Karlsruhe Institute of Technology

Detection of the ash cloud of the Eyjafjöll volcano* by a ceilometer network, its forecast by dispersion models and boundary layer impacts

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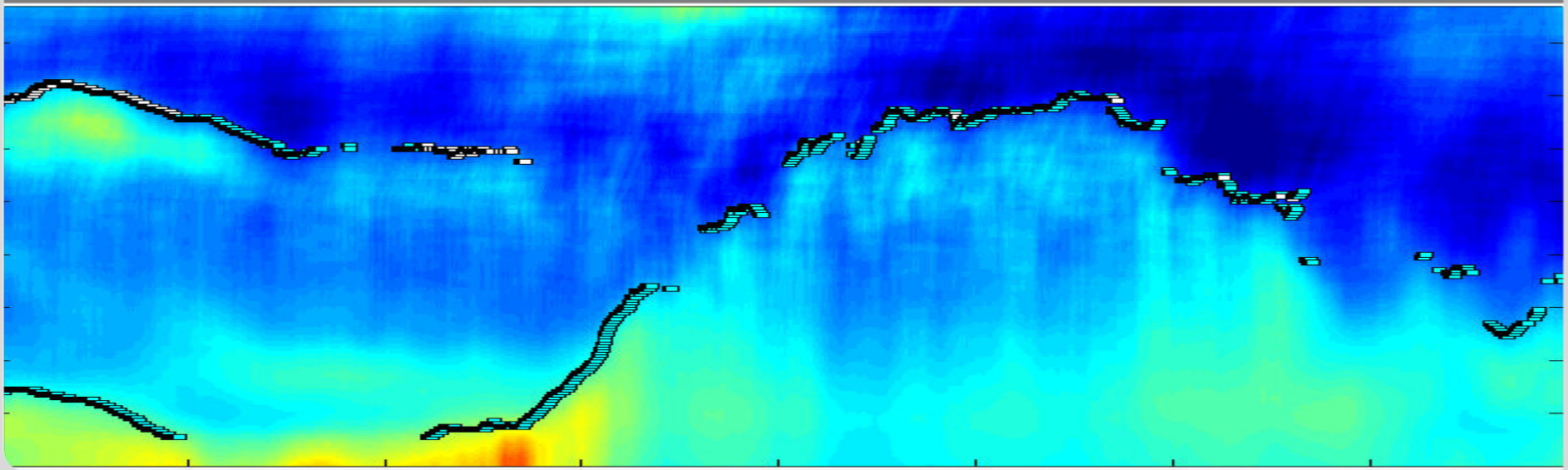
http://www.belleslettres.eu/artikel/eyjafjallajokull-aussprache.php
„eyja – fjalla – jökull“ means: „island mountain glacier“

INSTITUTE OF METEOROLOGY AND CLIMATE RESEARCH, Atmospheric Environmental Research



this has been investigated in teamwork by:

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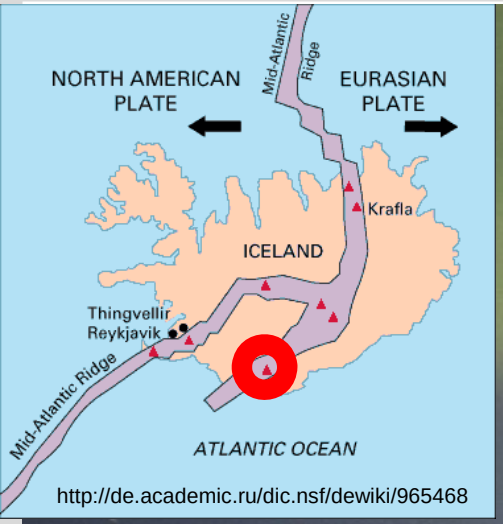
[9]Vaisala GmbH, Hamburg
[10]Bayerisches Landesamt für Umwelt, Augsburg
[11]Universität Rostock
[12]DWD, München



