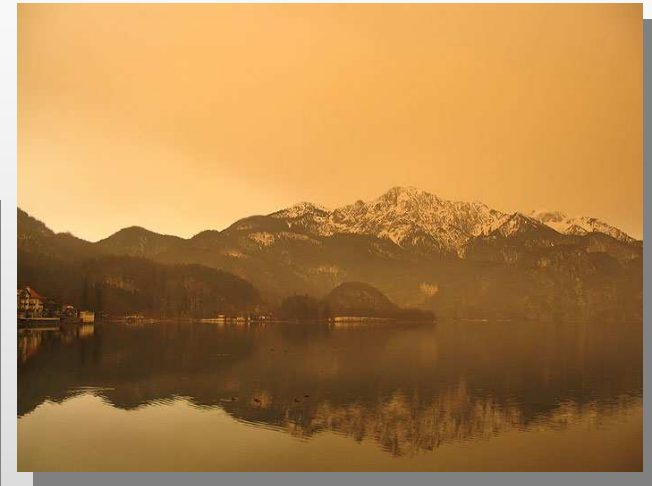
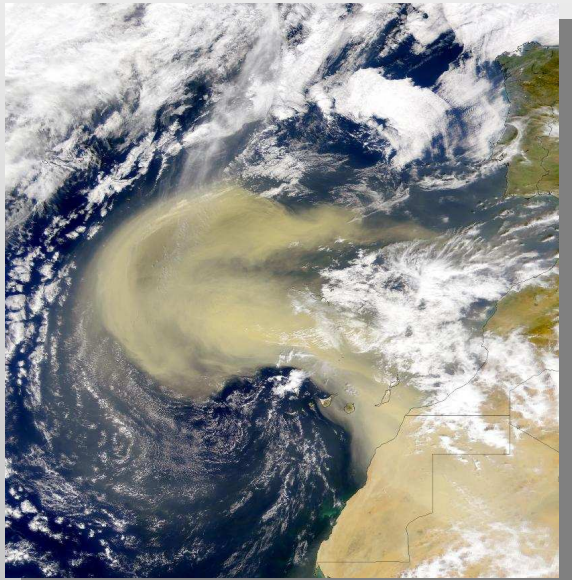


Numerical Simulation of a Saharan Dust Event and its Radiative Impact on the Atmosphere in the COPS Domain



Tanja Stanelle
Tobias Tröndle
Bernhard Vogel
Heike Vogel



7th COPS Workshop
Collège Doctoral Européen
Strasbourg, France, 27 - 29 October 2008



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Relevance of Saharan dust for Europe

