Take a deep breath?

Thursday, March 31st 2022

The Team

Filip Rankovic
Mathematics and Economics

Fresh out of university and interested in Data Science for Good

Johannes Herbig
Materials Science

5 years of experience in materials research and drone development

Dr. Kirsten Sunder
Materials Physics

7 years of experience in research & development and project management

Nicole Stijfhals
Industrial Engineering

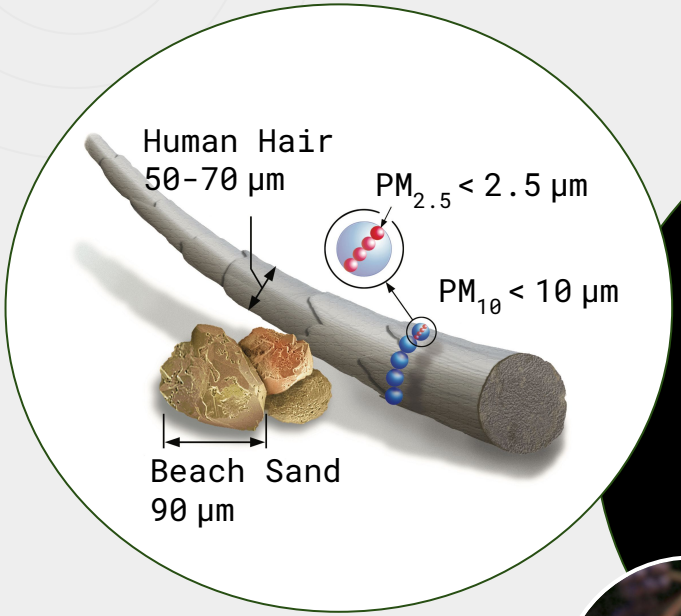
10 years of experience in IT-Consulting and Business Intelligence

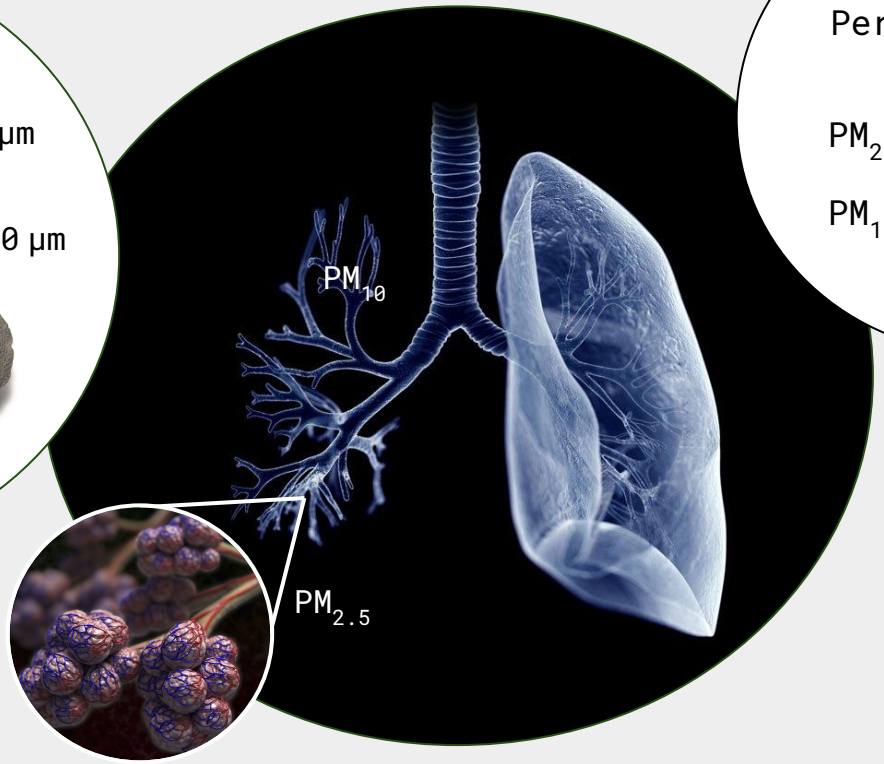
1

The Problem

> Outdoor air pollution was estimated to cause 4.2 million premature deaths worldwide in 2016 alone.
>
> There were 1.35 million road traffic deaths globally in 2016.
>
> **-WHO**

Particulate Matter (PM)





