

Project: 1300

Project title: **urbisphere — coupling dynamic cities and climate**

Principal investigator: **Swen Metzger, Andreas Christen**

Report period: **2023-05-01 to 2024-04-30**

Aim of this study is to investigate the effect of different horizontal resolutions on model results, using various ERA5 nudging data, i.e., down from approximately 300 km to 25 km.

Initial results have been presented at the EMAC Symposium 2021: “On the influence of aerosol hygroscopic growth on meteorology using model data — from global to urban scales”, Metzger, Swen, Feigel, Gregor, Steil, Benedikt, Rémy, Samuel, Christen, Andreas, Grimmond, Sue (<https://doi.org/10.5281/zenodo.4902248>).

TABLE: AOD change [%] – global station mean for different experiments (see text).

| Location | Global/mixed | Global/mixed | Global/mixed | Global/mixed | Global/mixed | Global/mixed |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Ref | OBS – CAMS | OBS – EMAC* | CAMS – EMAC* | Exp1 – Exp2 | Exp1 – Exp3 | Exp1 – Exp4 |
| Res | 60 vs 55 km | 60 vs 55 km | T255 vs T255 | T42 vs T42 | T42 vs T42 | T42 vs T42 |
| AW | yes – no | yes – yes | no – yes | yes – no | yes – yes | yes – no |
| Free | N/A – no | N/A – no | no – no | no – no | no – yes | no – yes |
| Npoints | 19237 | 19237 | 19237 | 22277 | 22277 | 22277 |
| Δ [%] | -8.75 | 16.63 | 23.34 | 19.26 | -37.90 | -22.73 |
| Europe | Urban/City | Urban/City | Urban/City | Rural/Coast | Rural/Coast | Rural/Coast |
| Exp | Exp1 – Exp2 | Exp1 – Exp3 | Exp1 – Exp4 | Exp1 – Exp2 | Exp1 – Exp3 | Exp1 – Exp4 |
| Npoints | 773 | 773 | 773 | 303 | 303 | 303 |
| Δ [%] | -31.57 | 30.59 | 9.47 | -31.95 | 29.10 | 0.98 |

Here we continued on our pre-study by repeating the simulations using a new setup for Levante.

Activities during the current grant period

During 2023-05-01 to 2024-04-30 the granted node hours have been used completely to set-up, debug and start the intended simulations, i.e., T42, T63, T106, T255 and T511 (all with L31).

However, we had not enough node hours to complete our set-up. Particularly, the T511 simulations are very CPU-time demanding, which partly results of a not fully optimised model configuration and too long initialisation phase, which we need to improve before we can continue with these high-resolution runs as initially planned. As a result, we could only perform for T511, one additional week (after spin-up) for each experiment, while for all other resolutions we managed to perform the full simulation period for each experiment, i.e., Exp1,2 nudged vs Exp3,4 free running, with Exp1,3 considering aerosol water while Exp2,4 exclude aerosol water. Preliminary results (4x4 runs for a 4 months period, 1x4 runs for one week) are shown in Figure 1-10.

Without going into details here, we briefly note that especially T63, T255 needs particularly fine tuning wrt the emissions scaling, while T511 needs to be debugged for a negative transport issue affecting specific humidity, before the final simulations can be performed for publication.

