Evaluation of the modelled distribution of the Eyjafjallajökull (E15) ash plume by means of ground based remote sensing over Germany

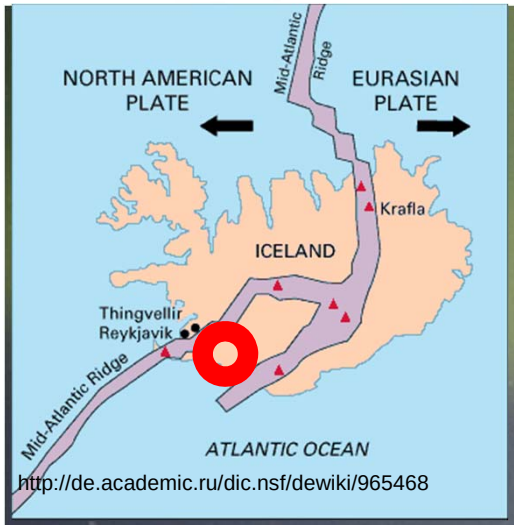
Peter Suppan ...

Karlsruhe Institute of Technology (KIT), Institute for Meteorology and Climate Research (IMK-IFU),
Campus Alpine, Garmisch-Partenkirchen, Germany

This has been investigated in teamwork by:

Stefan Emeis[1], Klaus Schäfer[1], Renate Forkel[1], Wolfgang Junkermann[1], Wolfgang Fricke[2], Harald Flentje[2], Stefan Gilge[2], Werner Thomas[2], Ludwig Ries[3], Frank Meinhardt[3], Annette Peters[4], Jürgen Schnelle-Kreis[4], Mike Pitz[4], Heinz-Erich Wichmann[4], Friedl Obleitner[5], Wolfram Birmili[6], Kay Weinholdt[6], Matthias Wiegner[7], Volker Freudenthaler[7], Silke Groß[7], Jens Soentgen[8], Josef Cyrys[4,8], Christoph Münkel[9], Jürgen Diemer[10], Ralf Zimmermann[11], Christian Freuer[12], Peter Suppan[1]

[1]IMK-IFU, KIT
[2]DWD, Hohenpeißenberg
[3]UBA, Dessau
[4]Helmholtz Zentrum München
[5]Universität Innsbruck
[6]Leibniz Institut für Troposphärenforschung, Leipzig
[7]Ludwig-Maximilians-Universität München
[8]Universität Augsburg
[9]Vaisala GmbH, Hamburg
[10]Bayerisches Landesamt für Umwelt, Augsburg
[11]Universität Rostock
[12]DWD, München



