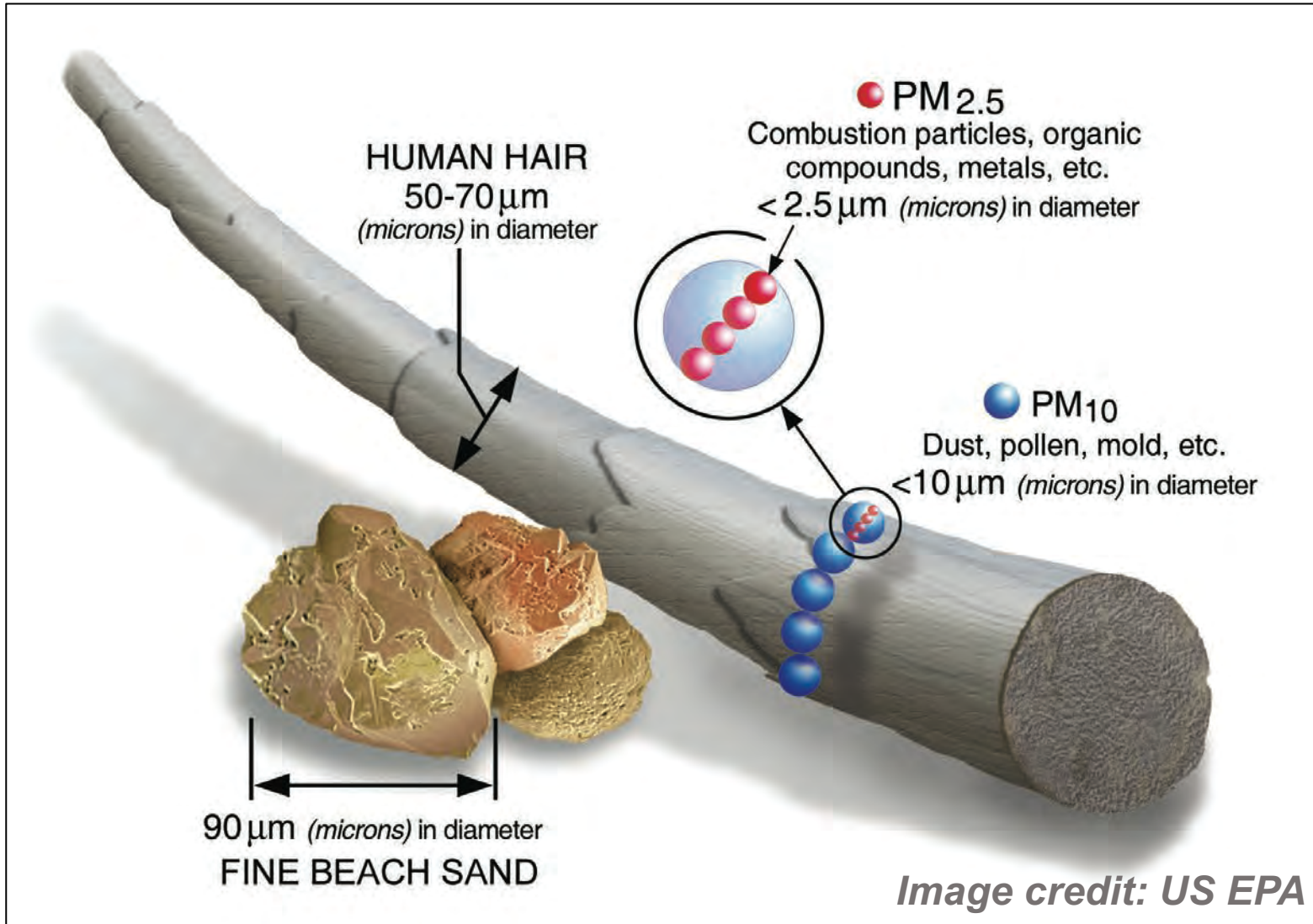


Local, national and regional contributions to PM_{2.5} pollution in Leicester

1st July 2021



The impact of air pollution on health



Most hazardous is **fine particles**

Small particles penetrate **deep into our lungs**

Many health consequences from exposure to fine particles. Most severe is **premature mortality**

Fine particles last in the atmosphere for **1-2 weeks**, so can be transported long distances

