The impact of using different climatology approaches and AERONET information on MAX-DOAS profiling results retrieved by BOREAS during CINDI2

Tim Bösch[1], Andreas Richter[1], Marijn de Haij[2], Bas Henzing[3], Arnoud Apituley[2], Mirjam den Hoed[2], Jan Vonk[4], François Hendrick[5], Marc Allaart[5], Henk Klein Baltink[2], CESAR team , and John P. Burrows[1]

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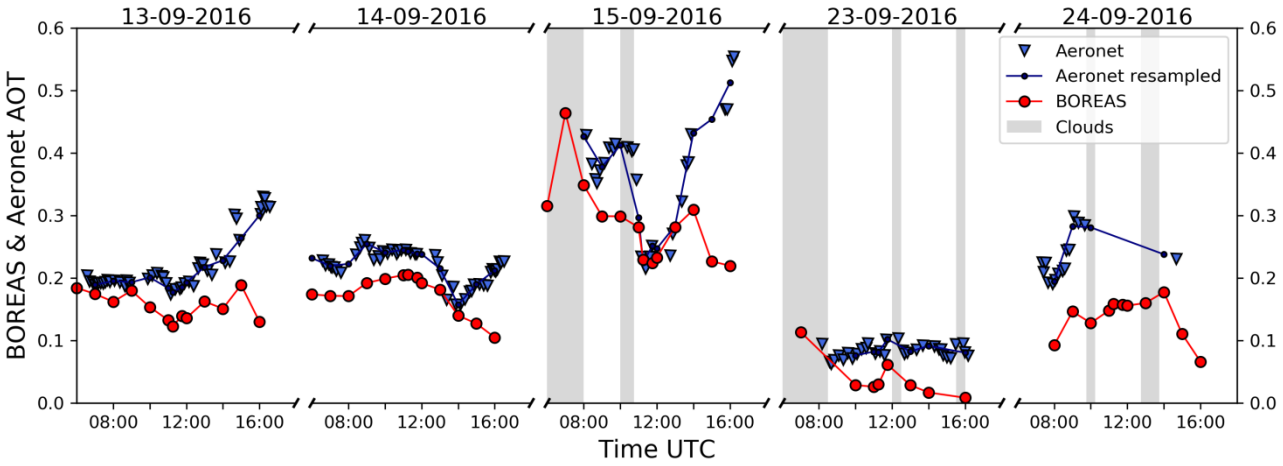
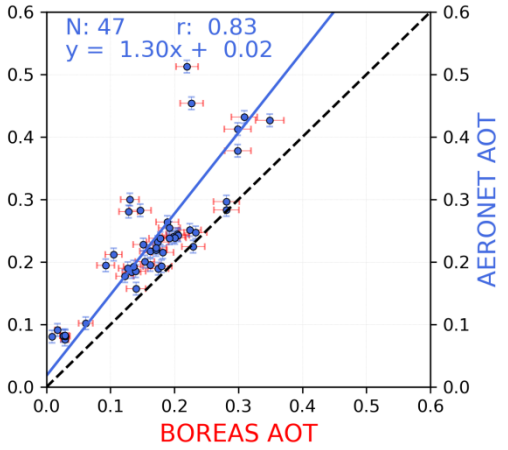
1 Institute of Environmental Physics, University of Bremen, Bremen, Germany
2 Royal Netherlands Meteorological Institute (KNMI), De Bilt, the Netherlands
3 Netherlands Organization for Applied Scientific Research (TNO), Utrecht, the Netherlands
4 National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands
5 Royal Belgian Institute for Space Aeronomy (BIRA-IASB), Brussels, Belgium

Paper results

Bösch et al. 2018, AMT (https://doi.org/10.5194/amt-11-6833-2018)





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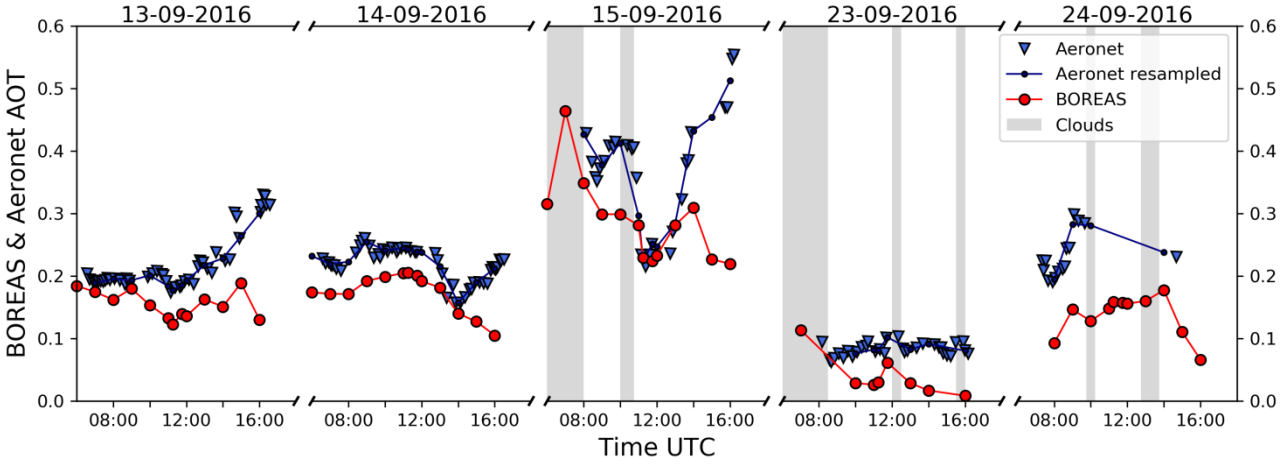