http://de.academic.ru/dic.nsf/dewiki/965468

14 April: eruption plume rose to up to 9.5 km height deflected to the east by westerly winds

16 April: pulsating eruptive plume reaches above 8 km, with overall height of 5 km

17 April: eruption plume loaded with tephra (ash) rises to more than 8 km

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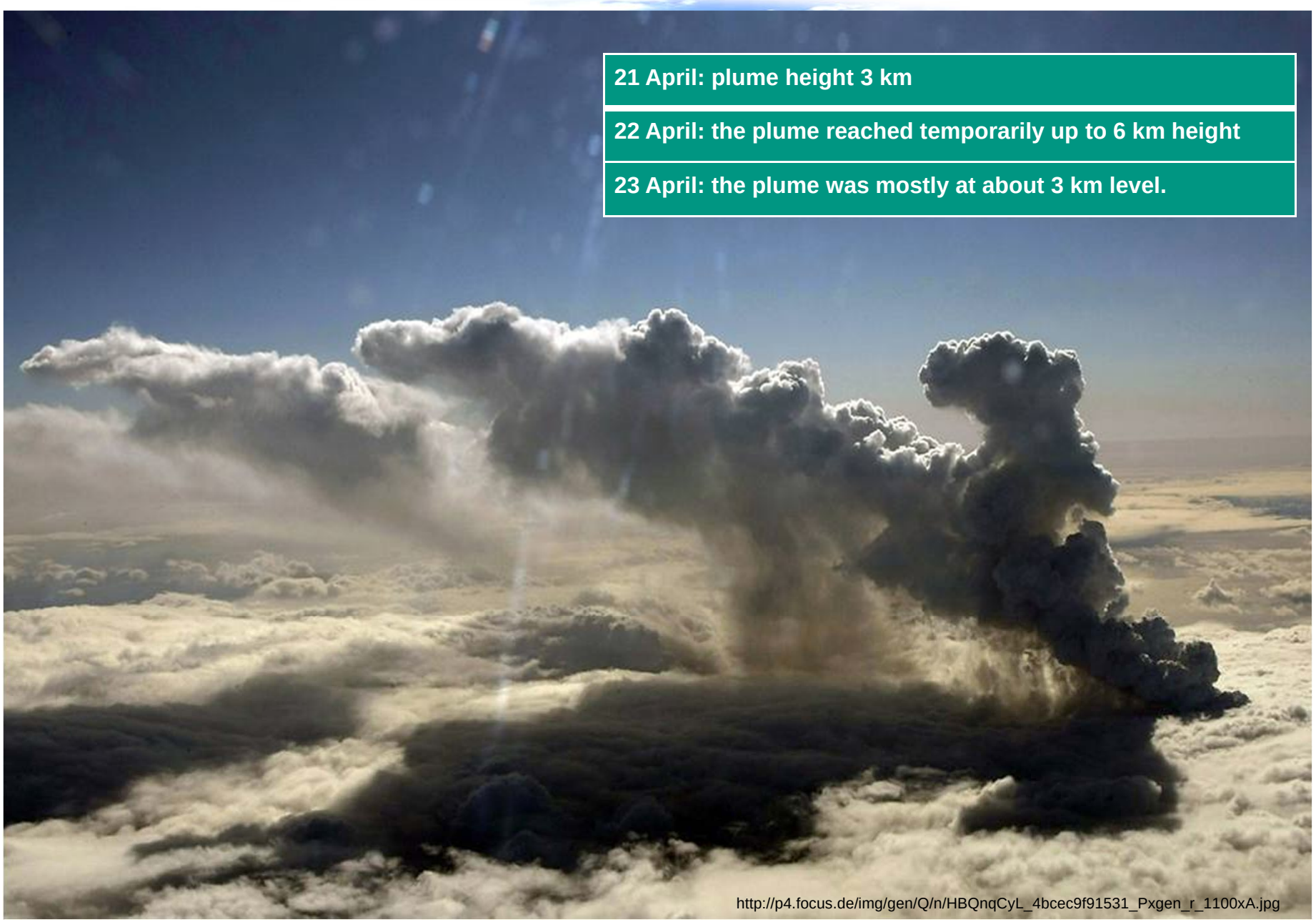
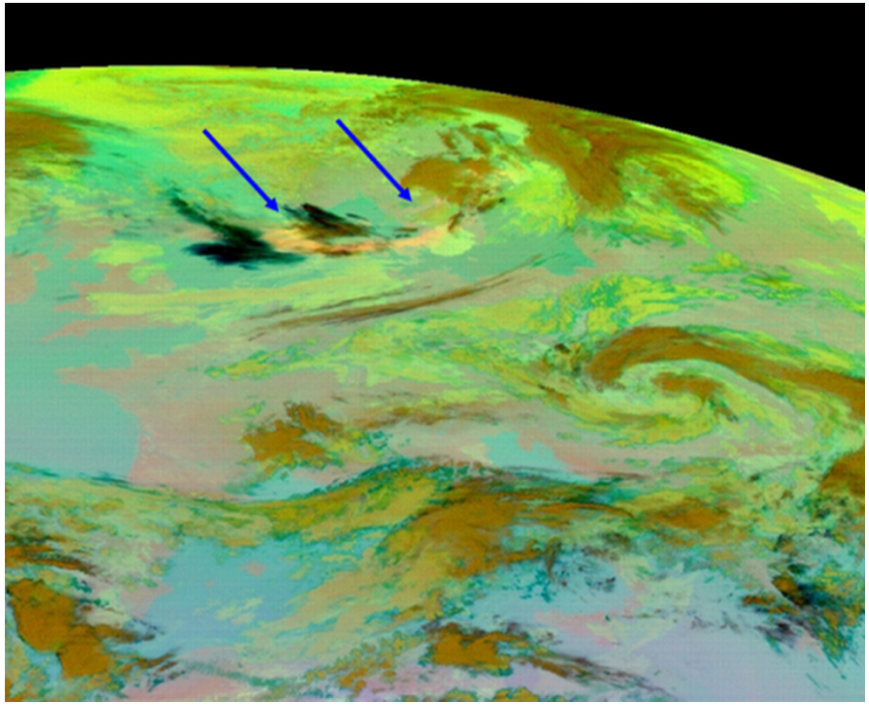
http://i.dailymail.co.uk/i/pix/2010/04/23/article-1268225-094360F3000005DC-143_964x641.jpg