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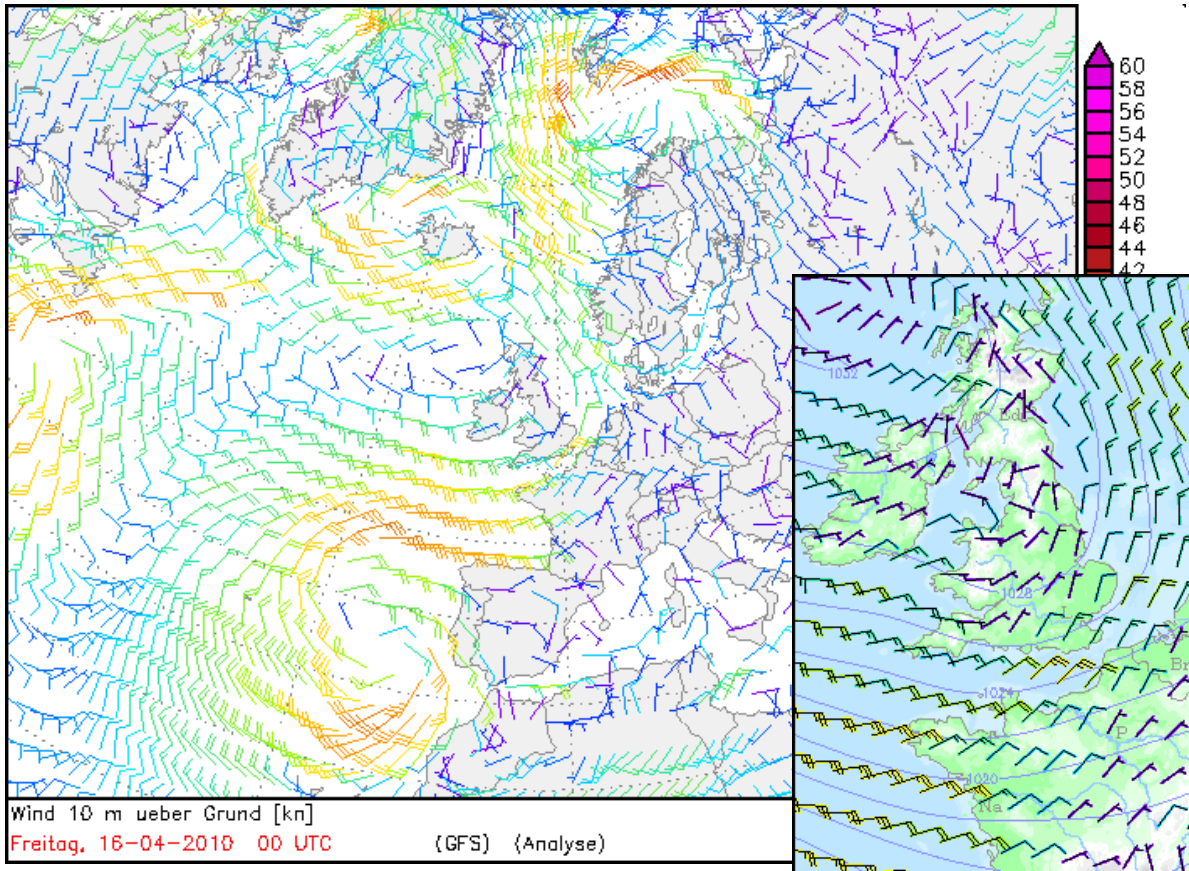
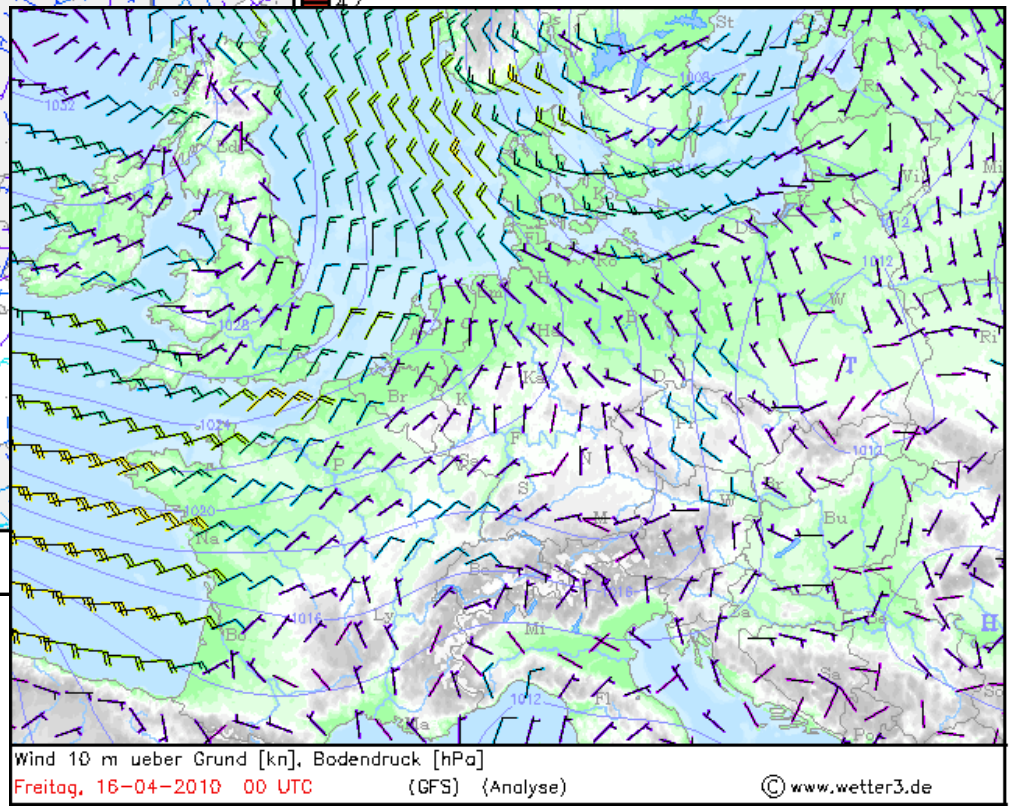


http://www.wetter3.de/Archiv/



Questions:

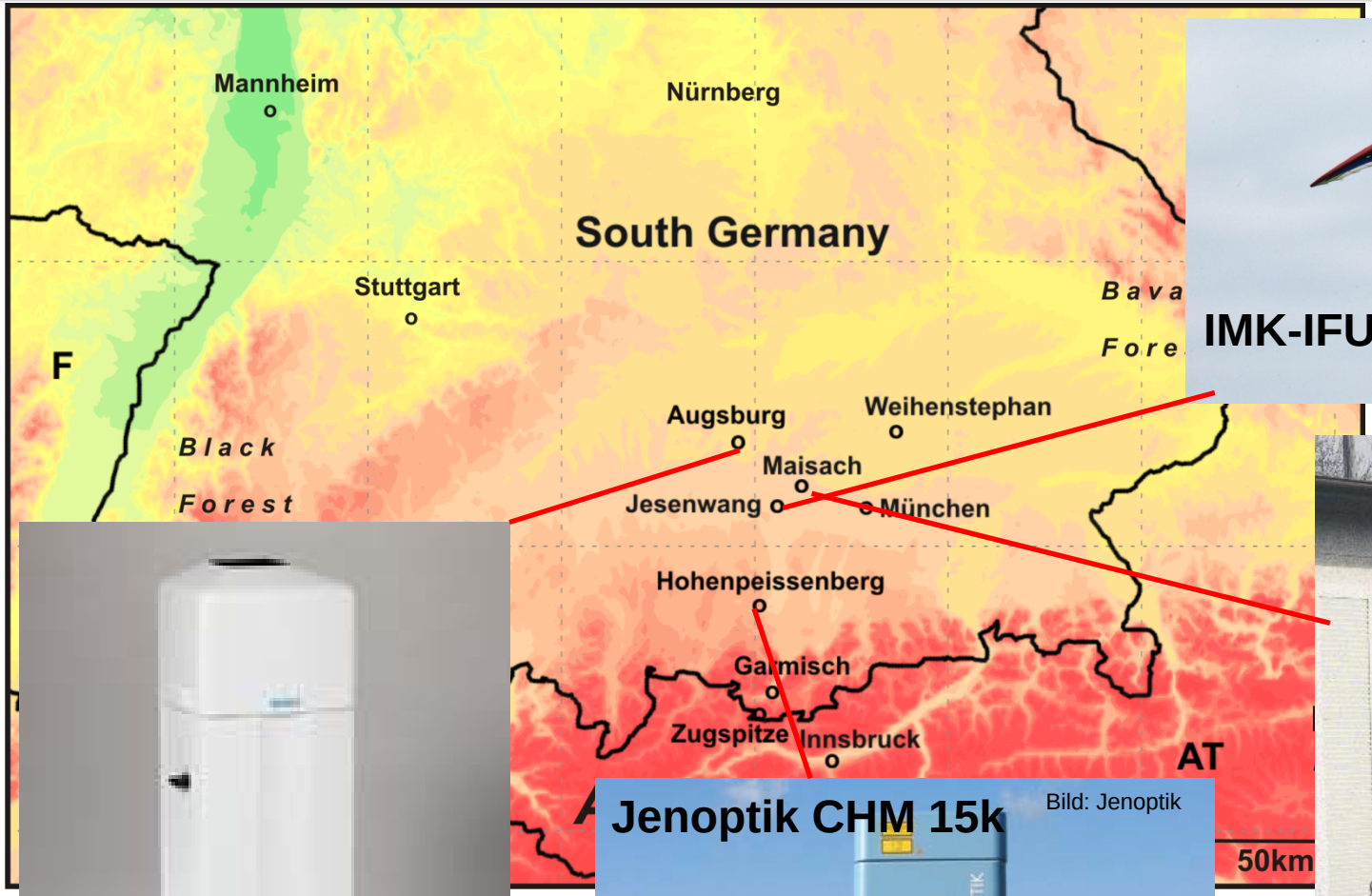
Can the propagation of the ash cloud be observed by surface-based remote sensing?