Permitted daily limits

$PM_{2.5}$: 25 µg/m^3

PM_{10} : 50 µg/m^3

2

The Solution

PM Analysis and Forecast

Time-limited bicycle paths

Take preventive measures

Exclusive bus lanes

Prohibition of air polluting cars

Inform the public

3

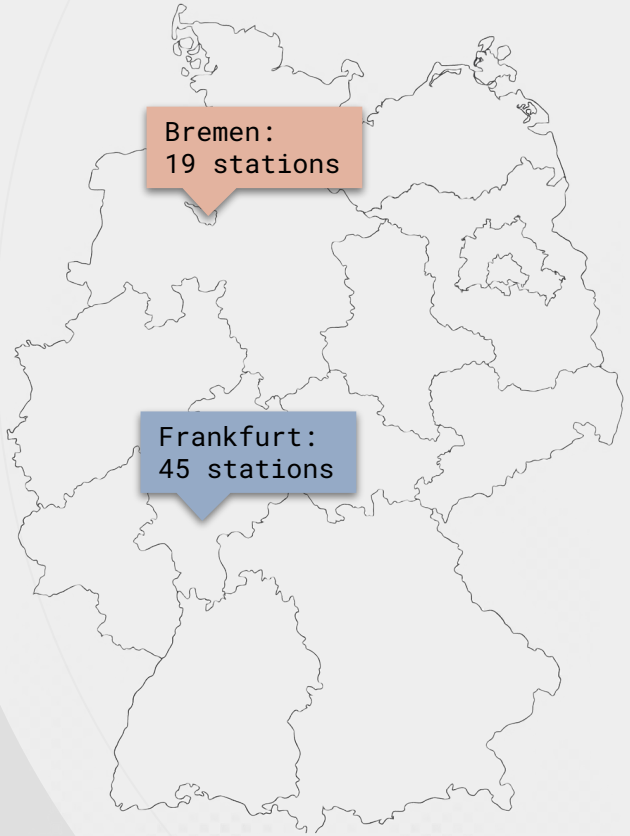
The Data

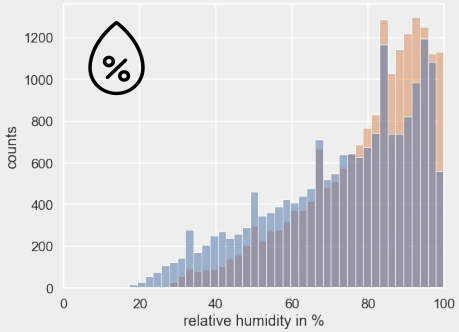
Data Sources for Germany

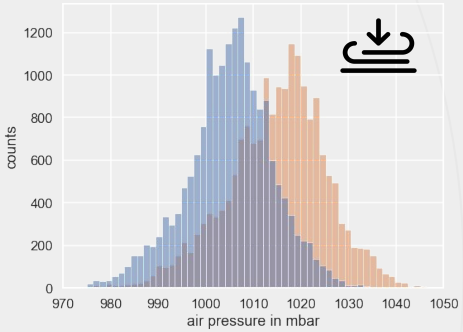
Source?	Sensor Community	Deutscher Wetterdienst	Meteomatics
What?	Historical & Current Particulate Matter 	Historical & Current Weather data 	Future Weather data 
How many?	~5500 stations ~Every 5 min	~500 stations Every 10 min	Any location Per Hour

