

Vlaga in temperatura

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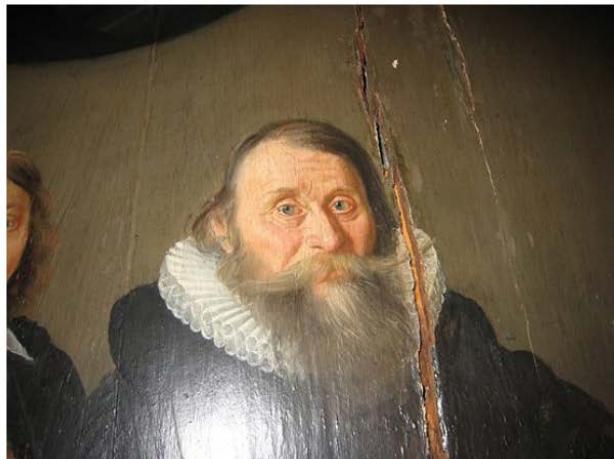
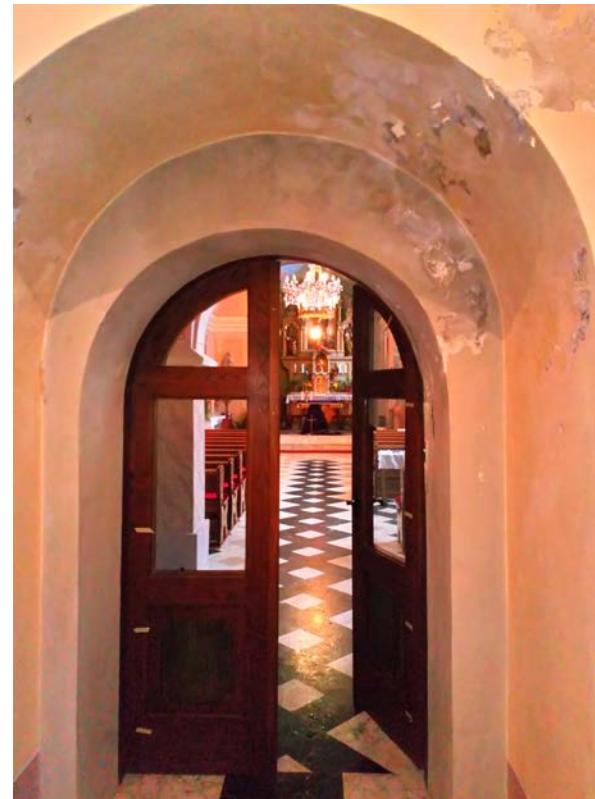


Fig. 3.5. A crack in a panel painting caused by contraction of the wood due to drying.

P. K. Larsen, T. Brostrom: Climate Control in Historic Buildings



Župnijska cerkev sv. Benedikta, Kančevci (2018)



K. Sterflinger, Fungal Biology Reviews, 24, 47-55 (2010)



Vsebina

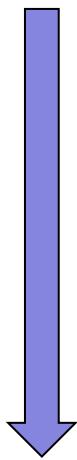
✓ Motiv

- Merilniki temperature in vlage (zrak, trdna snov)
- Analiza in uporaba rezultatov meritev
- Slikanje s termokamero



Župnijska cerkev sv. Benedikta, Kančevci (2018)

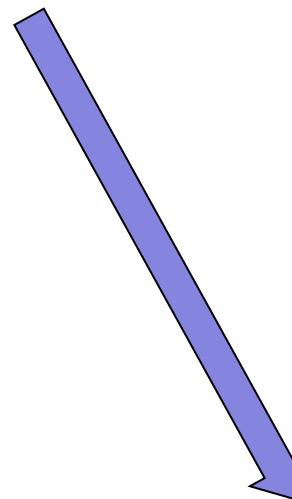
Merilniki temperature in vlage



Zraka

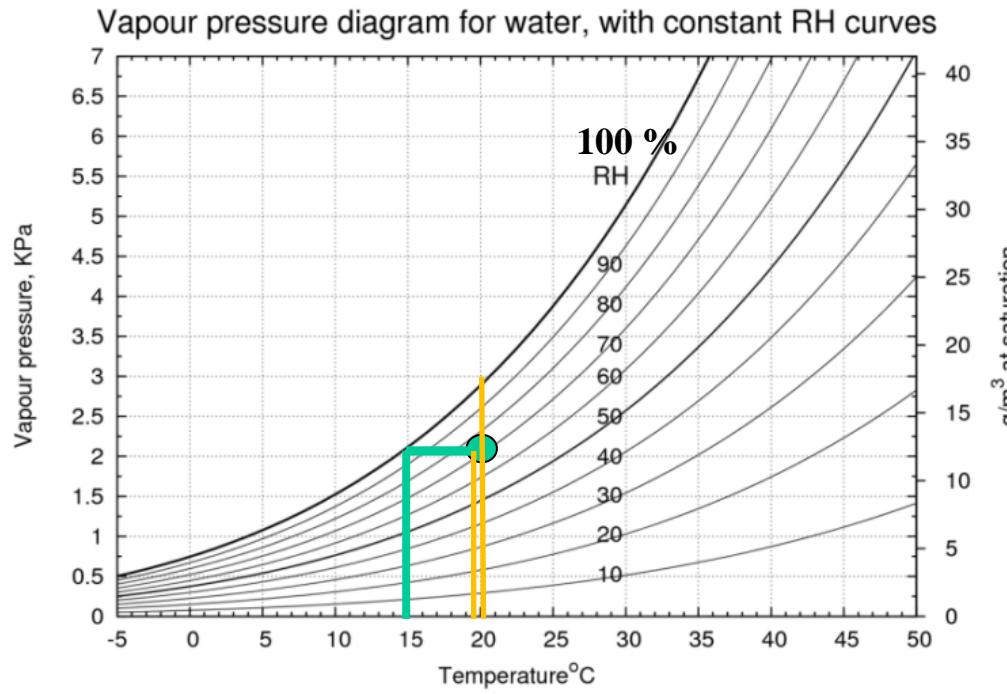
Temperatura

Vlažnost (RH, absolutna vlažnost, vsebnost vode ...)



