AIVC & Venticool webinar

Observing and modeling window states in French dwellings monitored during a summer with heatwaves

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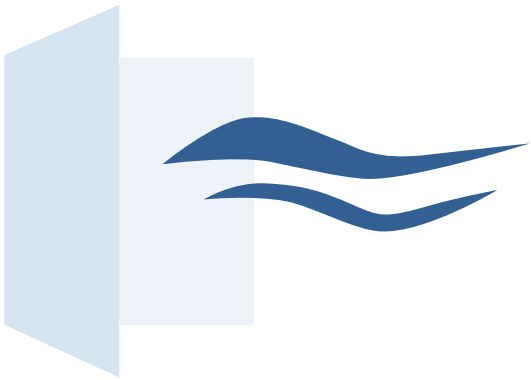
Context

- **Occupant behaviour** → impact on indoor environment
- **Window use** → a key passive cooling strategy

Presentation overview

- **Data collection**: field measurement campaign
- **Exploratory analysis**: link between in-situ measurement and surveys
- **Data-driven models**: window states prediction



Data collection

Field measurement campaign

Field measurement campaign

- CREATIV research project
  - Thermal comfort
  - Indoor air quality
  - Heatwave

ADEME funding: grant number 2062C0002

- 2 French cities
- 4 dwellings monitored
- June to September 2022
- Surveys :
  - Logbook
  - Thermal comfort surveys
  - General questionnaire
- Measurements

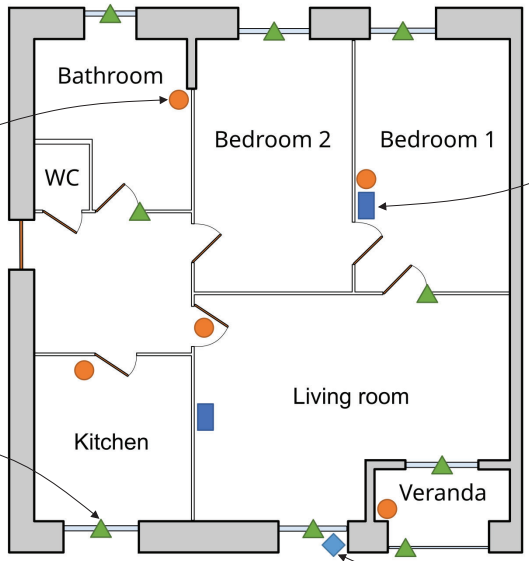
Monitoring

T_{int}
RH_{int}

Indoor sensor

$CO_{2,int}$
VOC_{int}
$PM_{1,int}$
$PM_{2.5,int}$
$PM_{10,int}$

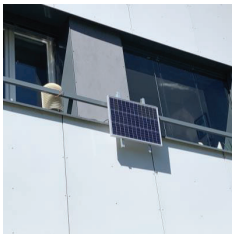
Indoor sensor



Dwelling A plan

Window use

Contact sensor



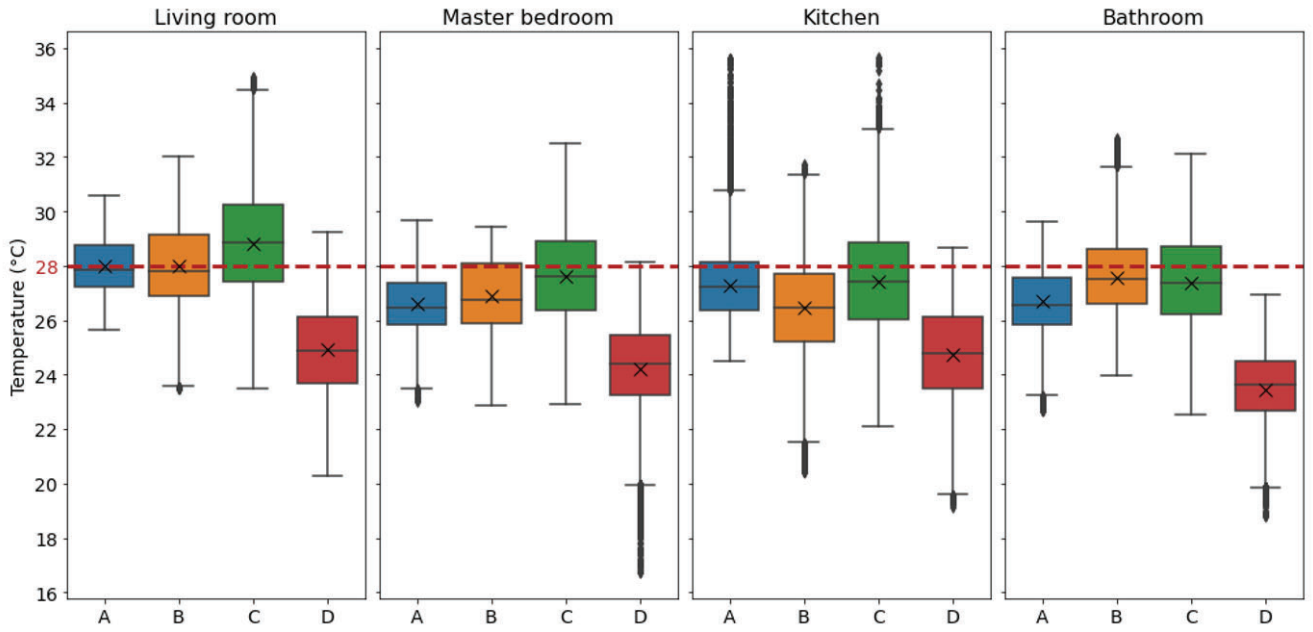
T_{ext}
RH_{ext}
VOC_{ext}
$PM_{1,ext}$
$PM_{2.5,ext}$
$PM_{10,ext}$