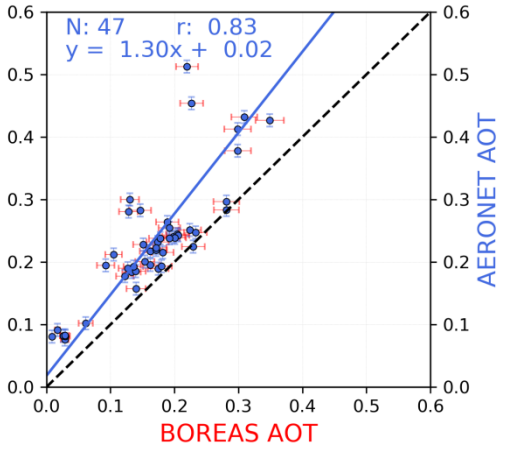

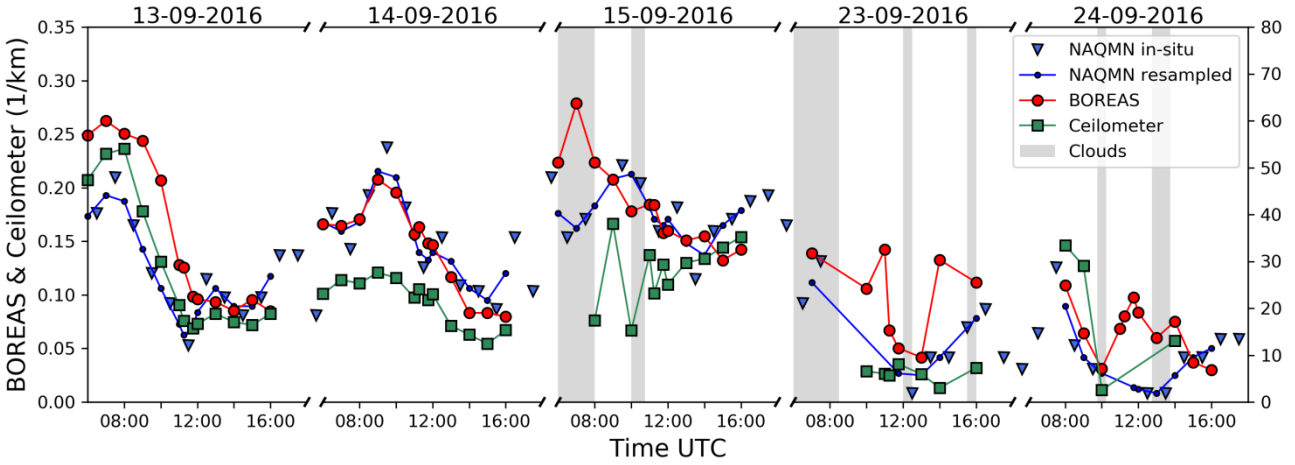

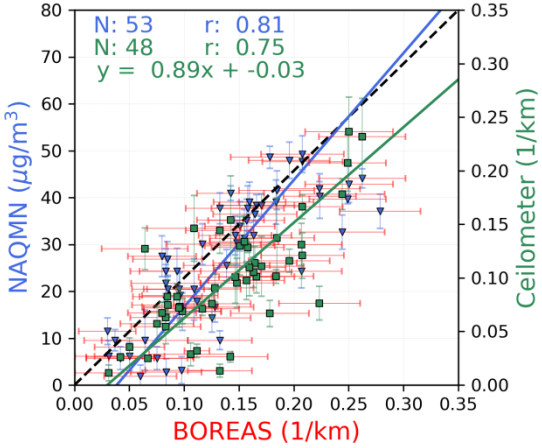

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Settings

a priori profile : exponential (SH = 1km, AOT = 0.18) + pre-scaling

Aerosol parametrization

Henyey-Greenstein
Asymmetry factor 0.68
SSA: 0.92

September variability

Asymmetry factor	
Mean	0.725
Min	0.659
Max	0.796
Single scattering albedo	
Mean	0.944
Min	0.902
Max	0.984

AERONET lev2 Almucantar

Climatology

Mean sonde profiles
(16 sonde, 2013 - 2015)