**Površine in
notranjosti sten
(trdna snov)**

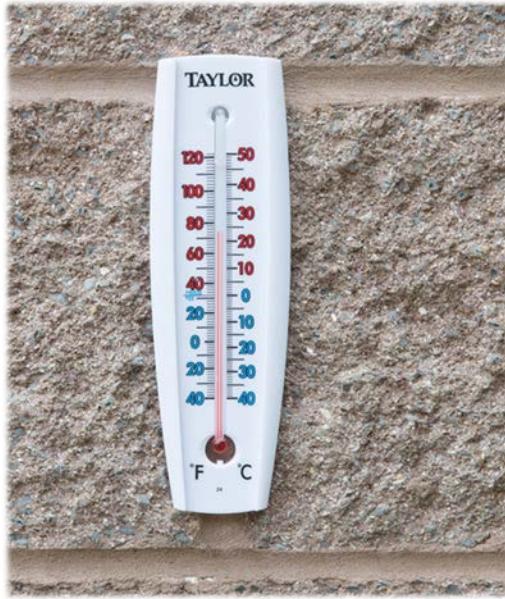
Merilniki temperature in vlage



absolutna vs. relativna vlažnost (RH) v zraku



Merilniki temperature in vlage v zraku



Natačnost $\approx \pm 5\%$

Merilniki temperature in vlage v zraku (digitalni)

Temperatura

- Upor
- Termočlen

 Delta OHM
Member of GHM GROUP



Professional measuring instrument and data logger ALMEMO® 2590A

- Professional measuring instrument with data logger function
- Comprehensive range of functions for all application areas
- Graphics display for showing measured values and programming
- 2 or 4 measuring inputs

[DATA SHEET](#)

Relativna vlažnost

- Upor
- Kapaciteta



Natačnost boljša od 1 %



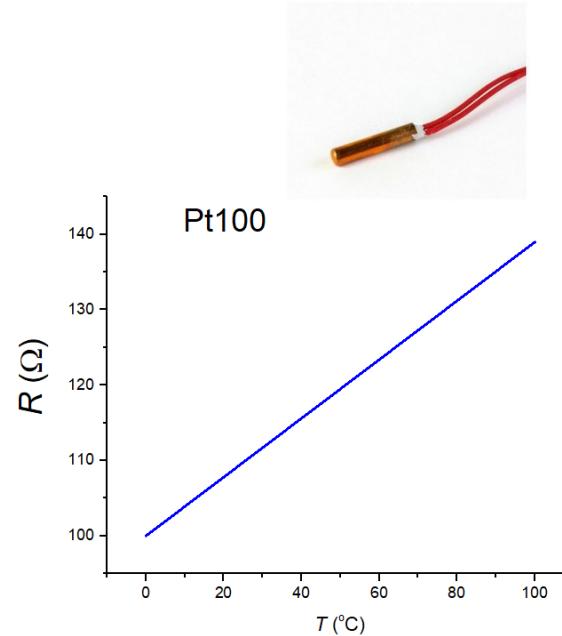
Merilniki temperature in vlage v zraku (digitalni)

Temperatura

- Upor
- Termočlen

Relativna vlažnost

- Upor
- Kapaciteta



$$\Delta R = \alpha R \Delta T$$

Merilniki temperature in vlage v zraku (digitalni)

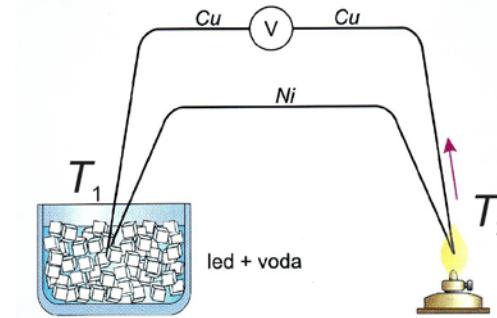
Temperatura

- Upor
- Termočlen



Relativna vlažnost

- Upor
- Kapaciteta



$$V = S \Delta T$$

Merilniki temperature in vlage v zraku (digitalni)