Outdoor sensor

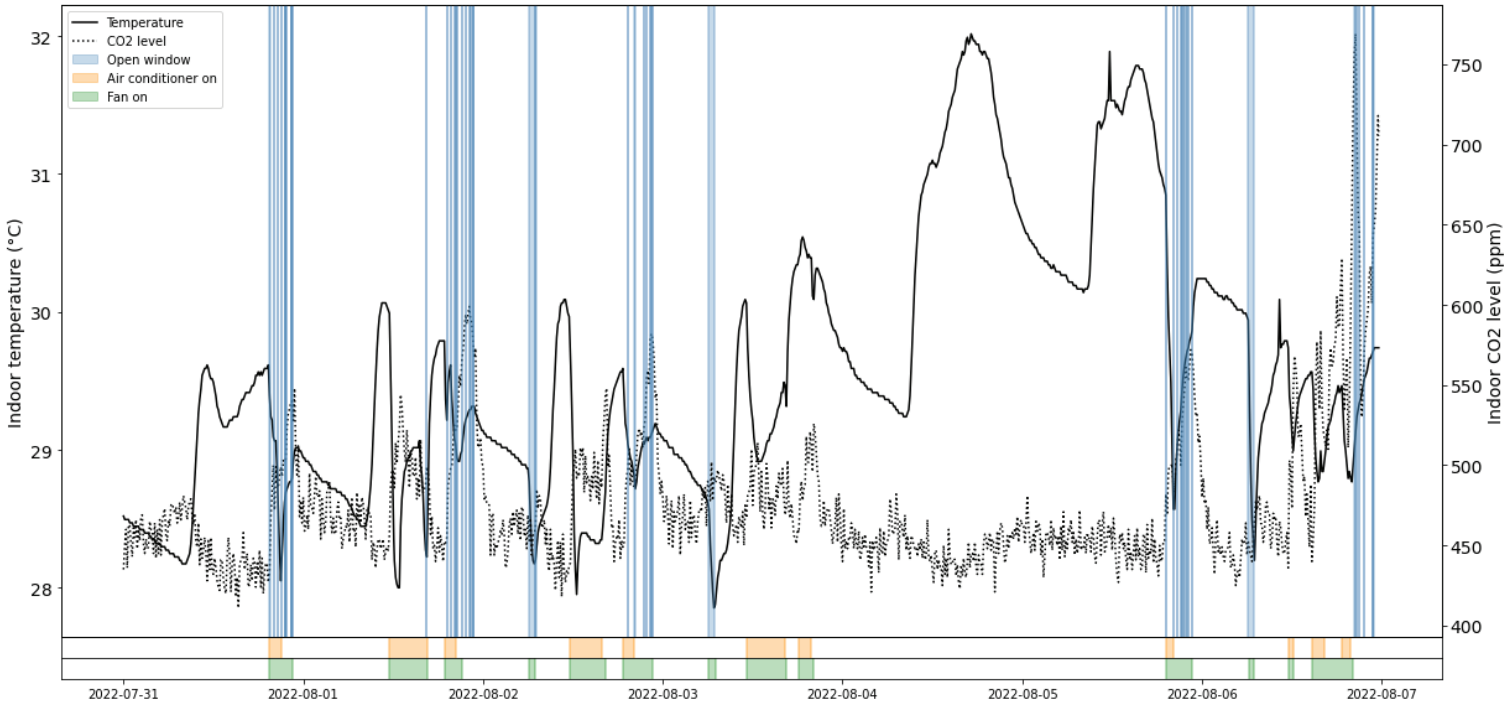
Exploratory analysis

Link between in-situ measurement and surveys