Were model-based dispersion forecasts realistic?

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?



IMK-IFU ultralight aircraft

Bild: IMK-IFU

Vaisala CL31

Bild: Vaisala

Jenoptik CHM 15k

Bild: Jenoptik

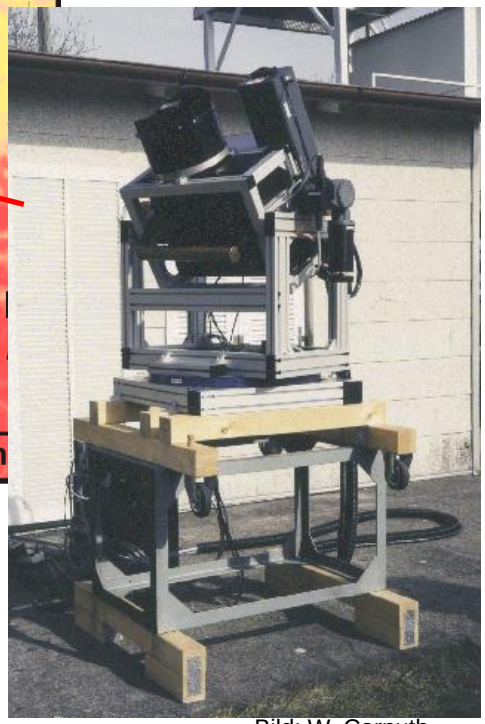
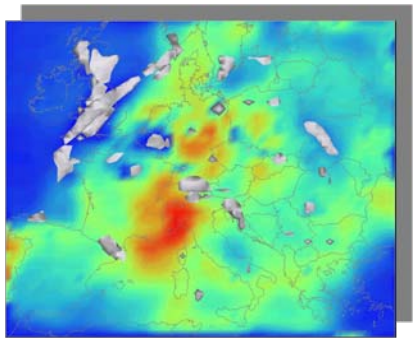


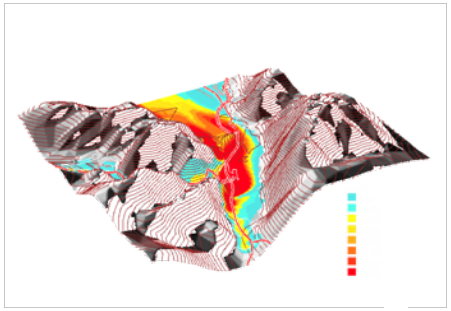
Bild: W. Carnuth

MULIS LMU Munich

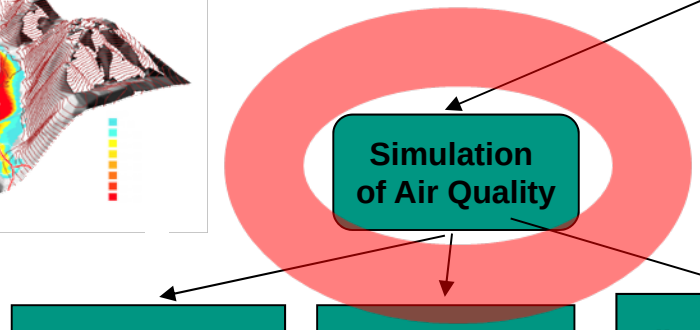
Model MCCM (based on MM5)

