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WM-NET ZERO

A Health-centred Systems Approach Towards Net-Zero:
Transforming Regional Climate Mitigation Policies

Modelling the impacts of net zero policies on air quality and health equity in the West Midlands, UK

Jian Zhong, James Hall, James Hodgson, Sue Jowett, Suzanne Bartington, William Bloss, Zongbo Shi

University of Birmingham

The WM-NetZero project is supported by Wellcome Trust (227150_Z_23_Z) under the *Advancing climate mitigation policy solutions with health co-benefits in G7 countries* scheme.

Air pollution and Net Zero

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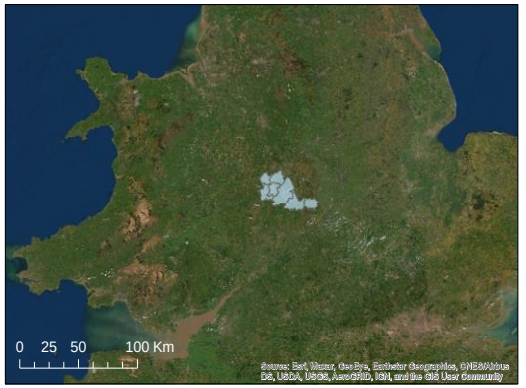
- Air pollution: Biggest environmental risk to human health
- Cities: typical hotspots
- Climate change and air pollution are closely interlinked
- Net Zero policies: air quality and associated health co-benefits.
- National and regional (WM2041) Net Zero strategy

https://ral.ucar.edu/pressroom/features/air-pollution-a-global-problem



https://www.nature.com/collections/ebbadffjfc

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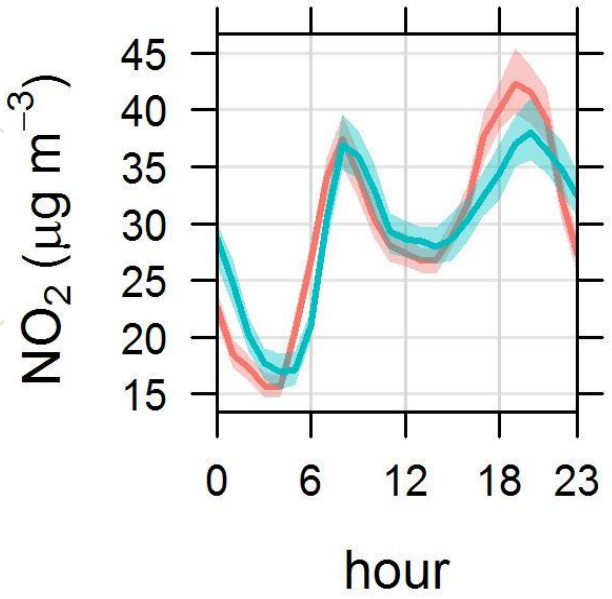
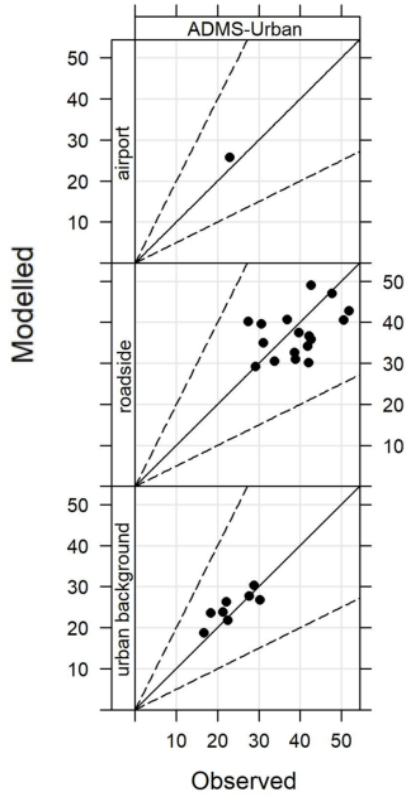
WM-Air model configuration

- ADMS-Urban model (CERC).
- Model baseline year: 2016 & 2019.
- Meteorology, background levels as observed.
- Advanced canyon and urban canopy.
- Emissions: Point, Road, and Grid.
- CERC Model Evaluation Toolkit.

