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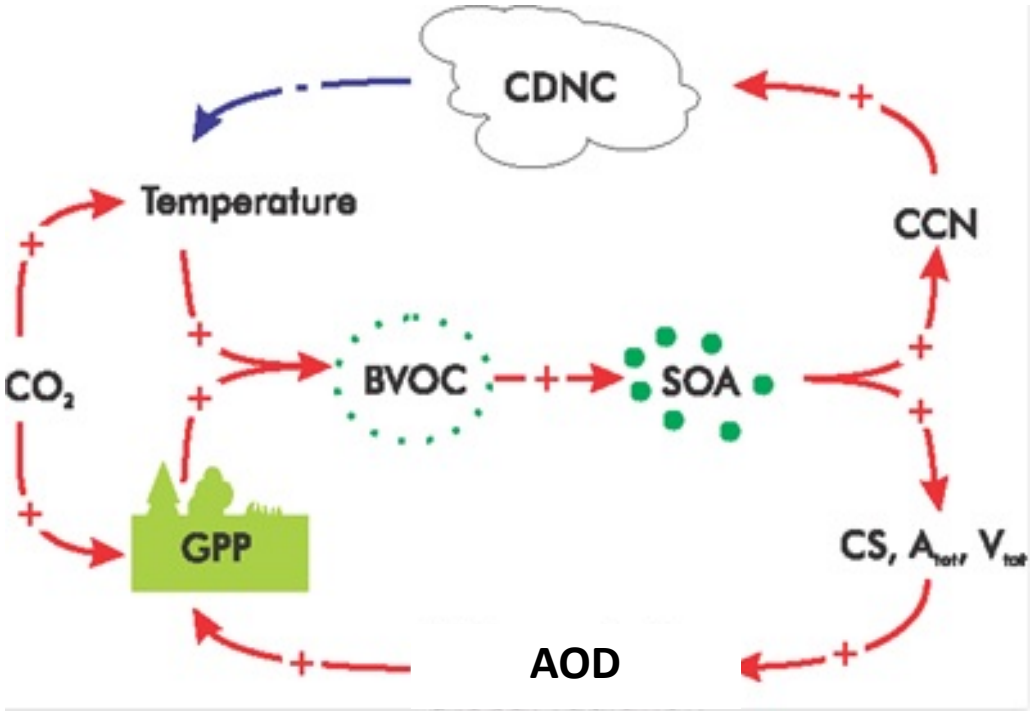
FINNISH METEOROLOGICAL INSTITUTE

The Climatic Significance of Biogenic Aerosols in the Boreal Region Now and in the Future

Tero Mielonen &
a long list of people

29.9.2019

Background



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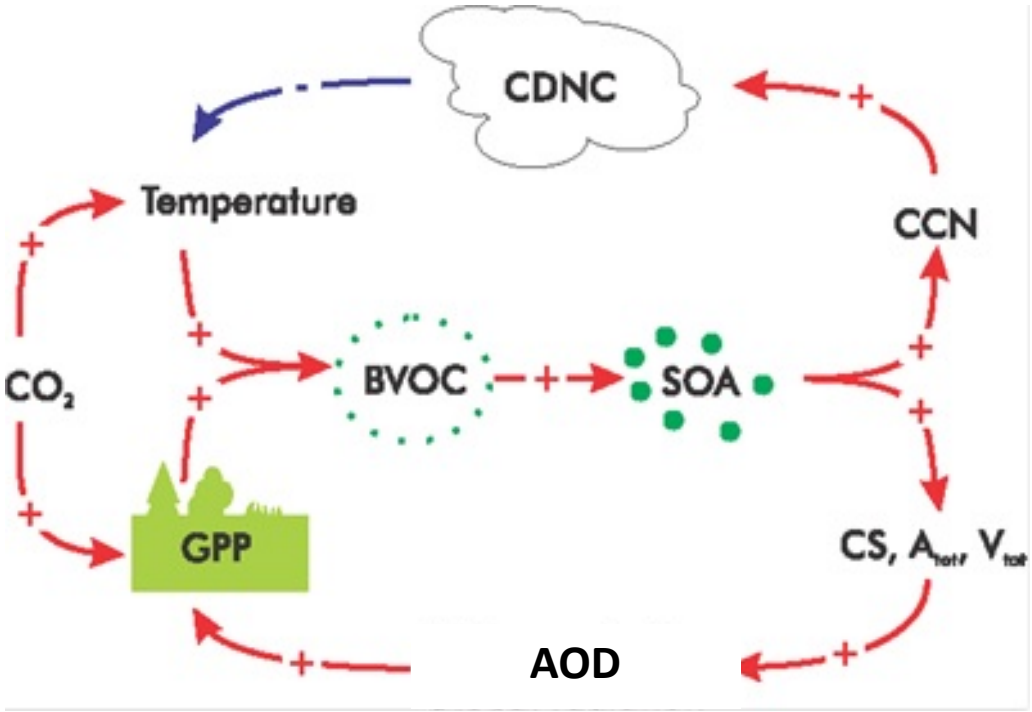
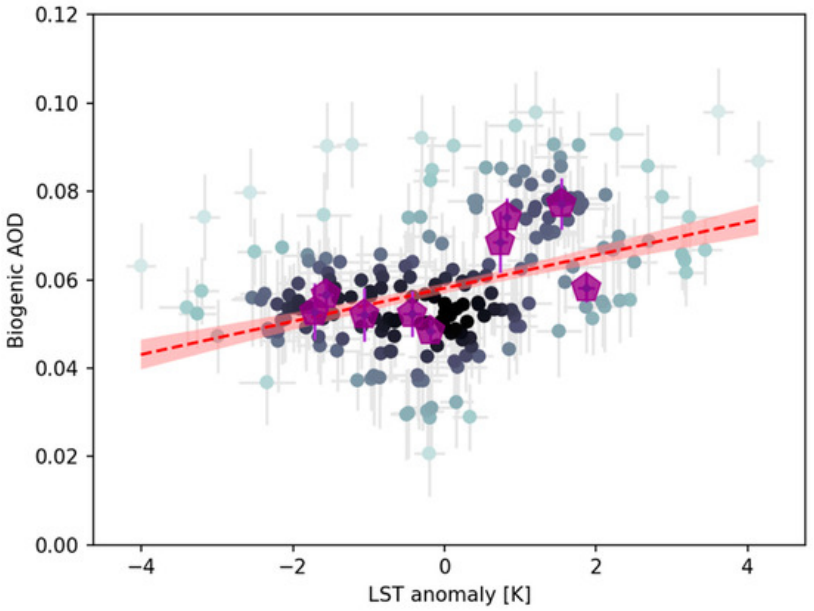
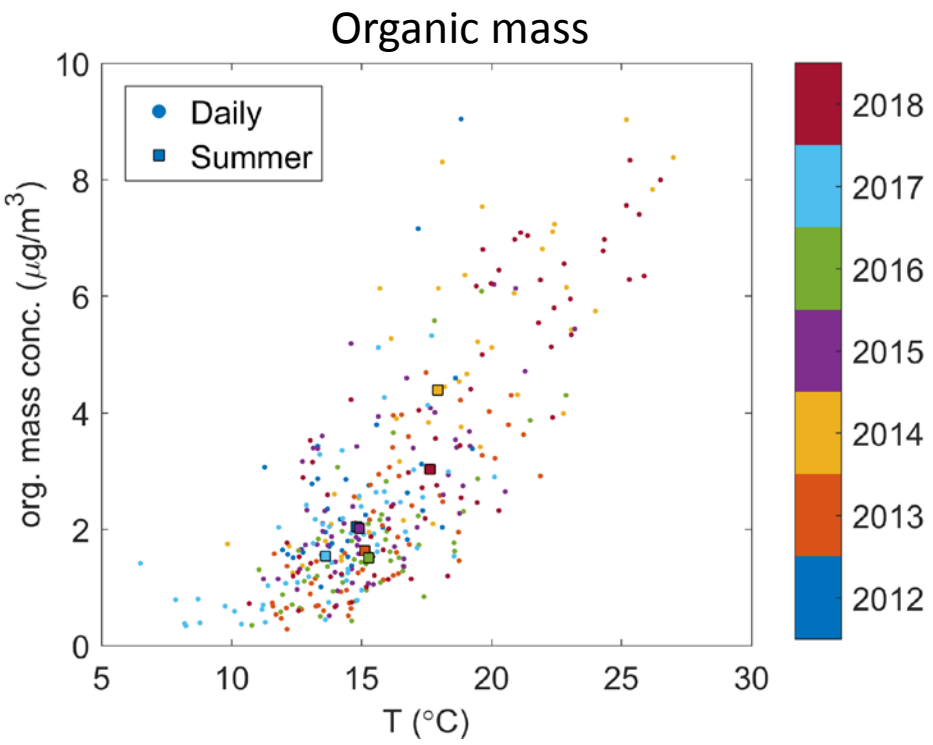




