Overheating Indicator and Calculation Method for Walloon Buildings

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PARTNERS

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Overheating in buildings is expected to be more intense and prolonged due to the current rate of climate change and global warming. There is a significant need for resilient building design and therefore it is mandatory to develop calculation methods and indicators to avoid overheating and invest in carbon neutral cooling technologies and sustainable solutions. There is still a challenge of keeping the occupants safe, comfortable, and productive in an affordable way despite the rising temperatures and changes in the rainfall and solar irradiance.

1. CONTEXT

Since the exceptional summer of 2003, extreme events like heat waves are likely to become more frequent by the end of this century and there is a growing opportunity for the designers to improve thermal comfort and resilience of the Belgian buildings.
Solutions to improve the building resilience should minimize the future maintenance and operational costs. As a result, the Belgian construction sector can generate new income streams by providing climate adaptation expertise, frameworks, and solutions for retrofit and construction projects.

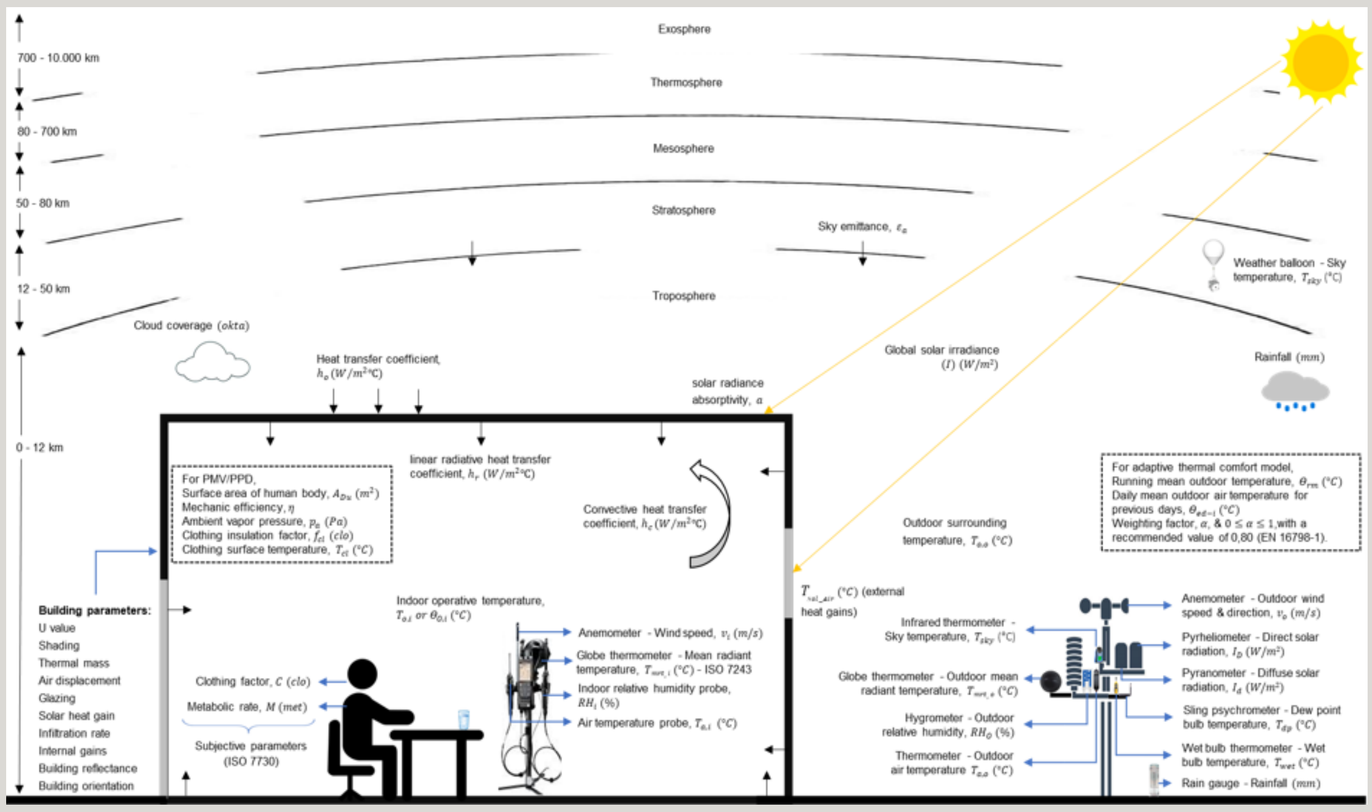
2. OBJECTIVES

Increase the competitiveness of the building service sector in Wallonia.

- Design a climate sensitive overheating indicator.
- Create a model framework and protocol with low input uncertainty and high-risk assessment.
- Develop low cost in-situ measurement methods and field measurement kit.

