

# Standardisation activity on the protection of sensitive materials like wood within CEN Technical Committee 346

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# The framework

CEN Technical Committee 346 'Conservation of Cultural Property', chaired by professor Vasco Fassina

Working Group 4 'Environment'

**draft CEN standard prEN 15757** *'A guide to specifying temperature and relative humidity in order to limit climate-induced physical damage to organic hygroscopic materials'*

# The standard adopts two approaches

## 1.Environment – acclimatisation approach

Maintain **the same microclimate** in terms of levels, seasonal cycles and fluctuations of temperature and RH, to which the materials have acclimatised for a long time, if this climate has been proved **not to be harmful**

## 2.Material – understanding the mechanical behaviour of painted wood

Variations of environmental parameters should stay below a **critical level** above which risk of physical damage appears

# Knowledge of **historic climate** required

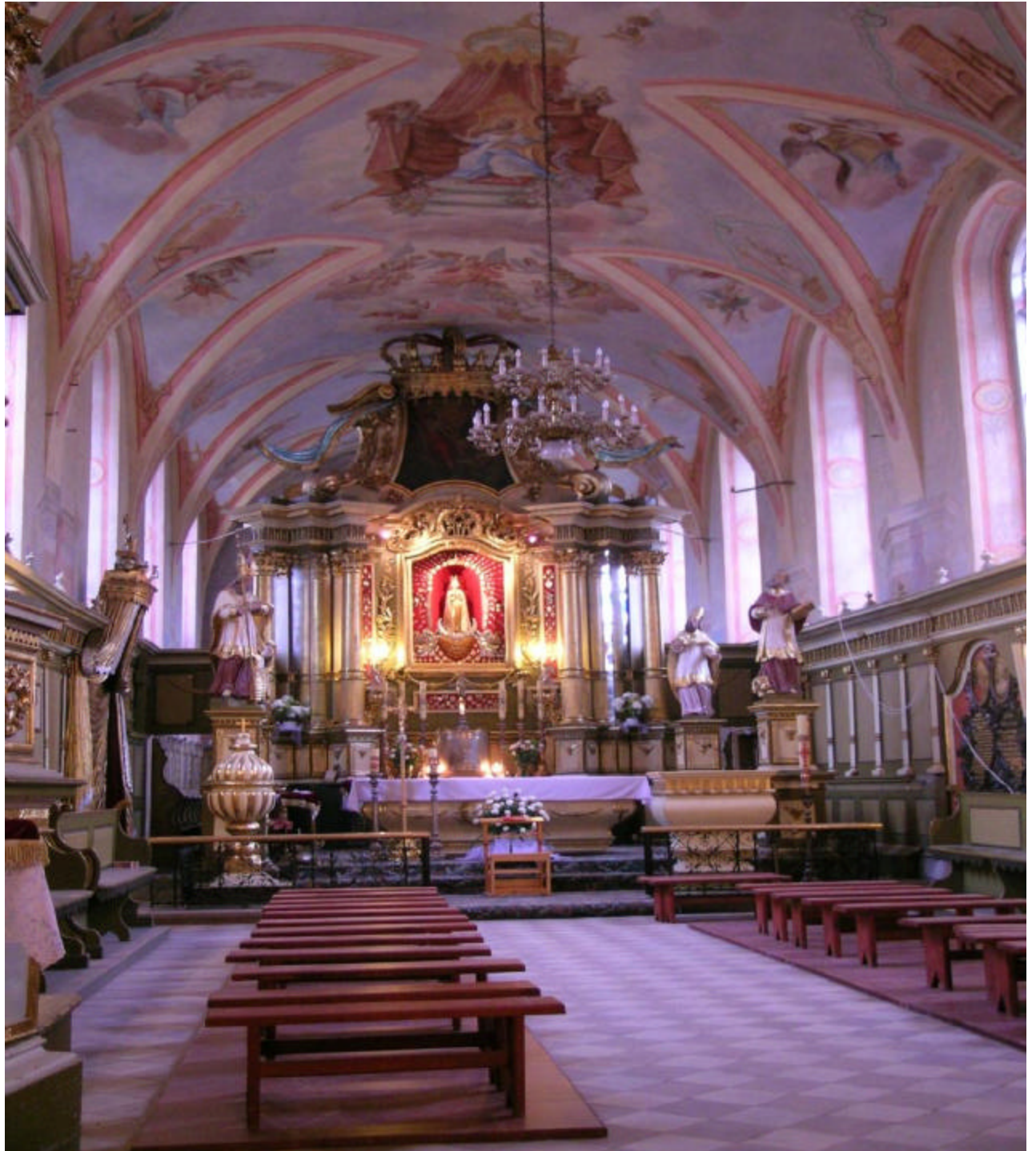
The standard provides guide to determining the RH target from the past indoor conditions (Informative Annex)

- monitor for one or more years
- describe the historic RH pattern by calculating:
  - average RH level over a selected period
  - seasonal cycle
  - short-term fluctuations