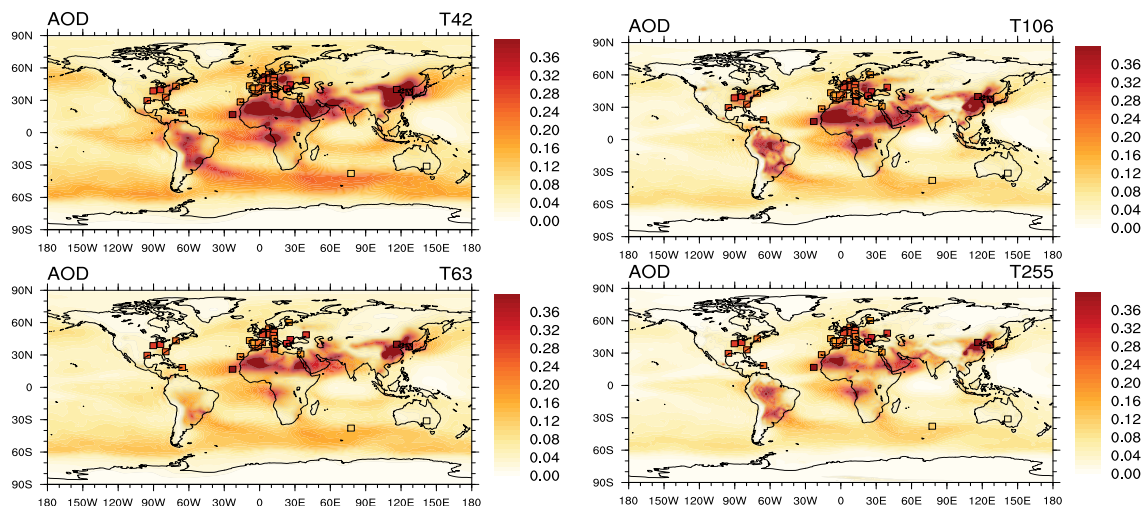


Figure 1. EMAC AOD vs Aeronet: Exp1 for T42, T63, T106, T255, average June 1 — September 30, 2013.

