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Comparison of hygrothermal measurements and calculations in a single-family wooden house in the Swedish town of Växjö

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2013

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1

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221 00 Lund
+46 46-222 00 00

7.12 Position 12

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof close to the upper part of the wall that is facing northwest.

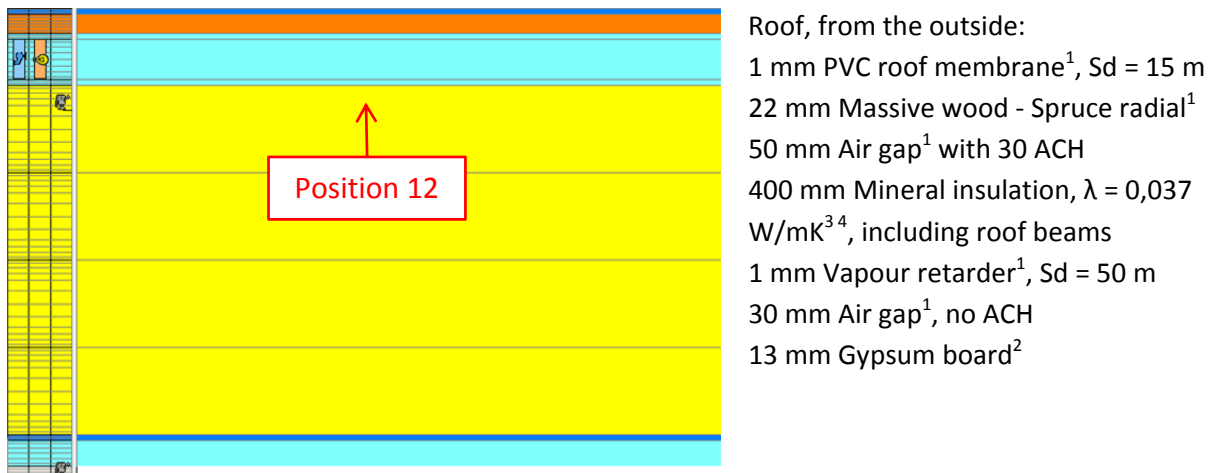


