Whole house heat recovery ventilation in residential dwellings where spot heating is used

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Structure

- Methodology
- How are we heating our homes
- Two-zone heat recovery ventilation model and parameters
- Results
- Summary

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Methodology

- Gathered in-use temperature data from 16 homes in Lower Hutt over winter 2017.
- Typically 1960s build, timber weatherboard, low levels of insulation
- Applied a two-zone heat recovery ventilation model using the temperature data as input.
- Modelled case where one room is periodically heated and the other is not.
- Observed effect on temperature in the unheated room for different levels of insulation.

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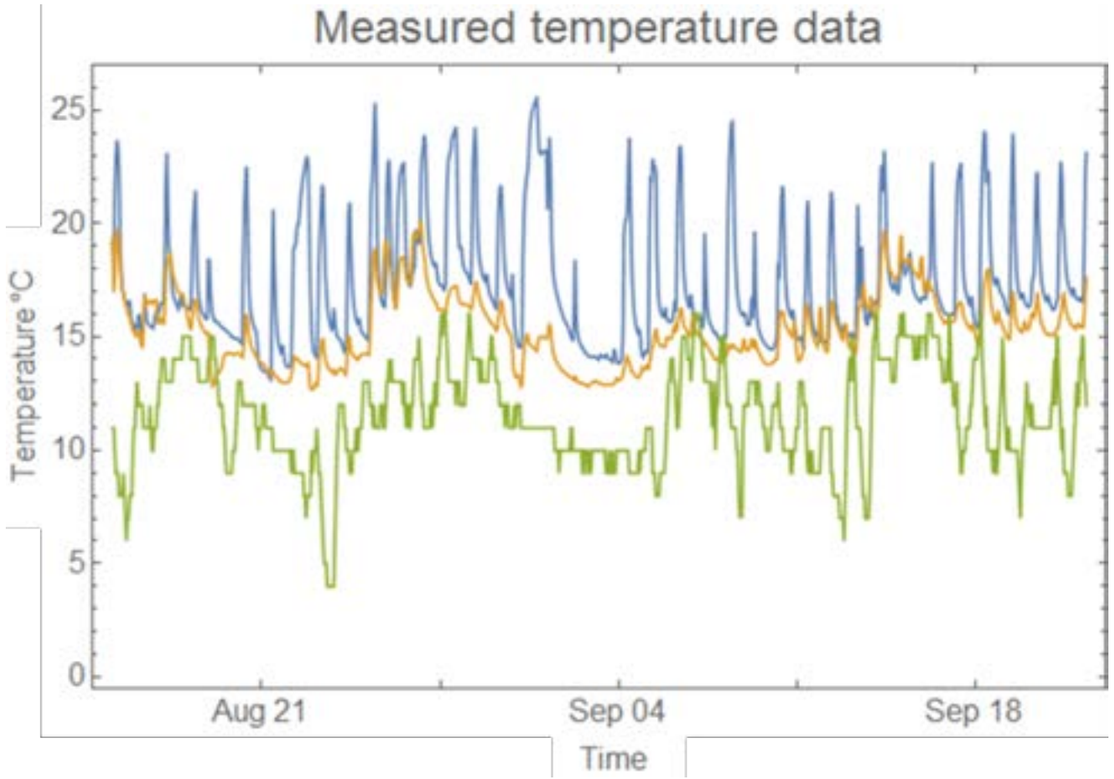
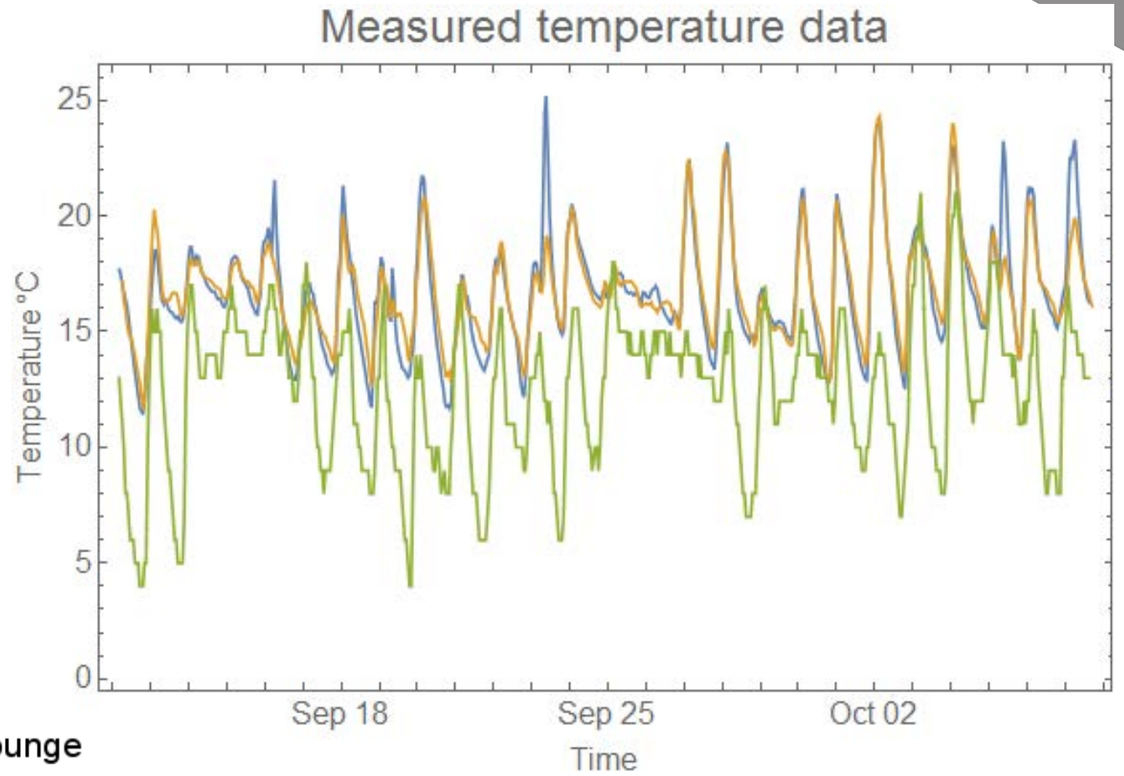
How are we heating