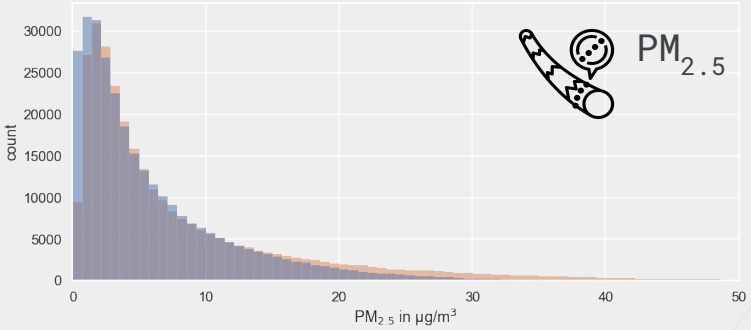
Icons from thenounproject.com

Proof of Concept

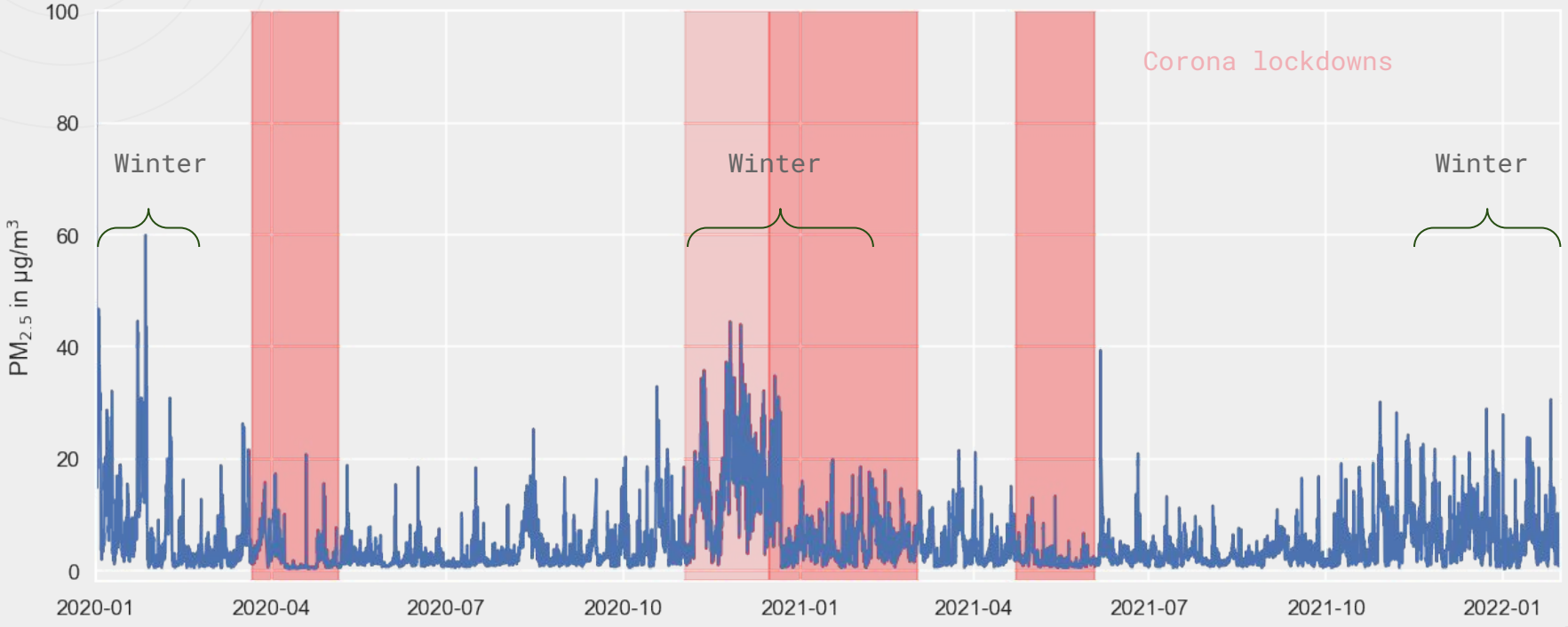