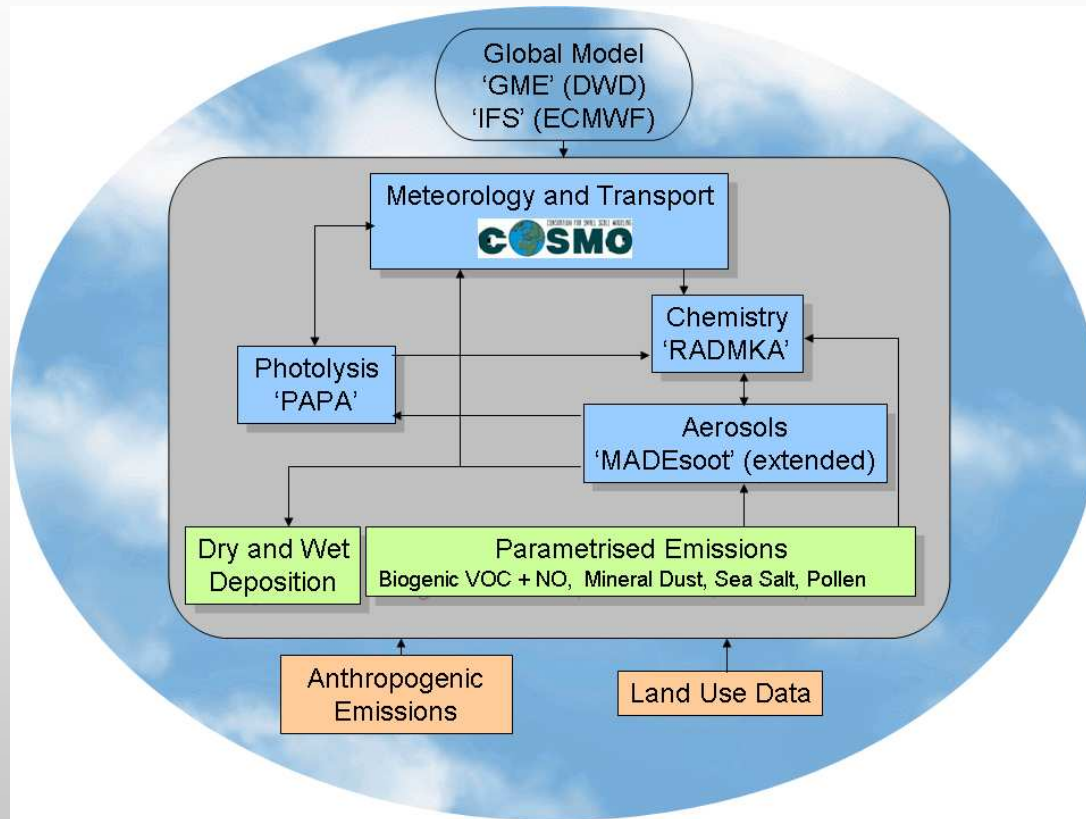
Mineral dust

**contributes to the violations of the PM10 threshold,
modifies the albedo of glaciers in the Alps,
modifies the radiative fluxes,
and modifies the cloud formation.**

Approximately 1 event per month



COSMO-ART (ART = Aerosols and Reactive Trace Gases)



Concept:

COSMO-ART is online coupled.

Identical methods are applied for all scalars as temperature, humidity, and concentrations of gases and aerosols to calculate the transport processes. This includes the treatment of deep convection.

It has a modular structure.

www-imk.fzk.de/tro/ACP/



= operational weather forecast model (DWD)



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Treatment of the aerosol particles

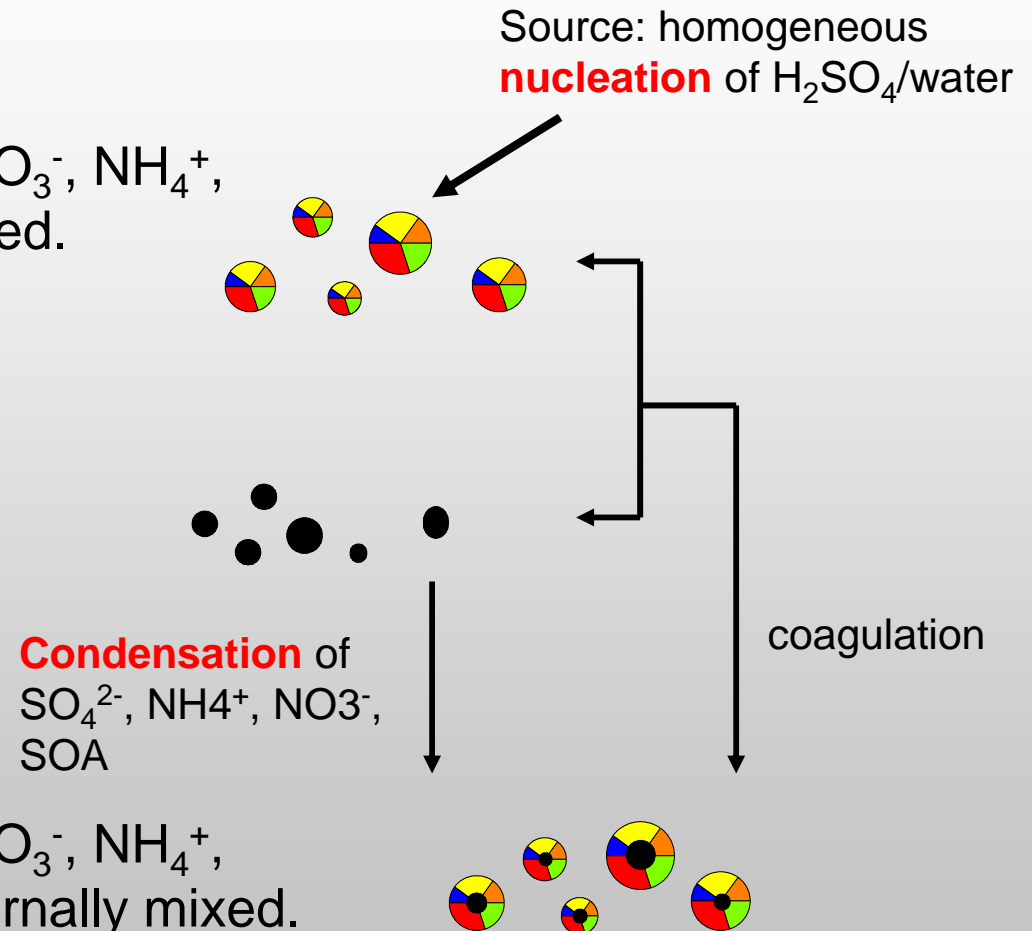
Three modes for mineral dust particles + for **sea salt** particles

Interaction of five modes:

- **Two modes** for SO_4^{2-} , NO_3^- , NH_4^+ , H_2O , SOA, internally mixed.