Lounge
Bedroom
Outside

Spot heating

No heating

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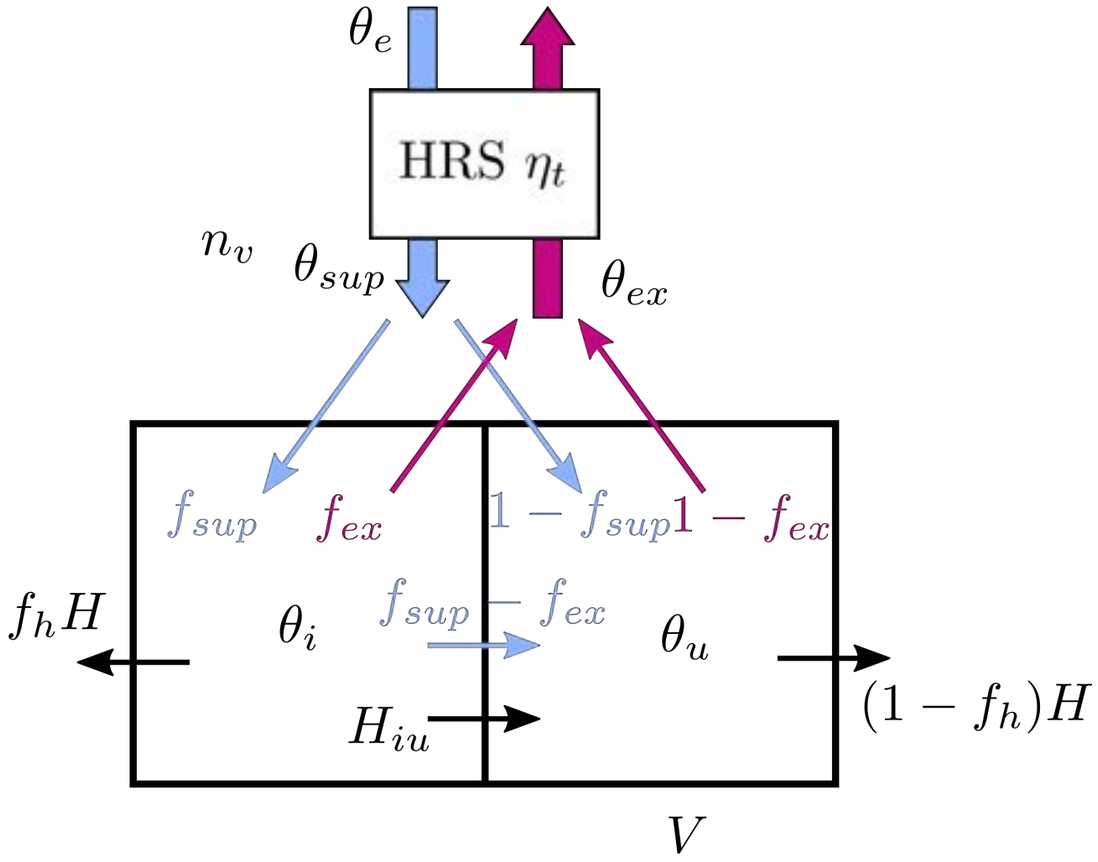
More appropriate model