Many different emission sources of PM_{2.5}

Traffic



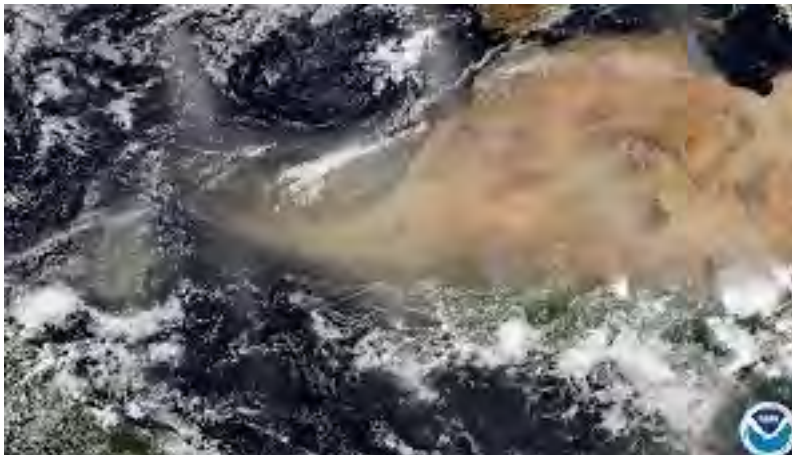
Construction



Agriculture



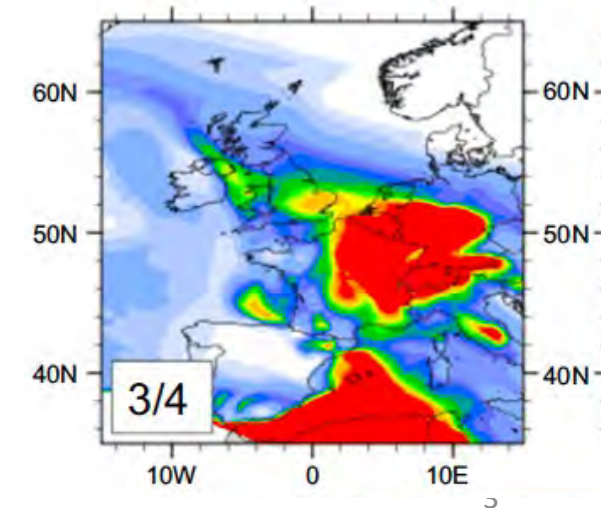
Saharan Dust



Shipping



European



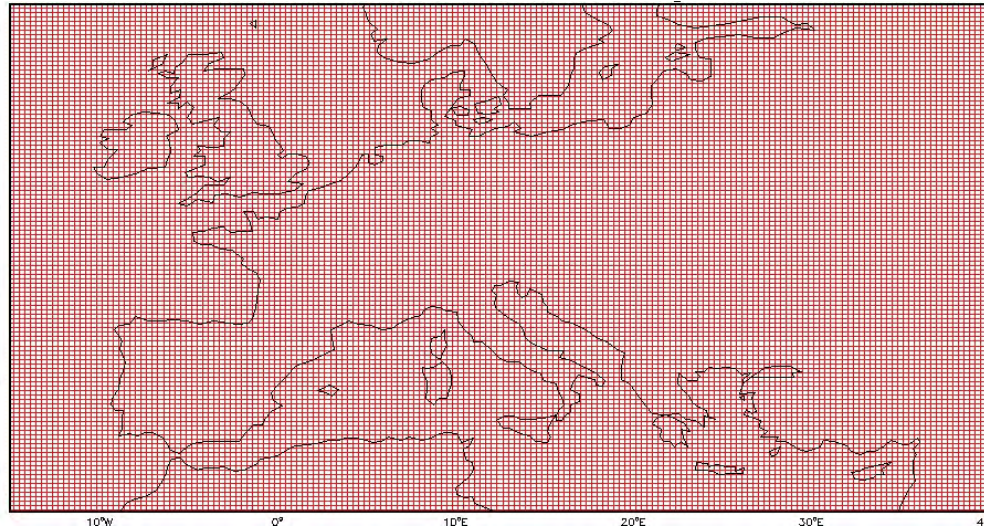
3D atmospheric chemistry transport model (GEOS-Chem)

Time period: January 2019 – December 2019

Emissions
(natural and human)