- **One mode** for pure soot.

- **Two modes** for SO_4^{2-} , NO_3^- , NH_4^+ , H_2O , SOA, and soot internally mixed.



Feedback with radiation

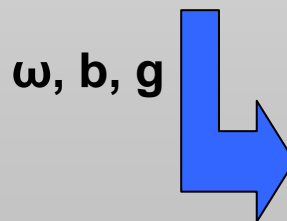
refractive index of aerosols

Mie ↓ calculations

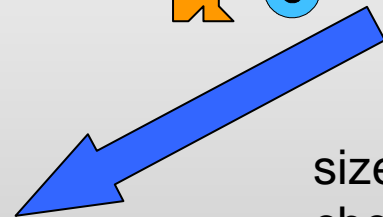
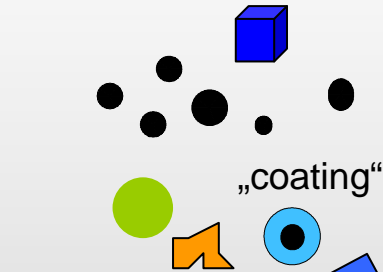
single scattering albedo (ω),
specific extinction coefficient (b_s),
asymmetry parameter (g)



computation of ω , b , g for
prevailing aerosol concentration

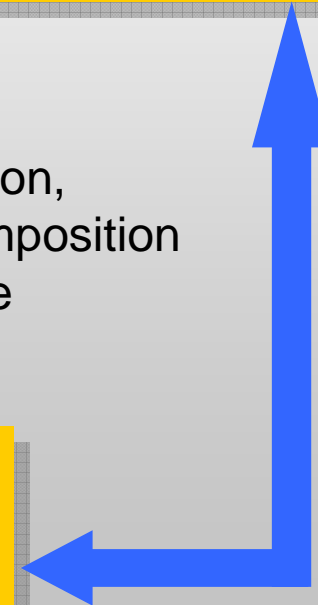


substitution of climatological optical
properties based on current aerosol
concentrations



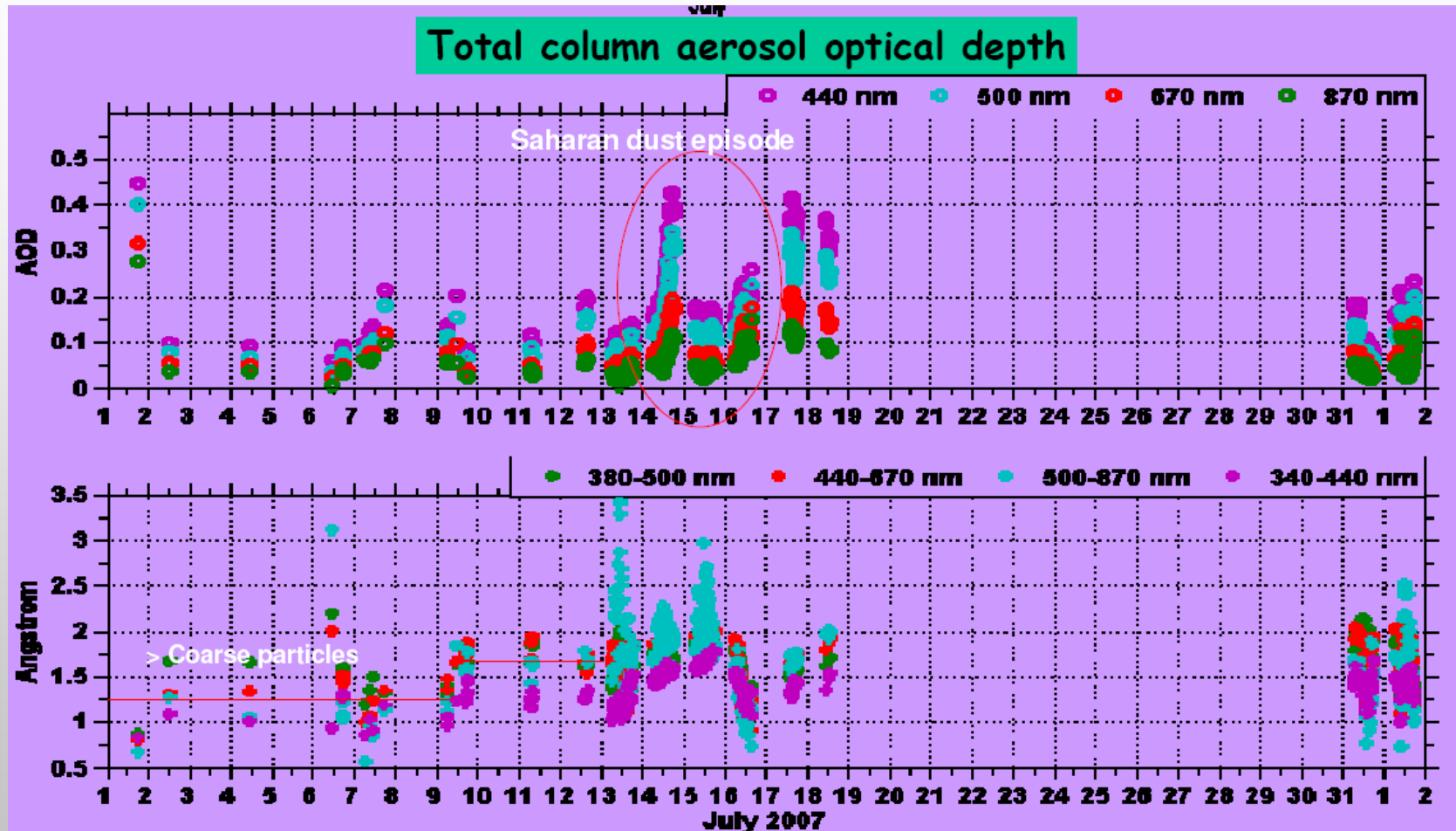
size distribution,
chemical composition
of each mode

