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Will declining condensation sinks lead to enhanced New Particle Formation?

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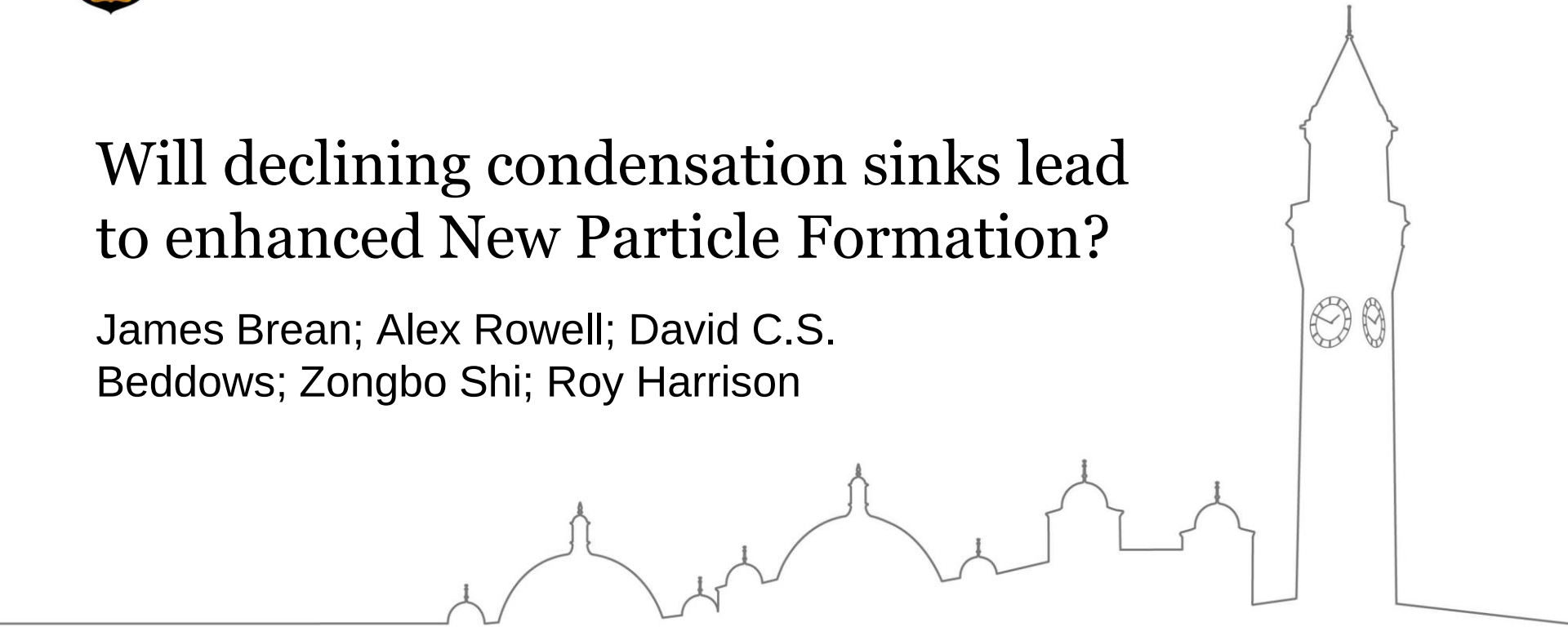
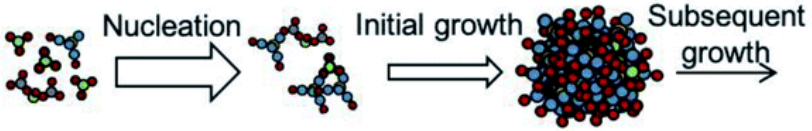


