

Direct atmospheric emissions of polyester microfibres from clothing



Author's contact:
Valentina Höchtl
valentina.hoechtl@gmx.at

Höchtl Valentina¹, Stohl Andreas¹, Evangelou Ioanna¹ and Bucci Silvia^{1,2}

1) IMGW, University of Vienna, Vienna, Austria
2) DAFNE, University of Tuscia, Viterbo, Italy

MOTIVATION

WHY? The **growth** of the **textile and fast fashion industry** has increased the use of synthetic clothing, with **polyester** as the dominant fibre. Everyday wear releases airborne polyester microfibres, leading to continuous exposure **and potential health risks**. Despite this, direct atmospheric emissions remain **largely overlooked**.

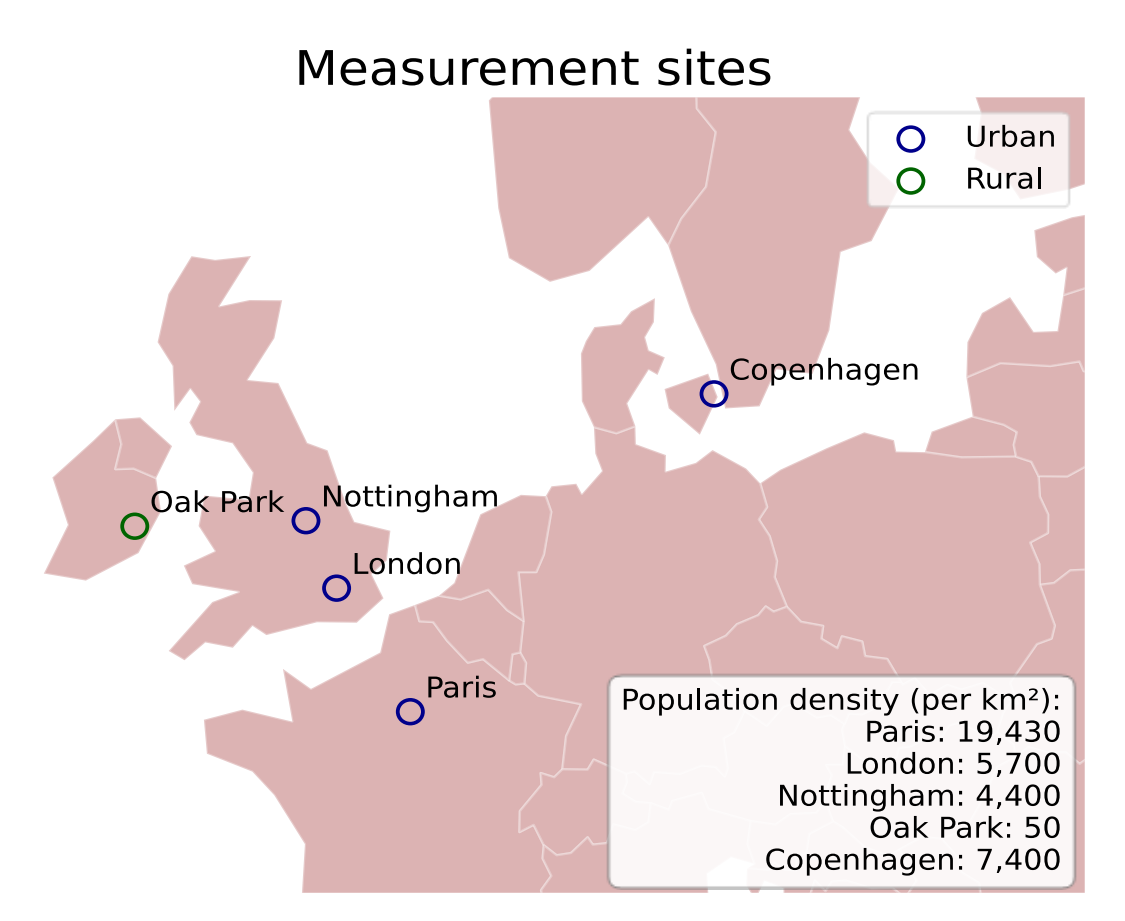
→ **Does population density drive outdoor polyester microfibre concentrations?**

HOW? We test using Lagrangian **simulations coupled with population data**.