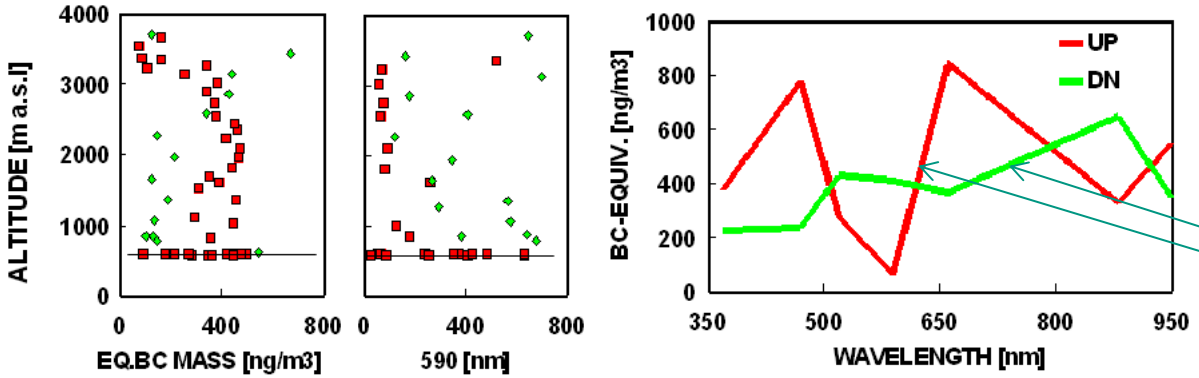


regional



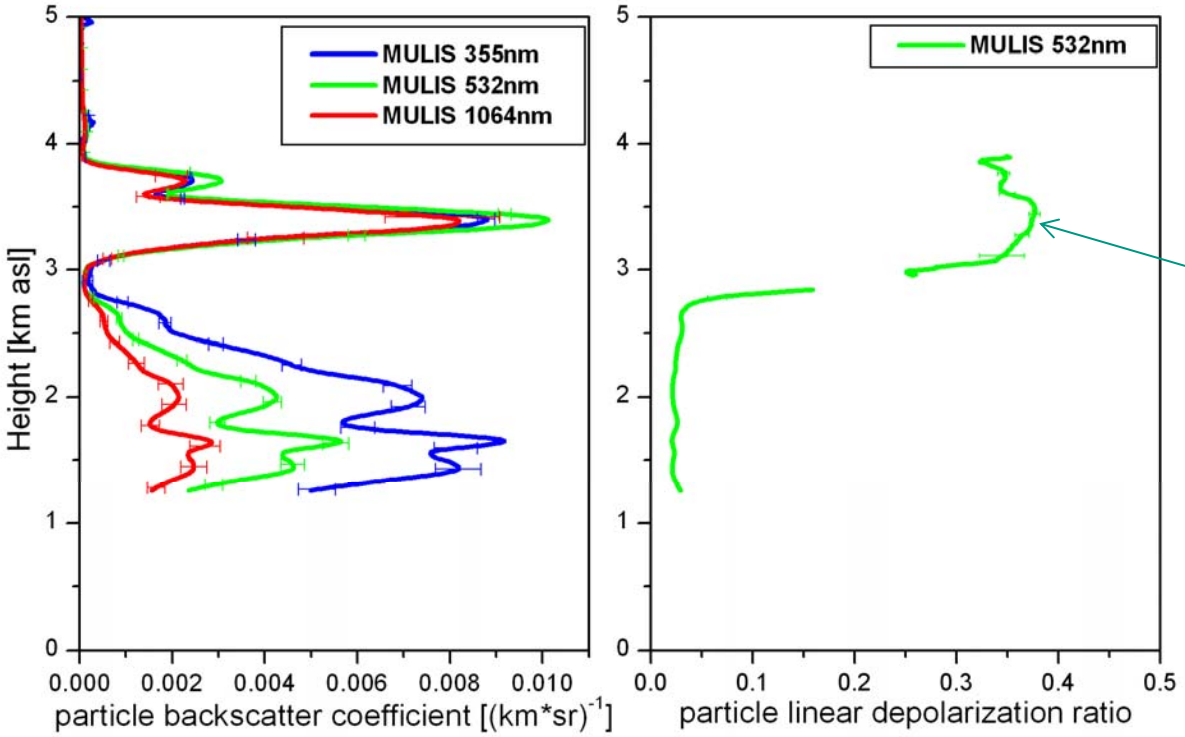
local





ultralight results

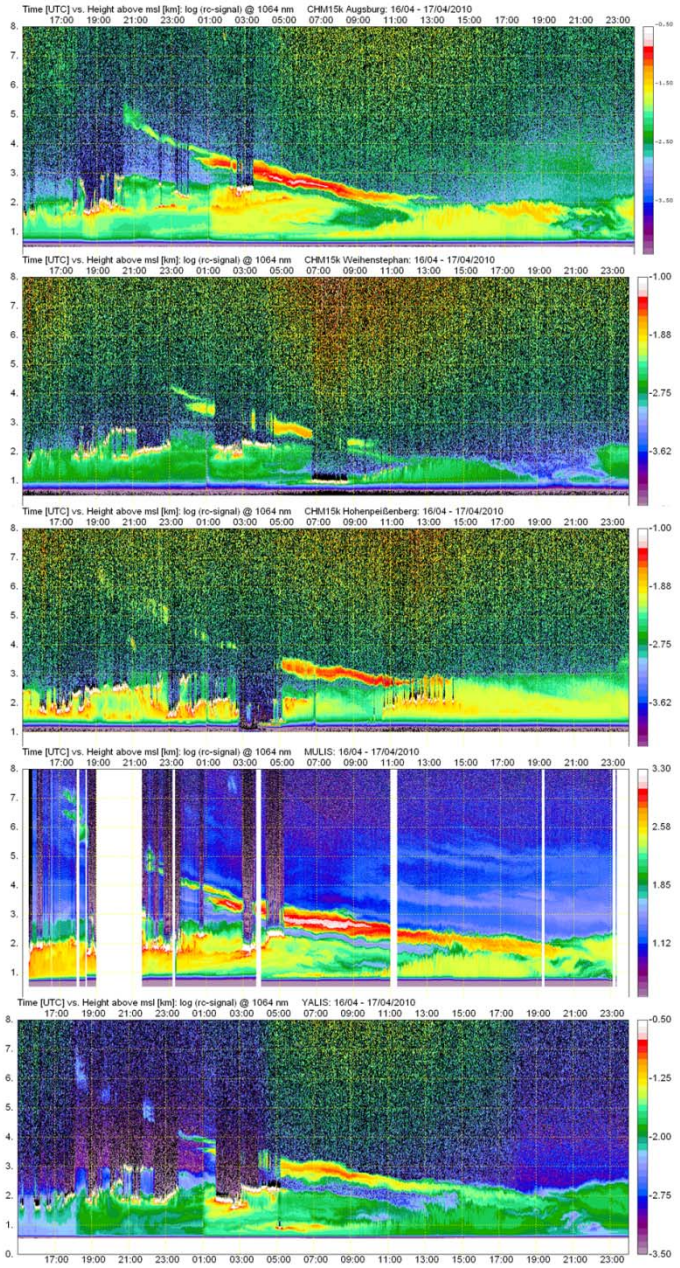
ash
normal, aged polluted air

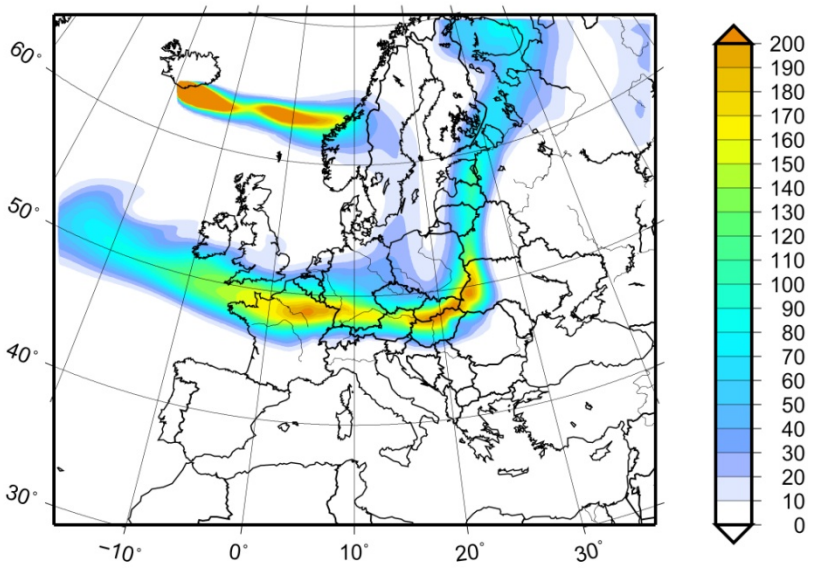