15.09

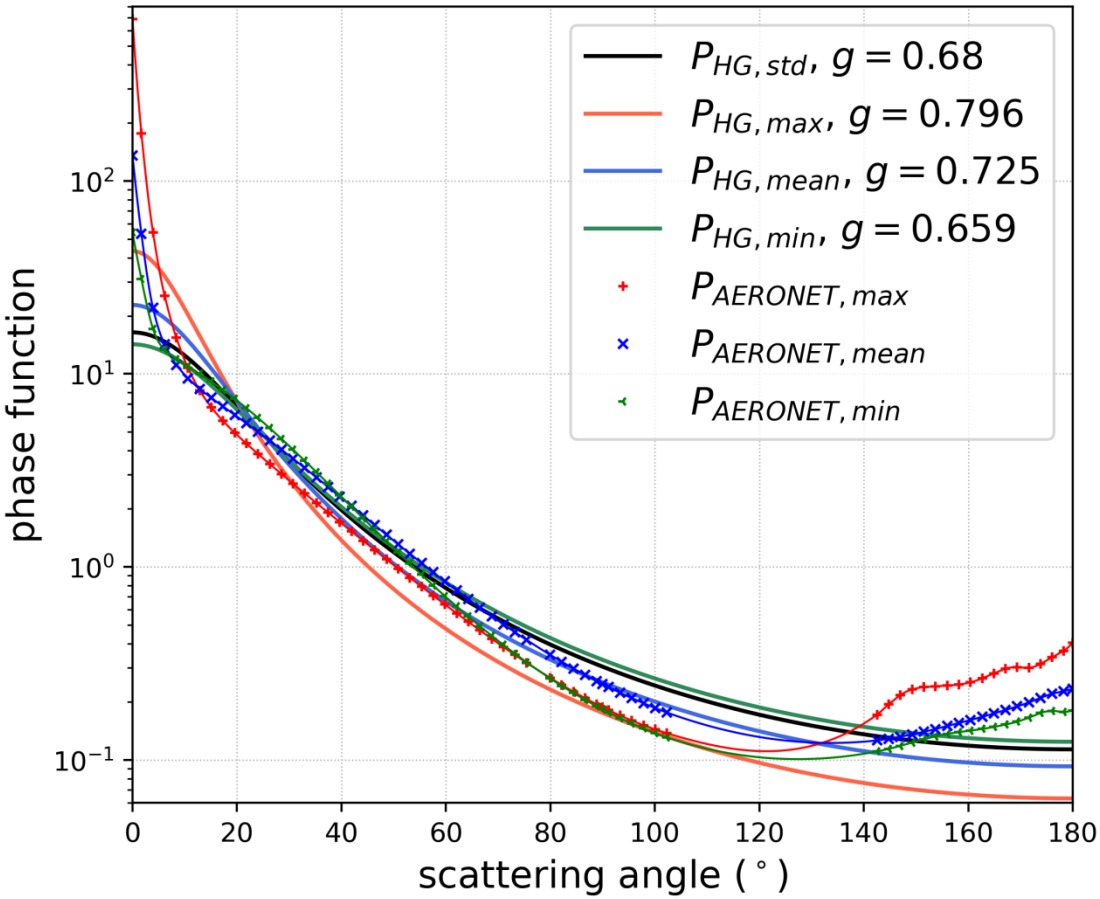
US standard, NO_2 &
KNMI sonde, surface
extrapolation (CESAR)

Phase function comparison

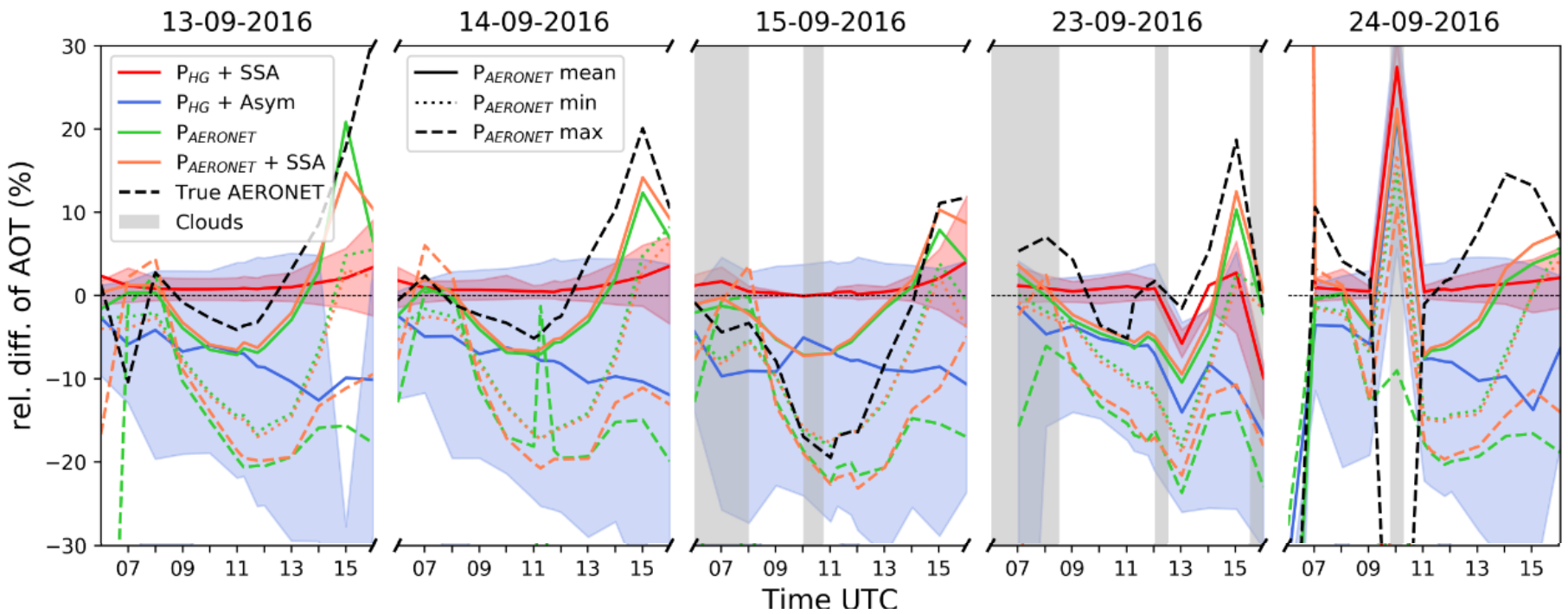
- g = 0.68 closer to the minimum than the mean