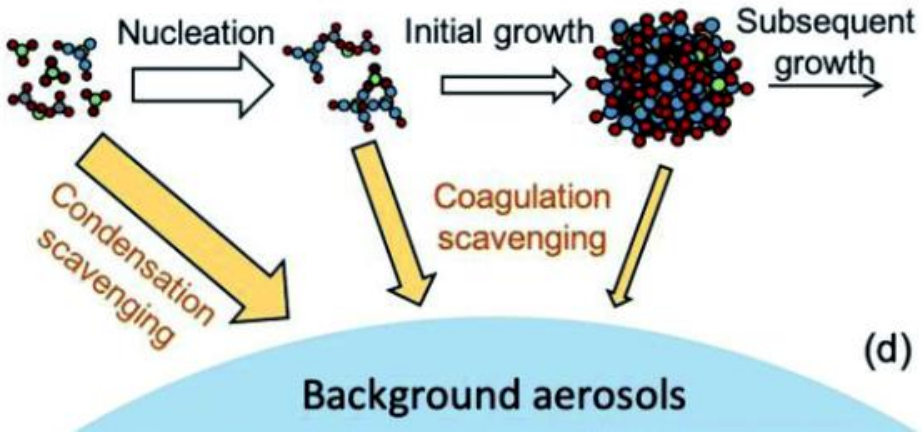
Where do aerosols come from?

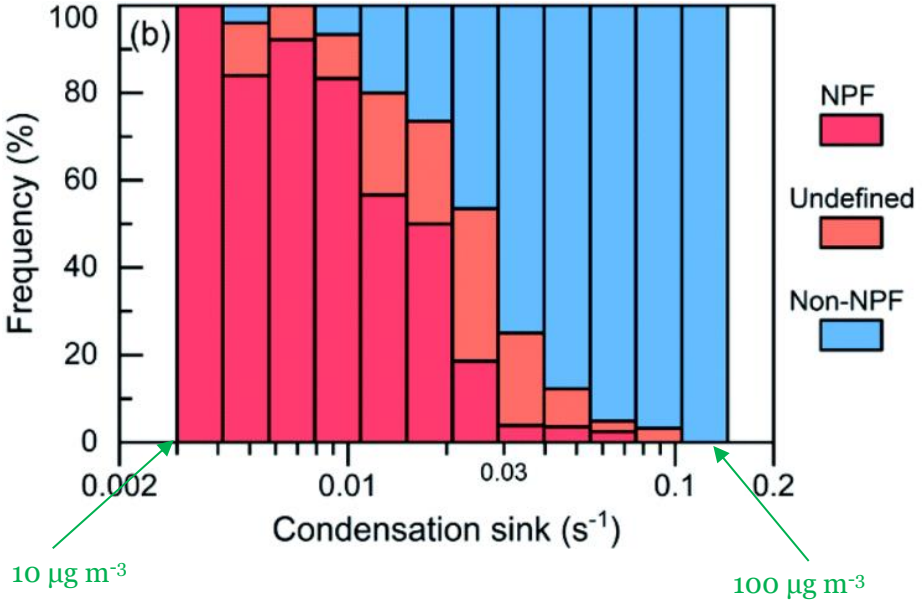
Primary emissions



New particle formation

New particle formation is suppressed by high $PM_{2.5}$ ($CS \approx PM_{2.5}$)