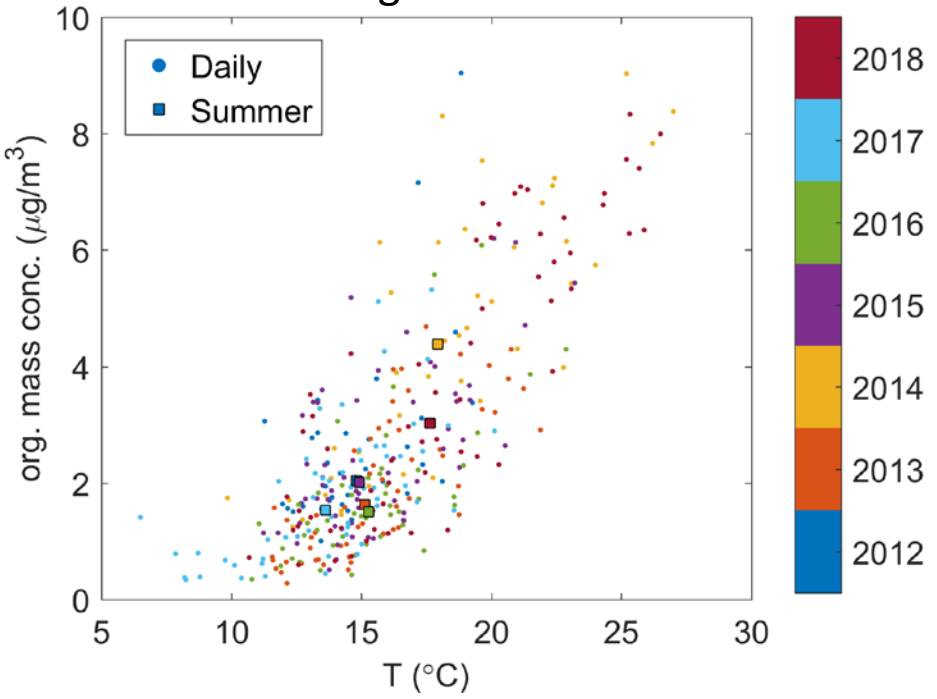
Mielonen, et al. *Atmosphere* **2018**, *9*, 180.