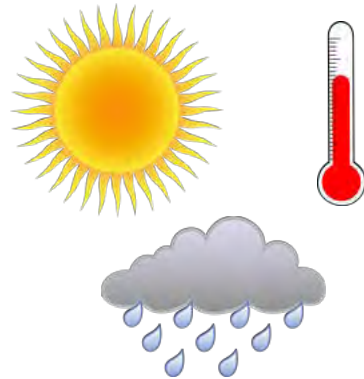
GEOS-Chem



Europe Nested Domain:
0.25 x 0.3125 or ~25-30 km



Offline Assimilated
Meteorology

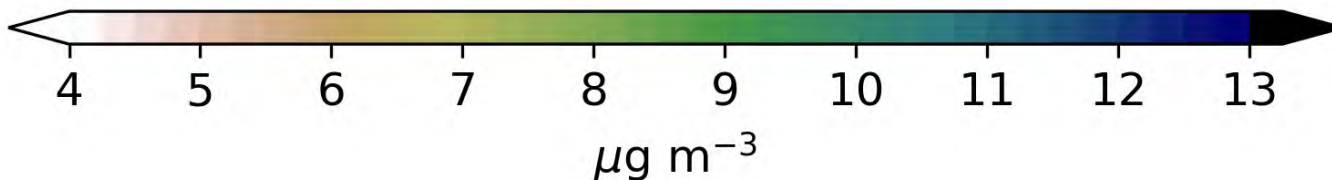
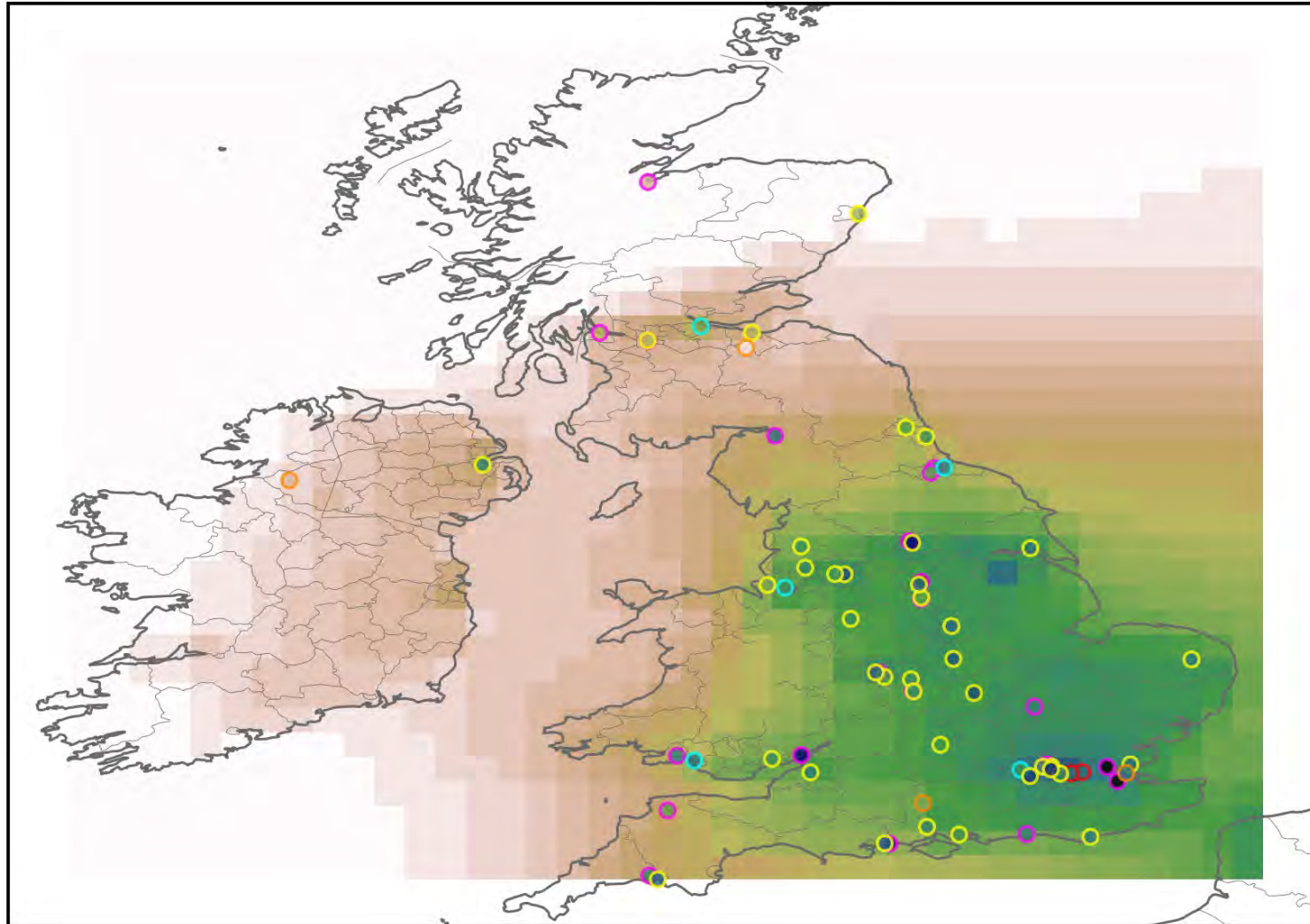