METHODS

Lagrangian particle dispersion model **FLEXPART v11** (ERA5):
Description of **fibrous particles**

5 European measurement sites

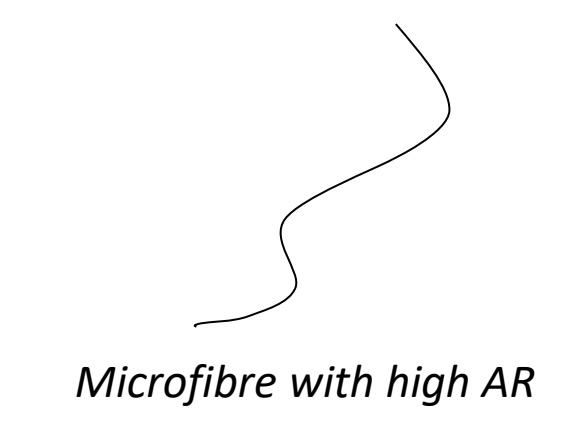


Source contribution to assess influence of population density

- 40 days backward simulations
- Simulations done for each site to obtain source–receptor sensitivity
- Coupling of sensitivity with population density data
- Model–data comparison

Sensitivity studies to assess the influence on source contribution and transport

- 40 days back- & forward simulations
- Done for aspect ratio, length and emission factor