Field measurements from Hyytiälä, Finland

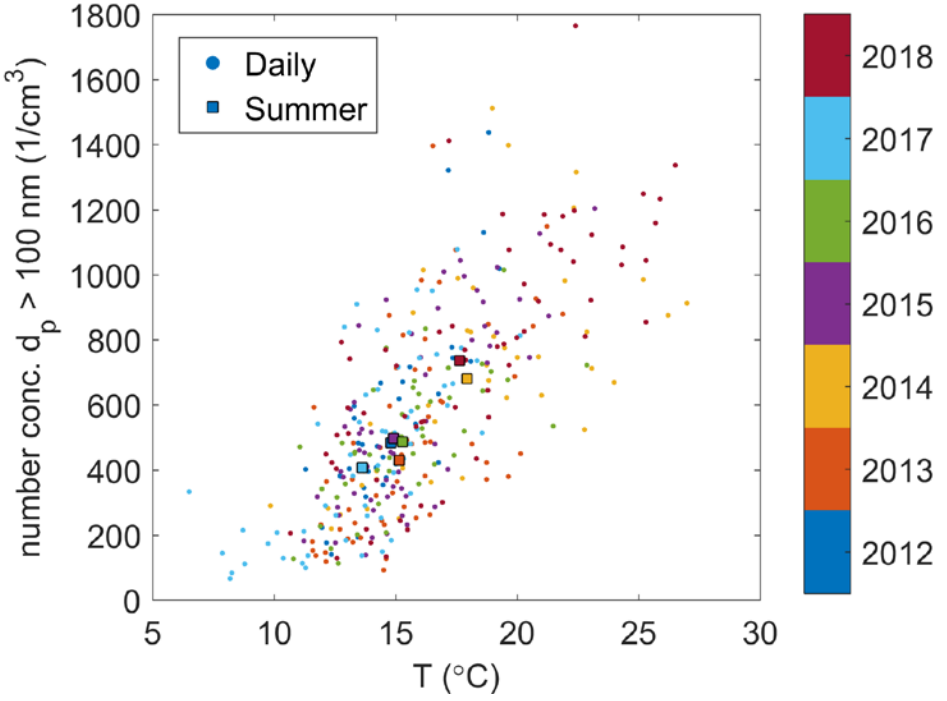


Field measurements from Hyytiälä, Finland

Organic mass

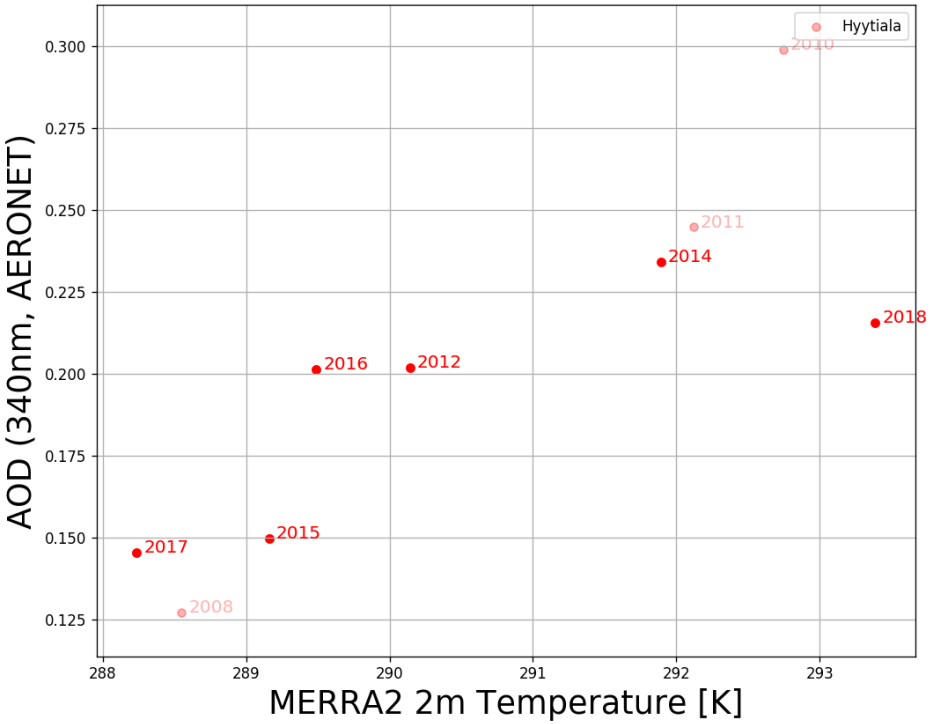


CCN



From Taina Yli-Juuti and Annele Virtanen (UEF)

AERONET at Hyytiälä, Finland



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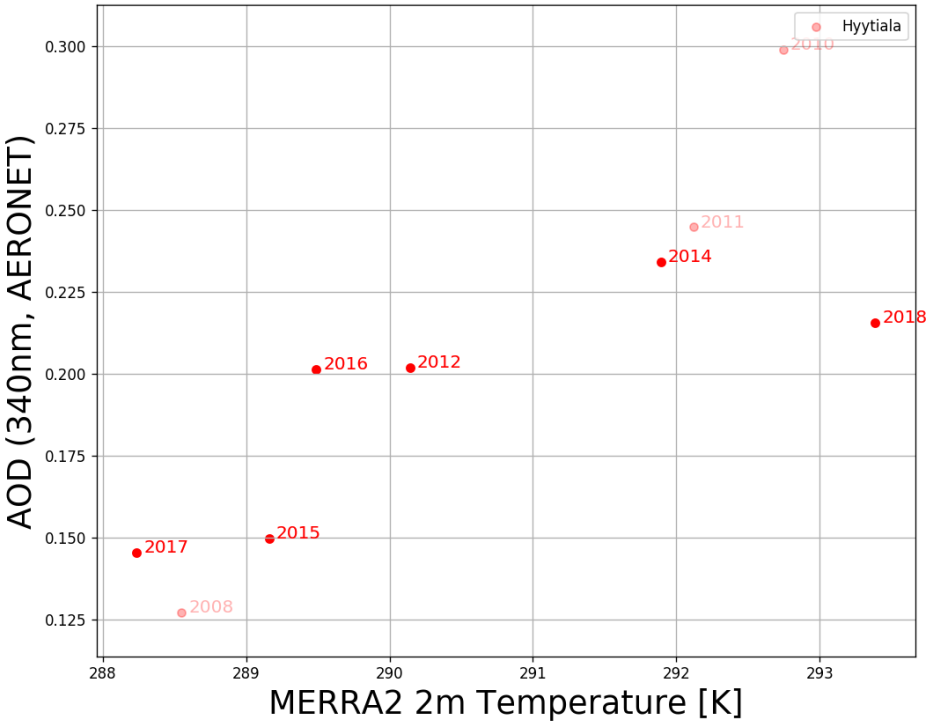