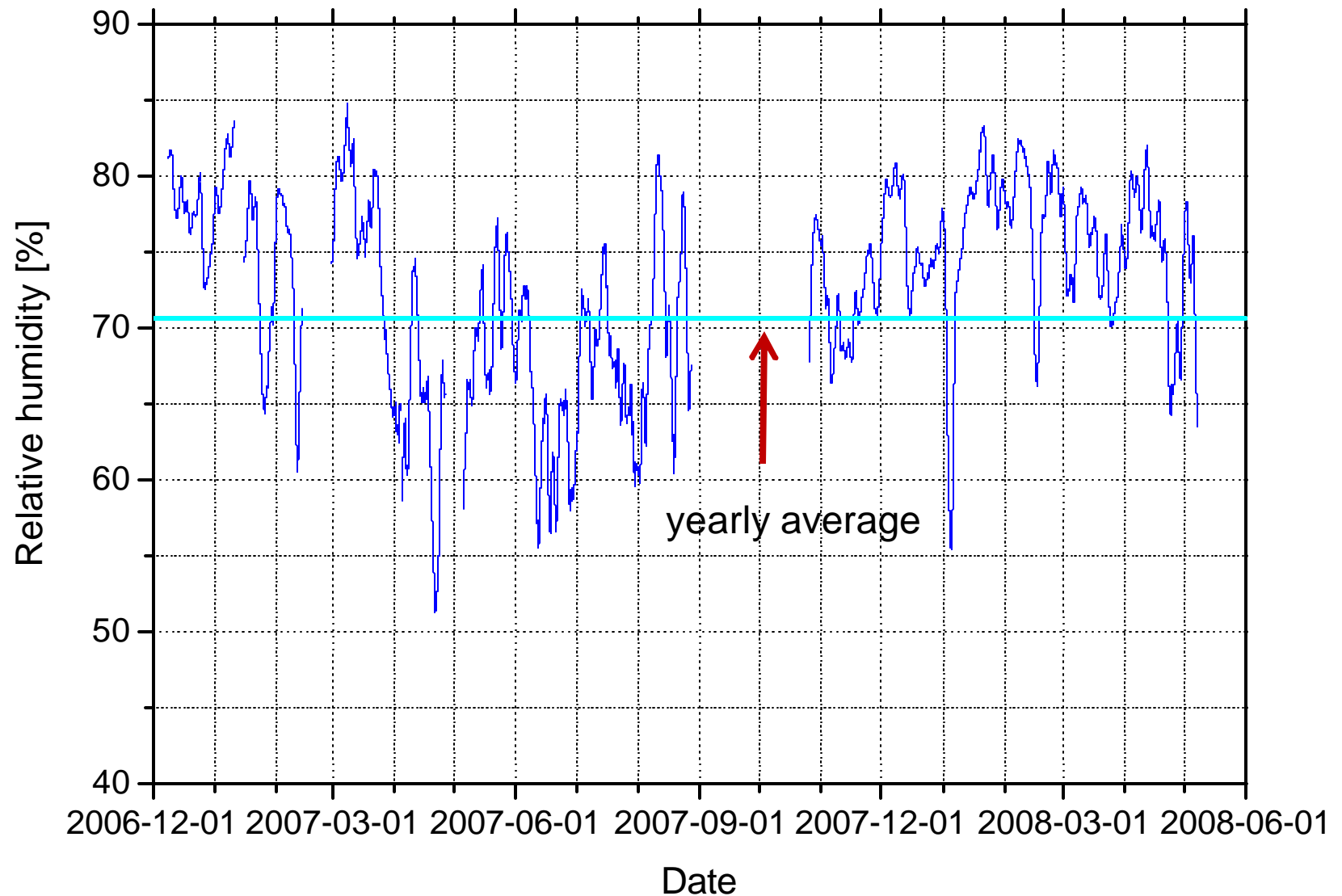
# Church of Annunciation Skepe, Poland

valuable  
paintings

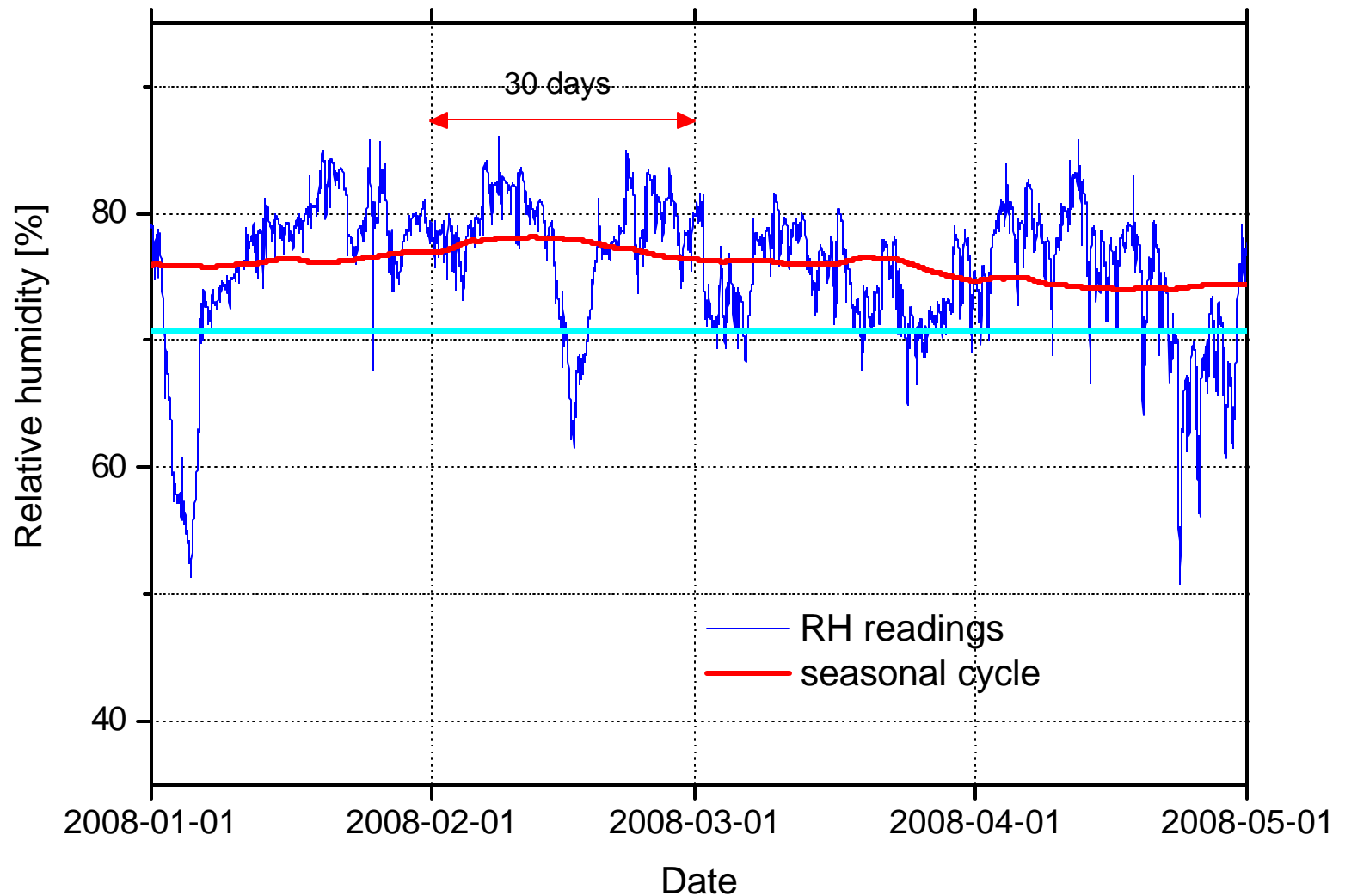
1750-53



**Yearly average** - arithmetic mean of