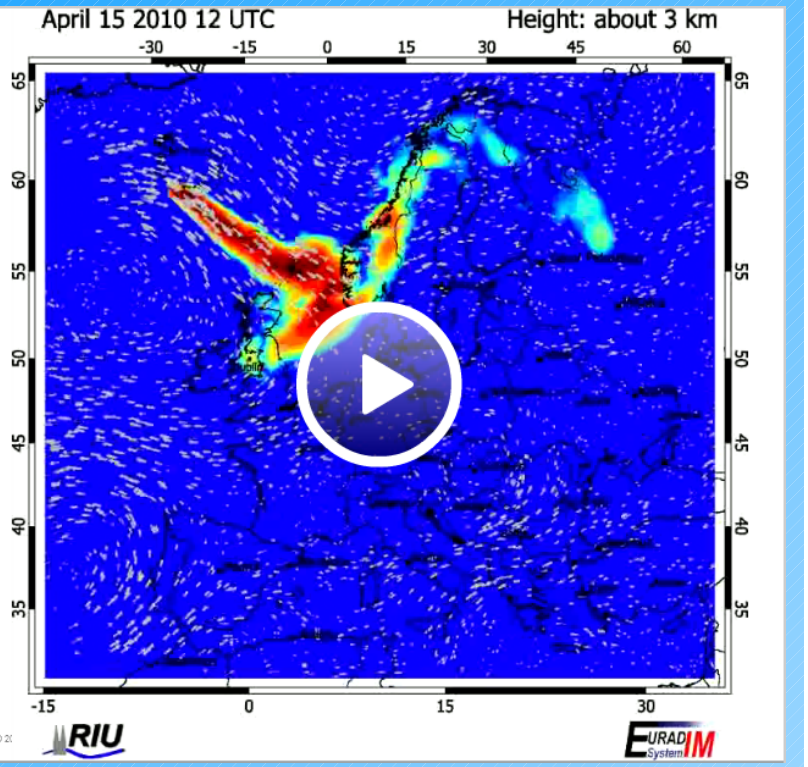
* What is EARLINET ?
* 4 dimensional distribution of the ash plume over Europe
* Sensitivity of lidars and ceilometers
* Estimation of mass profiles from lidar measurements

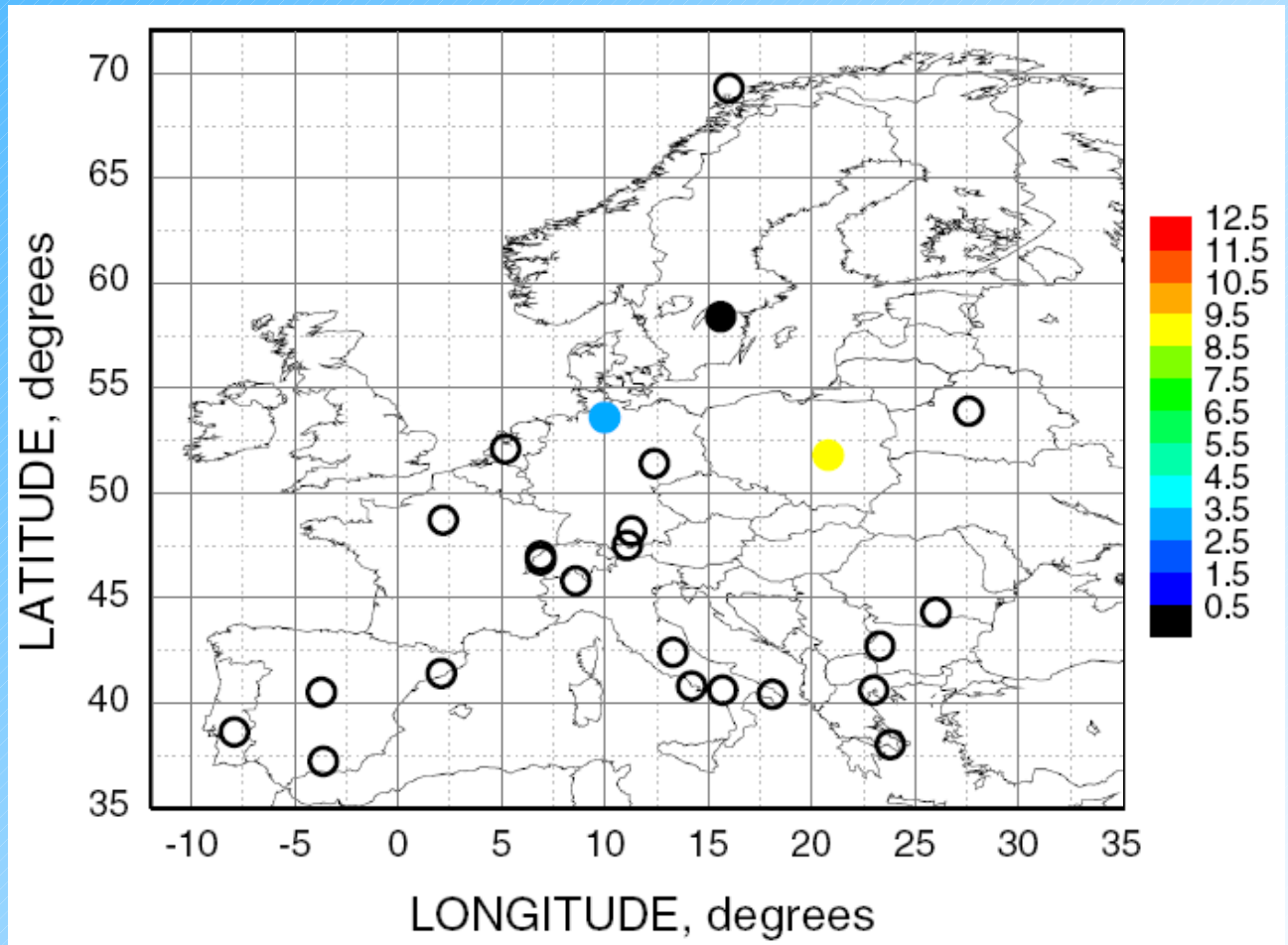
4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 15 12 UTC

EURAD simulation



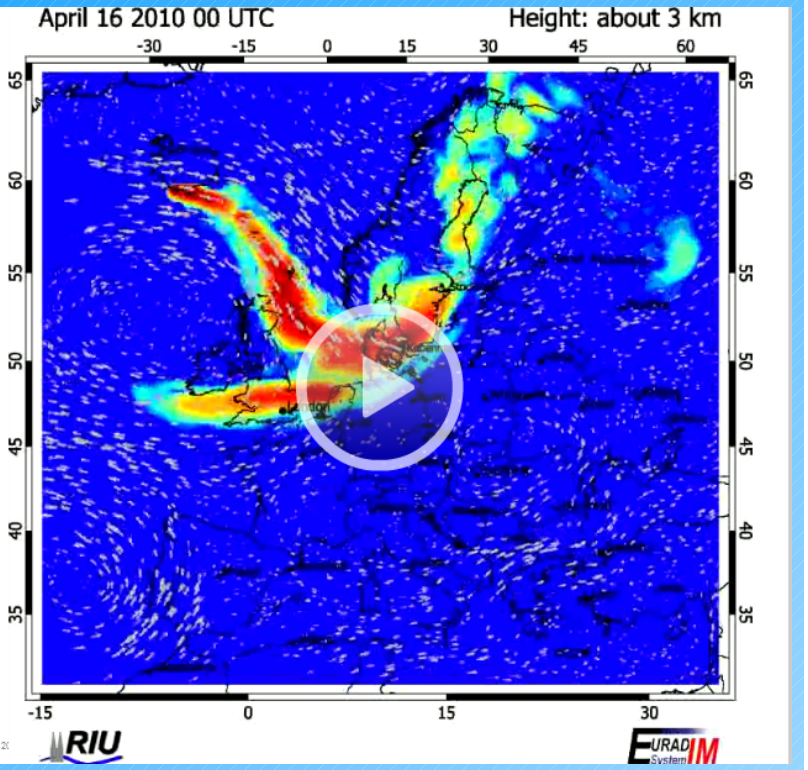


Preliminary data

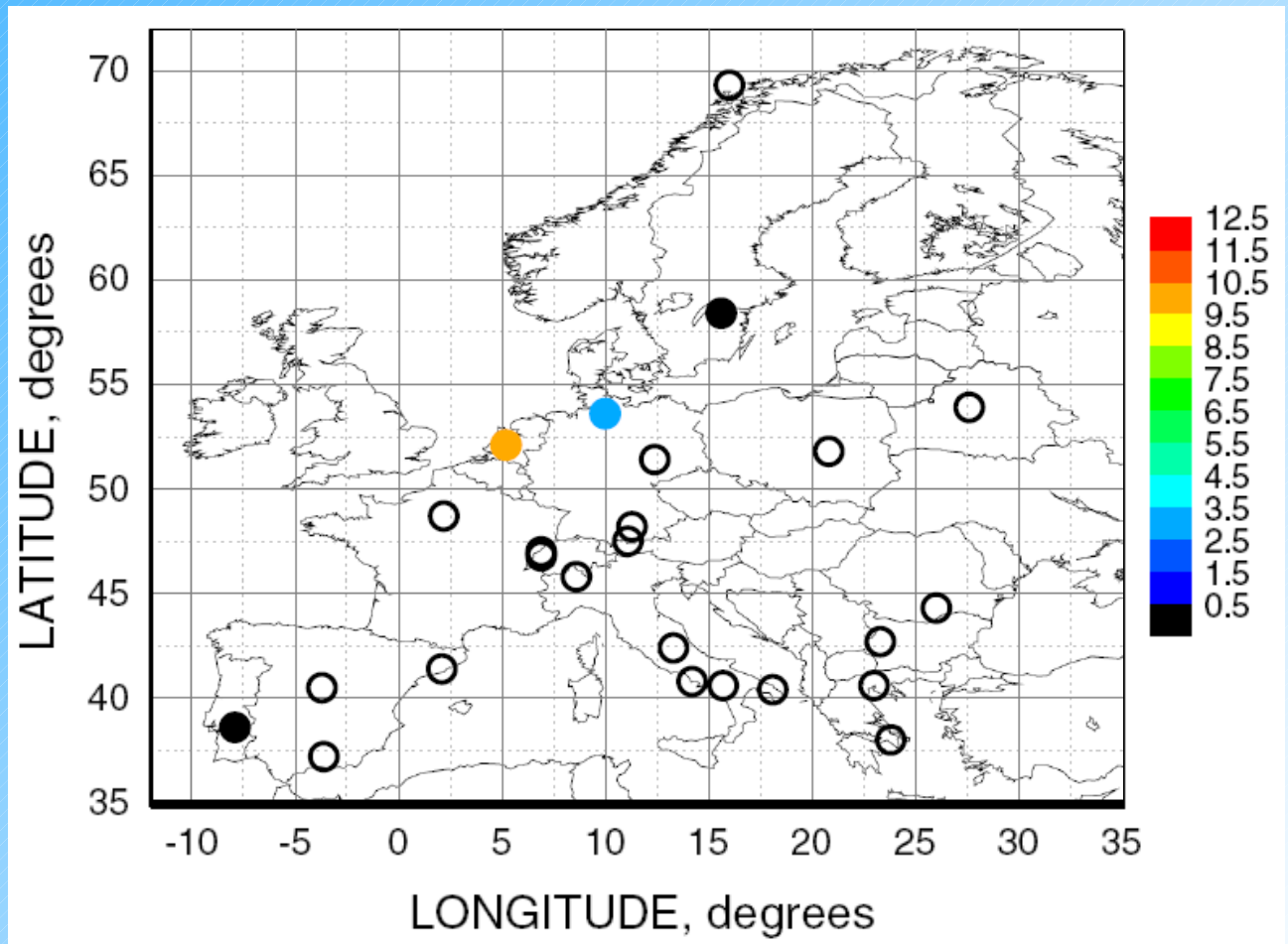
4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 16 00 UTC



http://www.eurad.uni-koeln.de/



Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

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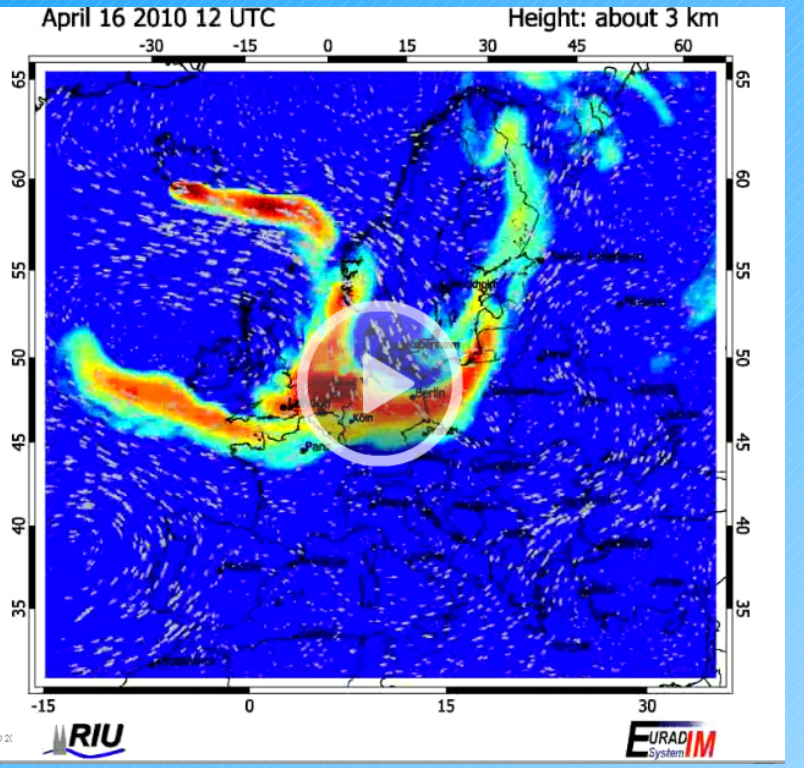