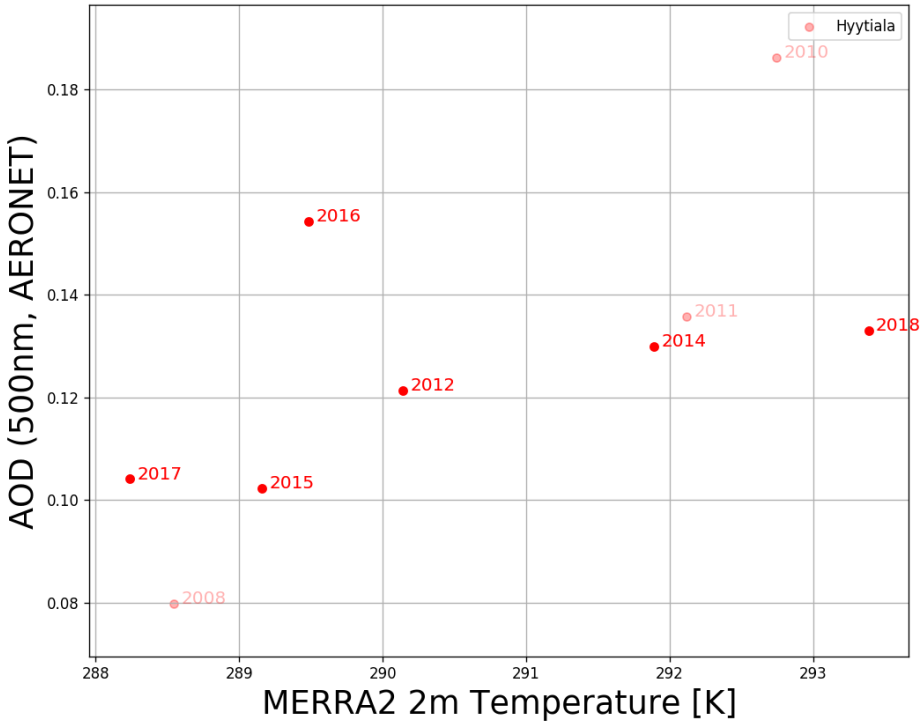

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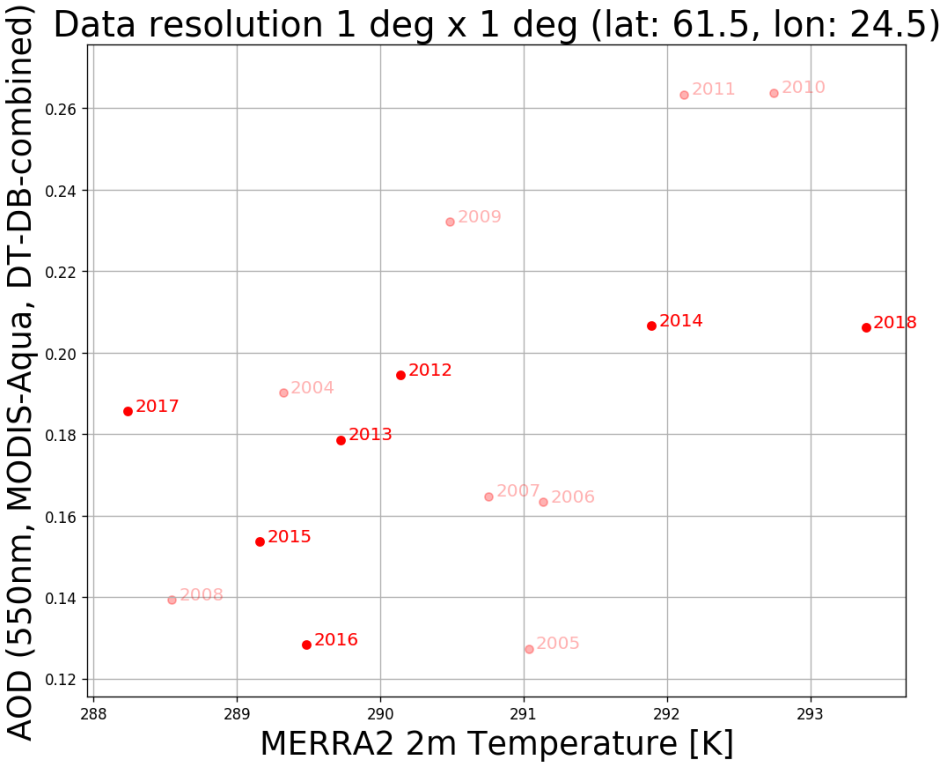
MODIS (L3) and ECHAM6-SALSA at Hyytiälä



