Simulating heat load profiles in buildings using mixed effects models

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FLEXBUILD

DTU

Objective

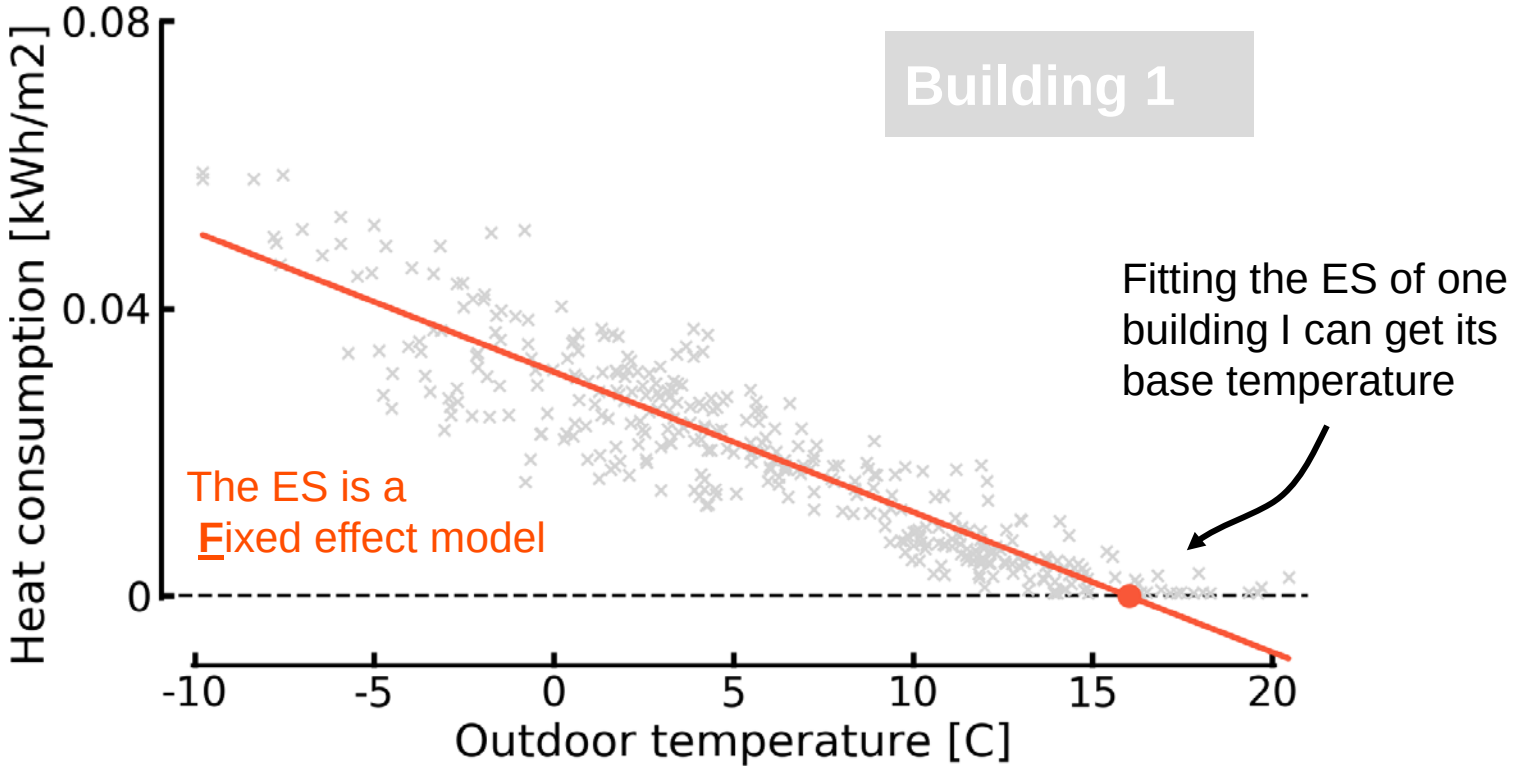
“Creating a simulation tool for long-term forecasting of hourly energy profiles of different building categories”

