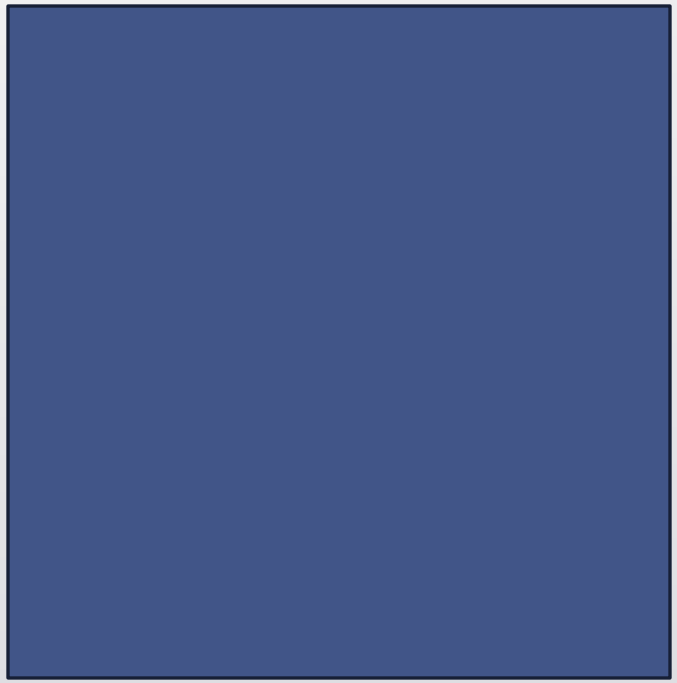
[redacted] – Sensor Analysis

Analysis of Wiiste and Miran data of the P4/P3 attic.



Executive summary

- The differences in humidity between the sections are noticeable in the recorded data.
  - Osien väliset kosteuserot näkyvät tallennetuissa tiedoissa.
- Period of worst conditions occurs every year in March/April.
  - Pahimpien olosuhteiden kausi tapahtuu joka vuosi maalis-huhtikuussa.
- The RH% in L1 has lowered since the measures were taken during April 2023.
  - L1:n suhteellinen kosteus on laskenut huhtikuun 2023 toimenpiteiden jälkeen.
- There hasn't been any noticeable changes to MC% and Vaisala RH% values.
  - MC% ja Vaisala RH% arvoissa ei ole tapahtunut merkittäviä muutoksia.
- Reasons include large temperature differences between the sections, along with some other factors.
  - Syitä ovat suuret lämpötilaerot osien välillä sekä jotkut muut tekijät.

Approach

Problem: Mould is occurring in some areas of the attic.

- 1. Find the differences of RH% and MC% between the different sections.
  - During which seasons are the differences most significant?
- 2. Has the measures taken at April 2023 had any effect?
- 3. Why do these differences occur?
- 4. What can be done about it?

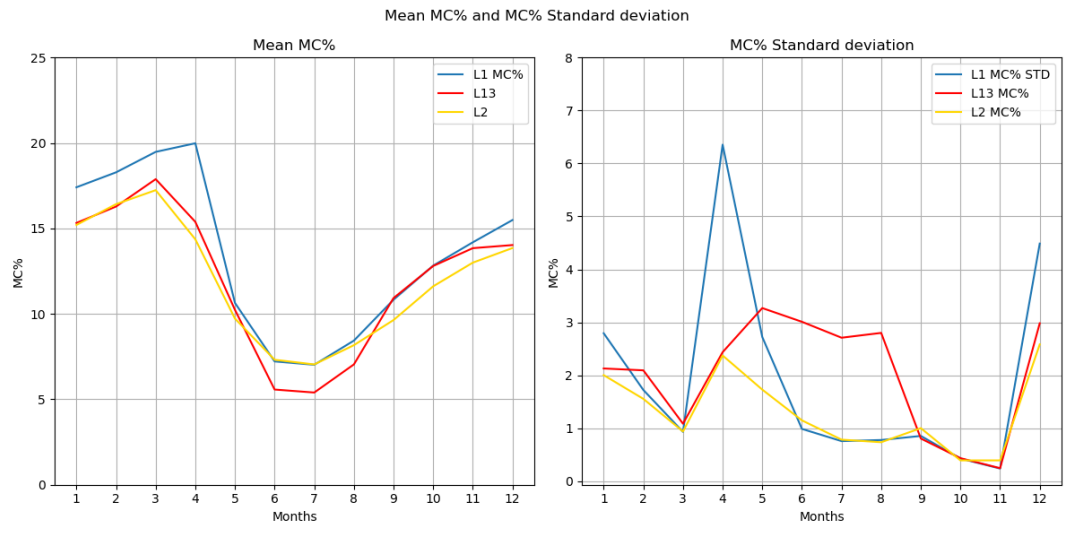
0. When does mould grow?