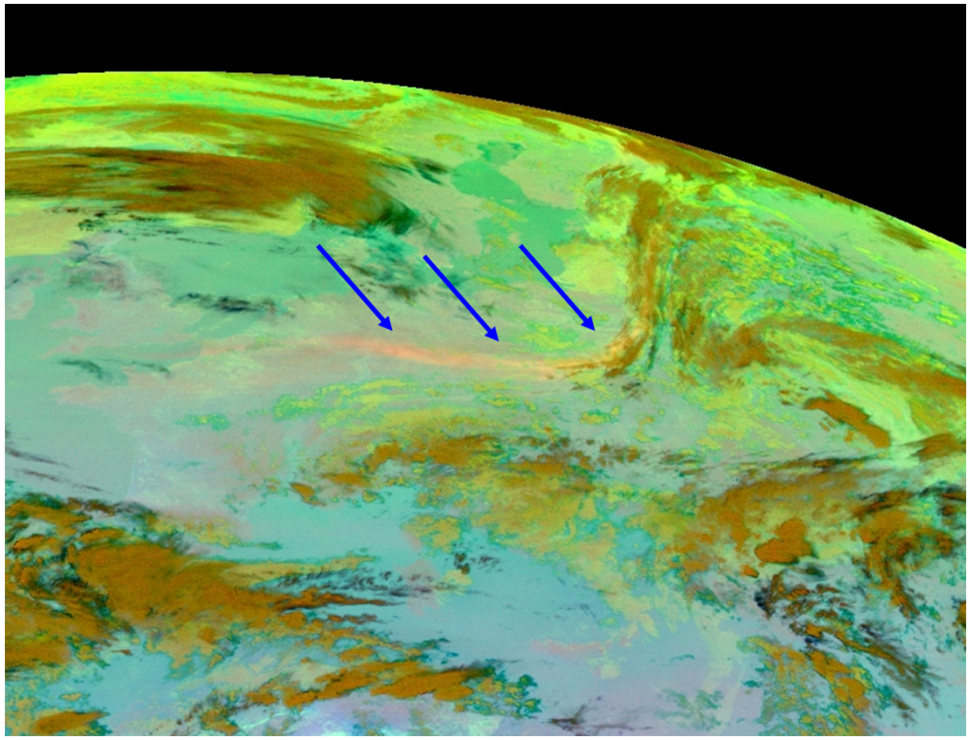

21 April: plume height 3 km
22 April: the plume reached temporarily up to 6 km height
23 April: the plume was mostly at about 3 km level.
http://p4.focus.de/img/gen/Q/n/HBQnqCyL_4bcec9f91531_Pxgen_r_1100xA.jpg

Ash Product



16 April, 00:00 UCT

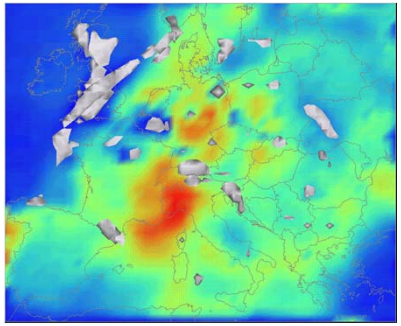
16 April, 18:00 UCT



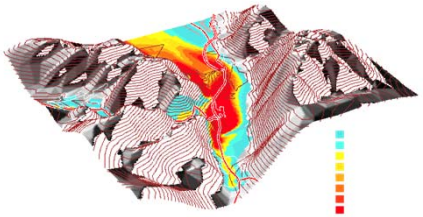
Motivation

- **Were model-based dispersion forecasts realistic?**
- **Can the propagation of the ash cloud be observed by surface-based remote sensing?**
- **Was ash mixed into the planetary boundary layer?**
- **Can volcanic material be analysed from air quality network data?**
- **Is it distinguishable from „normal“ pollution?**
- **Was there a threat to the population due to mixing volcanic into the PBL?**

