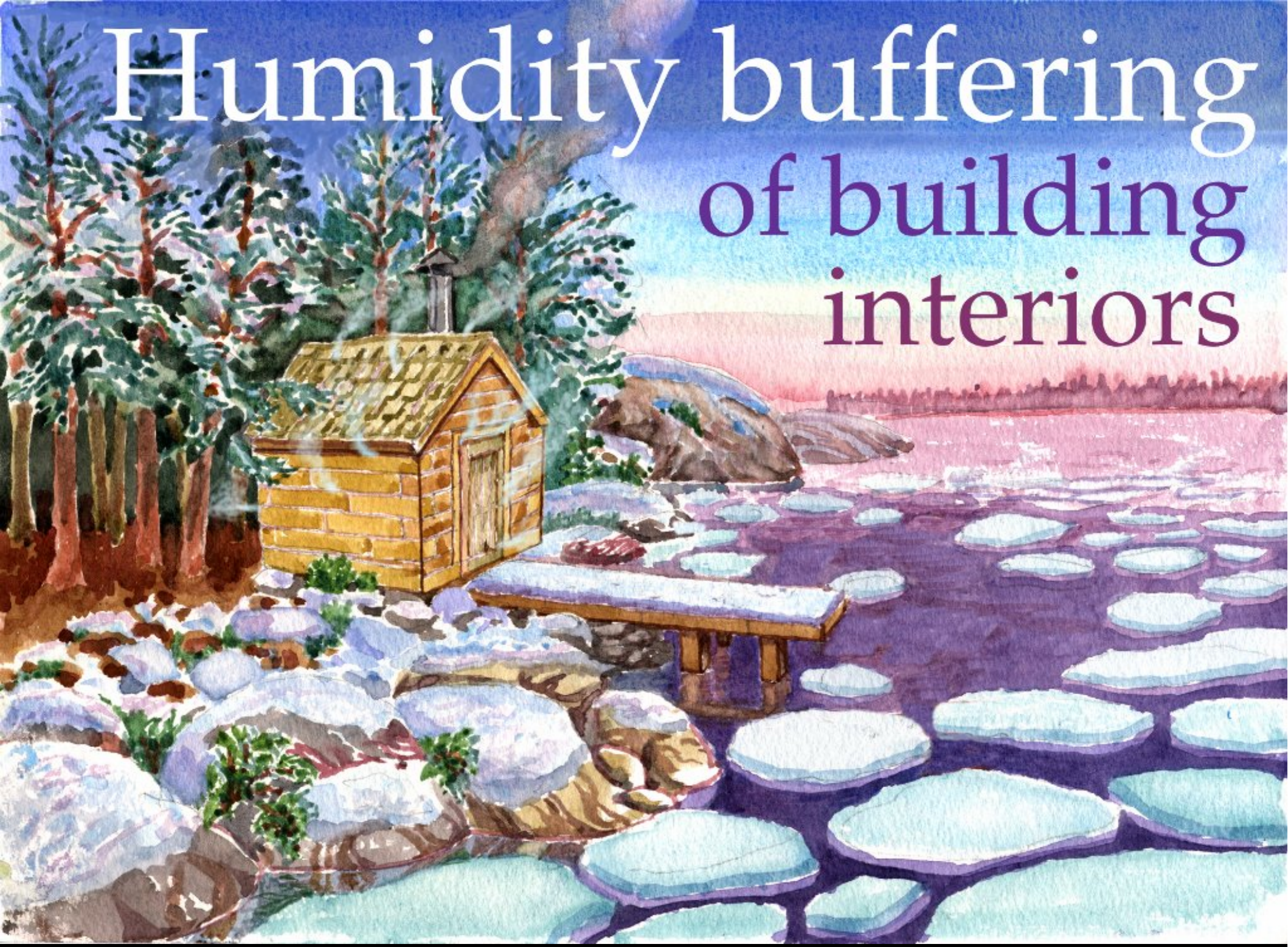
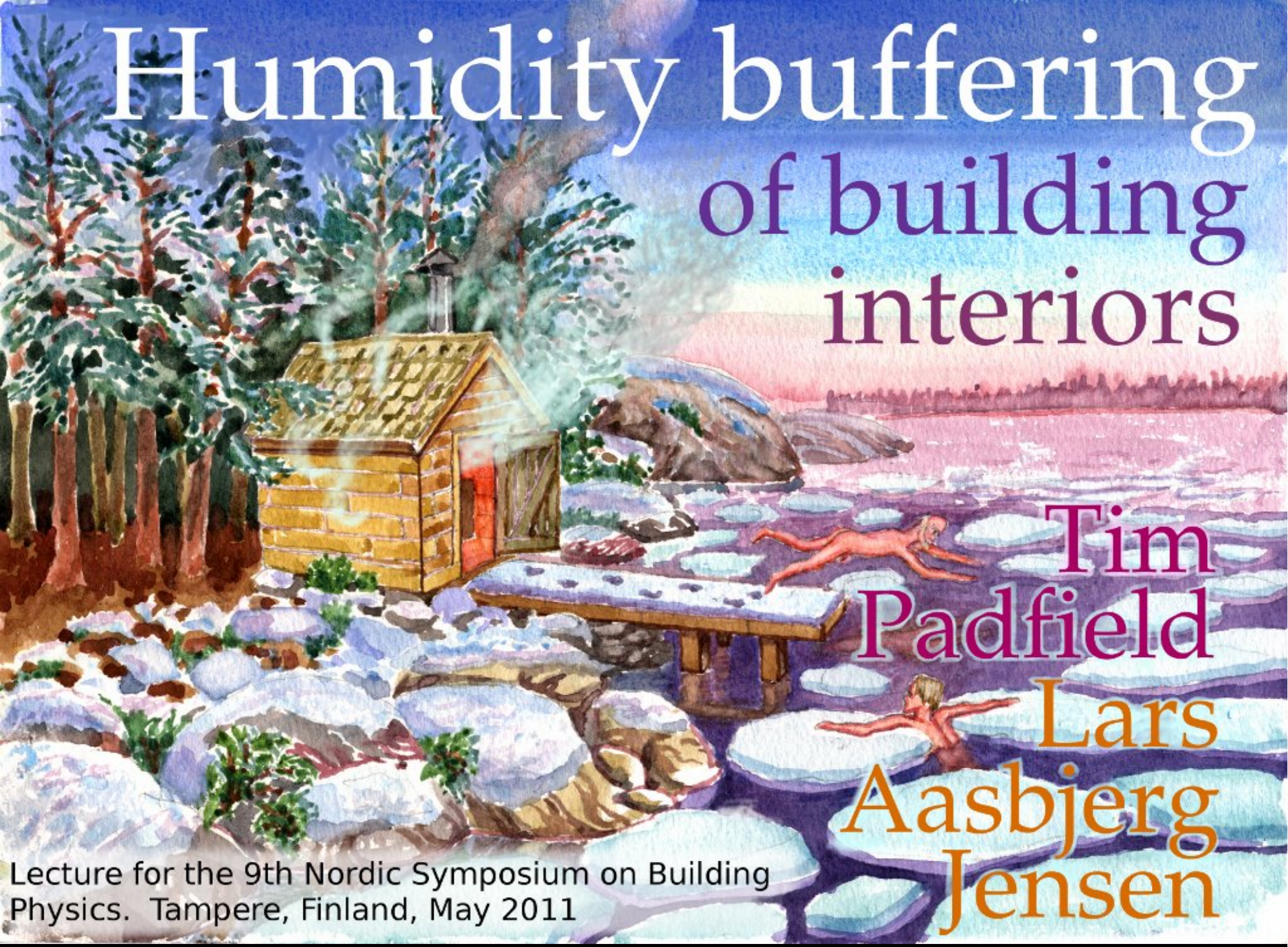
Humidity buffering of building interiors