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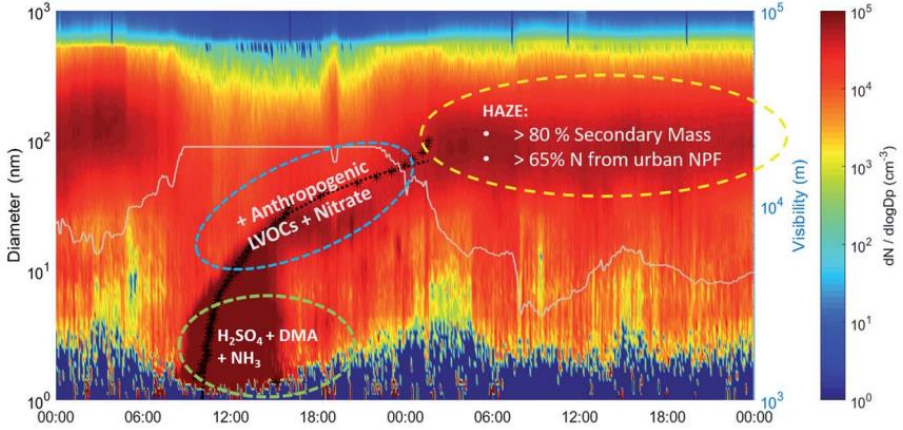
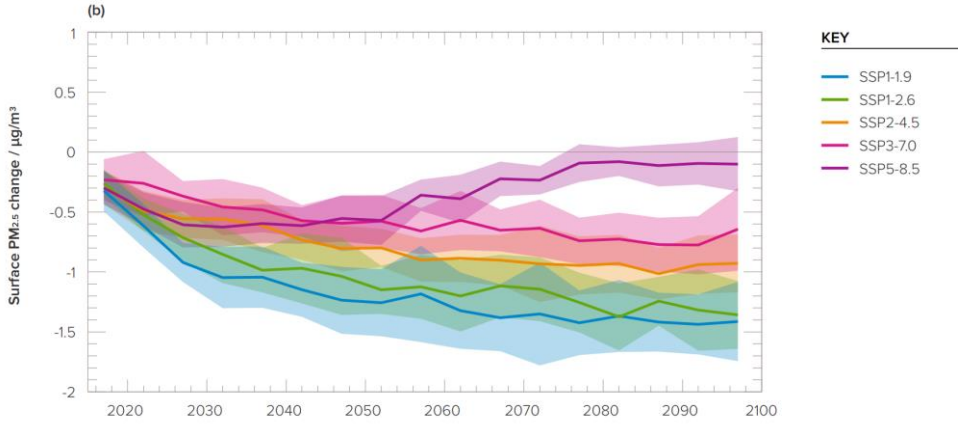
Deng, C., et al.: Formation and growth of sub-3 nm particles in megacities: impact of background aerosols, Faraday Discuss, 226, 348-363, 10.1039/d0fd00083c, 2021.

New particle formation in urban areas





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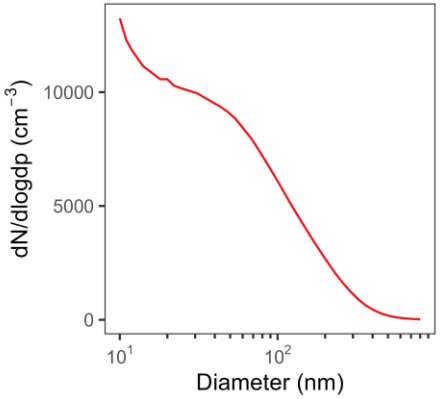
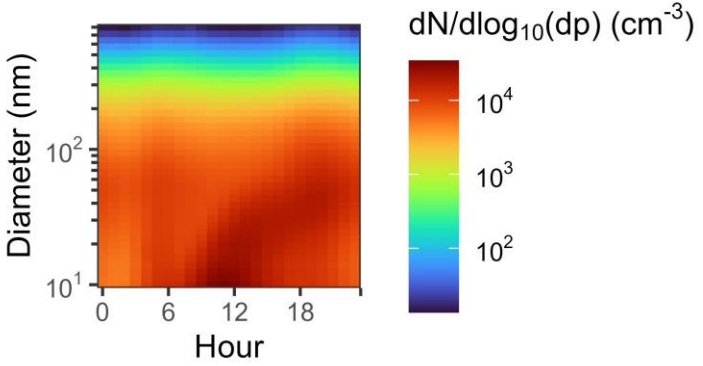
Kulmala, M., et al.: Is reducing new particle formation a plausible solution to mitigate particulate air pollution in Beijing and other Chinese megacities?, Faraday Discuss, 226, 334-347, 10.1039/d0fd00078g, 2021.