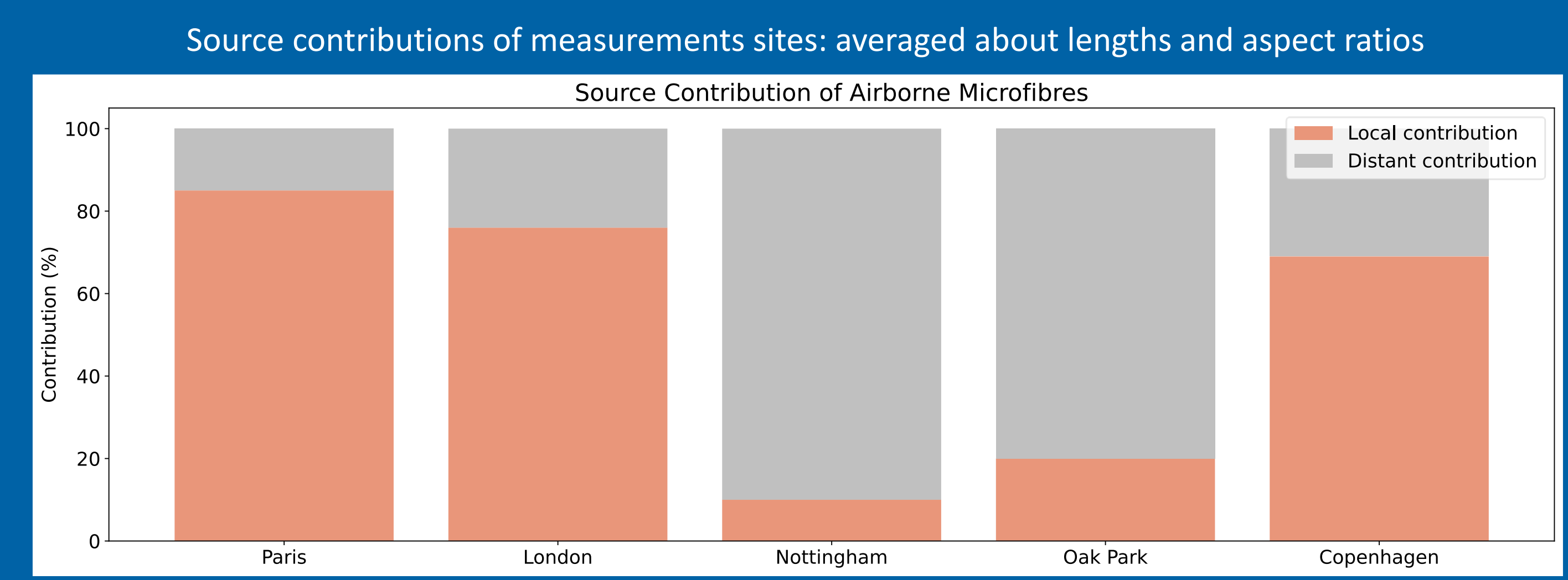
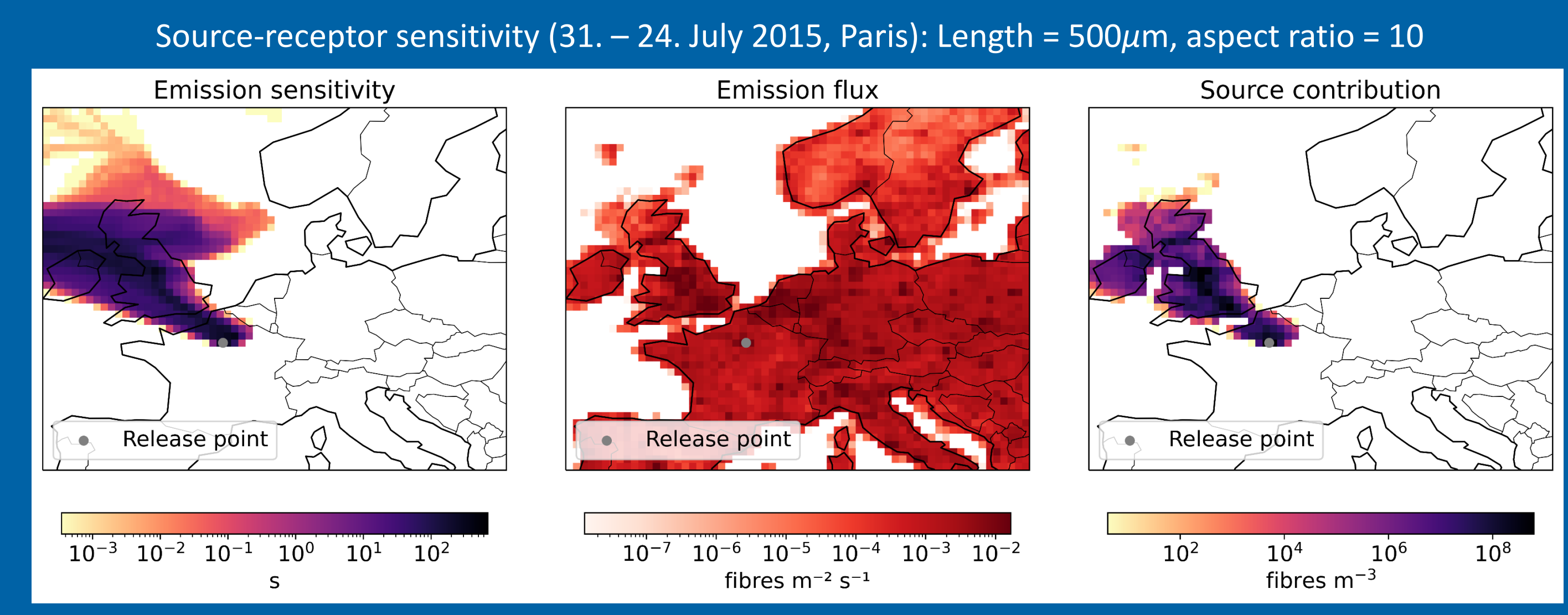