Bristol Road (Roadside)





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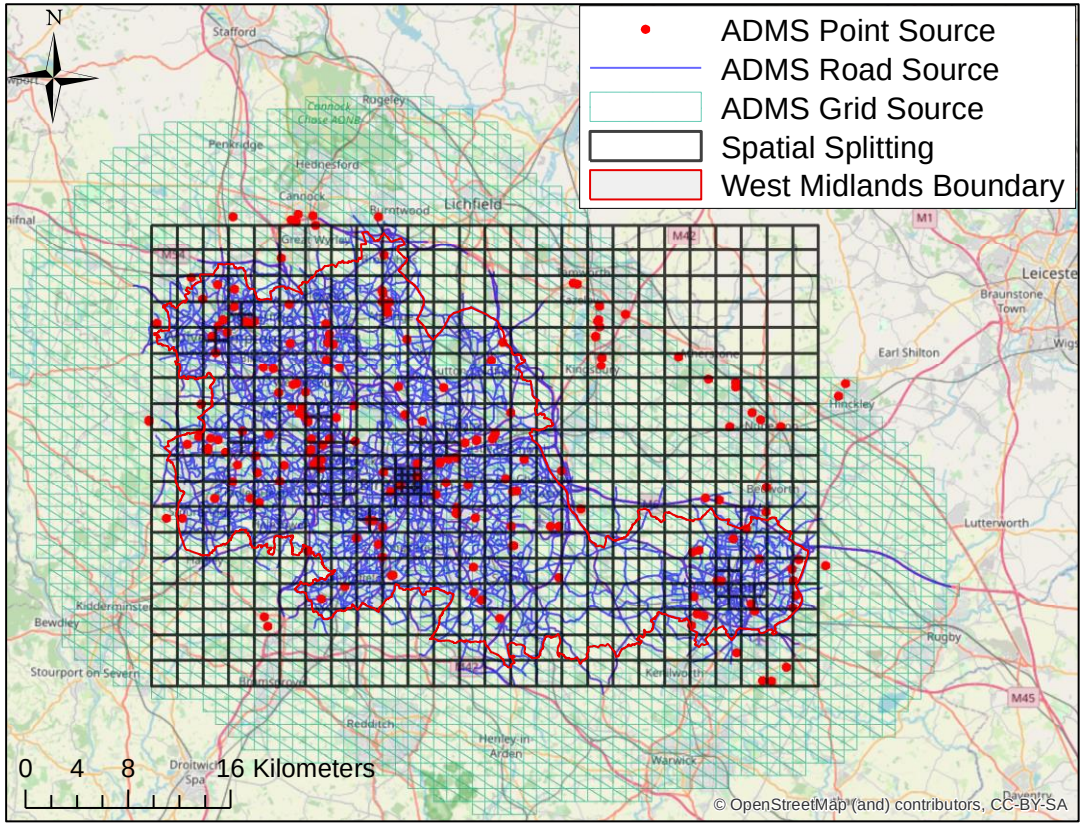

(Zhong et al, 2021, https://doi.org/10.3390/atmos12080983,
Zhong et al, 2024, https://doi.org/10.1016/j.uclim.2024.101961)