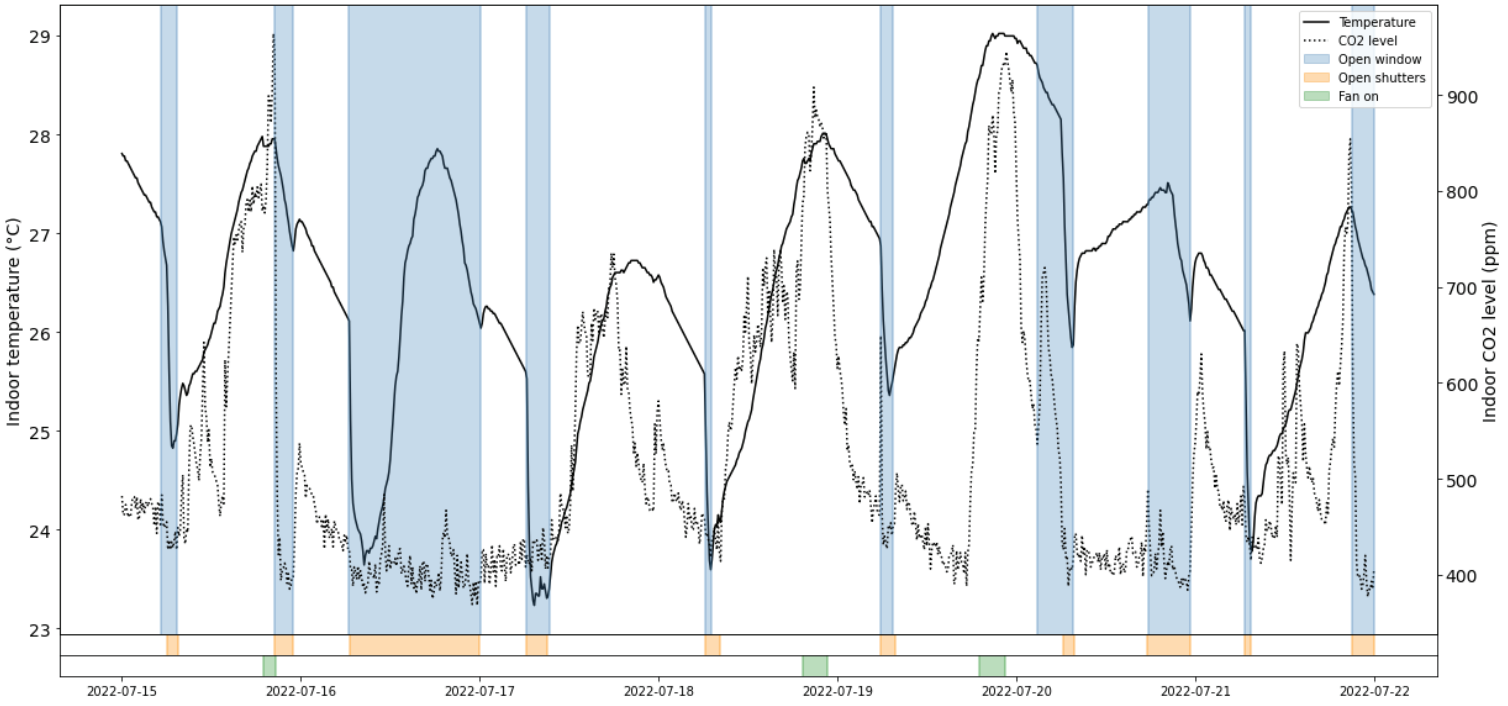
Comparison of temperature by room in the different dwellings using boxplot diagrams with means displayed