~PROFET 2

Proposed method

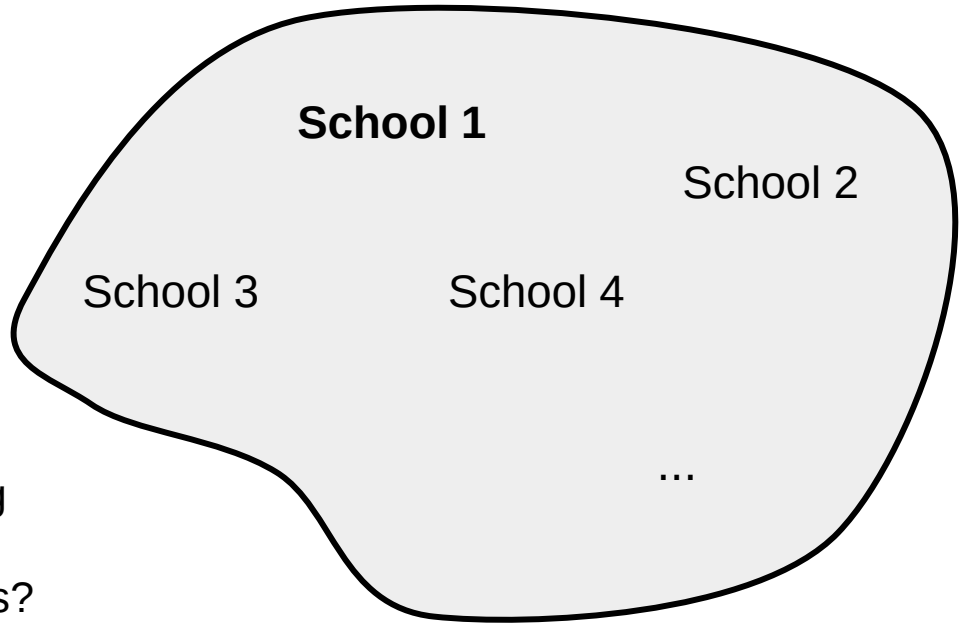
Using linear mixed effects models

Example with the energy signature