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WM-Air model capability

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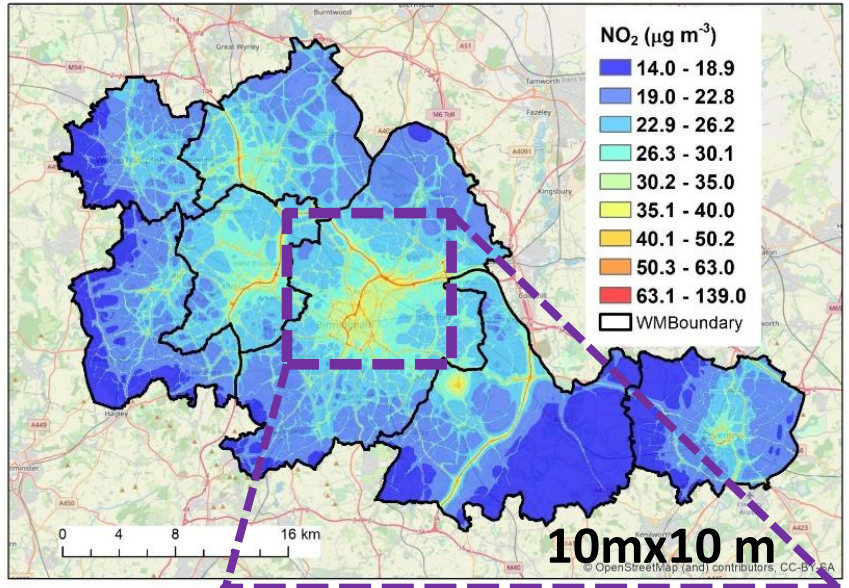
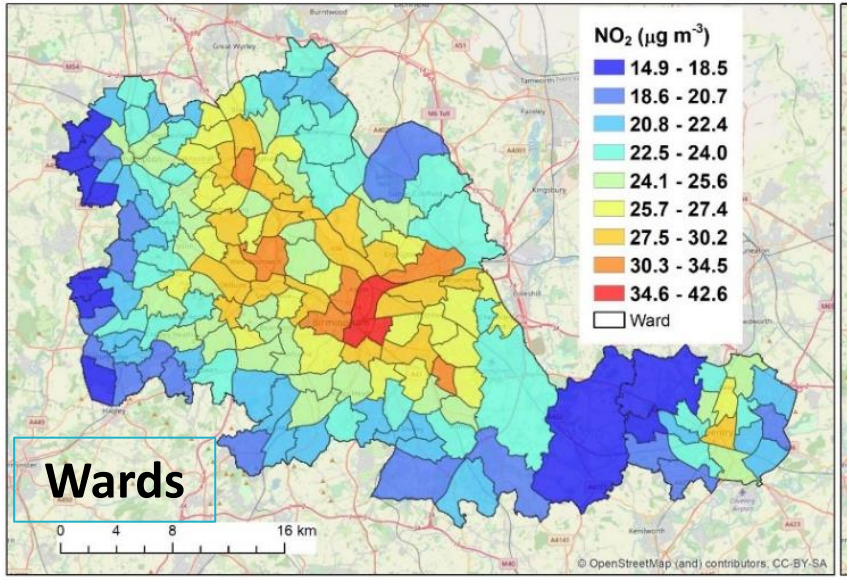
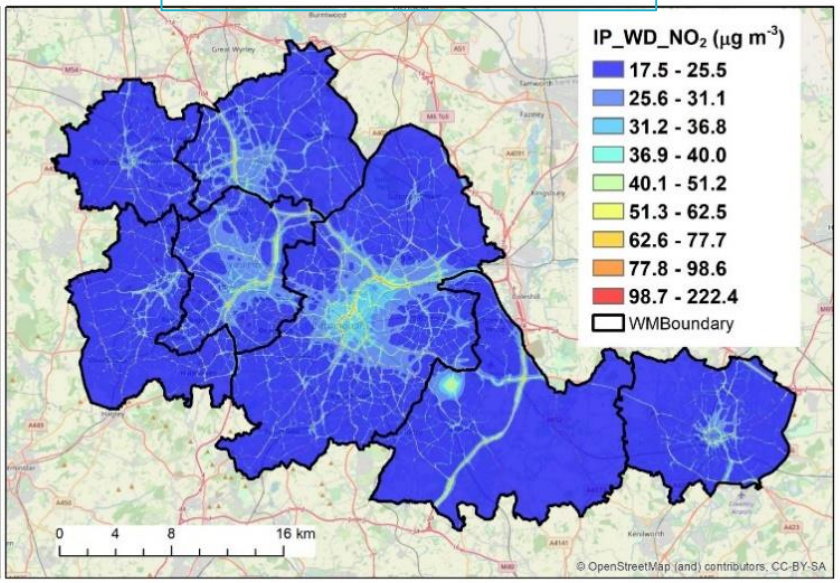


- 'Raw' high resolution concentration contours
- Spatially aggregated to LSOA and Wards
- Averaged over different diurnal subsets e.g. peak hours
- Assessment of health impact
- Evaluation of interventions

Weekday inter-peak





Scenarios: Clean Air / Net Zero

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- **2021 BAU** Business-as-usual: no covid impacts on activity (updated from the baseline model)
- **2030 BAU** Business-as-usual: Anticipated emissions reductions in line with NECD commitments

  https://www.eea.europa.eu/data-and-maps/data/necd-policies-and-measures-database
- **2030 NZS** Emission reductions estimated in line with the UK Net Zero Strategy; Assume a change in technology and therefore emissions (rather than behavioural change etc..)
- **2030 EV** Transport-sector only changes in line with the above 2030 NZS (24% car; 9% HGV; 25% bus/Coach=EV)

…these are all really quite substantial approximations…

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Air quality: 2021 BAU vs 2030 BAU