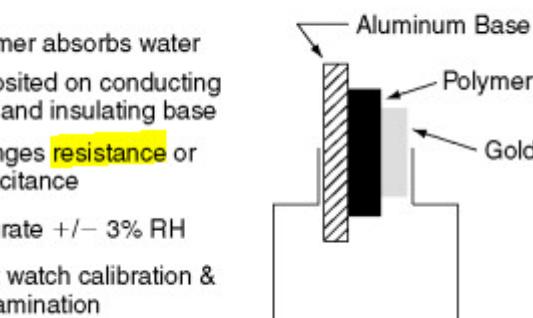
Temperatura

- Upor
- Termočlen

Relativna vlažnost

- Upor
- Kapaciteta

Thin Film Humidity Sensor



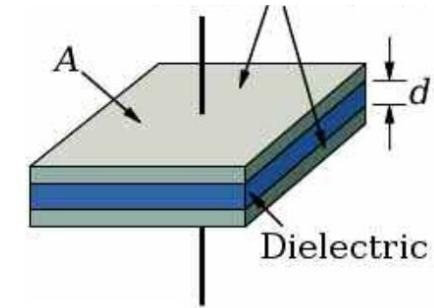
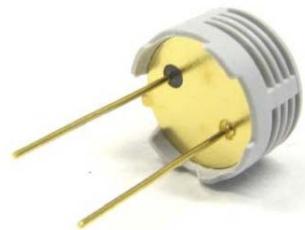
- Polymer absorbs water
- Deposited on conducting grid, and insulating base
- Changes **resistance** or capacitance
- Accurate +/- 3% RH
- Must watch calibration & contamination

$$\Delta R \propto RH$$

Merilniki temperature in vlage v zraku (digitalni)

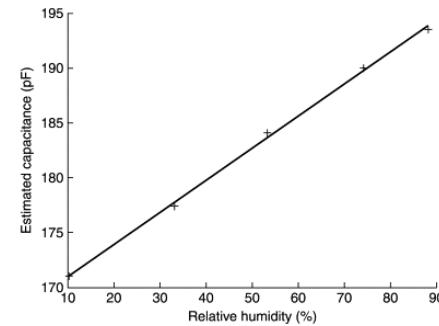
Temperatura

- Upor
- Termočlen



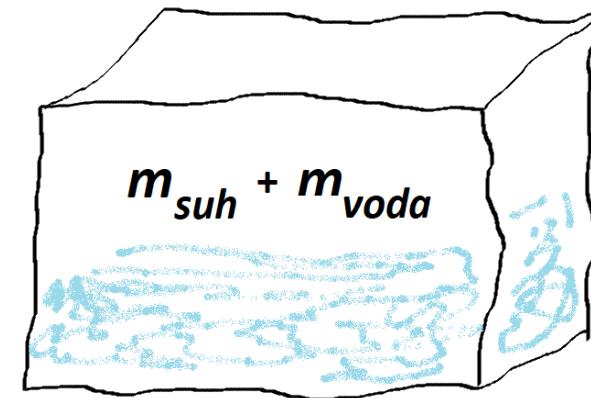
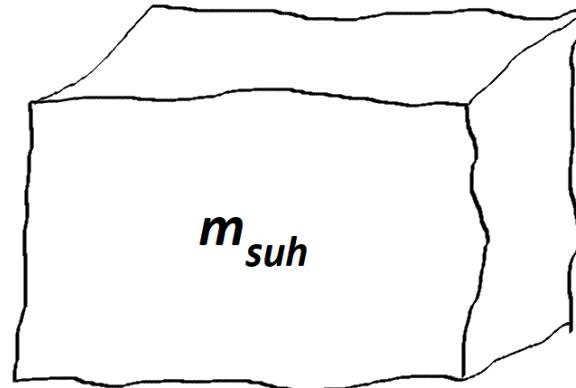
Relativna vlažnost

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- Kapaciteta



$$C = \epsilon_0 \epsilon A / d$$

Vlažnost gradbenih materialov (trdna snov)