emissions, transport,
transformations,
sedimentation,
deposition



Observations

VOSGES SUPER SITE (SS): at Meistratzheim (48.4°N 7.5° E 161m)



Cuesta et al., 2007

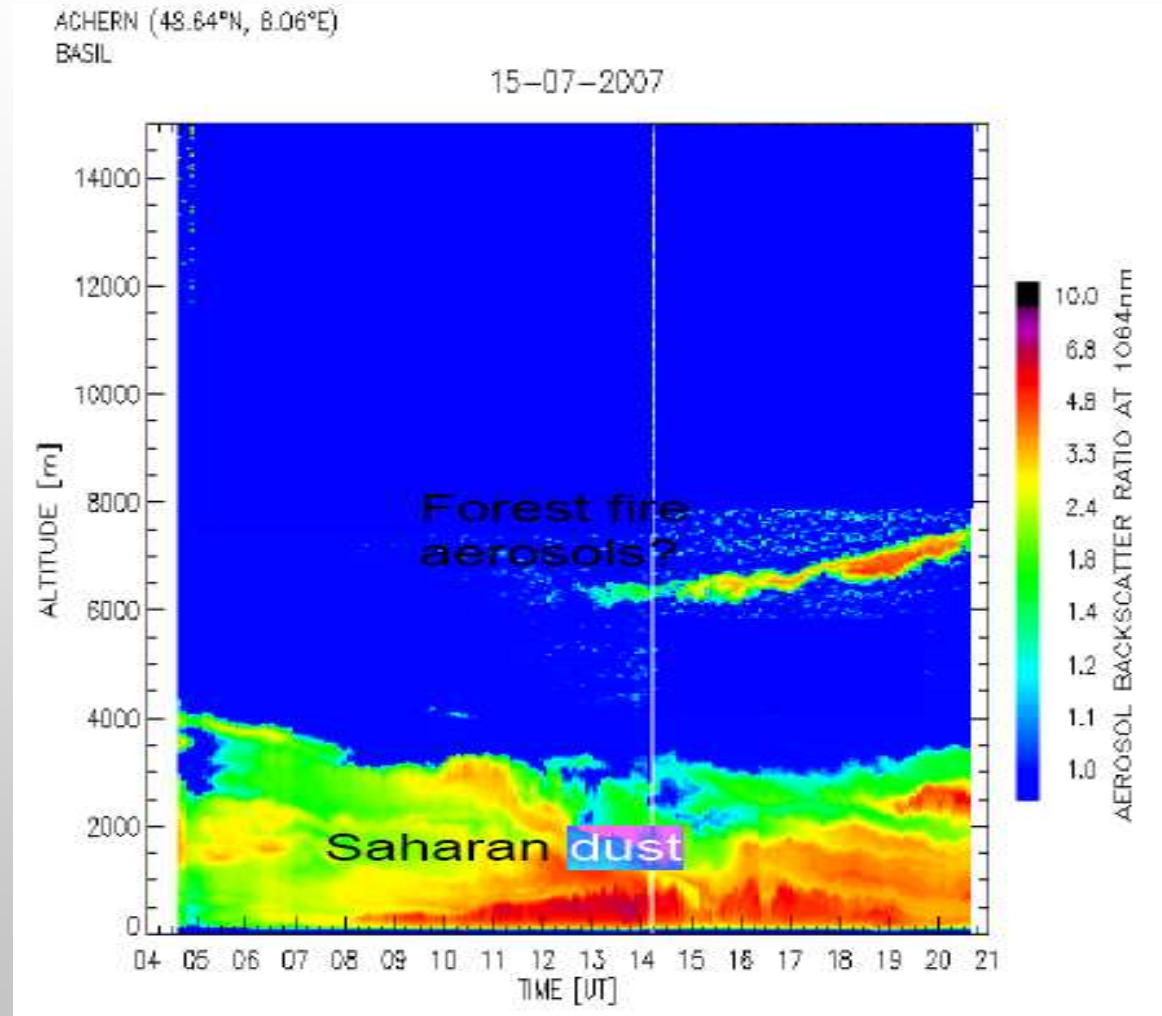