Humidity buffering of building interiors

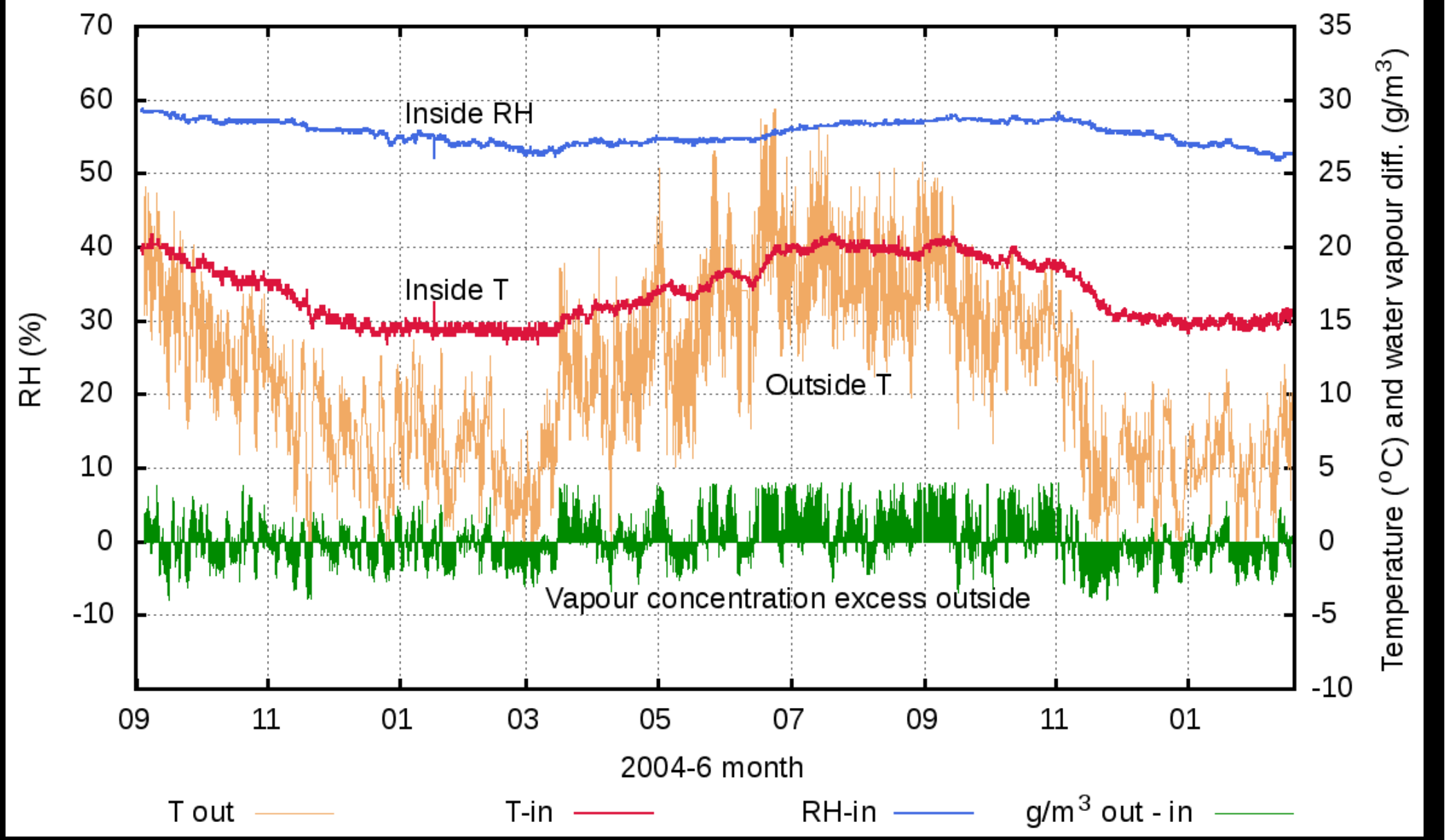


Tim Padfield
Lars Aasbjerg Jensen

Lecture for the 9th Nordic Symposium on Building Physics. Tampere, Finland, May 2011