Methodology

- Data are from Leipzig, Germany
- Hourly particle number size distribution data for 10 years
- NPF events were manually identified
- Formation and growth rates calculated





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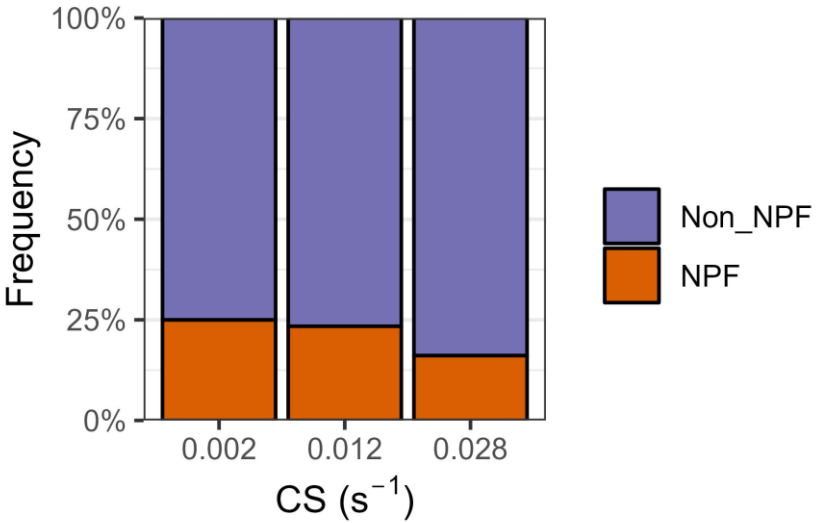
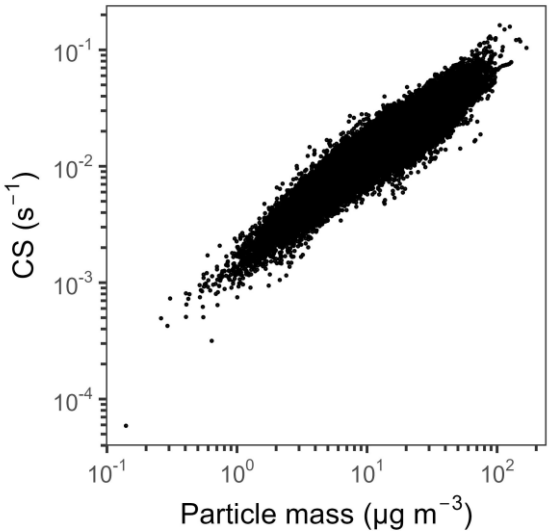
Birmili, W., et. al.: Long-term observations of tropospheric particle number size distributions and equivalent black carbon mass concentrations in the German Ultrafine Aerosol Network (GUAN), Earth Syst. Sci. Data, 8, 355–382, https://doi.org/10.5194/essd-8-355-2016, 2016.

When CS ($PM_{2.5}$) is low, we get more NPF events





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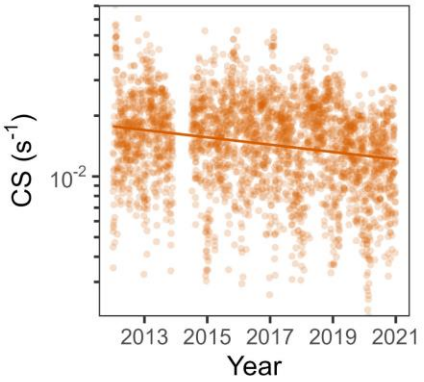
CS has been declining, NPF has been accelerating