$$\theta_{ex} = f_{ex}\theta_i + (1 - f_{ex})\theta_u$$

$$\theta_{sup} = \theta_e + \eta_t(\theta_{ex} - \theta_e)$$

$$\Phi_L = f_h H(\theta_i - \theta_e) + H_{iu}(\theta_i - \theta_u) + 0.34 f_{sup} n_v V(\theta_i - \theta_{sup})$$

$$(H_{iu} + 0.34(f_{sup} - f_{ex})n_v V)(\theta_i - \theta_u) = (1 - f_h)H(\theta_u - \theta_e) + 0.34(1 - f_{sup})n_v V(\theta_u - \theta_{sup})$$

Janssens, A., Laverage, J., Delghust, M. & Himpe, E. (2017) Utilization of heat recovery ventilation problem statement based on steady-state two-zone heat loss analysis and field studies, 38th AIVC Conference 2017

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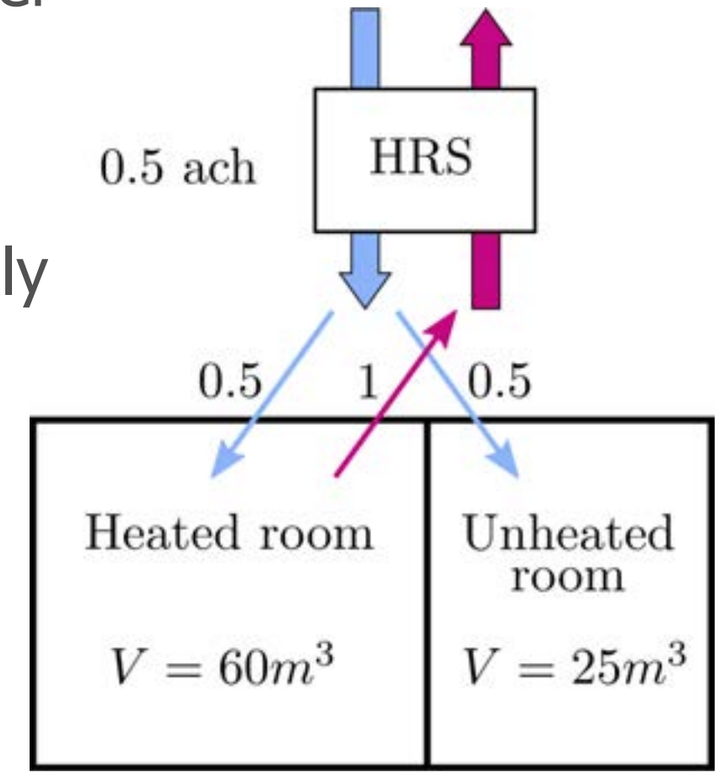
Model parameters

- Internal temperature data from 16 houses in Lower Hutt
- Heat recovery efficiency of 0.8
- Heated room and unheated room are not thermally connected i.e. at different ends of the house
- Insulation levels:
  - Ceiling = R3.5
  - Walls = R2.4
  - Floor R1.2