→ Overestimation for backward scattering and underestimation for forward scattering.

- Henyey Greenstein leads to a strong underestimation in forward and backward scattering directions.



Results with different phase functions



$$\text{rel. diff. of AOT} = \frac{\text{AOT}_{\text{paper}} - \text{AOT}_{\text{new}}}{\text{AOT}_{\text{new}}}$$

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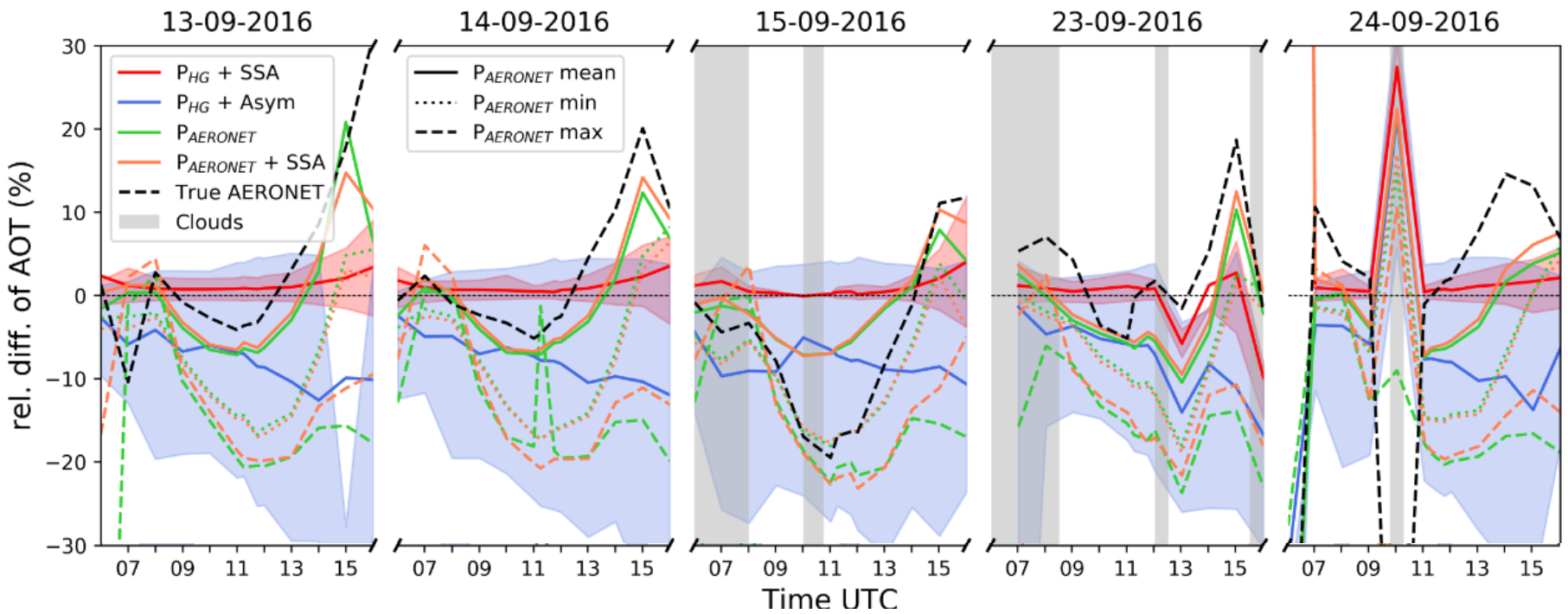

Henyey Greenstein + SSA and asym. factor changed (min, max, mean)

- P_{HG} + SSA: Differences up to 12%, especially in the afternoon (forward scattering)
- P_{HG} + Asym: Differences up to -41% → g = 0.68 leads to large underestimations!