REFERENCES

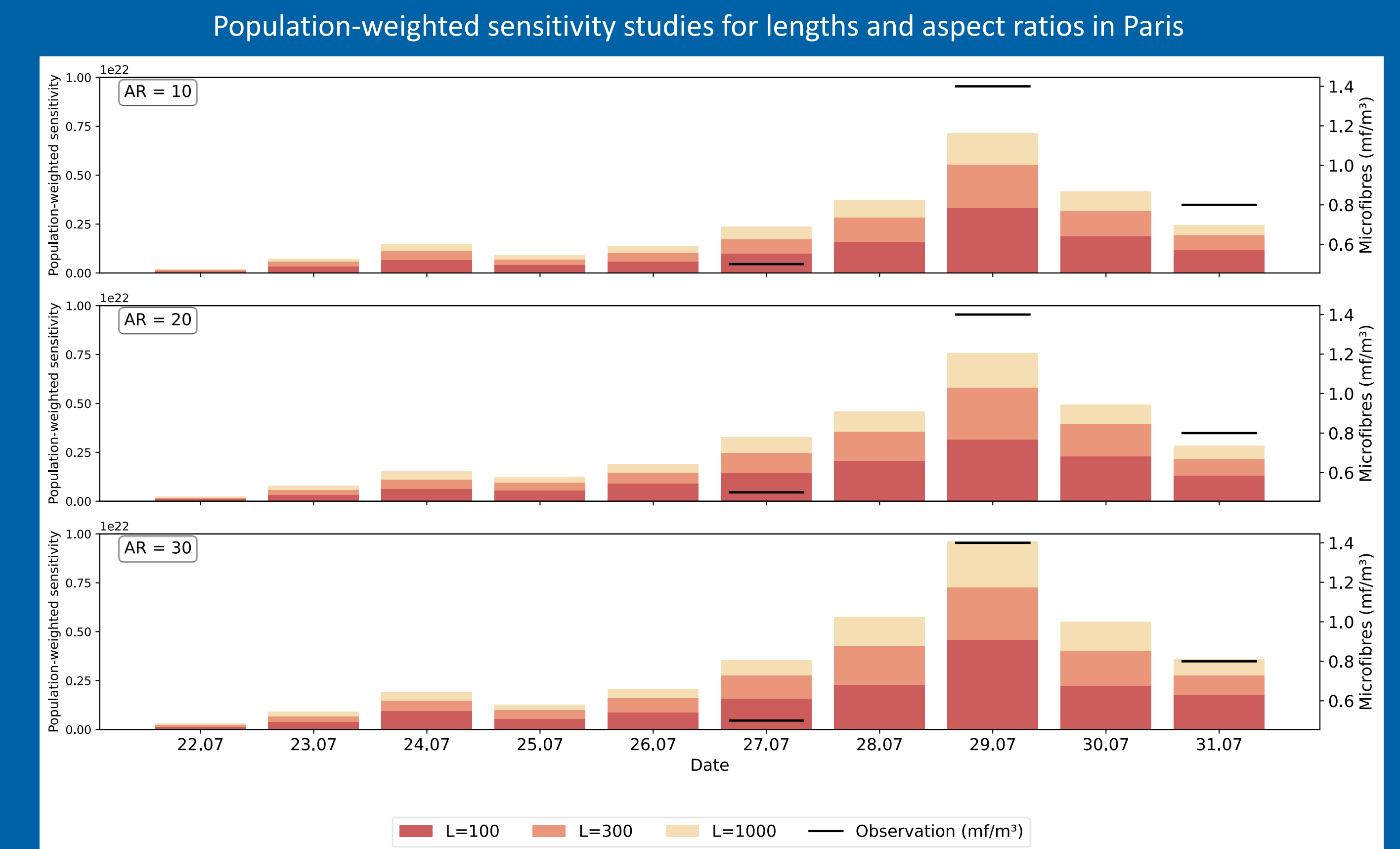
De Falco, F., M. Cocca, M. Avella, and R. C. Thompson (2020). "Microfiber release to water, via laundering, and to air, via everyday use: A comparison between polyester clothing with differing textile parameters".

Dris, R., J. Gasperi, C. Mirande, C. Mandin, M. Guerrouache, V. Langlois, and B. Tassin (2017). "A first overview of textile fibers, including microplastics, in indoor and outdoor environments".