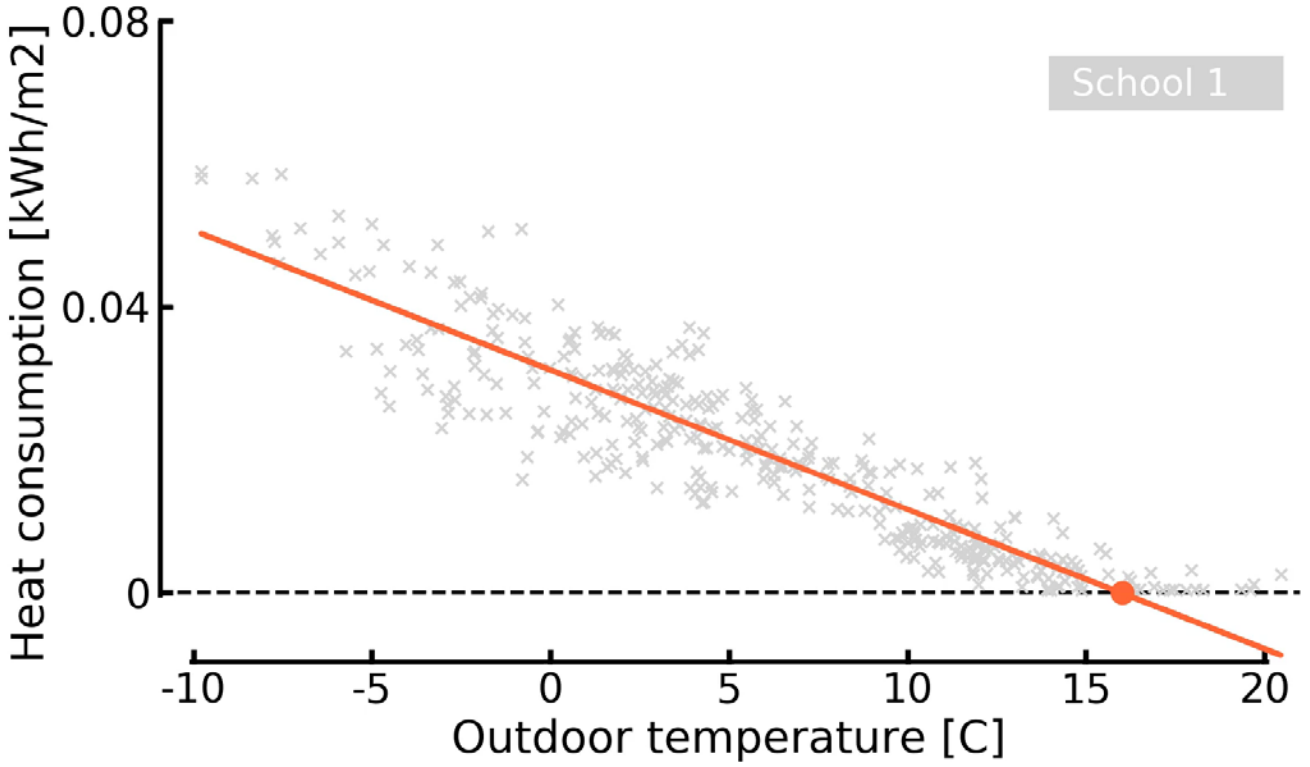


We are interested in modelling a whole category of buildings.

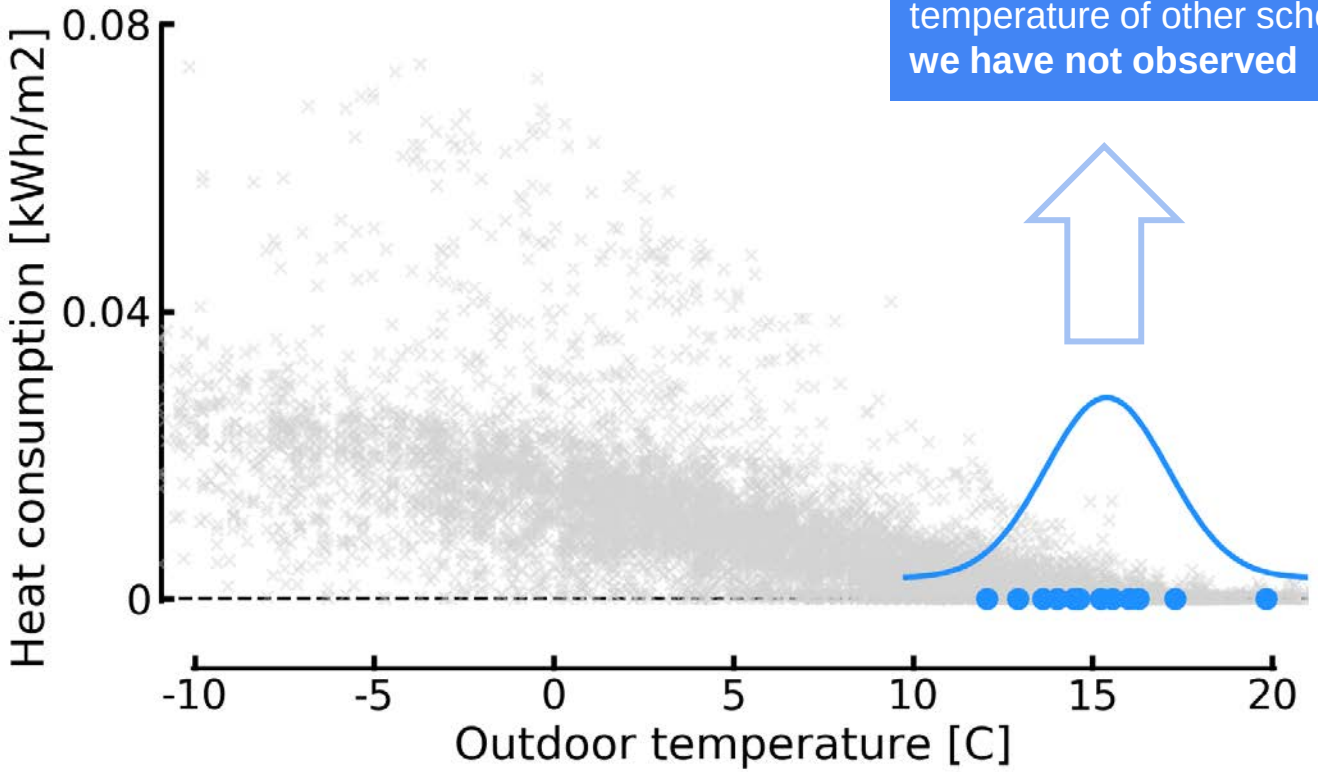
Let’s say Schools.