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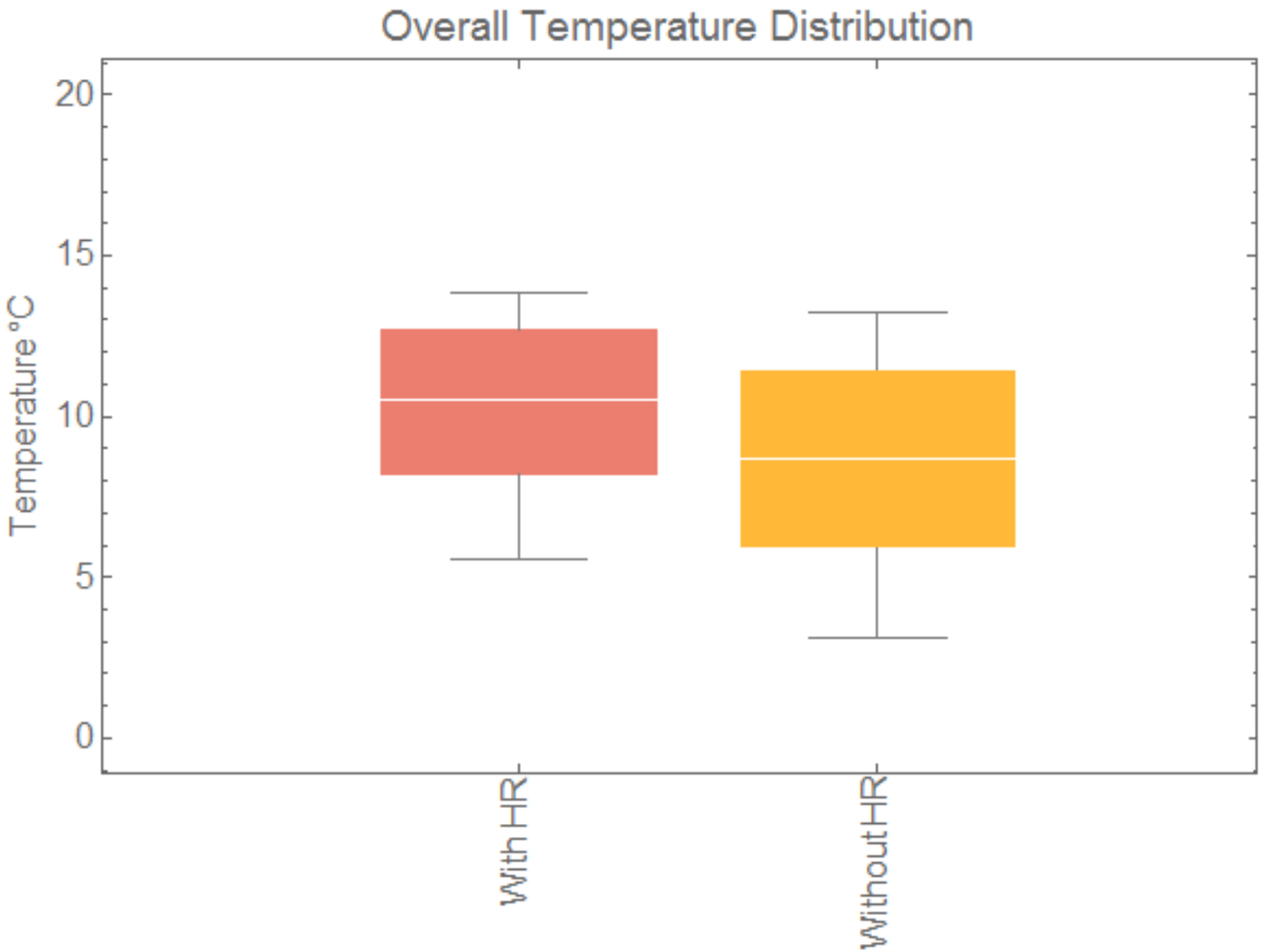