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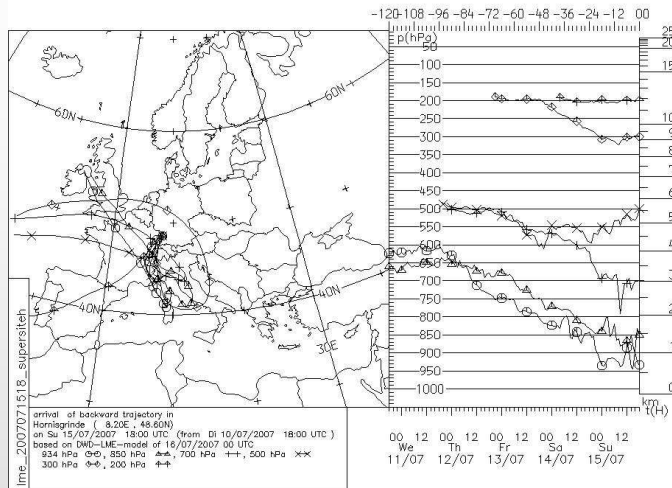


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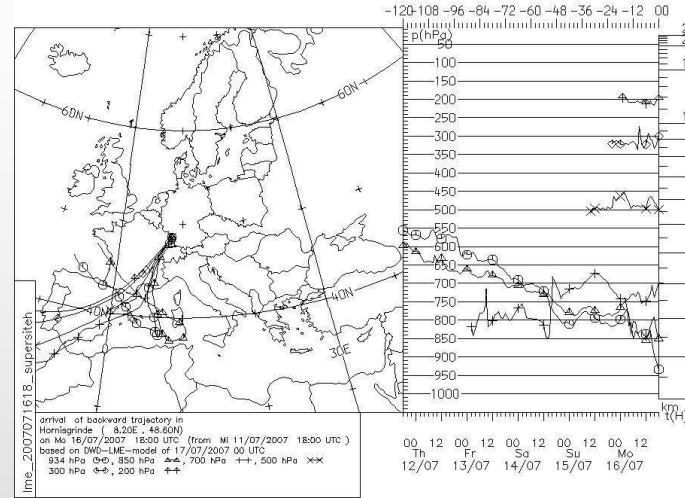
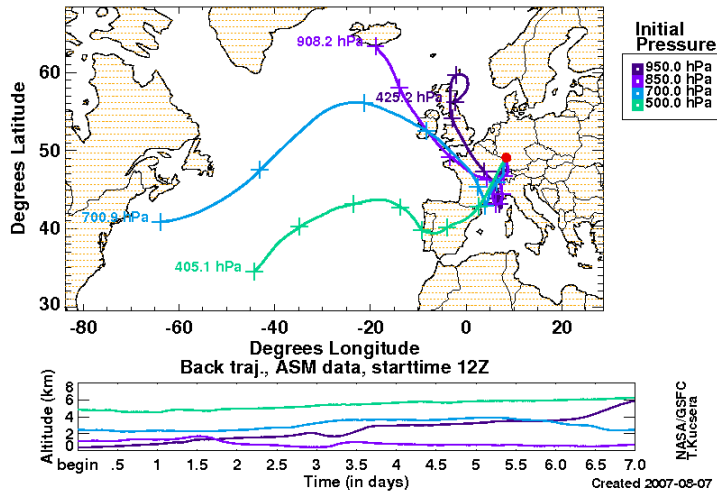
Observations (BASIL)