Already in 1934, engineer MacIntyre published the concept of humidity buffering a museum gallery

The Suffolk Record Office, Ipswich, UK
The climate is controlled by winter heating alone

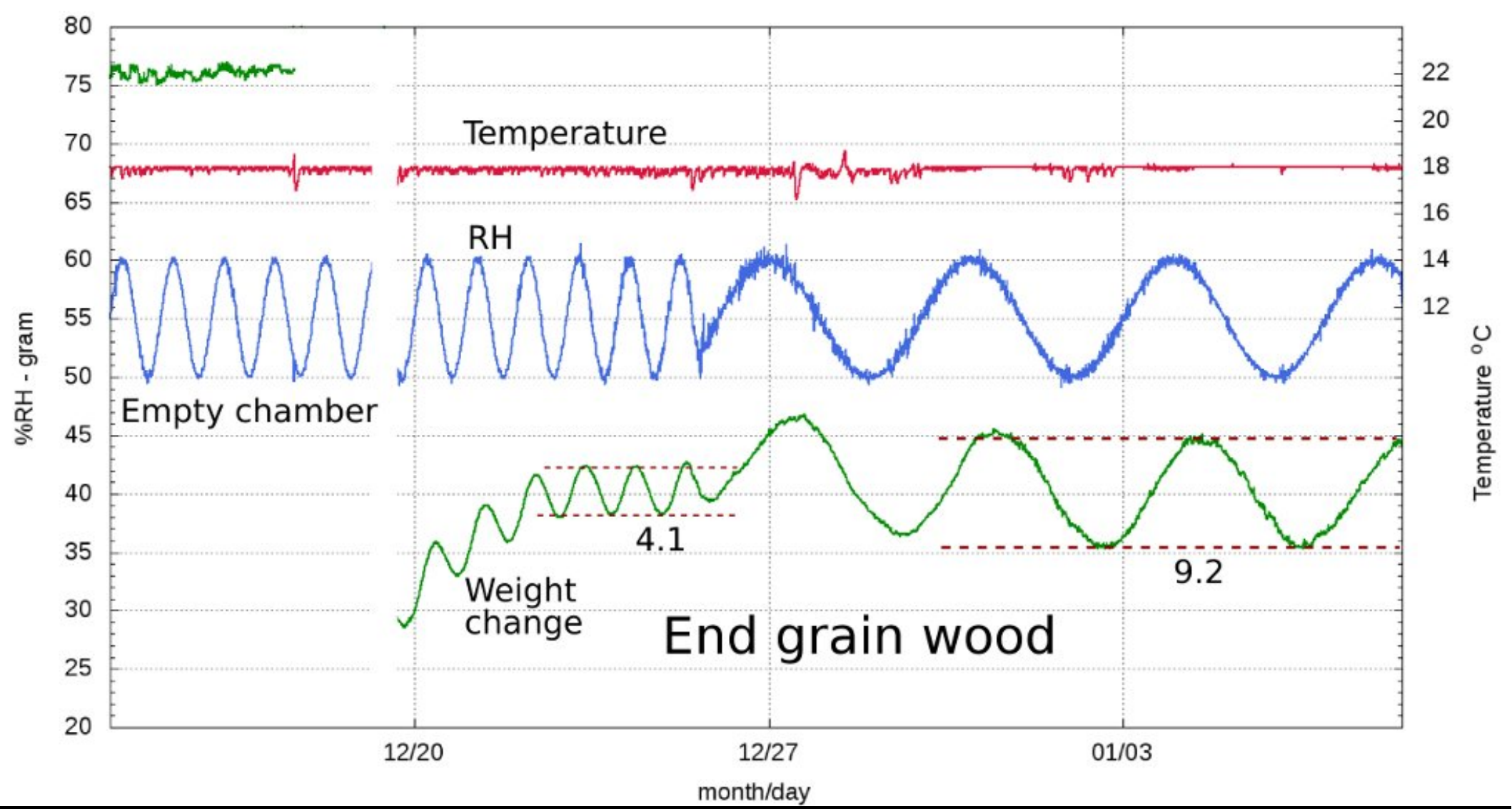


The climate within the Suffolk Record Office. The green trace shows the imbalance in water vapour concentration inside and out