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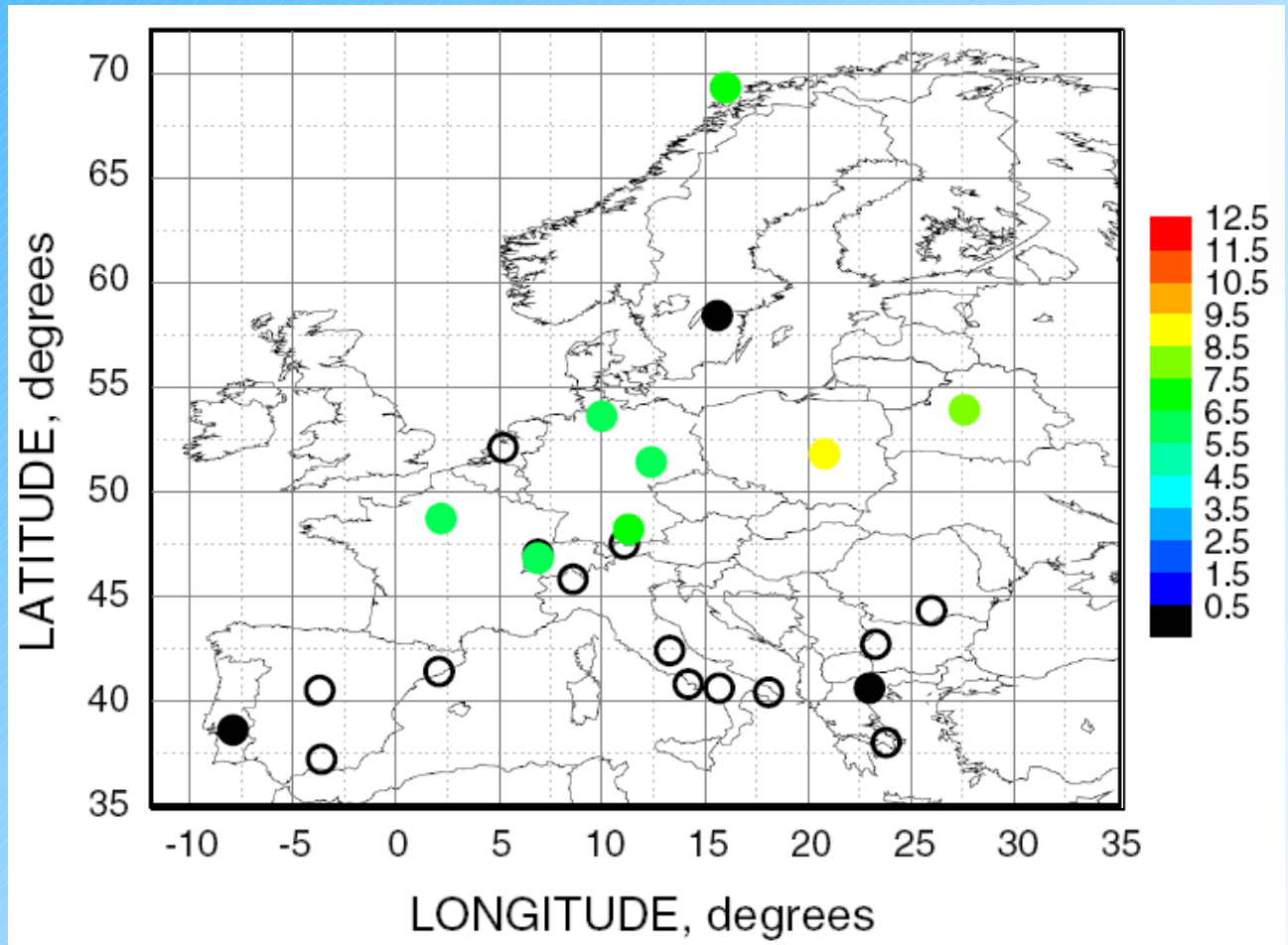
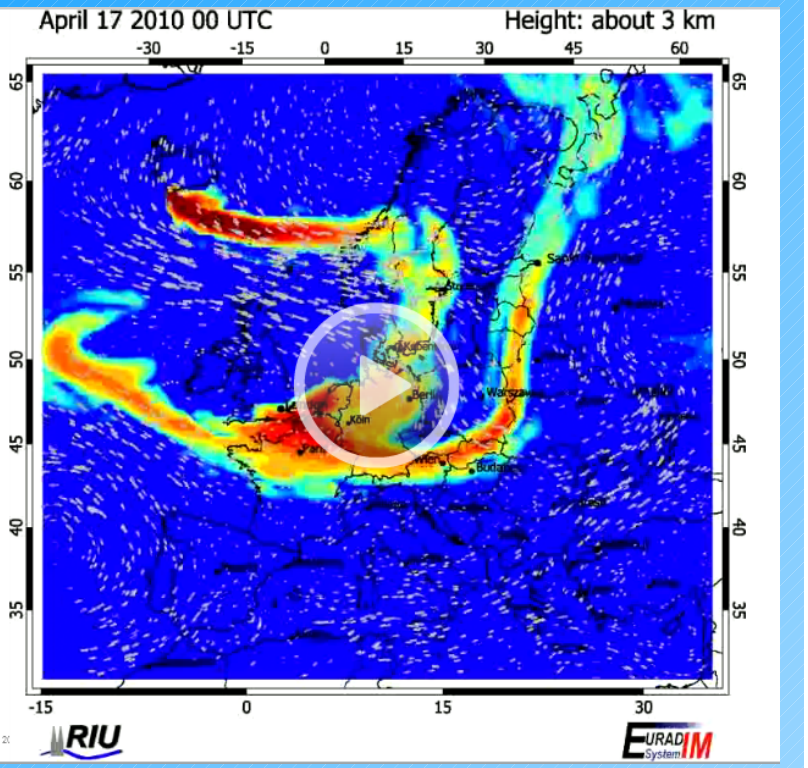


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 17 00 UTC



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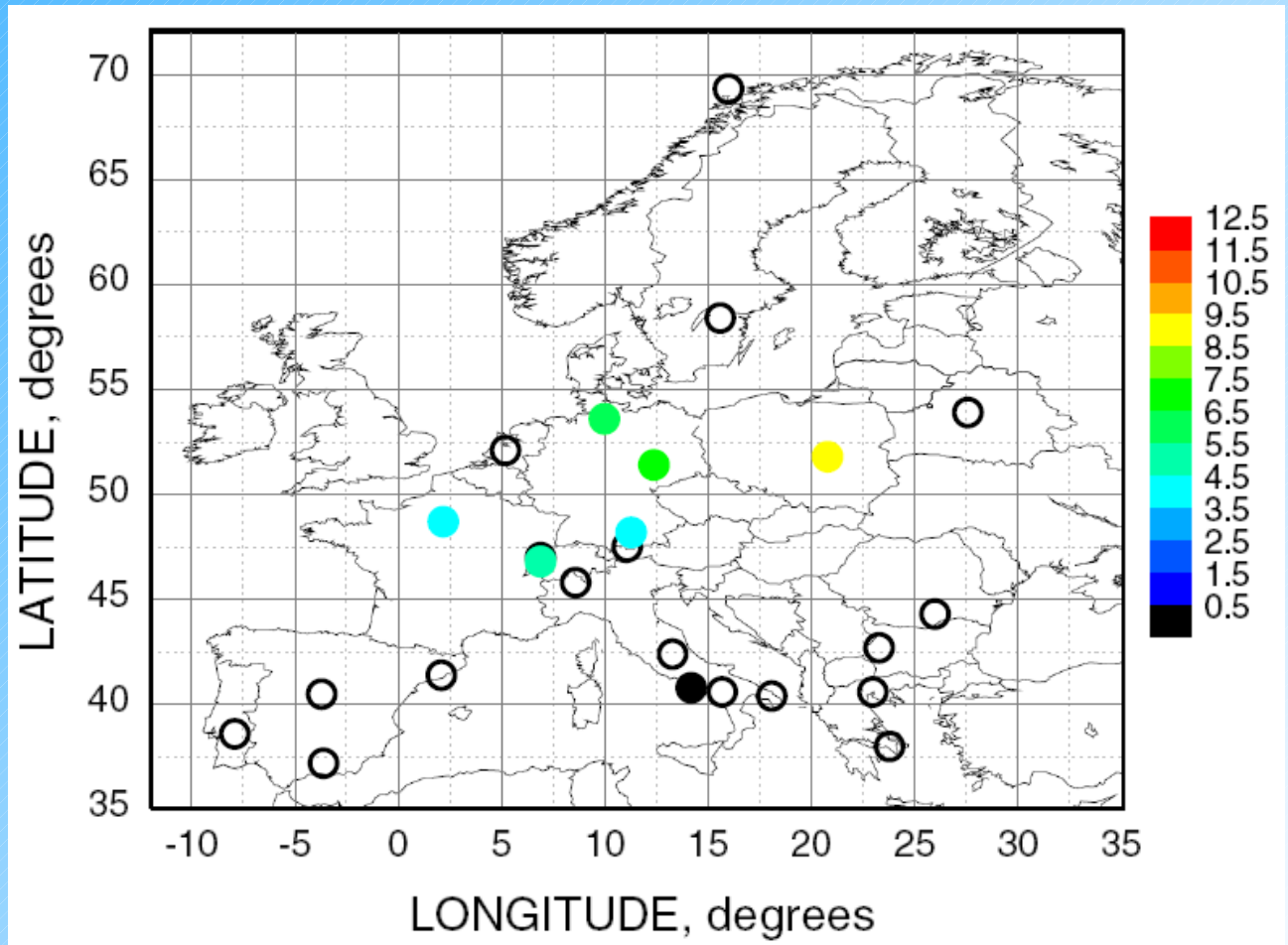

Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

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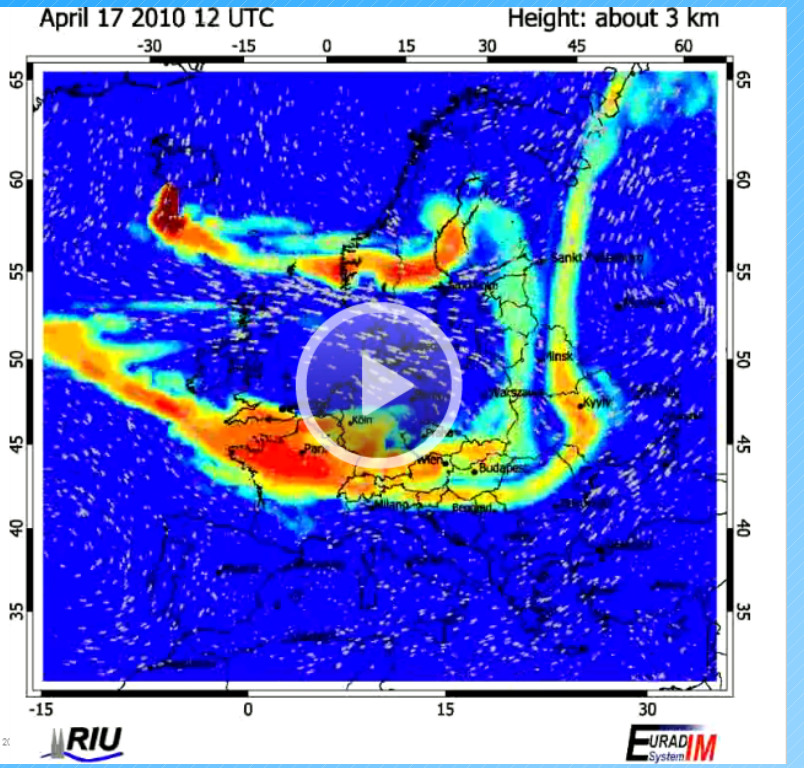

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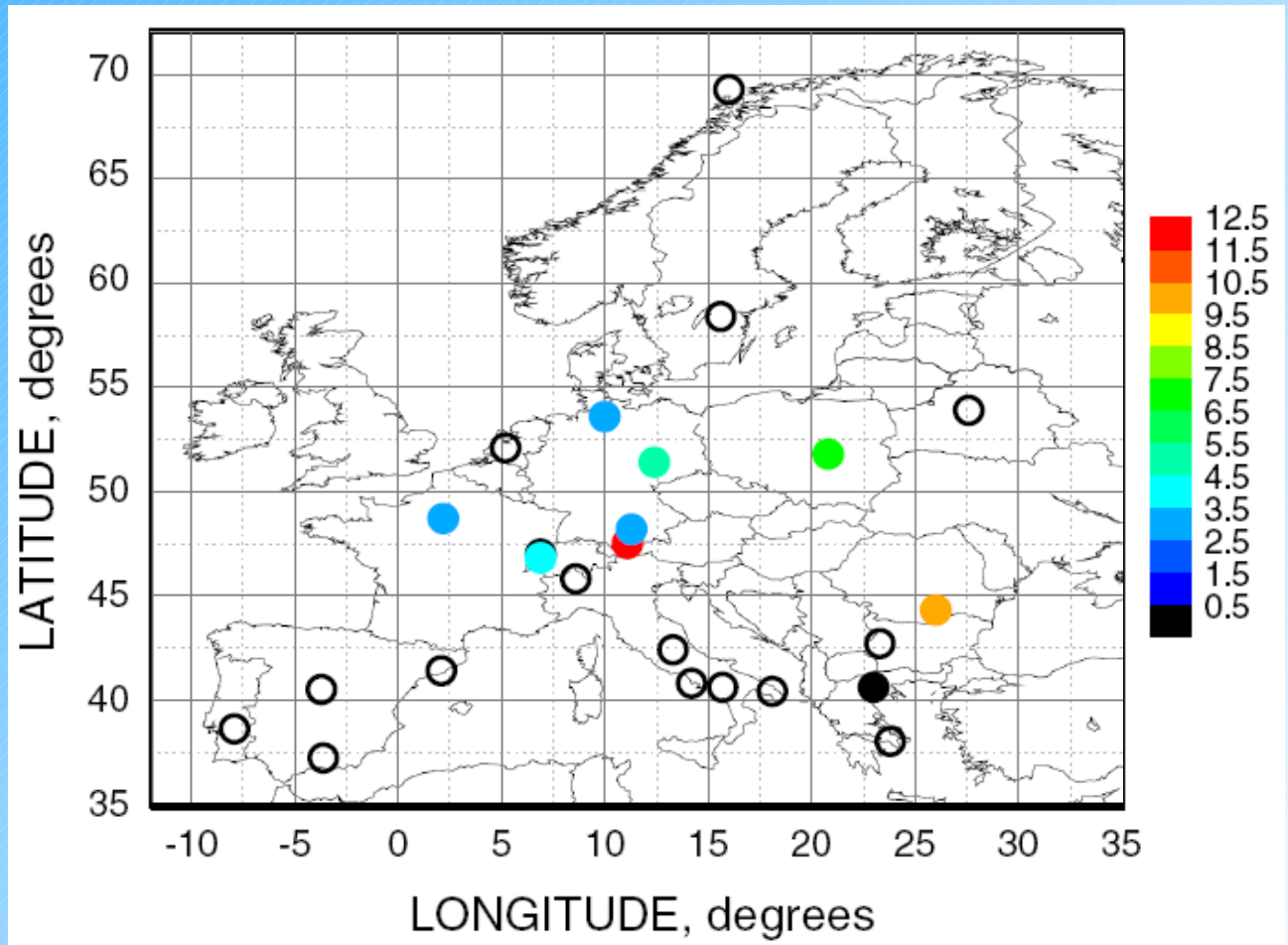
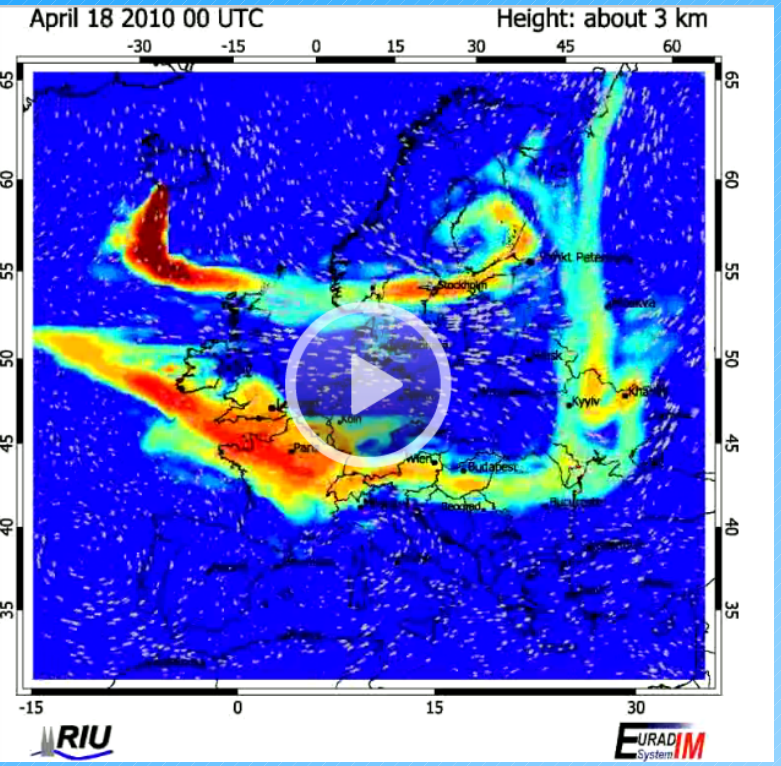