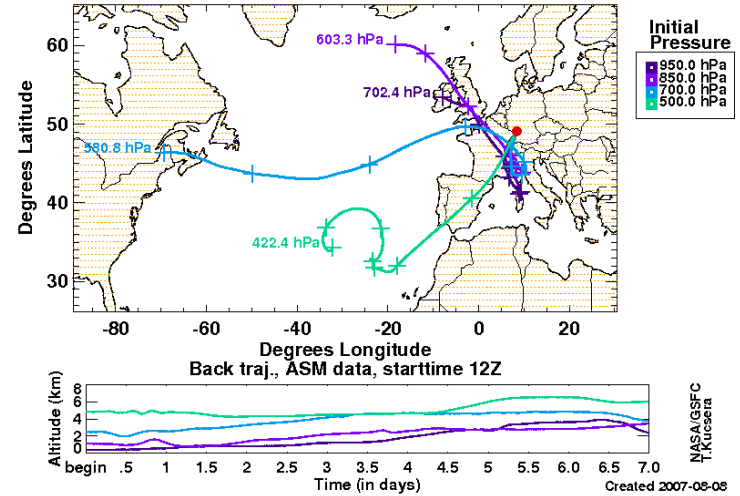
What do trajectories tell us?



Starting Location Station (red dot): Karlsruhe
7-Day Back-Trajectories: kinematic, 2007-07-15T12:00:00



Starting Location Station (red dot): Karlsruhe
7-Day Back-Trajectories: kinematic, 2007-07-16T12:00:00