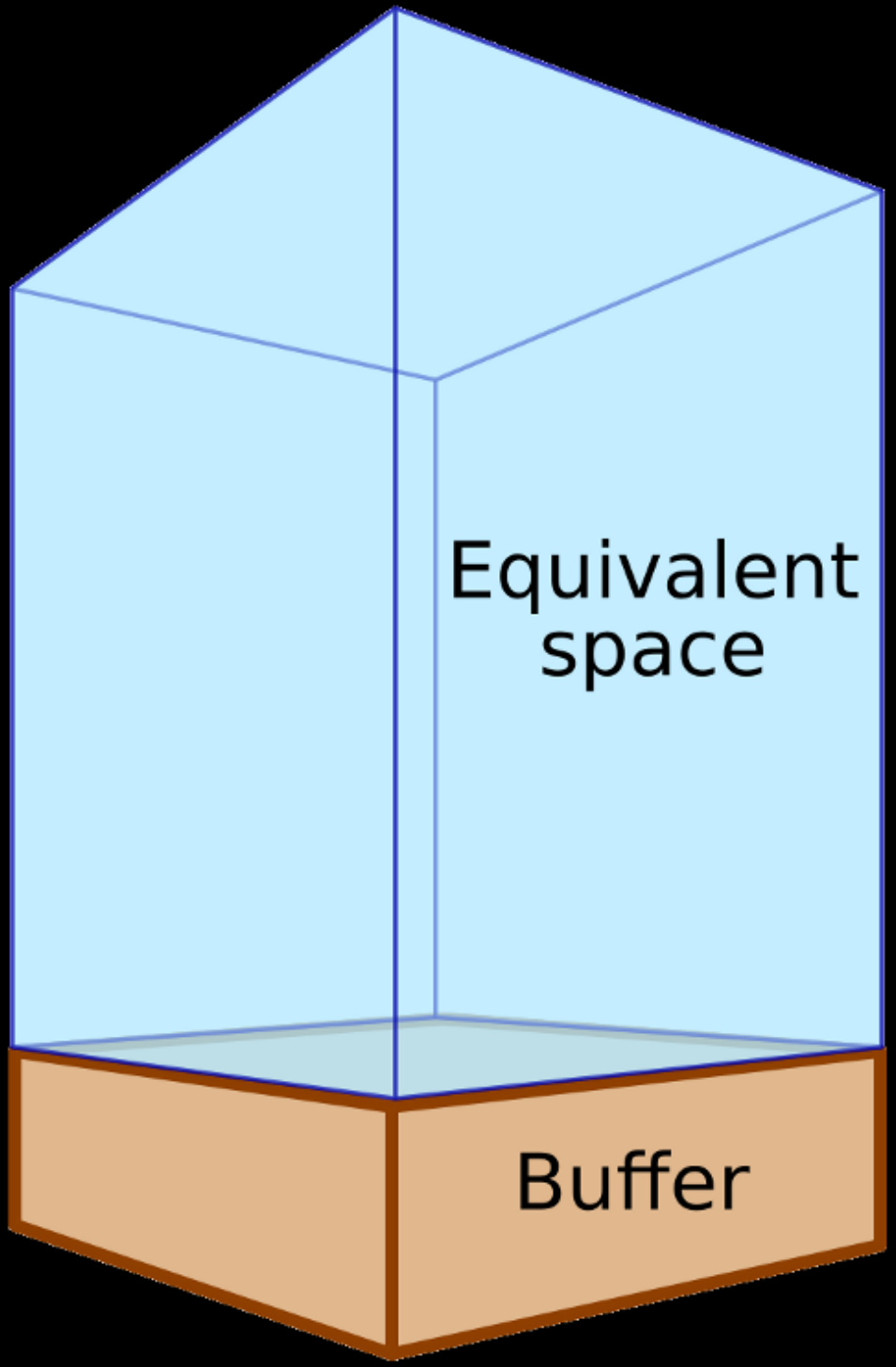
The record office is full of paper. Can one stabilise the RH in a sparsely furnished space?

(Sharpham House, Devon UK)

The experimental apparatus. Unfired perforated brick is exposed in an airtight chamber to a fluctuating RH

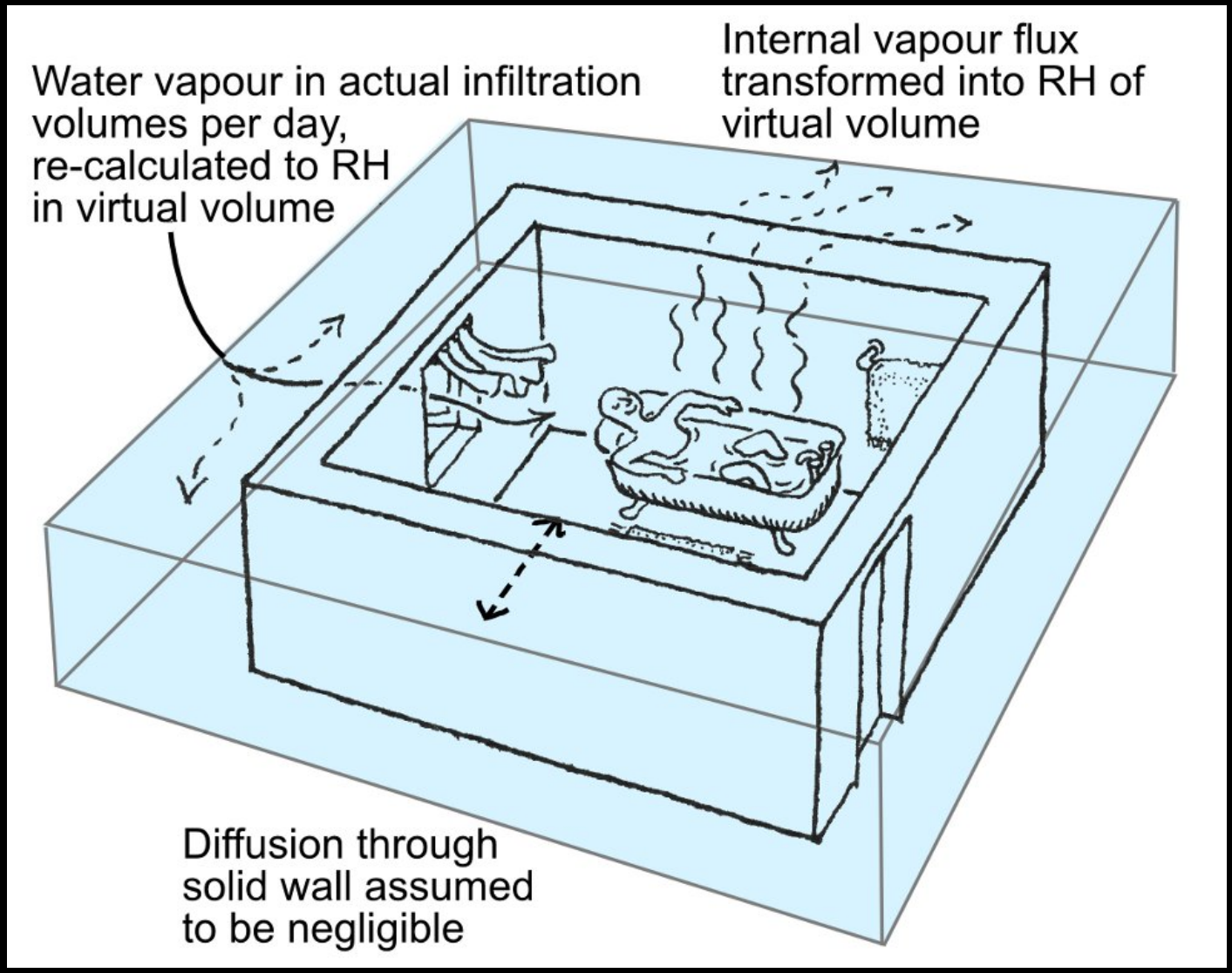


An example of the raw data format: the water exchanged in grams as the RH fluctuates between 50% and 60%