- General poor indoor climate conditions:
  - Relative Humidity (RH) > ~70%
  - Moisture content (MC) > ~16 %

- Additional condition for mould growth:
  - Temperature > 0 degrees C.

1. MC% conditions at L1, L2 and L13

Keskimääräinen kuukausittainen MC% kosteusarvot ja keskihajonta.



Ajanjakso 1.2022 – 5.2024

L1 mean MC% is peaking in April, when the other sections are reducing.

Significantly higher standard deviation during April.

L1 MC% rises above the others from November onwards.

True MC% is calculated as ~(recorded MC% * 0.7)

L1 Peak MC%: 20%

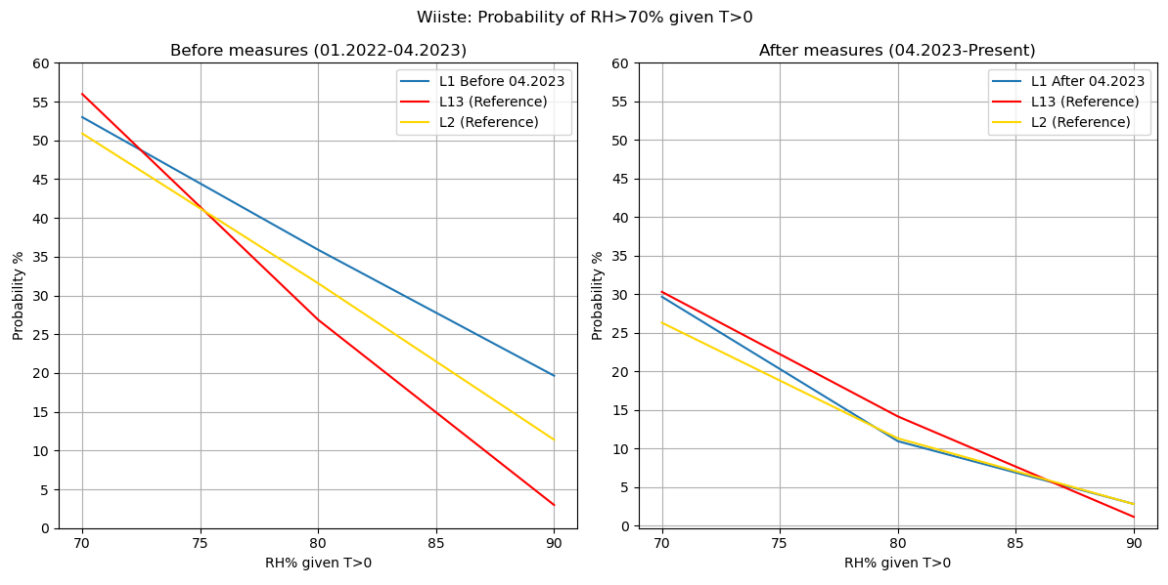
L1 std dev: 6%

L2 Peak MC%: 17%

L2 std dev: 2%

2. Did the measures done during April 2023 have any effect on RH%

Huonojen kosteusolosuhteiden päivät prosentteina, kun lämpötila on yli 0 C.



- Niiden päivien määrä, joissa RH% on korkea L1:ssä, on vähentynyt toimenpiteiden jälkeen.

