Quantifying Changes in Air Pollution Concentrations Caused by Traffic Interventions

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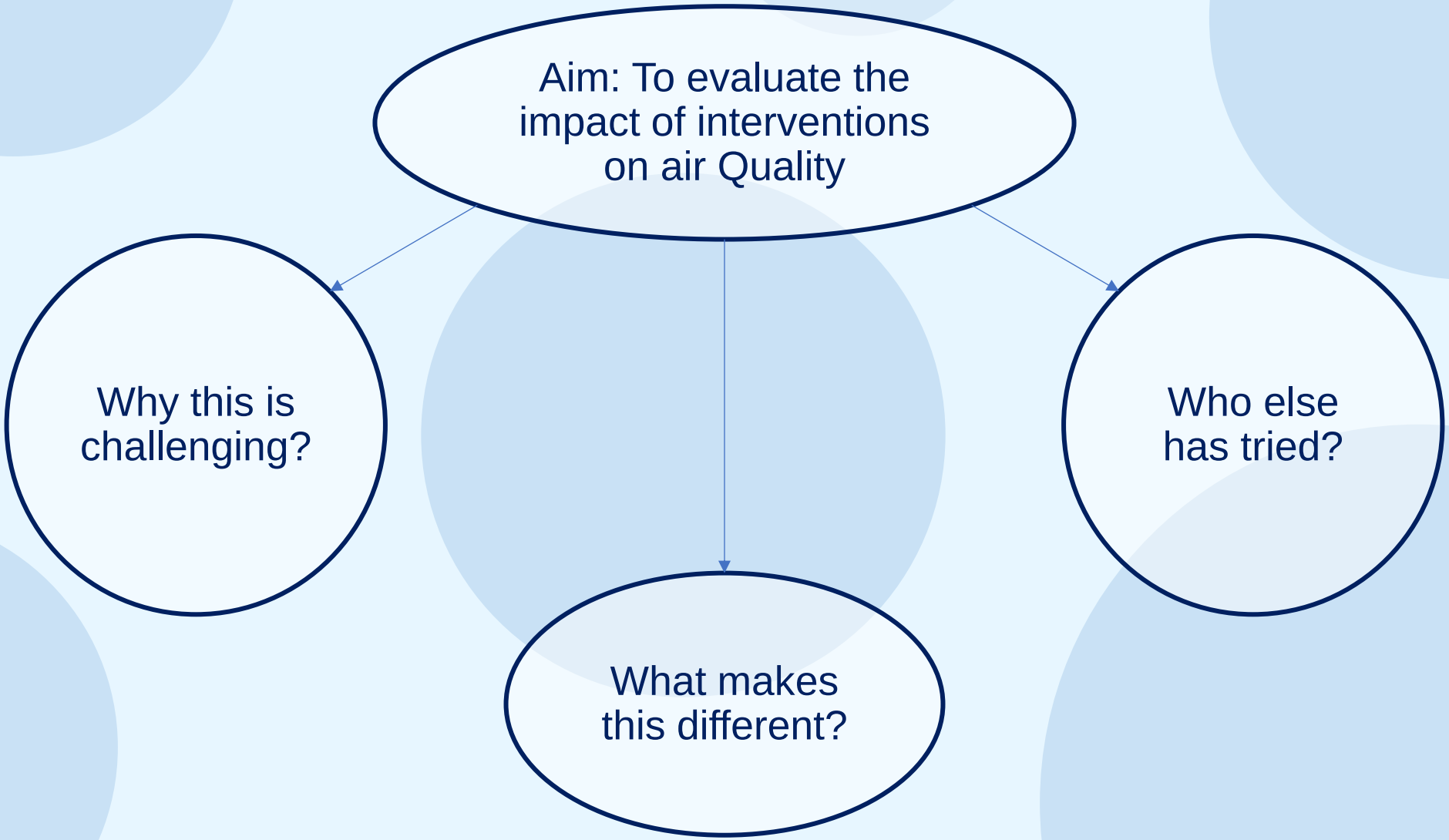
Introduction



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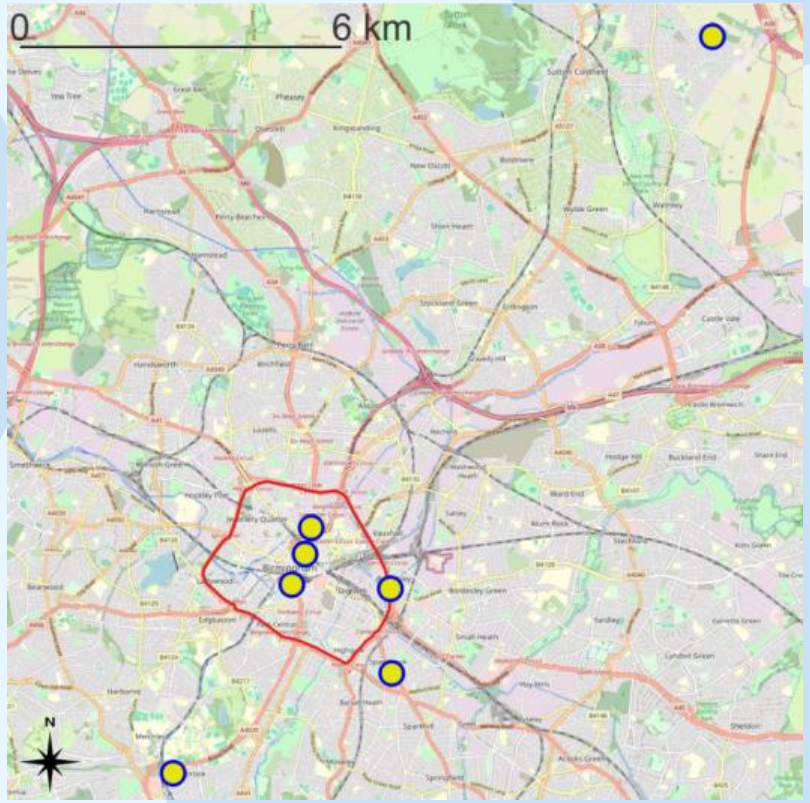
Case Study: Birmingham, UK

Pre COVID-19 | Between | Since CAZ

Up to March 1st 2020 — Since July 1st 2021

Site Name	Start	End	Location
Birmingham A4540 Roadside	09/09/2016	31/12/2023	Outside CAZ
New Hall	01/01/2010	07/05/2024	Outside CAZ
Selly Oak	01/01/2010	07/05/2024	Outside CAZ
Stratford Road	01/01/2010	07/05/2024	Outside CAZ
St. Chads Queensway	26/07/2018	07/05/2024	In CAZ
Colmore Row	08/03/2018	07/05/2024	In CAZ
Lower Severn Street	29/06/2018	07/05/2024	In CAZ