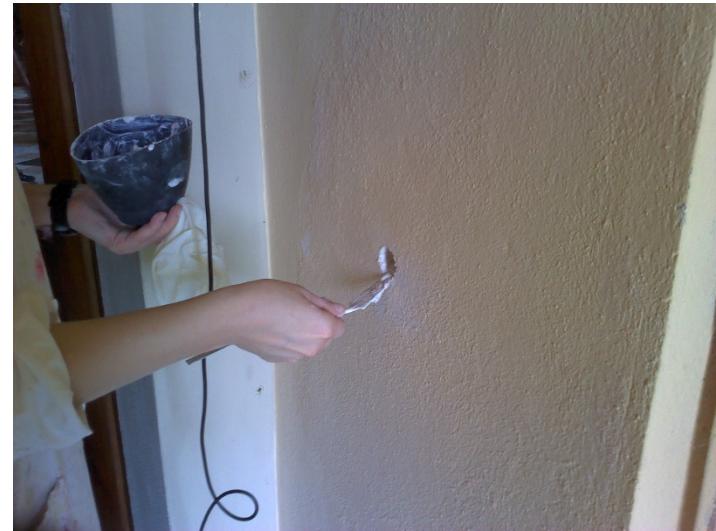


vsebnost vode: $u = m_{voda}/m_{suh}$

masna koncentracija vode: $u = m_{voda}/V$

relativna vlažnost RH v porah

Vlažnost gradbenih materialov



Vlažnost gradbenih materialov

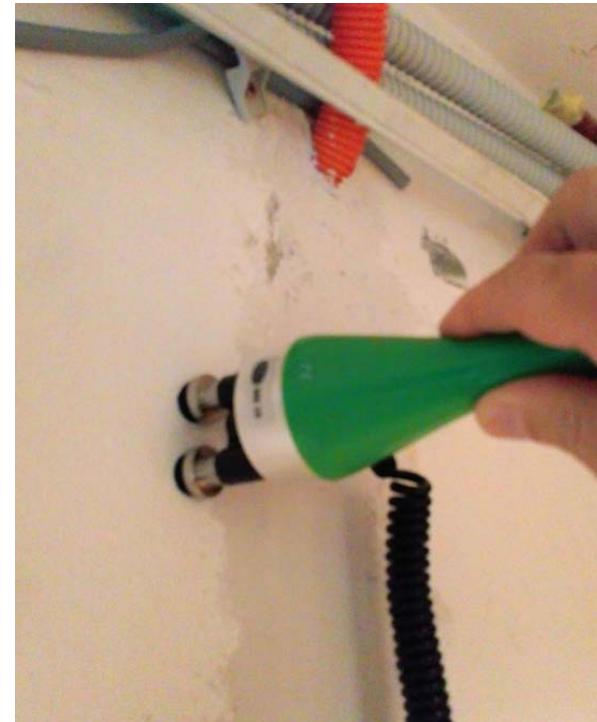


GANN B 50

Visokofrekvenčno EMV

Globina do 10 cm

Relativne enote (*zelo suho, suho, vlažno ...*)



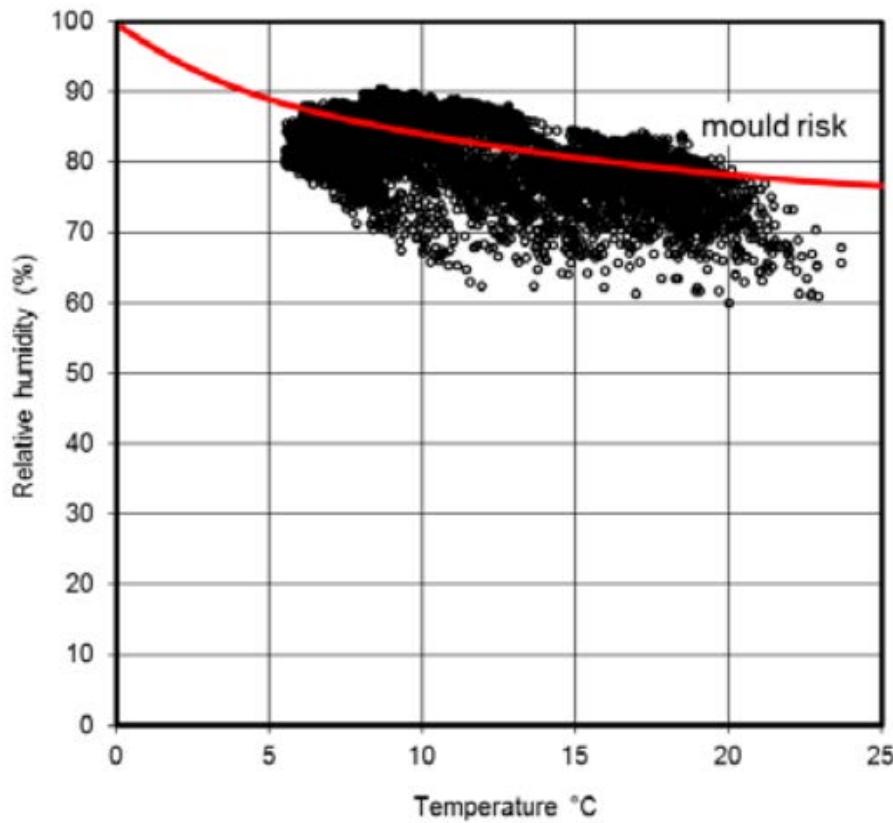
GANN MB 35

Uporovni

Globina do 5 mm

Umerjen (vsebnost vode od 2 – 8 %)