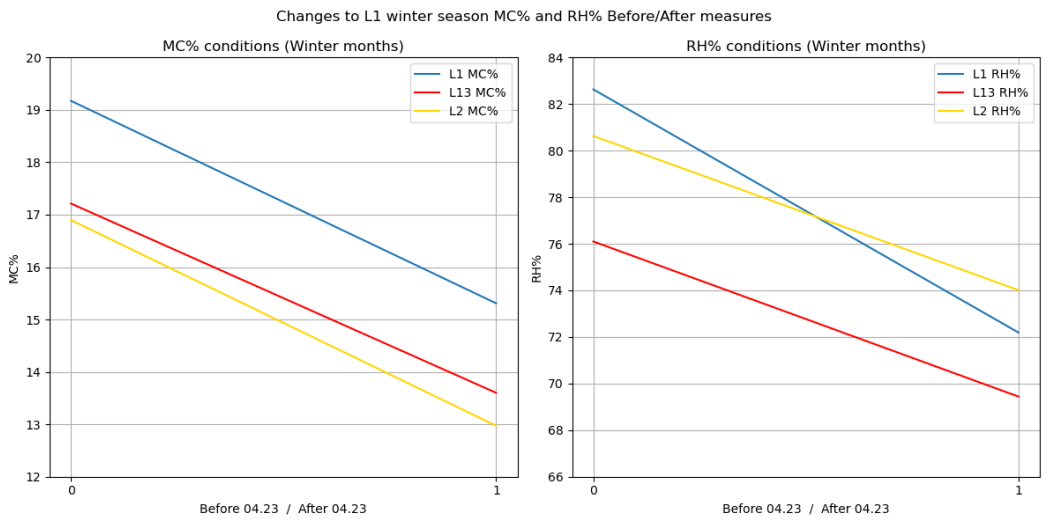
Ennen: 1.2022 – 04.2023
Jälkeen: 04.2023 – 05.2024

- L2 and L13 act as reference data.
- Long periods of missing data exist during both periods.
- When comparing data over different years, the variations between seasonal weather and availability of data may effect the results.
- These probabilities are calculated so that the effect of seasonal changes are limited.
- Amount of days with high RH% at Lape 1 has reduced after the measures were taken..

2. Comparing changes in MC% and RH% during October-April.

Can the same effect be seen in overall MC?

Vertaamalla MC% ja RH% ennen ja jälkeen huhtikuussa -23 tehtyjä korjauksia.



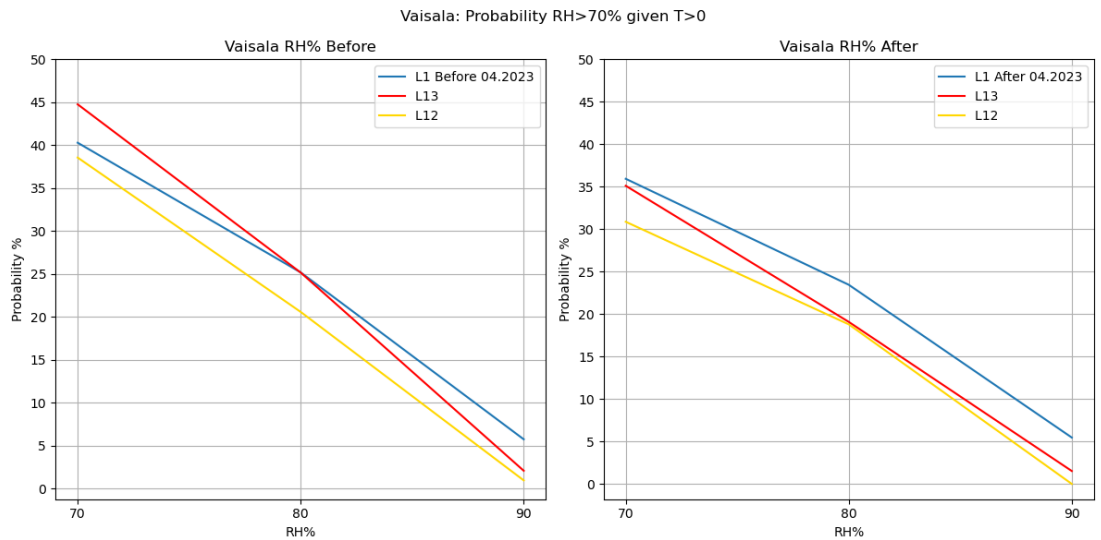
- L1 MC% ei ole muuttunut muihin osiin verrattuna.