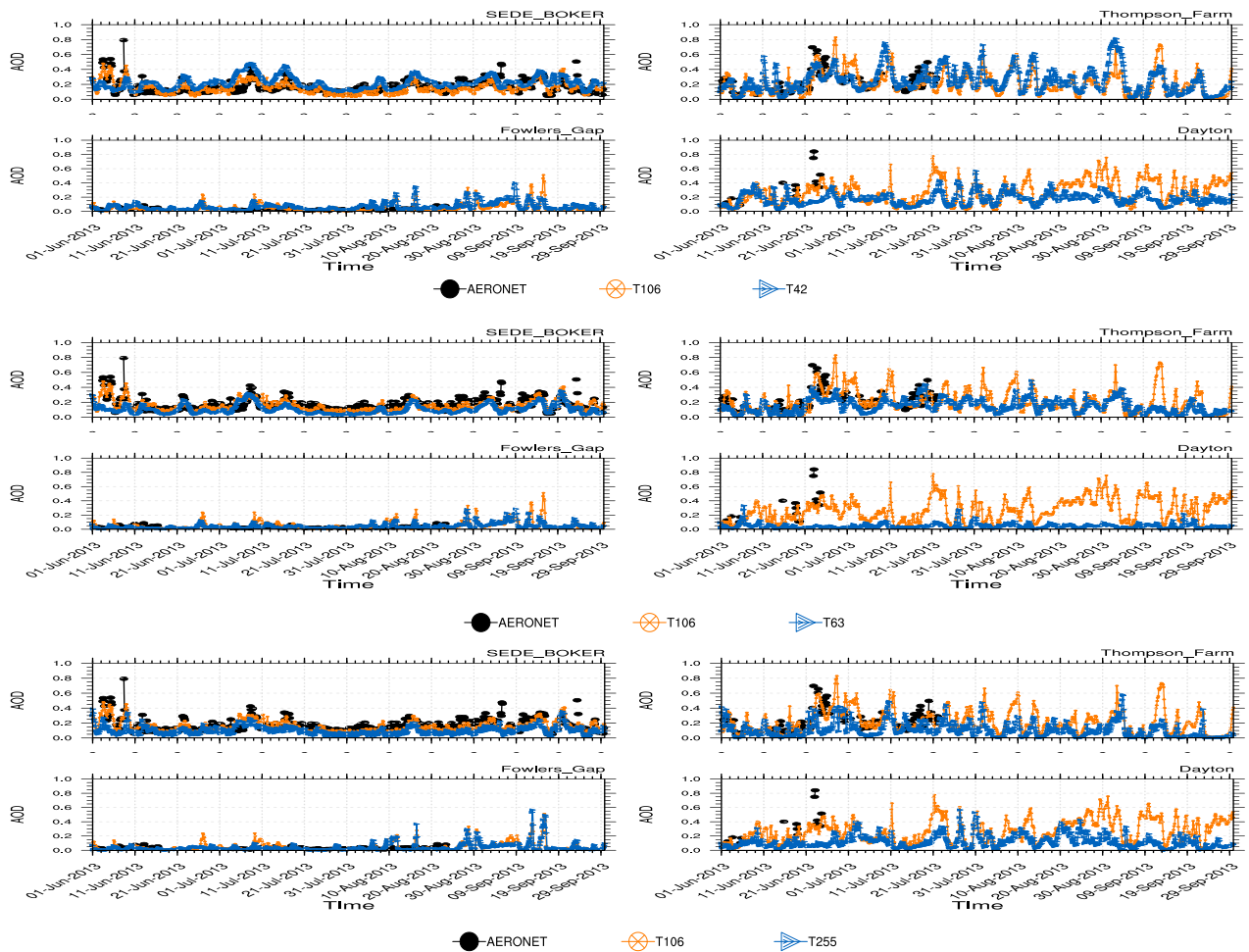


Figure 2. EMAC AOD vs Aeronet: Exp1 for T42, T63, T106, T255, June 1 — September 30, 2013.

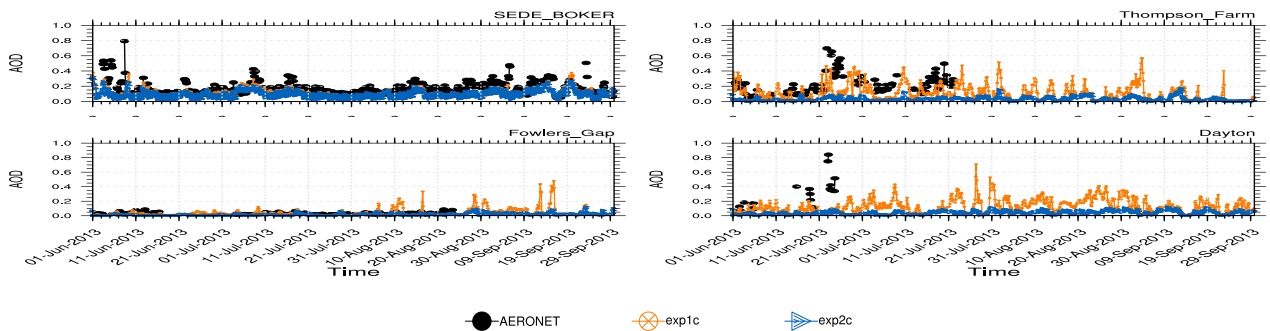


Figure 3. EMAC AOD vs Aeronet: Exp1 vs Exp2 for T255, June 1 — September 30, 2013.

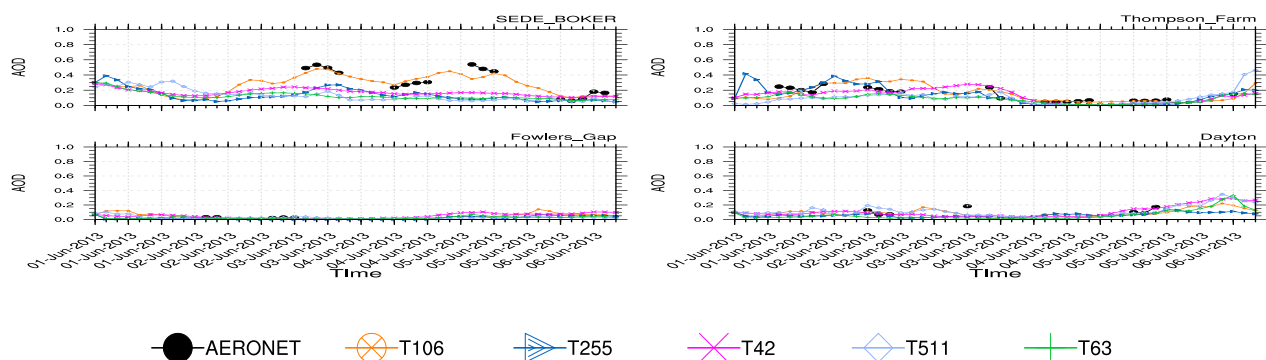


Figure 4. EMAC AOD vs Aeronet: Exp1 for T42, T63, T106, T255, T511, June 1 — 7, 2013.