The weight change is converted into the volume of air which will accept the same weight of water as the specimen for the same rise in RH

This is the B-value, expressed as metres above a flat surface of one square metre



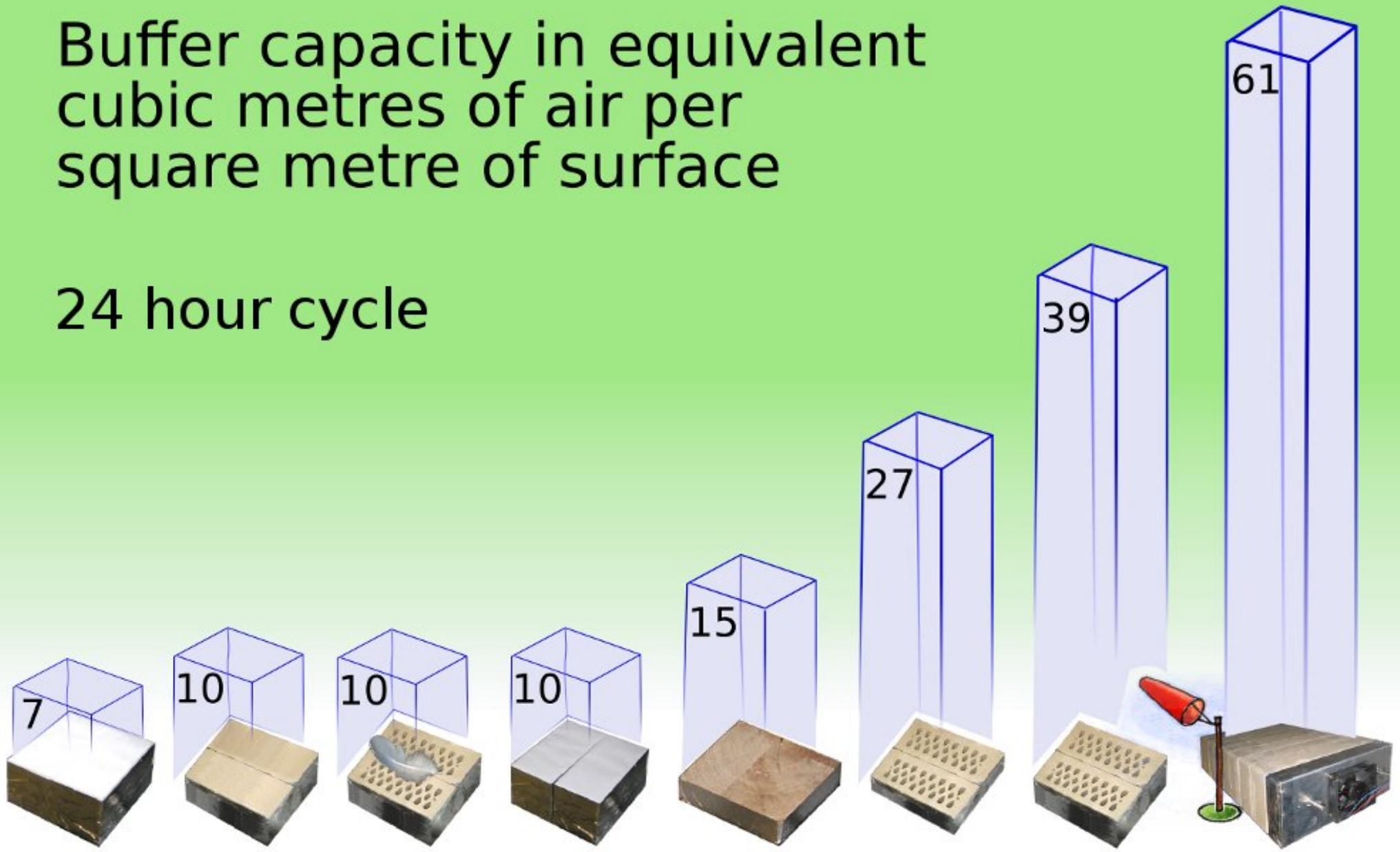
The sum of all B-values, converted to volume, becomes a virtual volume for the room which is used to calculate the effect on the interior climate of all moisture fluxes