Ennen: 1.2022 – 04.2023
Jälkeen: 04.2023 – 05.2024

- The RH% conditions at L1 has lowered but the same effect can't be seen in the MC% data.

2. Vaisala RH% data

Huonojen kosteusolosuhteiden päivät prosentteina, kun lämpötila on yli 0 C.



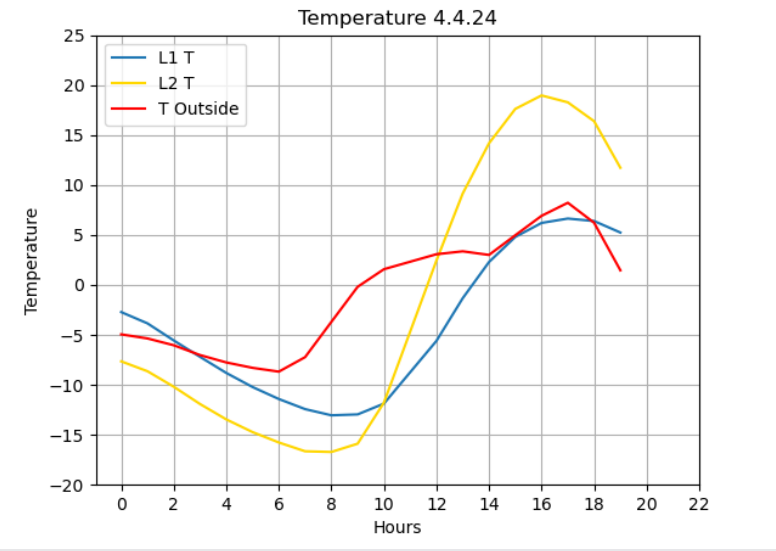
- Myöskään Vaisalan tiedoissa ei suuria muutoksia.

Ennen: 1.2022 – 04.2023
Jälkeen: 04.2023 – 05.2024

- No changes to the Vaisala data after the measures.
- The differences in Vaisala RH% between the sections are fairly small, even for West-East.

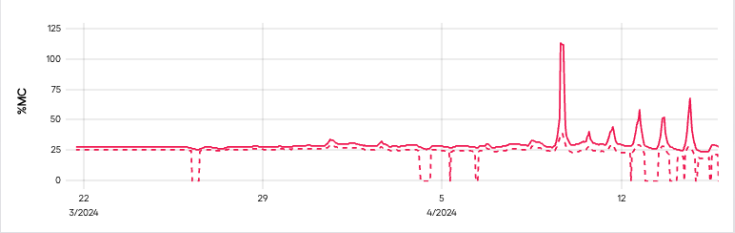
3. L1 – March/April

Suuri lämpötilaero maaliskuussa-huhtikuussa

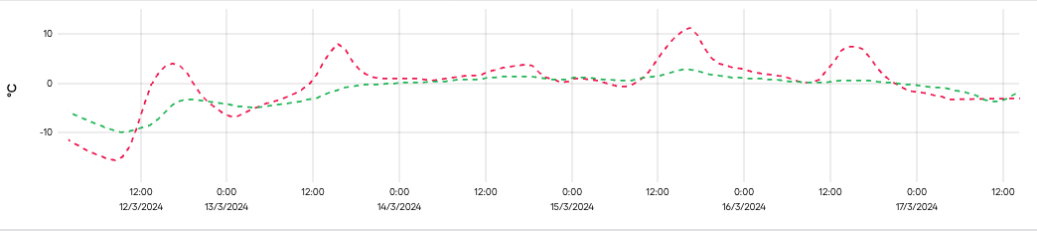


Factors:

- Weeks of bad conditions at L1 every spring.
- Temperature differences of 15 degrees between L1 and L2
- Shaded area on the roof during the early spring.
- Snow is on the roof for longer above L1.
- Smaller volume of air in L1 against a colder wall.



L1 MC % piikkeja tapahtuu joka huhtikuu.