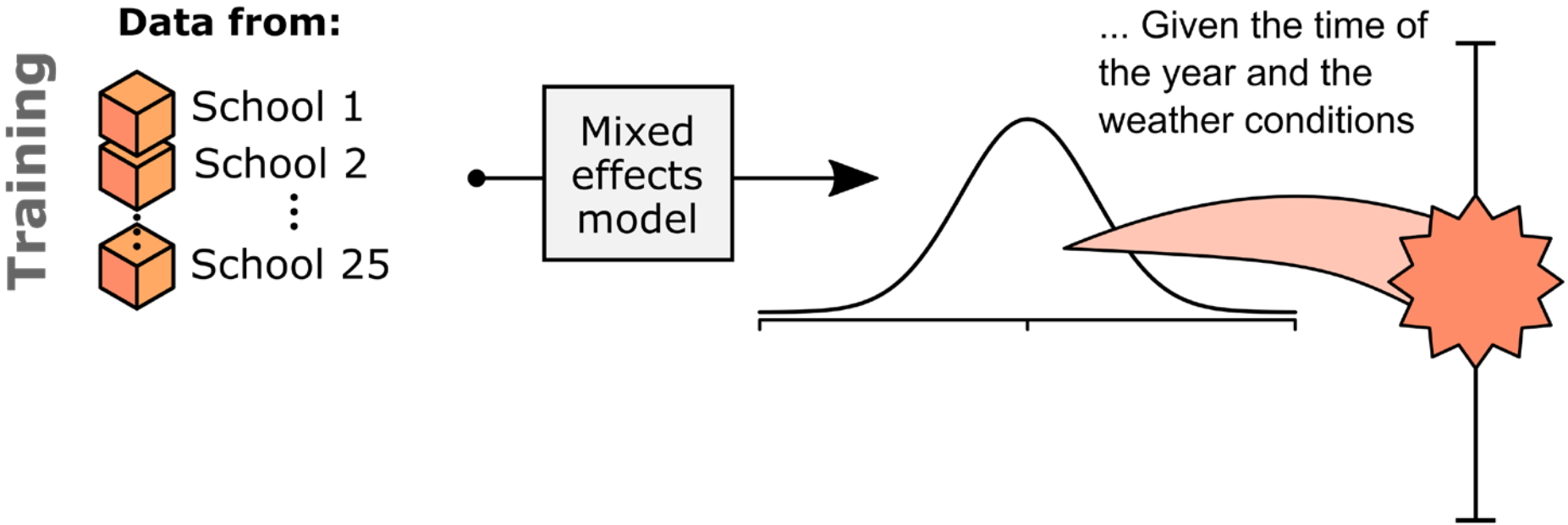
Can we say something about the base temperature of schools?