Analiza in uporaba rezultatov meritev



P. K. Larsen, T. Brostrom: Climate Control in Historic Buildings

Analiza in uporaba rezultatov meritev

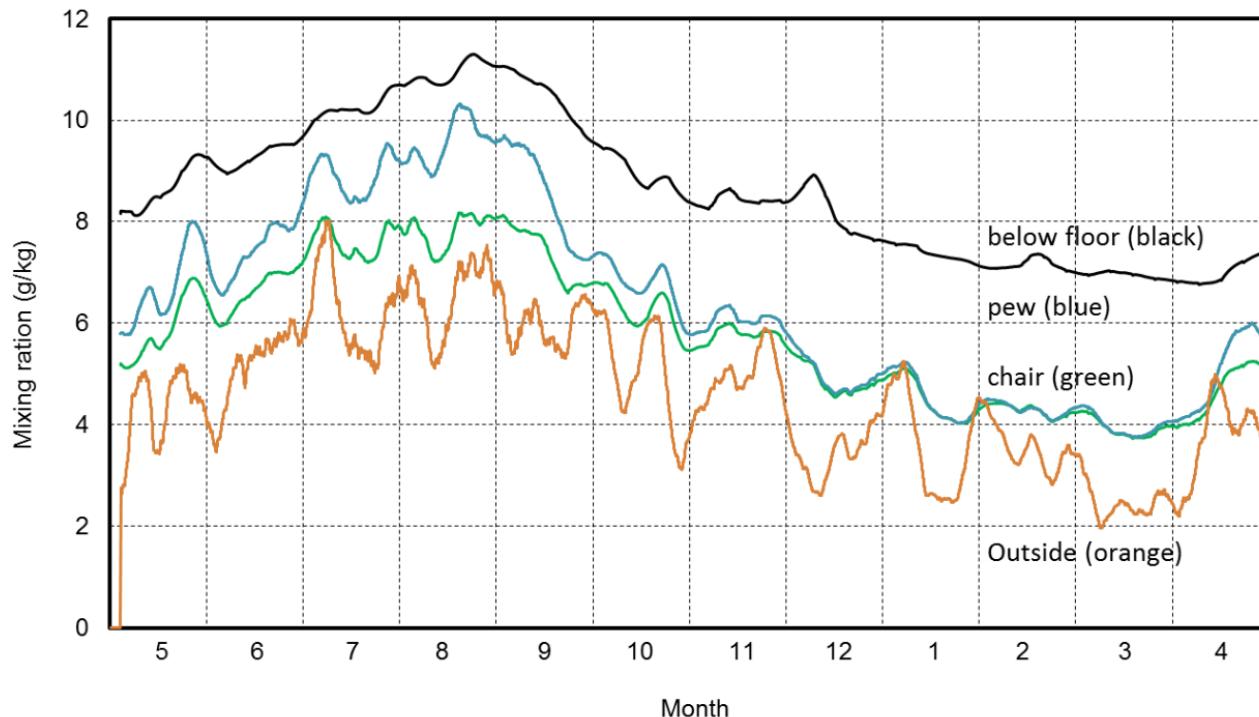


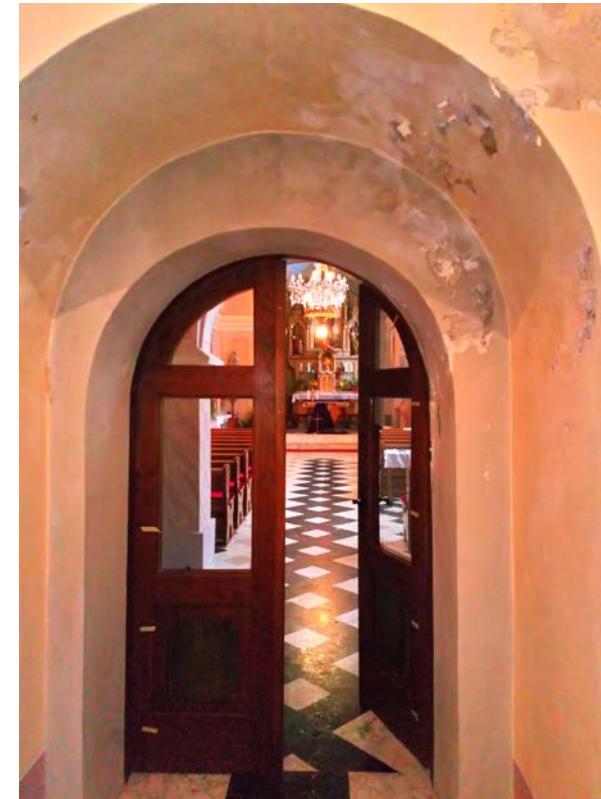
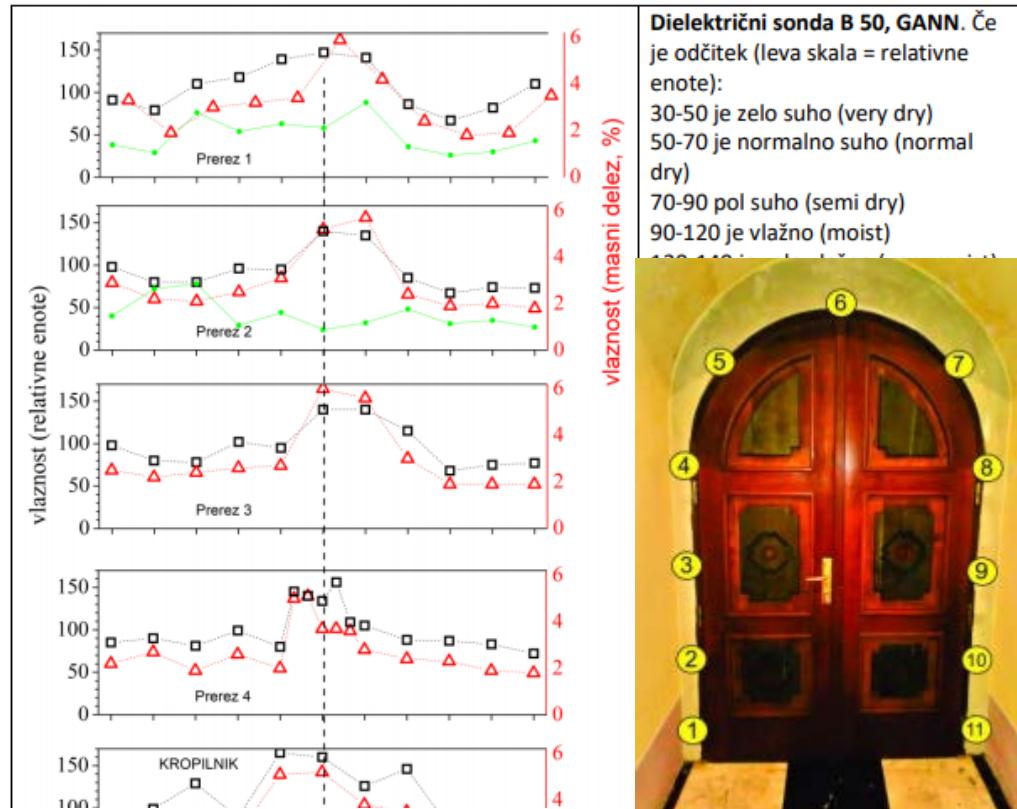
Fig 2.14. Mixing ratio calculated as a moving average over 7 days from climate measurements in four different locations as indicated. The source of humidity is clearly evaporation from the floor.