UK NAEI emissions
(with temporal information)

Chemistry, transport, wet/dry deposition

GEOS-Chem version 12.1.0
(doi:10.5281/zenodo.1553349)

Annual-average PM_{2.5} across the UK and guideline values



All sites:

Measured = $10.0 \mu\text{g m}^{-3}$

Modelled = $8.4 \mu\text{g m}^{-3}$

Normalised mean bias = -16 %

Leicester:

Measured = $11.4 \mu\text{g m}^{-3}$

Modelled = $9.4 \mu\text{g m}^{-3}$



Department
for Environment
Food & Rural Affairs

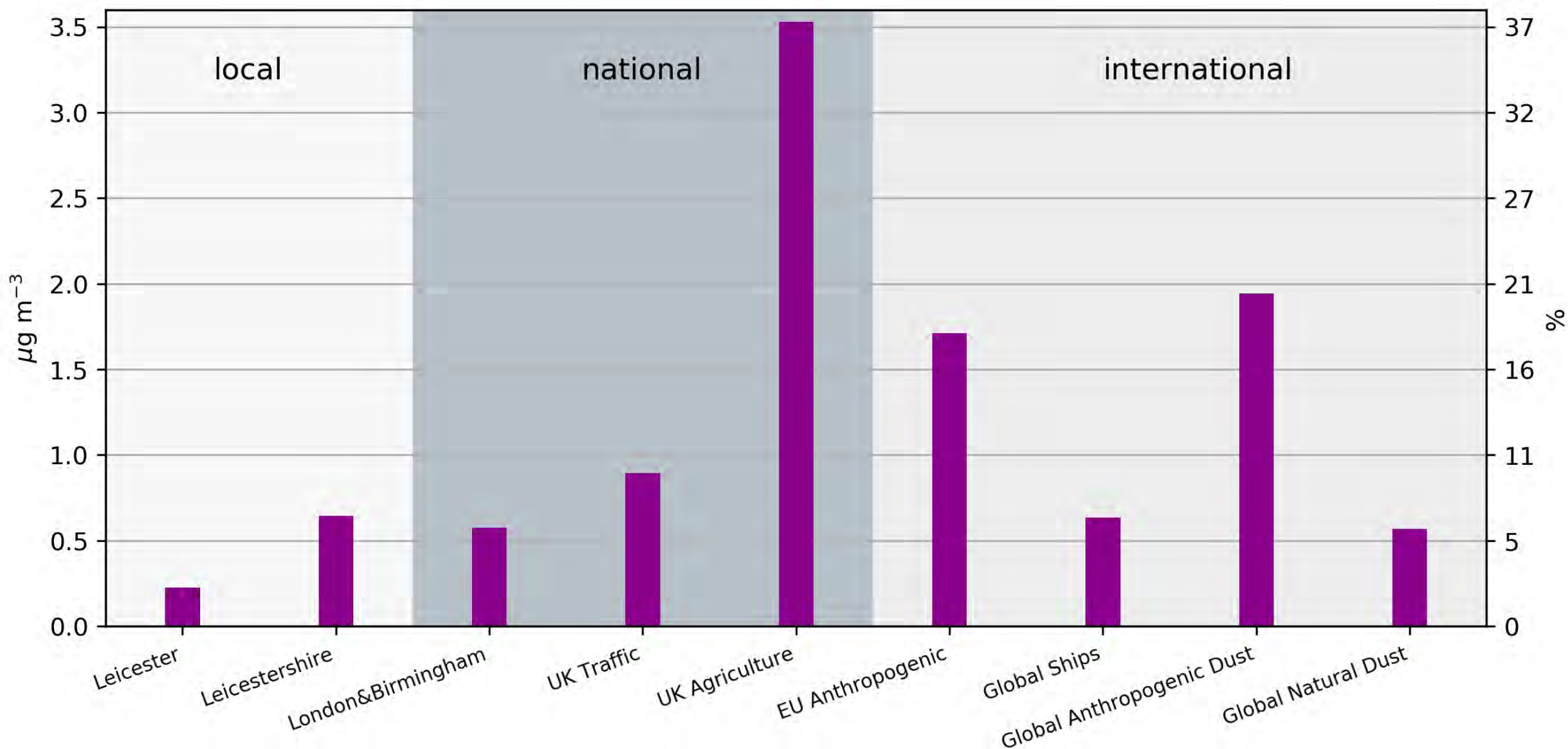
National
guideline:
 $25 \mu\text{g m}^{-3}$