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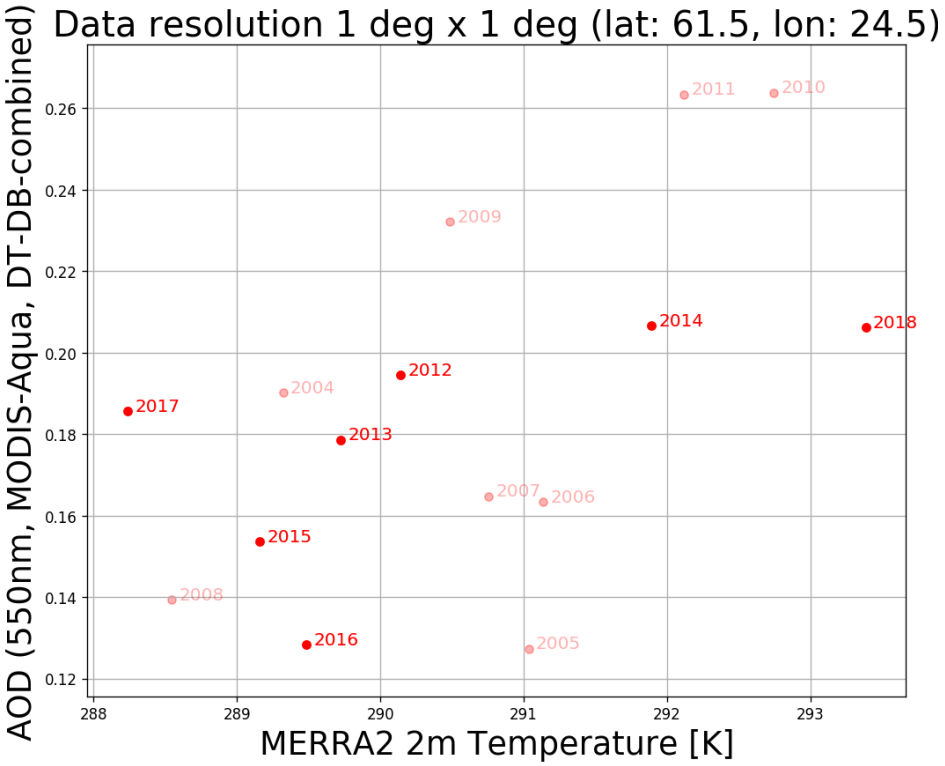
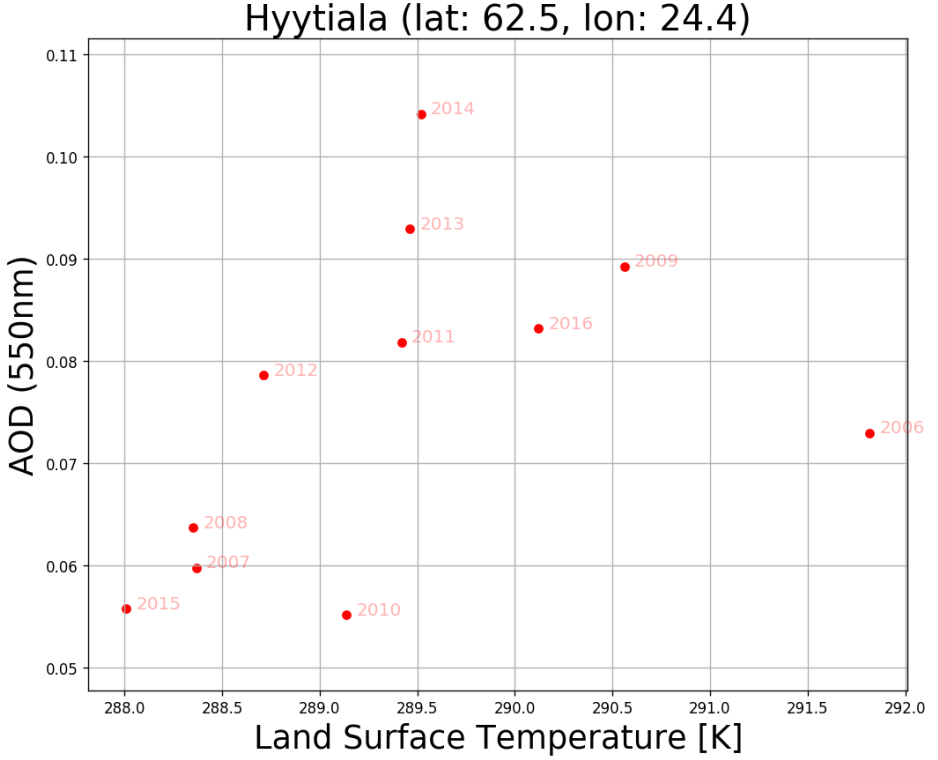
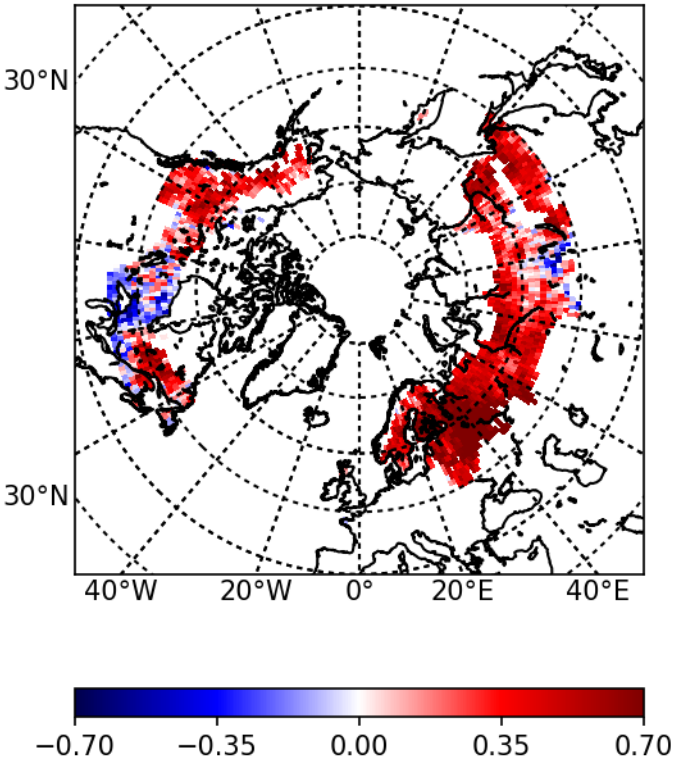




Correlation between 2m temperature (MERRA2) and AOD (MODIS-Aqua)