the RH readings

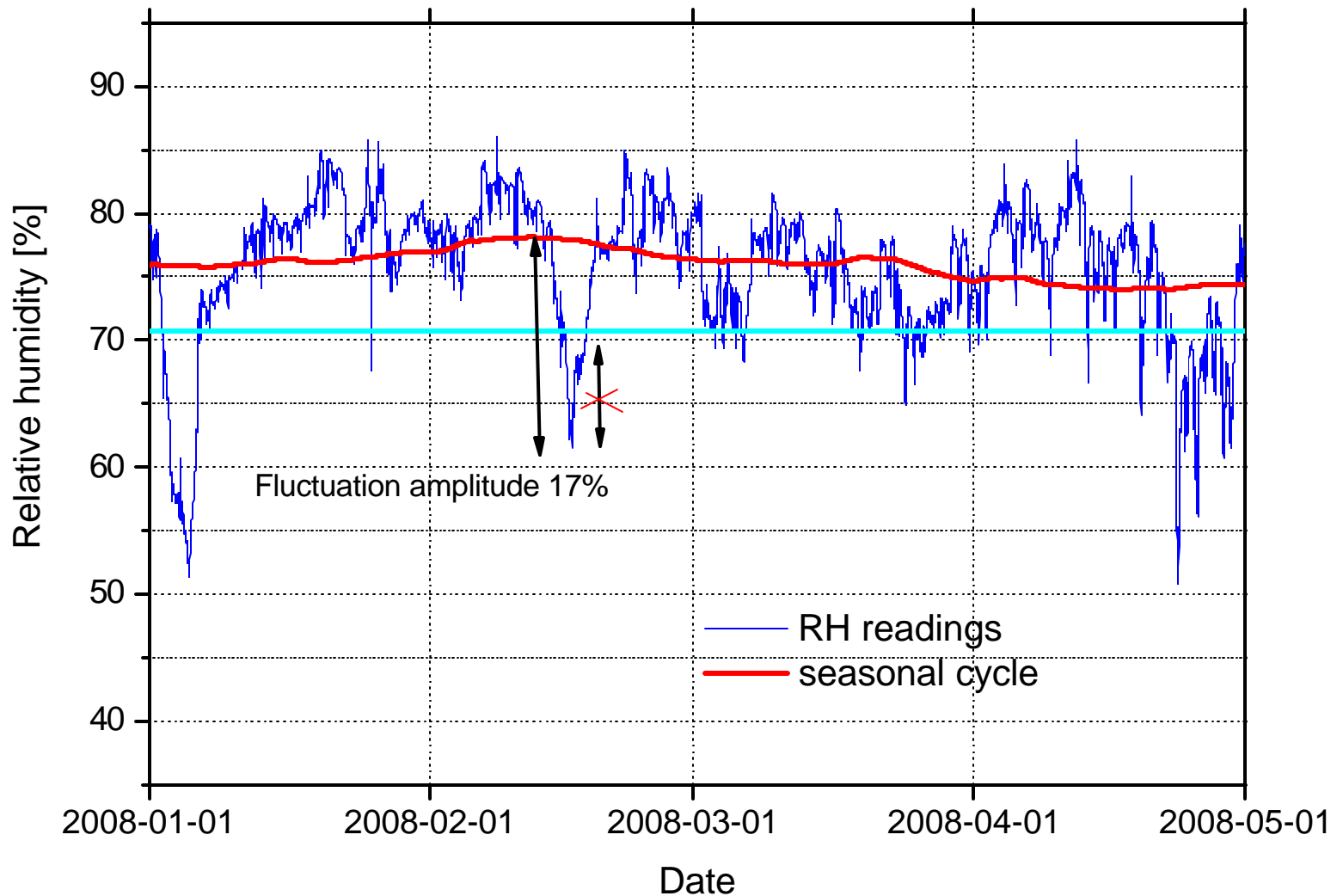


**Seasonal cycle** - the 30-day central moving average of the RH readings smooths out the fluctuations and highlights long-term cycles