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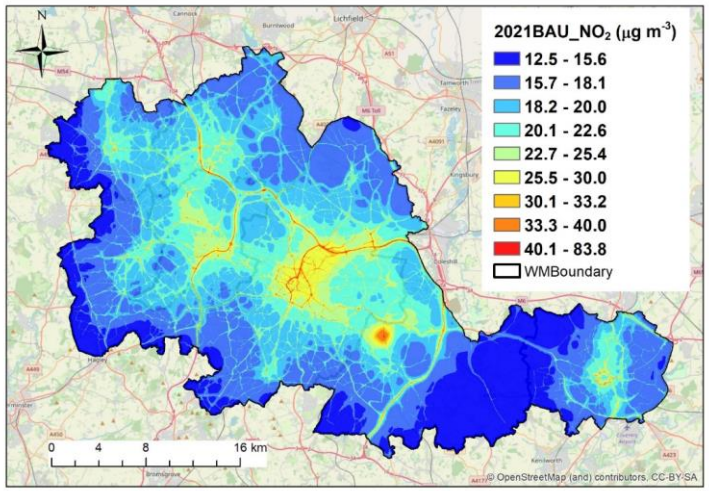
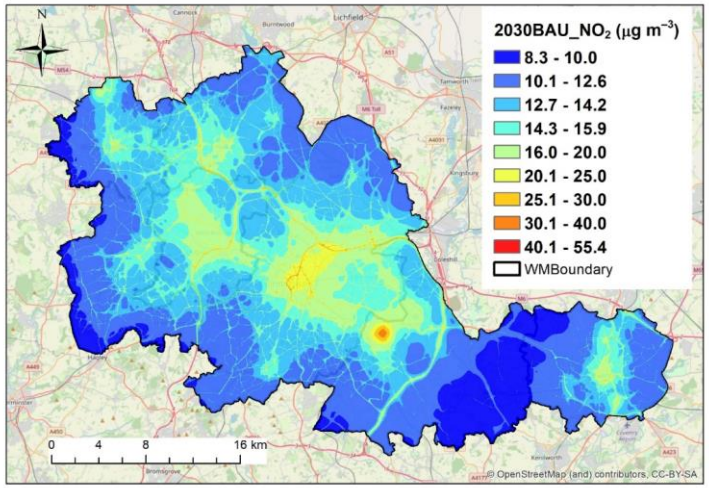
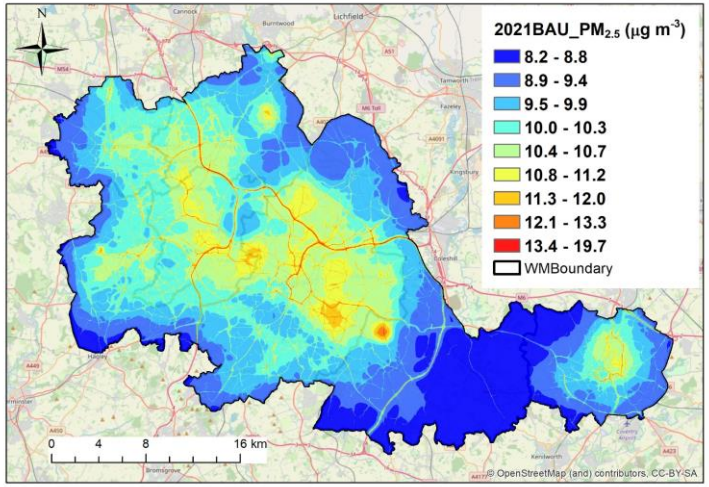
(a) NO_2 for 2021 BAU



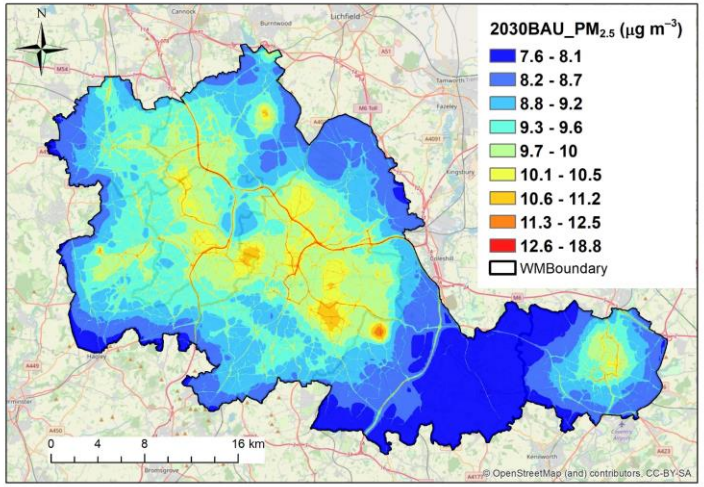
(b) NO_2 for 2030 BAU



(c) $PM_{2.5}$ for 2021 BAU



(d) $PM_{2.5}$ for 2030 BAU



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Impact of NZ policies on NO_2