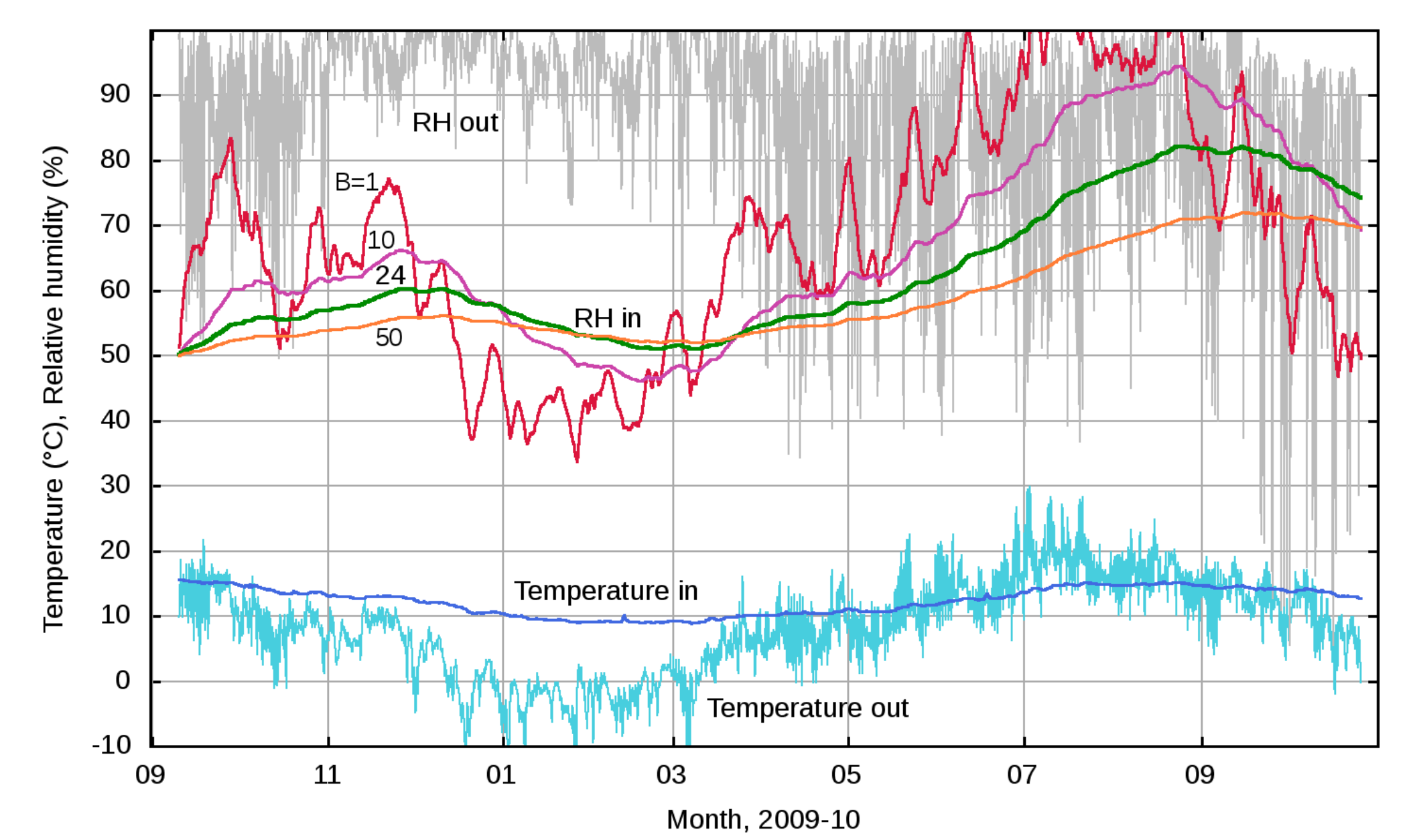
For rooms with absorbent furniture and waistcoats, a ventilation test is followed by...