Figure 7.12.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

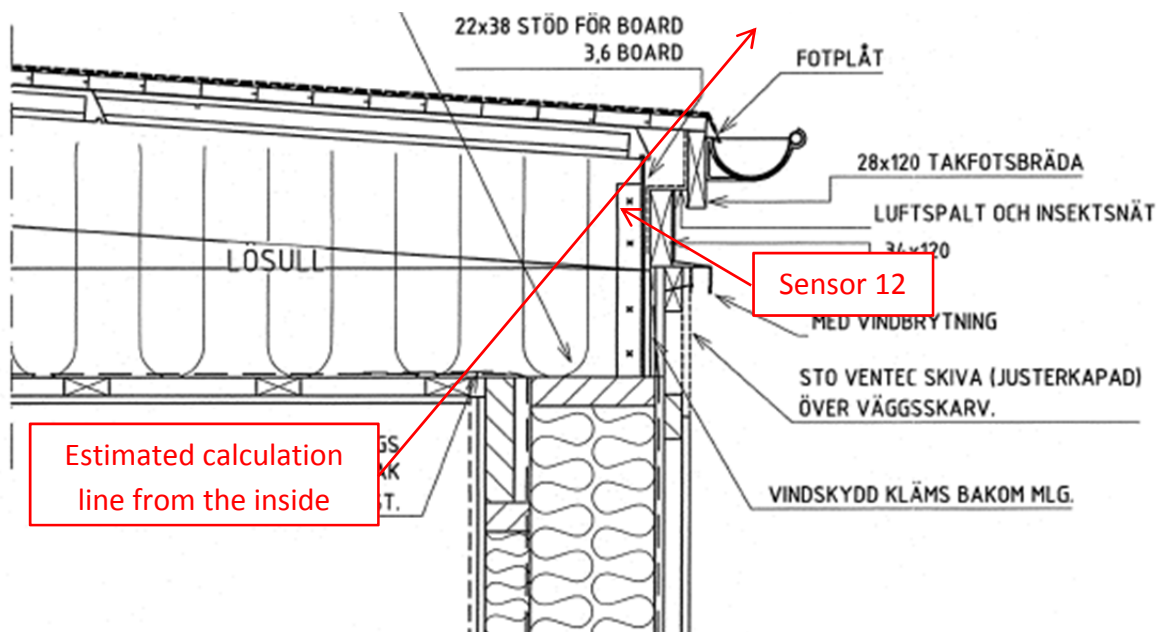


Figure 7.12.2. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

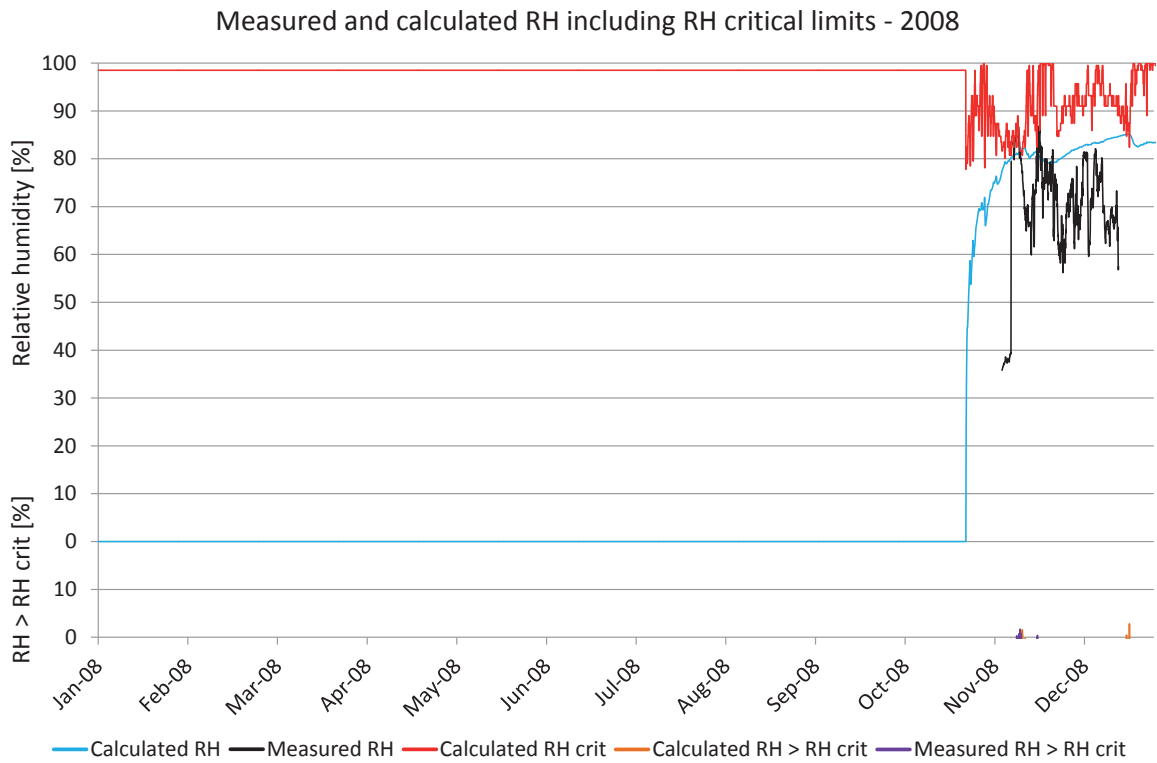


Figure 7.12.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

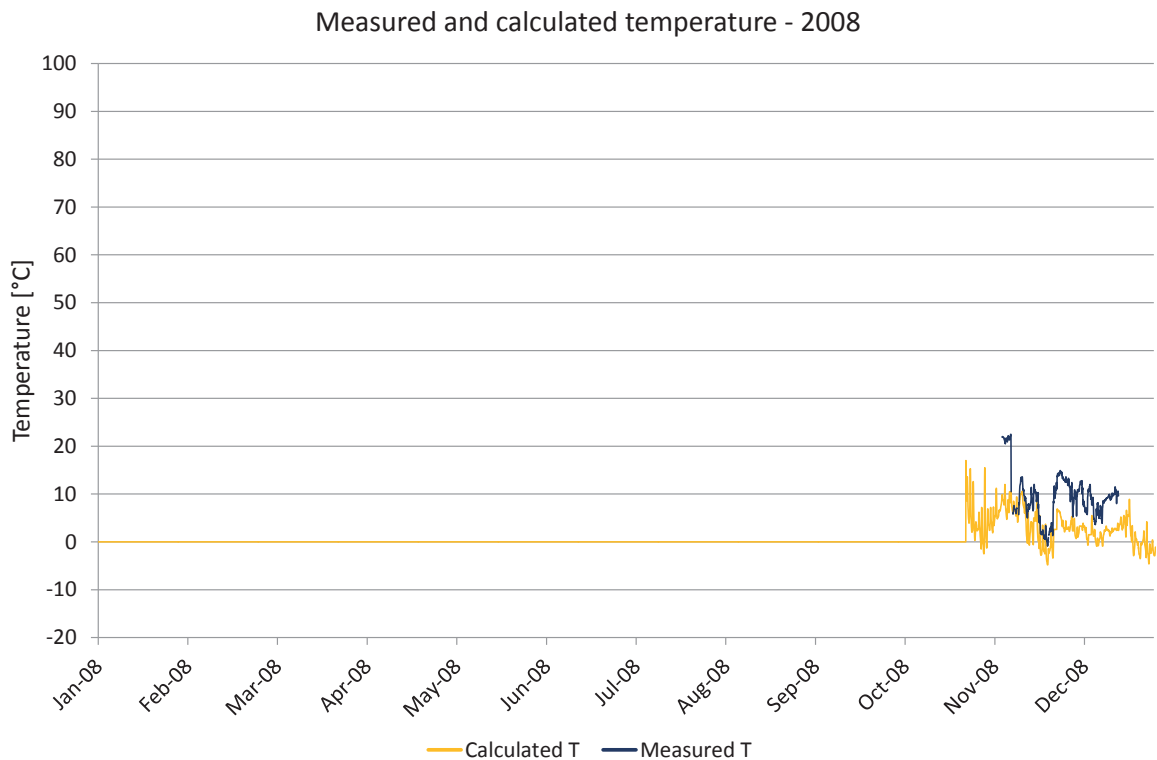


Figure 7.12.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

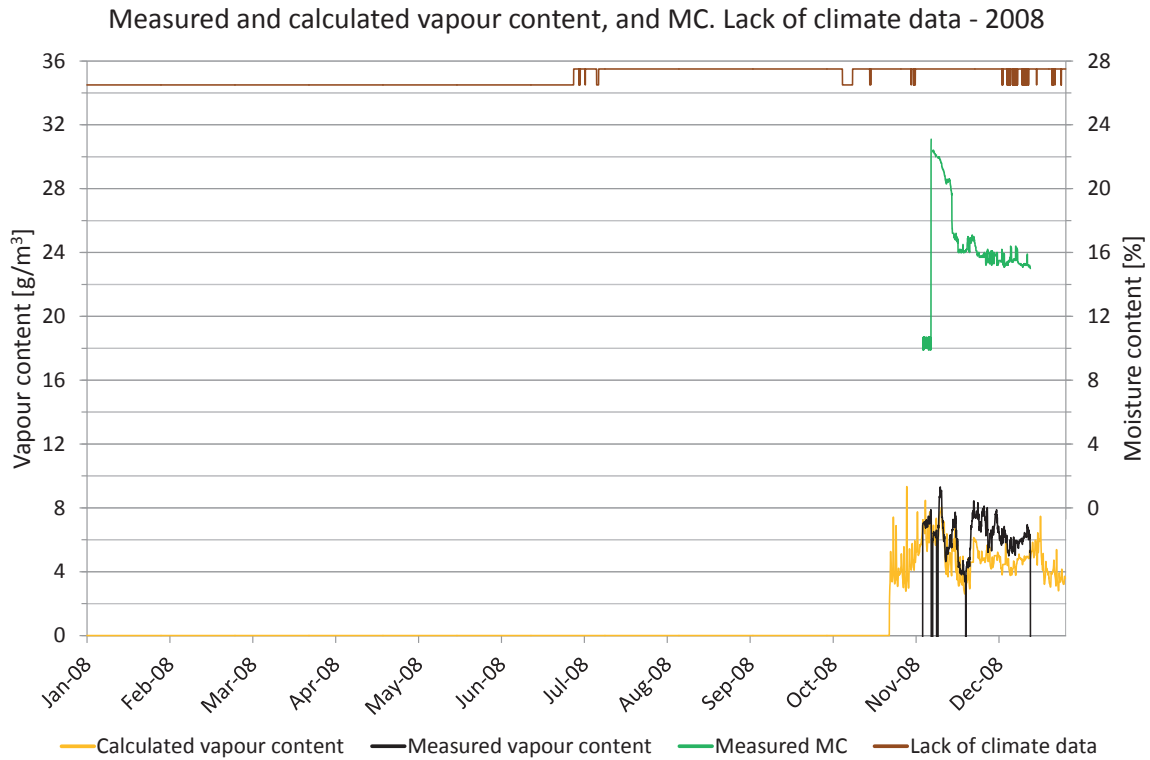


Figure 7.12.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