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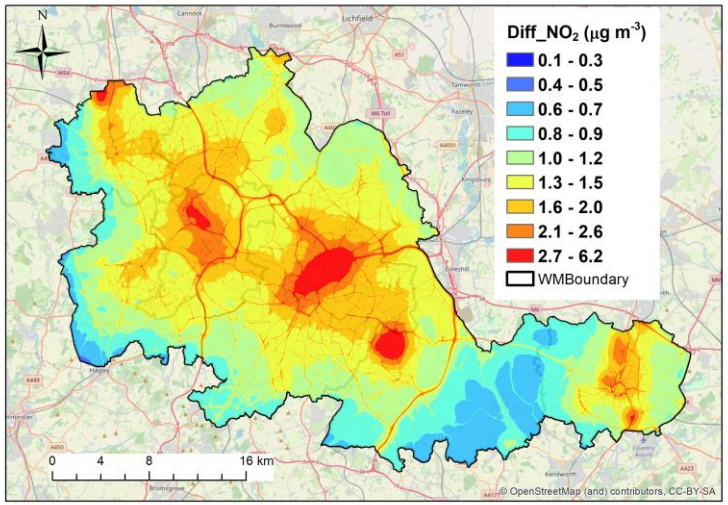
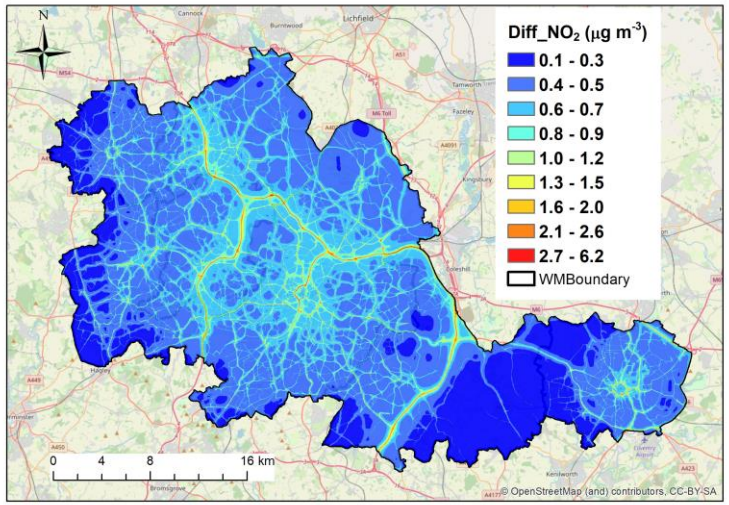
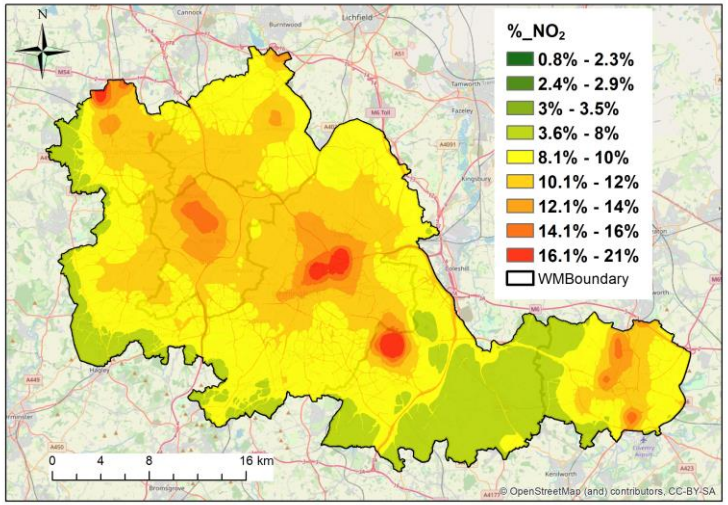
(a) 2030 BAU-2030 NZS