… a steam test to find the B-value

Buffer capacity in equivalent cubic metres of air per square metre of surface

24 hour cycle

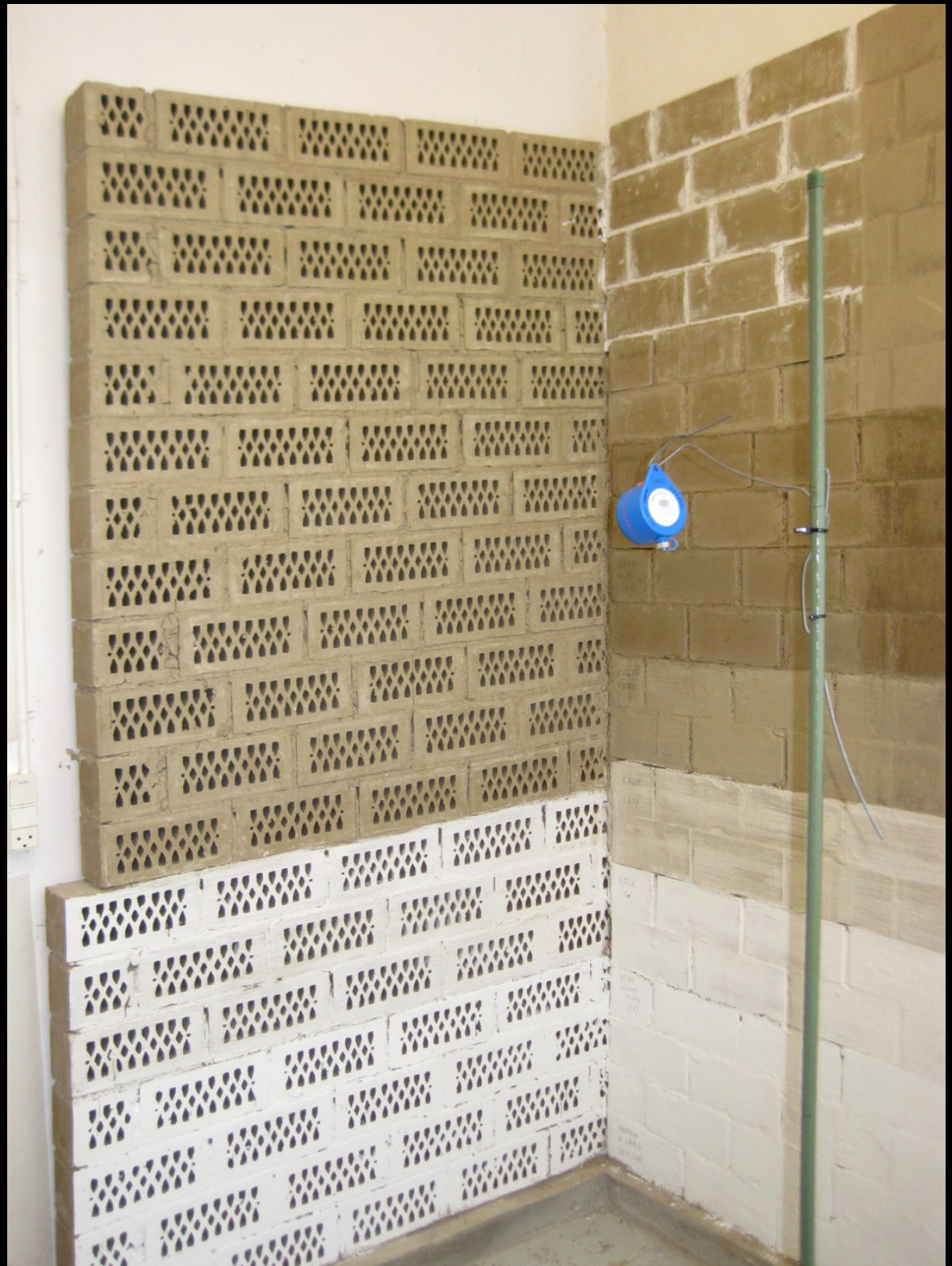


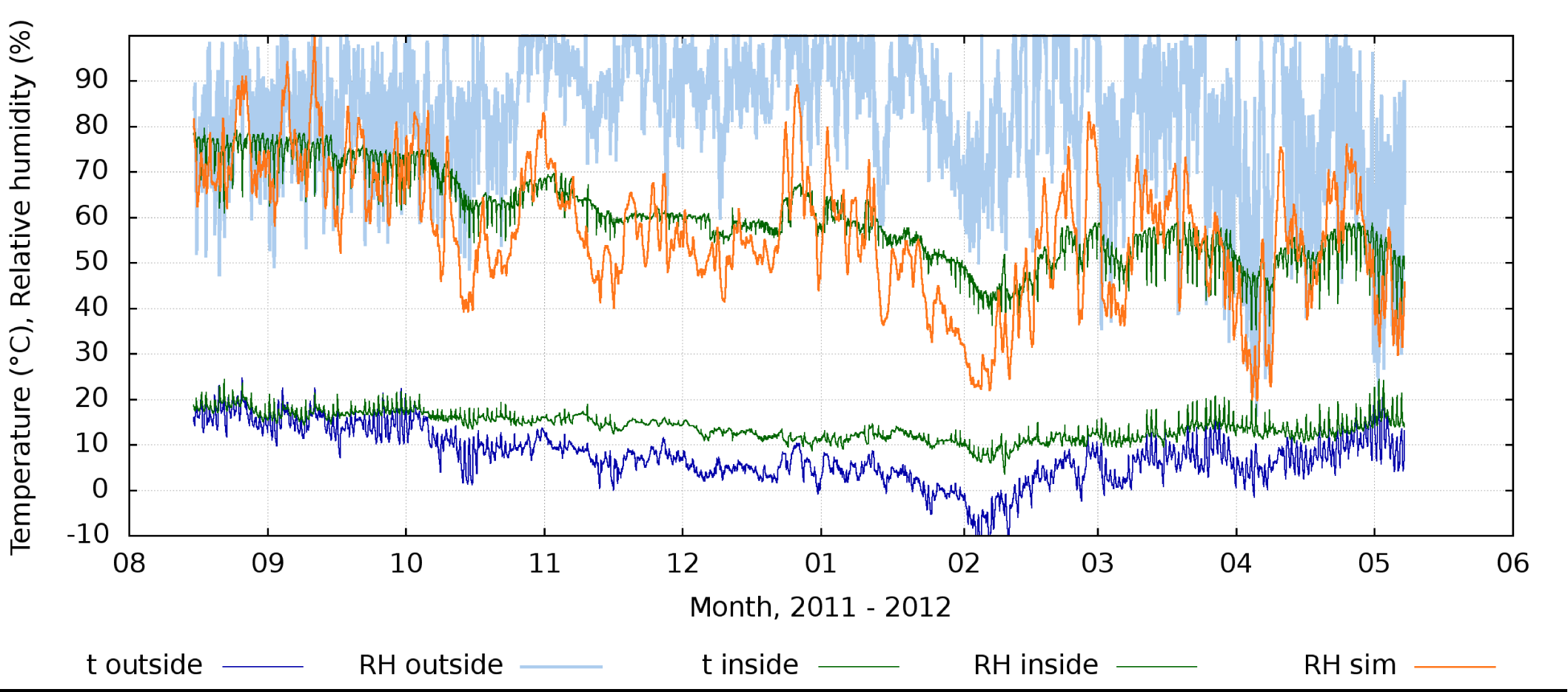


The effect of varying B-value on the projected rate of change of RH in an empty store room lined with perforated unfired brick. Air exchange rate 0.03/hr

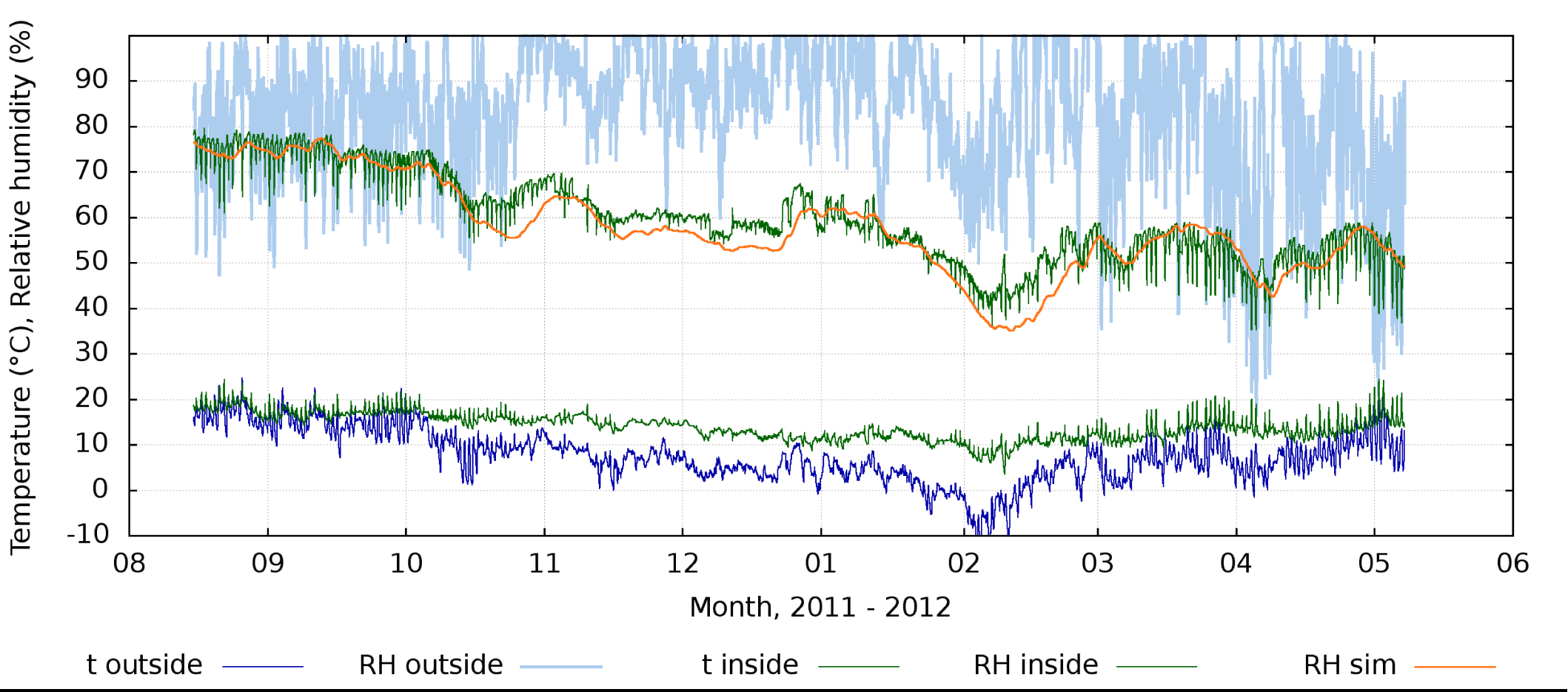
What happens in reality?