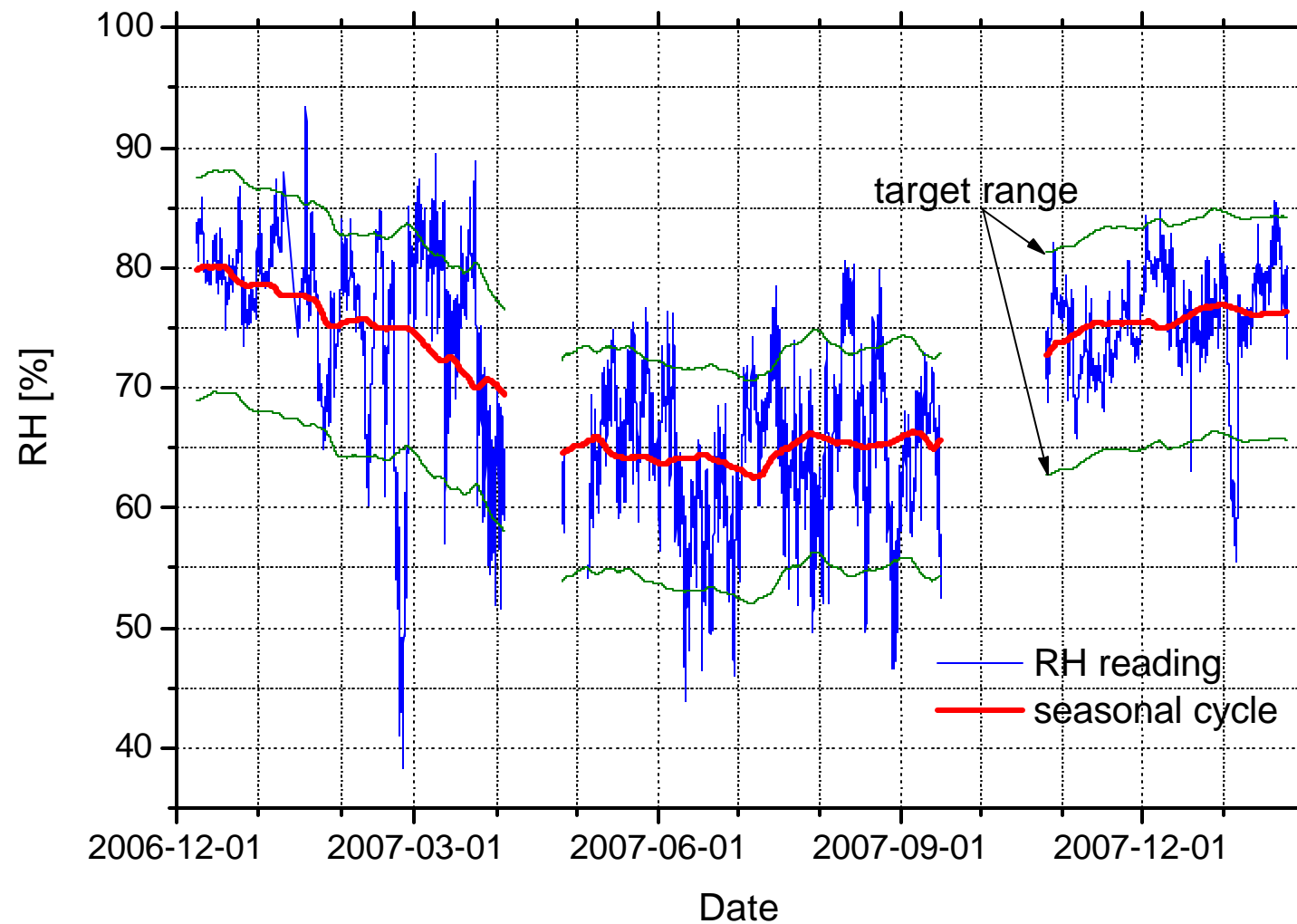




**Short-term fluctuation** - a difference between a current RH reading and a 30-day moving average



Target RH range – 14% of the largest, most risky fluctuations are excluded



# Absolute allowable RH variation

- If the analysis of the historic climate determines that RH fluctuations depart by less than 10% from the seasonal RH level, the calculated limit is considered **unnecessarily strict** and can be disregarded.
- **The 10% RH threshold** can be accepted instead under responsibility of a qualified conservation professional.

- the standard proposes a **mathematical** processing of historic climate records to define a clear **quantitative** target microclimate
- **criteria** for defining tolerable fluctuations should be informed by research or condition surveys
- **$\pm 10\%rh$**  is allowed whatever the historic climate

# Heating system installed



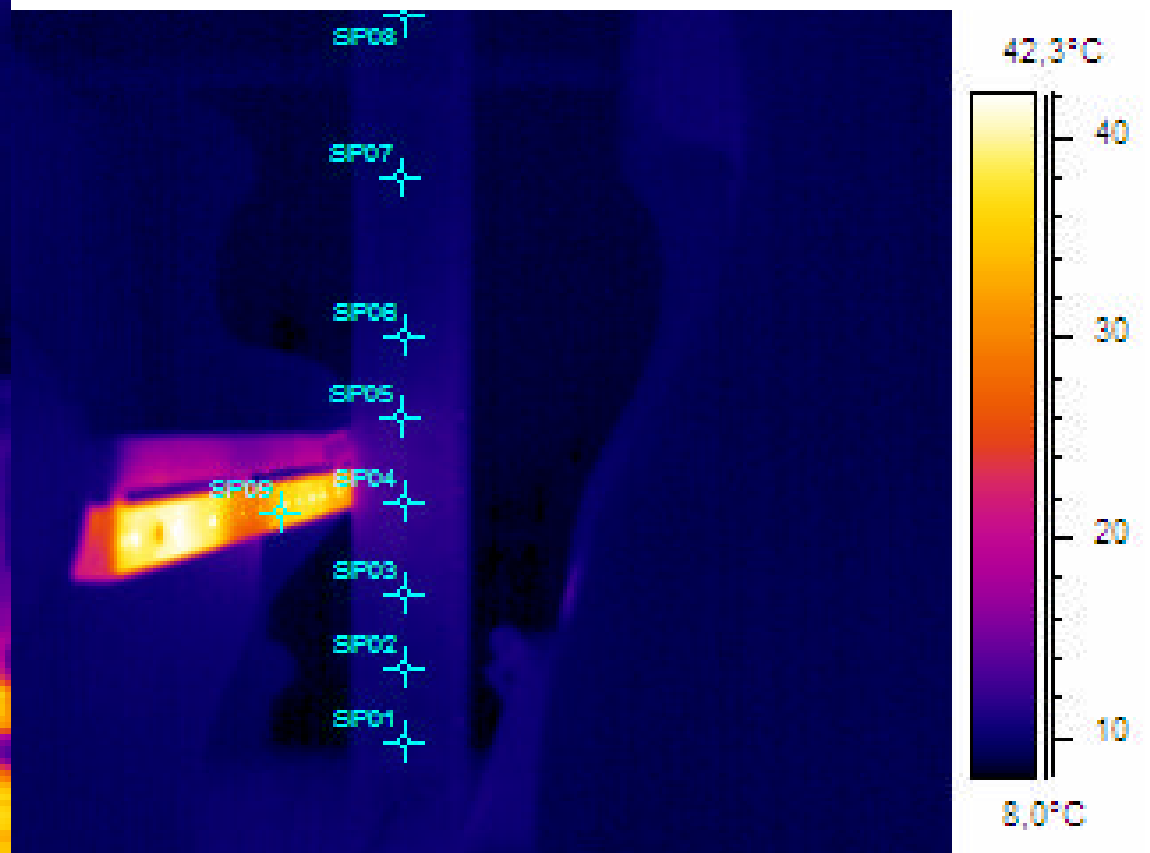
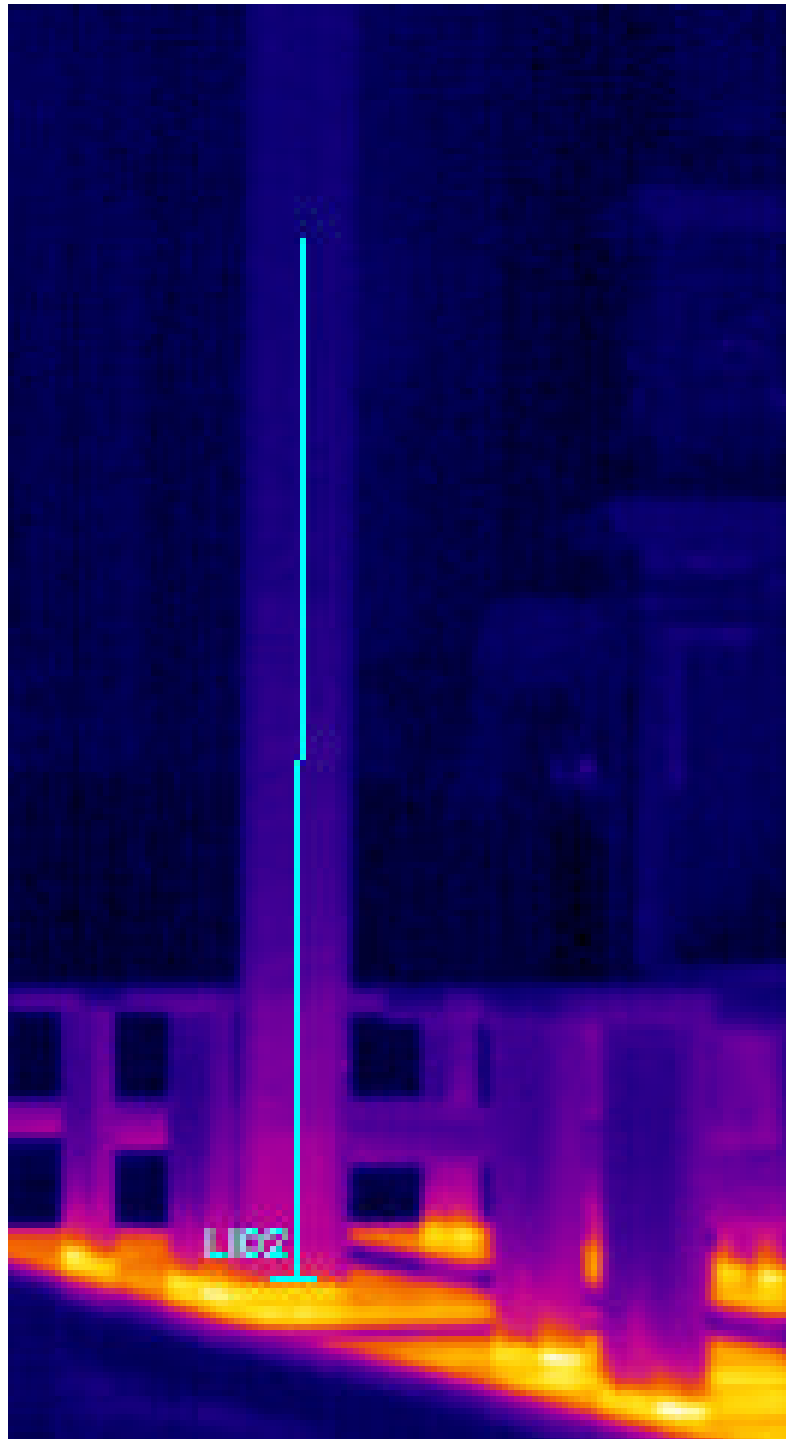