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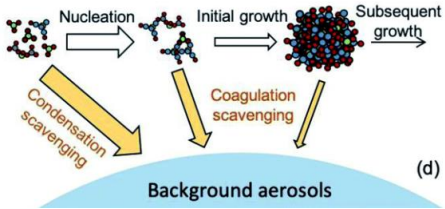
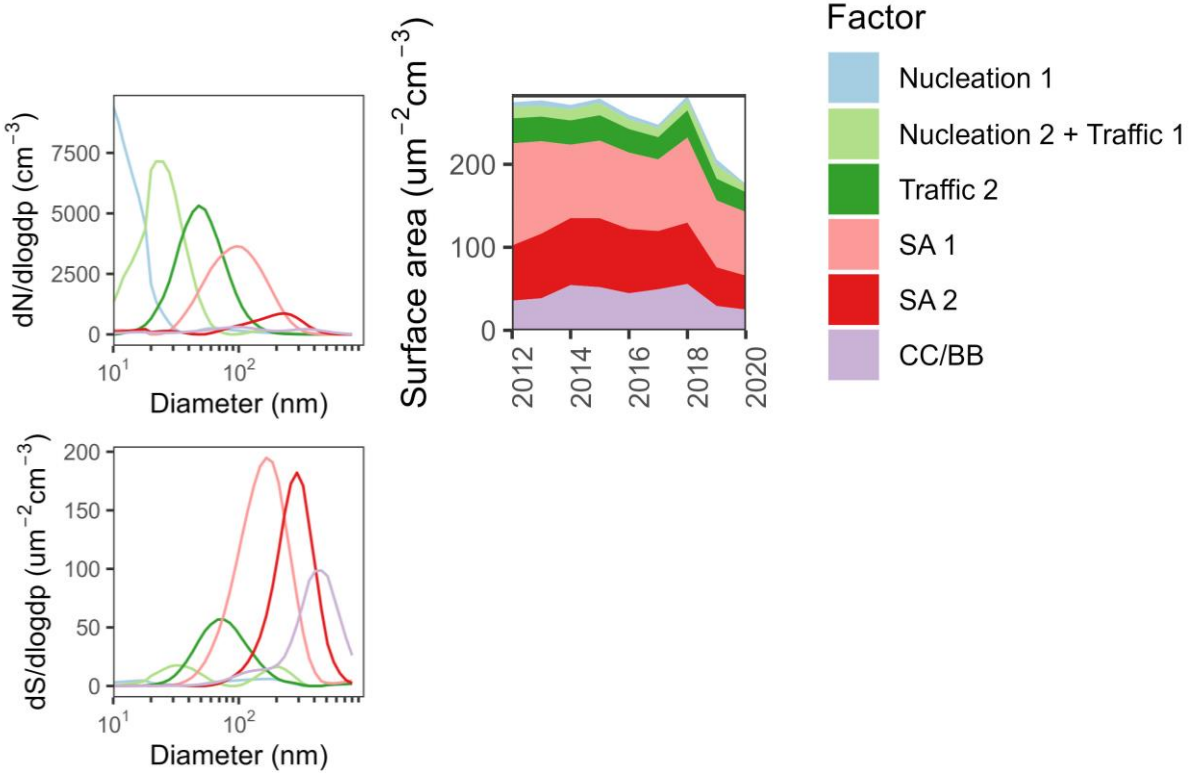


Declining PM: caused by secondaries?

- PMF source apportioned PNSD data into 6 factors
- Decline in particle surface area is from reducing secondaries



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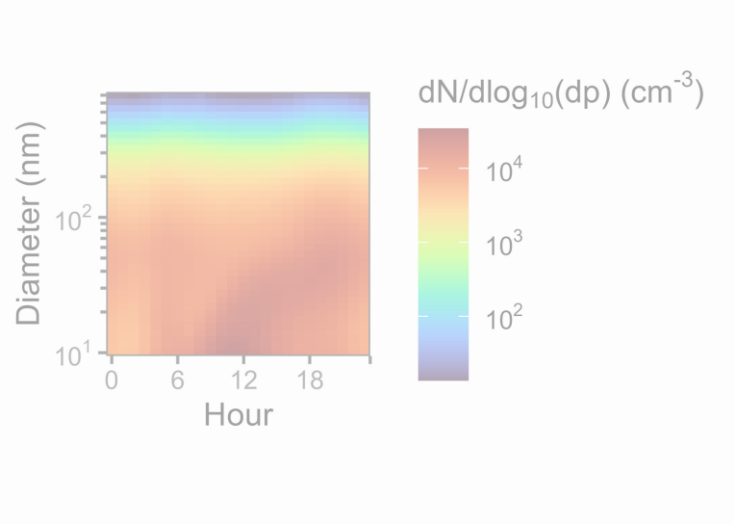
Conclusions

- Reducing $PM_{2.5}$ increases the lifetime of new particles
- At least *one* site in Europe has shown increasing NPF as a direct consequence of reductions to $PM_{2.5}$
- The reduction in surface area *may* come from reduced secondaries



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