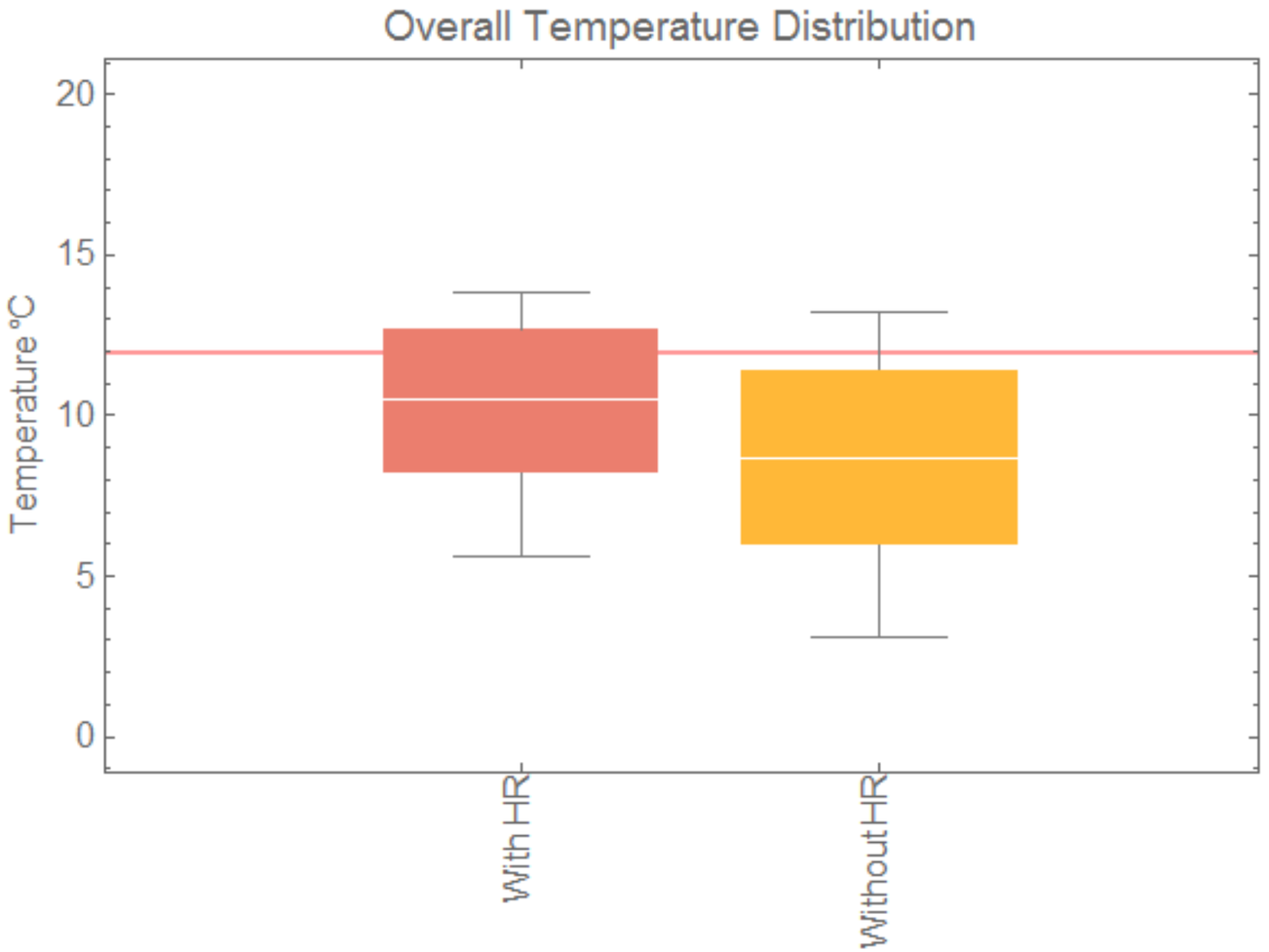
Fully insulated – Floor, ceiling, walls