We look into this corner room

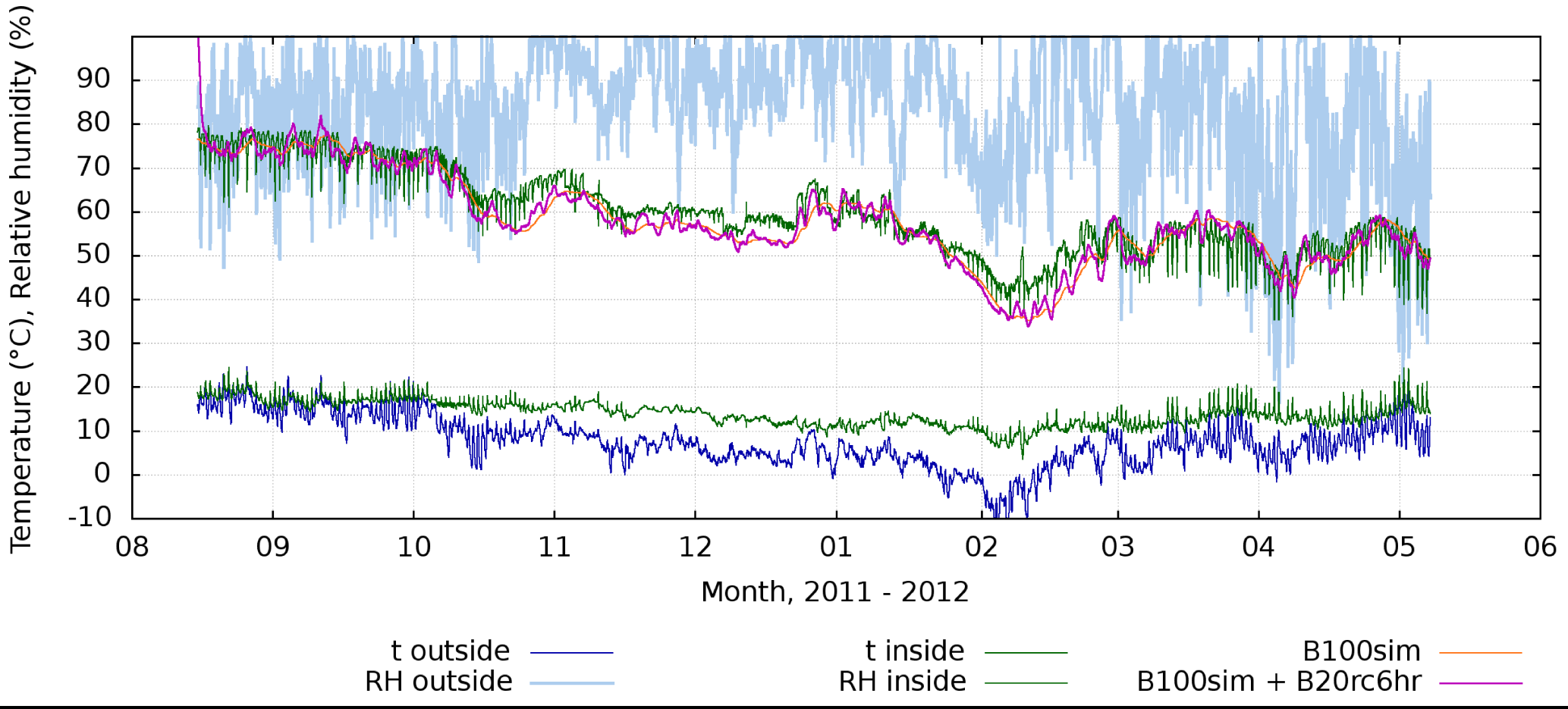




The measured RH and temperature are in green
The blue line is the outside temperature
The orange line is the calculated RH for an empty room with inert walls



The orange line is the RH predicted for a B-value 100
Notice that it is much smoother than the measured line



The purple line gives the best fit. It is obtained by using a 6 hour high-pass filter which lets through the high frequency RH changes caused by sunlight. These are not buffered by the bricks because of their thermal inertia and slow sorption rate

Acknowledgements

The National Museum
Of Denmark

Department of
Civil Engineering
Technical University
of Denmark

Suffolk
Record office

Danish
Energy Agency

La

www.conservationphysics.org