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 18 00 UTC



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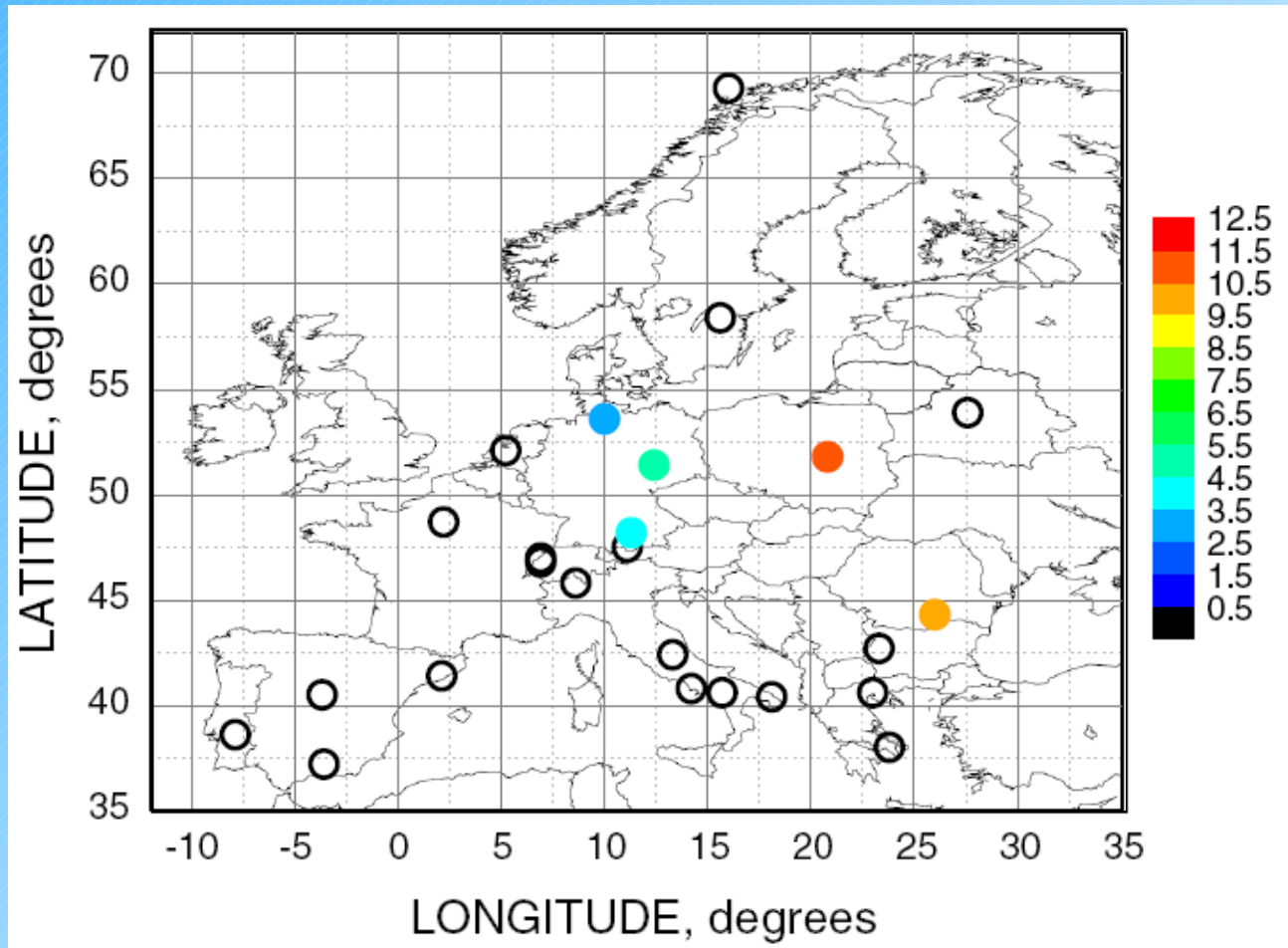

Preliminary data

4-dimensional data set from EARLINET

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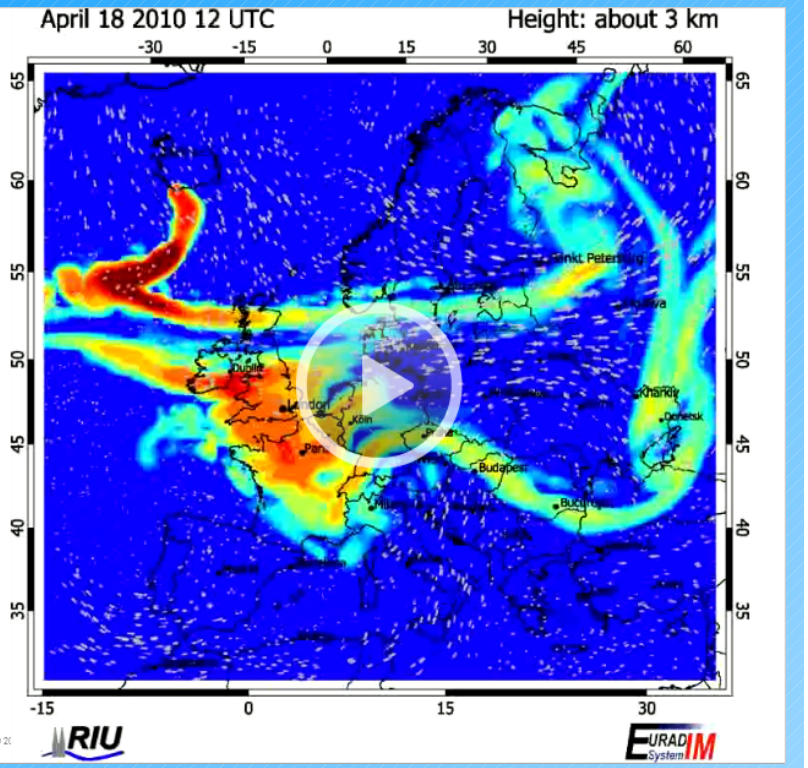
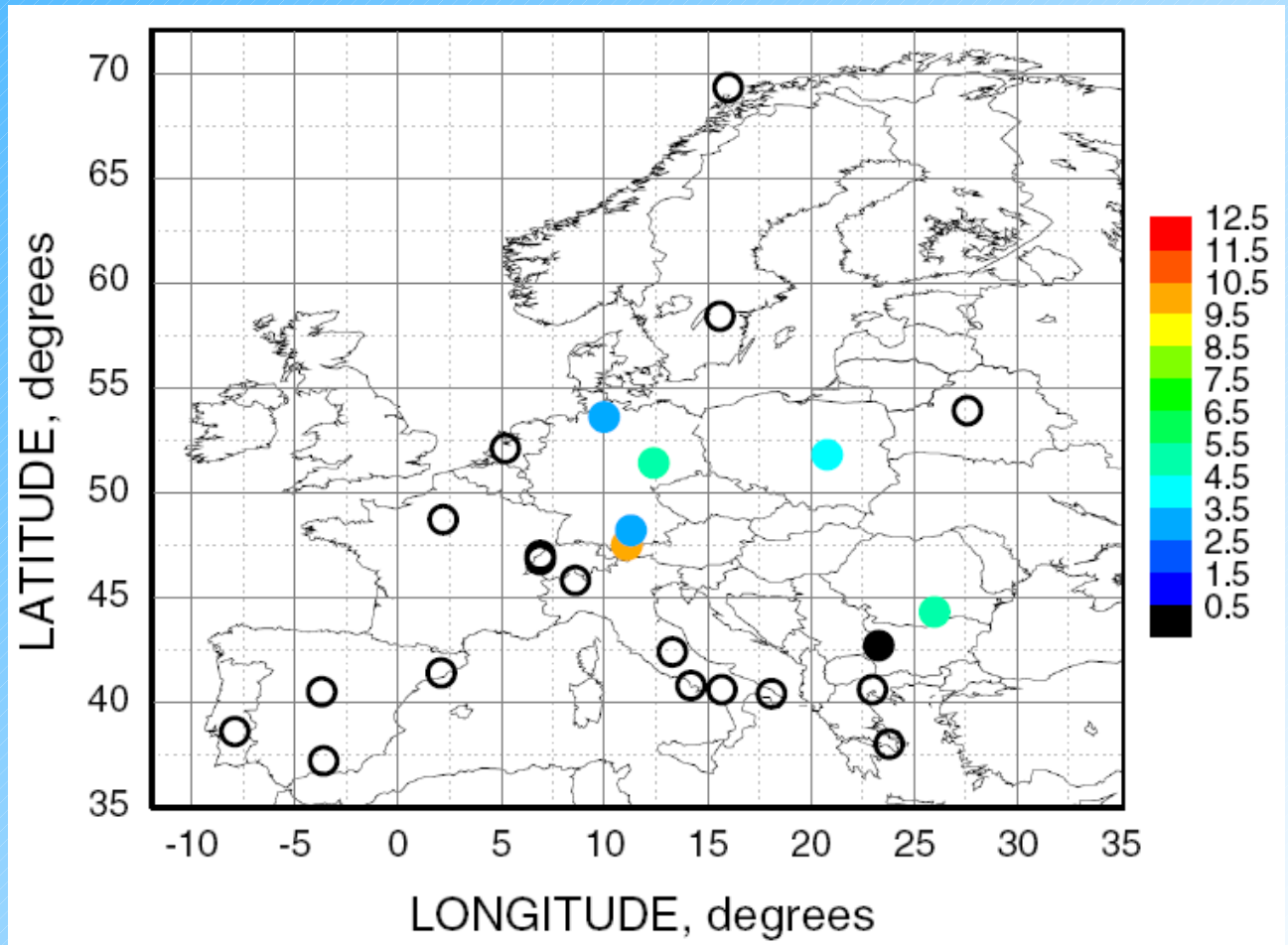


http://www.eurad.uni-koeln.de/

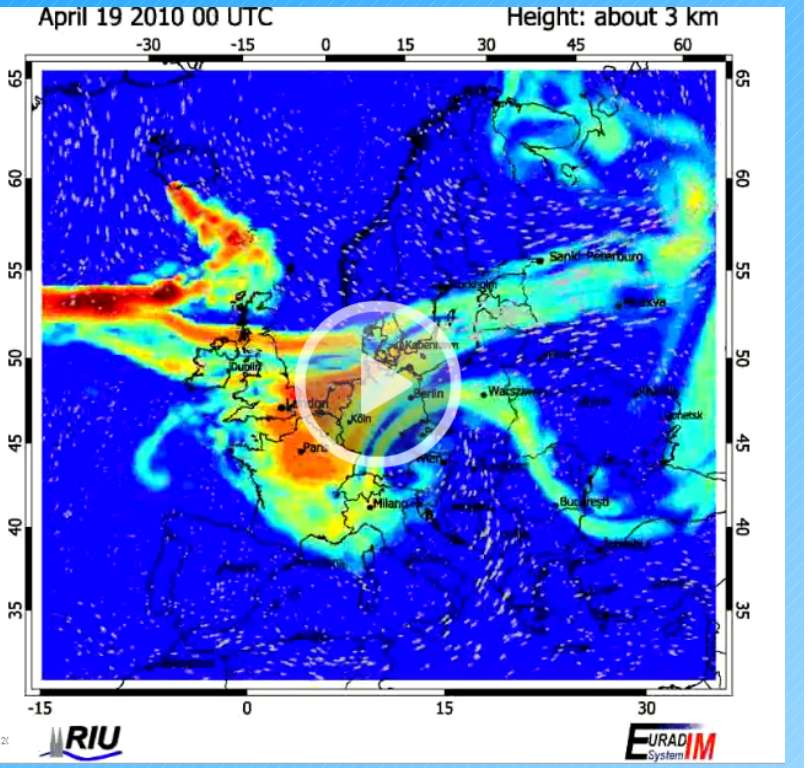


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 19 00 UTC



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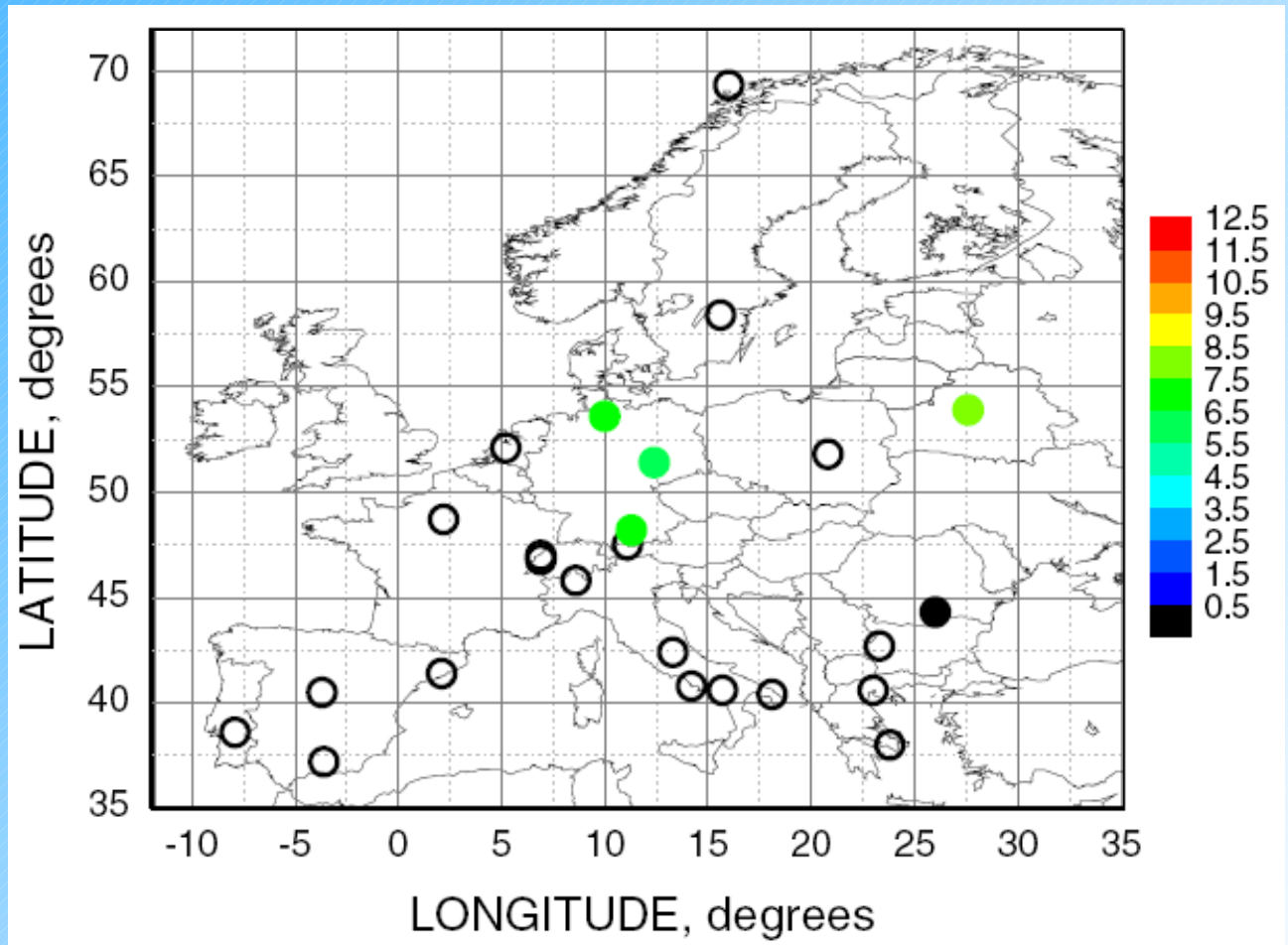
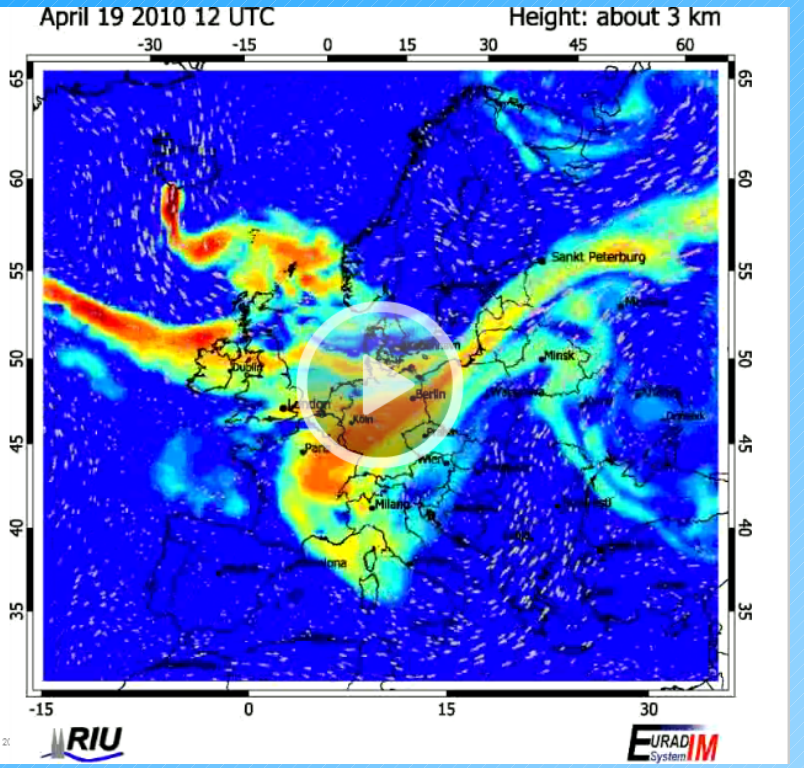