AIRBORNE POLYESTER MICROFIBRES ARE DOMINATED BY LOCAL SOURCES AT MORE DENSELY POPULATED SITES

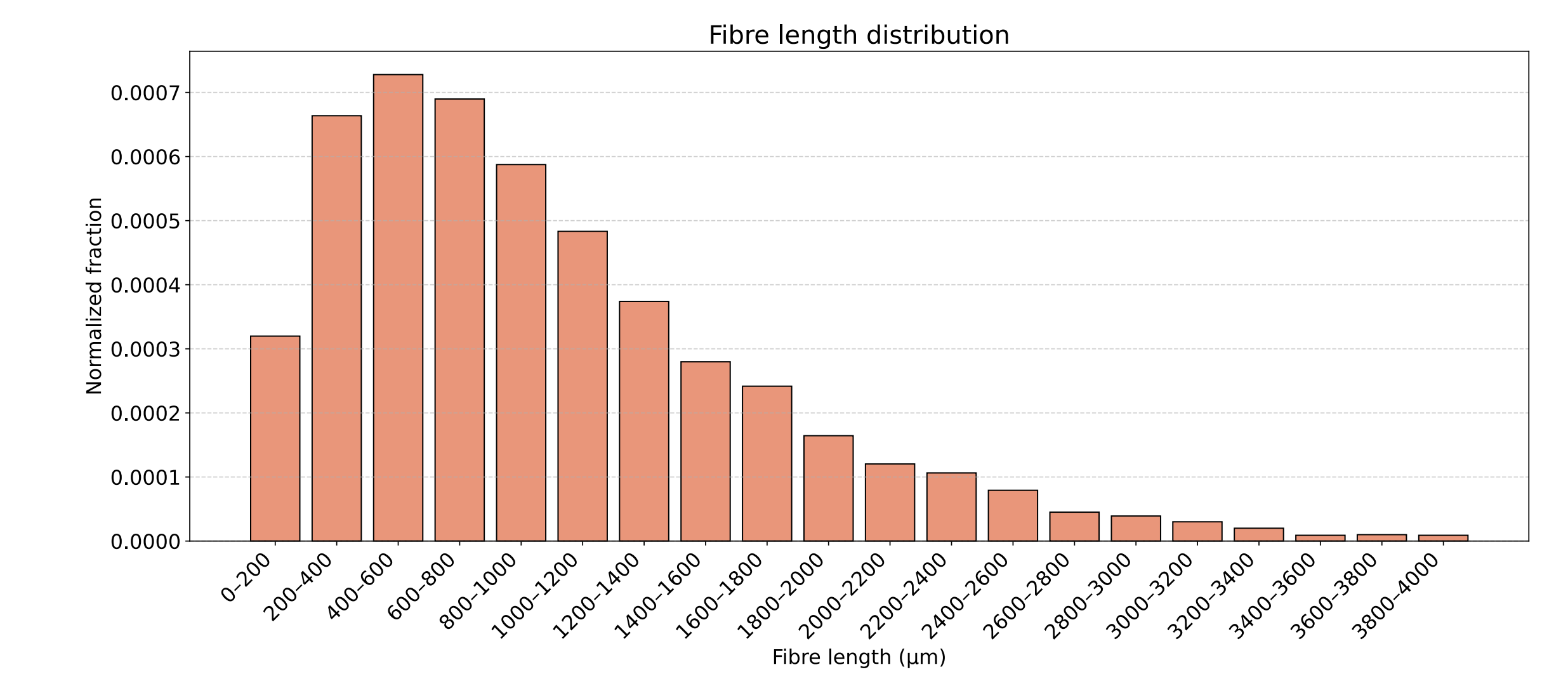


POPULATION-WEIGHTED SENSITIVITY REPRODUCES OBSERVED PATTERNS IN THE PARIS STUDY



Larger fibres (high aspect ratio) show more local sources and limited transport.

