Dr. Matthew Thomas

2010-19: Undergraduate & Postgraduate (Bath)

- Air quality and health
  - Global air quality
  - Climate change mitigation on health
- Public health
  - Health impact analysis
  - Treatment effectiveness in arthritis research

2019-Present: Postdoctoral (Imperial, Exeter, Manchester)

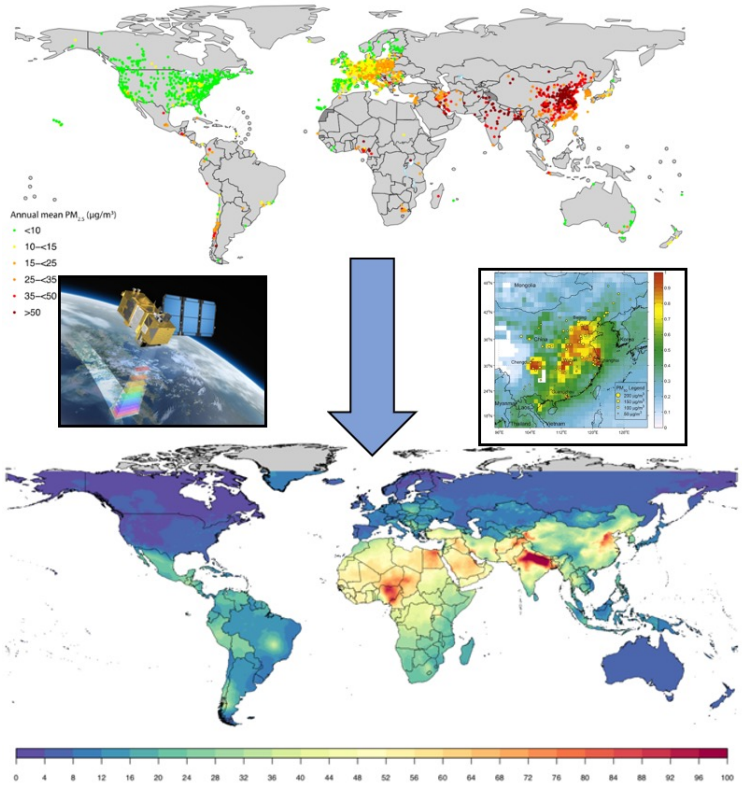
- HIV epidemiology
- Air quality and health
  - Global air quality
  - Effects of air quality on dementia and ageing
  - Personal exposure modelling

Research interests

- Application-based methodological developments
  - Environment
  - Public health
- Research Interests
  - Bayesian hierarchical modelling
  - Large scale computation
  - Spatial/spatio-temporal statistics
  - Data integration
- Multi-disciplinary research

Data Integration Model for Air Quality (DIMAQ)

- Ambient air pollution has been identified as a global health priority
- Burden of disease calculations require detailed information of exposures to air pollution for every country
- Accurate estimates of exposure to air pollution are required
  - Global, national and local levels
  - Measures of uncertainty
- Ground monitoring is limited
- Utilise information from multiple sources
  - Satellite remote sensing
  - Chemical transport models
  - Land-use information
  - Topography