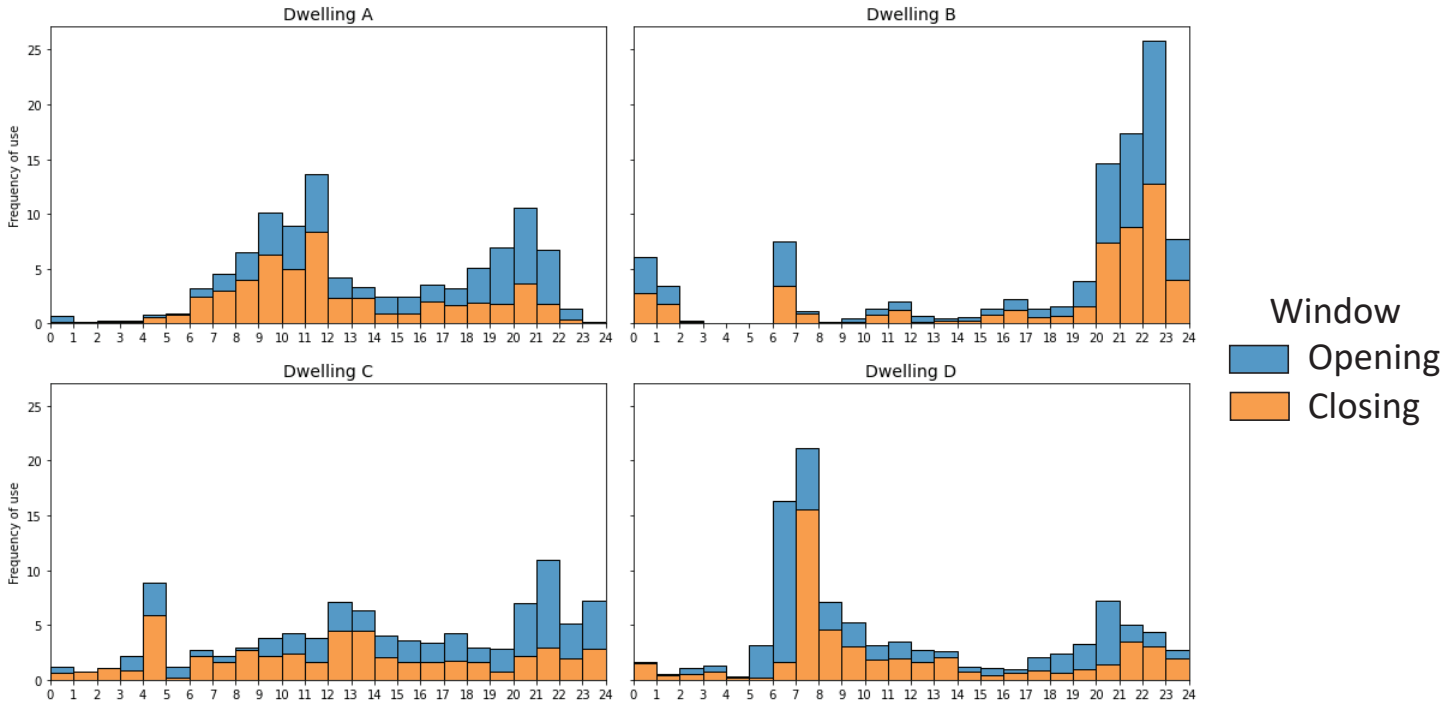
Evolution of the indoor environment with adaptation actions in the living room of dwelling B during the 3rd heatwave



Evolution of the indoor environment with adaptation actions in the living room of dwelling D during the 2nd heatwave