Aeronet phase function (min, max, mean) + SSA changed (min, max, mean)

- $P_{AERONET}$: Deviations largest around noon: -25%, afternoon: -20%, morning: < +- 13%
- $P_{AERONET}$ + SSA: Similar to explanation above → SSA leads to small deviations

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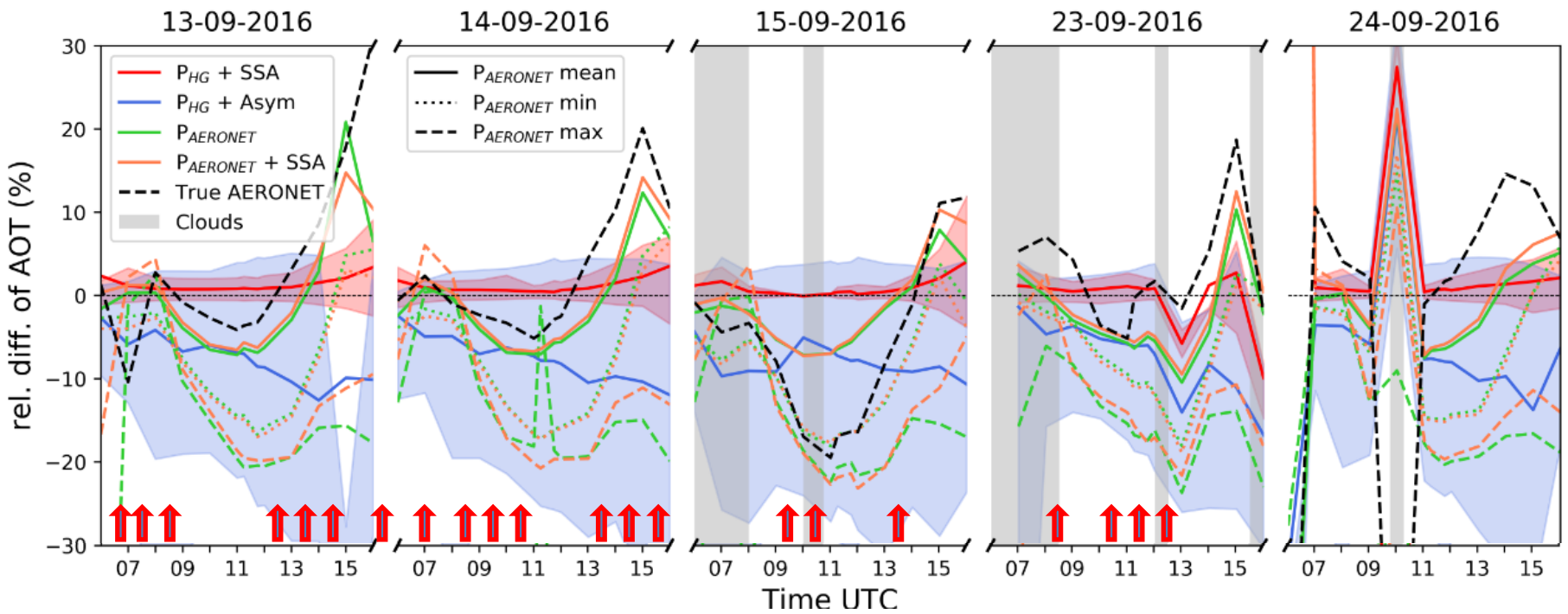

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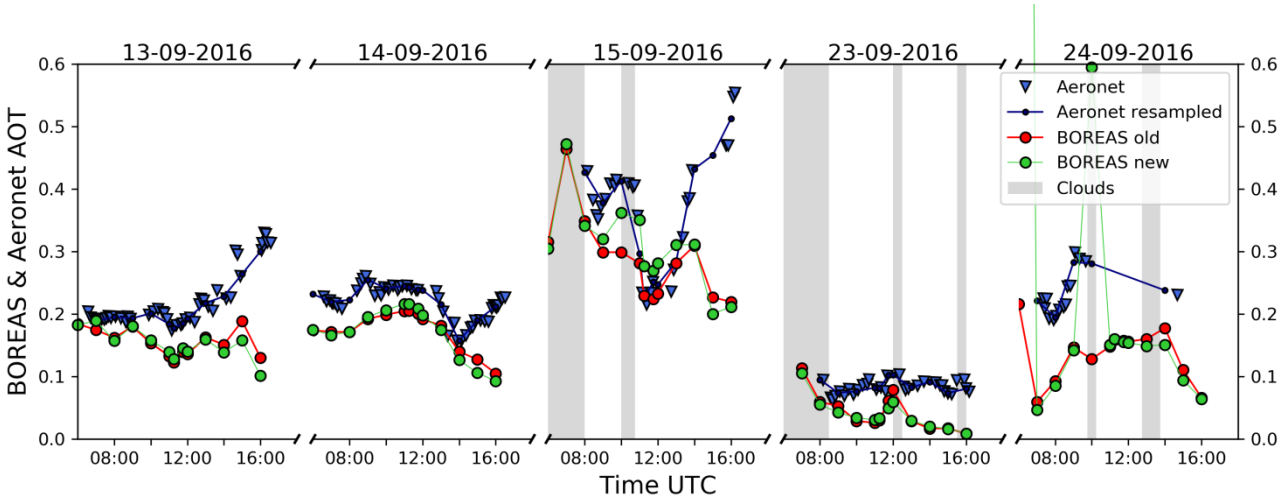
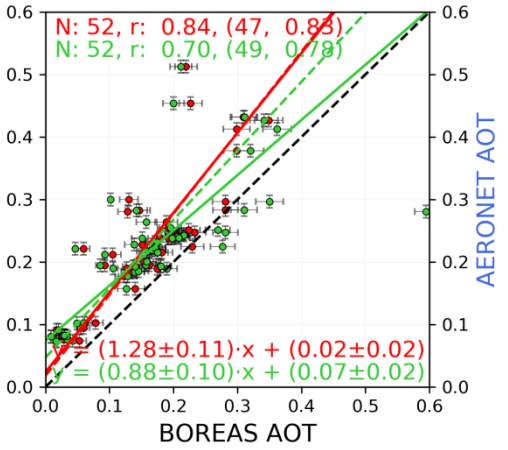
Aeronet phase function (min, max, mean) + SSA changed (min, max, mean)