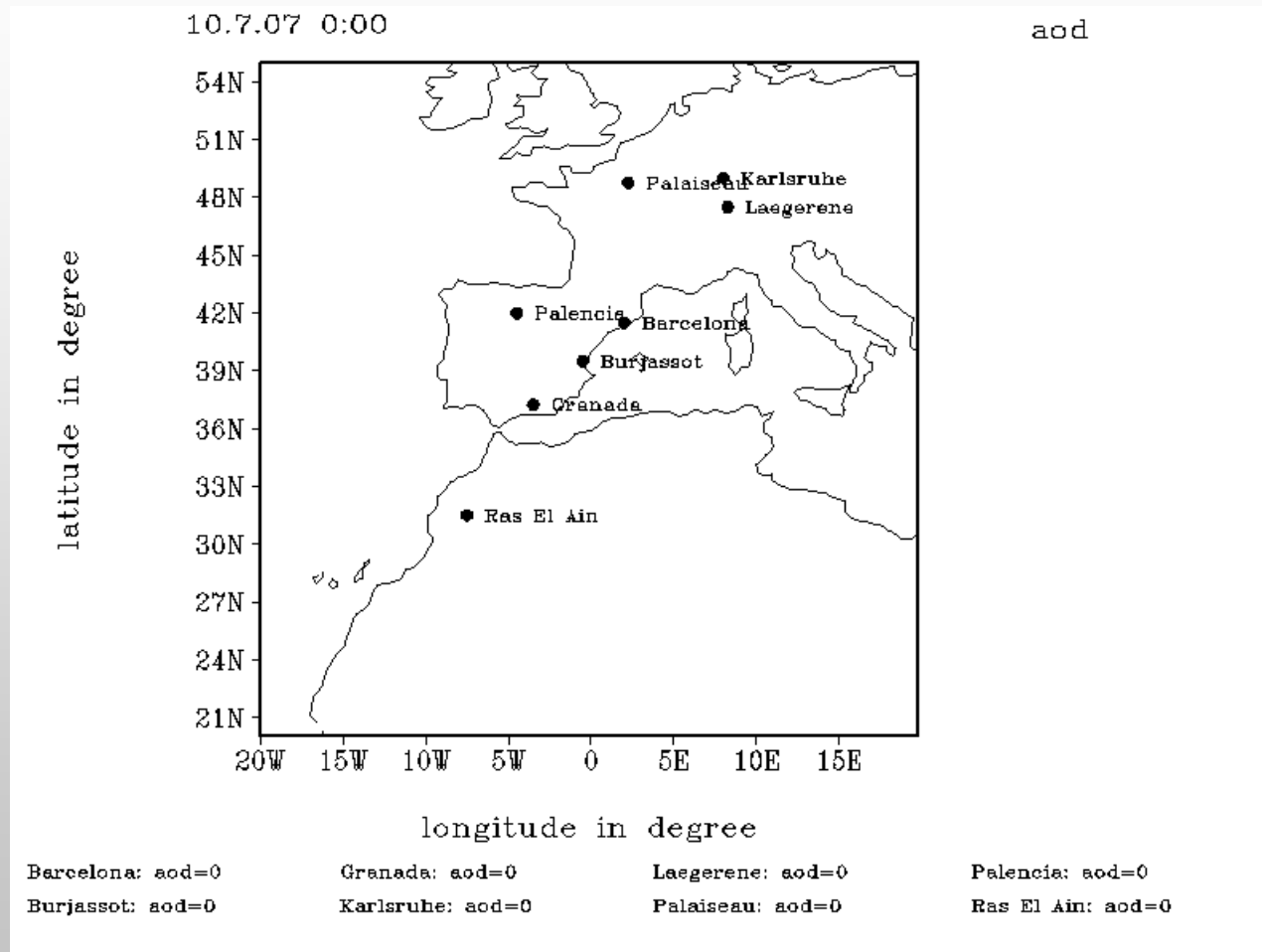


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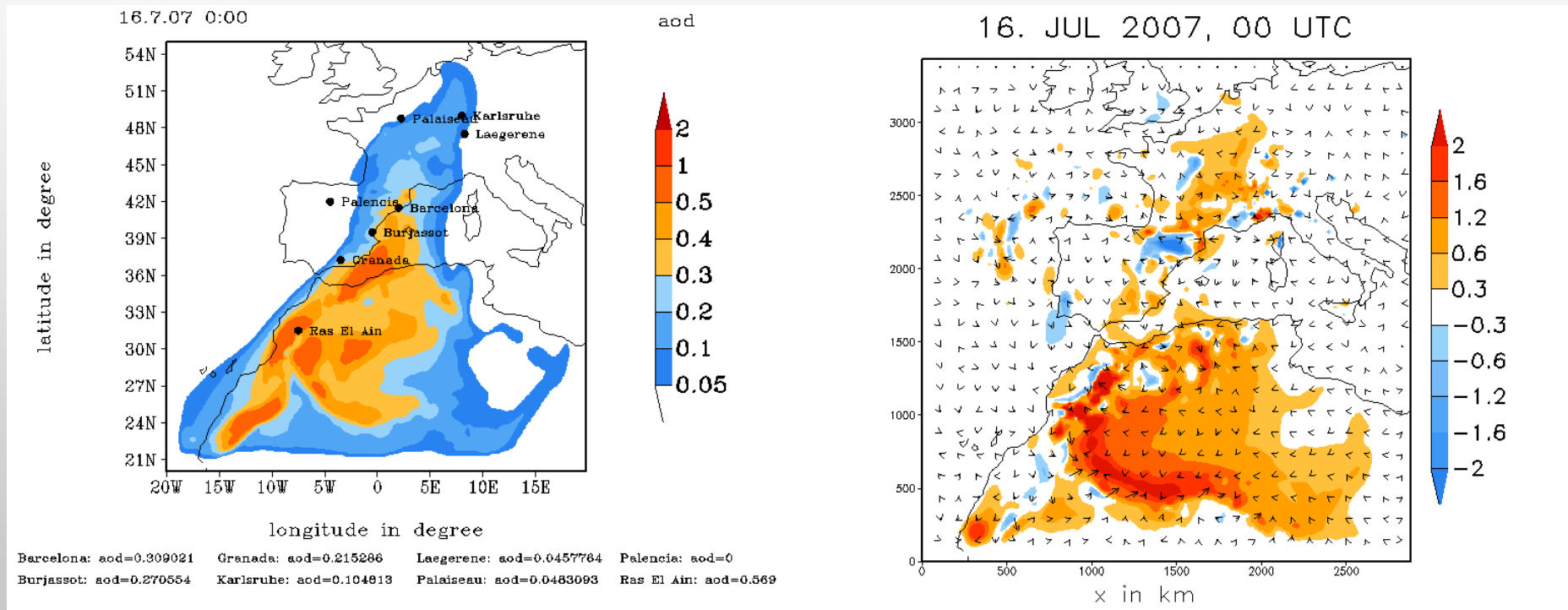
Simulated AOD



Simulated AOD and temperature difference

AOD

ΔT in K



Conclusion

Our model results show that mineral dust reaches the COPS domain in the early afternoon of July, 15th 2007.

If the model is right what kind of aerosols have we observed before that point of time?