P. K. Larsen, T. Brostrom: Climate Control in Historic Buildings



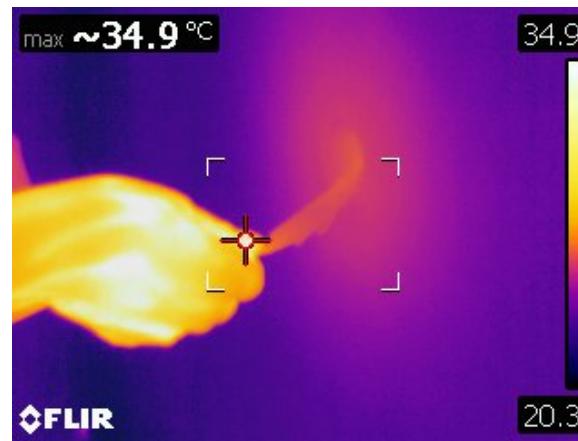
Analiza in uporaba rezultatov meritev

Rezultati meritev vlažnosti pri vhodu, pod zvonikom.



Župnijska cerkev sv. Benedikta, Kančevci (2018)

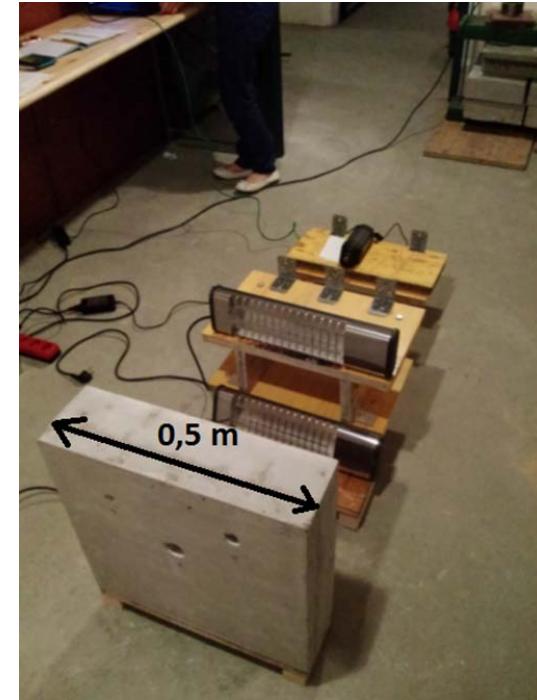
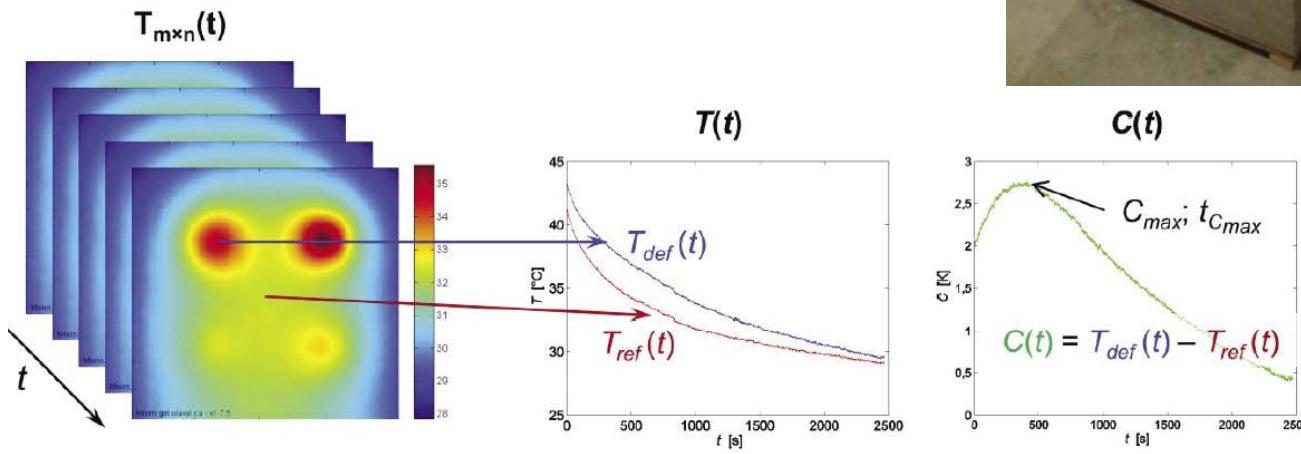
Termokamera



Župnijska cerkev sv. Benedikta, Kančevci (2018)

