

Exposure Perspectives on the MAPLE Study

HEI Low Exposure Review Panel

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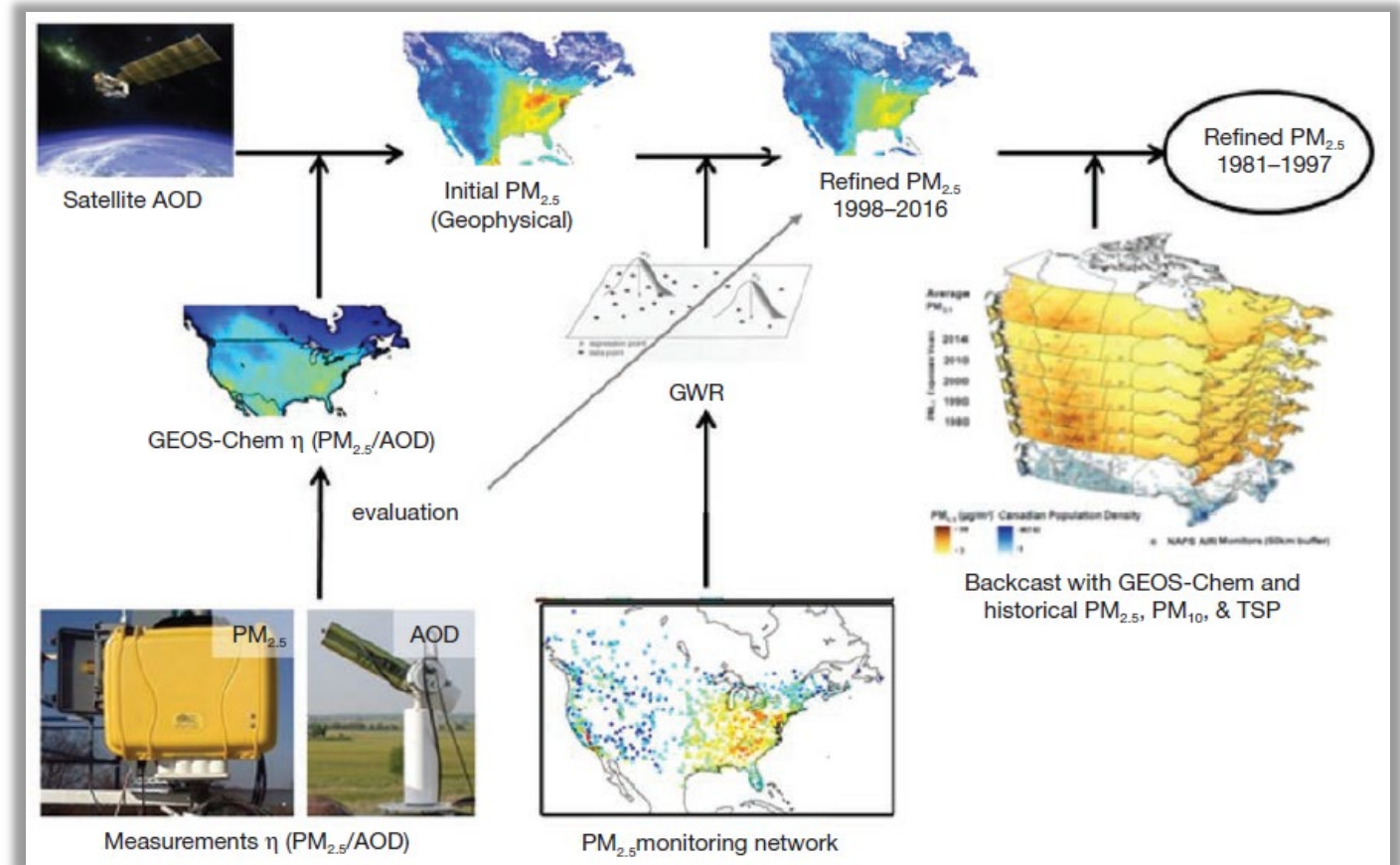
Imperial College London, United Kingdom