Modeling system

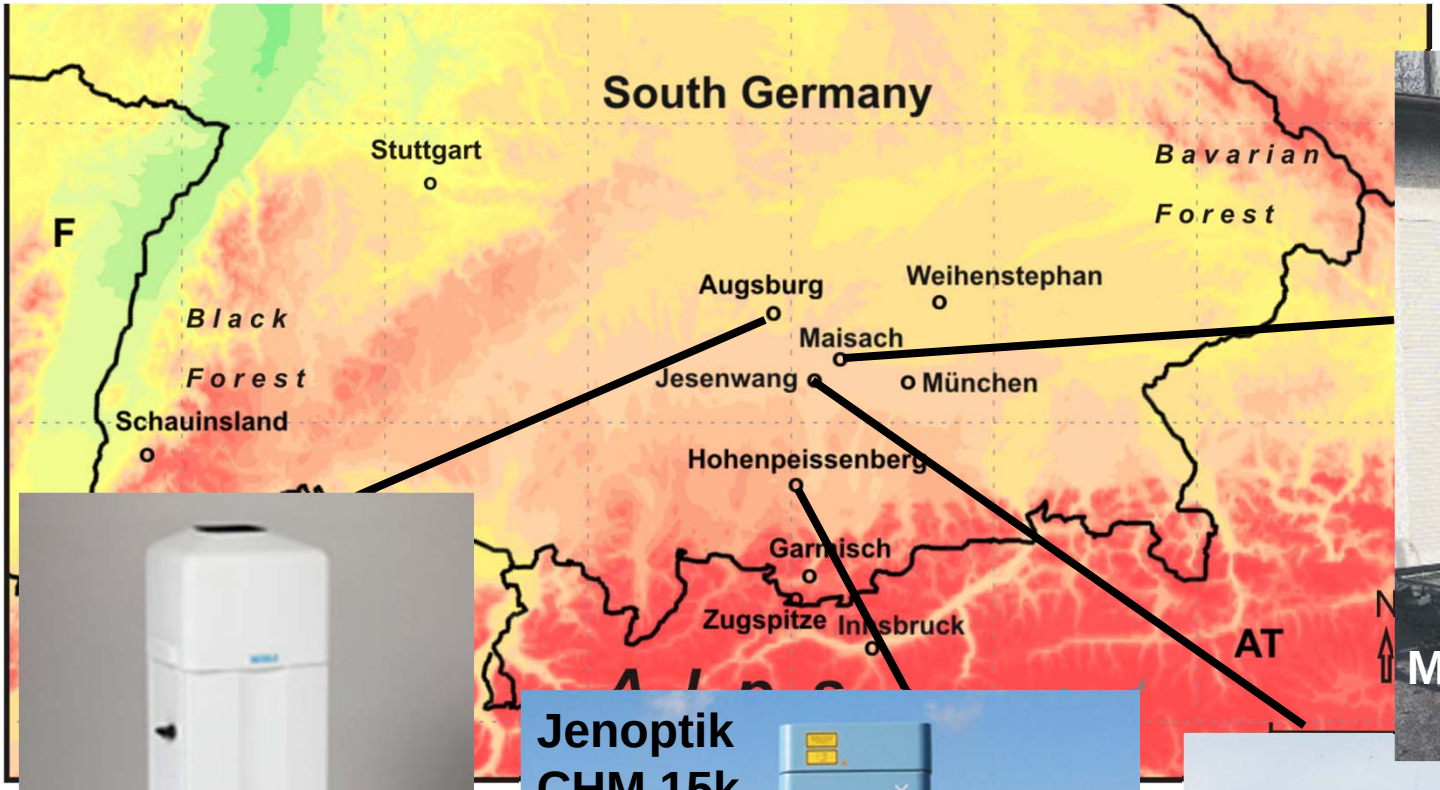


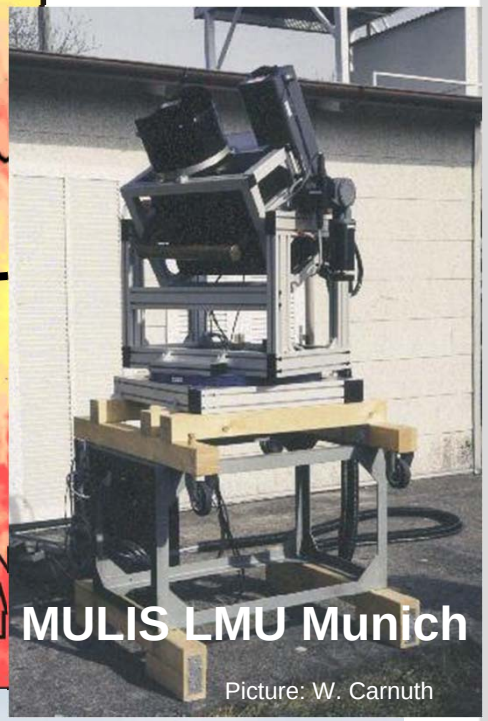
regional



local

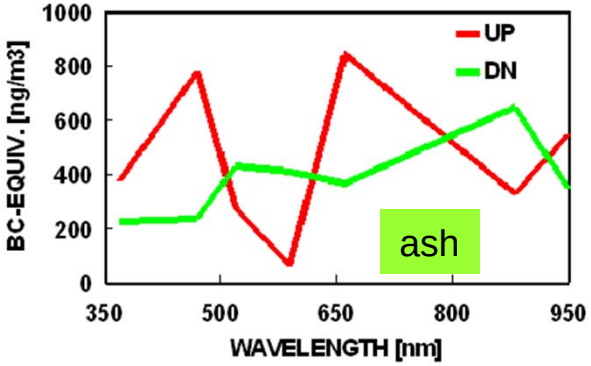
Measurement Facilities





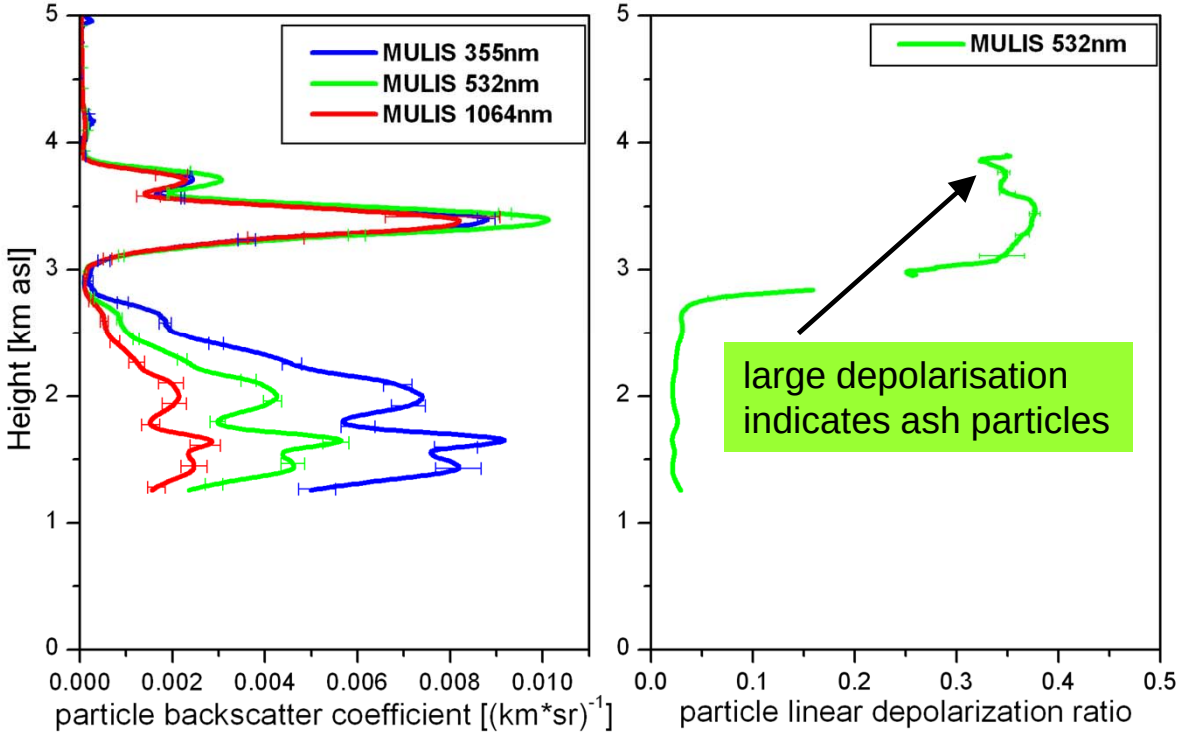
Measurement Results