World Health
Organization

WHO
guideline: $10 \mu\text{g m}^{-3}$

Contributors to PM_{2.5} in Leicester



PM_{2.5} is controlled by agriculture, as opposed to local emission sources within the city/county

Validating against a sensor network (EarthSense®)

Our study

Local contribution =
3-5 %

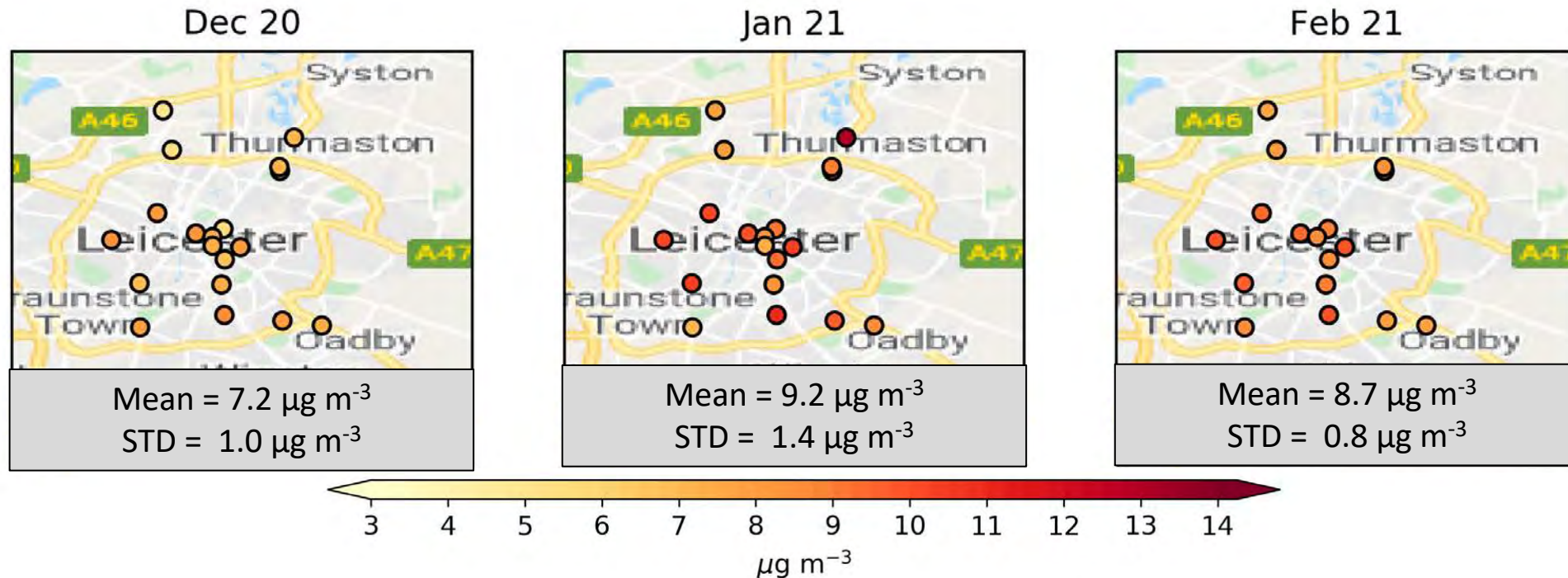
EarthSense®

Local contribution =
5-11 %

Jan 19

Jul 19

Dec 19/Jan 20



Both the model and sensors agree that local emissions have a low contribution to PM_{2.5} in Leicester

Concluding remarks

😊 Thanks for listening 😊

1. UK **agricultural** emissions have a **large (37 %)** influence on $\text{PM}_{2.5}$ in Leicester
2. **Transboundary** emissions from continental **Europe** have a **large (18 %)** influence on $\text{PM}_{2.5}$ in Leicester
3. **Local** emissions have **small (< 5 %)** influence on $\text{PM}_{2.5}$ in Leicester
4. UK **traffic** emissions both have **small (10 %)** influence on $\text{PM}_{2.5}$ in Leicester