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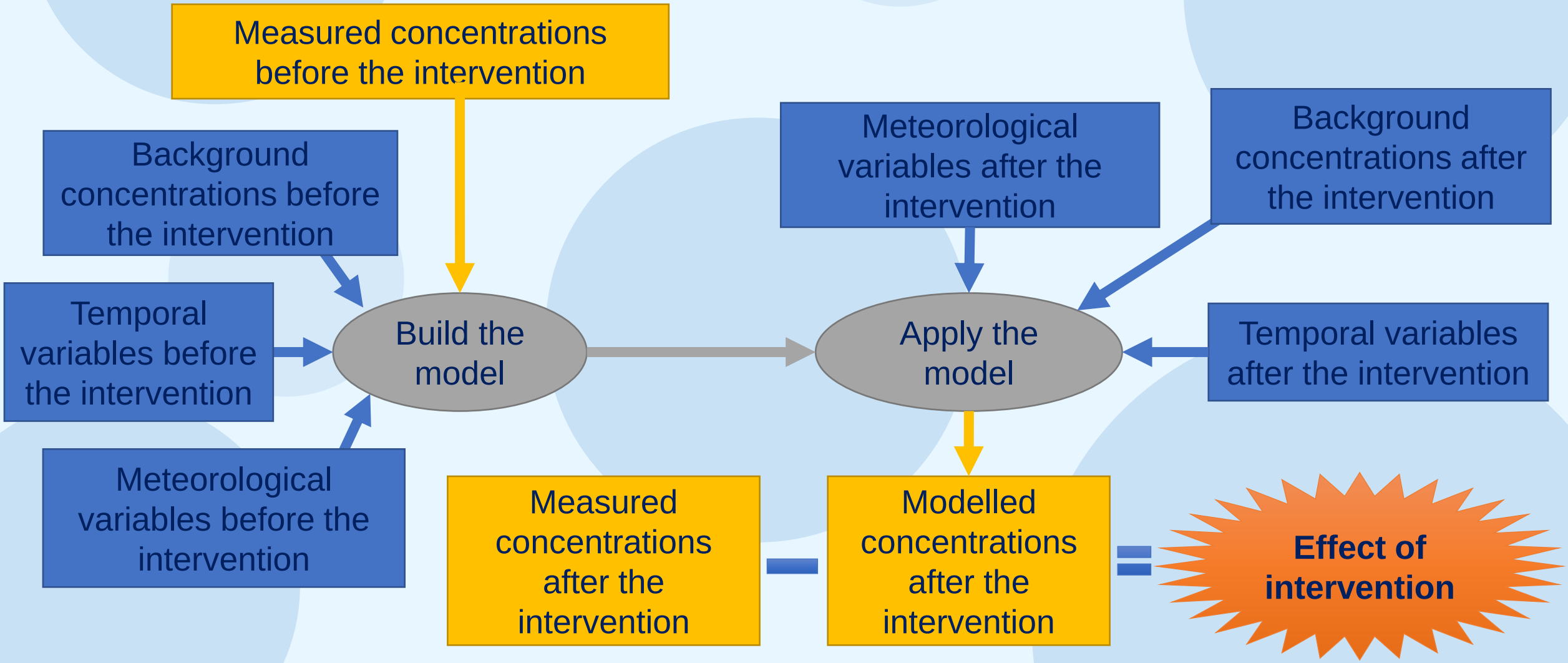
An Overview of the Process



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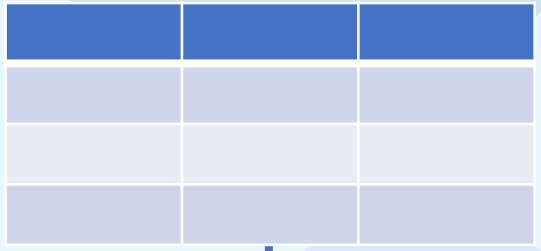
Building a Gradient Boost Model

Data and loss function



Residuals

Residuals

Residuals

Initial model output value

Multiply tree outputs by the learning rate

The model

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Optimising Model Parameters

Step 1

Set a high learning rate with fixed tree parameters and determine the number of trees

Learning rate	0.1
Maximum number of trees	10,000
Interaction depth	1
Minimum observations per node	10
Bagging Fraction	0.5

Step 2

With the same learning rate and the number of trees you just calculated, optimise the tree parameters

Learning rate	0.1
Number of trees	As calculated
Interaction depth	1 – 10
Minimum observations per node	10 – 100
Bagging Fraction	0.1 – 0.9

Step 3

With the optimised tree parameters, see if you achieve any improvement by decreasing the learning rate

Learning rate	0.02 – 0.1
Maximum number of trees	10,000
Interaction depth	As calculated
Minimum observations per node	As calculated
Bagging Fraction	As calculated

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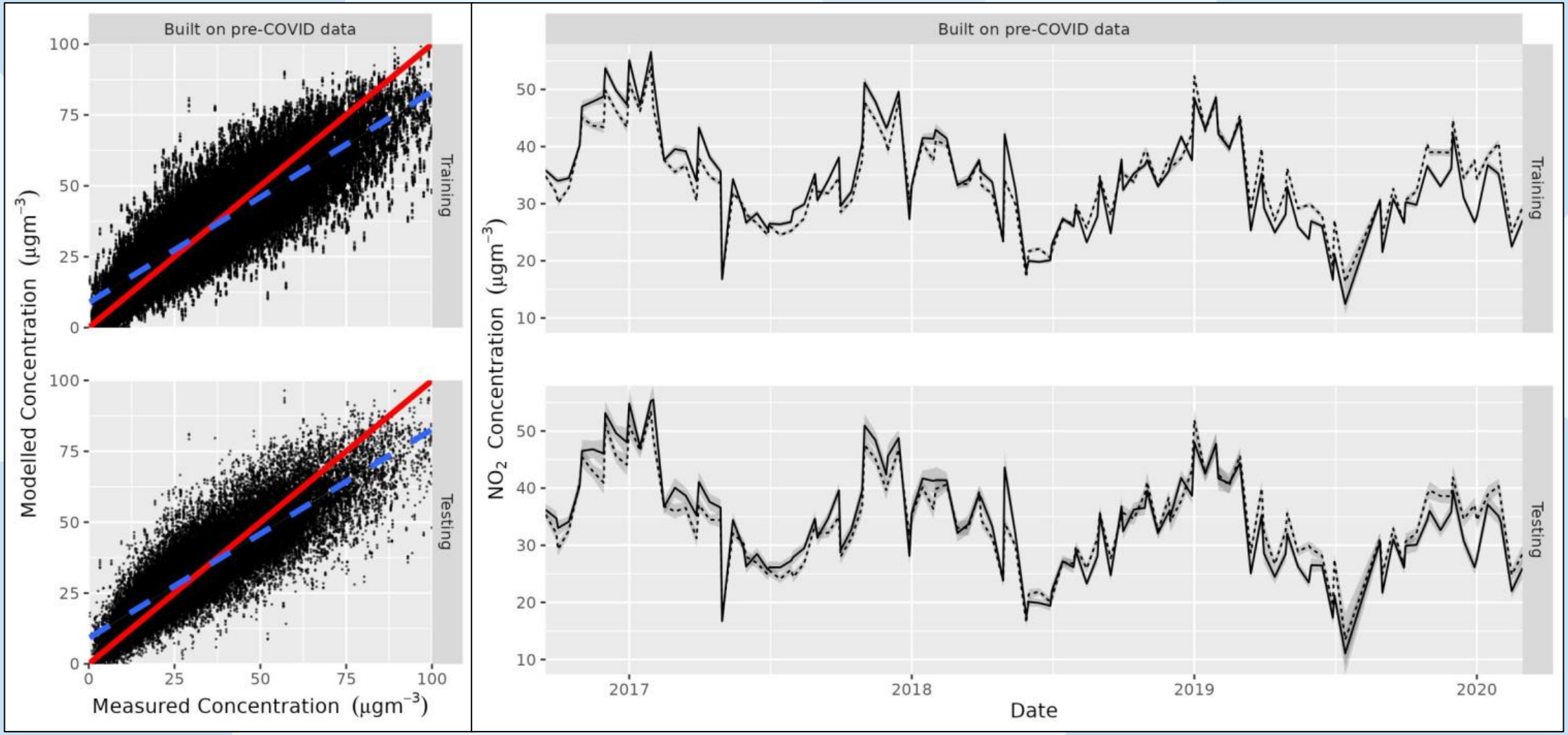
Birmingham A4540 Roadside