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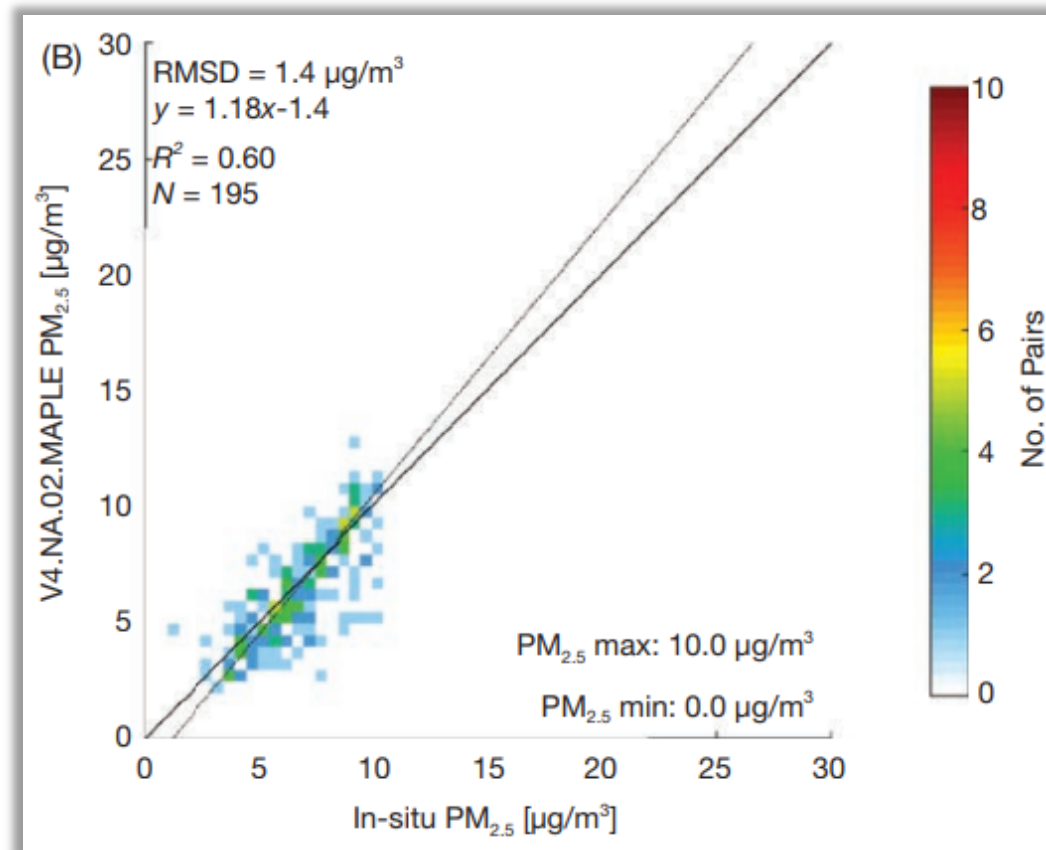
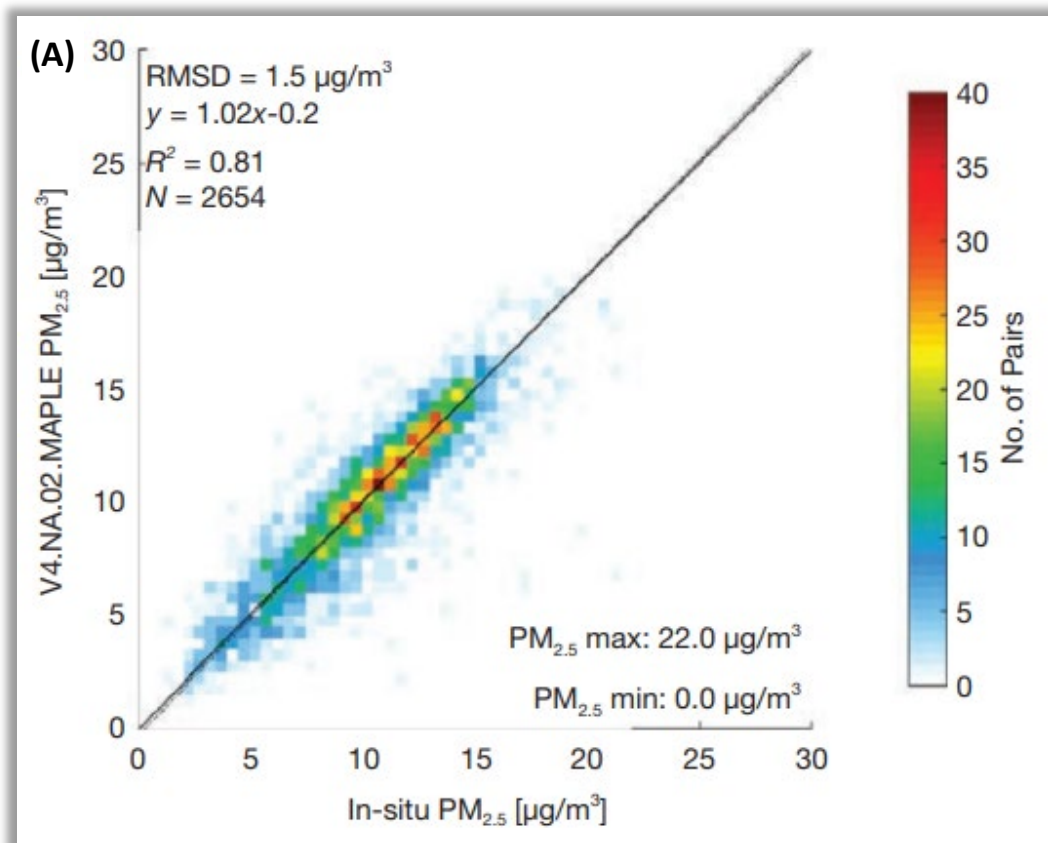
MAPLE Study Exposure Model