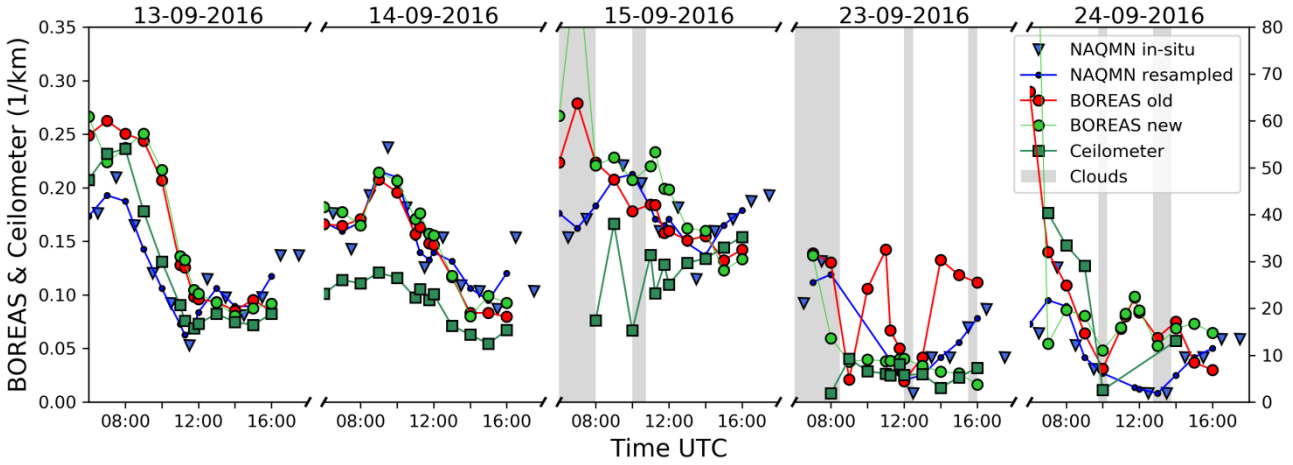
- $P_{AERONET}$: Deviations largest around noon: -25%, afternoon: -20%, morning: < +- 13%
- $P_{AERONET}$ + SSA: Similar to explanation above → SSA leads to small deviations
- True AERONET (7 pts. 13. – 14, 3 pts. 15., 4 pts. 23. marked as ⇑):
  Phase function & SSA closest in time: → +-20% (exception 13.09 16:00)

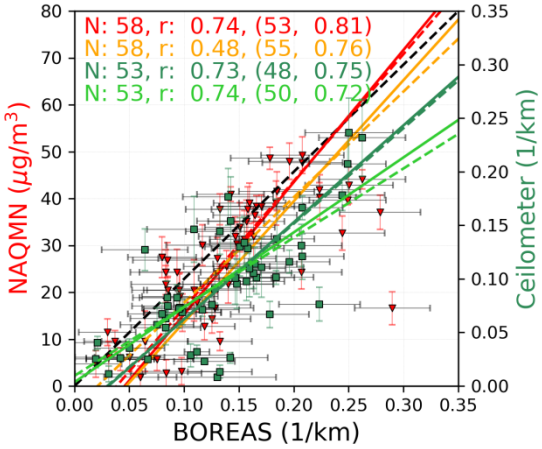
Paper results vs new aerosol retrieval

Bösch et al. 2018, AMT (https://doi.org/10.5194/amt-11-6833-2018)