Exemplary $PM_{2.5}$ concentration

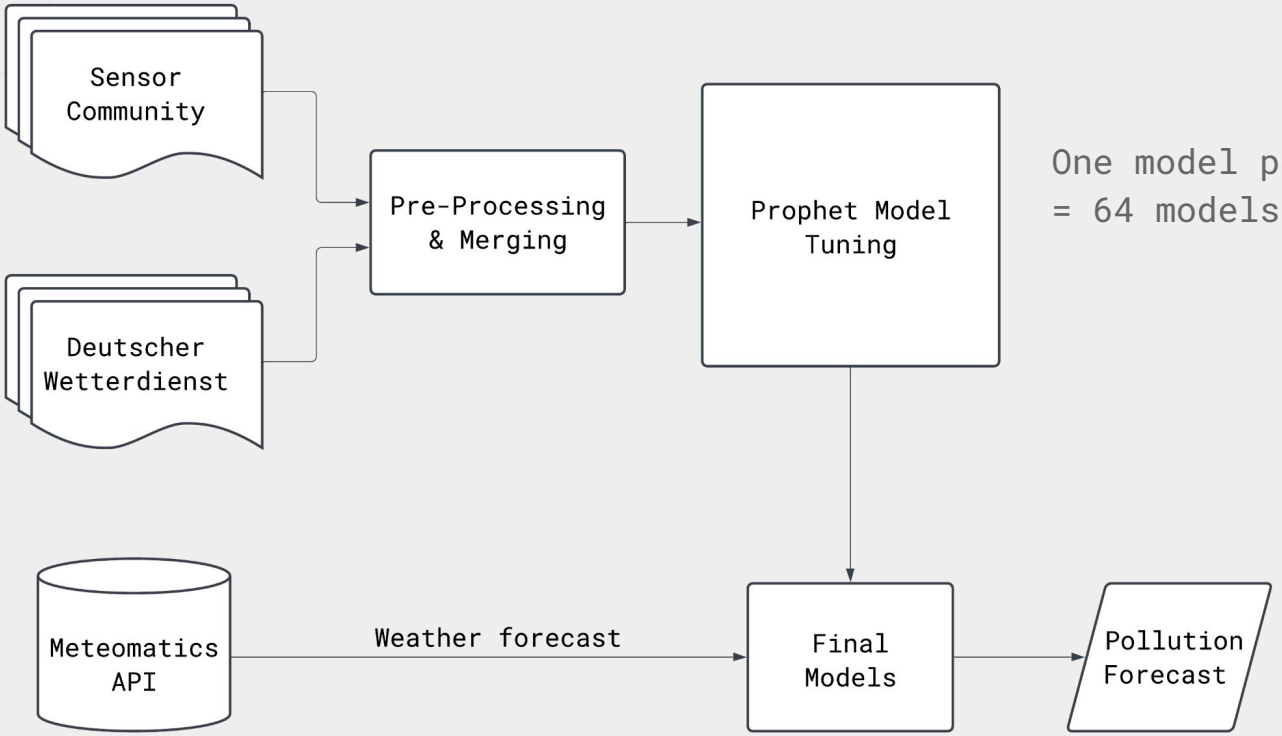


2 years of training data

4

The Approach

Workflow