School 1
Heat consumption [kWh/m2]
0.08
0.04
0
-10
-5
0
5
10
15
20
Outdoor temperature [C]

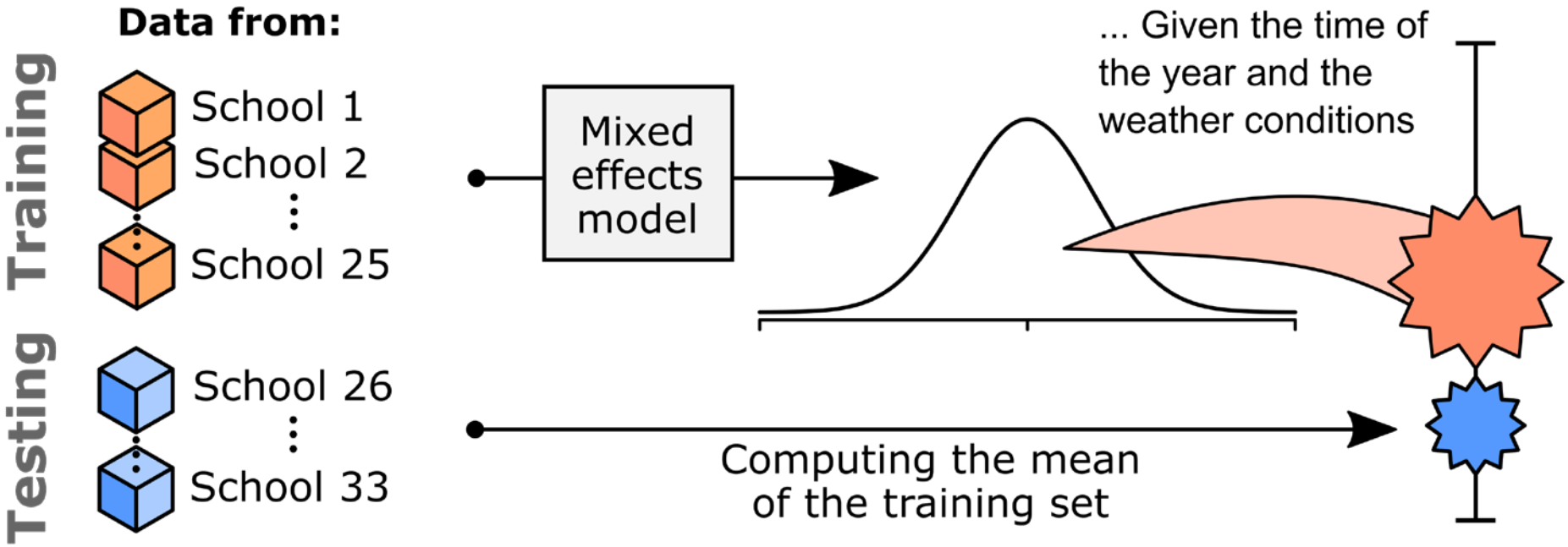
Now we can predict the base temperature of other schools **we have not observed**



That’s it


Training
Data from:
School 1
School 2
School 25
Mixed effects model
... Given the time of the year and the weather conditions