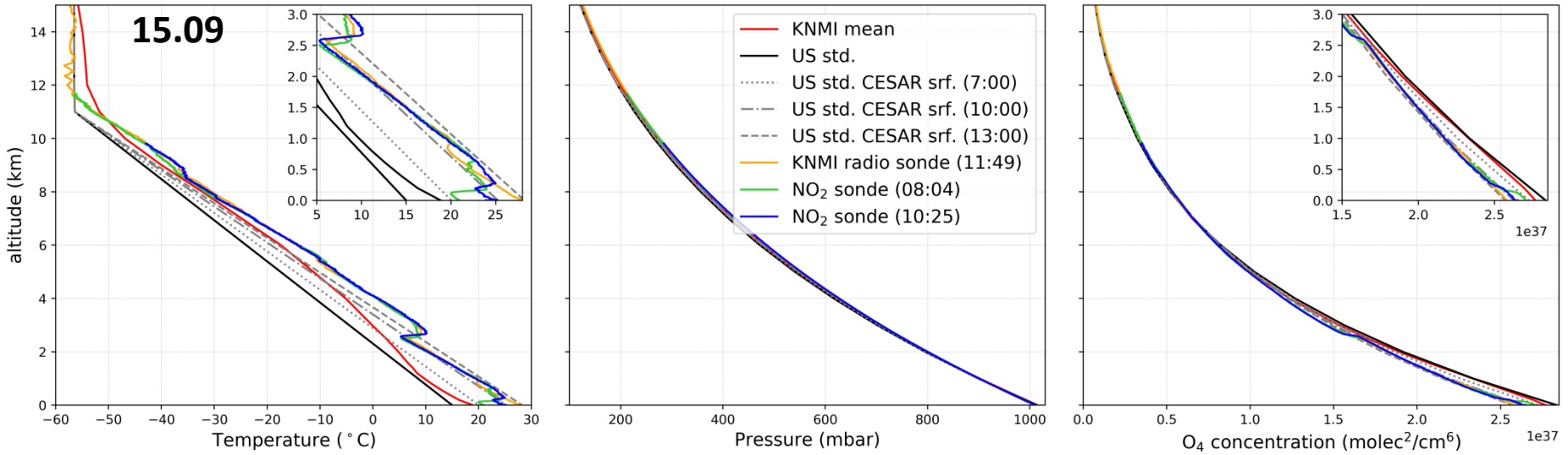








Different climatologies



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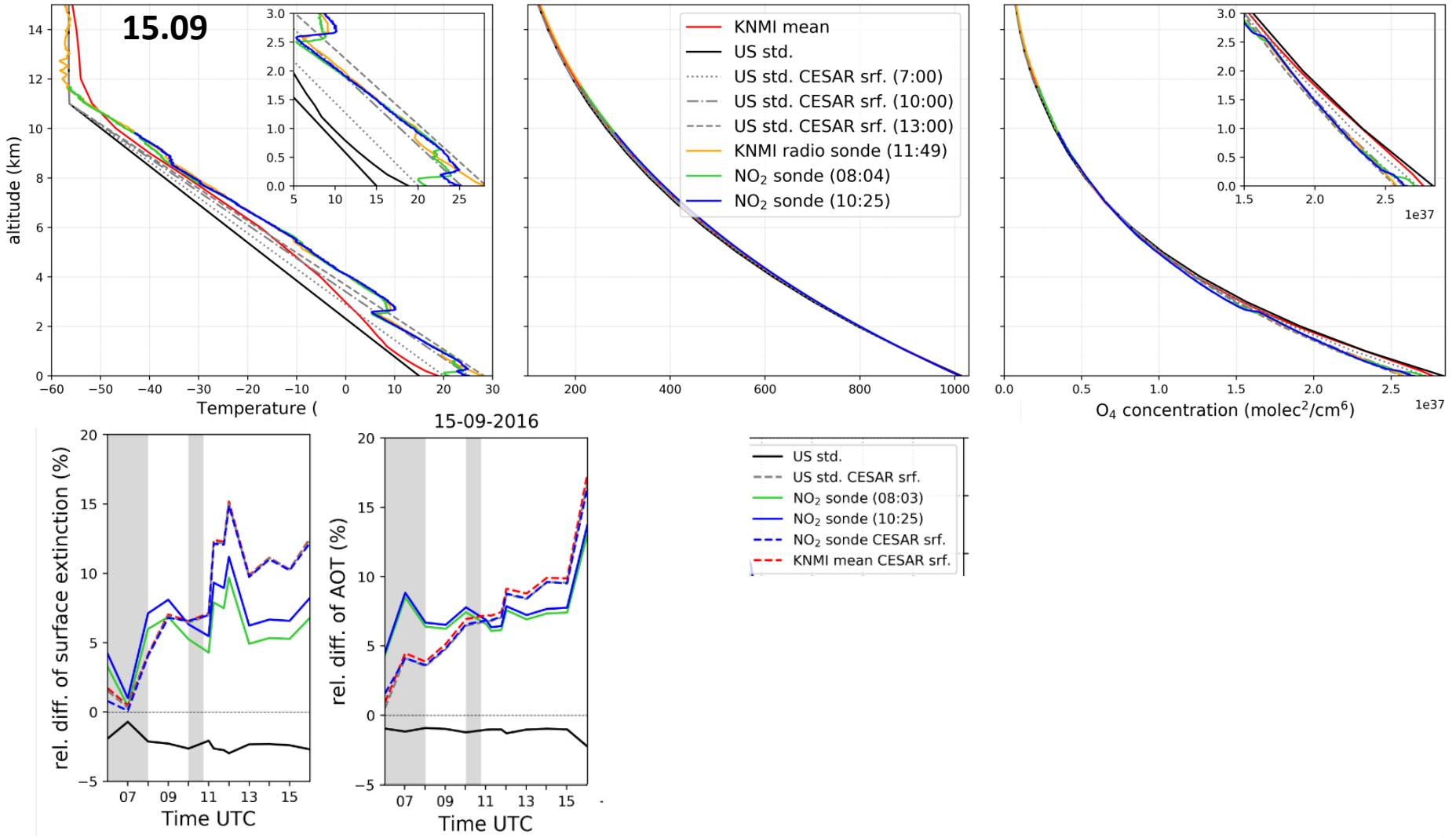