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 19 12 UTC



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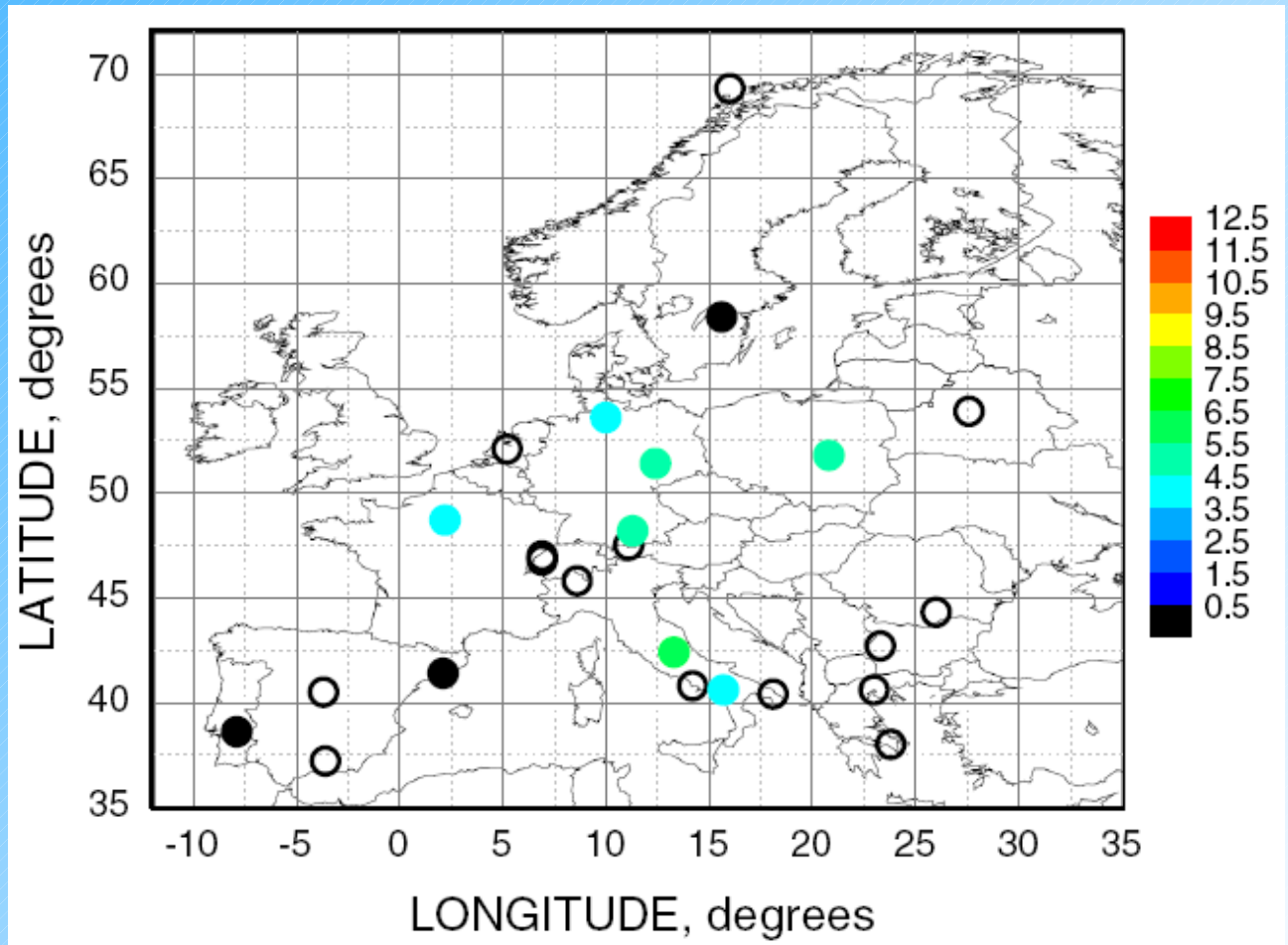
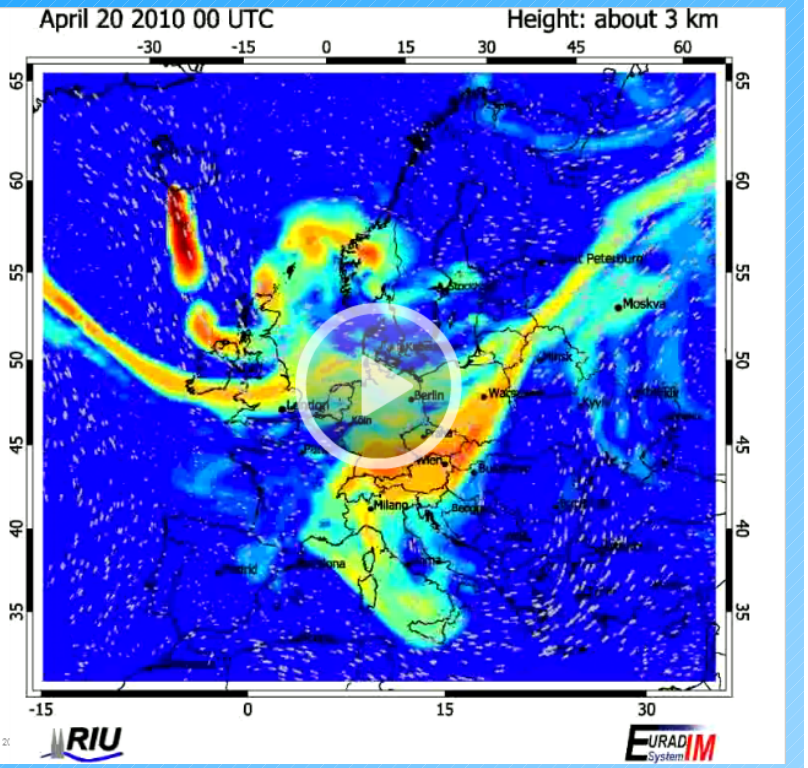


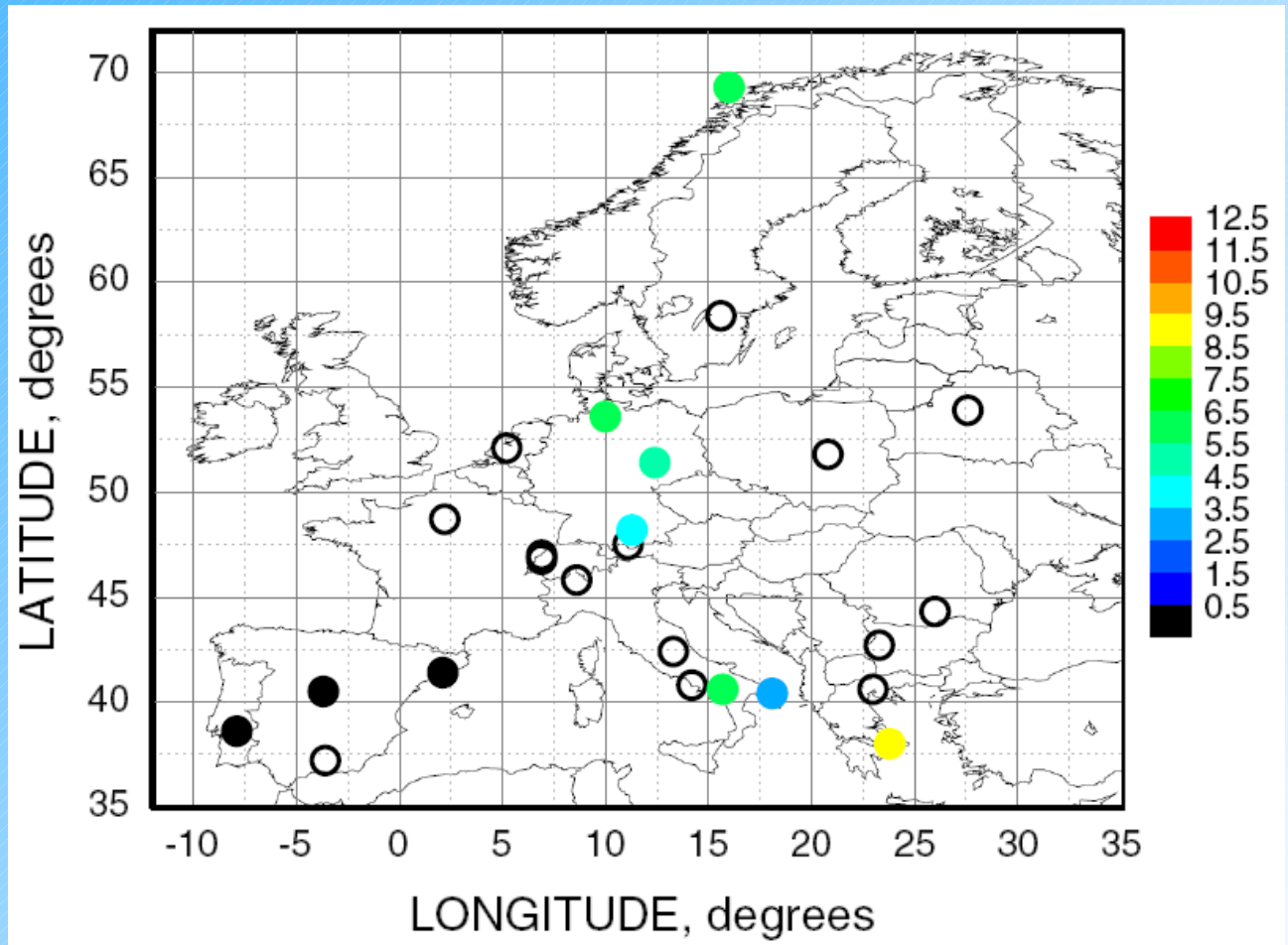
Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 20 00 UTC





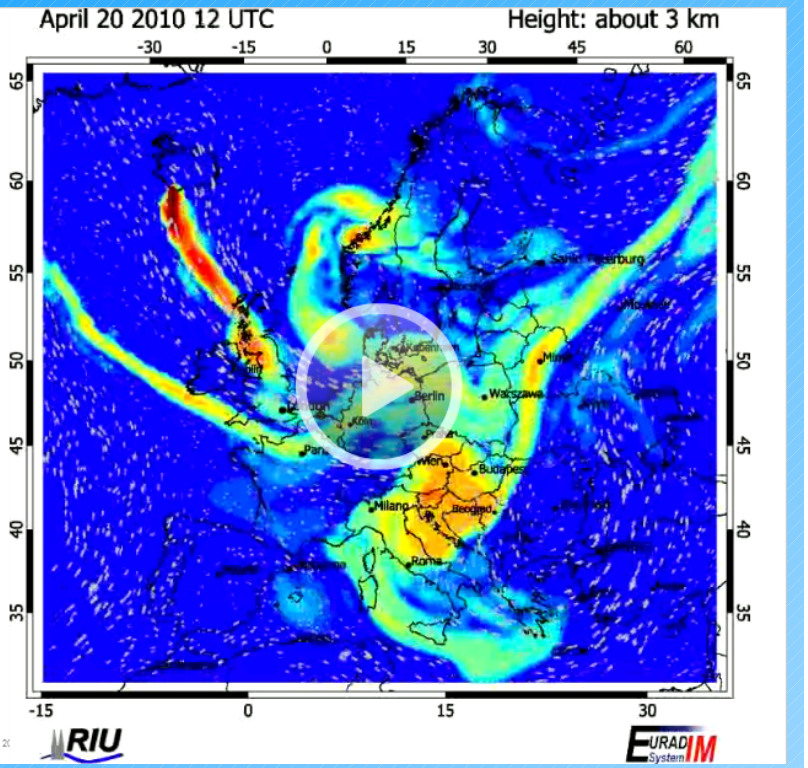
http://www.eurad.uni-koeln.de/

Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 20 12 UTC



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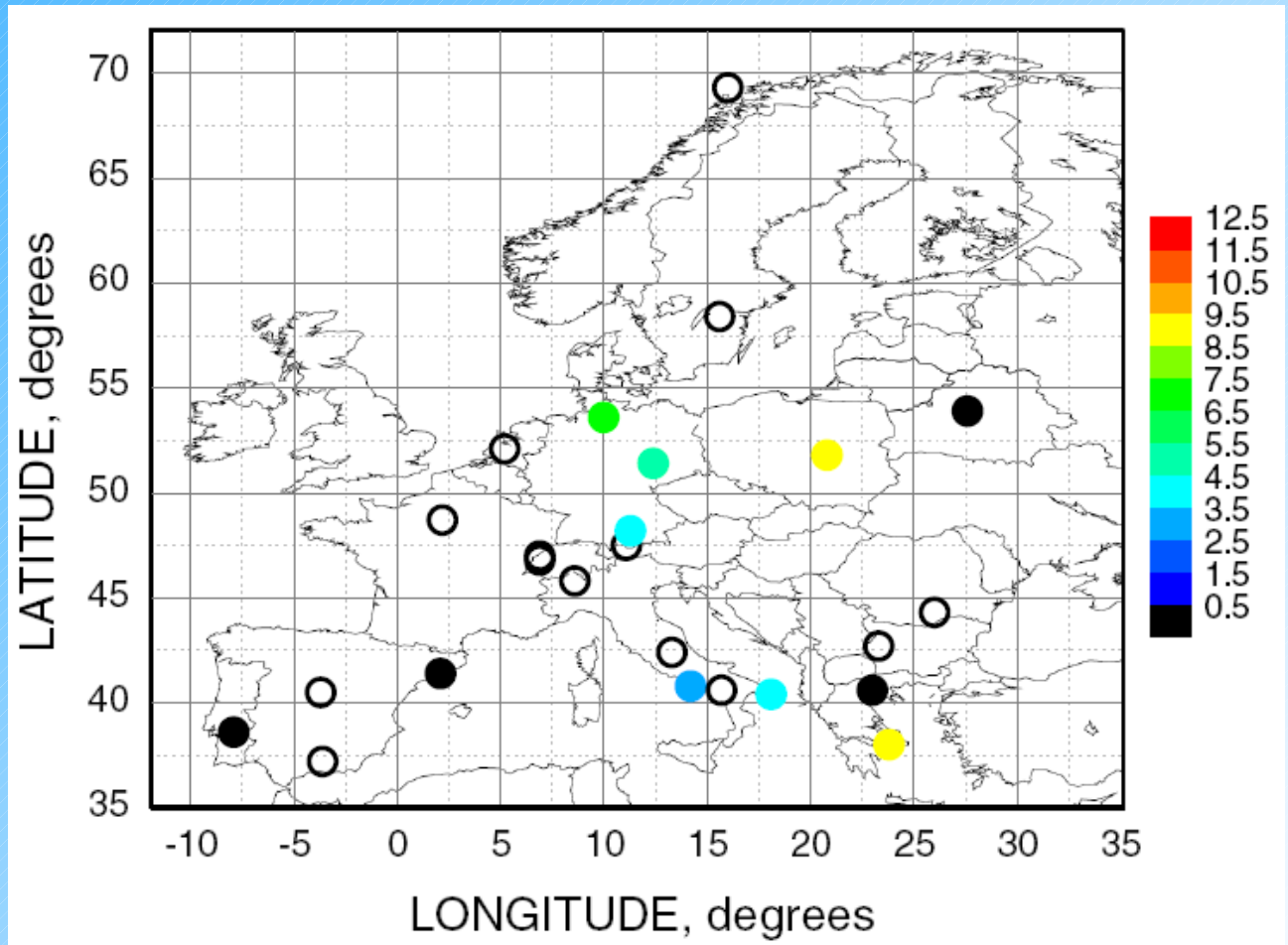
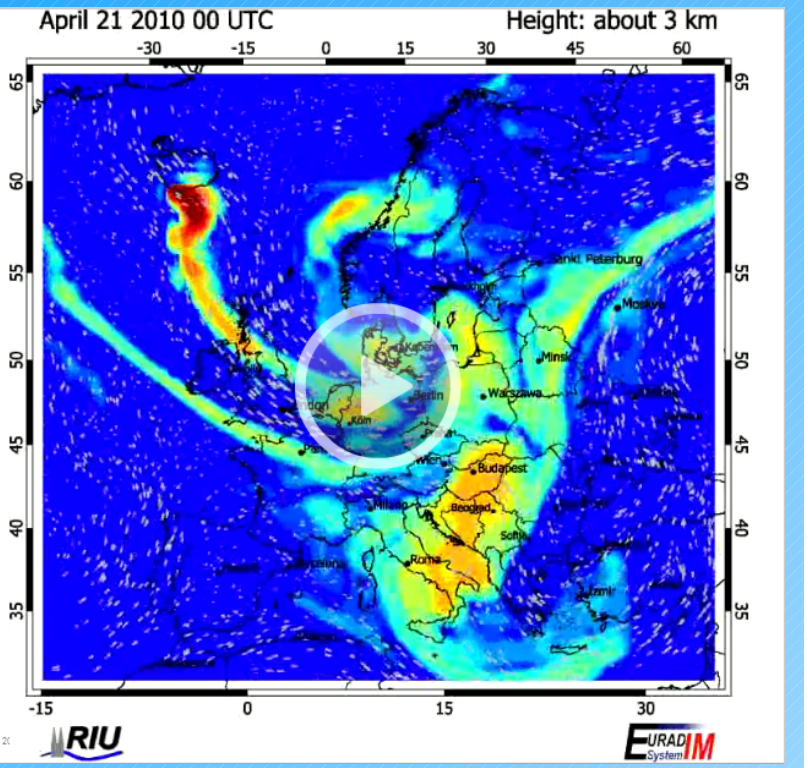