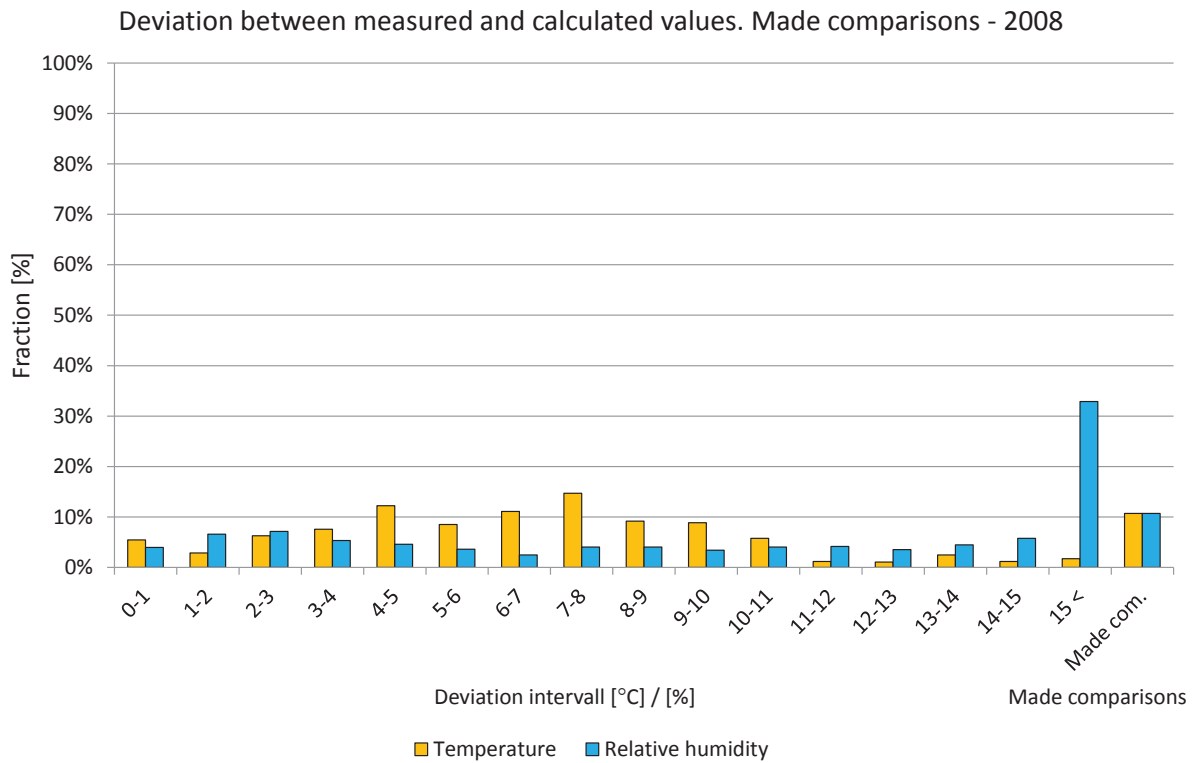


Figure 7.12.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

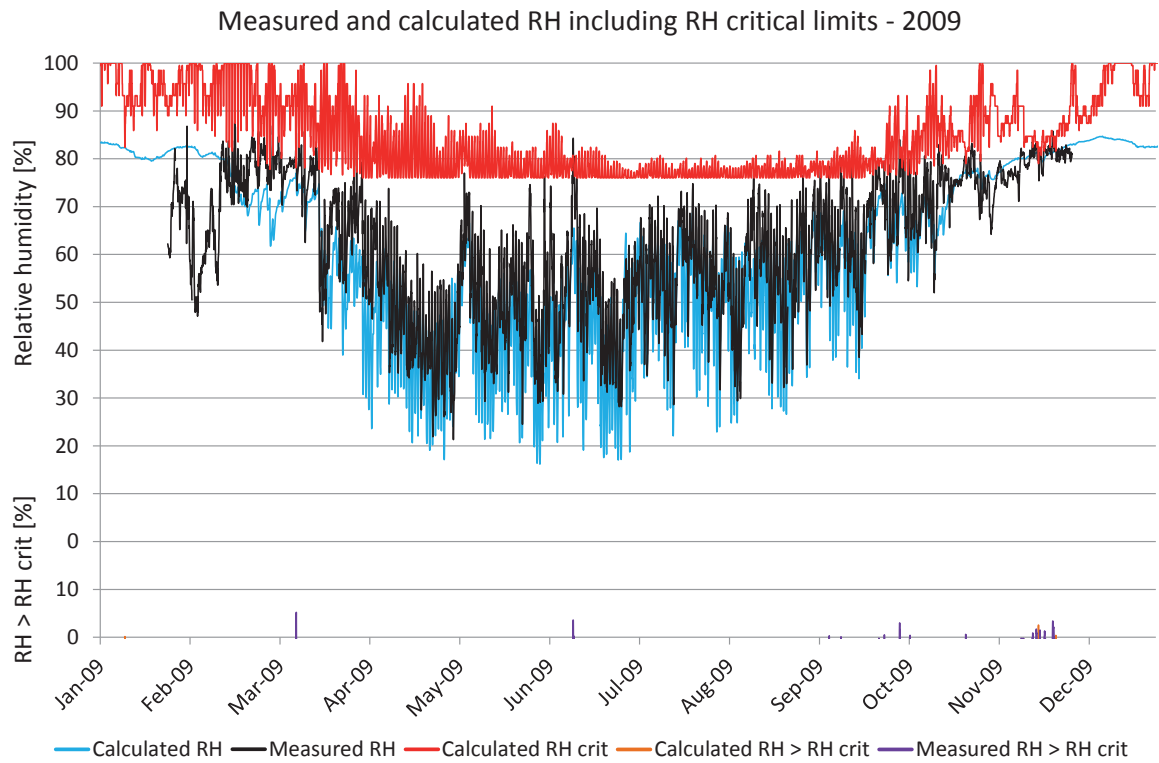


Figure 7.12.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

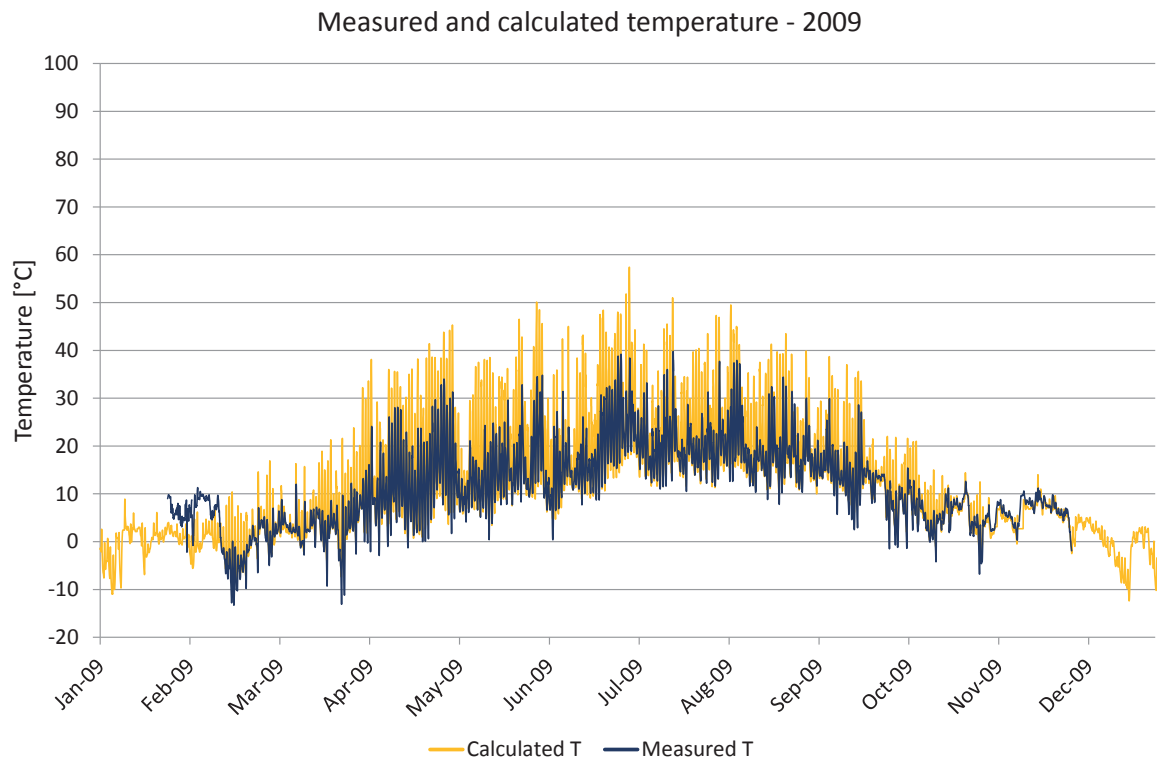


Figure 7.12.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

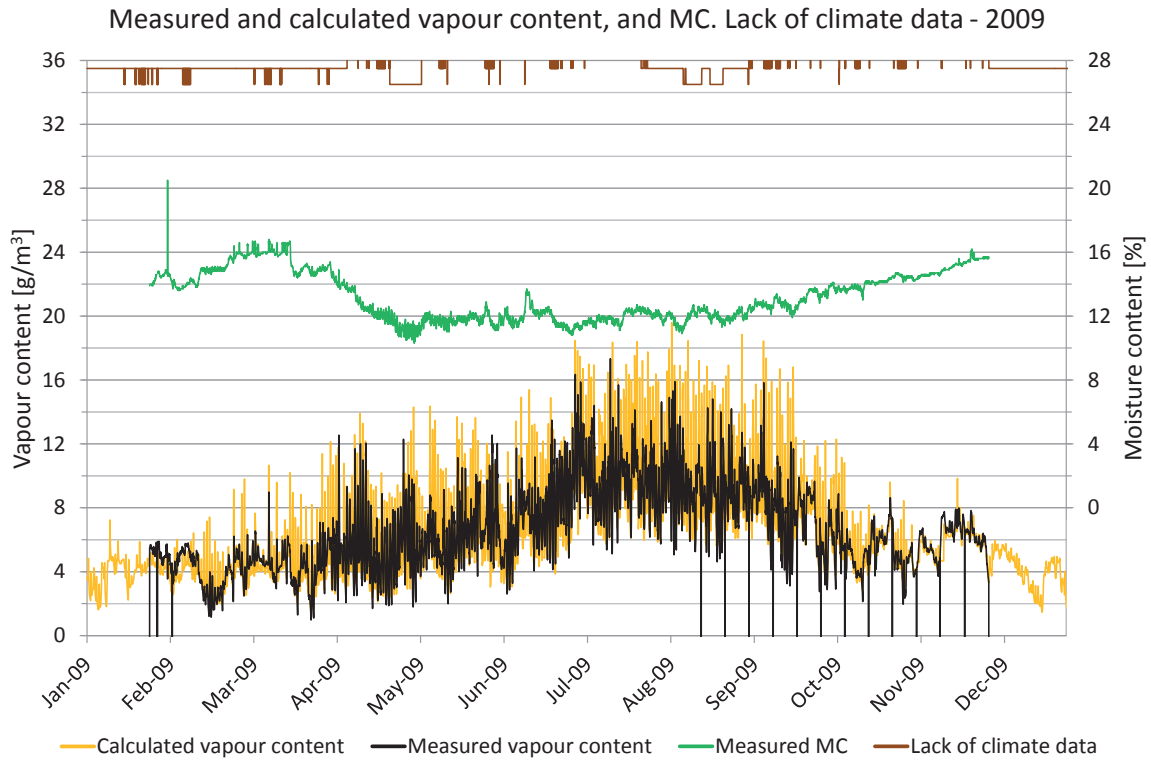


Figure 7.12.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

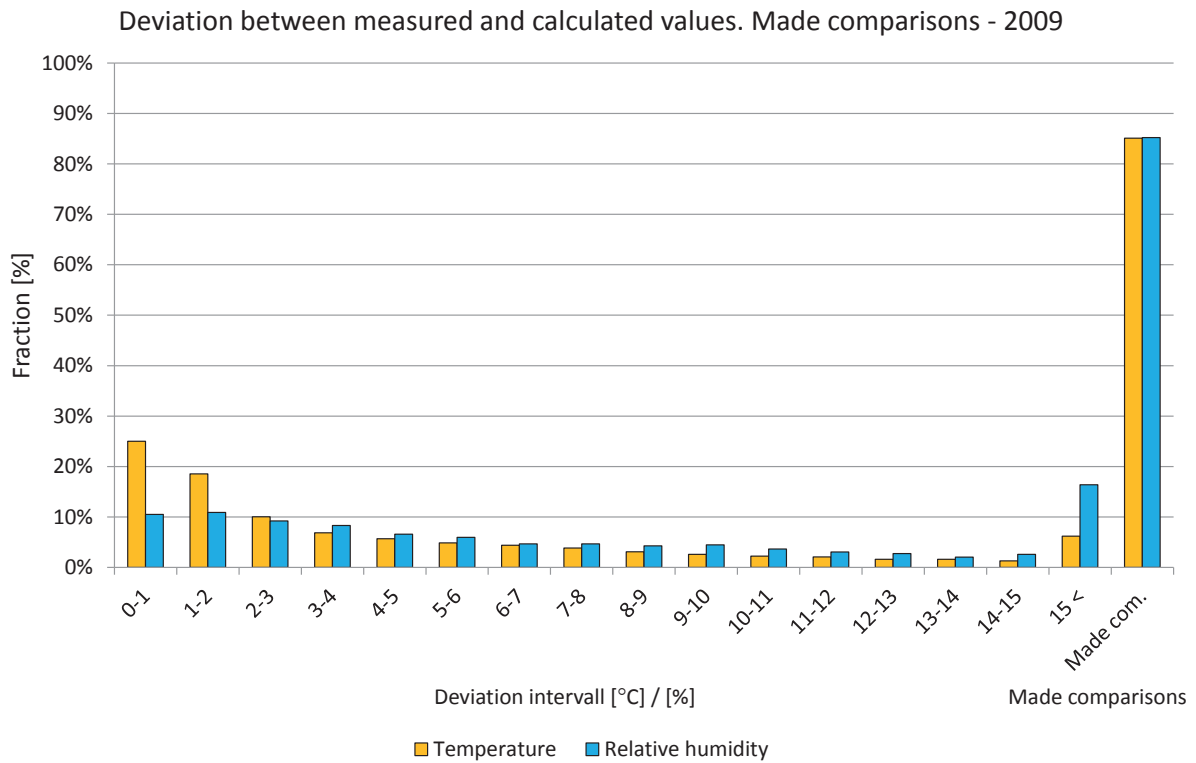


Figure 7.12.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