Rel. differences are always positive (except US std.) leading to lower AOT and srf. extinctions

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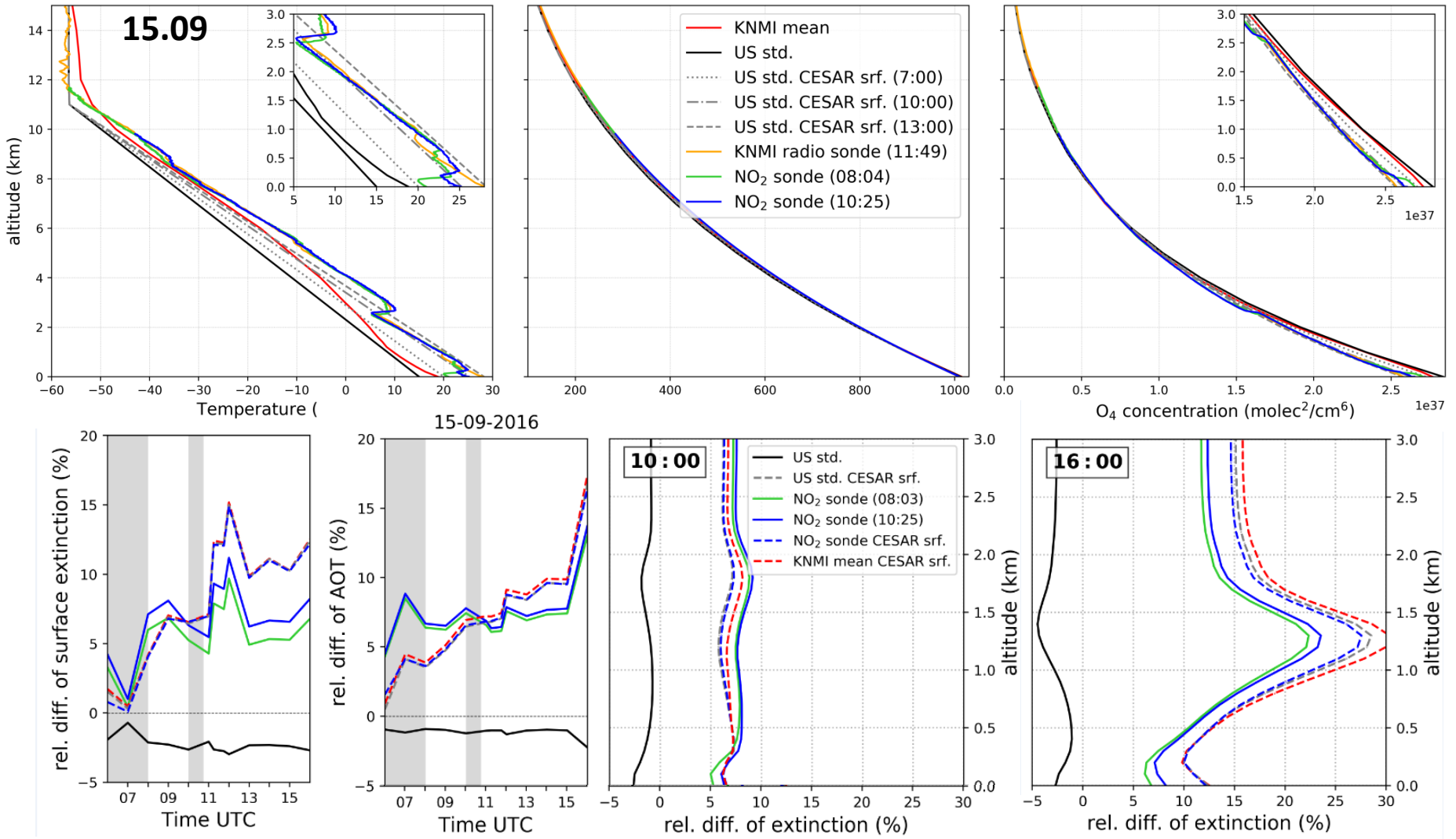

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Conclusion

Aerosol parameter

- AERONET aerosol parameter closest in time should be used
- AERONET **monthly mean** values are also reliable
- **Annual mean** values should be avoided (when possible)

Climatology

- Pressure and temperature profiles closest in time might increase the underestimation of MAX-DOAS compared to AERONET
- Mean climatology data could be used but large deviations to an „optimal“ result are possible
- Model data could be used as well but near real-time retrieval are then impossible