All available pixels (July-August)



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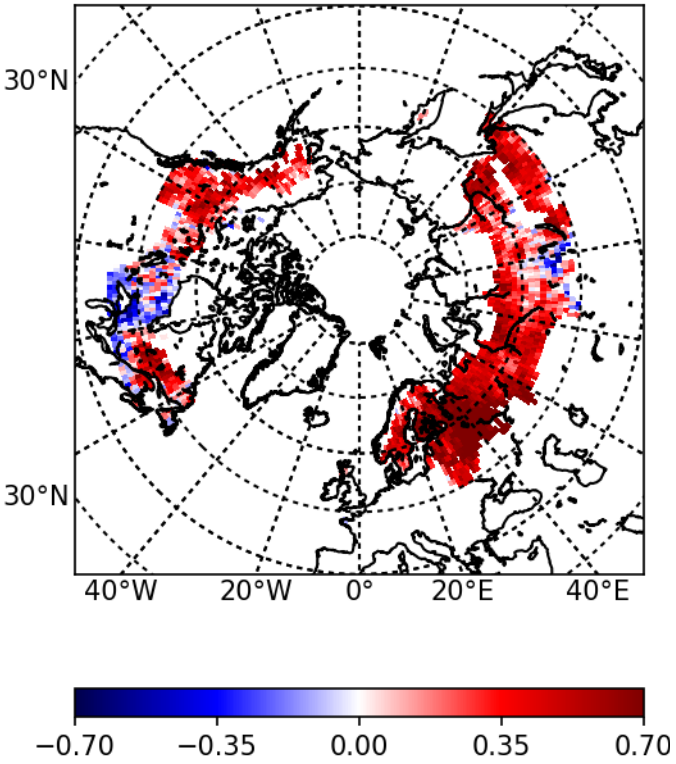
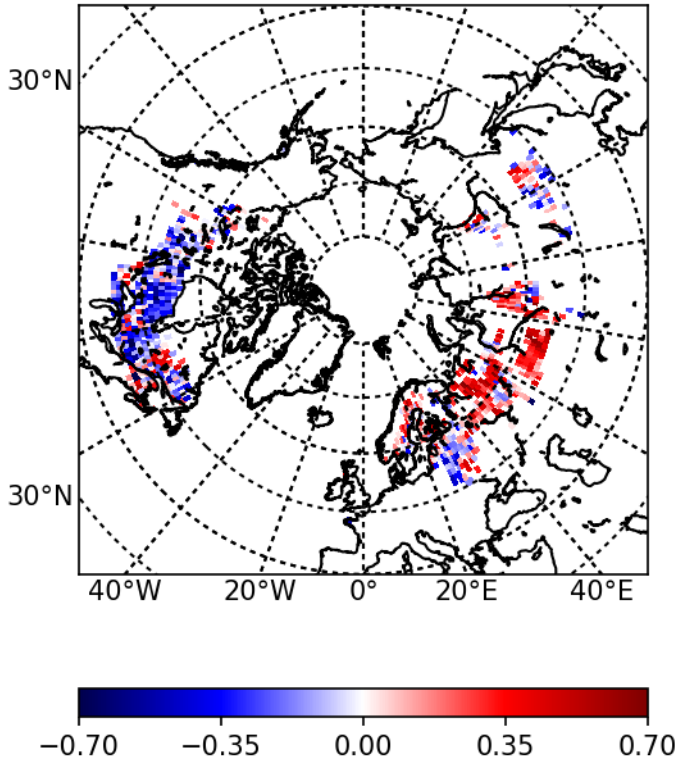
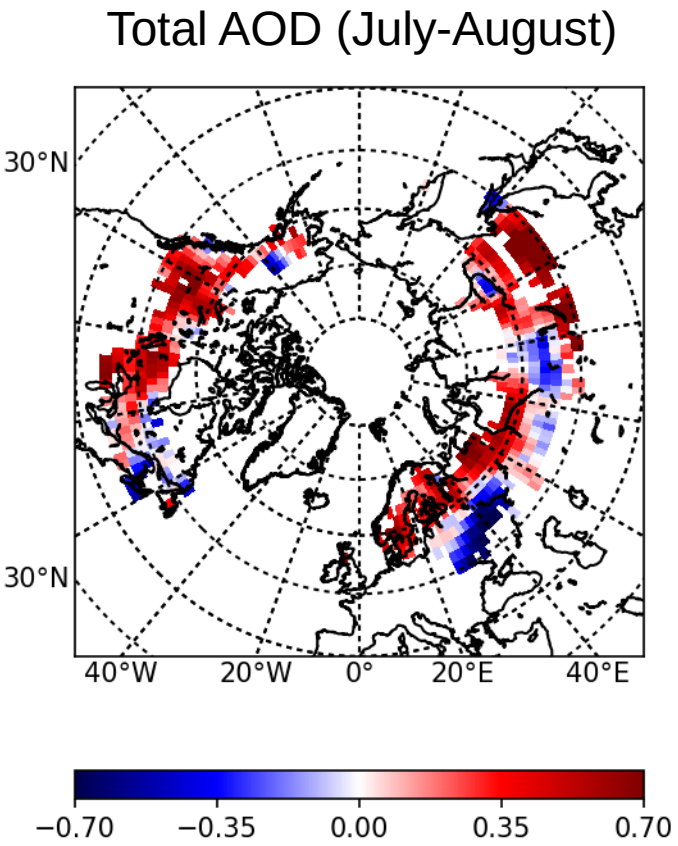


”Smoke-free” pixels (July-August)