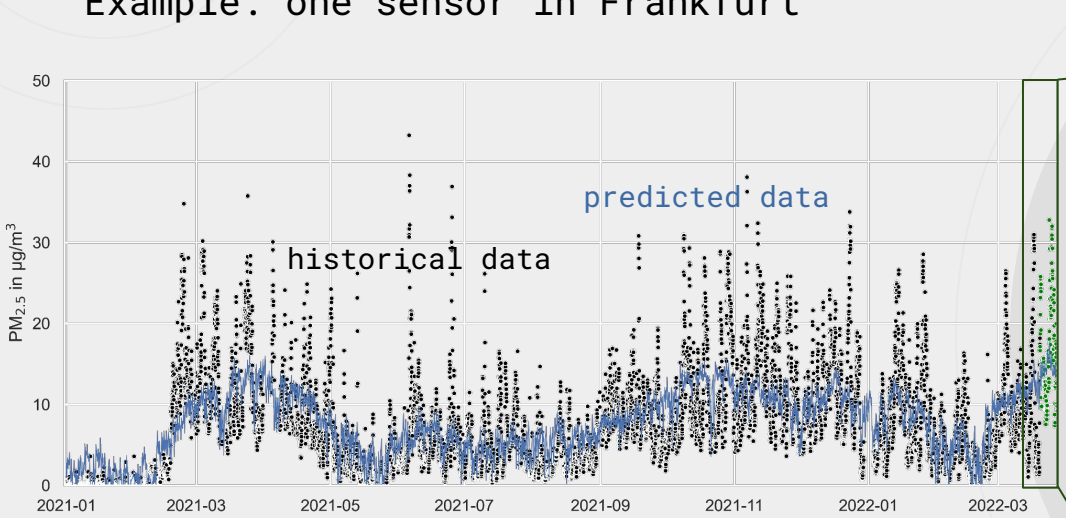
One model per location
= 64 models

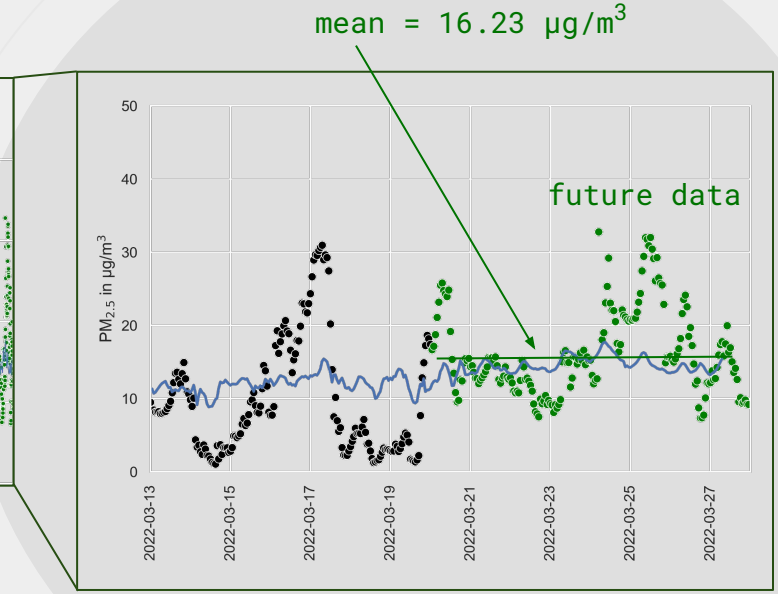
5

The Results

Time Series Analysis with Prophet