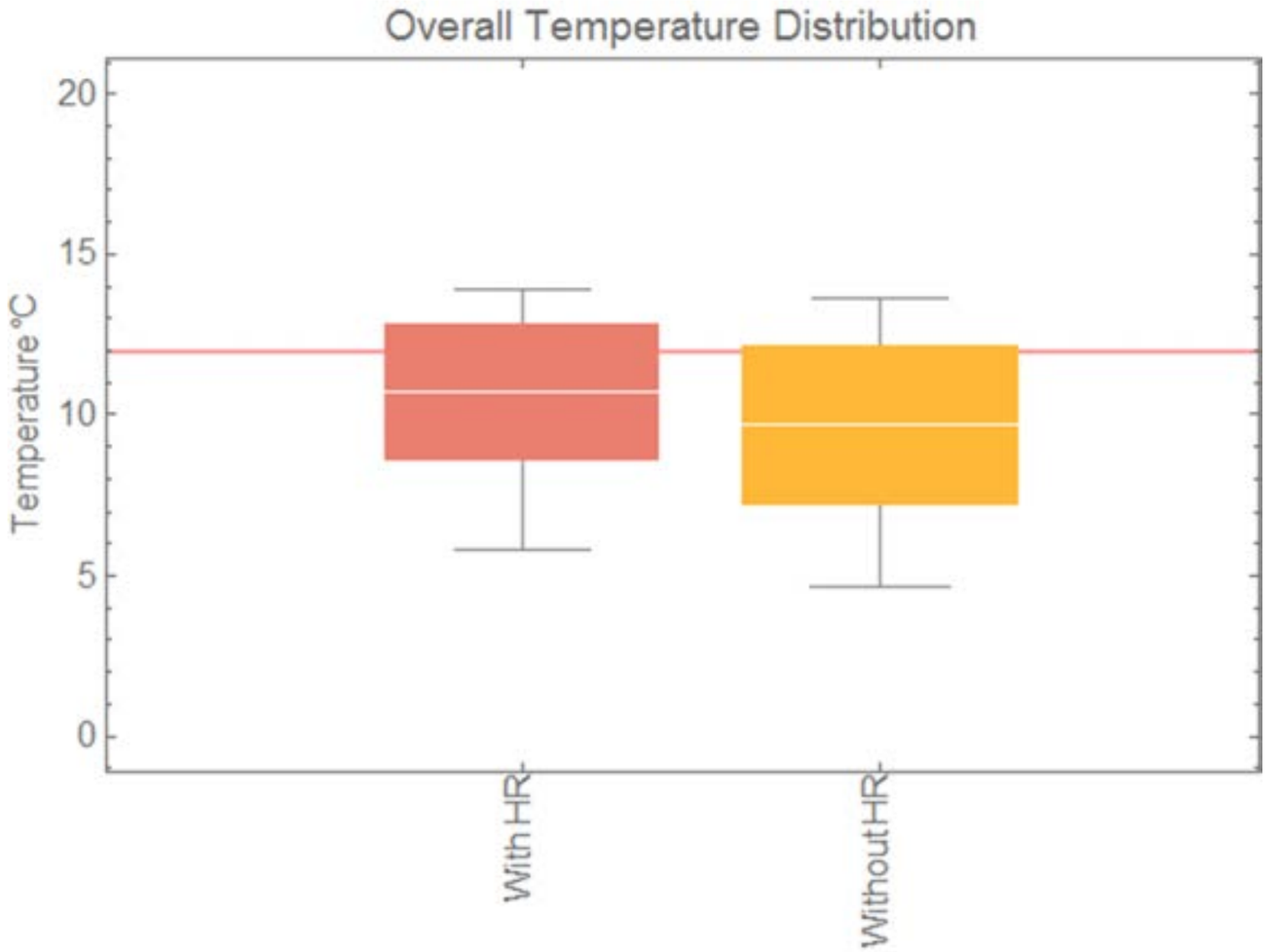
Mean temperature difference
1.7℃

Fully insulated – Floor, ceiling, walls



Mean temperature difference
1.7℃

Partly insulated – Floor, ceiling



Mean temperature difference
0.9℃

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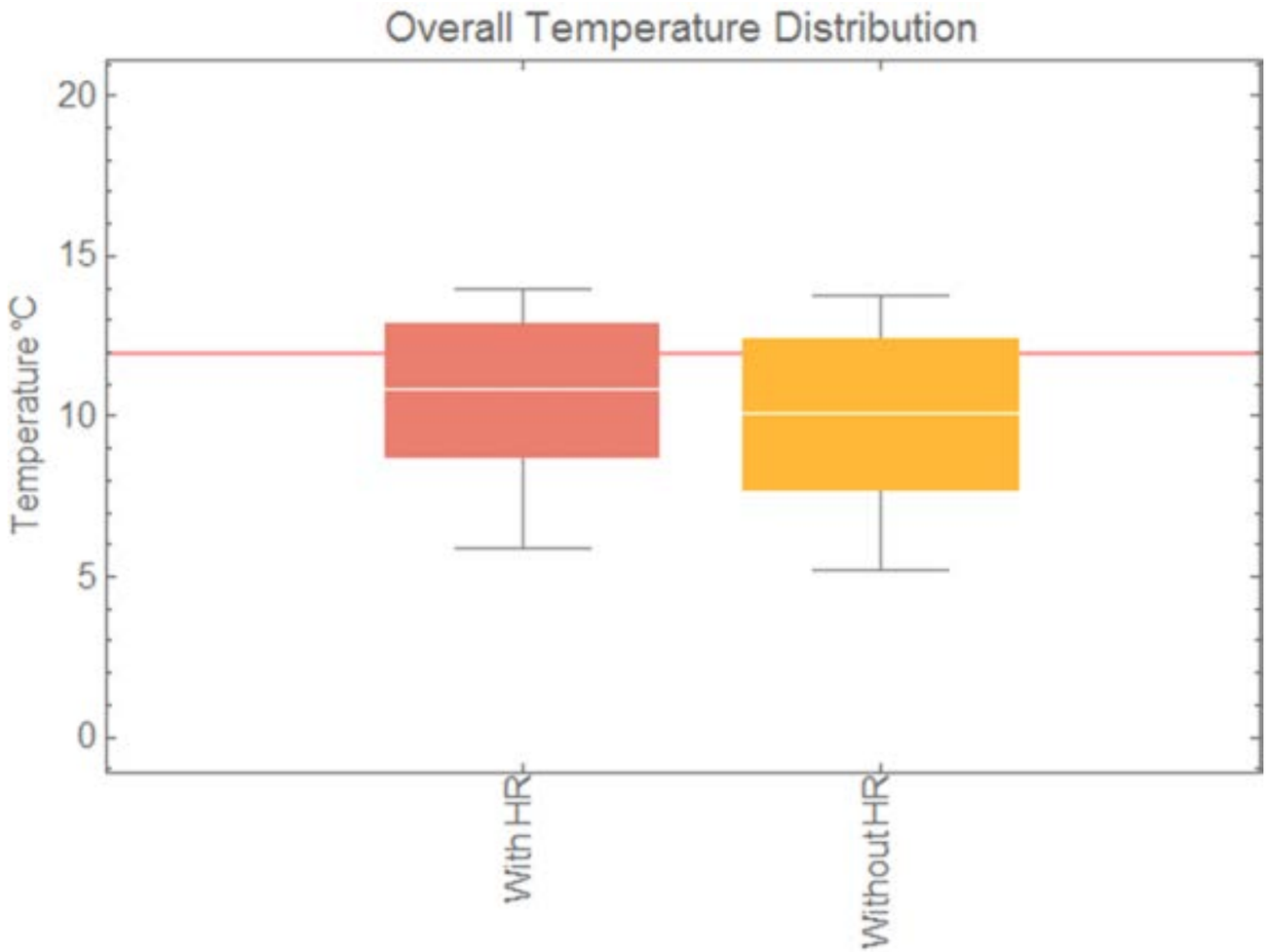
No insulation



Mean temperature difference
0.6℃

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Summary

- People don’t tend to heat whole house, we are unlikely to break this habit easily
- Applied two-zone heat recovery ventilation model developed by A. Janssens et al.
- Heat recovery ventilation can be used to raise temperature of rest of the house if only one room is heated
- More insulation helps
- Still need to account for heat lost due to exfiltration
- At low temperatures, even a few degrees can have a large physiological impact.

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Thank you