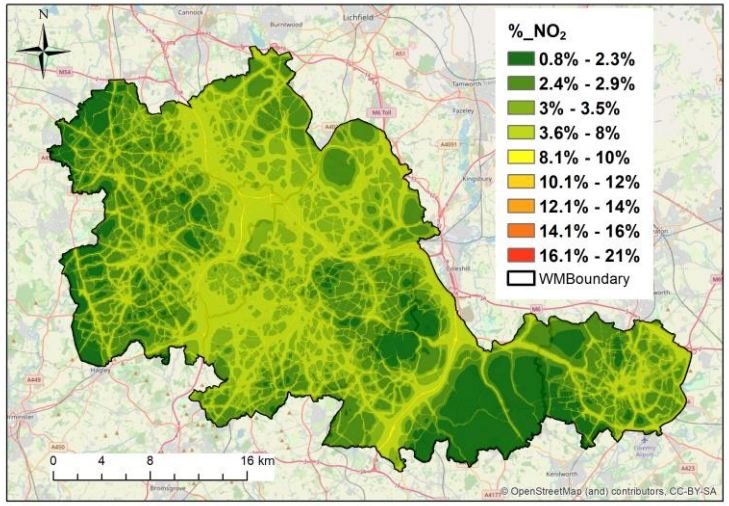
(b) 2030 BAU -2030 EV



(c) (2030 BAU -2030 NZS)/2030 BAU



(d) (2030 BAU -2030 EV)/2030 BAU



Net Zero Scenario

EV only Scenario

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Impact of NZ policies on $PM_{2.5}$

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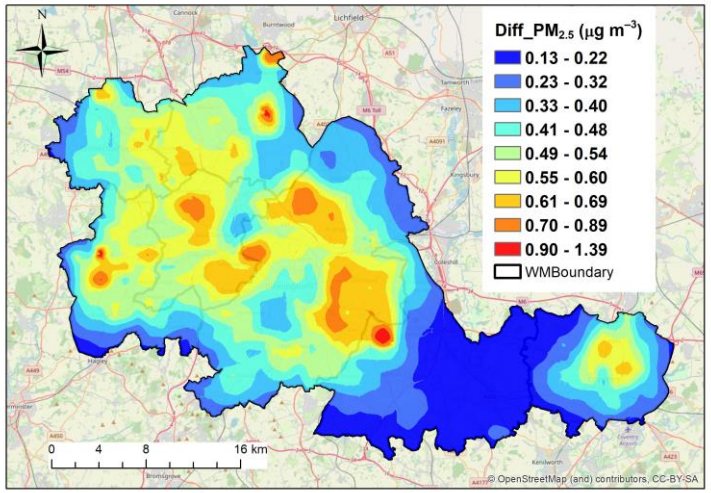
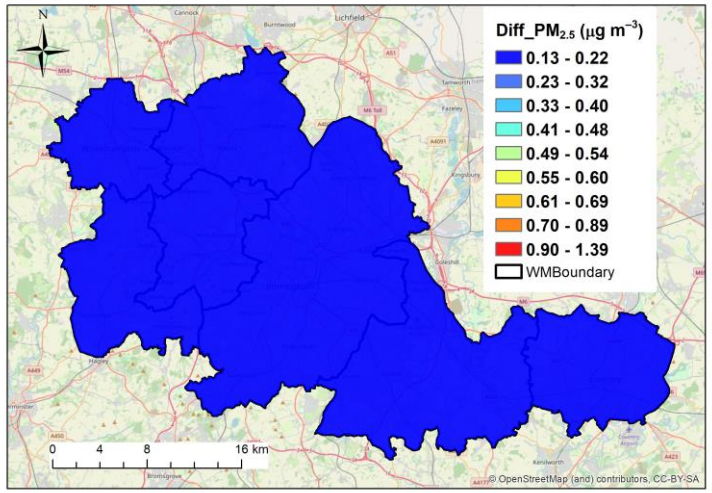
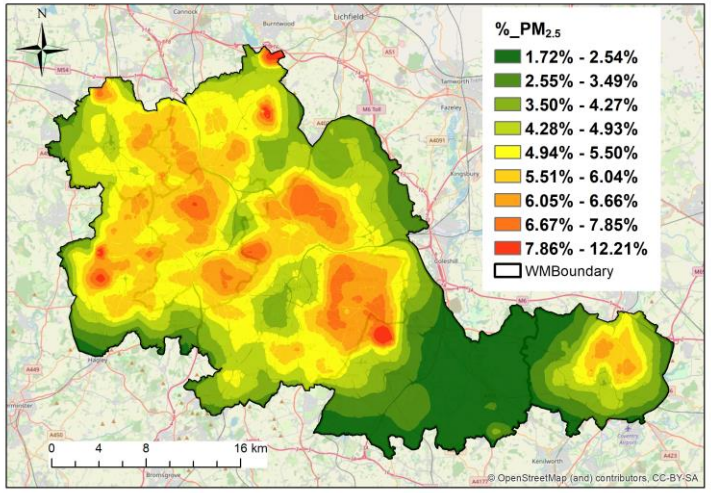
(a) 2030 BAU-2030 NZS