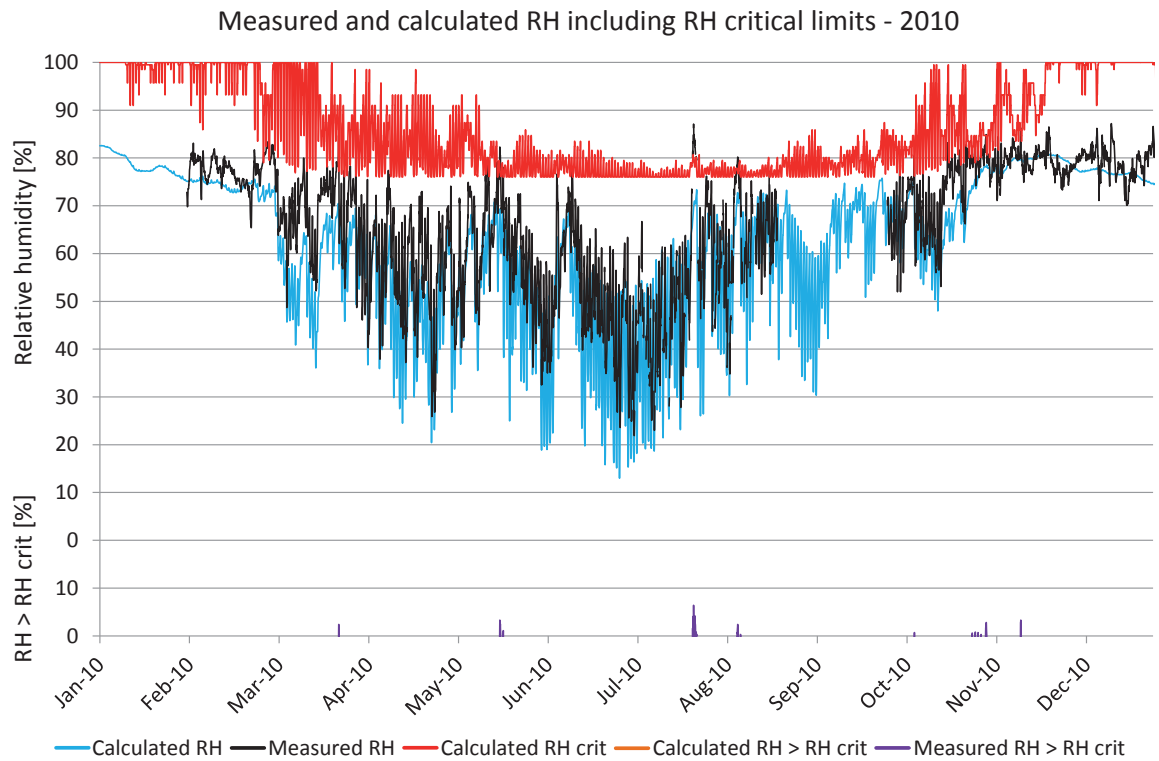


Figure 7.12.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

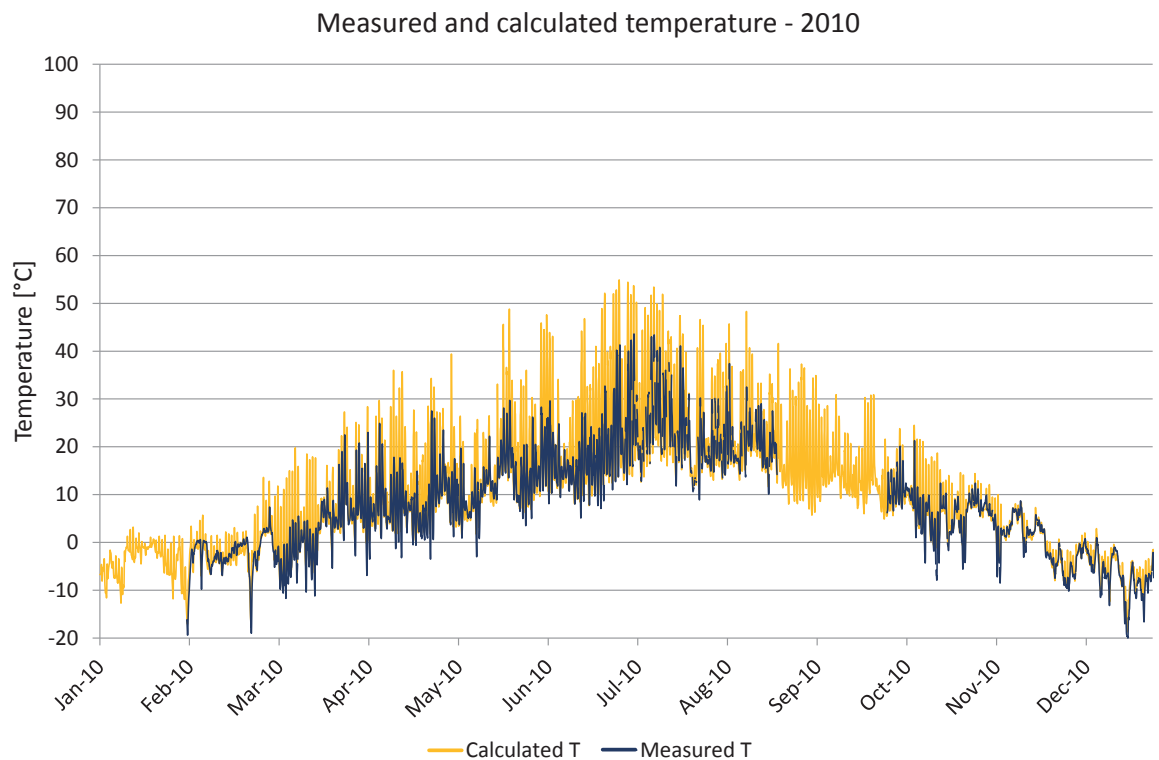


Figure 7.12.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

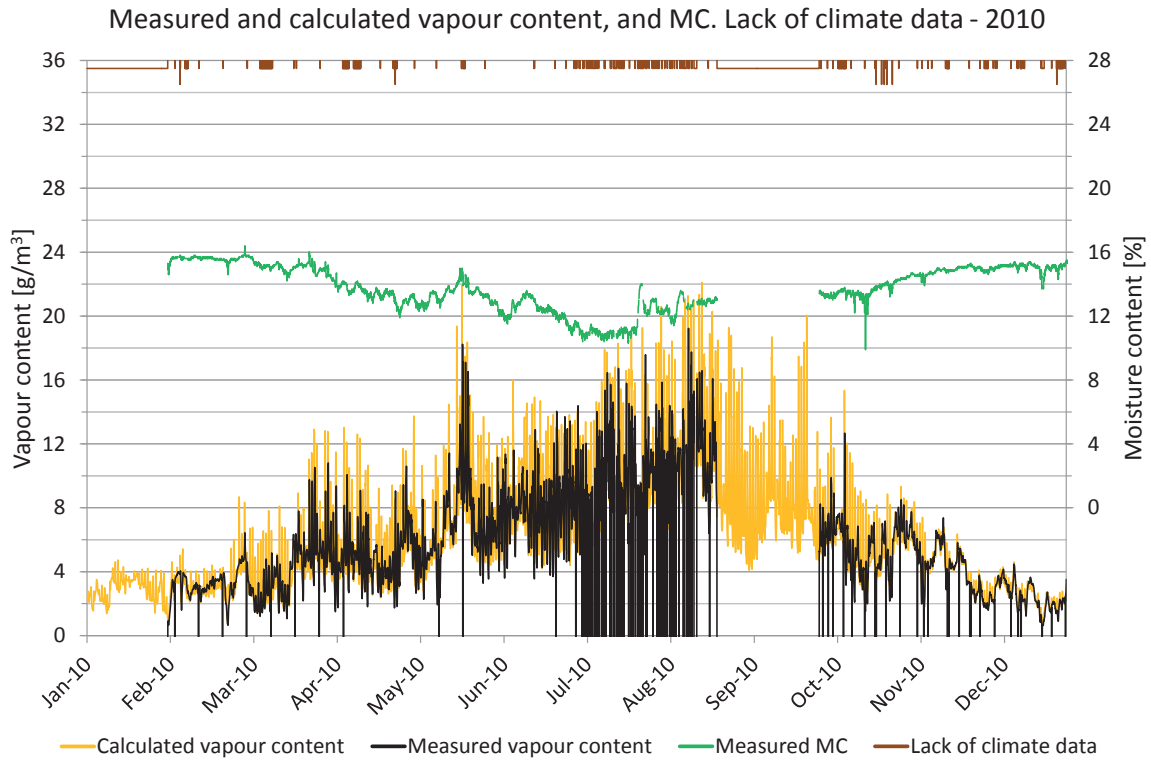


Figure 7.12.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

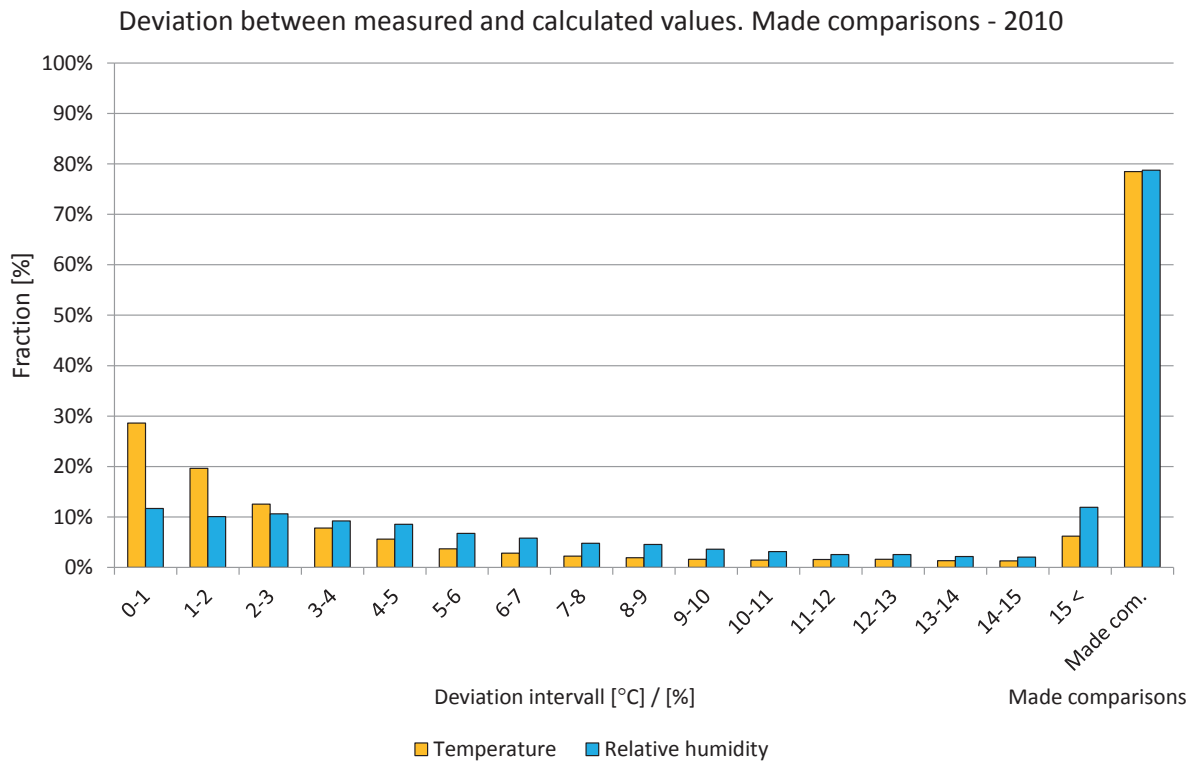


Figure 7.12.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

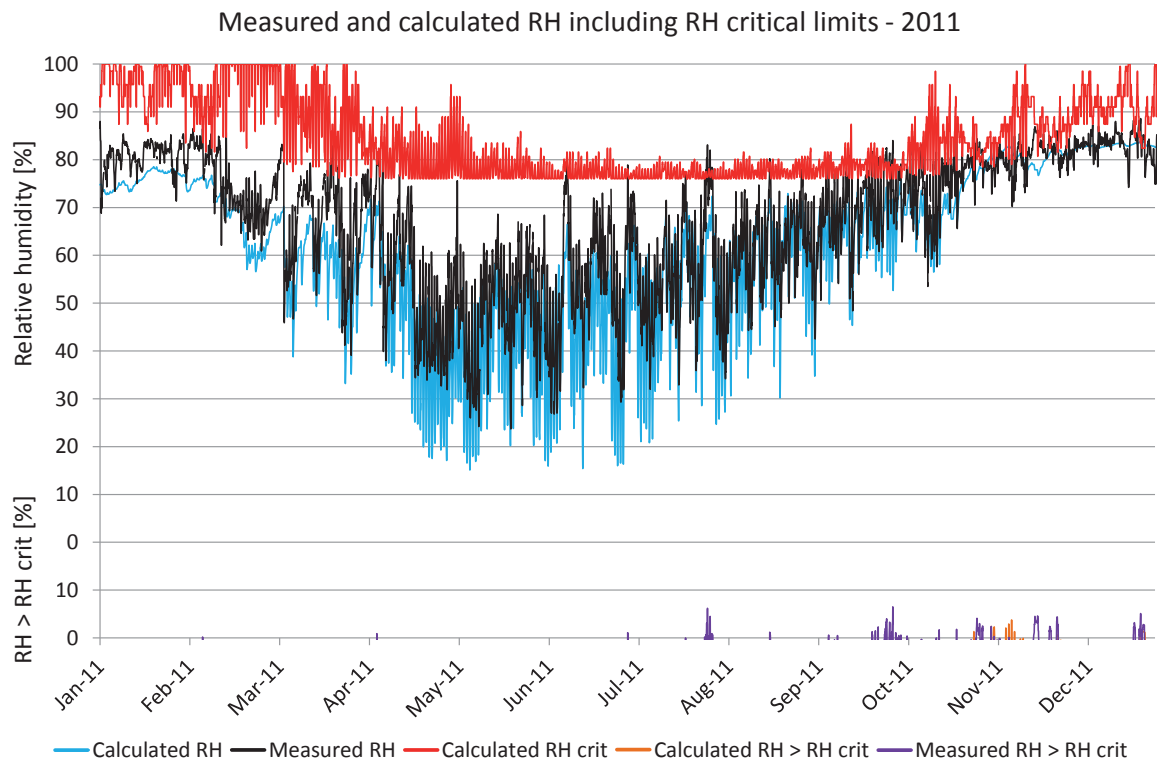


Figure 7.12.15. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