Example: one sensor in Frankfurt

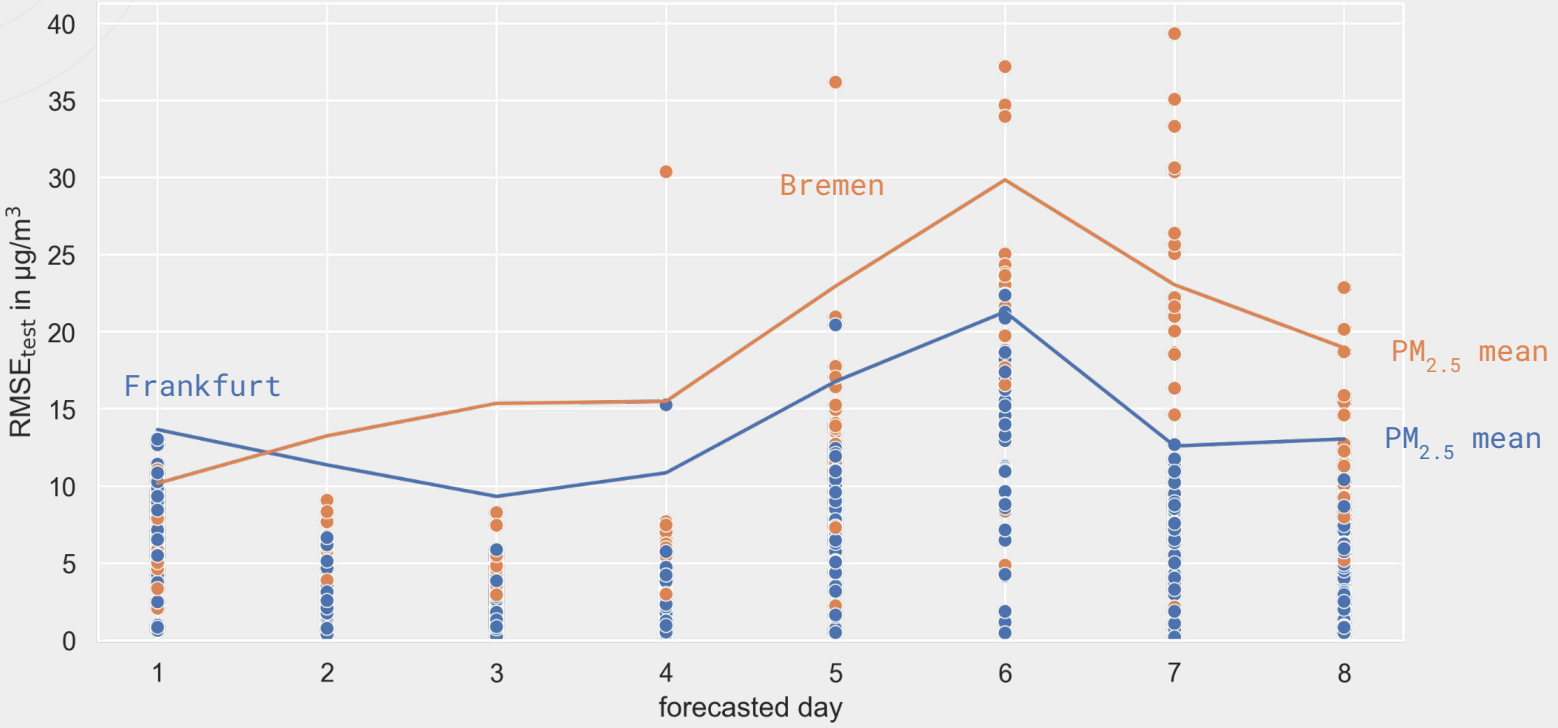




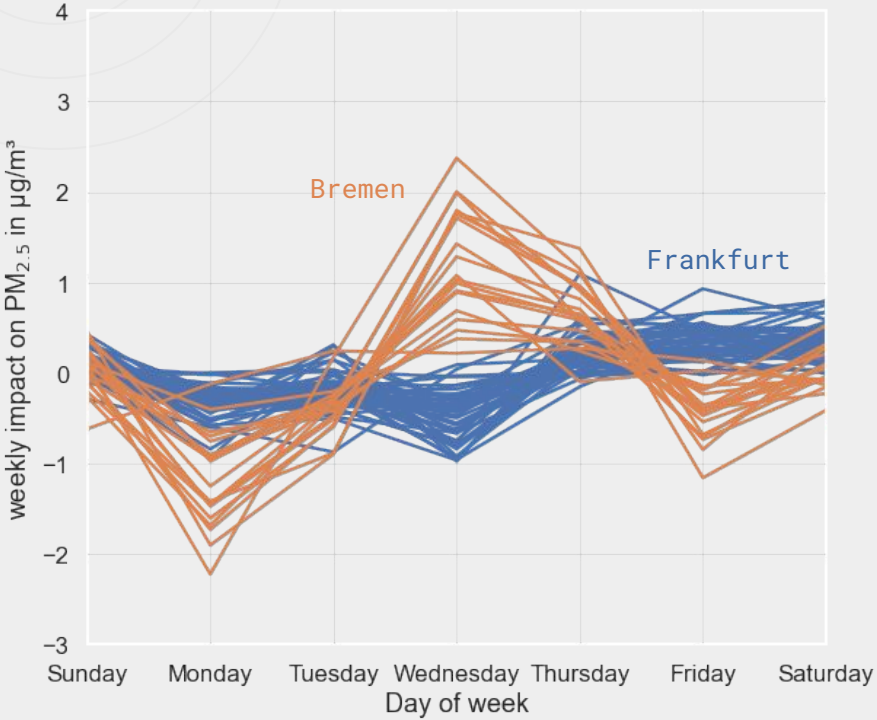
Error metric:

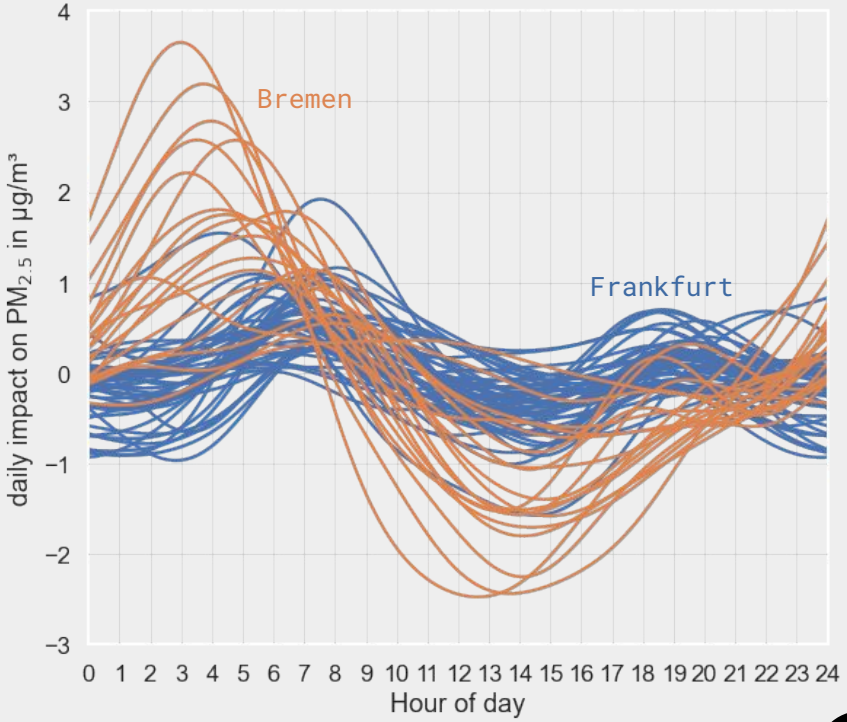
$RMSE_{test}$ = 5.88 µg/m^3

Daily overview - RMSE per location



Seasonality Decomposition

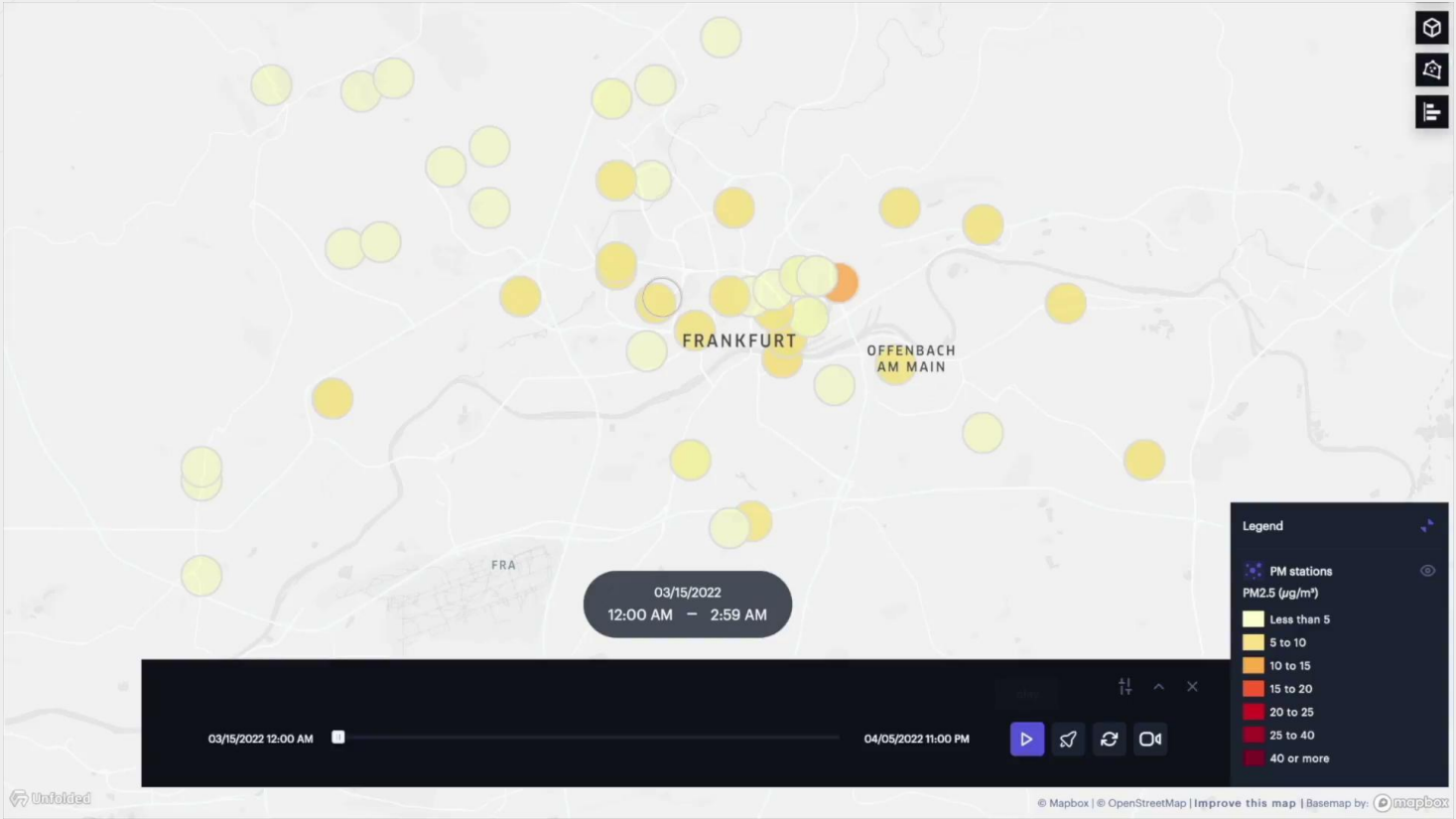




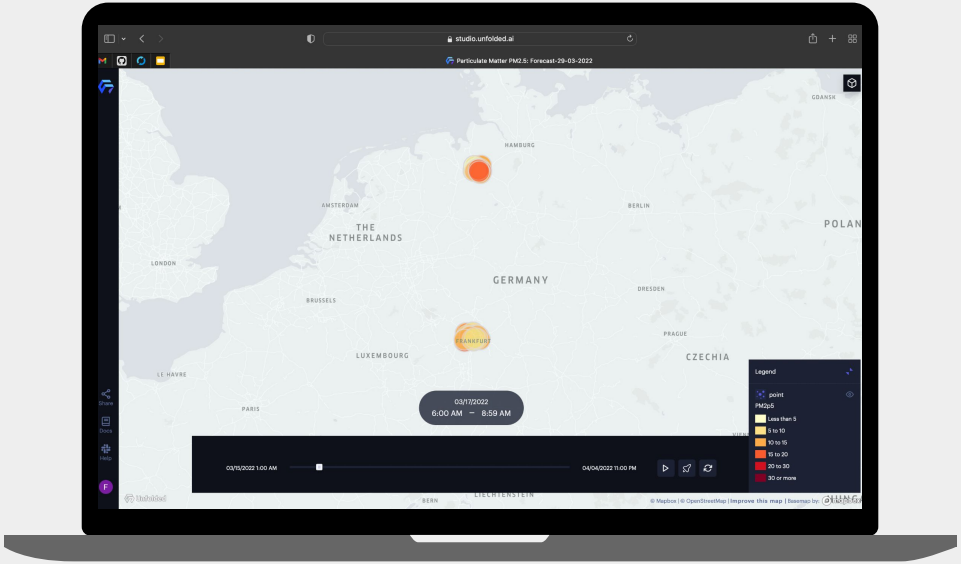
4

The Visualization

$PM_{2.5}$ Forecast - Timelapse



Live Demo



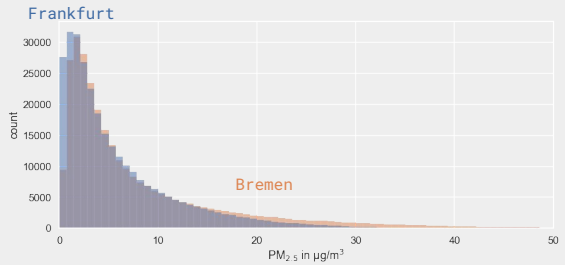
https://bit.ly/air-pollution-forecast

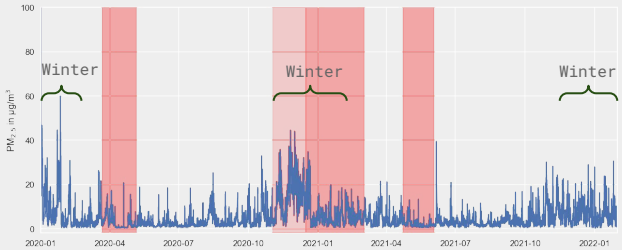
5