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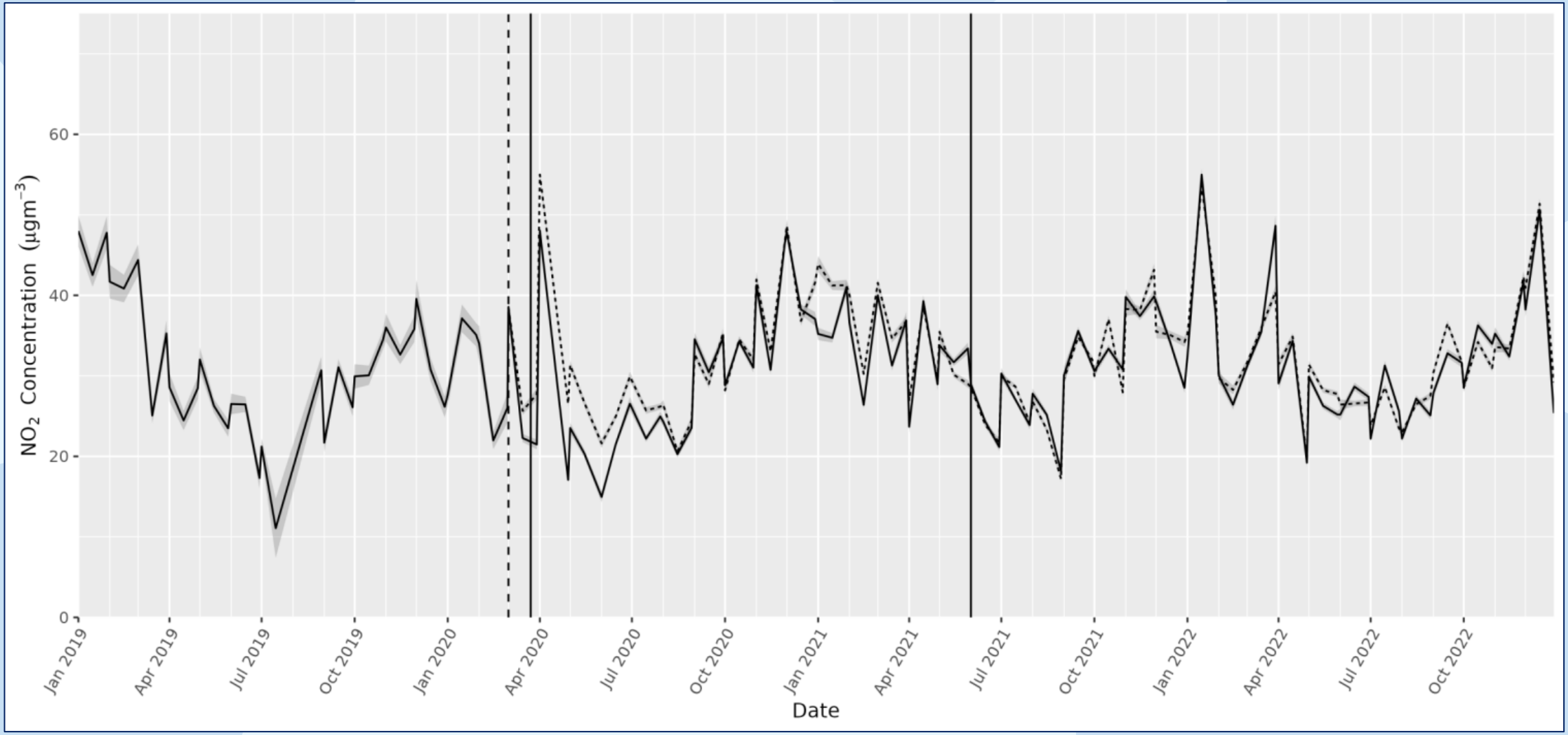

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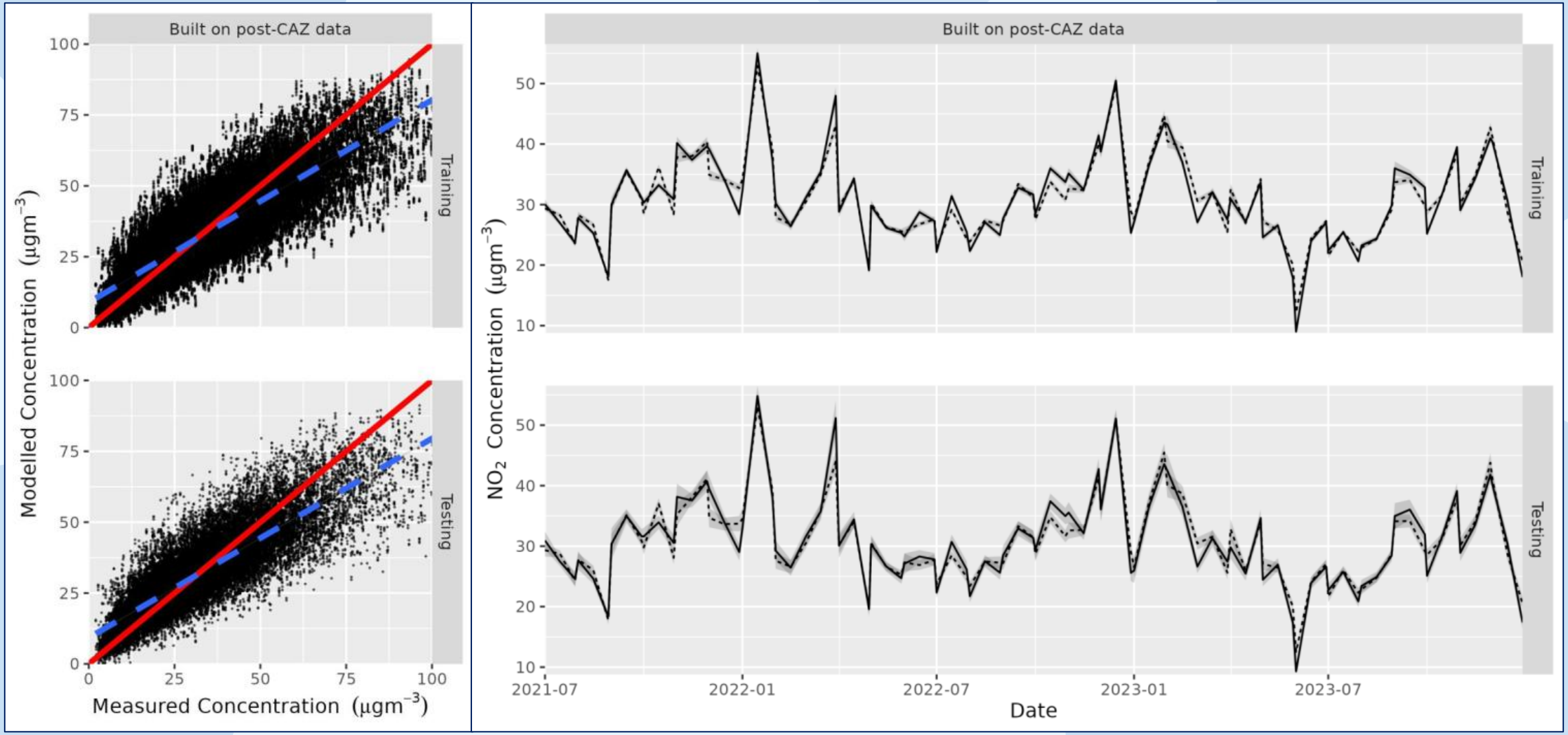