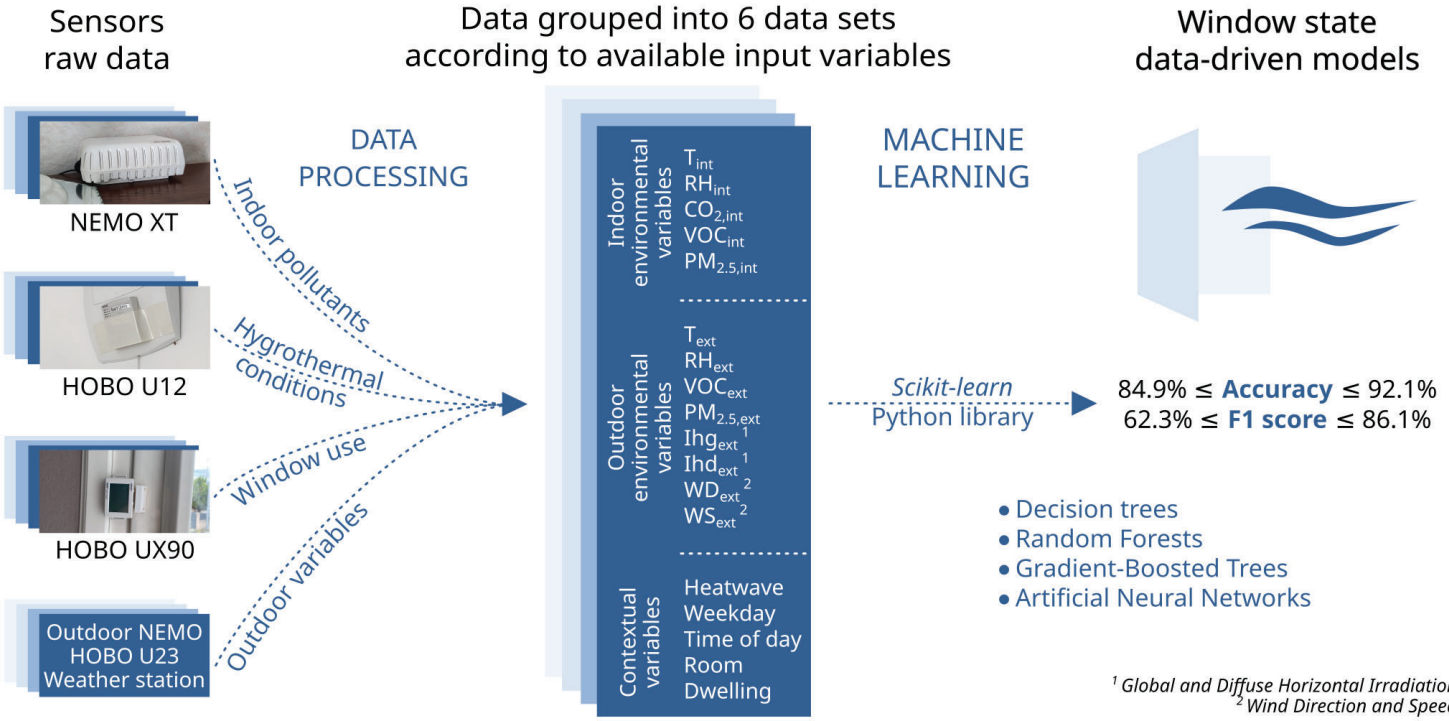
Windows openings and closings according to the time of day