- ✓ Coverage – entire N America
- ✓ Diverse inputs (1999 onward)
- ✓ 35 year time span (1981-2016)
- ✓ Multipollutant (co-pollutants and PM species)
- ✓ Spatial scales :
 - ✓ $PM_{2.5}$: 1km
 - ✓ O_3 : 21/10km (13 yr backcasted CTM)
 - ✓ NO_2 : 0.1km (1 yr backcasted LUR)



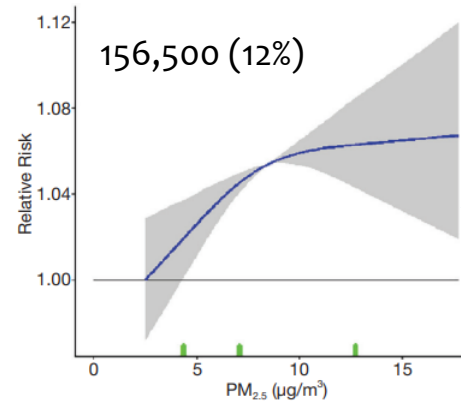
Schematic of exposure development process for $PM_{2.5}$ (Brauer et al. 2022)

Model Performance in Low Exposure Settings

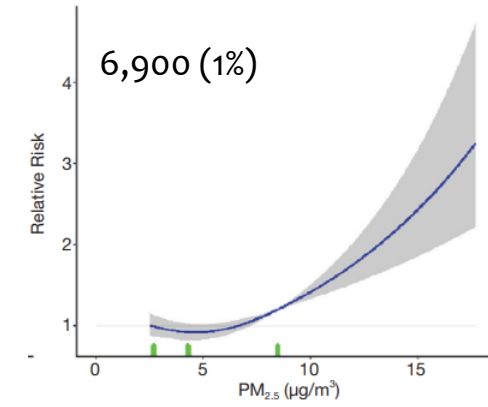


- ✓ Evaluation against ground-based monitors 2000-2012 A) All North America, B) Canadian $< 10 \mu\text{g}/\text{m}^3$
- ✓ 50% of all person-years in CanCHEC cohort $< 8.26 \mu\text{g}/\text{m}^3$, 25% $< 6.26 \mu\text{g}/\text{m}^3$