Preliminary data

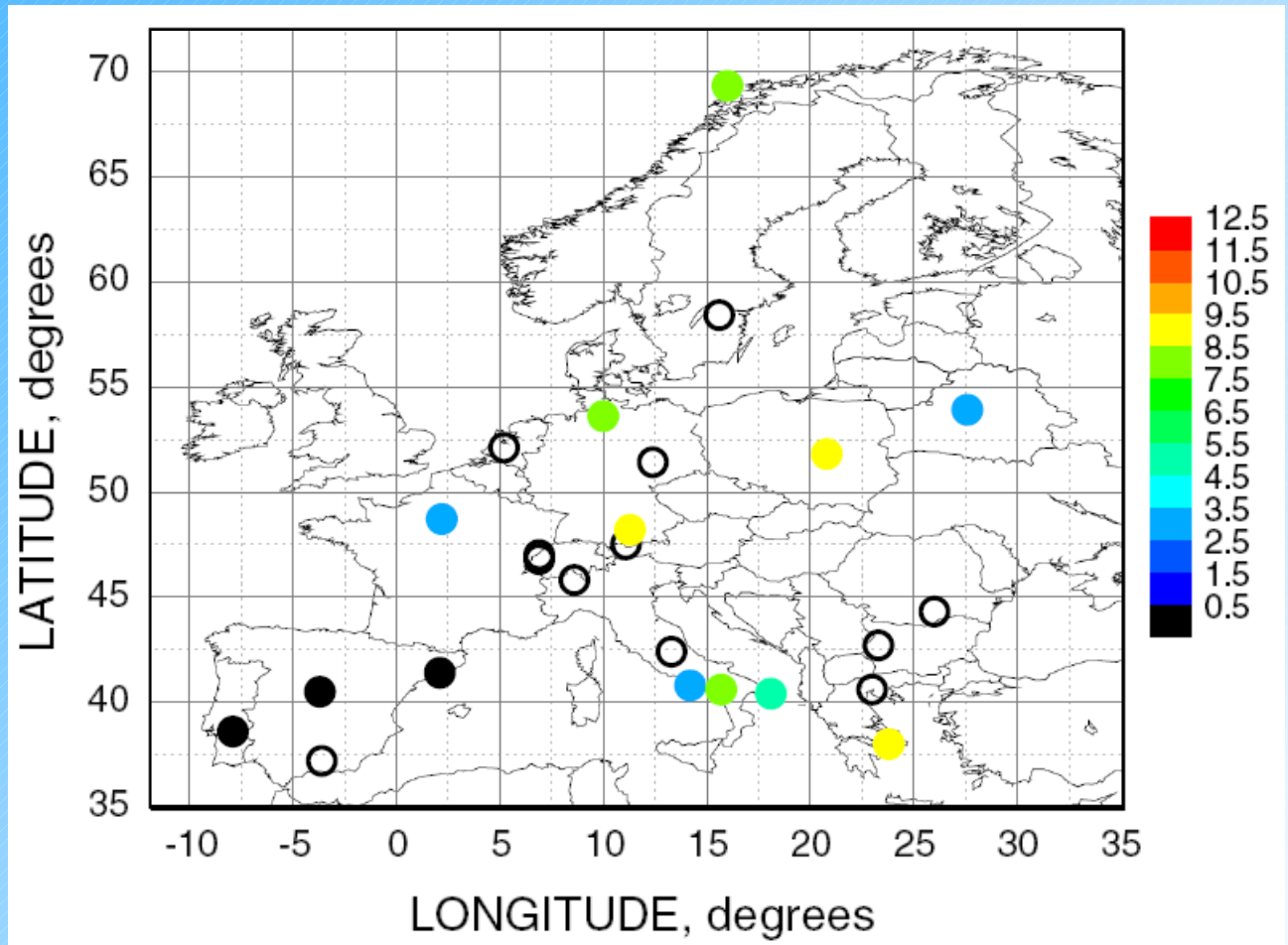
4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 21 00 UTC



http://www.eurad.uni-koeln.de/

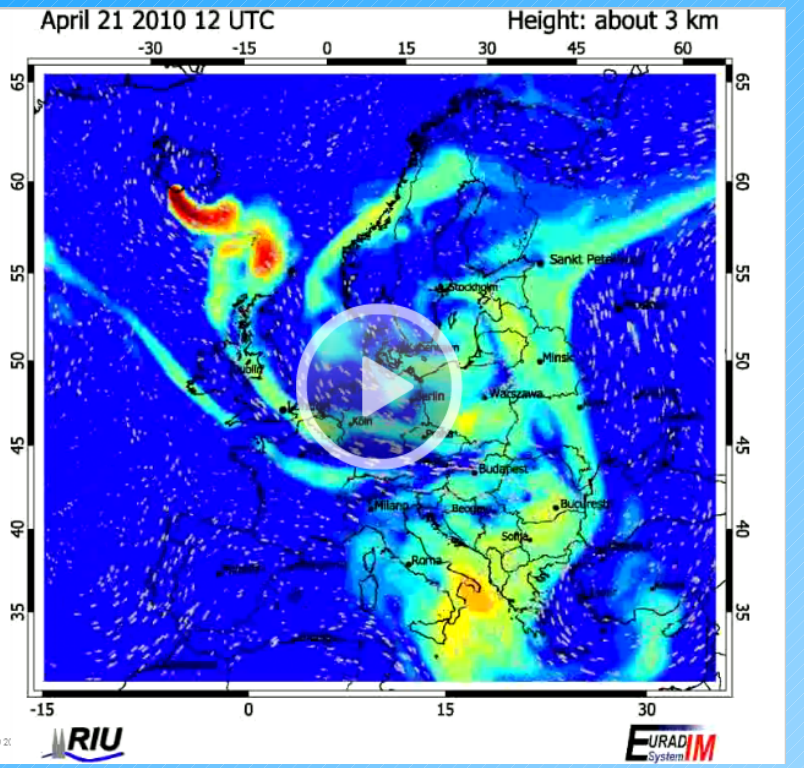


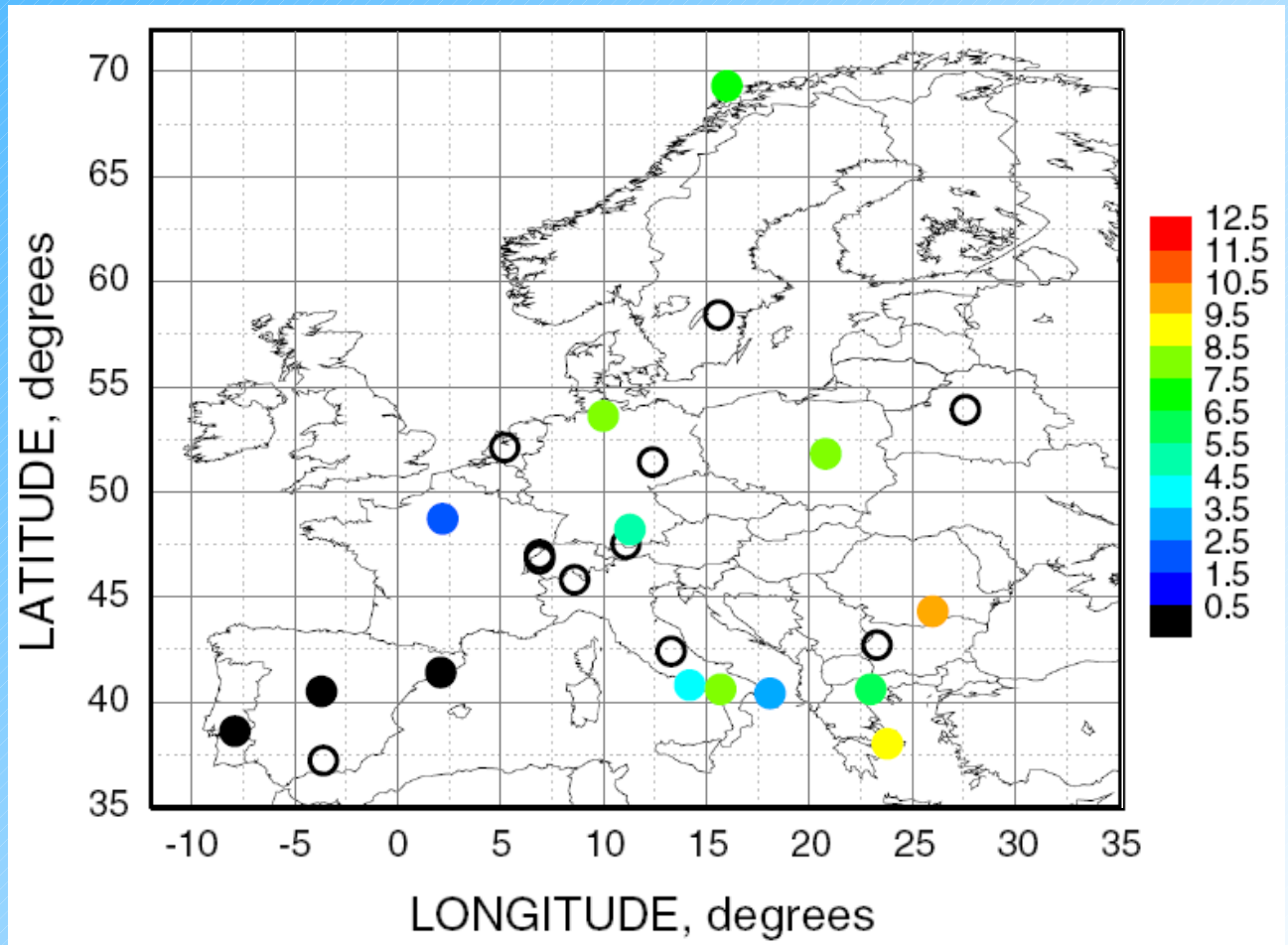
Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 21 12 UTC





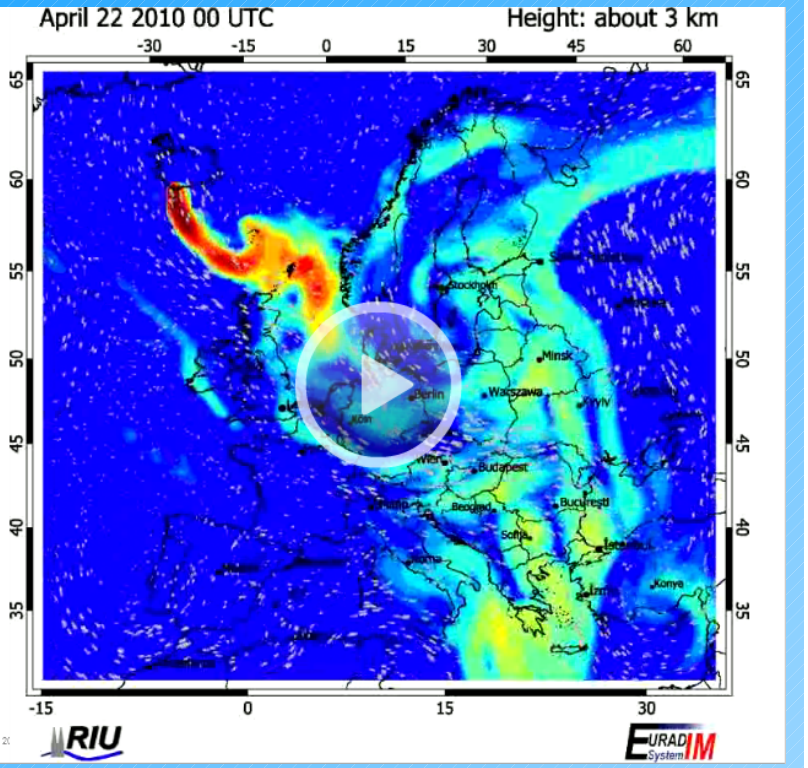
http://www.eurad.uni-koeln.de/

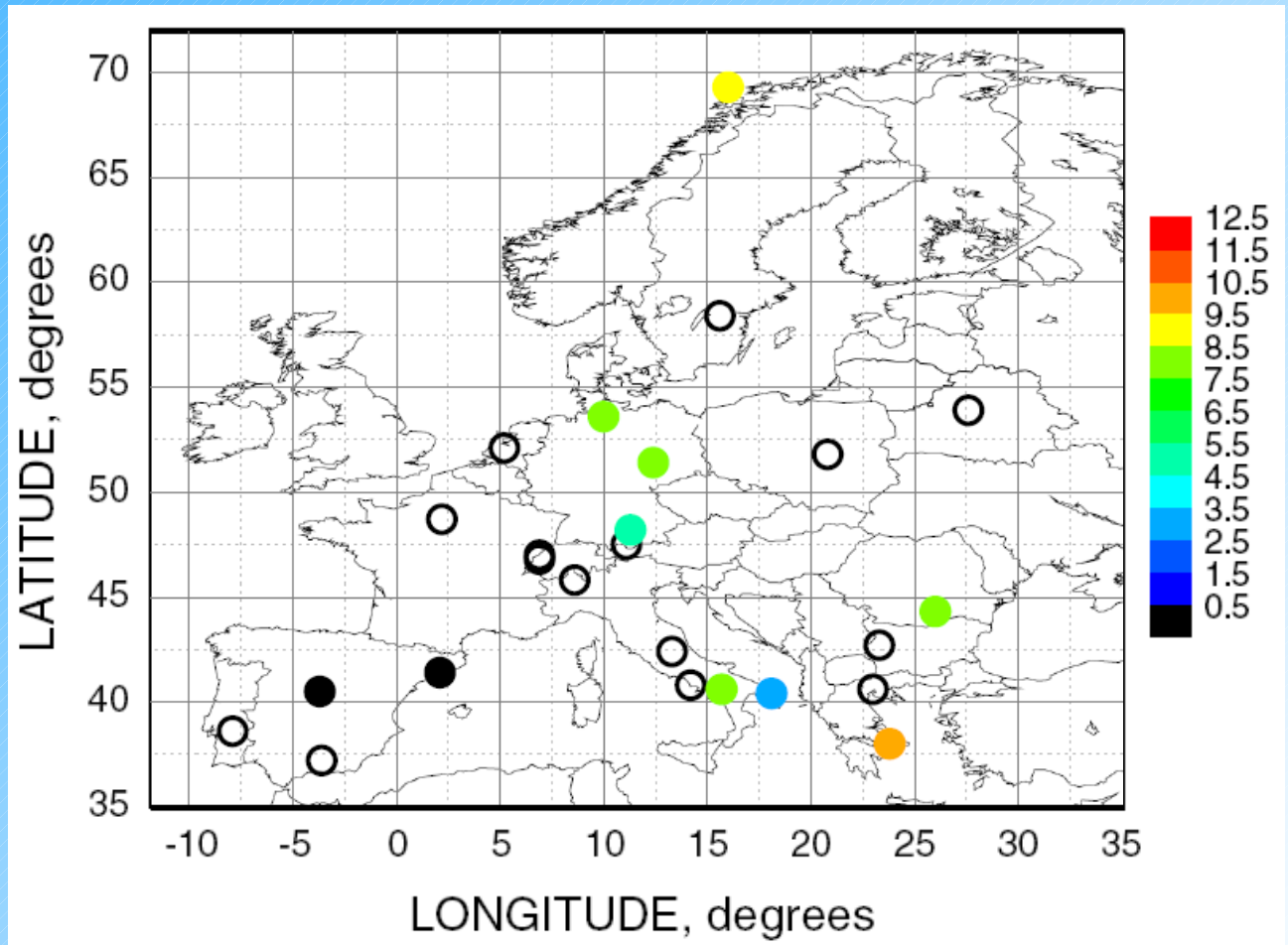
Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 22 00 UTC