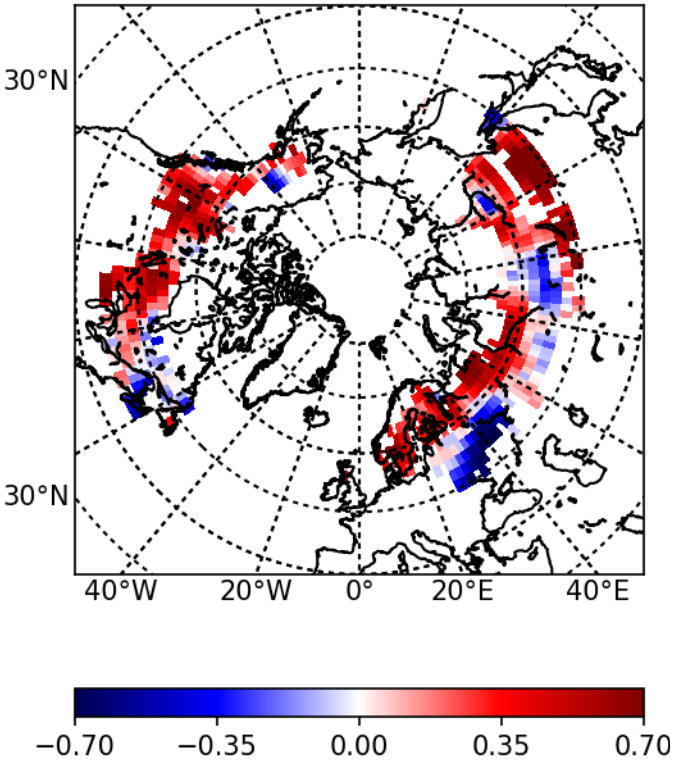


Correlation between 2m temperature and AOD: ECHAM6-SALSA

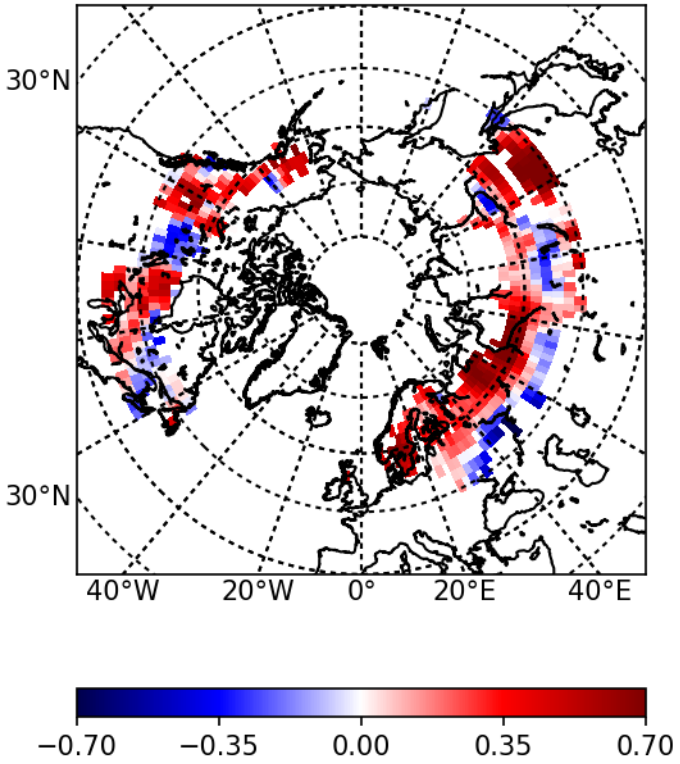


Correlation between 2m temperature and AOD: ECHAM6-SALSA

Total AOD (July-August)

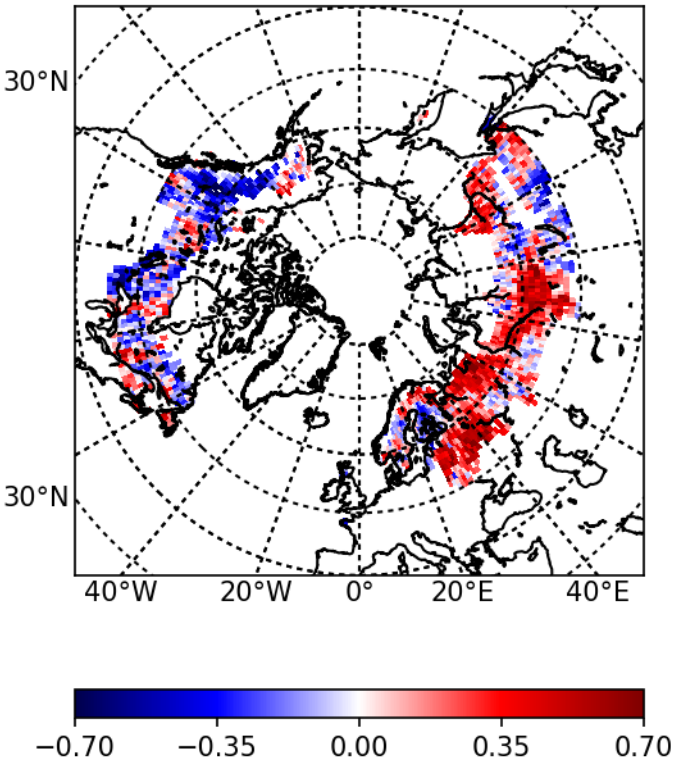


Biogenic AOD (July-August)



Correlation between 2m temperature (MERRA2) and CER (MODIS)

All available pixels (July-August)