normal, aged polluted air



Ultra-light Aircraft

average absorption equivalent to black carbon mass in the seven channels

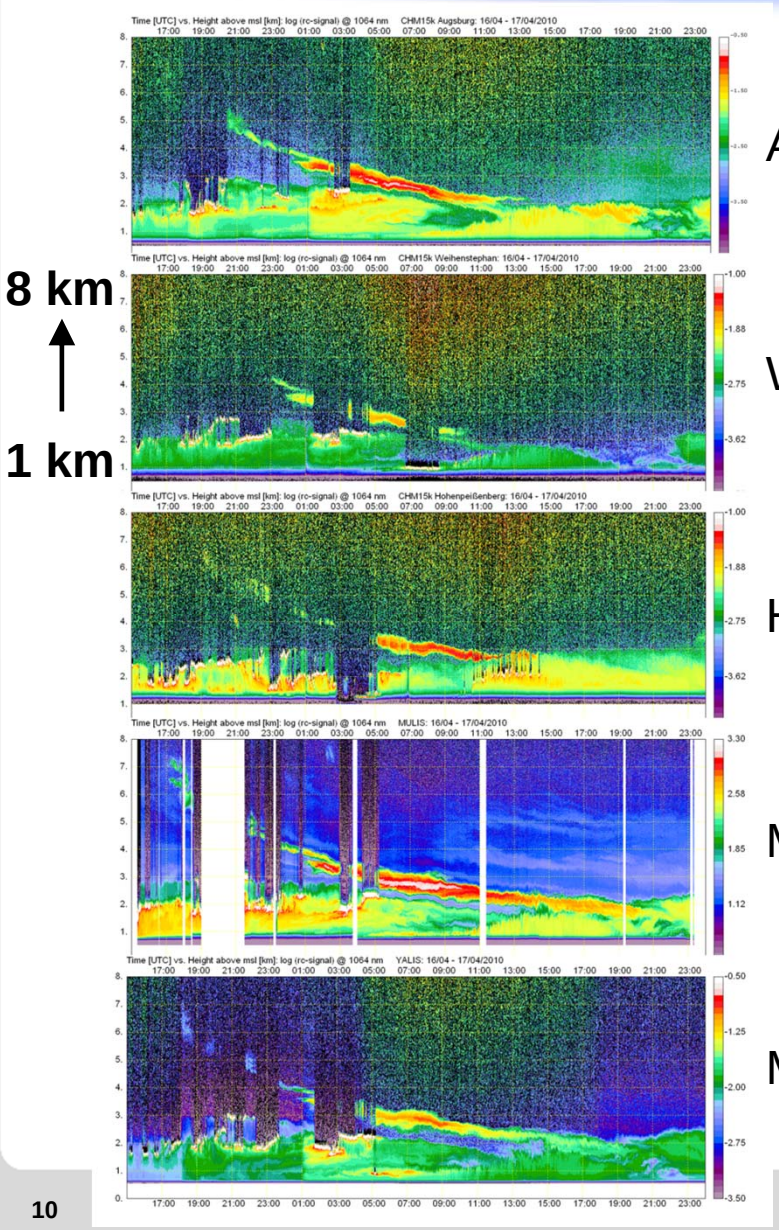


MULIS

One-our average of particle backscatter coefficient (left)