## Localised heating





# Low energy consumption

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- total power 12kW
- benches – 7kW, 100W/1 m of a heating element,  $T_{\max}$  - 50°C,
- platforms – 5 kW, 300W/1 m<sup>2</sup> of a heating foil,  $T_{\max}$  - 30°C

# Monitoring and control

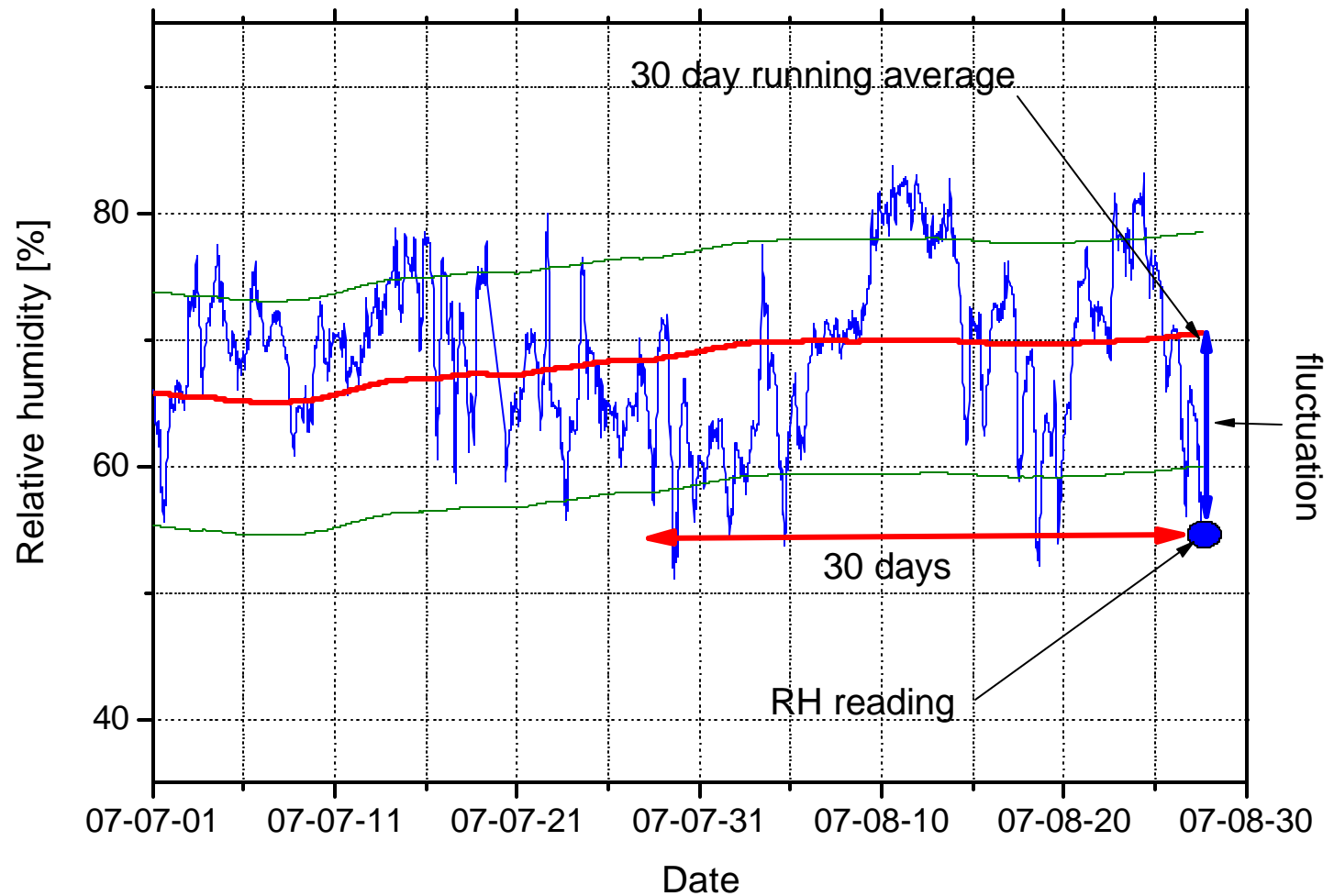
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# Monitoring and control