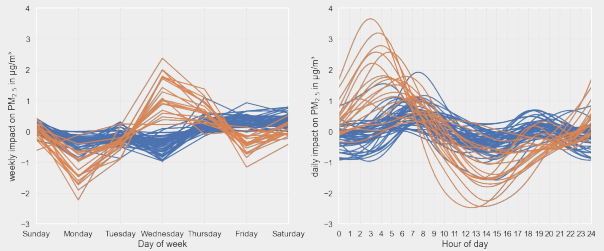
Takeaways & Outlook

Takeaways

- Bad air is not always where you expect it
- Stay at home during winter times
- Visit Bremen during the day on weekends

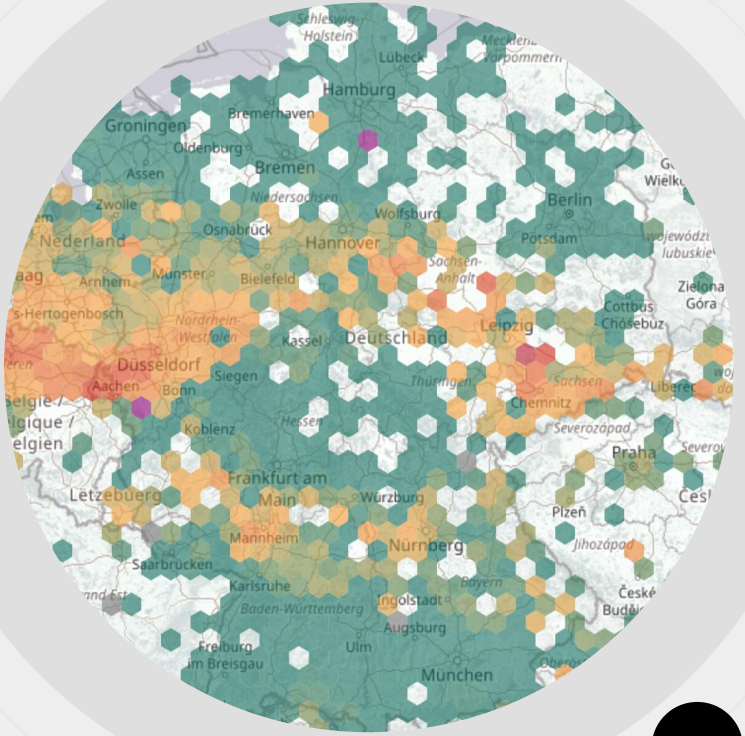






Outlook - Project Forecast

- Further optimization of models
- More historical data for training
- Automated prediction with daily data
- Expand to more cities
- Spatial inter-/extrapolation



Thank you!