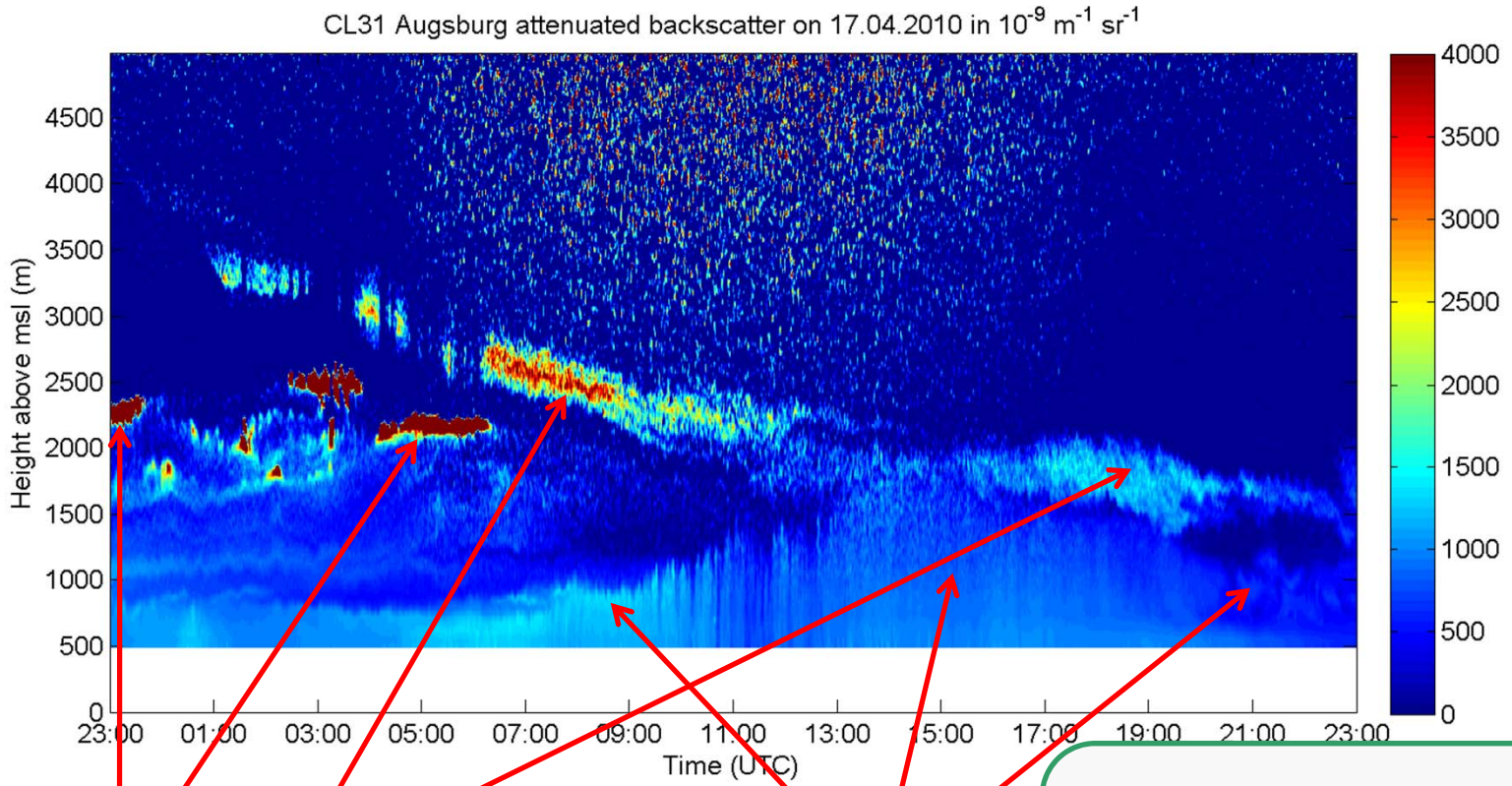
linear depolarisation ratio (right)