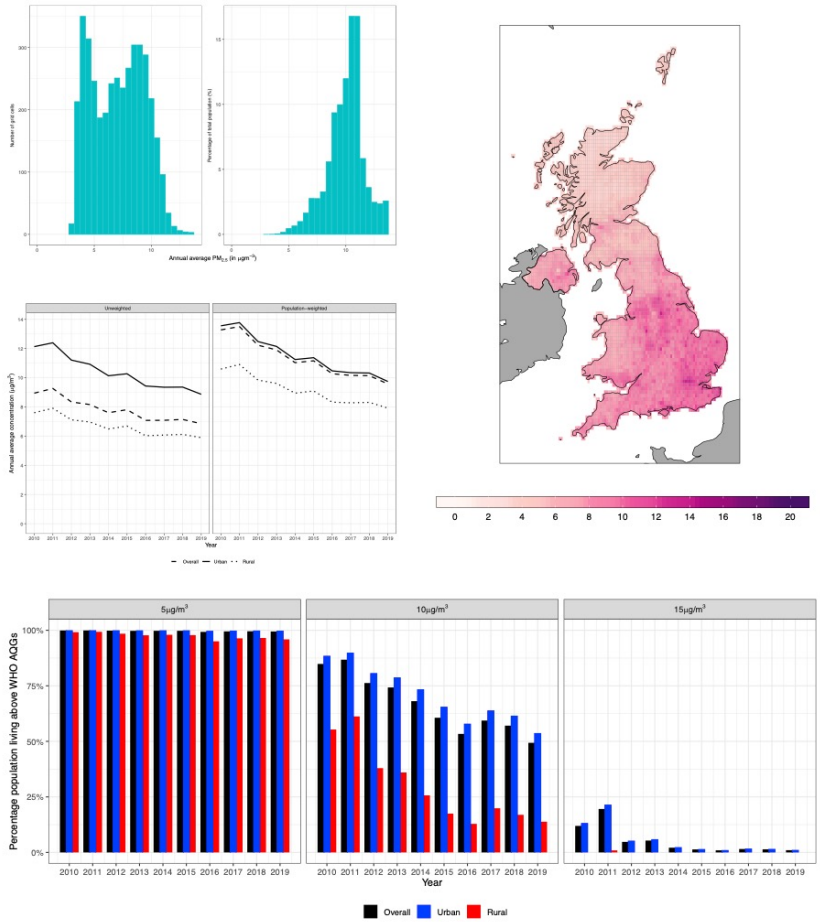


11 SUSTAINABLE CITIES AND COMMUNITIES

Indicator 11.6.2 Annual mean levels of fine particulate matter (e.g. PM2.5 and PM10) in cities (population weighted)

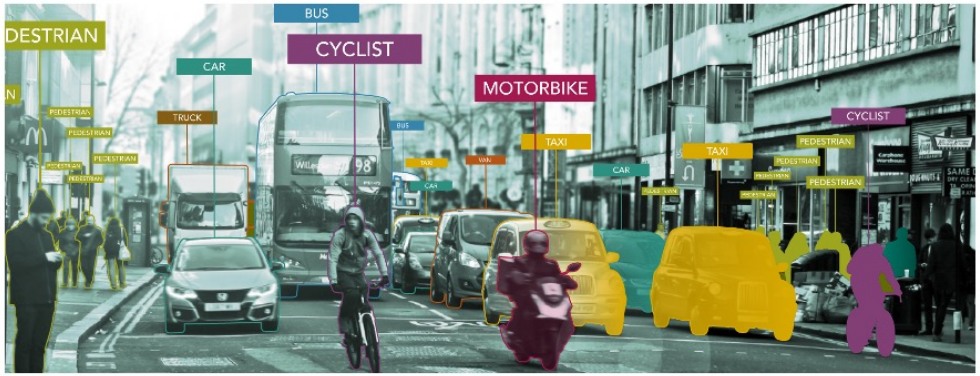
Data Integration Model for Air Quality (DIMAQ)

