Atmospheric aerosol concentrations are decreasing, but ground measurements and climate models still differ

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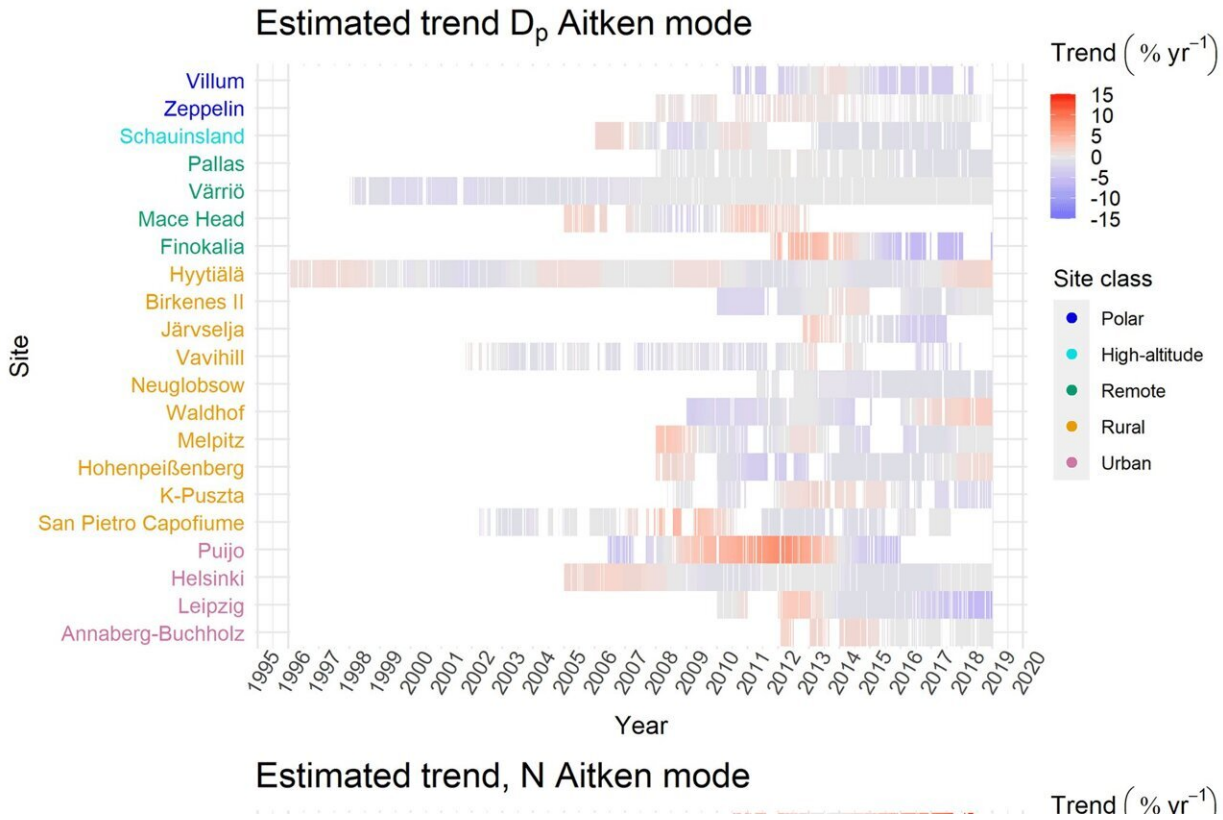

Estimated trends for Aitken mode D_p and N at measurement sites. Trend has been calculated by DLM; see Sect. 2.3.1 for details. The overall trend presented in the figure is comparable with the long-term trend estimates given in Sect. 3.1. To get a DLM trend for 1 year, the 1 d trend given by the model was multiplied by the number of days in a year (365 used for all years) and divided by the mean of the variable over the first observed year. For example, if the trend shows an

increase of 10 % yr^{-1} it means that if the short-term increase would continue for a year, the concentration would be increased by 10 % during the year compared to the first-year mean. Credit: *Atmospheric Chemistry and Physics* (2022). DOI: 10.5194/acp-22-12873-2022

Published in *Atmospheric Chemistry and Physics*, an international study shows that the number of atmospheric aerosol particles measured at observation sites across Europe has, on average, declined since the beginning of the 2000s. The declining trend was also observed by the climate models studied, but on average the relative decrease was lower in the models than in the ground measurements. There are clear differences between different models in how they describe seasonal variation. The study utilized long-term time series data from 21 observation sites and results from five different climate models.

The ability of climate models to describe the impact of aerosols on the Earth's radiative equilibrium depends on their ability to describe temporal and local trends in aerosol concentrations. In terms of seasonal variation, there were clear differences—both between different models and when compared to the seasonal variation observed in measurements.

In some models, seasonal variation is modeled in a similar manner regardless of the location of the observation site, whereas in some models, seasonal variation is modeled to reflect changes in the North-South axis, being stronger in the North. It is notable that the greatest differences were found in particle size, which plays a key role in the cloud formation process.

The findings suggest that the differences between the climate models are likely to be explained by, e.g., differences in processes describing the formation, development and transport of aerosols. Based on the study, it

is considered important for the further development of climate models to conduct more detailed model comparisons focusing on different processes, which could be used to identify the causes of the differences identified.

More information: Ville Leinonen et al, Comparison of particle number size distribution trends in ground measurements and climate models, *Atmospheric Chemistry and Physics* (2022). DOI: 10.5194/acp-22-12873-2022

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