MULIS results

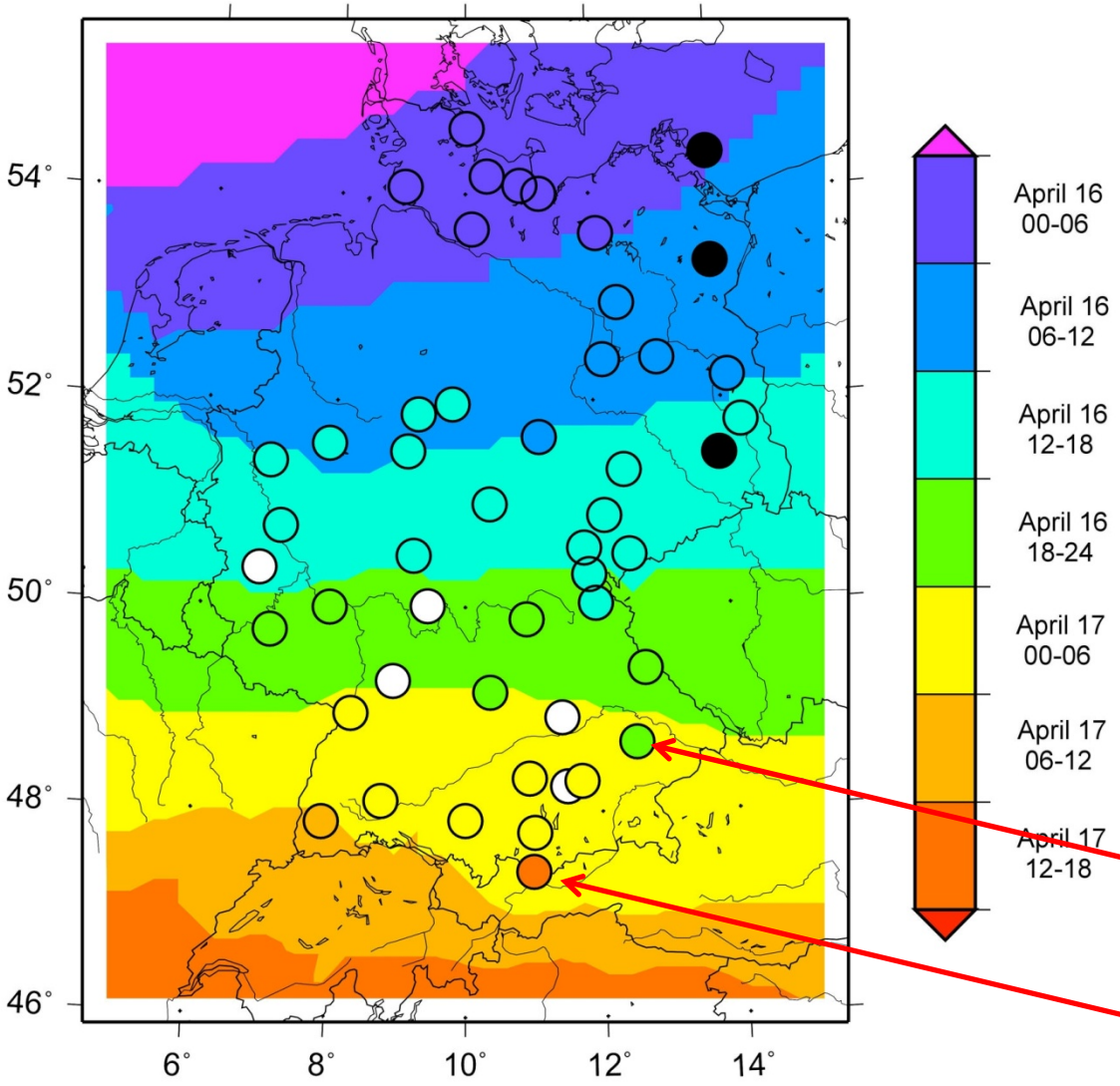
large depolarisation
indicates ash particles

Ceilometer results





MCCM simulation for April 17, 2010 00 GMT



Comparison of

ceilometer results (dots)