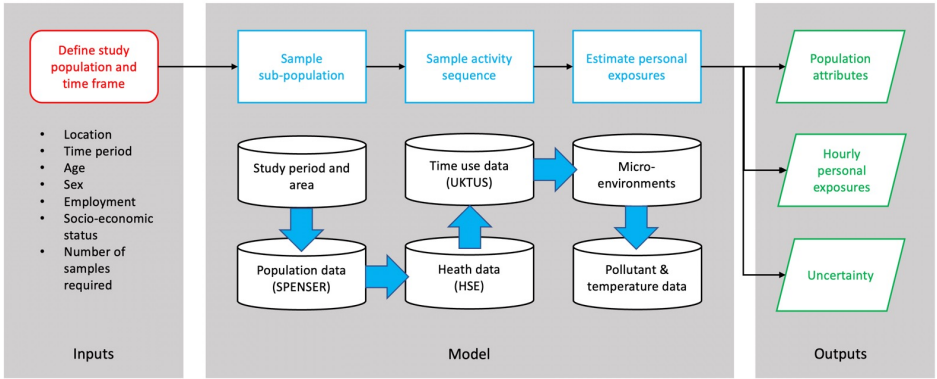
- Integrated modelling framework to estimate population level exposures to air pollution
- Bayesian calibration model
- High-resolution estimates of concentrations across the world along with relevant summaries
- Used by WHO for country consultation and to drive policy
- Form part of SDG submission
  - SDG 11.6.2 - Concentrations of fine particulate matter
  - SDG 3.9.1 - Mortality attributed to household and ambient air pollution



Data Integration Model for Exposures (DIMEX)

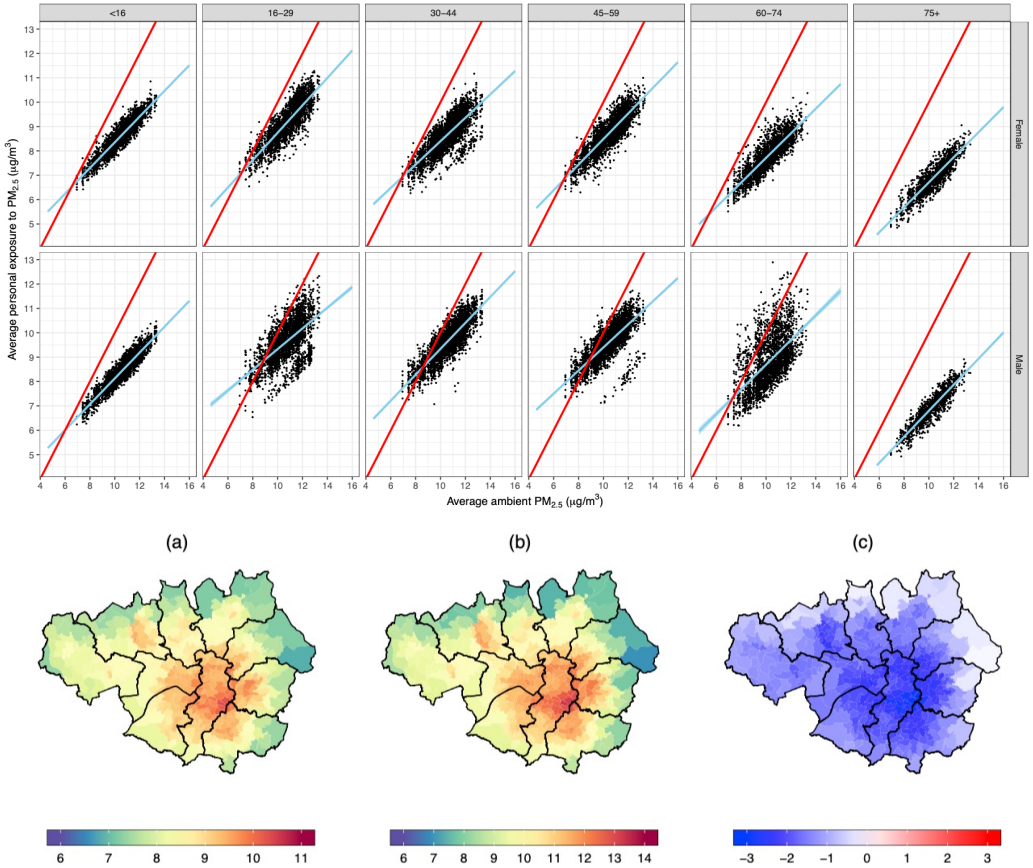
- Majority of research related to the health effects of air pollution has been at a population level
- This does not necessarily reflect individual's exposures to different levels of air pollution throughout the day
  - Move through micro-environments with different levels of pollution
- DIMEX is a modelling framework that estimates personal exposures to air pollution
  - Simulate daily exposure of different population groups using agent-based modelling
- Understand differences between personal exposures and measured concentrations