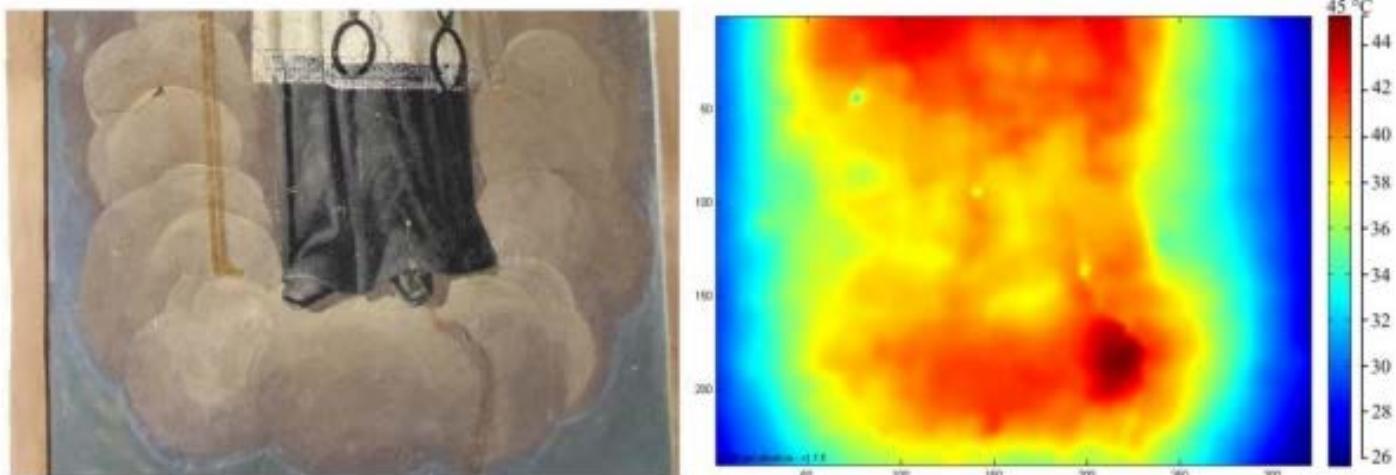
Vлага in temperatura

Termokamera



Determination of the applicability and limits of void and delamination detection in concrete structures using infrared thermography.
Cotić, P., Kolarič, D., Bokan-Bosiljkov, V., Bosiljkov, V., Jagličić, Z., NDT & E International 74, 87-93, (2015).

Termokamera

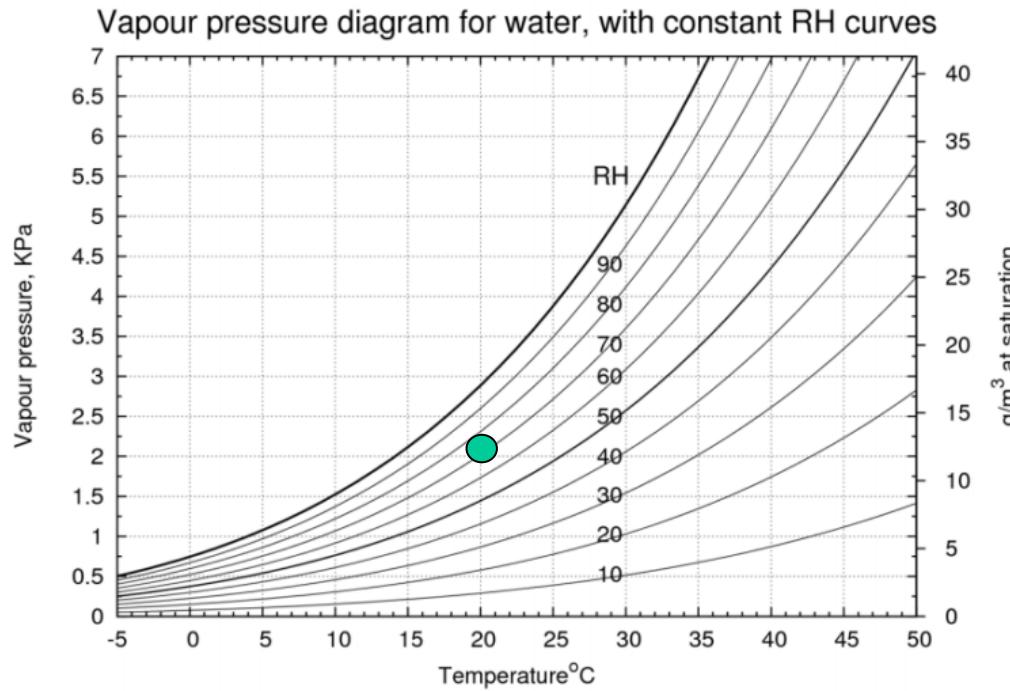


Slika 5.8: Fotografija z označeno lokacijo termografske meritve (levo), temperaturna slika po 30-ih s končanega gretja (desno).

Kapela v Šetarovi pri Lenartu

Padovnik, A. 2016. Utrjevanje odstopajočih plasti ometov stenske poslikave z nekonstrukcijskim injektiranjem. Doktorsko delo UL FGG.