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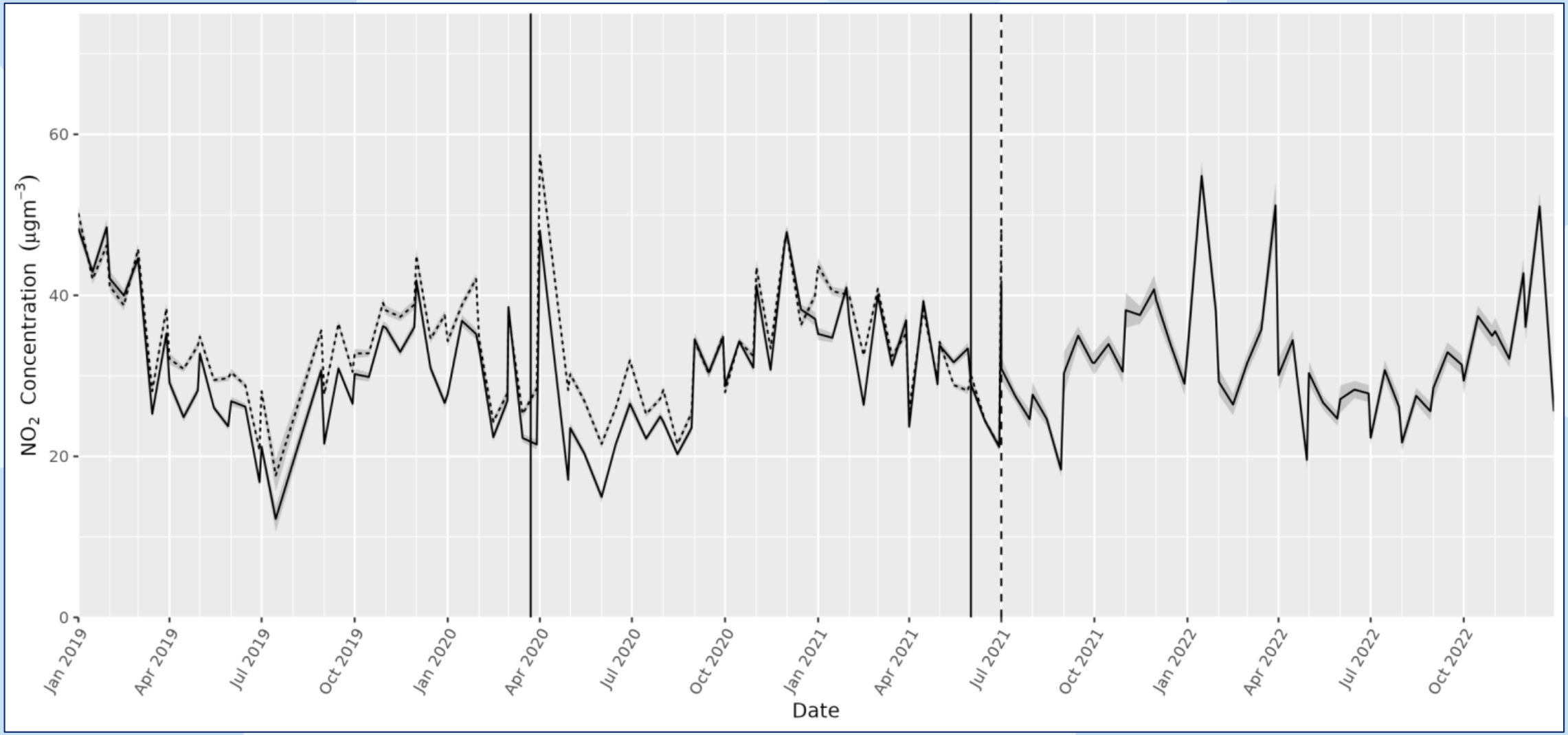

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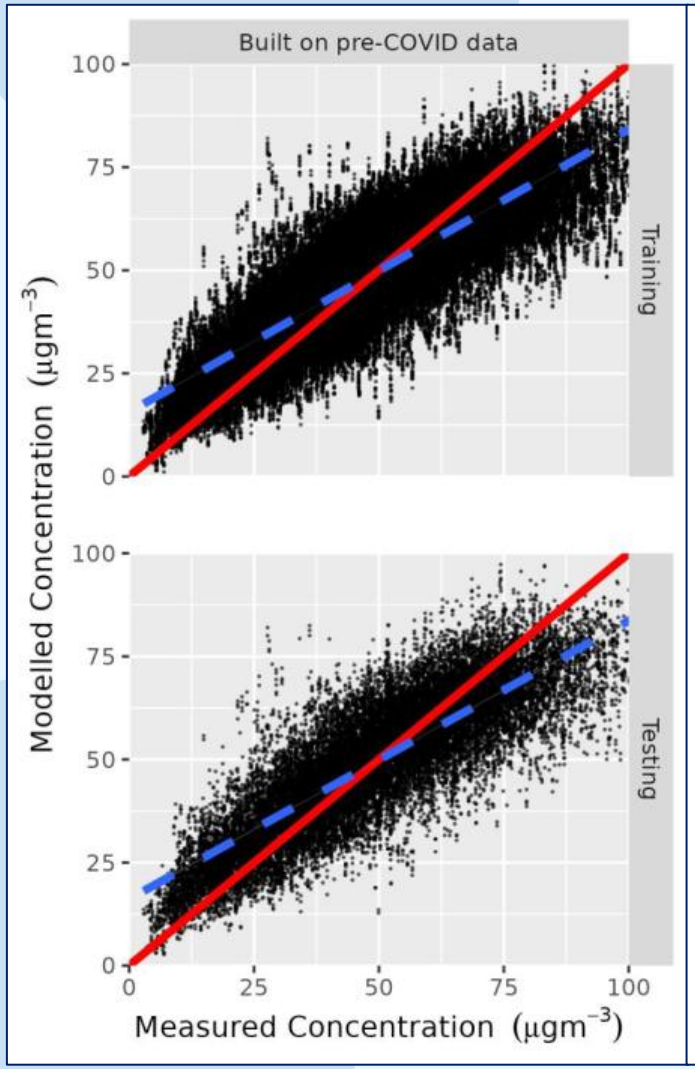
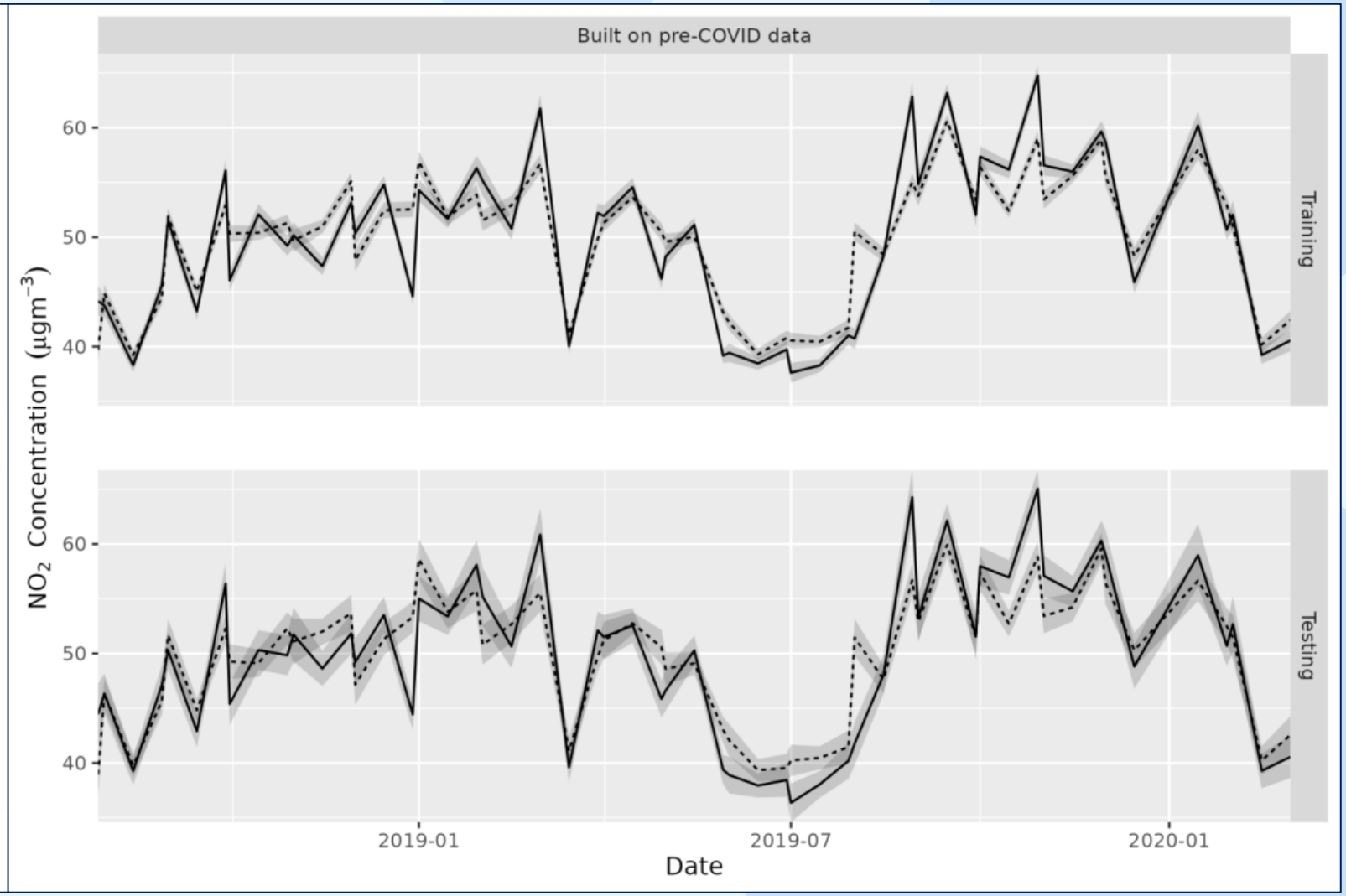
St Chads Queensway