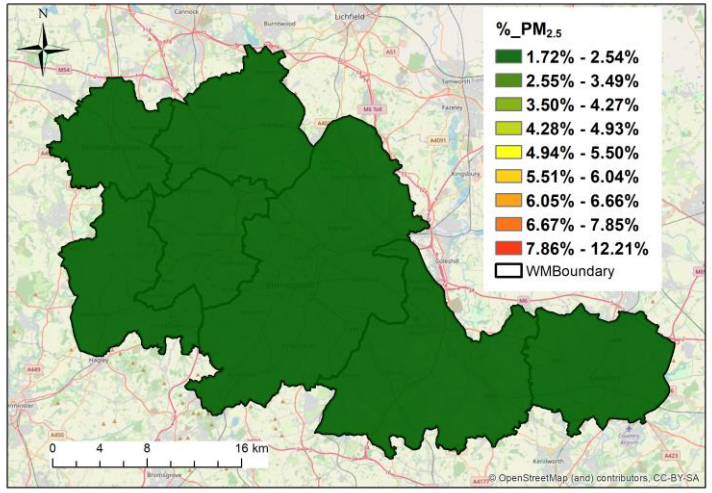
(b) 2030 BAU -2030 EV



(c) (2030 BAU -2030 NZS)/2030 BAU



(d) (2030 BAU -2030 EV)/2030 BAU



Net Zero Scenario

EV only Scenario

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Air quality Life Assessment

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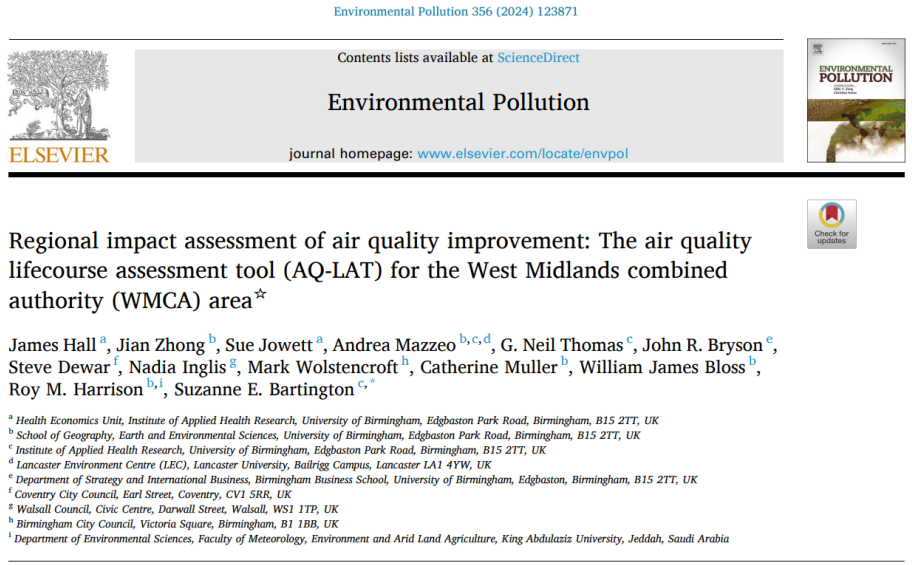
Air quality Life Assessment Tool (AQ-LAT) (Hall et al. 2024):

- Improved air quality under 2030 Net Zero scenario would have significant public health benefits with an estimated 2,853 lives saved and 16,751 less diseases cases over the next 20 years.

	Net Zero Scenario		EV only Scenario	
	Disease	**Deaths**	**Disease**	**Deaths**
Birmingham	7032	1060	5819	706
Coventry	1674	299	1399	215
Dudley	1706	344	1401	231
Sandwell	2069	382	1686	251
Solihull	950	176	811	134
Walsall	1901	316	1608	215
Wolves	1419	276	1151	187
WMCA	16751	2853	13875	1939



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Regional impact assessment of air quality improvement: The air quality lifecourse assessment tool (AQ-LAT) for the West Midlands combined authority (WMCA) area☆