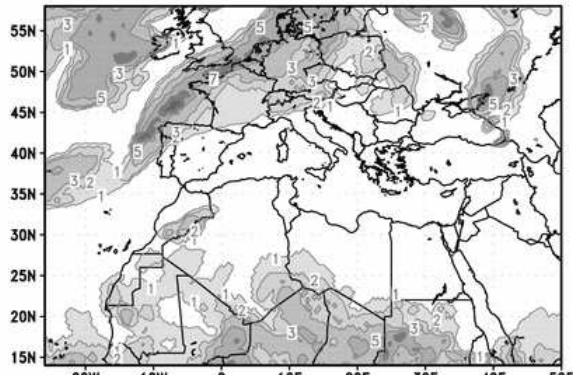
The model results show that mineral dust causes differences in temperature of up to one K although the interaction with cloud physics is neglected so far.



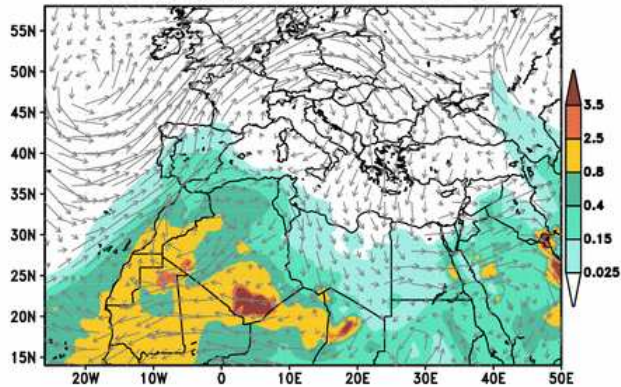
Results of the DREAM model

<http://www.bsc.es/projects/earthscience/DREAM>

BSC/DREAM Total Cloud Cover
0h forecast for 12z 14 JUL 07

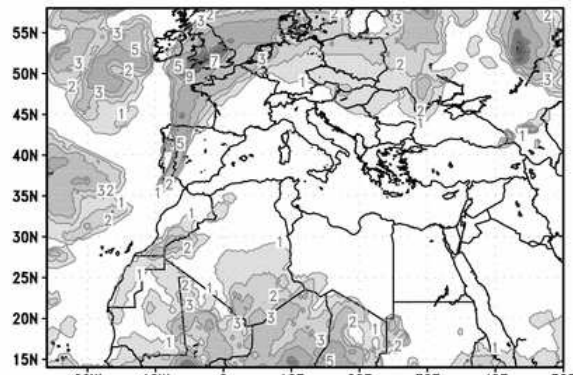


BSC/DREAM Dust Opt. Depth 550nm and 3000m Wind
0h forecast for 12z 14 JUL 07

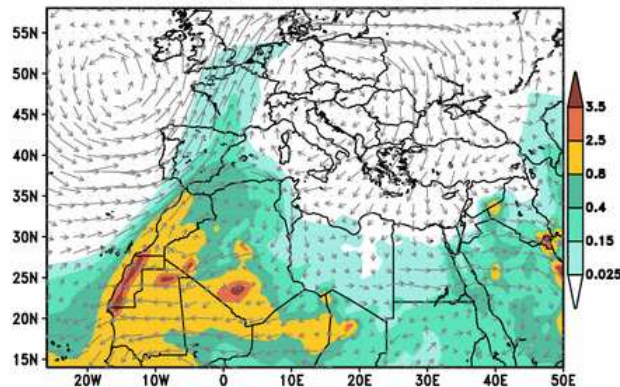


<http://www.bsc.es/projects/earthscience/DREAM>

BSC/DREAM Total Cloud Cover
0h forecast for 12z 15 JUL 07

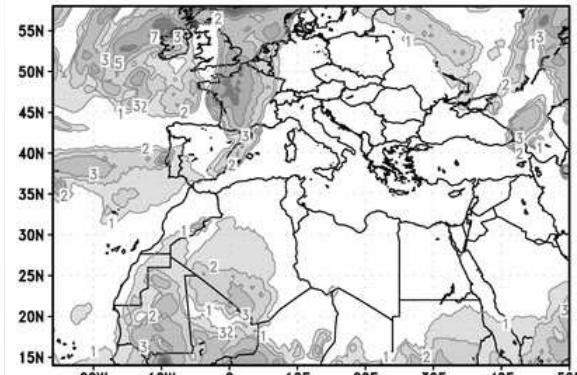


BSC/DREAM Dust Opt. Depth 550nm and 3000m Wind
0h forecast for 12z 15 JUL 07



<http://www.bsc.es/projects/earthscience/DREAM>

BSC/DREAM Total Cloud Cover
0h forecast for 12z 16 JUL 07



BSC/DREAM Dust Opt. Depth 550nm and 3000m Wind
0h forecast for 12z 16 JUL 07