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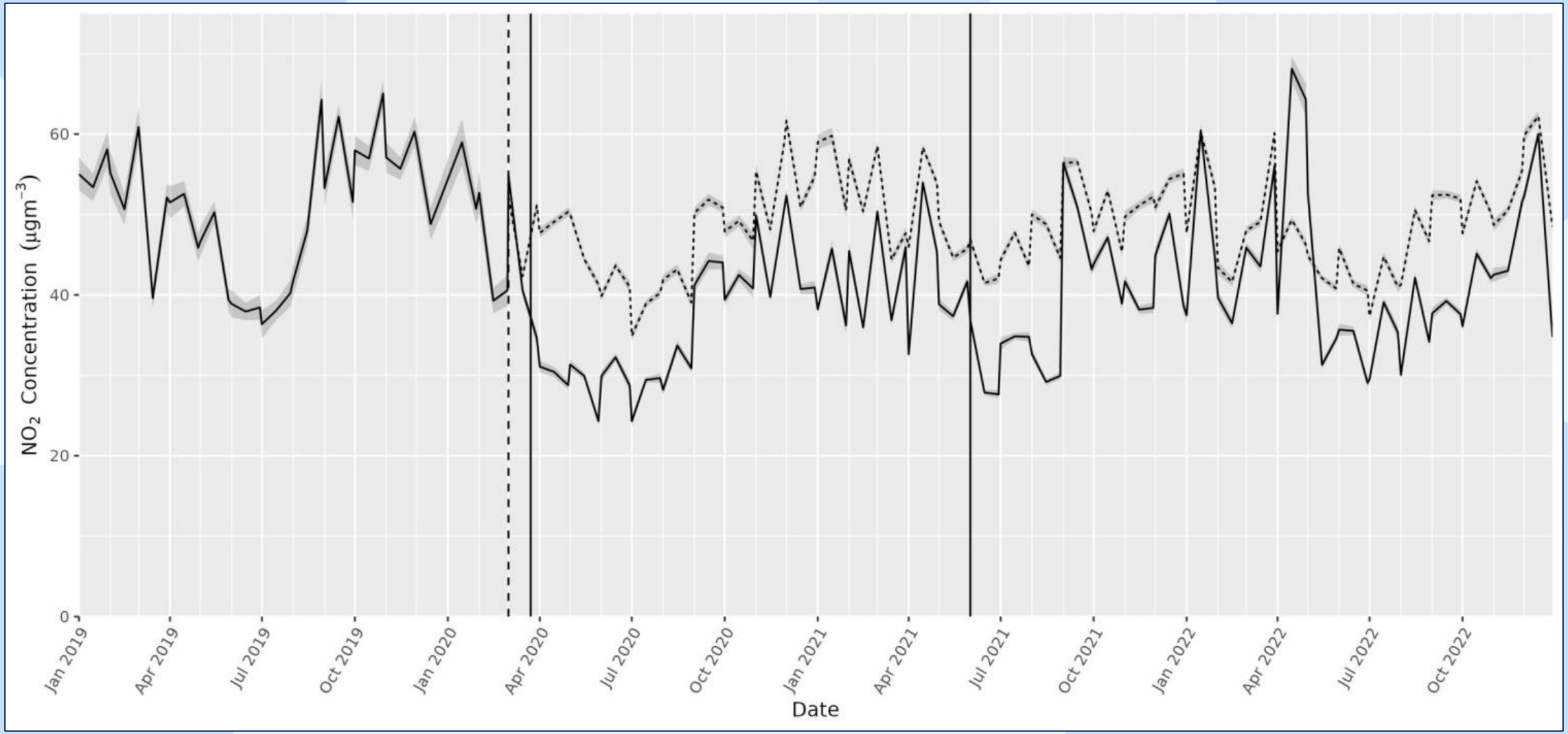

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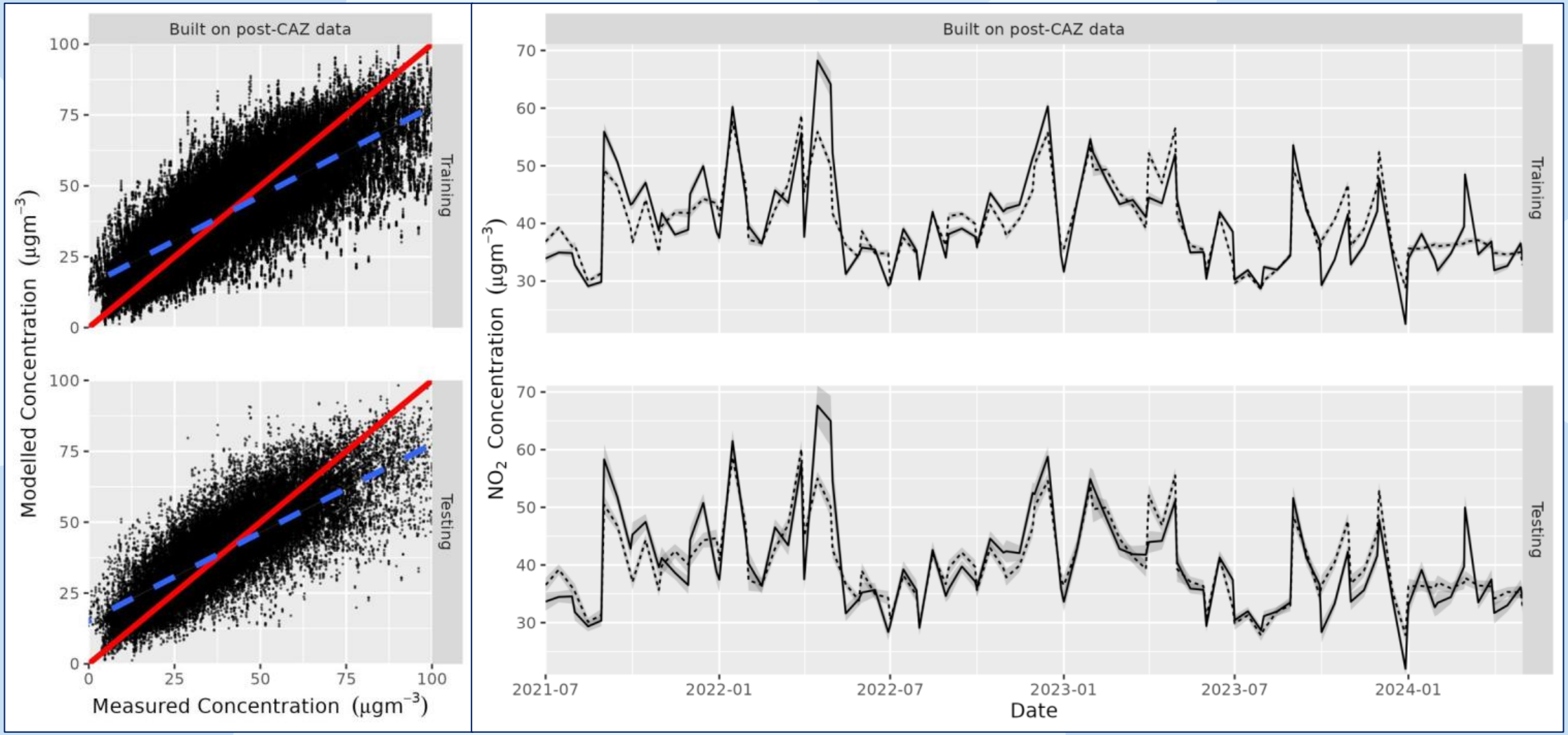