Merilniki temperature in vlage



absolutna vs. relativna vlažnost (RH) v zraku



Analiza in uporaba rezultatov meritev

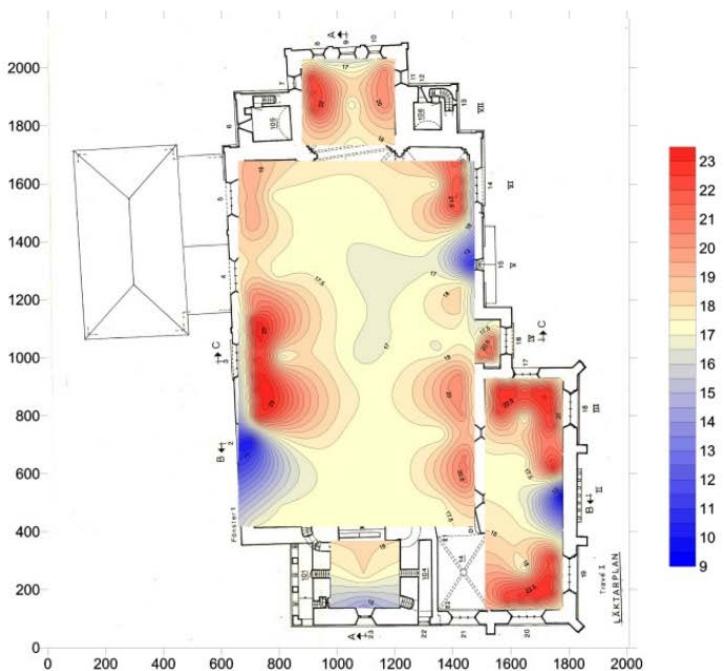
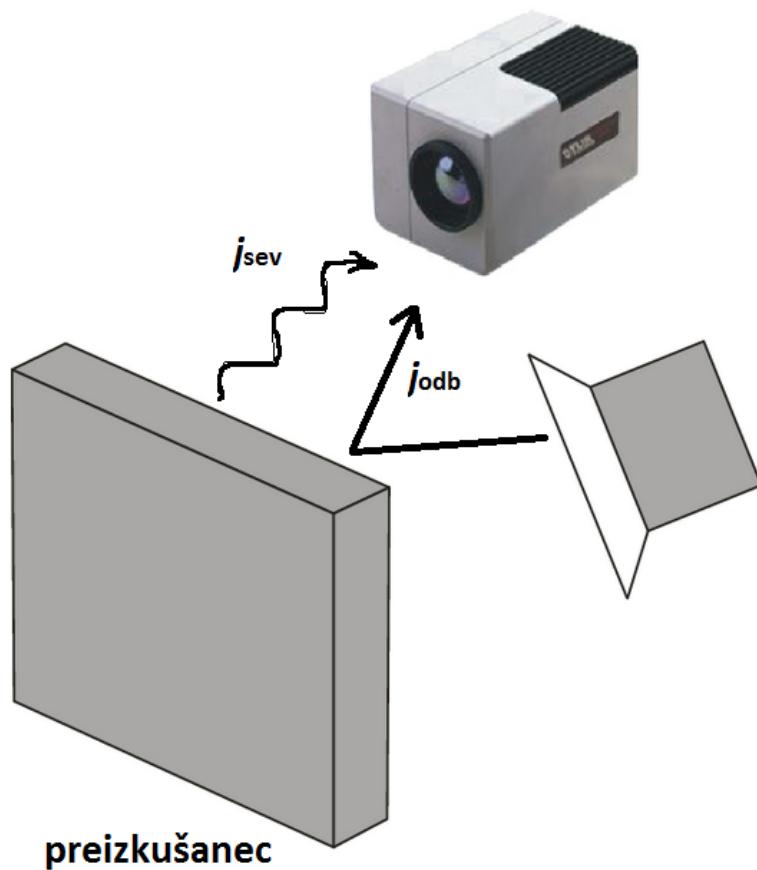


Fig. 2.11. Map of temperature based on spot measurements. Maria Church, Visby.

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Termokamera



$$j = e \sigma T^4$$

↑
merimo ↑
izračunamo

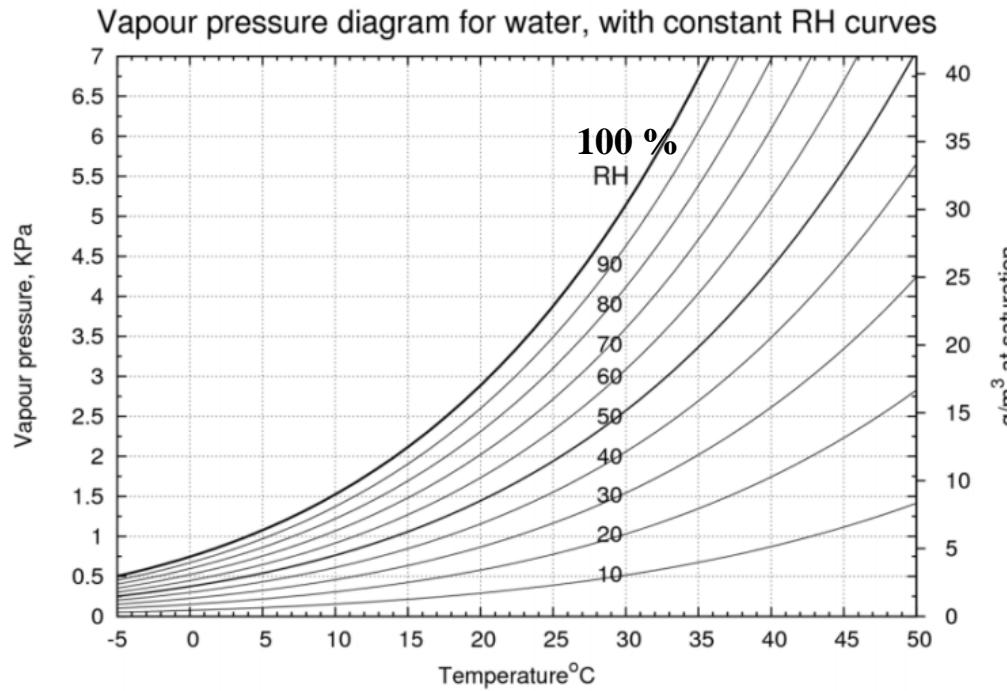
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