Measurement Results



Ceilometer measurements:
16 April 2010, 15 UTC to 17 April 2010, 24 UTC

Measurement Results

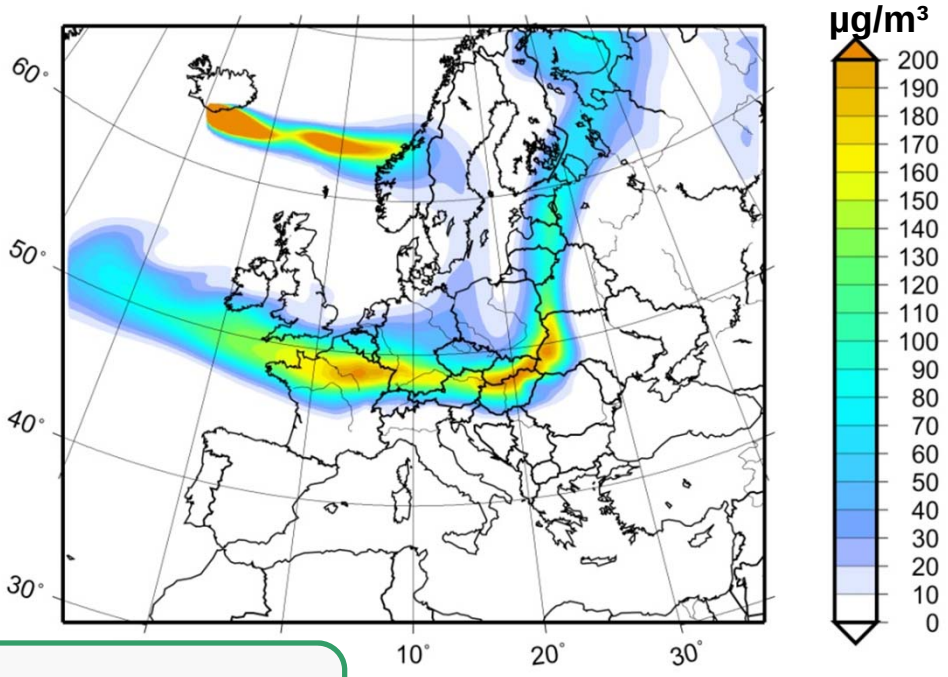


clouds **ash** **boundary layer**

interaction of the ash cloud with the PBL:

CL31 observations at Augsburg

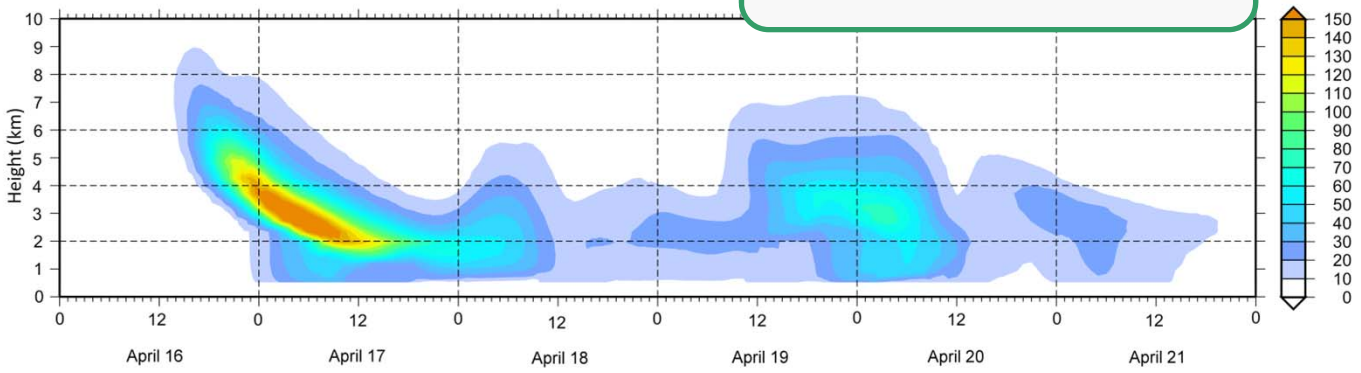
Simulations



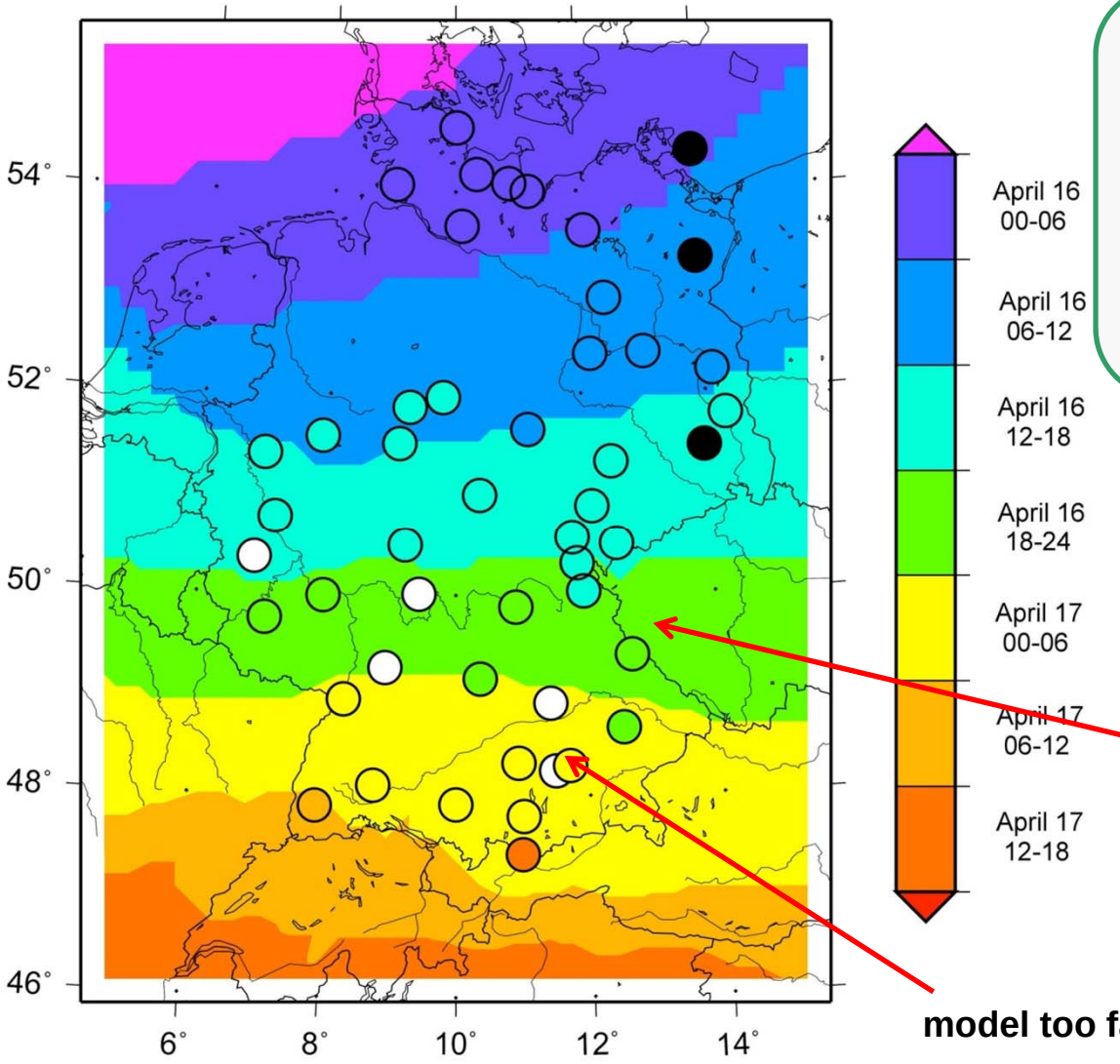
MCCM simulation for April 17, 2010 00 GMT

appr. 3.5 km above ground

Cross section of the area of Munich



Measurements vs Simulations



Ceilometer results (dots)

vs

MCCM simulations (colours)

model too slow

model too fast

Conclusions

- **Propagation of the ash cloud was well simulated by the Eulerian model MCCM**
- **Propagation of the ash "front" was traced by the Ceilonet of the DWD and other lidars and ceilometers (cloud free areas !!).**
- **Ash was mixed into the planetary boundary layer (day time)**
- **Earliest reports on near-surface ash measurements were from Alpine stations**
- **Ash contributed to about 25% of the near-surface PM_{10} on April 19 and April 20, 2011.**
- **The volcanic nature of air pollutants could be proofed from their optical backscatter**

Full Story:

Emeis, S., R. Forkel, W. Junkermann, K. Schäfer, H. Flentje, S. Gilge, W. Fricke, M. Wiegner, V. Freudenthaler, S. Groß, L. Ries, F. Meinhardt, W. Birmili, C. Münkel, F. Obleitner, P. Suppan, 2011:

Measurement and simulation of the 16/17 April 2010 Eyjafjallajökull volcanic ash layer dispersion in the northern Alpine region.

Atmos. Chem. Phys., 11, 2689–2701 www.atmos-chem-phys.net/11/2689/2011/
DOI:10.5194/acp-11-2689-2011

Schäfer, K., W. Thomas, A. Peters, L. Ries, F. Obleitner, J. Schnelle-Kreis, W. Birmili, J. Diemer, W. Fricke, W. Junkermann, M. Pitz, S. Emeis, R. Forkel, P. Suppan, H. Flentje, H. E. Wichmann, S. Gilge, F. Meinhardt, R. Zimmermann, K. Weinhold, J. Soentgen, C. Münkel, C. Freuer, and J. Cyrys, 2011:

Influences of the 2010 Eyjafjallajökull volcanic plume on air quality in the northern Alpine region.

Atmos. Chem. Phys. 11, 8555–8575 www.atmos-chem-phys.net/11/8555/2011/
DOI:10.5194/acp-11-8555-2011.

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Aerosol, Climate, and Health

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Ludwig-Maximilians University Munich
Federal Environmental Agency
Karlsruhe Institute of Technology

Thank you very much for your attention