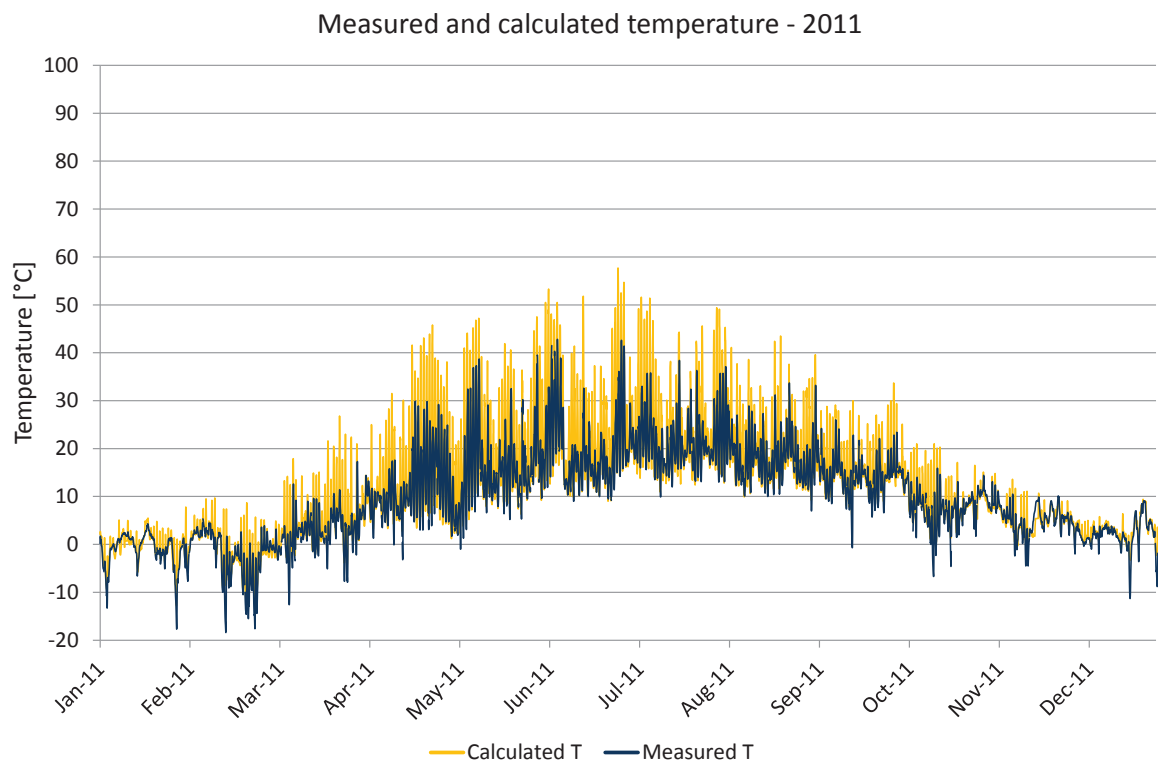


Figure 7.12.16. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

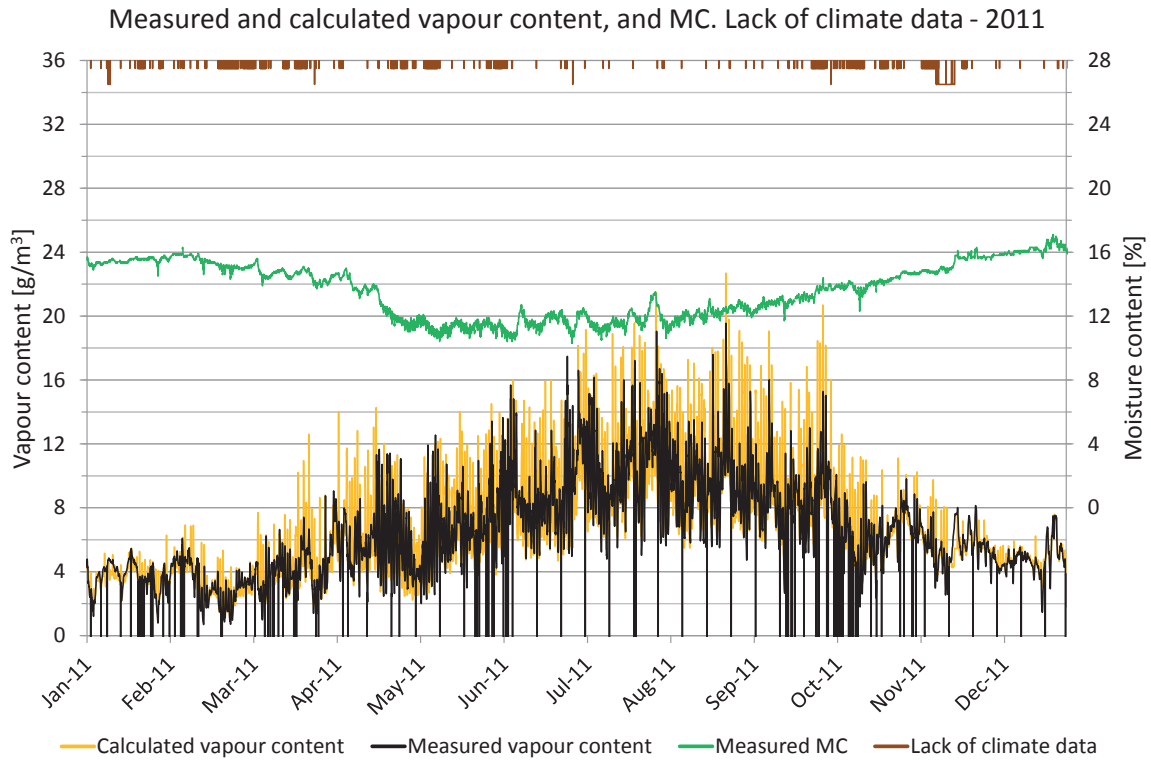


Figure 7.12.17. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

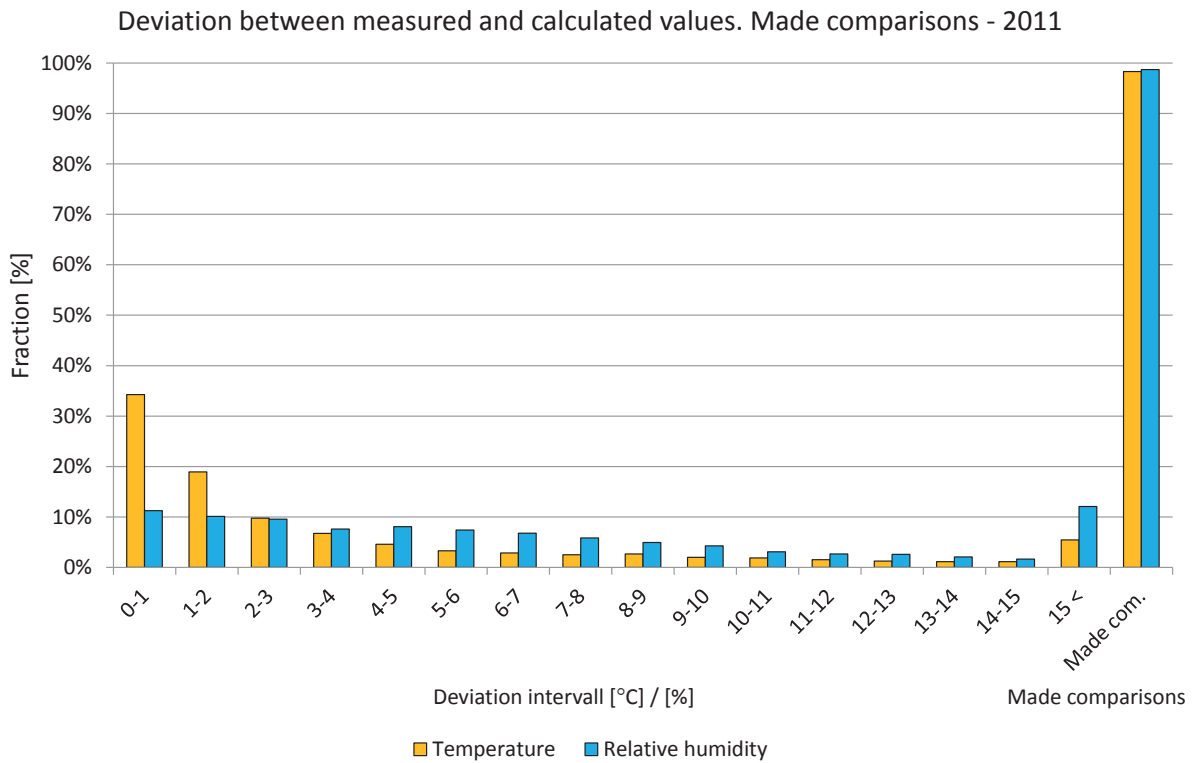
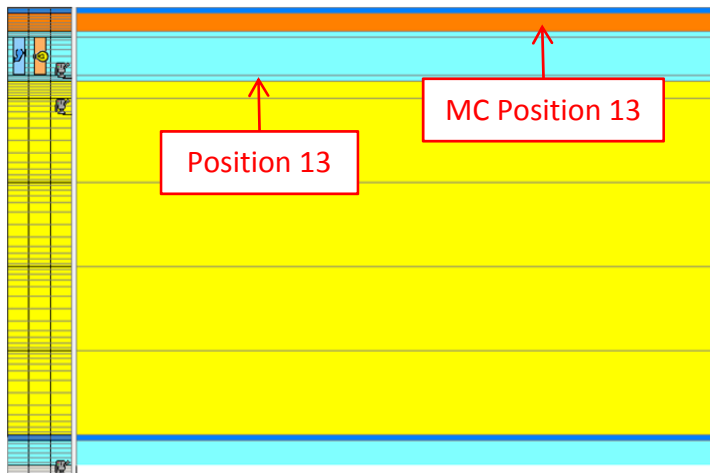


Figure 7.12.18. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.13 Position 13

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof.



Roof, from the outside:

- 1 mm PVC roof membrane¹, $S_d = 15$ m