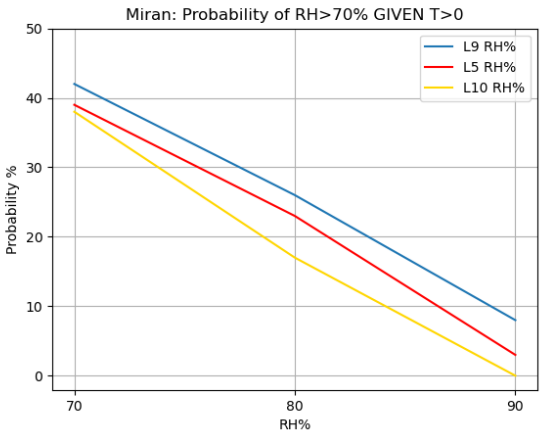


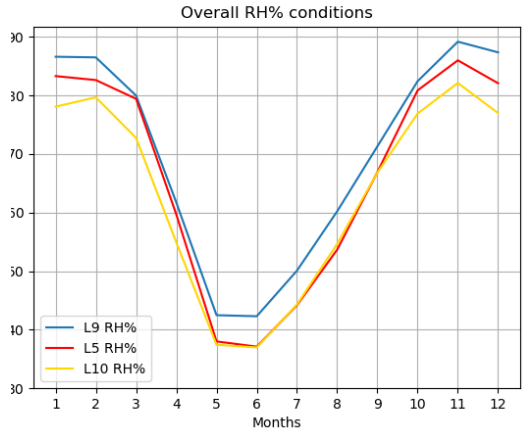
Lämpötilaerot L1:n ja L2:n välillä maaliskuussa