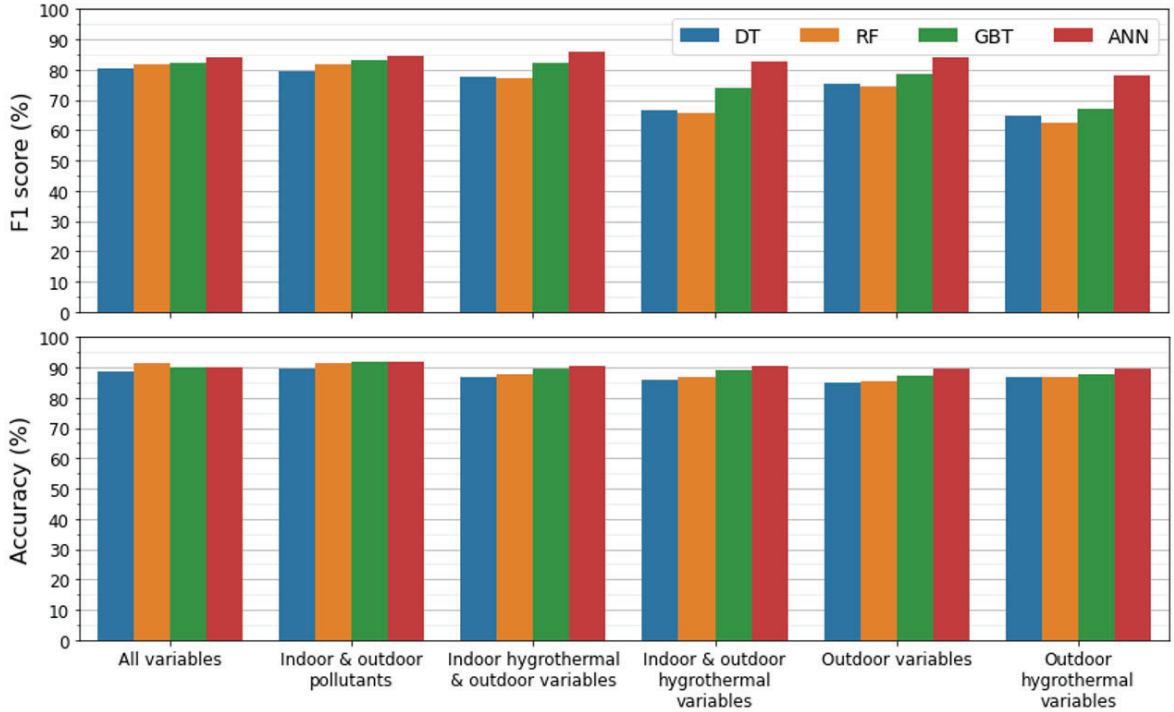
Data-driven models

Window states prediction

Graphical abstract

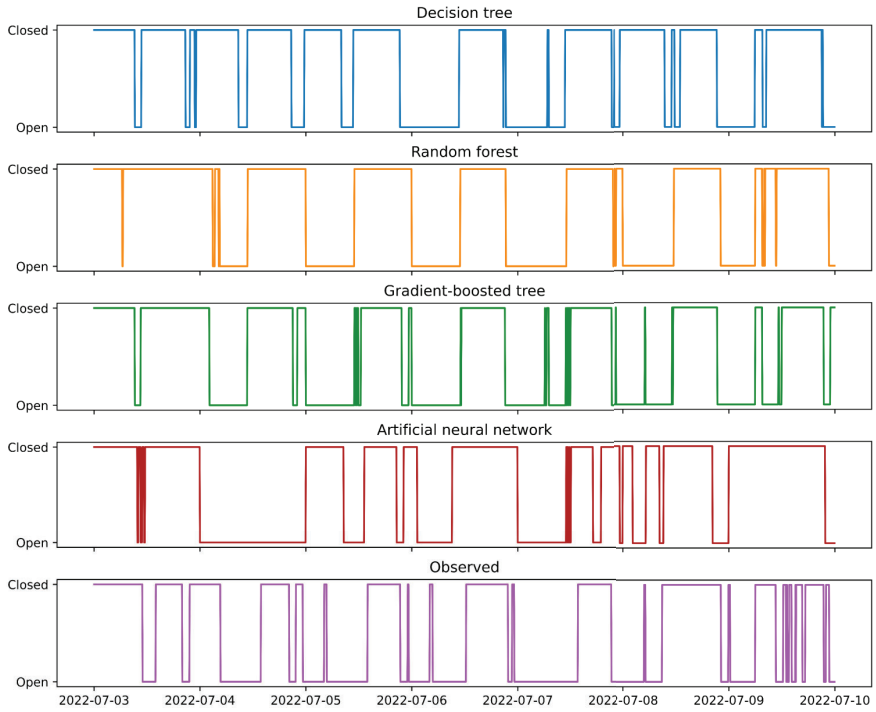


Metrics of the 4 data-driven models tested on the 6 dataframes with different input variables



Window states observed and predicted

Window states observed and predicted by the four data-driven models in the master bedroom C with only the contextual and outdoor hygrothermal variables given as inputs



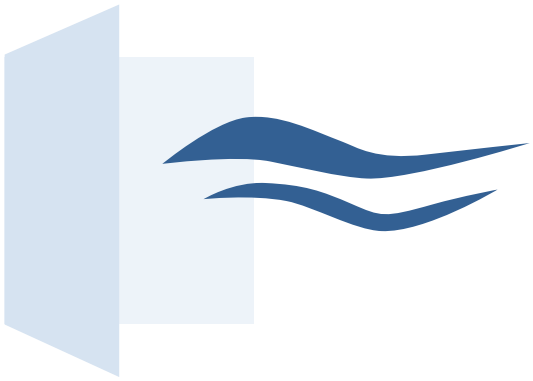
Next steps

→ Testing the models on an external dataset

- another field measurement campaign last summer
- same data collection methodology applied to a multi-family building in Nantes (France)

→ Conducting semi-structured interviews with more households

- to address additional drivers for window use
- to consider in a more comprehensive way the adaptation actions that occupants implement in their homes to cope with heat



Thank you for your attention!

Do you have any questions ?

Hostein M, Moujalled B, Musy M and El Mankibi M. 2023. "**A study of indoor environment and window use in French dwellings monitored during a summer with heatwaves**" in *43rd AIVC, 11th TightVent and 9th Venticool conference*. Copenhagen.