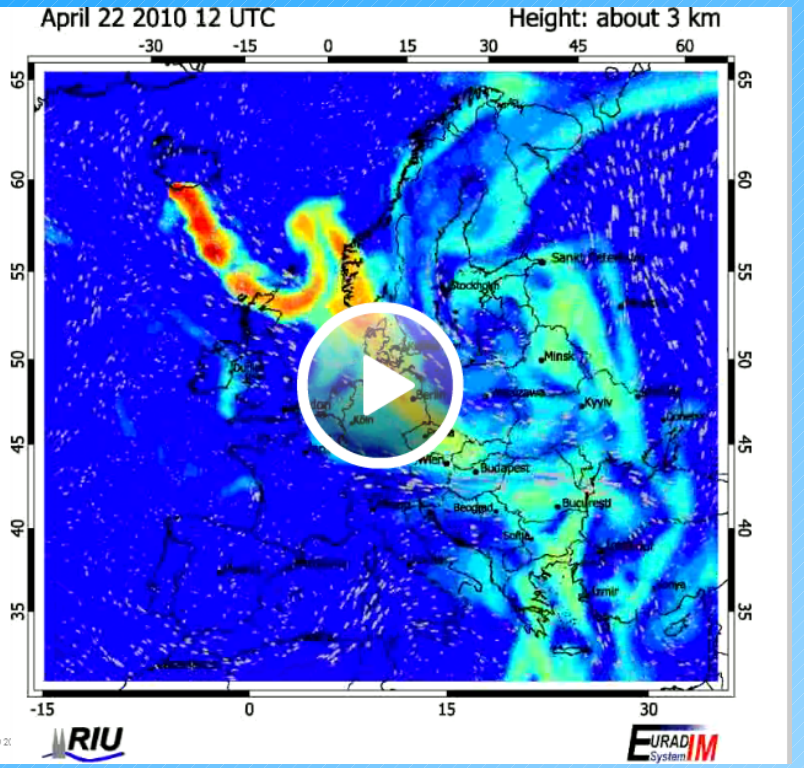
http://www.eurad.uni-koeln.de/

Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 22 12 UTC



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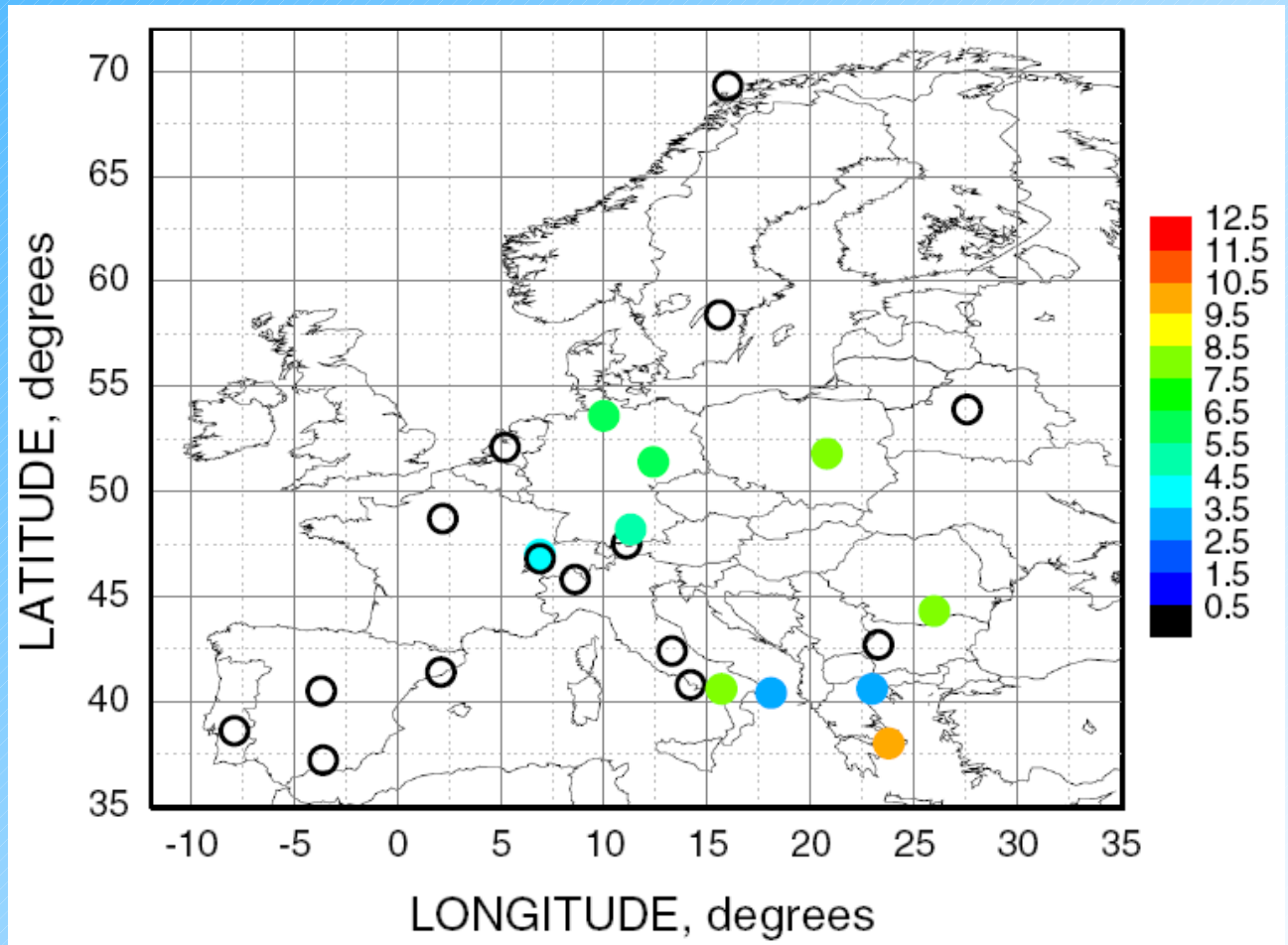
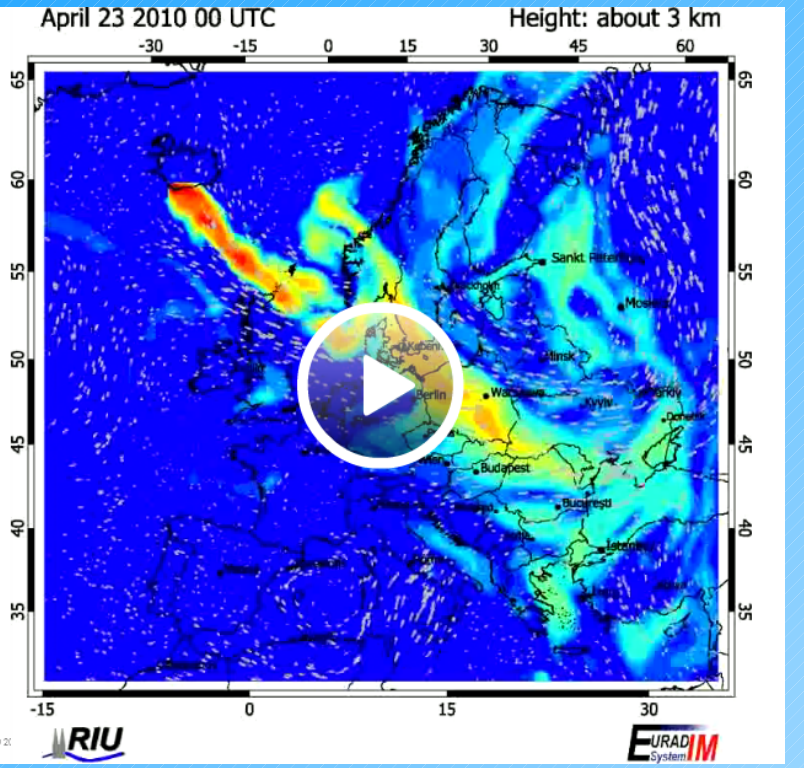


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 23 00 UTC



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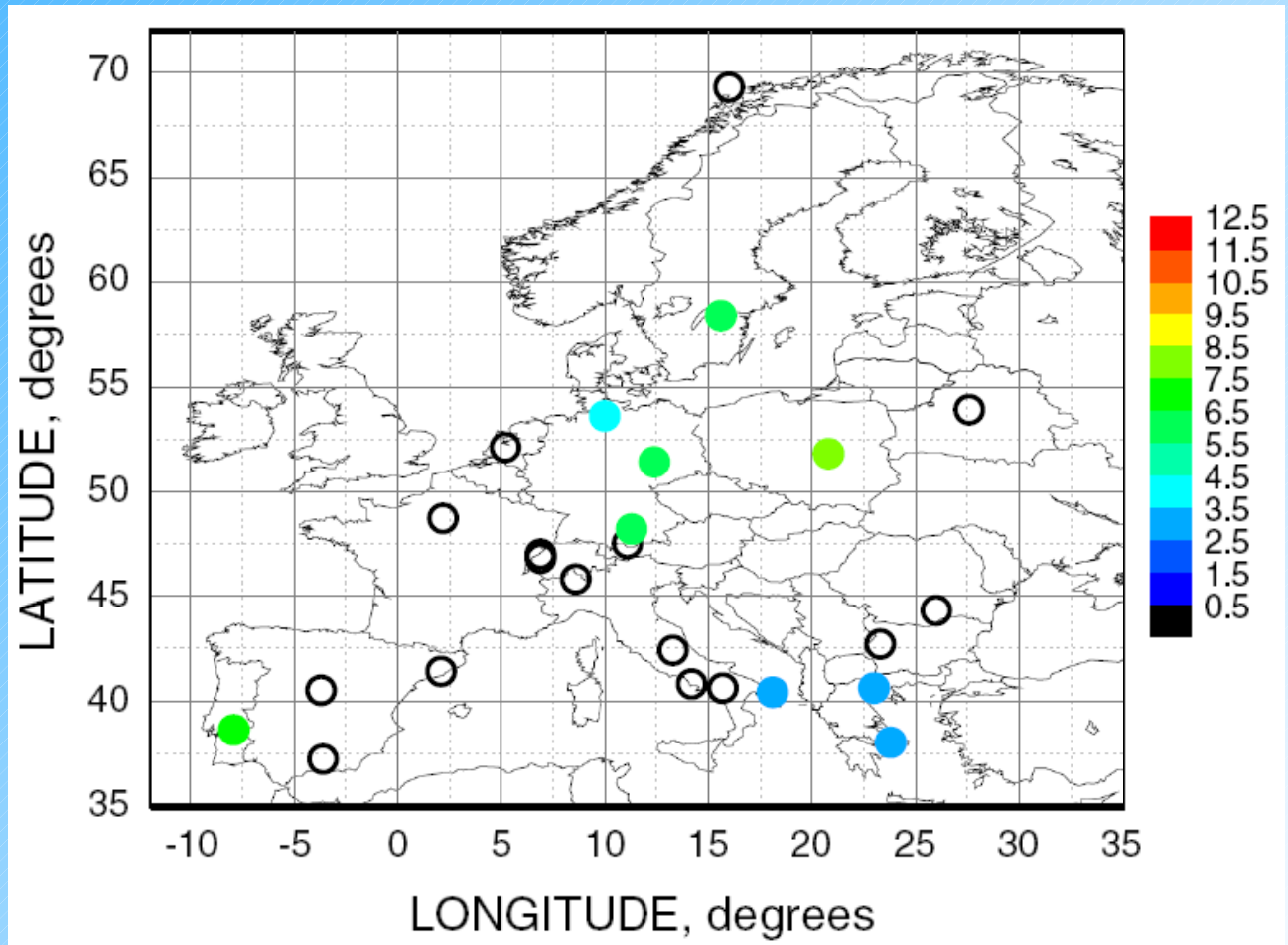
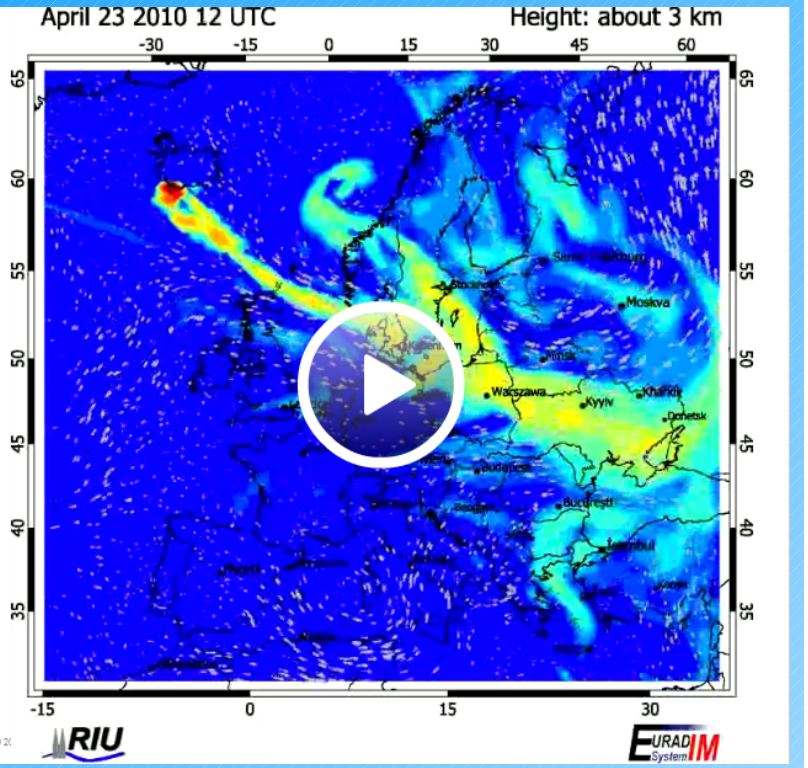


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 23 12 UTC



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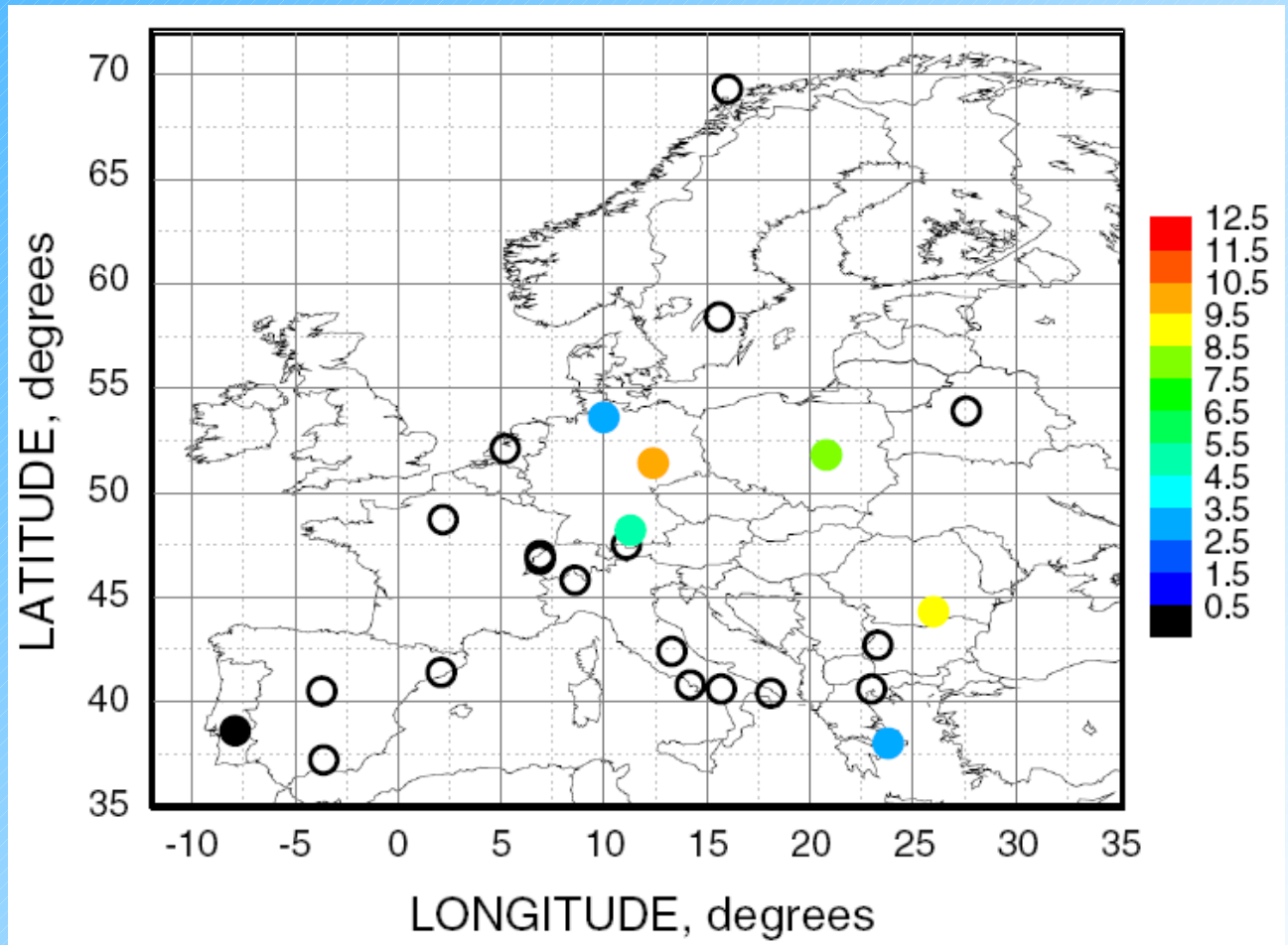
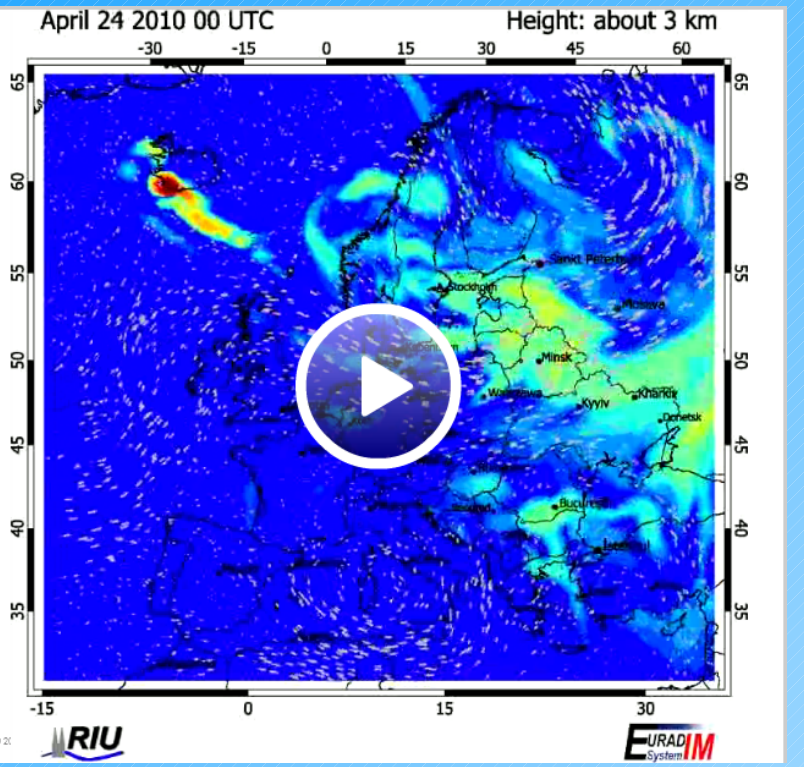


