nature portfolio

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Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our Editorial Policies and the Editorial Policy Checklist.

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

n/a	Confirmed	
☐	☒	The exact sample size (*n*) for each experimental group/condition, given as a discrete number and unit of measurement
☐	☒	A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly
☒	☐	The statistical test(s) used AND whether they are one- or two-sided *Only common tests should be described solely by name; describe more complex techniques in the Methods section.*
☒	☐	A description of all covariates tested
☒	☐	A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons
☐	☒	A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals)
☒	☐	For null hypothesis testing, the test statistic (e.g. *F*, *t*, *r*) with confidence intervals, effect sizes, degrees of freedom and *P* value noted *Give P values as exact values whenever suitable.*
☒	☐	For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings
☒	☐	For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes
☒	☐	Estimates of effect sizes (e.g. Cohen's *d*, Pearson's *r*), indicating how they were calculated

Our web collection on statistics for biologists contains articles on many of the points above.

Software and code

Policy information about availability of computer code

Data collection	Aerosol Instrument Manager® (TSI) Xcalibur (version 4.4.16.14, Thermo Fisher Scientific)
Data analysis	Xcalibur (version 4.2.47, Thermo Fisher Scientific) Matlab (R2021b)

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio guidelines for submitting code & software for further information.

Data

Policy information about availability of data

All manuscripts must include a data availability statement. This statement should provide the following information, where applicable:
- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our policy

The data shown in this study is available at 10.5281/zenodo.6876277

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research.](#)

Reporting on sex and gender	No human research participants were involved in the study
Population characteristics	No human research participants were involved in the study
Recruitment	No human research participants were involved in the study
Ethics oversight	No human research participants were involved in the study

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

☐ Life sciences   ☐ Behavioural & social sciences   ☒ Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](#)

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	The study includes the volatility and new-particle formation ability of a common synthetic jet oil in the laboratory and the quantified oil fraction in ambient UFPs downwind of Frankfurt International Airport, Germany. Our results show that jet oil nucleation is an important mechanism that can explain the numerous observations of high concentrations of non-refractory UFPs near airports.
Research sample	25 ambient filter samples including 3 blank samples
Sampling strategy	We used a Micro Orifice Uniform Deposition Impactor (Nano-MOUDI, Model 115, MSP, Minneapolis, MN, USA) at an air-quality monitoring site 4 km north of Frankfurt Airport and sampled particles on the three nano-stages < 56 nm. All stages were equipped with aluminium foils (TSI, diameter 47 mm and thickness 0.015 mm), and the upper ten stages were coated with Apiezon® grease to minimize the bounce-off of larger particles.
Data collection	Ambient filter samples were collected using a Nano-MOUDI sampler. Particle number size distribution data was collected using an SMPS-system. The SMPS data of seven filter sampling periods was analysed as no data is available for one sampling period due to an instrument failure.
Timing and spatial scale	From August to October 2019, we sampled UFPs for 18 - 54 hours during airport operating hours (5:00 – 23:00 CET) and during southerly wind direction. Without an active sampling airflow, we collected field blanks for 115 hours on the three nano-stages.
Data exclusions	The smallest size fraction (10-18 nm) was not used for the Nano-MOUDI characterization due to insufficient collected mass.
Reproducibility	Nano-MOUDI characterization measurements were performed 3 times. For external calibration each concentration point was measured 3 times in succession.
Randomization	No randomization was required as all samples were collected in the same way
Blinding	No blinding was required as all samples were collected in the same way

Did the study involve field work?   ☒ Yes   ☐ No

Field work, collection and transport

Field conditions	Ambient filter samples were collected from August to October 2019, during airport operating hours (5:00 – 23:00 CET) and during southerly wind direction. The temperature was around 20 °C on average. Wind direction and wind speed are provided in Fig. 2.
Location	The air quality monitoring station used as sampling site is located 4 km north of Frankfurt Airport (Frankfurt Schwanheim; F-Schwanheim). Highly frequented streets are not located within a distance of 1 km.

Access & import/export	Ambient filter sampling took place in compliance with the local authority Hessian Agency for Nature Conservation, Environment and Geology.
Disturbance	No disturbance occurred

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

n/a	Involved in the study
☒ ☐	Antibodies
☒ ☐	Eukaryotic cell lines
☒ ☐	Palaeontology and archaeology
☒ ☐	Animals and other organisms
☒ ☐	Clinical data
☒ ☐	Dual use research of concern

Methods

n/a	Involved in the study
☒ ☐	ChIP-seq
☒ ☐	Flow cytometry
☒ ☐	MRI-based neuroimaging