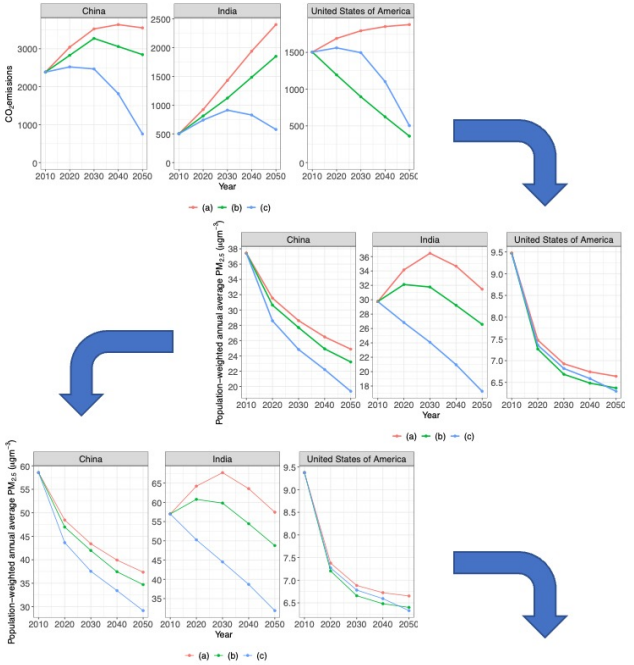
Data Integration Model for Exposures (DIMEX)

- Human activity and the locations play an important role in their exposures
- Substantial variation observed across different demographic groups
- Substantial variability in air quality across regions suggests that denser, targeted, networks of air quality sensors are required
- Concentrations of air pollution vary considerably across different micro-environments
- Majority of people spend 90% indoors on average, demonstrating the importance of indoor air quality as an important exposure route for public health policy



Health Co-benefits of Climate Change

- Fossil fuel combustion constitutes 85% of $PM_{2.5}$.
- Climate change mitigation policy will have associated “co-benefits”.
- A comprehensive analysis of co-benefits are crucial in determining the true costs of climate change mitigation.
- Analyse the health co-benefits of the subsequent reduction in $PM_{2.5}$.
- Estimated that 1.22 million deaths (~12%) can be saved from pursuing a 2^{o}C temperature target.
- Project with the WHO.



World Health Organization

Region	Year	Scenario	Estimated Deaths		Reductions in deaths	
			Median	Uncertainty	Median	Uncertainty
Global	2030	(a)	6027864	(5234476, 6913808)	0	(0, 0)
		(b)	5898347	(5105703, 6770842)	125064	(115178, 156855)
		(c)	5477743	(4736925, 6342850)	531644	(487418, 665252)
	2040	(a)	8018471	(6906767, 9265149)	0	(0, 0)
		(b)	7776099	(6673641, 9022470)	233970	(215656, 297038)
		(c)	7191759	(6137722, 8439822)	798741	(728624, 1013286)
	2050	(a)	10147384	(8641497, 11813409)	0	(0, 0)
		(b)	9811679	(8334760, 11474961)	328276	(300406, 424472)
		(c)	8874504	(7493771, 10535170)	1226905	(1114707, 1573862)

Gateway – Health and Retirement Studies

- Epidemiological studies often require estimates geolocated to places of residence.
- Need to capture micro-scale features.
- Very high-resolution estimates of air pollution.
- NIH funded series of epidemiological studies looking at the relationship between $PM_{2.5}$ and ageing.
  - USA, England, India and South Korea.
  - Expanding to Mexico, Brazil, Northern Ireland, Ireland and Chile.