4. What can be done about it?

Overview of L9 RH% compared to L5 and L10

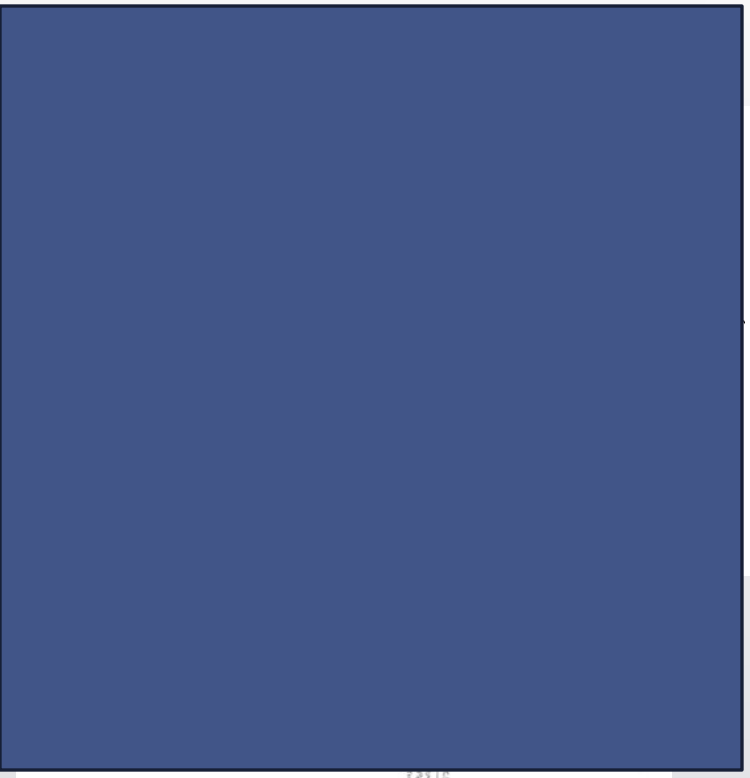
Yleiskatsaus L9-kosteusolosuhteisiin

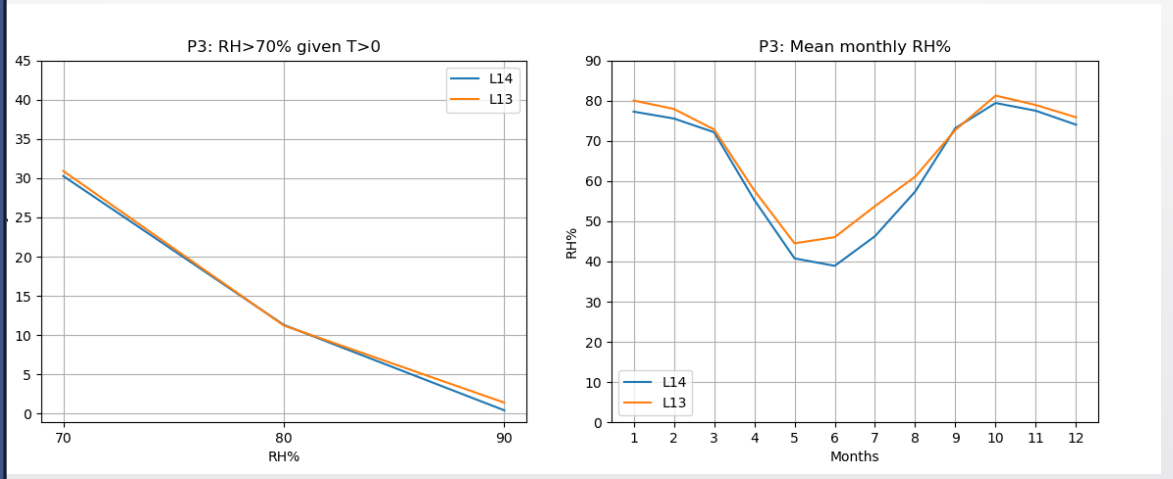




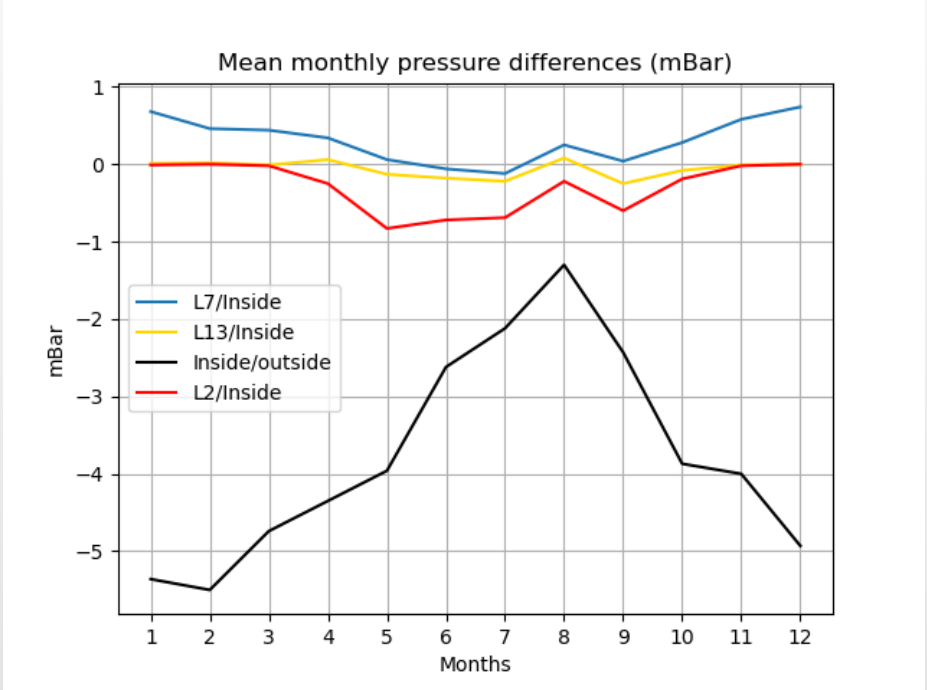
L9 is constantly at a higher RH value than L5 and L10.