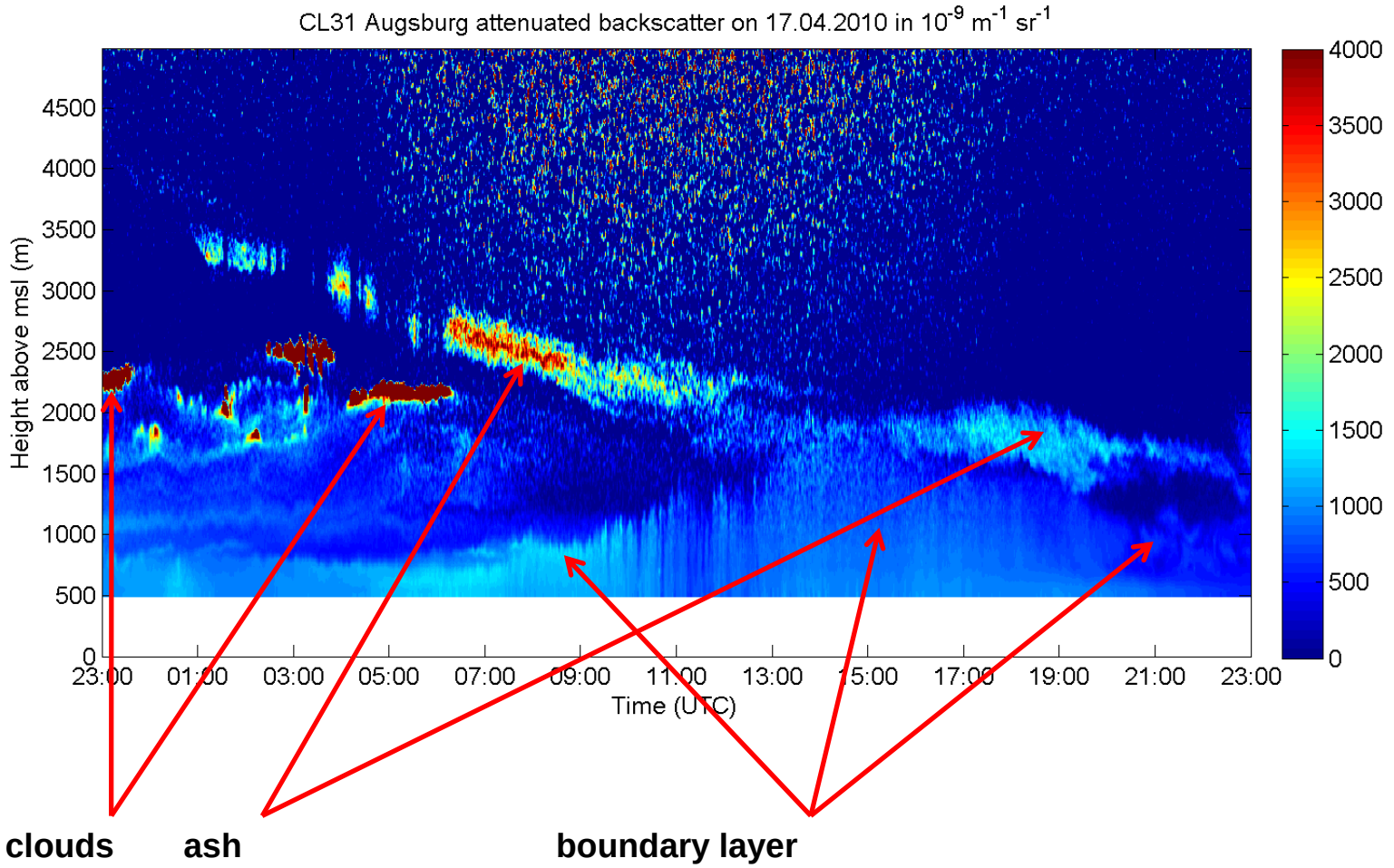
and

MCCM simulations (colours)

model too slow

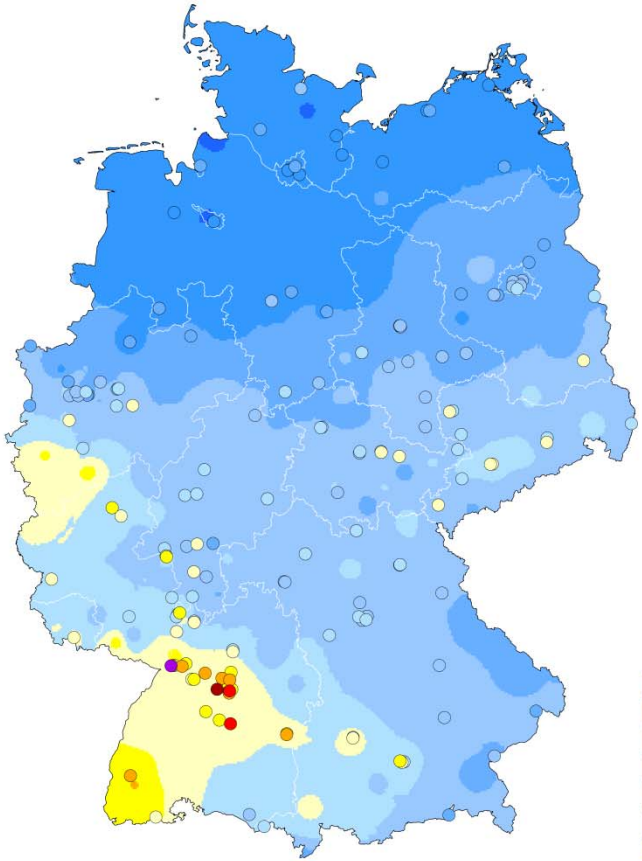
model too fast

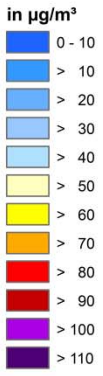
interaction of the ash cloud with the PBL: CL31 observations at Augsburg