- 22 mm Massive wood - Spruce radial¹, initial MC 23,4 %
- 50 mm Air gap¹ with 30 ACH
- 20 mm EPS¹
- 400 mm Mineral insulation, $\lambda = 0,037$ W/mK^{3,4}, including roof beams
- 1 mm Vapour retarder¹, $S_d = 50$ m
- 30 mm Air gap¹, no ACH
- 13 mm Gypsum board²

Figure 7.13.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

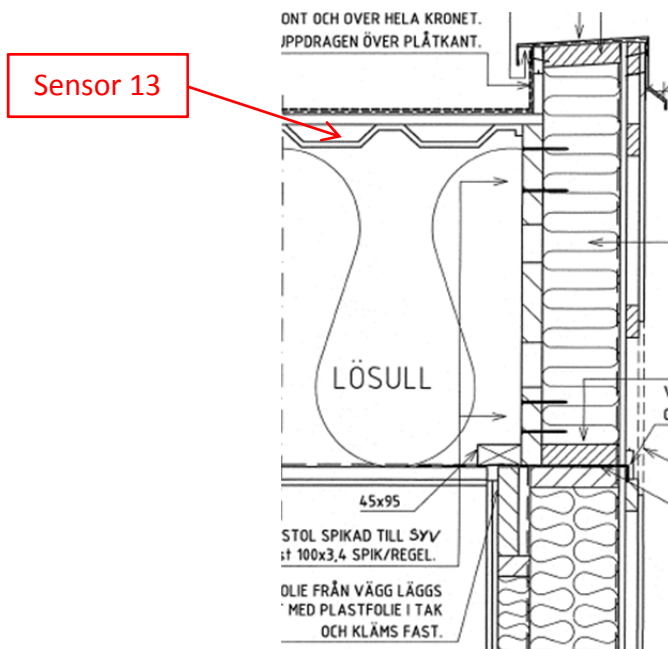


Figure 7.13.2. Location of the studied position.

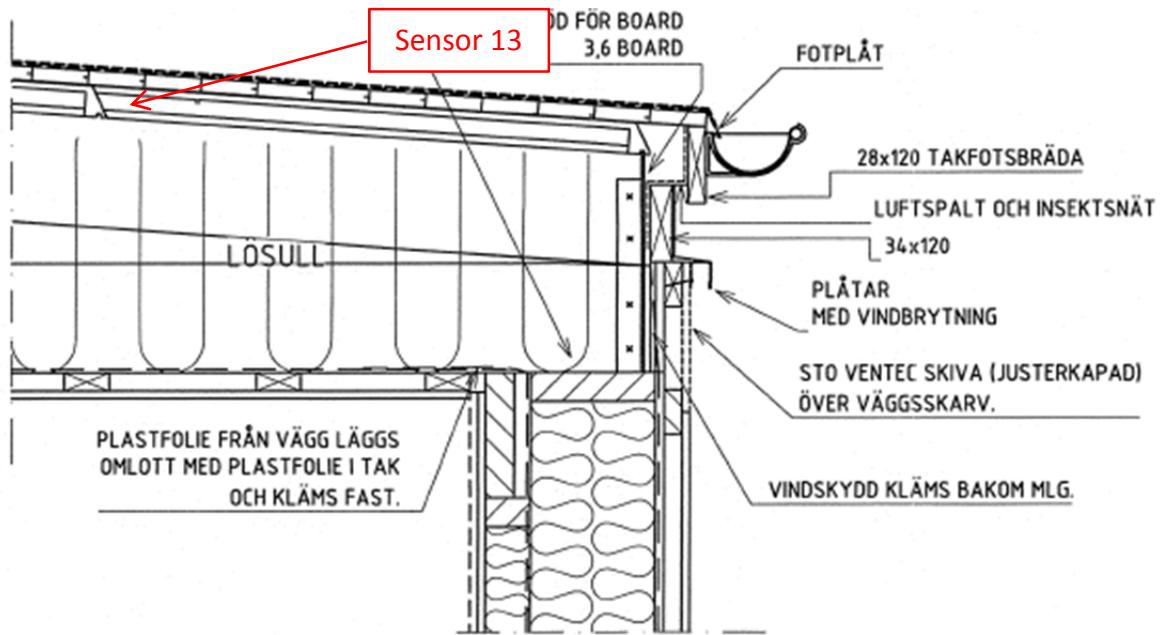


Figure 7.13.3. Location of the studied position.