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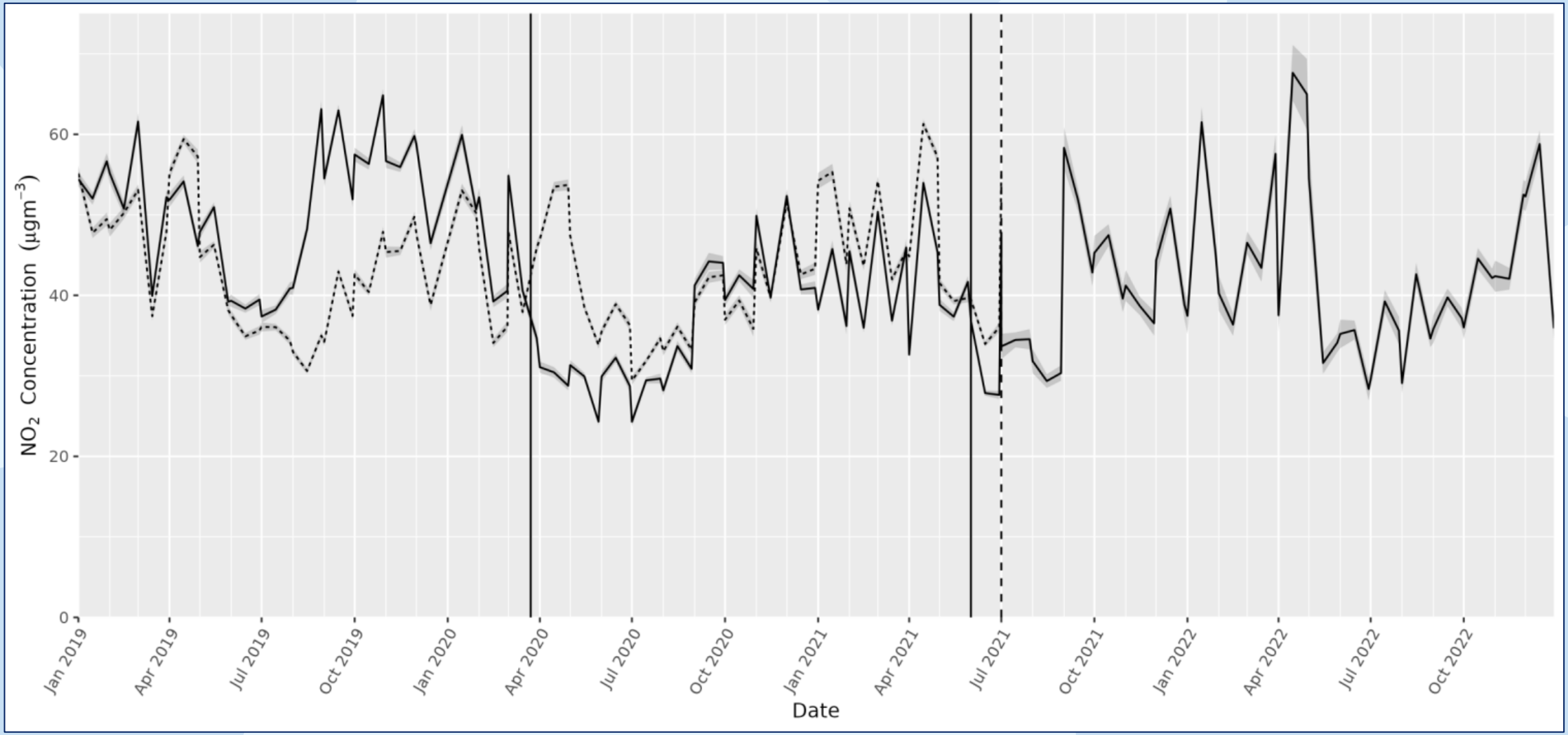

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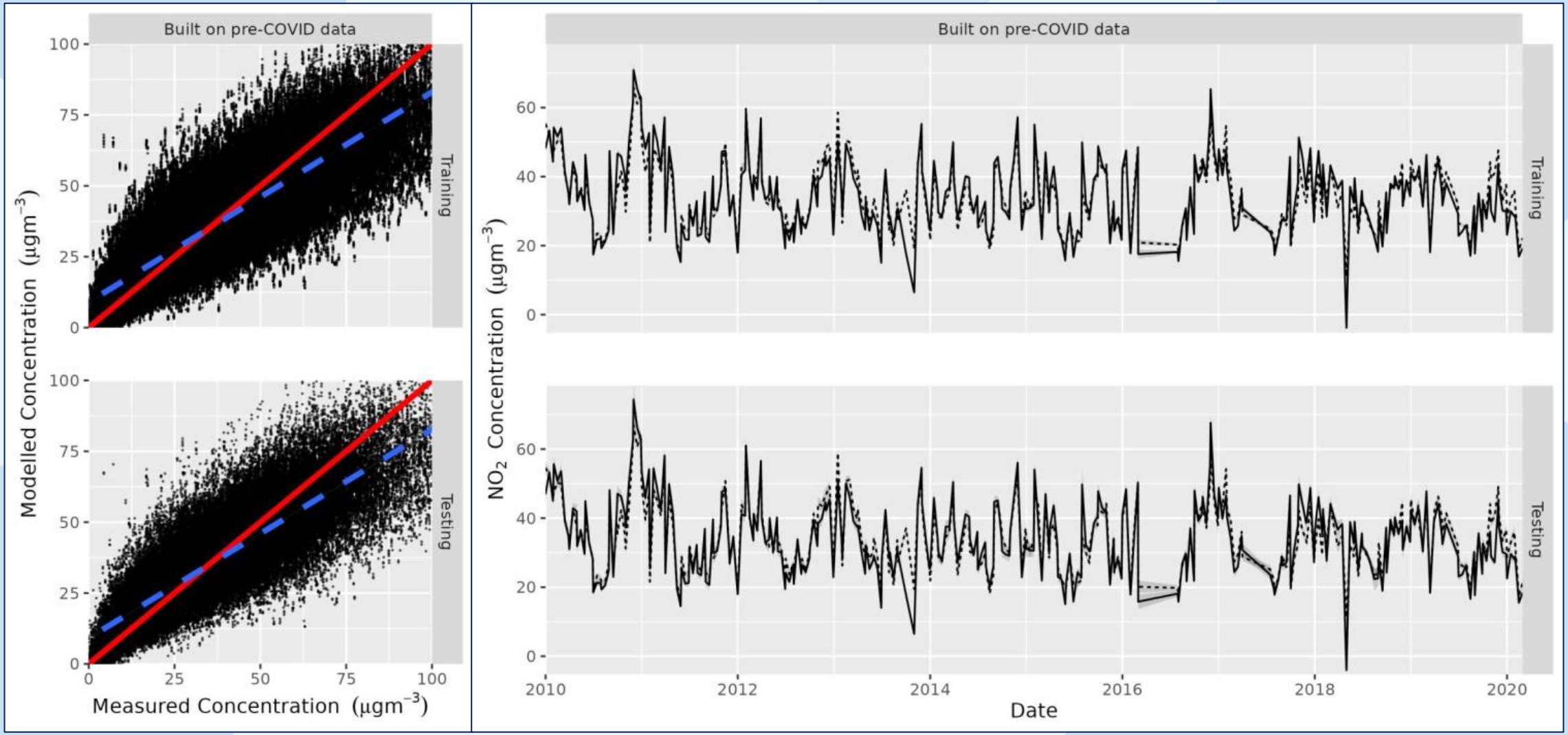
Stratford Road