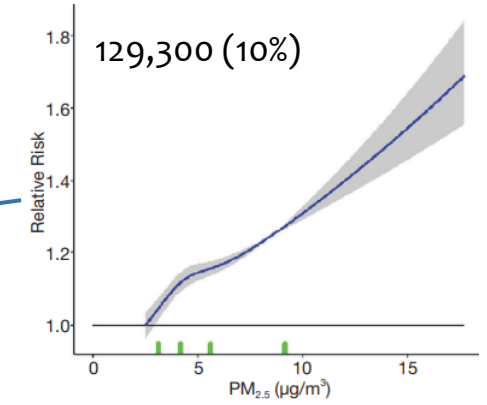
Regional Airsheds



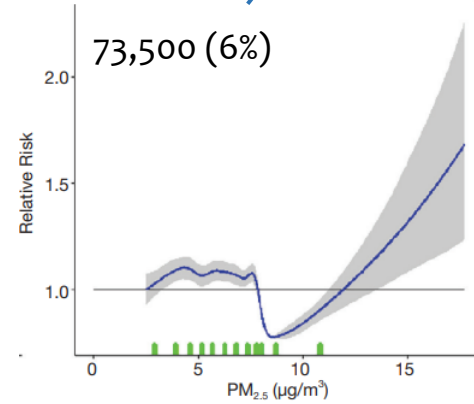
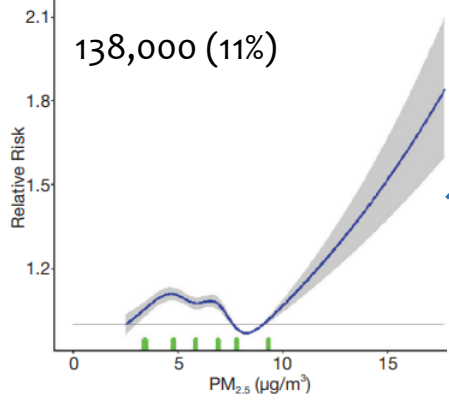
Western



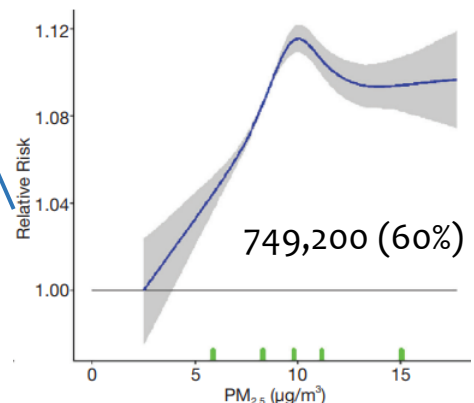
Northern



Southern Atlantic



West Central



East Central

Exposure Model Comparisons

- ✓ *Large overlaps in methodology of the three HEI-funded low exposure studies – US, Canada, Europe*
- ✓ *Comparison underway*
- ✓ *Hybrid methods make independent validation difficult – bottom-up emissions modelling could help*

Conclusions

- ✓ *Impressive effort to create highly detailed hybrid exposure model for North America utilisable for future studies*
- ✓ *Co-pollutant effects important, but spatial mismatch of models limits interpretation*
- ✓ *Despite advances exposure measurement errors remain – rural areas, model performance at low levels, spatial alignment, backcasting*
- ✓ *Heterogeneity in regional airshed exposure-response curves requires further investigation – is it chemical composition?*
- ✓ *Comparison of three LE studies' models eagerly awaited*