That’s it

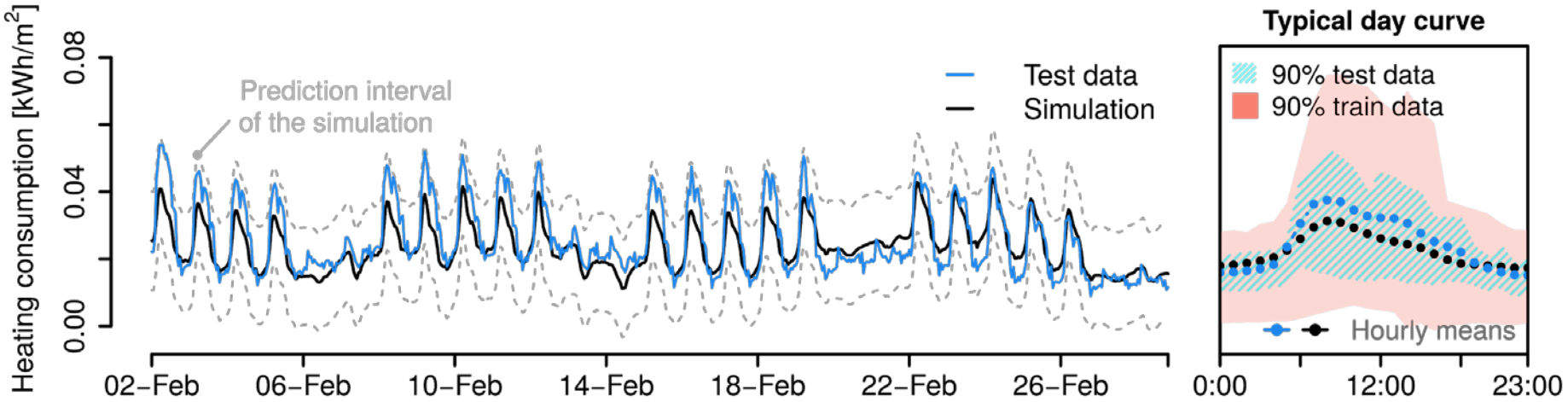

Data from:
Training
School 1
School 2
School 25
Testing
School 26
School 33
Mixed effects model
... Given the time of the year and the weather conditions
Computing the mean of the training set

Results so far

Overall dynamics are captured

2 regimes
work &
non-work hours

Virtually 100% of data is inside the 90% P.I.

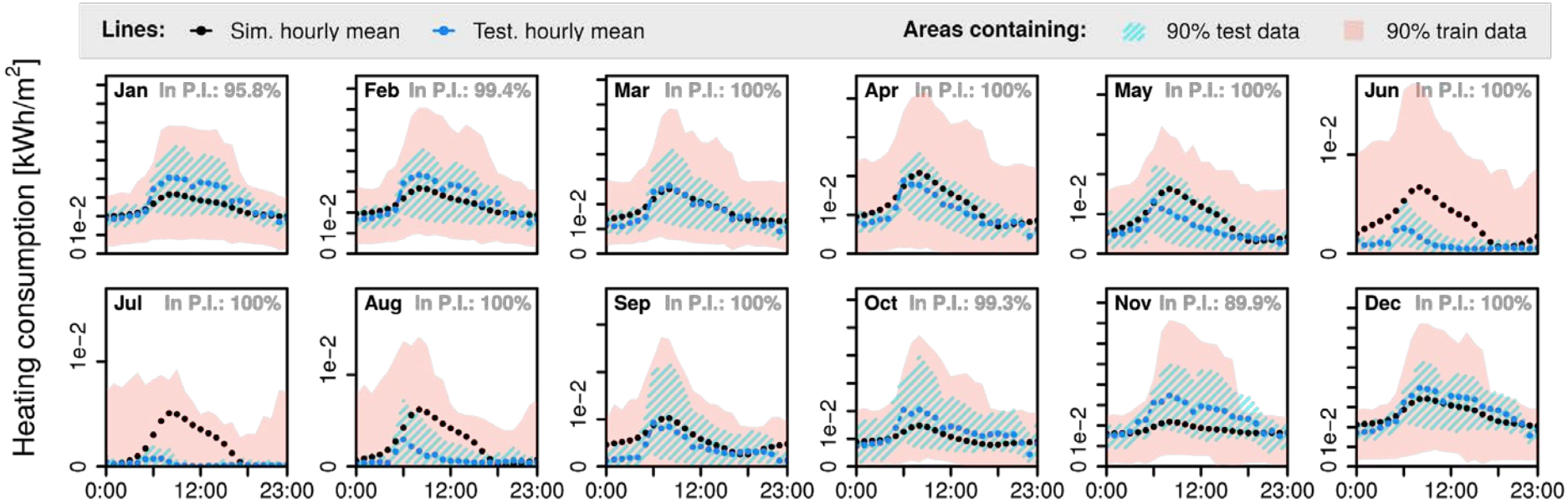


Missing the peaks

Constant uncertainty

Prediction interval captures the data during all year round

Noticeable hour effects in summer



Output so far

- Conference paper submitted to IBPC 2021 conference

Next steps

- Leaving gaussianity assumptions behind
- Creating a smooth transition between seasons
- Trying different building types

Thank you.

Questions?