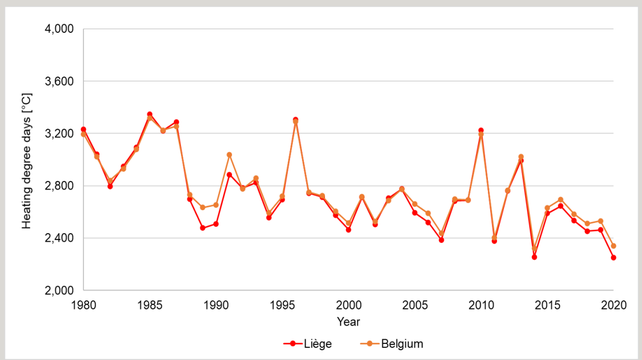
3. THERMAL COMFORT

ASHRAE 55 (2020) defines thermal comfort as “the condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation”. The external and internal parameters that influences indoor thermal comfort and their respective measurement devices are shown in the figure. The figure includes PMV/PPD and adaptive thermal comfort model parameters according to EN 16798 (2019).

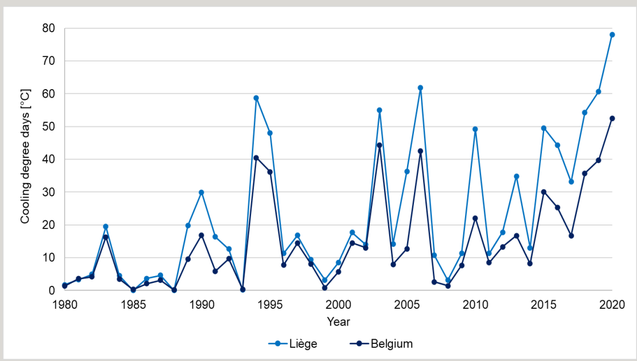


4. STUDIES

HDDs for Liege and Belgium, are studied and shows a decreasing trend from 1980 to 2020. In addition, HDD for Liege is lower compared to Belgium, and indicates warmer winters.

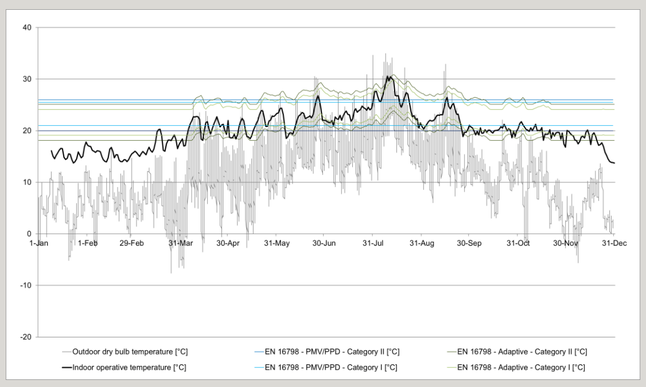


CDDs for Liege and Belgium, are studied and shows an increasing trend from 1980 to 2020. In addition, CDD for Liege is higher compared to Belgium, and indicates hotter summers.



5. ANALYSIS

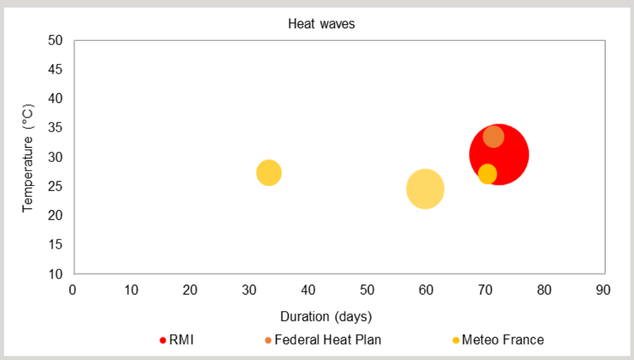
Weather files from MAR forced by the reanalysis model ERA5 based on the real observation is used for the analysis.
Indoor operative temperature and outdoor air temperature are overlaid on upper and lower limits of category I and II as per EN 16798 (2019) for 2020.
Indoor operative temperature range exceeds the PMV/PPD and adaptive thermal comfort limits during August and was considered as heat wave event as per RMI, Belgium.



Another important criteria to be noted here is that the adaptive model limits tend to exceed 30 °C and more.
These limits in real scenarios might not be comfortable. This is to be considered for the future standard developments.

6. EFFECTS

Heat wave definitions according to RMI, Federal heat plan, and Meteo France are considered, and a single heat wave event was detected in Liege during 2020.



In addition, the intense and longest heat waves from 2015 to 2020 in Liege, according to (Machard, 2020) classification are added.

DISCUSSIONS

1. The climate and weather patterns in Liege indicates warmer winters and hotter summers in the future.
2. There is a significant need for a resilient design and to develop calculation methods and indicators to avoid overheating in buildings.

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