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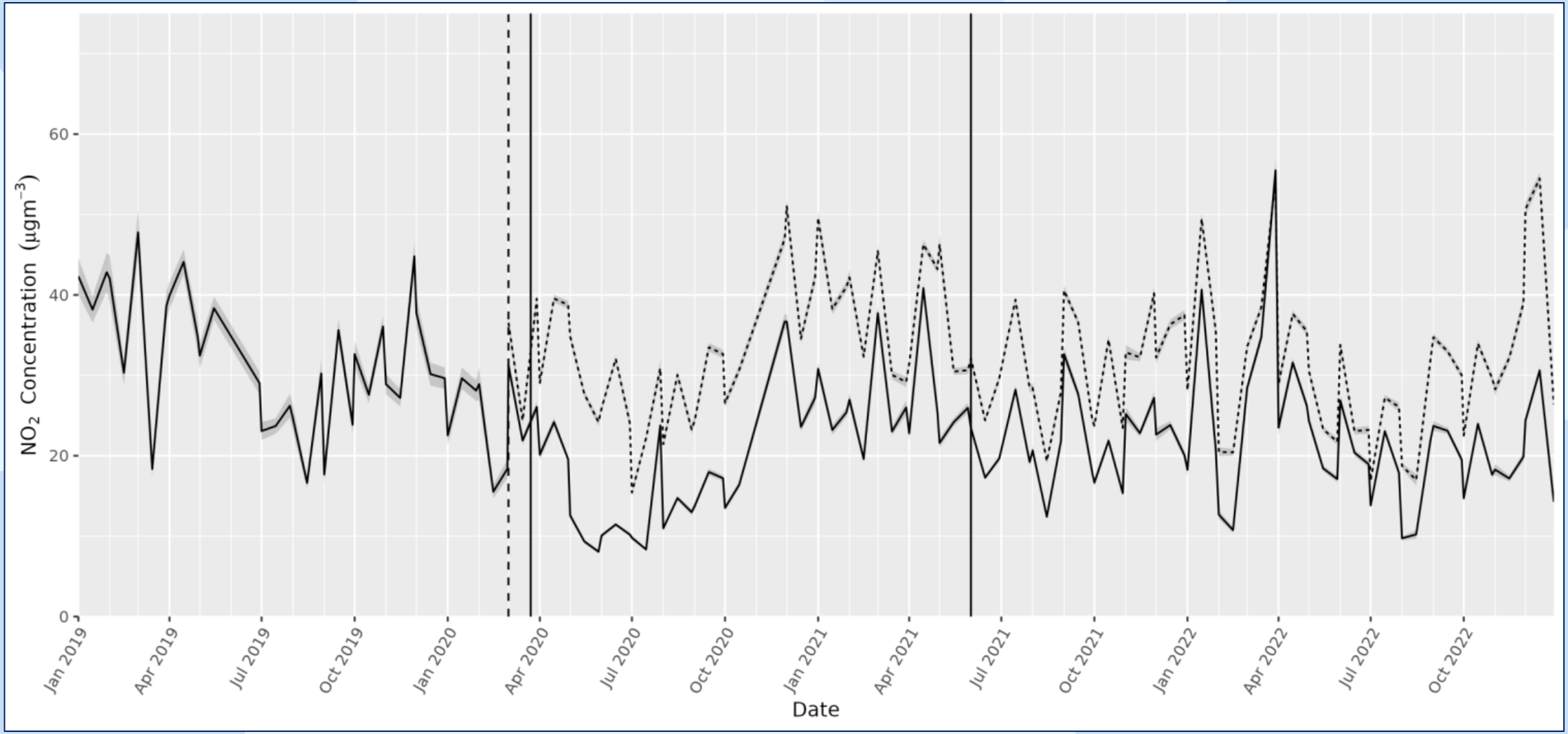

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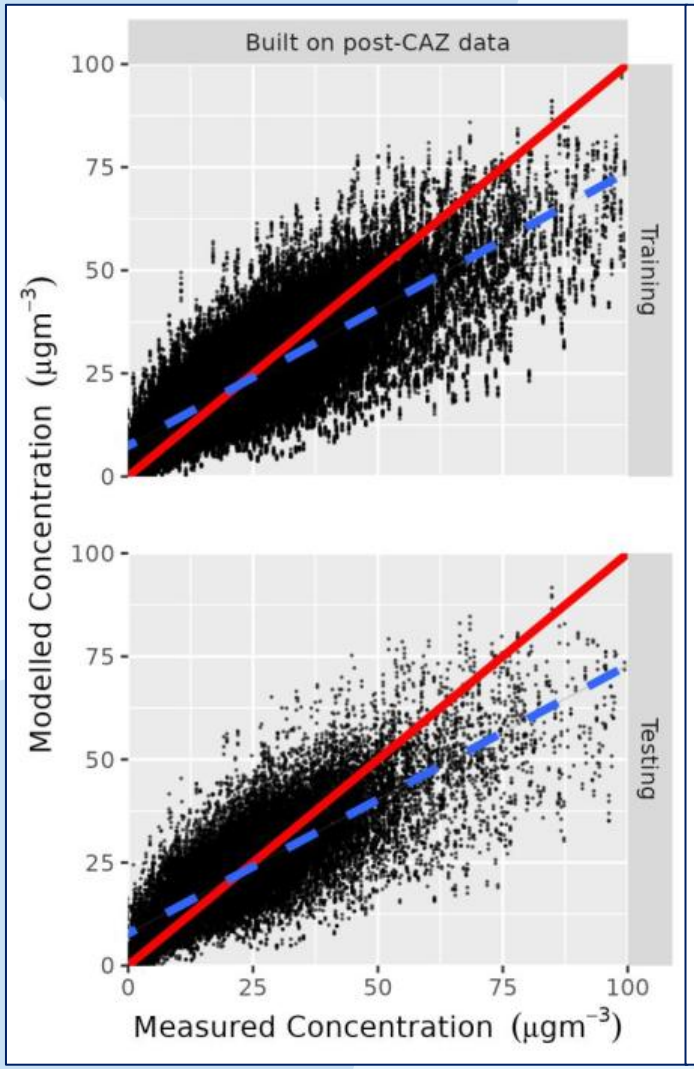