Preliminary data

4-dimensional data set from EARLINET

Layer top height of the volcanic plume:

April 24 00 UTC



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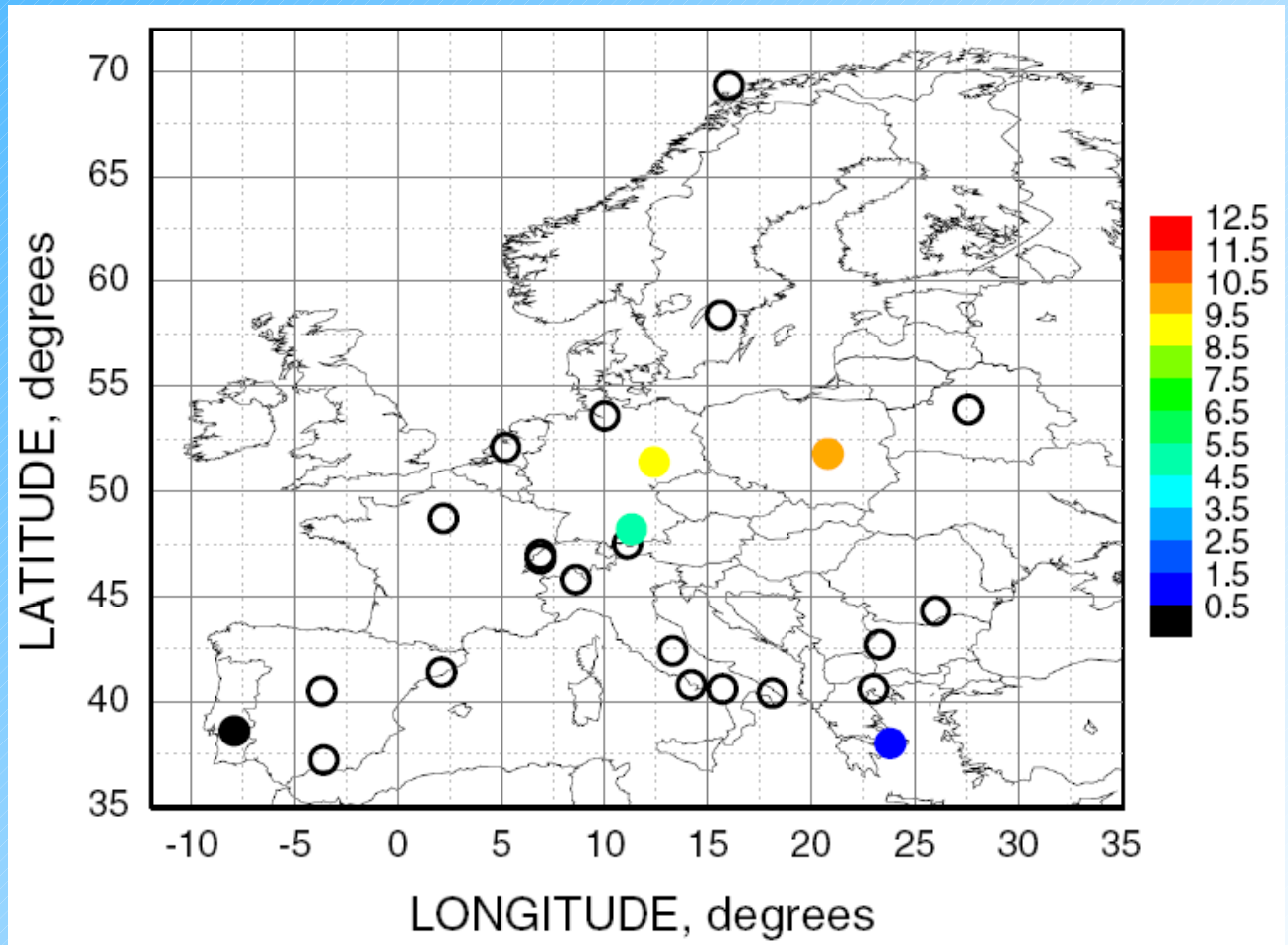


Preliminary data

4-dimensional data set from EARLINET

4-dimensional distribution of Eyjafjalljökull ash over Europe from EARLINET observations

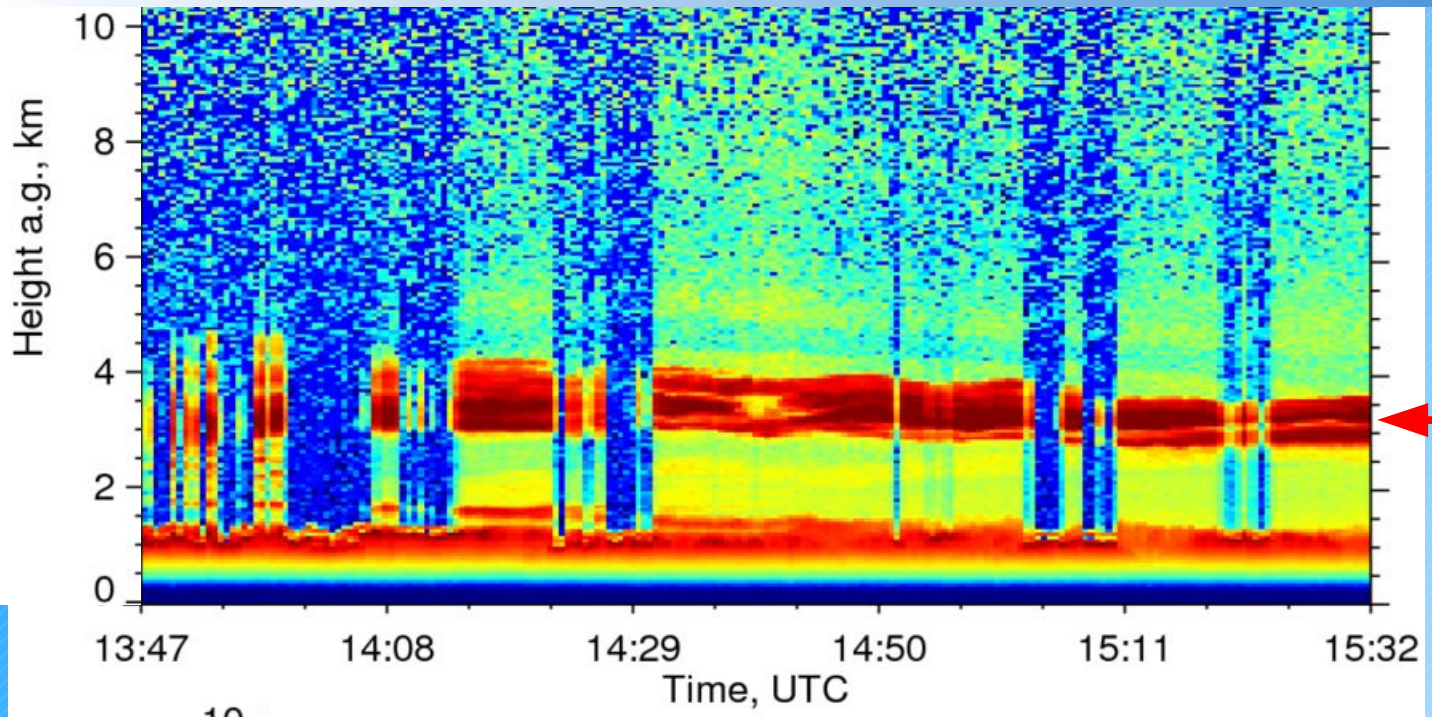
→ will be provided soon

→ contact Gelsomina Pappalardo pappalardo@imaa.cnr.it

* What is EARLINET ?
* 4 dimensional distribution of the ash plume over Europe
* Sensitivity of lidars and ceilometers
* Estimation of mass profiles from lidar measurements

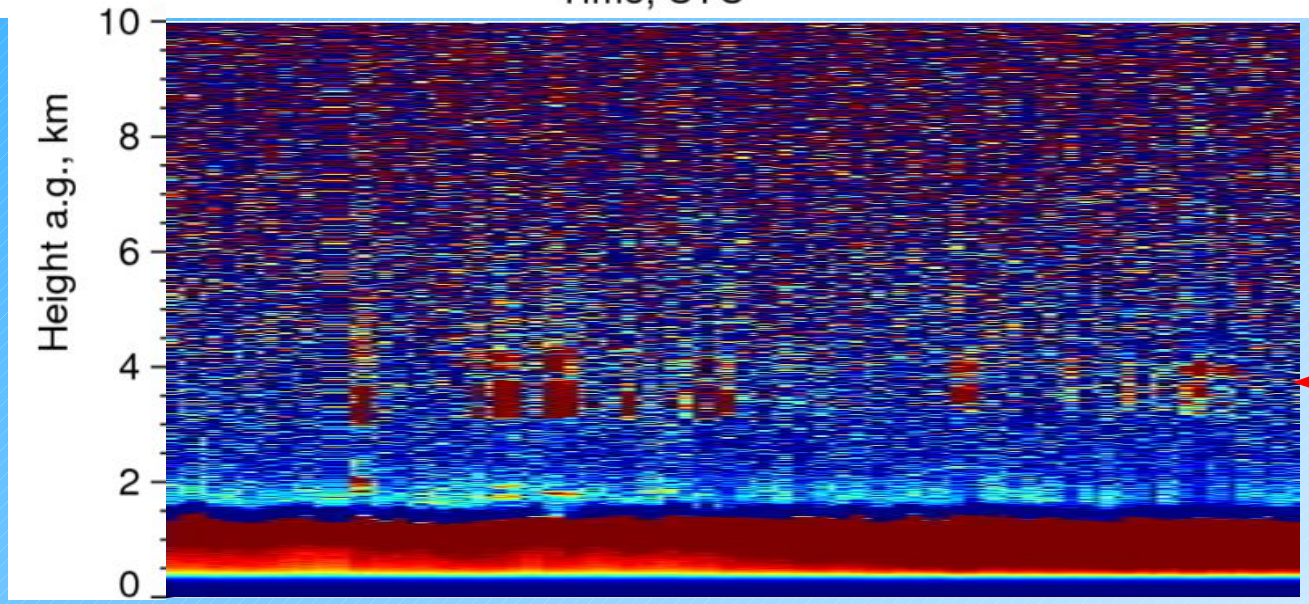
Detection limits: lidar vs. ceilometer

1) strong, low-altitude plume



MARTHA
lidar optimized for the
free troposphere

ash layer



Jenoptik
Ceilometer CHX

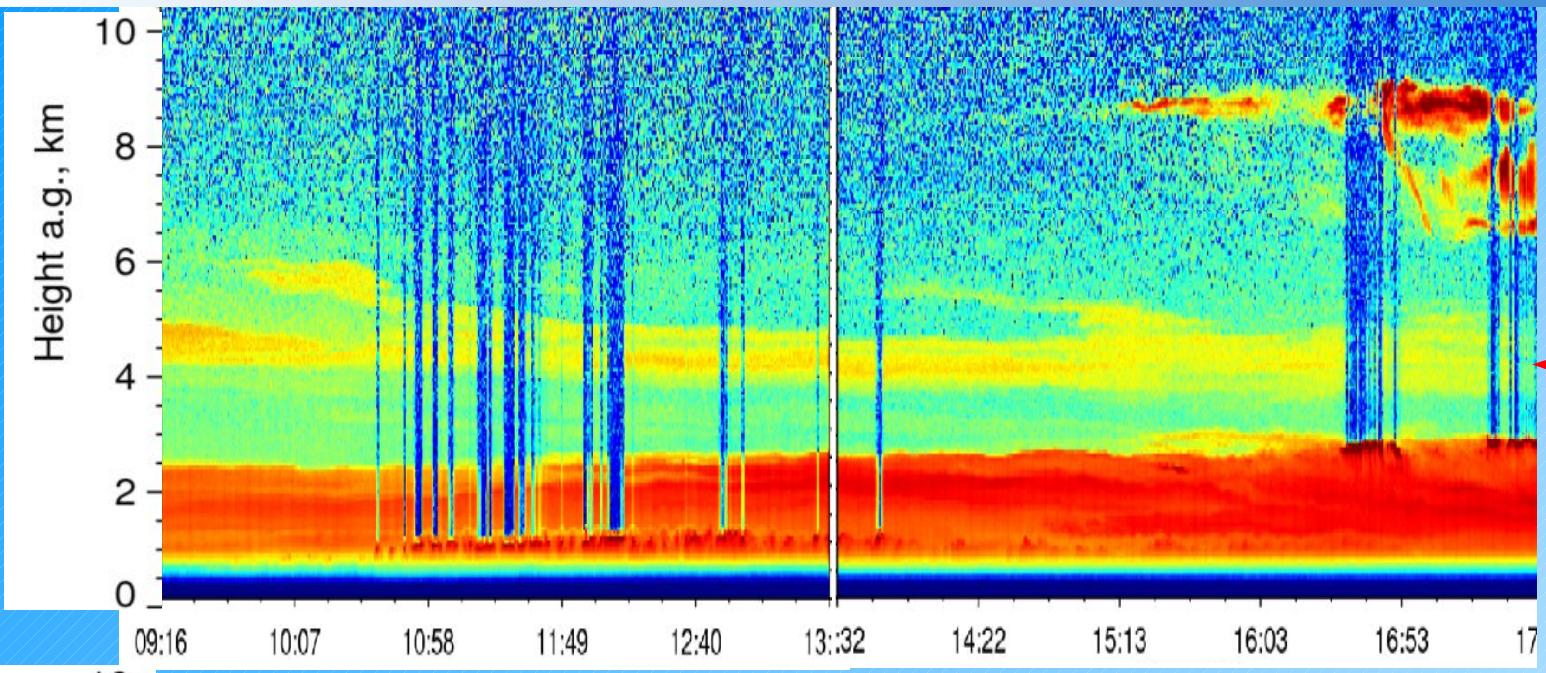
ash layer

Preliminary data

By Courtesy of IfT Leipzig; B. Heese, M. Tesche, P. Seifert, A. Hiebsch, J. Schmidt