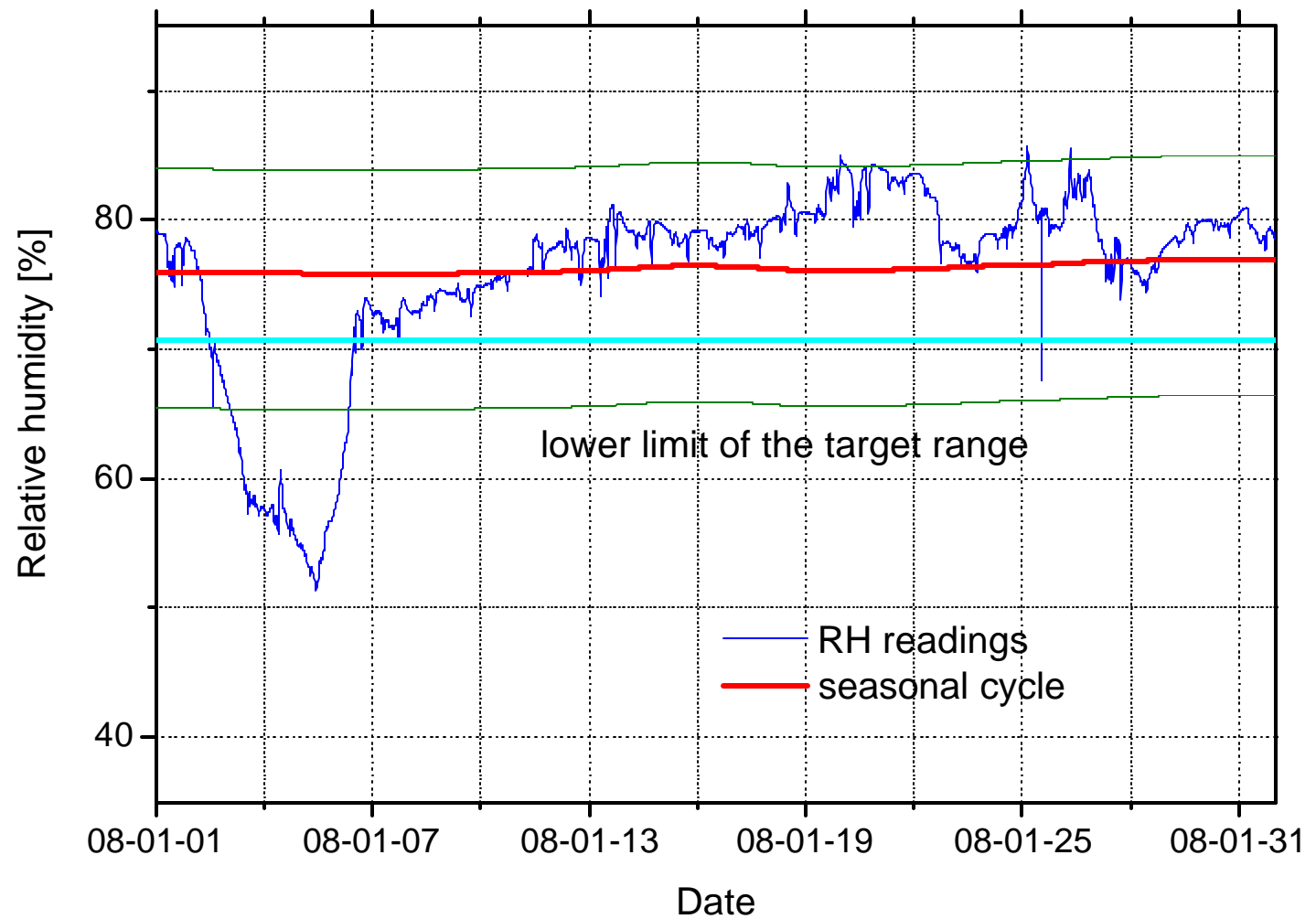
# Recording and calculating the parameters



# Conditions governing the operation of the heating system - **initial**

- $RH_{\text{nave}}$  and  $RH_{\text{choir}} > RH_{\text{30 day av.}} - \Delta RH$
- $\Delta RH = 11\%$
- Safety precautions