Figure 7.13.4. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

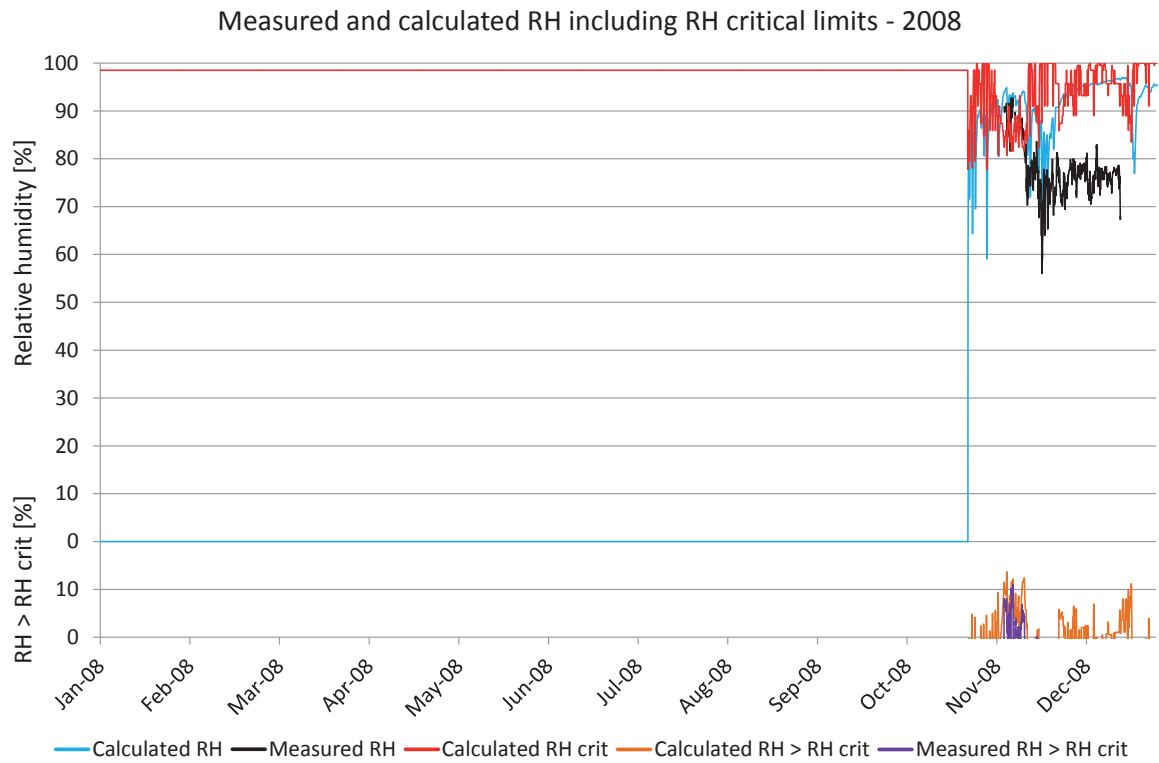


Figure 7.13.5. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

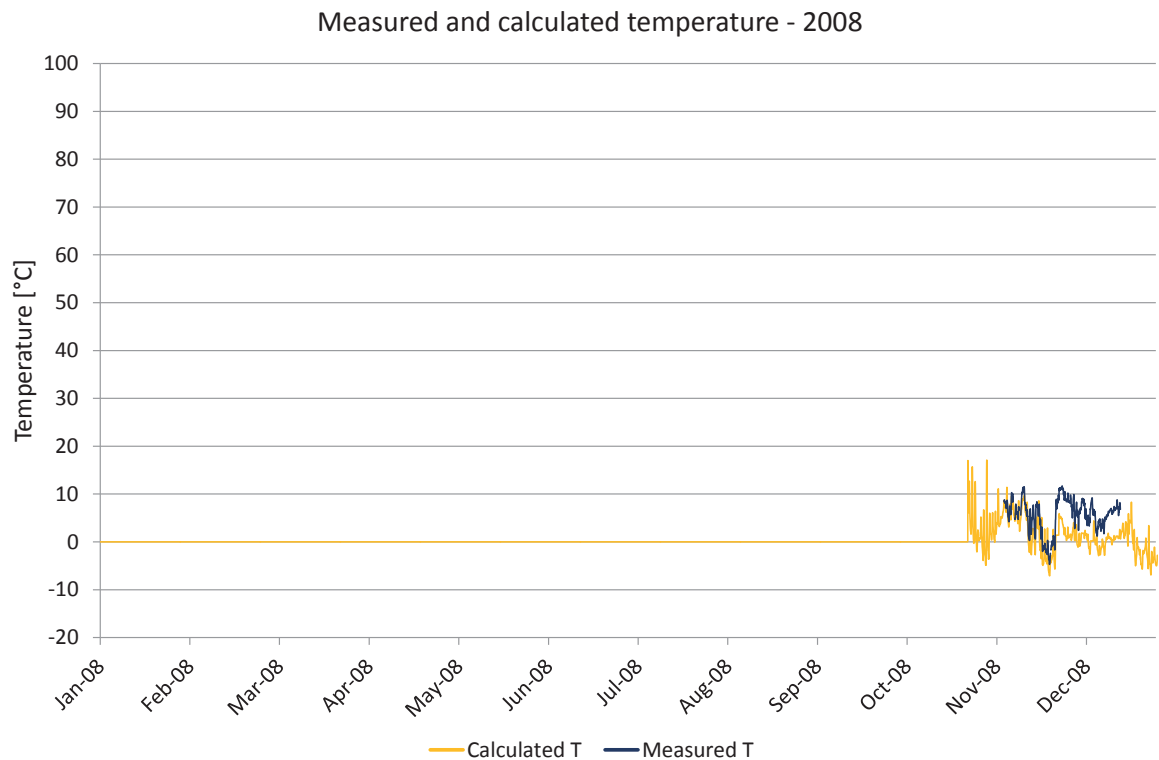


Figure 7.13.6. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

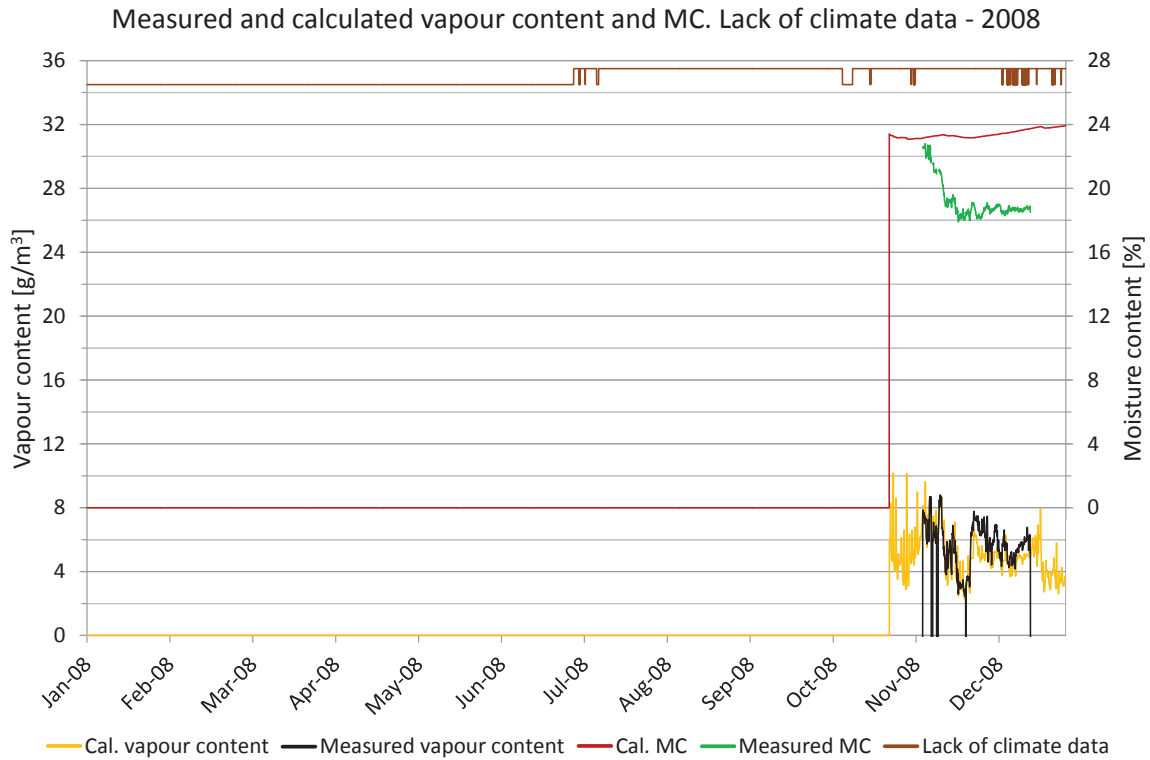