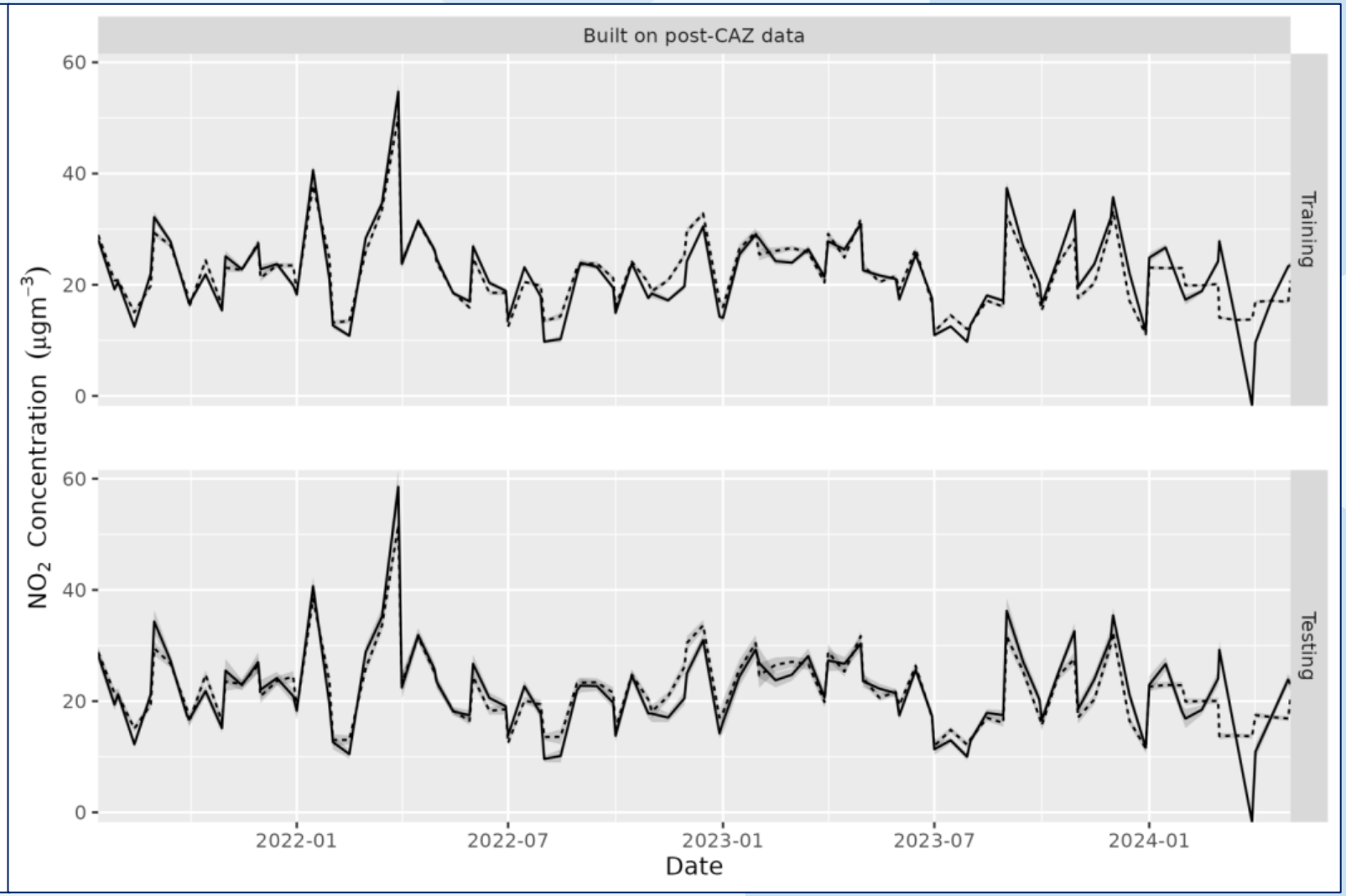

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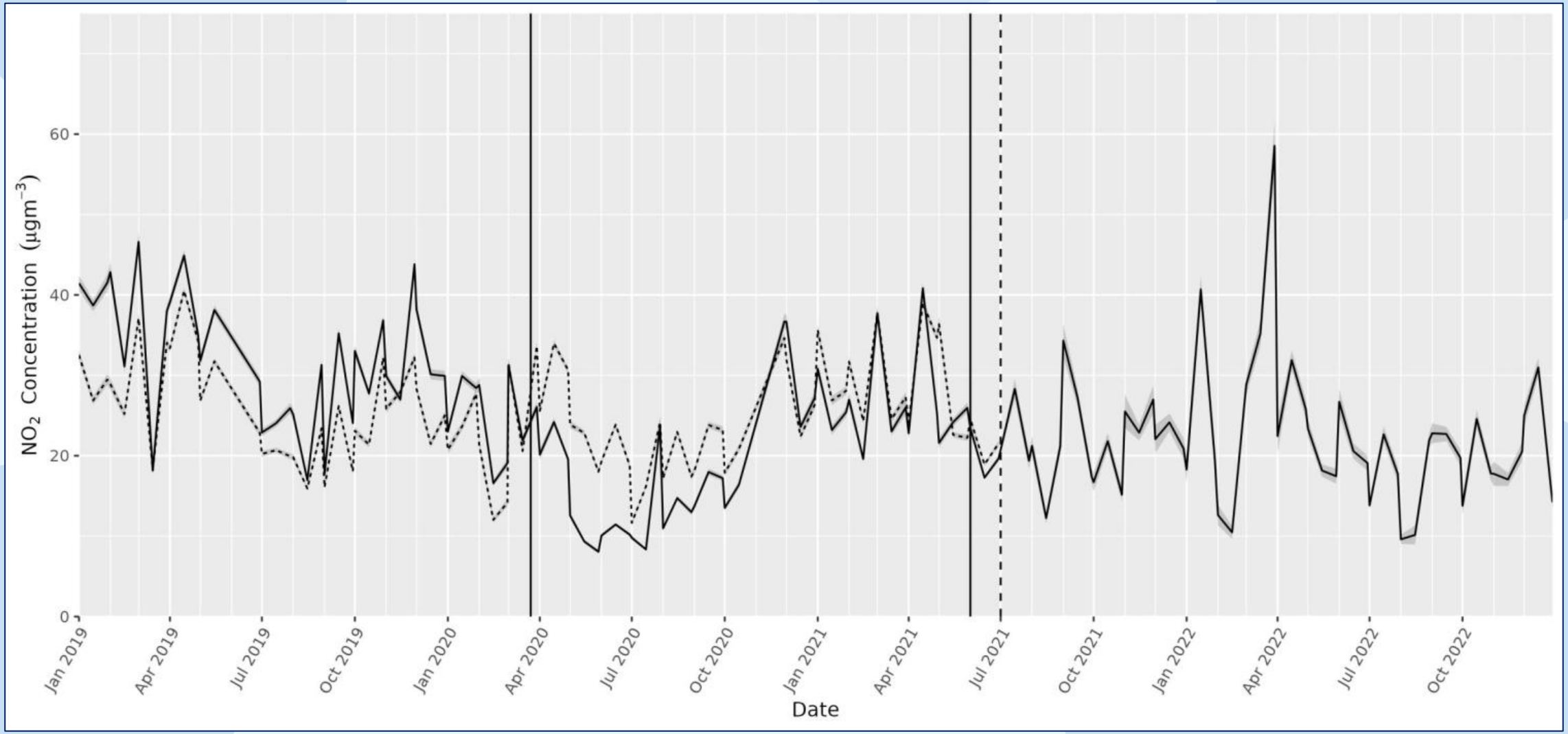

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Conclusions and Future Work

Gradient boost can be used to help quantify the effects of an intervention

This method is sensitive to overfitting, making parameter optimising an important step

Looking at partial dependencies and the influences of different variables can help us interpret results

Thank you

Questions

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UNIVERSITY OF LEICESTER

Leicester City Council