# An episode of dry outdoor weather



# Conditions governing the operation of the heating system - improved

- $RH_{nave}$  and  $RH_{choir} > RH_{30 \text{ day av.}} - 11\%$

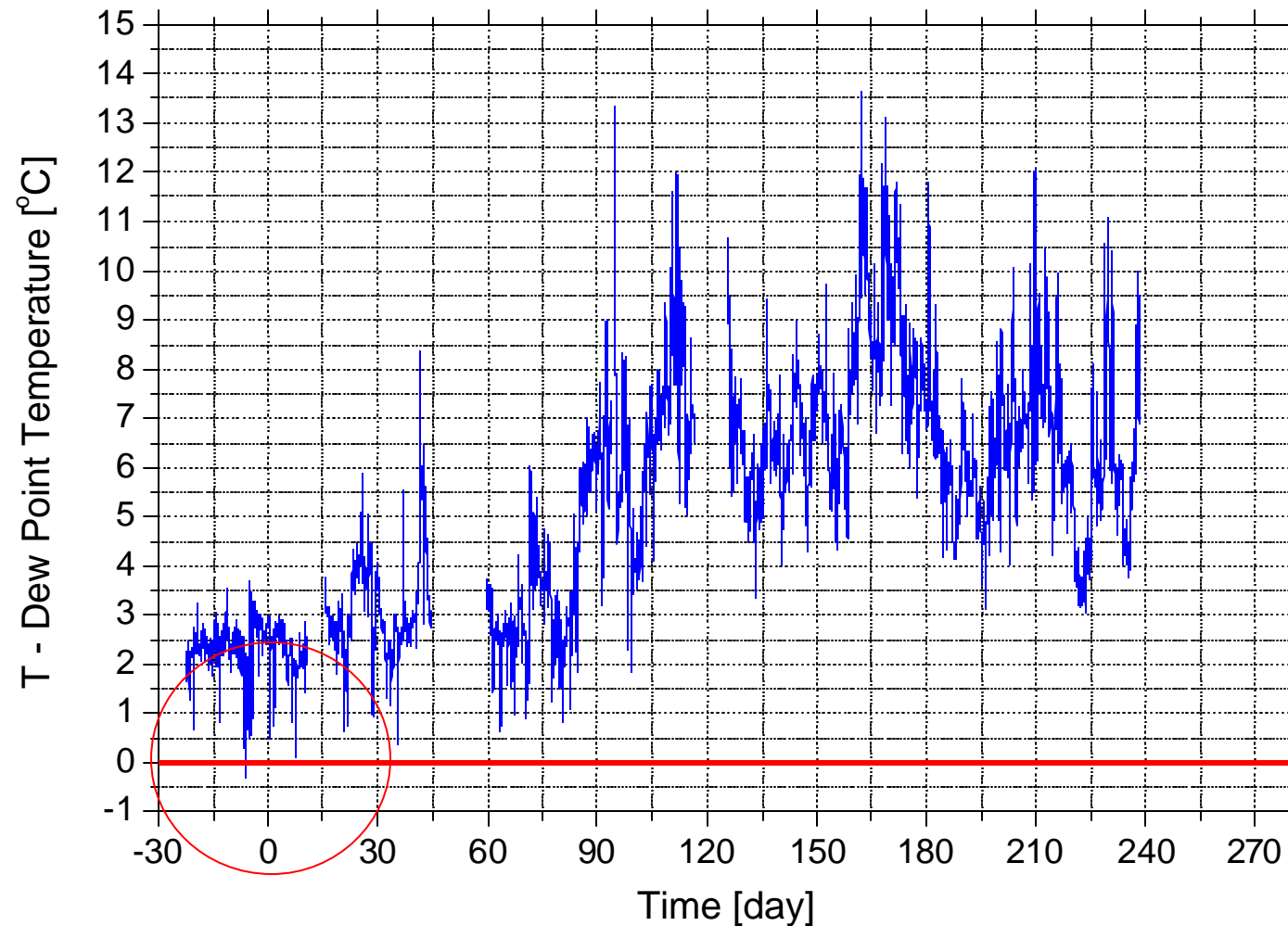
and

- $\Delta RH_{nave}$  and  $\Delta RH_{choir}$  in 1.5 hour less than 2%

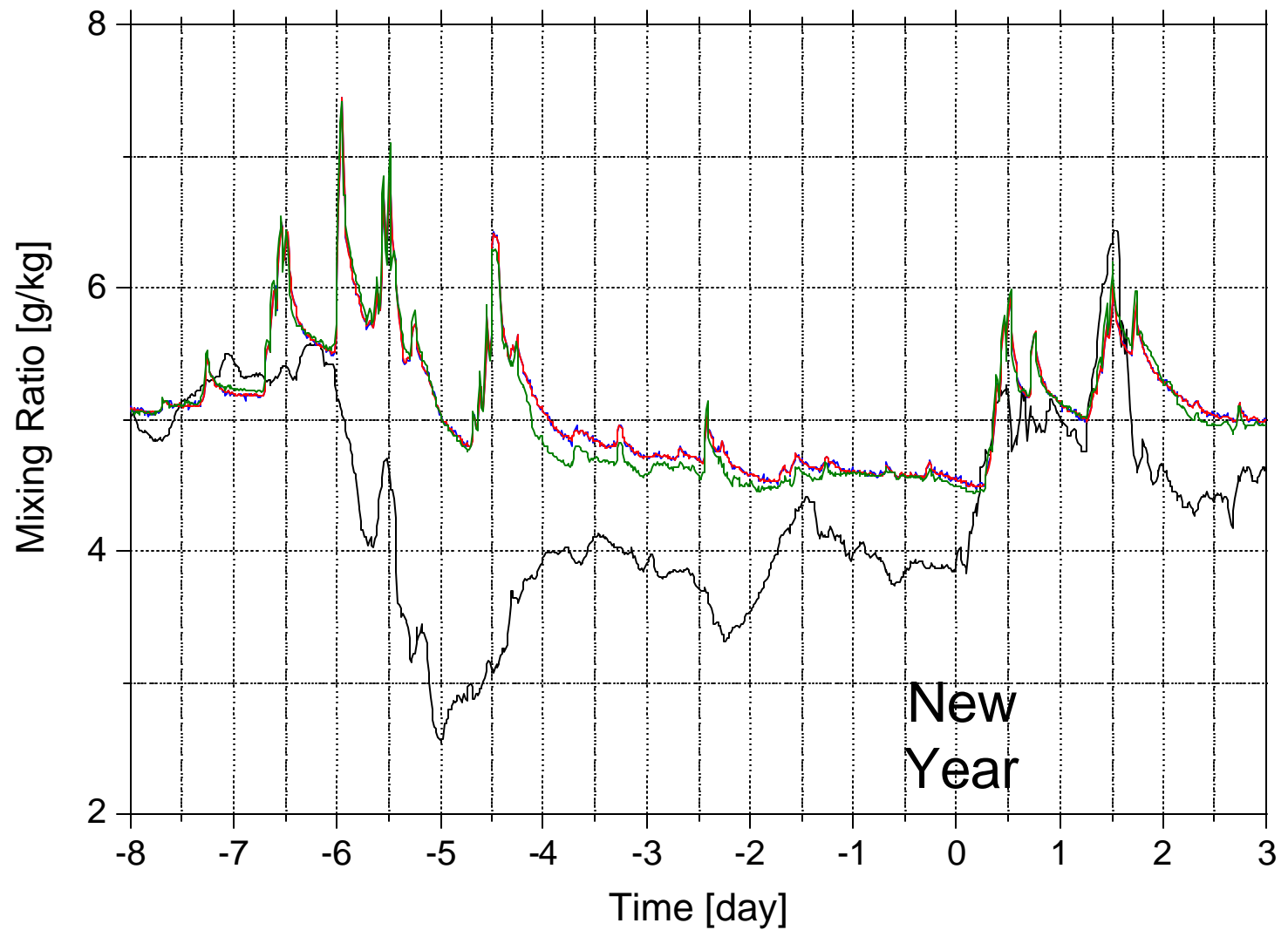
**Warning!** The harmlessness of the pre-existing climatic conditions has been a key assumption in the approach.