Daily mean particle concentration

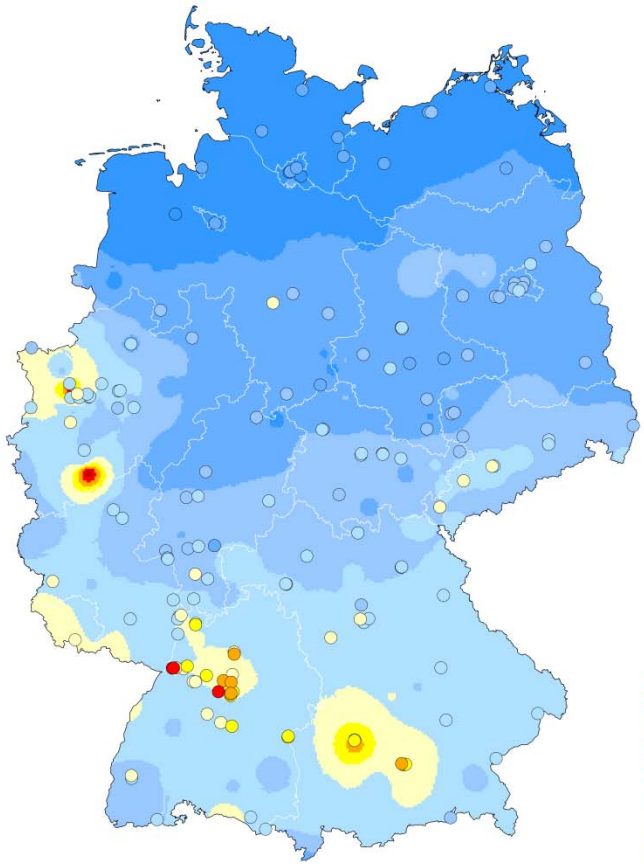
19.04.2010

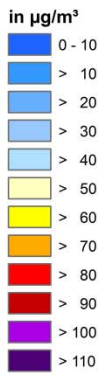


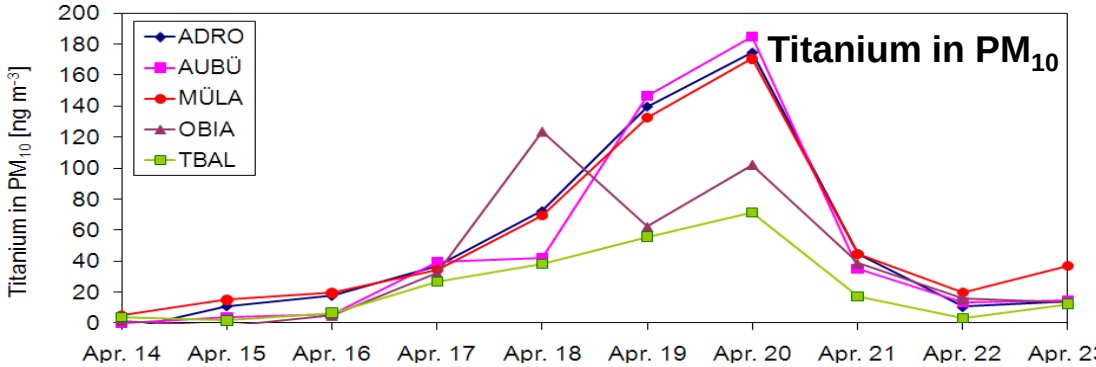


Daily mean particle concentration

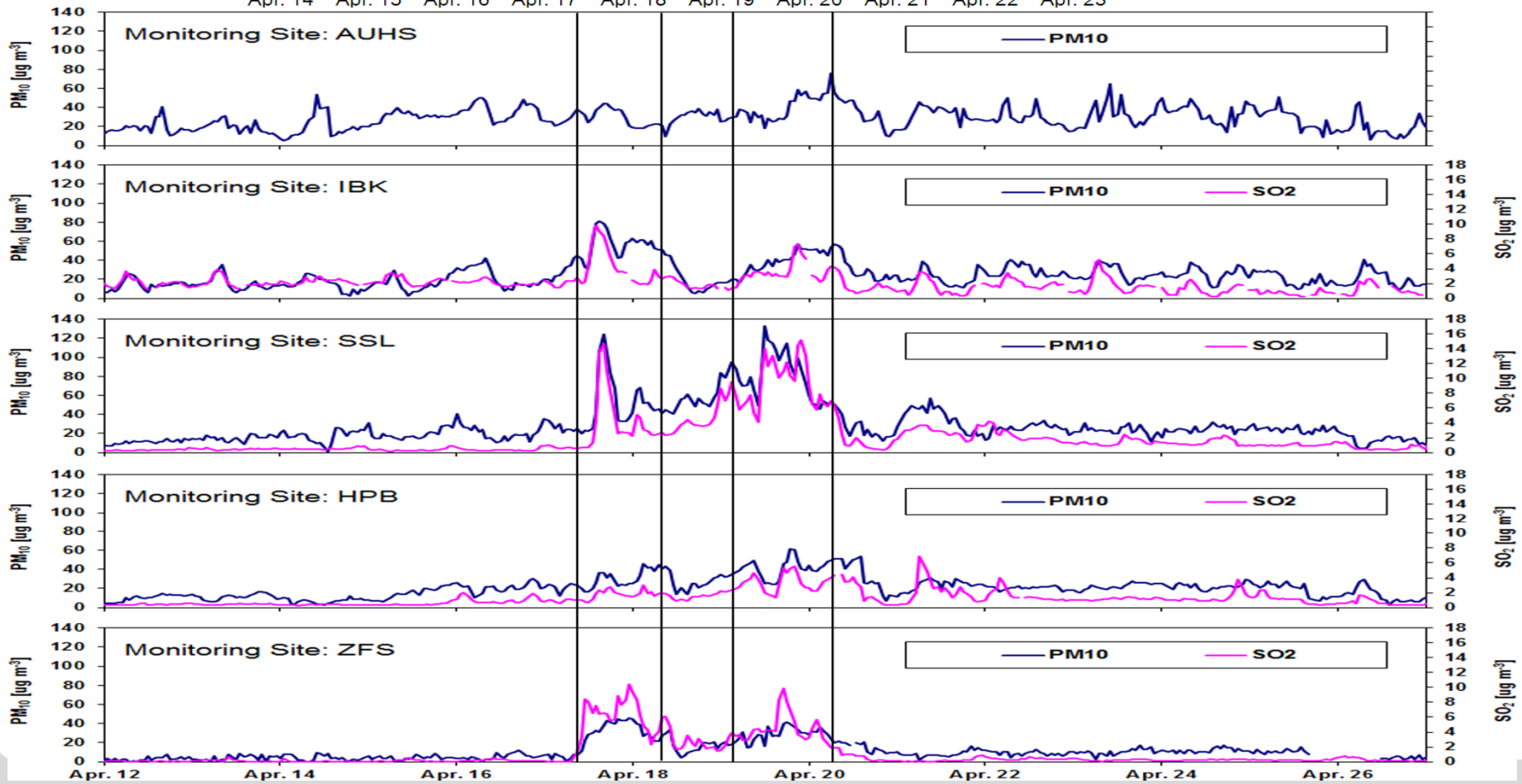
20.04.2010





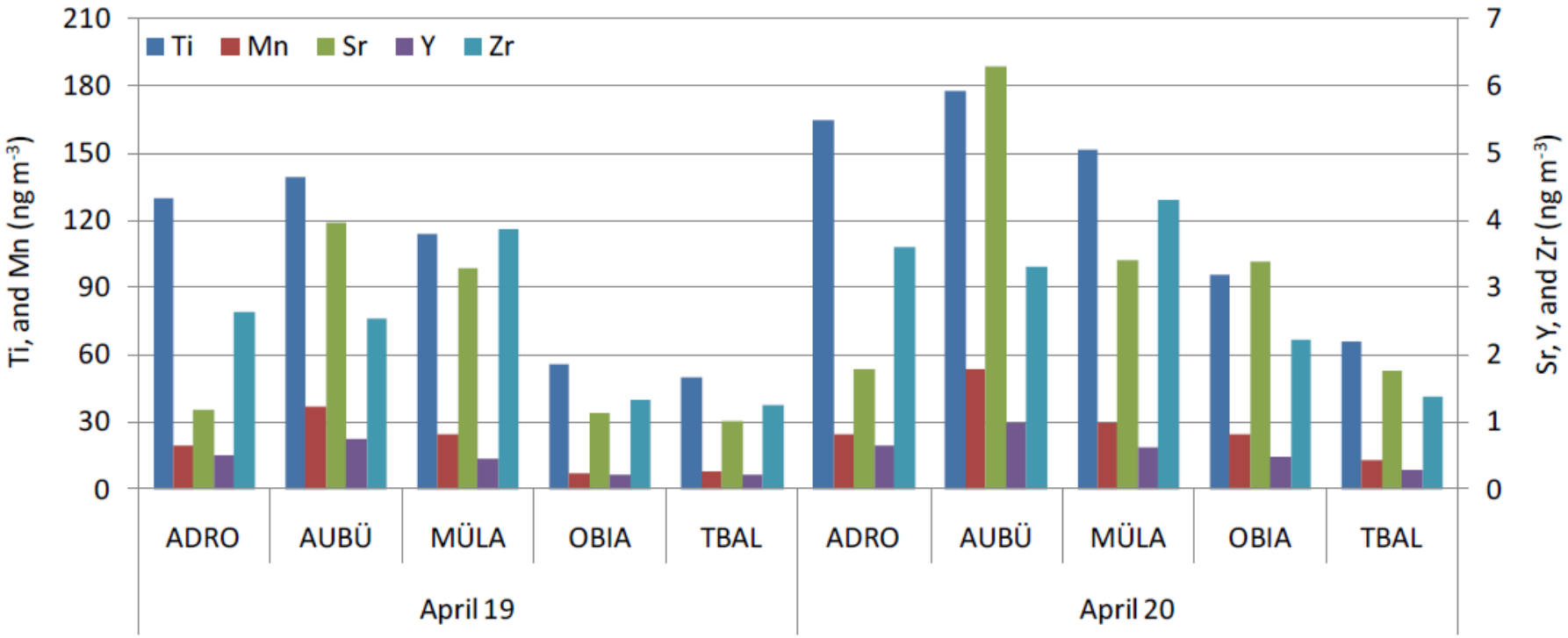


Andechs/Rothenfeld (ADRO),
Augsburg (AUBÜ, AUHS),
München (Landshuter Allee) (MÜLA),
Oberaudorf (OBIA),
Tiefenbach/Altenschneeberg (TBAL)
Innsbruck (IBK)
Schauinsland (SSL)
Hohenpeißenberg (HPB)
Zugspitze (ZFS)



Other substances were enhanced either

Andechs/Rothenfeld (ADRO),
Augsburg (AUBÜ),
München (Landshuter Allee) (MÜLA),
Oberaudorf (OBIA),
Tiefenbach/Altenschneeberg (TBAL)



Conclusions:

The propagation of the ash “front” was traced by the Ceilonet of the German Weather Service and other lidars and ceilometers (in cloudfree areas).

The propagation of the ash cloud was well simulated by the Eulerian model MCCM.
Thus, this study contributed to a validation of this model.

Ash was mixed into the planetary boundary layer, when the daytime CBL reached the ash layers. Orography strongly enhances downward mixing of ash. Earliest reports on near-surface ash measurements were from Alpine stations.

The 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 characteristics (e.g., depolarisation) and from chemical analyses (e.g., titanium).

Fortunately, this outbreak did not have measurable influence on public health, but stronger outbreaks in the past did so. Therefore, an accurate forecast of ash dispersion and downward mixing into the PBL is mandatory.

The full story is available from the following two publications:

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. Discuss., **11**, 9083-9132.

Accepted for Atmos. Chem. Phys.

Acknowledgement:

This investigation and the two papers have been a joint effort of the newly-formed consortium on

aerosol, climate, and health

in Southern Germany.

Partners:

University of Augsburg
Helmholtz Zentrum München, German Research Center for Environmental Health
German Weather Service
Ludwig-Maximilians University Munich
Federal Environmental Agency
Karlsruhe Institute of Technology

Karlsruhe Institute of Technology

Thank you very much for your attention