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Impact on health inequality

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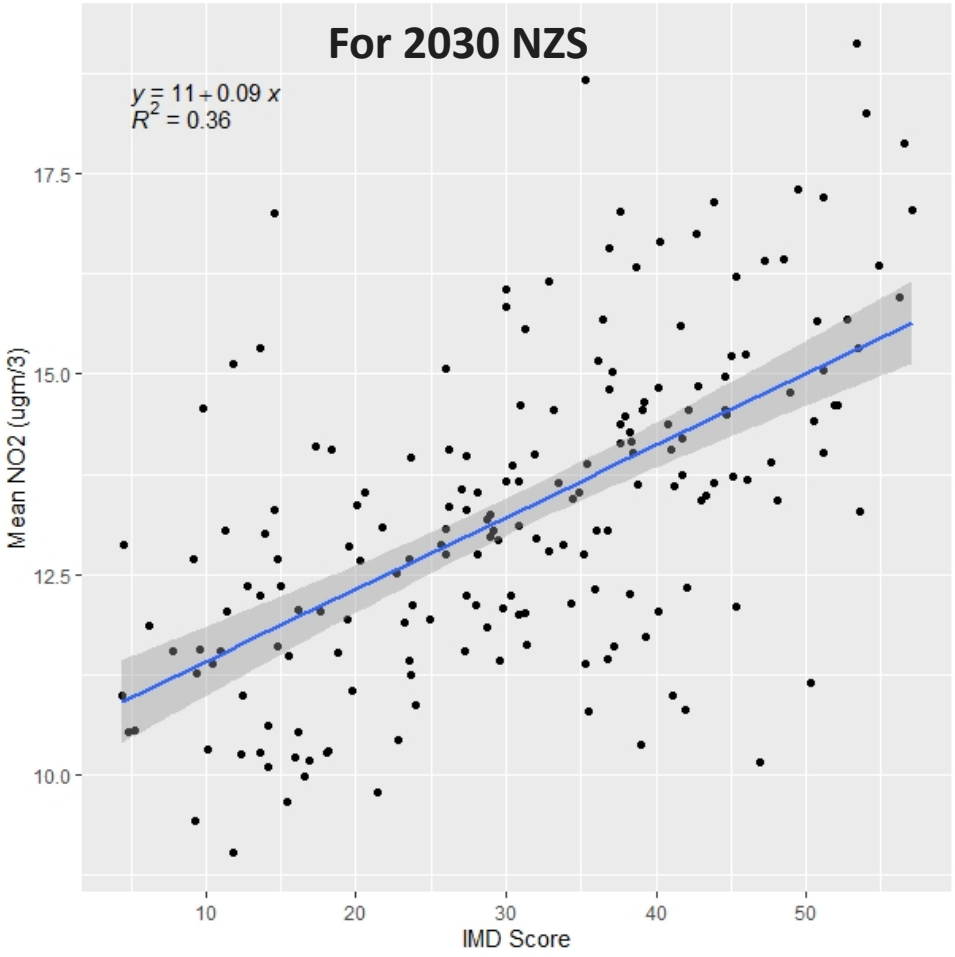

- The most deprived areas of the region are exposed to the highest air pollution levels.
- Health inequality would be reduced under the 2030 NZS scenario.

Difference between the most and least deprived ward air pollution levels (μg m^{-3})

Pollutant	2030 BAU	2030 EV	2030 NZS
NO_2	4.1	4.3	3.62
$PM_{2.5}$	1.42	1.42	1.17

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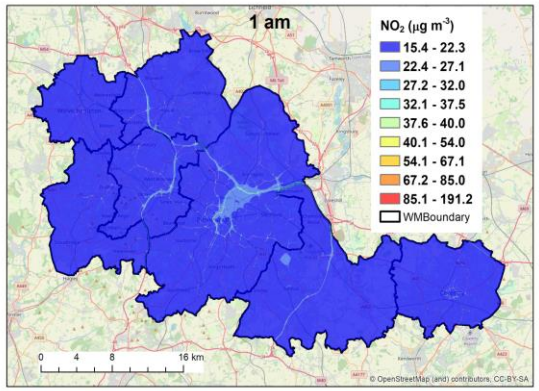
Thank you for your attention!

- NZS improves air quality.
- There are bigger benefits from NZS than from EV.
- NZS health benefits: 2,853 lives saved and 16,751 less diseases cases over the next 20 years.
- Health inequality is reduced.



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X: https://x.com/WMNetZero

LinkedIn: linkedin.com/company/wm-net-zero

E-mail: wm-netzero@contacts.bham.ac.uk

Website: https://wm-netzero.org.uk/

Mailing List: eepurl.com/iN7L2U

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https://www.youtube.com/watch?v=Z5C2p509thc

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