# Harmful aspect of the historic climate - condensation events on the ceiling



# Condensation events – when?



# IR heating of the ceiling



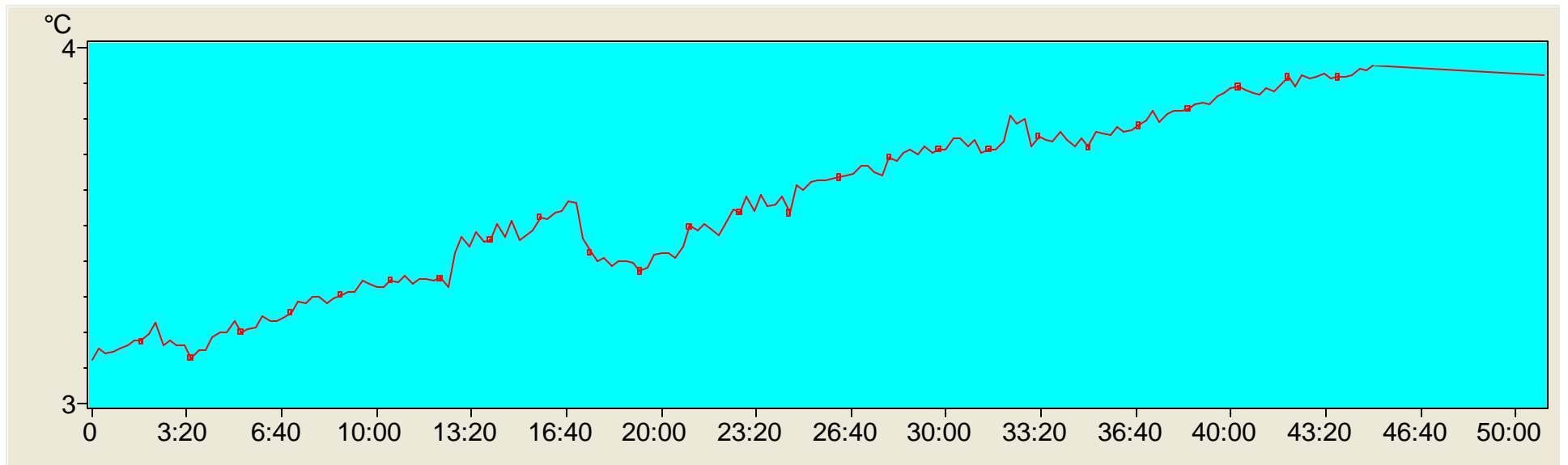
# Conditions governing the operation of the ceiling heating

The control is independent for the nave and the choir:

$$T_{\text{surface}} > \text{Dew Point} + 0.75^{\circ}\text{C}$$

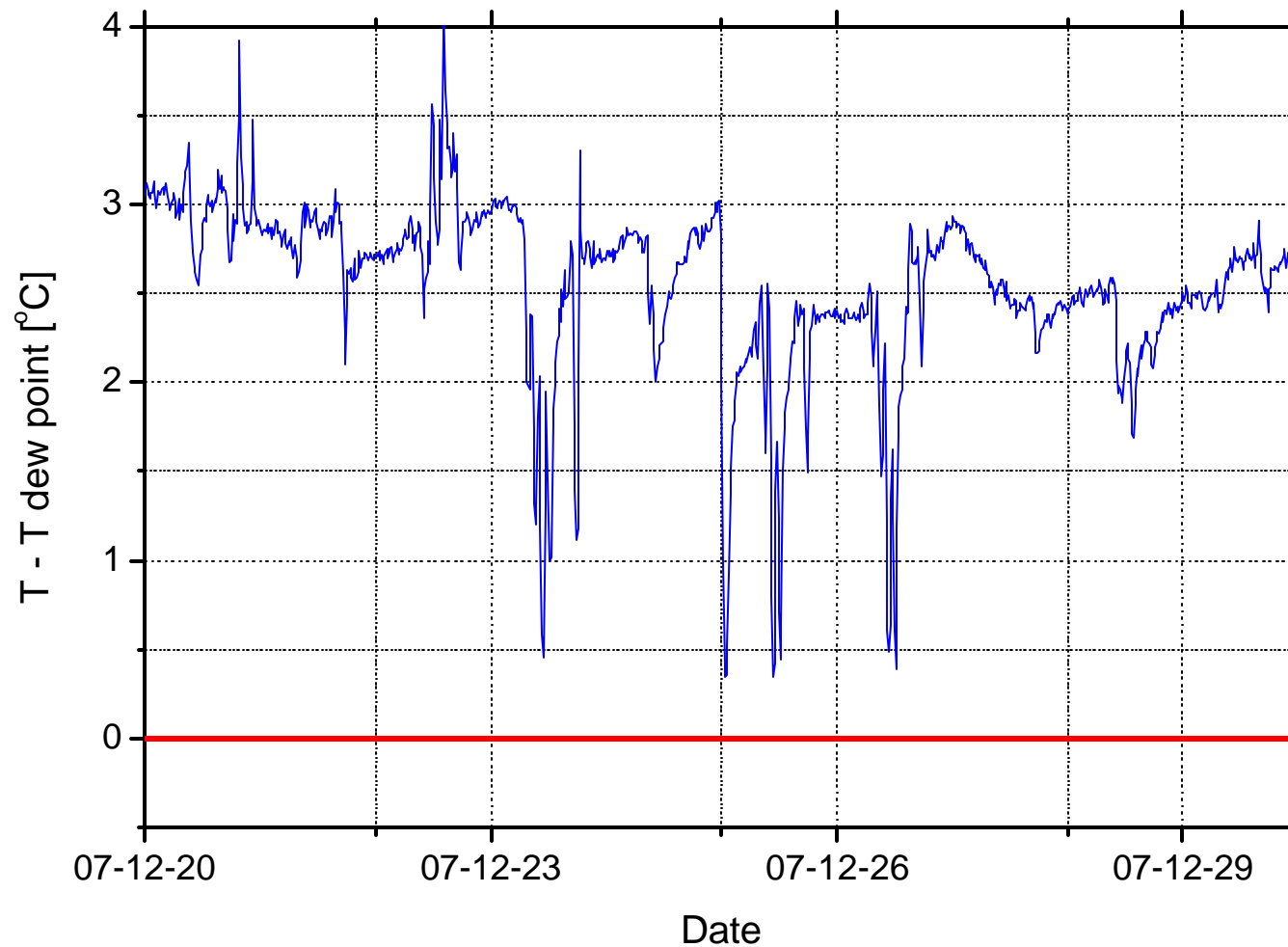
(hysteresis 0,25 °C)

# Capacity of IR heaters



Heating rate of the ceiling: 1°C / hour

# The system has prevented the episodes of condensation



# Conclusions

- ❑ **programmable criteria** to control the active systems (like heating) in historic buildings and museums can be derived from historic climate
- ❑ **a standard** can be a useful guide to procedures in such process
- ❑ if the historic climate is **harmful**, for whatever reason, studies and measures must be undertaken