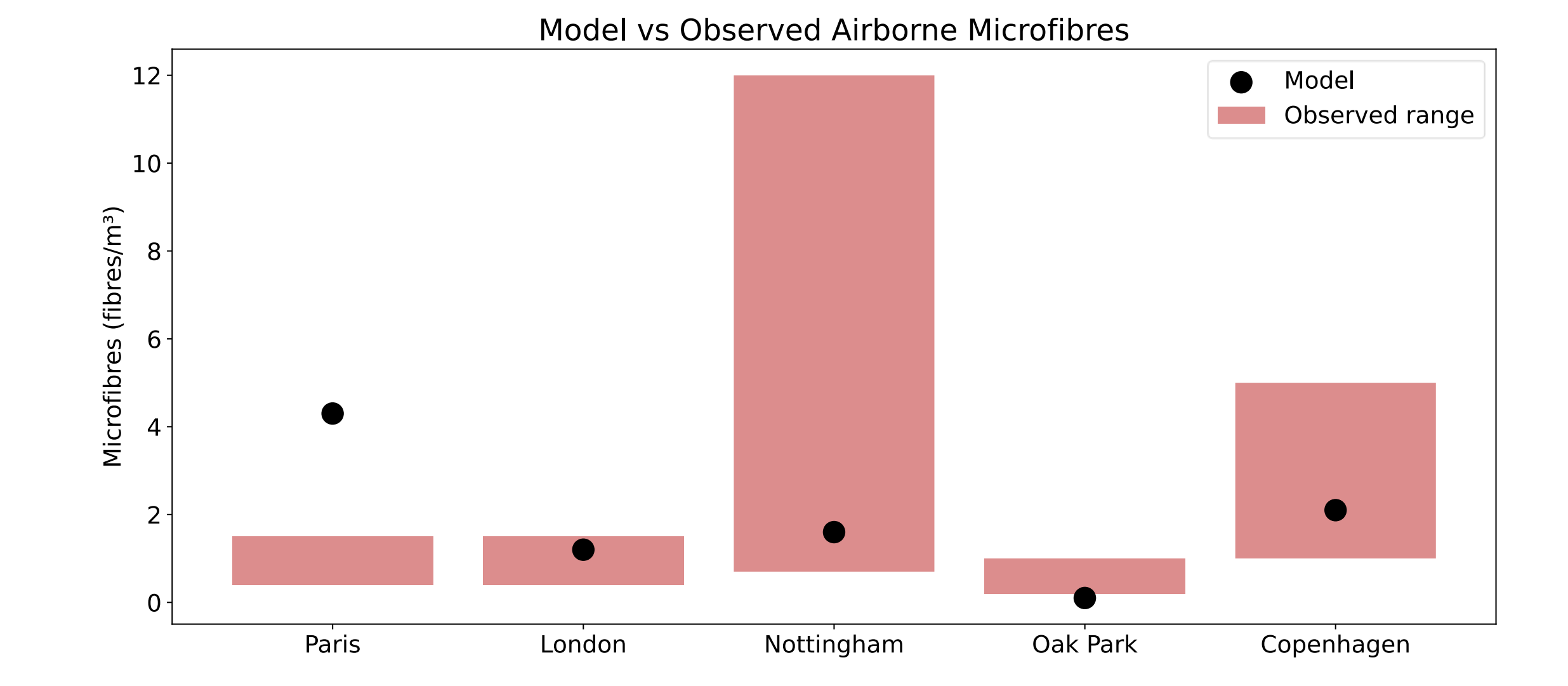
STATISTICS FOR SENSITIVITY STUDIES



Microfibre length distribution extracted from available literature. The respective **aspect ratios** are between **10 to 30**.

MODEL-OBSERVATION COMPARISON

Forward simulations



Length = 500 µm, AR = 10, emission factor = 1.03*10⁹ polyester microfibres per person per year (De Falco et al., 2020)

Good agreement of model and observations
Deviations in magnitude indicate **uncertainties in emission factors, size distributions and aspect ratios**

WHAT'S NEXT?

- Emission factor sensitivity studies: Impact on model and observation comparison
- Size distribution and aspect ratio sensitivity studies: Impact of microfibre properties on transport
- Uncertainty quantification