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A STUDY INTO THE INSULATIVE EFFECTS OF SNOW ON FLAT ROOFS UNDER EXTREME CONDITIONS

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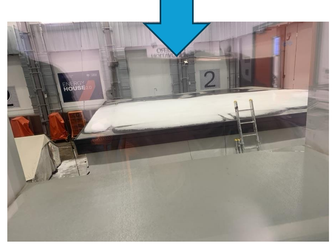
ABSTARCT

Research centres in extreme conditions should be well insulated, provide good levels of thermal comfort and should have a limited effect on the natural environment. Generally, these metrics are modelled and are taken as fact. However, research over many years has illustrated a performance gap between buildings that are designed and measured, in terms of heat loss through elements. Snow has been shown in past studies to provide a layer of insulation that can help reduce thermal transmission. Snow also has very dynamic characteristic during its change from one past to another. This study will be carried out at the Energy House 2 Research Facility at the University of Salford, Manchester. A set of large climatic chambers will be used to create real snow on the roof the test house and the chamber will cycle through a range of temperatures. Measurements are taken of surface/air temperature and heat flux to determine the measured U-value of the flat roofed structure. The research presents a real and dynamic view of the insulating effects that can then be used to help calibrate energy models of polar research bases.

EXPERIMENTAL HOUSE

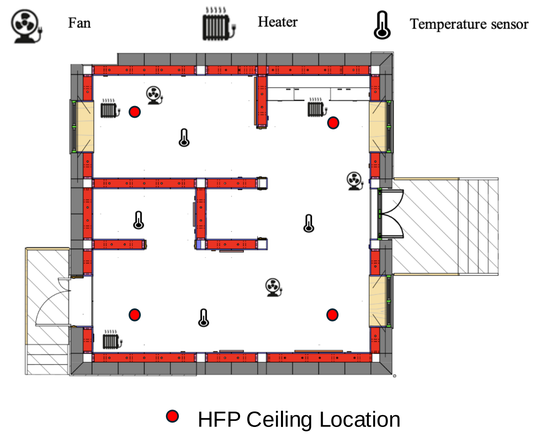






EXPERIMENTAL HOUSE - EXPERIMENTAL SETUP

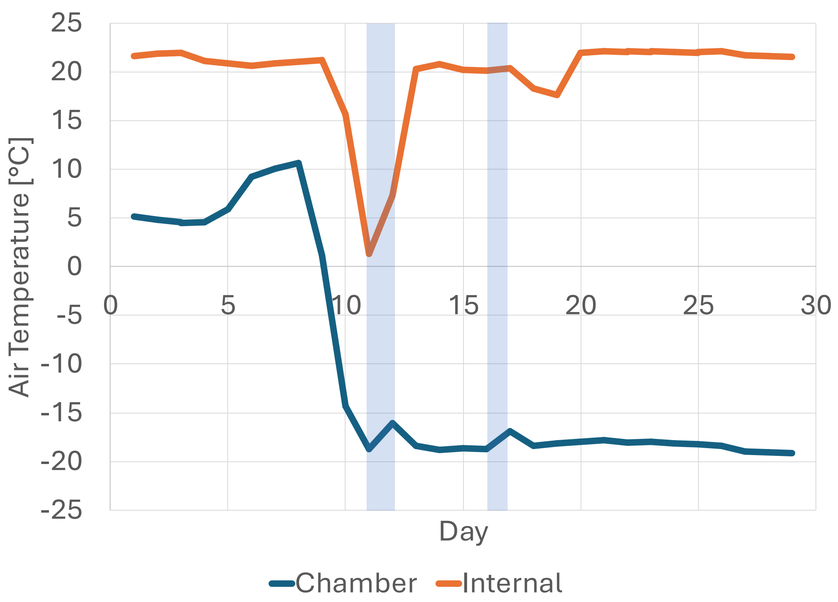
- Internal conditions achieved using “coheating” setup
  - Electric fan heaters connected to PID thermostatic controllers, set to 21 °C
  - Fans used to create homogenous internal air temperature
- HFP set up in 4 corners of the Ceiling, 1 m from external wall junctions
- IR Thermography used to ensure HFPs were not placed on repeating thermal bridges



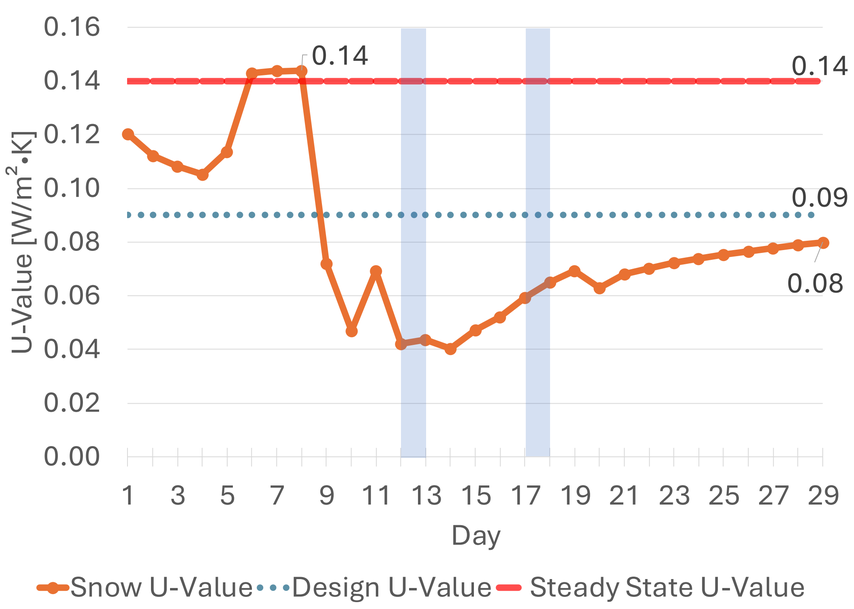
RESULTS

Key Events:
Day 1: Internal conditions set to 21 °C
Day 1: Chamber temperature set to 5 °C
Day 5: Chamber Increased to 10 °C
Day 8: Chamber temperature dropped to -18 °C
Day 10: Internal heating failure
Day 11: regained control of internal heating
Day 12: Snow machine, aimed at roof
Day 17: 2nd layer of snow applied
Day 18: Insufficient heating internally, increase power of heaters
Day 20-29: Constant conditions
(21 °C Internal, -18 °C Chamber)

24h Average Environmental Conditions



24h Average U-Value



CONCLUSION

Further research, characterising the snow produced within the Energy House 2.0 chambers and development of a greater understanding of why we see the change in U-Value, collaborating with other Universities, specialising in material characterisation, snow crystalline structures, and extreme environmental conditions.

Repeat study on other building types, understanding the effect on not just typical UK based constructions, but archetypes typically built in these extreme conditions.