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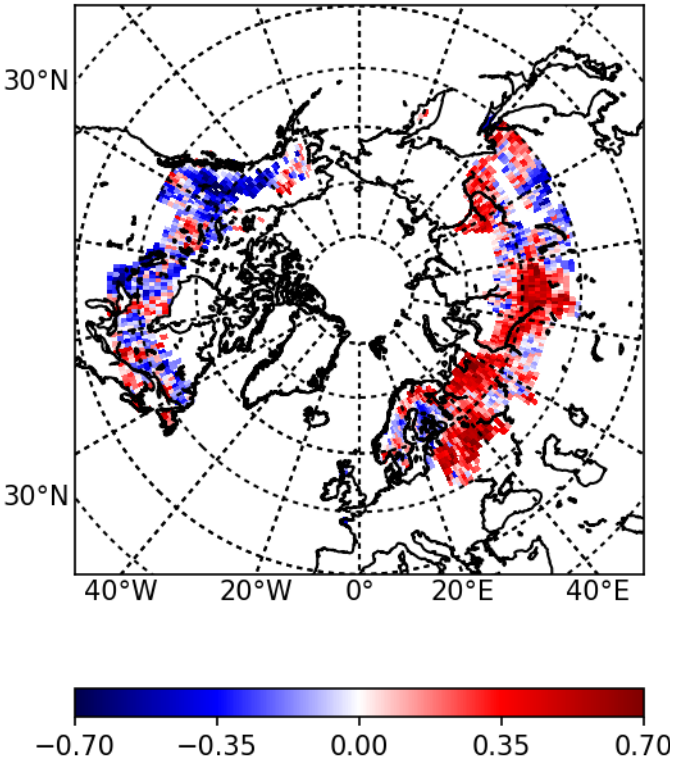
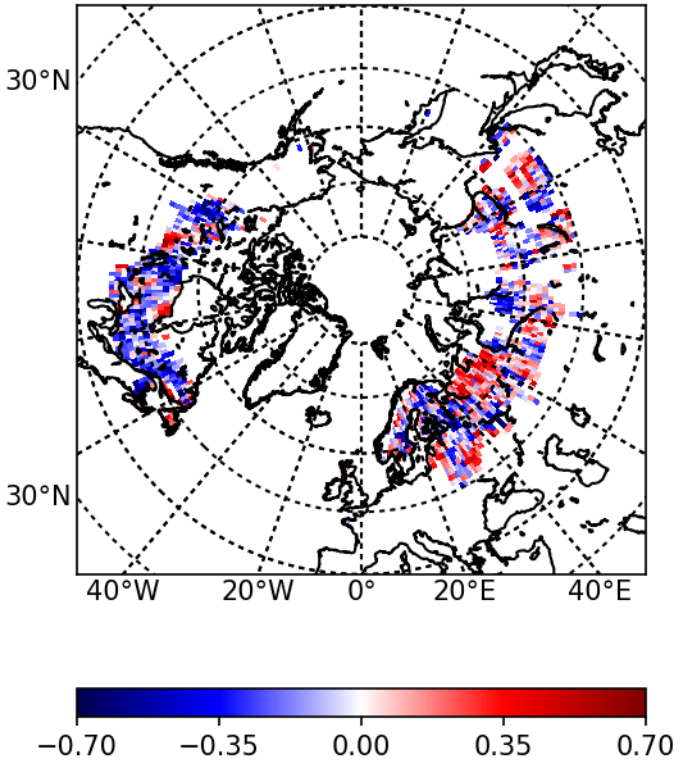


”Smoke-free” pixels (July-August)



ECHAM6-SALSA: AOD and radiative effects in the future

SUMMER (JJA)	bioAOD	AOD	bioRE clear [W/m^2]	RE clear [W/m^2]	Cloud cover [%]
PRES (2012)	0.015	0.083			

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ΔFUT (2050)	*0.004*	*-0.023*			
ΔFUT$_{emi12}$	*0.006*	*0.008*			

ECHAM6-SALSA: AOD and radiative effects in the future

SUMMER (JJA)	bioAOD	AOD	bioRE clear [W/m^2]	RE clear [W/m^2]	Cloud cover [%]
PRES (2012)	0.015	0.083	-0.63		
ΔT ~ 2 K	*Change from present day*				
ΔFUT (2050)	*0.004*	*-0.023*	*-0.26*		
ΔFUT$_{emi12}$	*0.006*	*0.008*	*-0.21*		

ECHAM6-SALSA: AOD and radiative effects in the future

SUMMER (JJA)	bioAOD	AOD	bioRE clear [W/m^2]	RE clear [W/m^2]	Cloud cover [%]
PRES (2012)	0.015	0.083	-0.63		72
ΔT ~ 2 K	*Change from present day*				
ΔFUT (2050)	*0.004*	*-0.023*	*-0.26*	*0.62*	*-4*
ΔFUT$_{emi12}$	*0.006*	*0.008*	*-0.21*	*-0.27*	*-4*

Conclusions (preliminary)

- All data sets indicate **mainly positive relationships between AOD and temperature** over the boreal region
  - However, large variability in the slopes between AOD and temperature
  - Simulations were in reasonable agreement with satellite observations

- Clouds are hard!
  - Meteorology has a stronger influence on clouds than biogenic aerosols
  - Hard to disentangle but we'll try to do it

- In the future, **clear-sky aerosol forcing is expected to decrease** if anthropogenic emissions decrease even though biogenic emissions increase
  - Relative contribution of biogenic emissions increases
  - But the climatic significance of biogenic aerosols is likely small

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Aerosol Radiative Effects

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Deadline for manuscript submissions:
15 November 2019

Message from the Guest Editors

Even though atmospheric aerosols have been studied extensively, their radiative effects, both direct and indirect, form the largest source of uncertainty in the estimates of the Earth's changing energy budget. Despite their small mass/volume fraction, aerosol particles have a significant impact on radiative transfer, thus affecting the weather and climate. Atmospheric aerosols interact with the solar radiation through scattering and absorption and, to a lesser extent, with the terrestrial radiation through absorption, scattering, and emission. Furthermore, aerosol particles can act as cloud condensation nuclei and ice nuclei upon which cloud droplets and ice crystals form. Consequently, the role of aerosols in the atmosphere is versatile, and aerosols from anthropogenic sources dominate the uncertainty in the total anthropogenic radiative forcing. Manuscripts on all these aspects are welcome for this Special Issue.