Overview of P3 RH% conditions

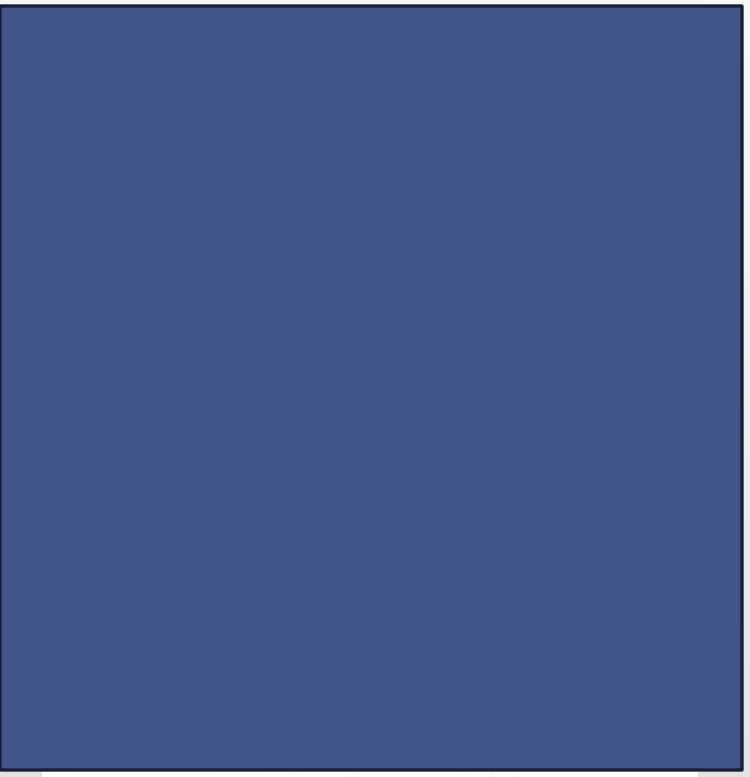




Overview of pressure conditions



Condensation on metal truss member

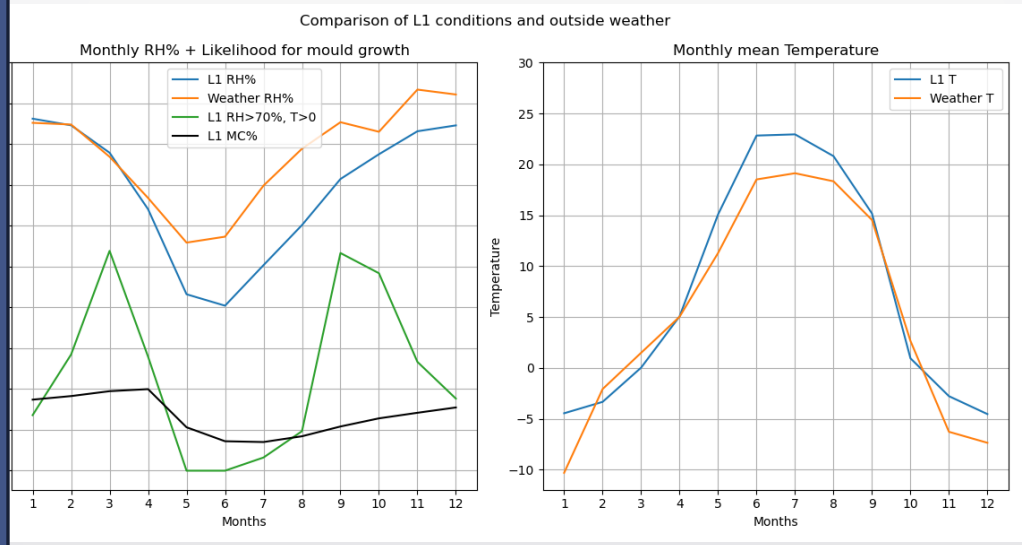


Date	Temperature	RH%
2022-03-22	3.16	95.32
2022-09-21	6.06	95.47
2022-10-29	8.53	96.61
2022-10-31	4.34	95.44
2022-11-11	7.64	96.17
2023-02-12	-0.22	96.11
2024-01-09	-3.04	96.56
2024-01-10	0.36	96.85
2024-03-15	5.17	95.04

RH% reaches 95% on a total of 9 days, from September to March.

1. Overview of Lokero 1 conditions against outside weather.

-olosuhteiden ja ulkosään vertailu



ahimmat olosuhteet esiintyvät lopputalvella - alkukeväällä.

- February-April has high mean RH% and MC% conditions while the temperature is close or above 0 degrees.
- Same period also has lower temperature inside than outside.
- Half of March (50% of total month) has poor RH% conditions.
- MC% starts rising in September, with high values starting from November/December.
- Peak MC% at L1 happens in April.