Detection limits: lidar vs. ceilometer

1) thin, high-altitude plume



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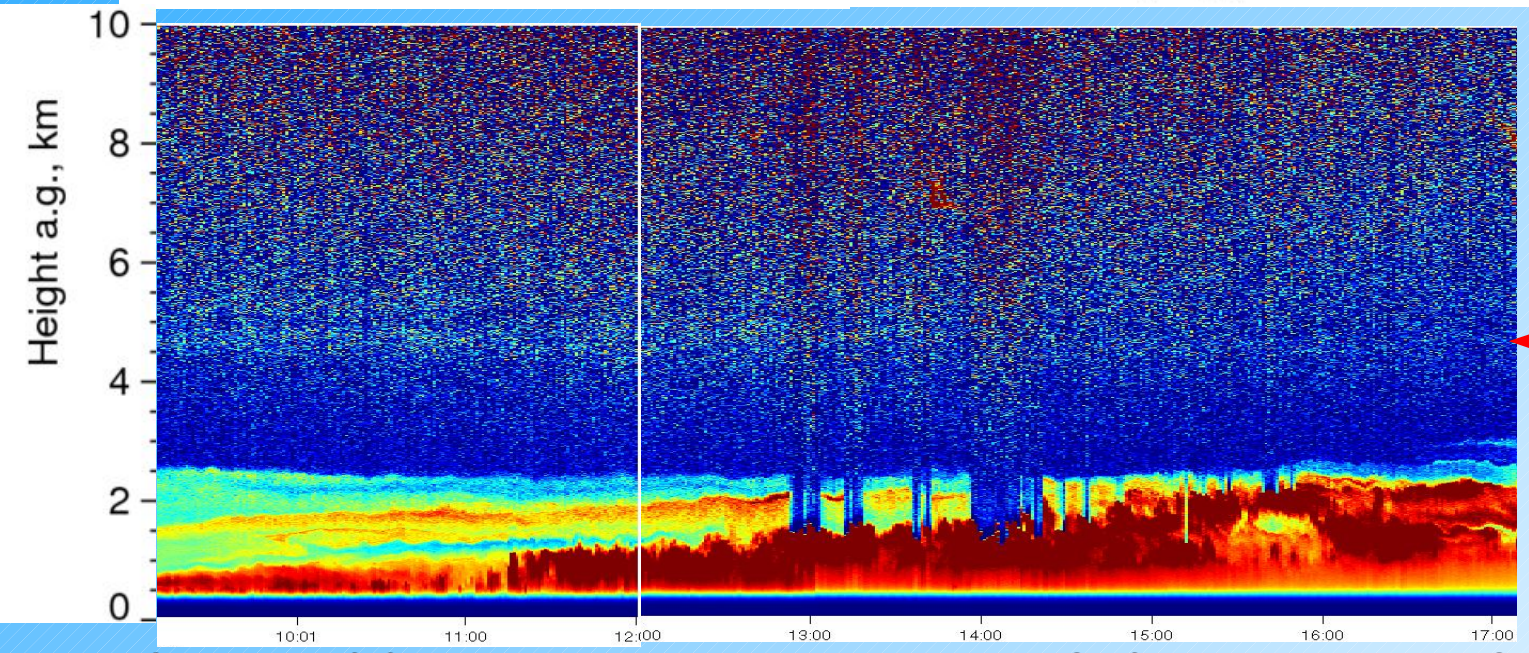

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Ceilometer CHX

ash layer

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Detection limits: lidar vs. ceilometer

Ceilometers and PBL lidars can detect only strong layers

→ o.k. for fast warnings in case of dense plumes

but

→ validation of models and assimilation need quantitative measurements of extinction profiles

→ separation between dangerous aerosol (e.g. ash) layers and 'usual' continental aerosols needs multi-wavelength information and depolarization

* What is EARLINET ?
* 4 dimensional distribution of the ash plume over Europe
* Sensitivity of lidars and ceilometers
* Estimation of mass profiles from lidar measurements

Estimation of mass concentration profiles

volcanic layers over Europe are very inhomogeneous in

* shape (depolarization profiles)
* size (Angström exponent profiles)
* density (extinction profiles)
* aging effects

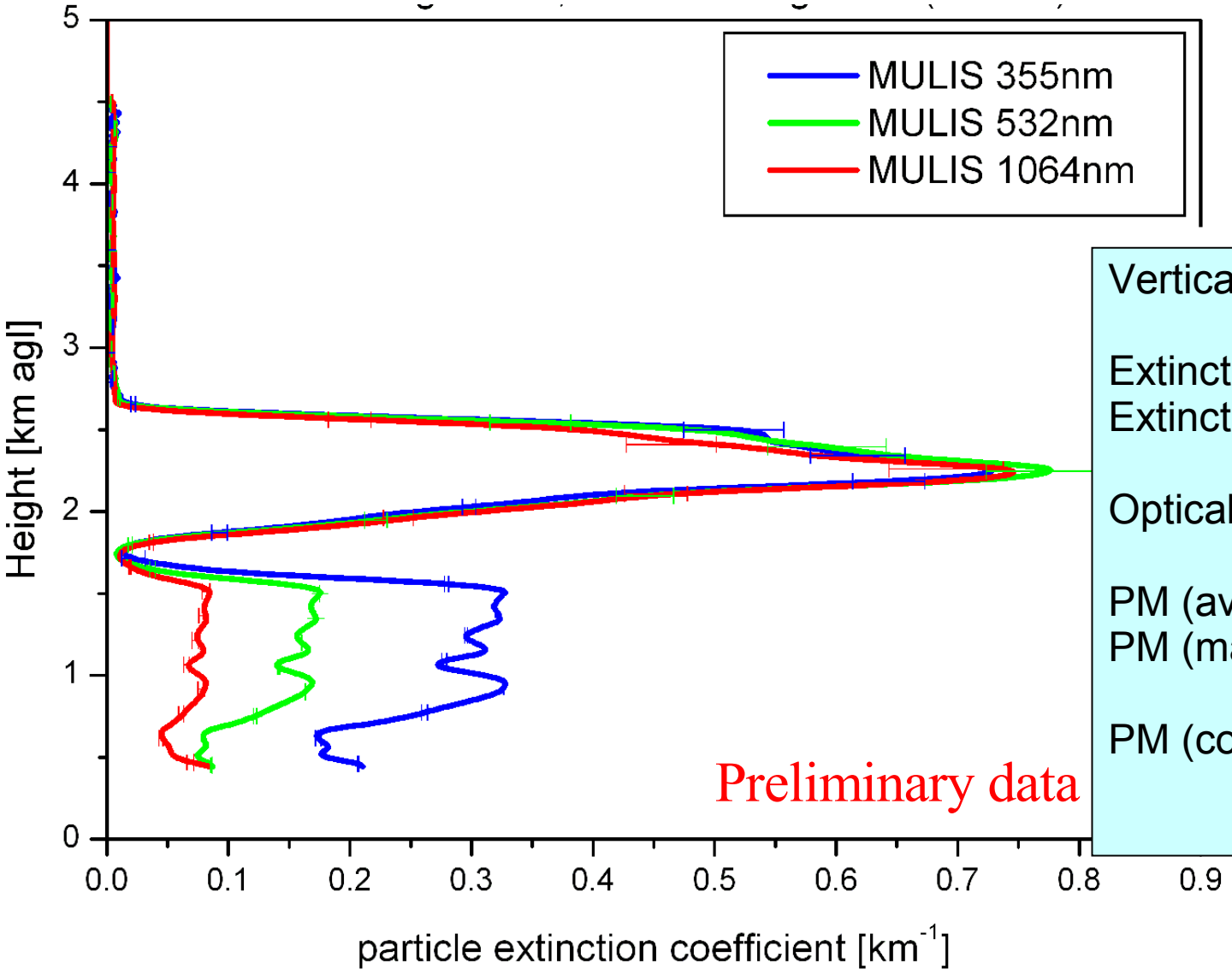
→ How to derive trustworthy microphsical properties?

(age dependent backscatter-to-mass conversion factors)

→ several approaches tested in EARLINET

Estimation of mass concentration profiles

From OPAC conversion factor: Maisach April 17



Ash-Layer

Vertical extent: 900 m

Extinction (avg): 0.4 km^{-1}
Extinction (max): 0.77 km^{-1}

Optical depth: 0.36

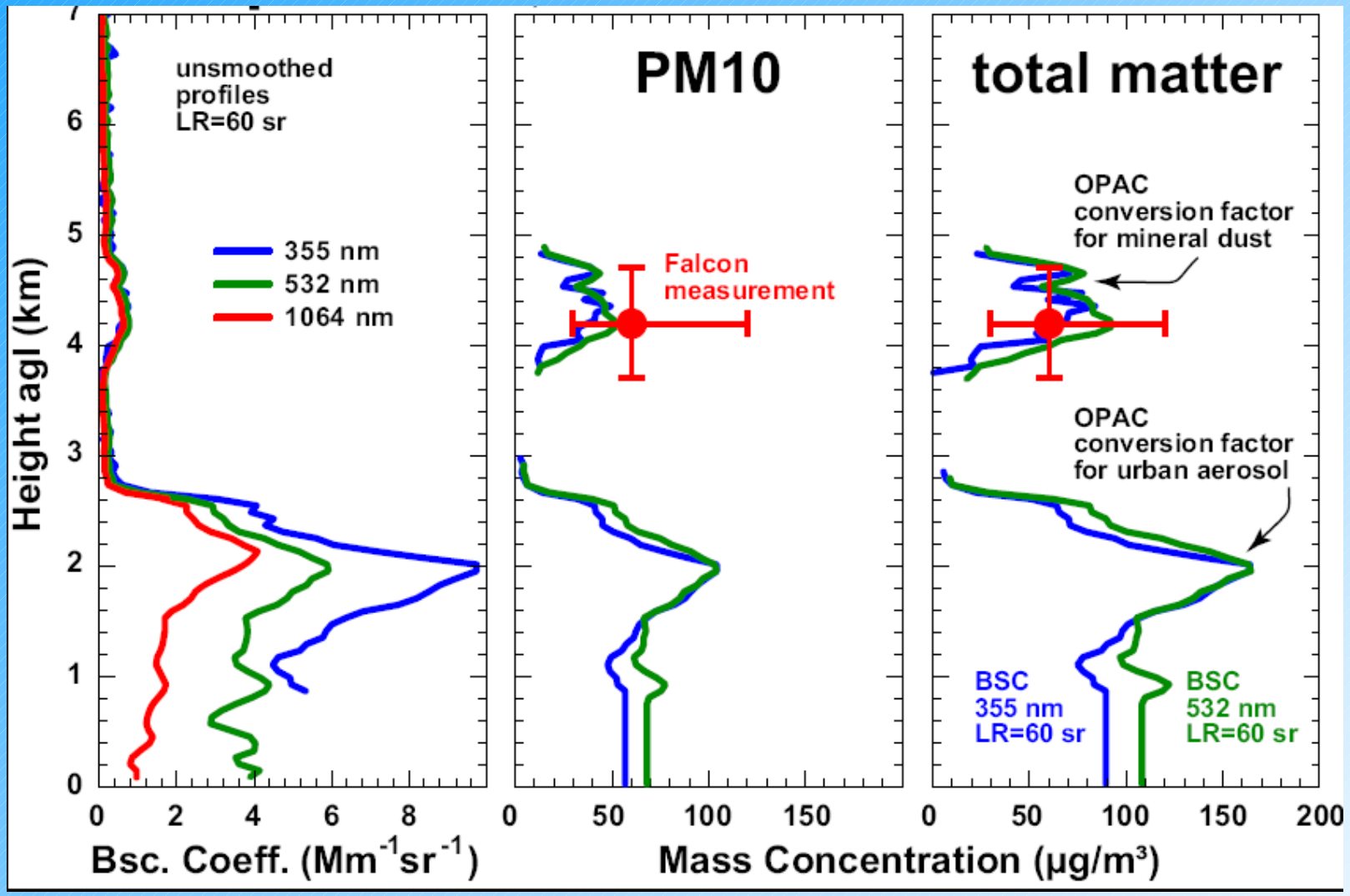
PM (avg): 500 $\mu g/m^3$
PM (max): 950 $\mu g/m^3$

PM (column): 0.45 g/m^2

By Courtesy of Met. Inst., Ludwig-Maximilians-Universität; Gross, Freudenthaler, Gasteiger, Wiegner

Estimation of mass concentration profiles

From OPAC conversion factor: Leipzig April 19

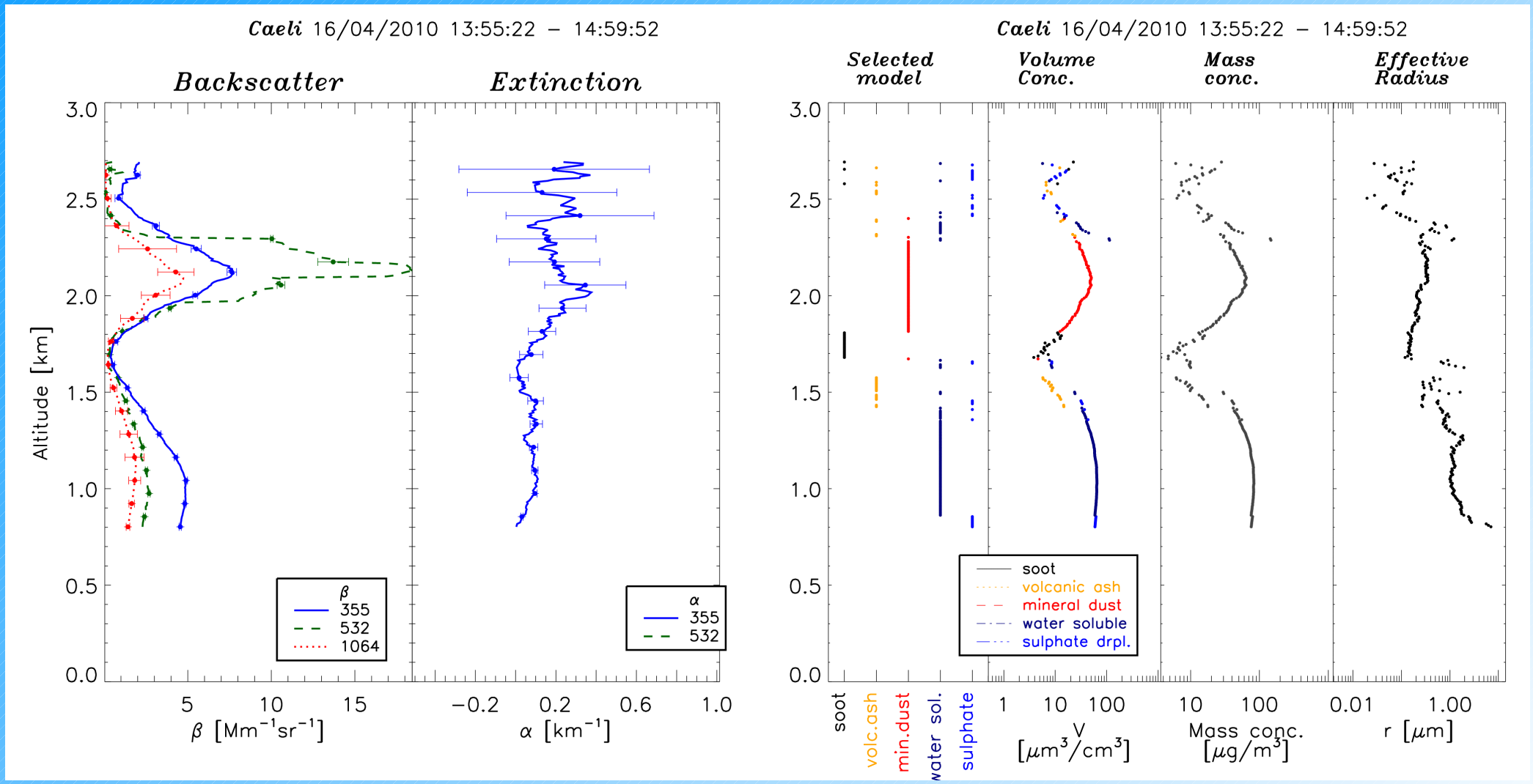


Falcon data:
http://bmvbs.de/Anlage/original_1134685/Bericht-zum-Falcon-Messflug-am-19.-April-2010.pdf

lidar data: By Courtesy of IfT Leipzig; M. Tesche, P. Seifert, A. Hiebsch, J. Schmidt

Estimation of mass concentration profiles

From principle component analysis: Cabauw April 16



By Courtesy of M. de Graaf, D.P. Donovan(KNMI), A. Apituley, K. Wilson (RIVM)

Summary

* EARLINET is a unique tool for the measurement of the 4dim distribution of pollutant plumes over Europe
* EARLINET lidars can detect filaments of pollution
* different approaches for estimation of mass profiles are tested

* EARLINET is a research infrastructure, no operational network
  → flexible measurement schedule, short reaction times
  → near-real time data processing to be improved

* see posters: A 519 – A 530, Wed. 17:30 - 19:00

EARLINET

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