Figure 7.13.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

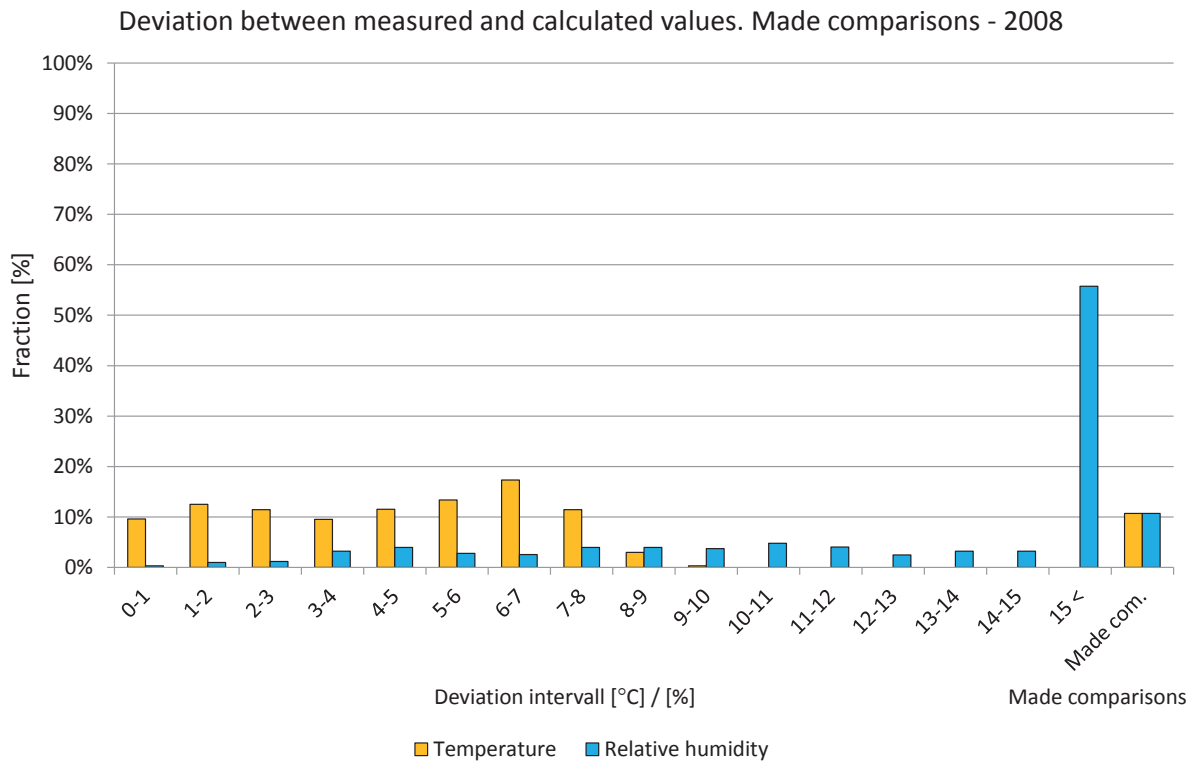


Figure 7.13.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

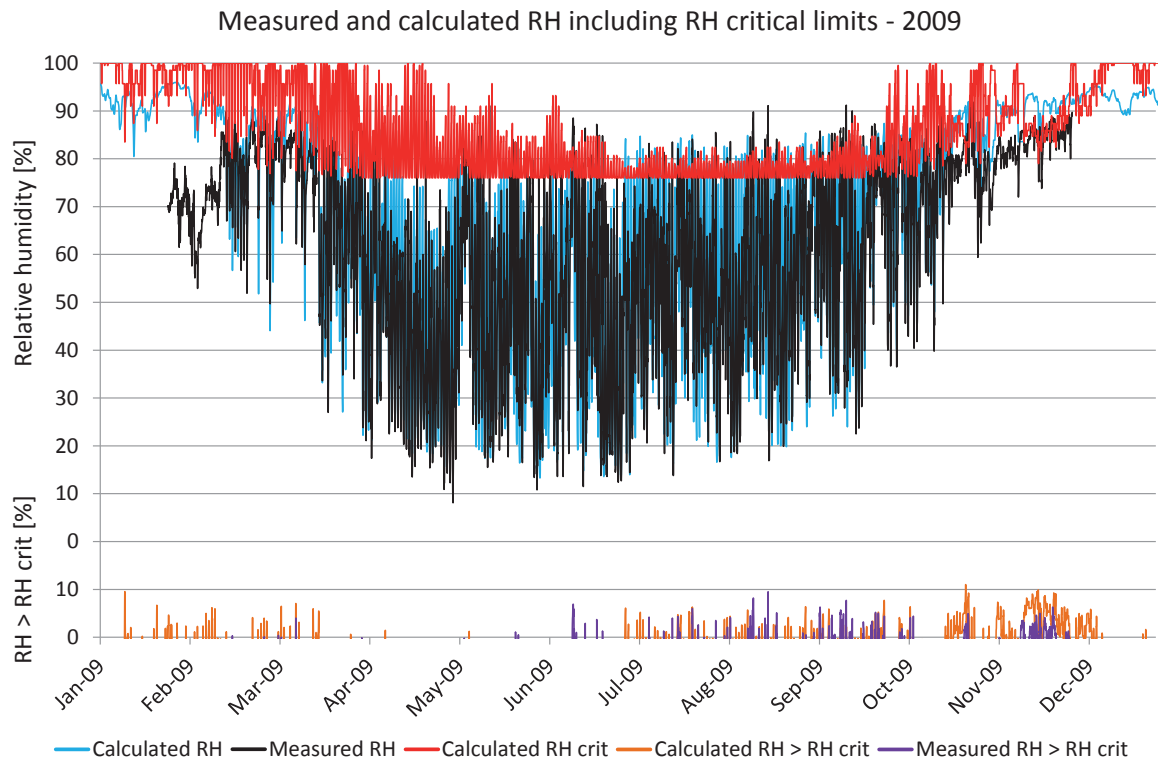


Figure 7.13.9. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

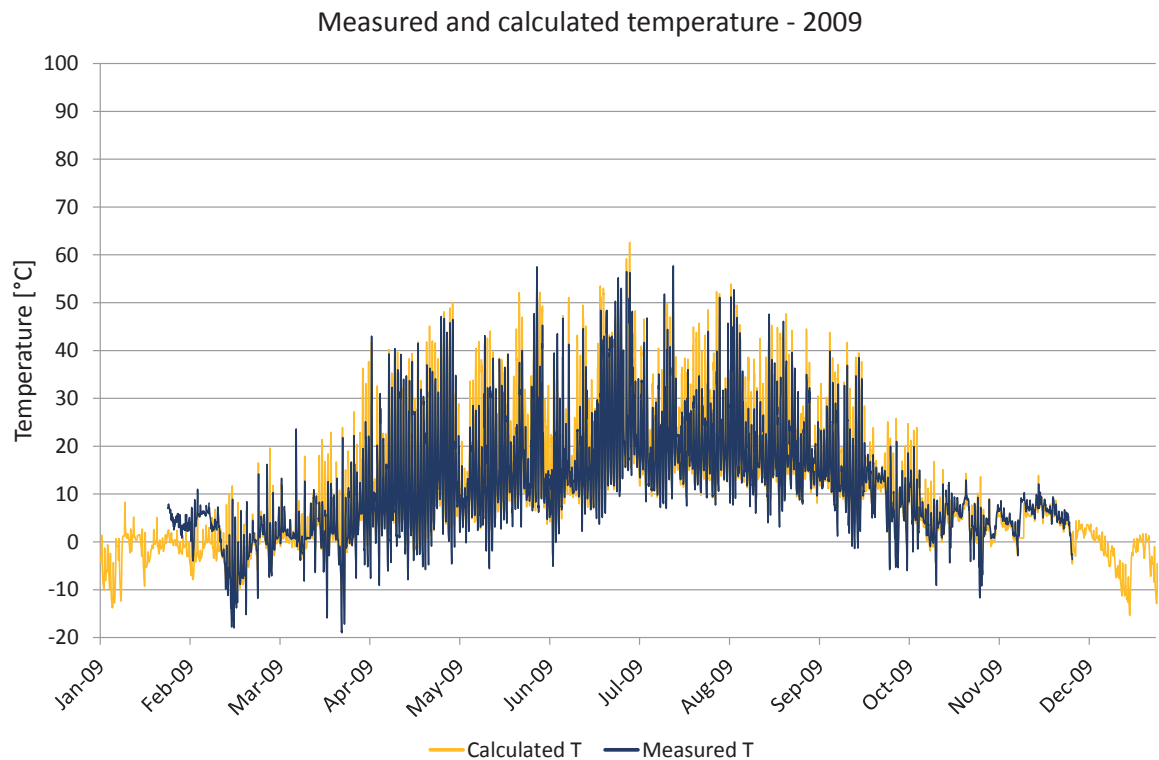


Figure 7.13.10. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

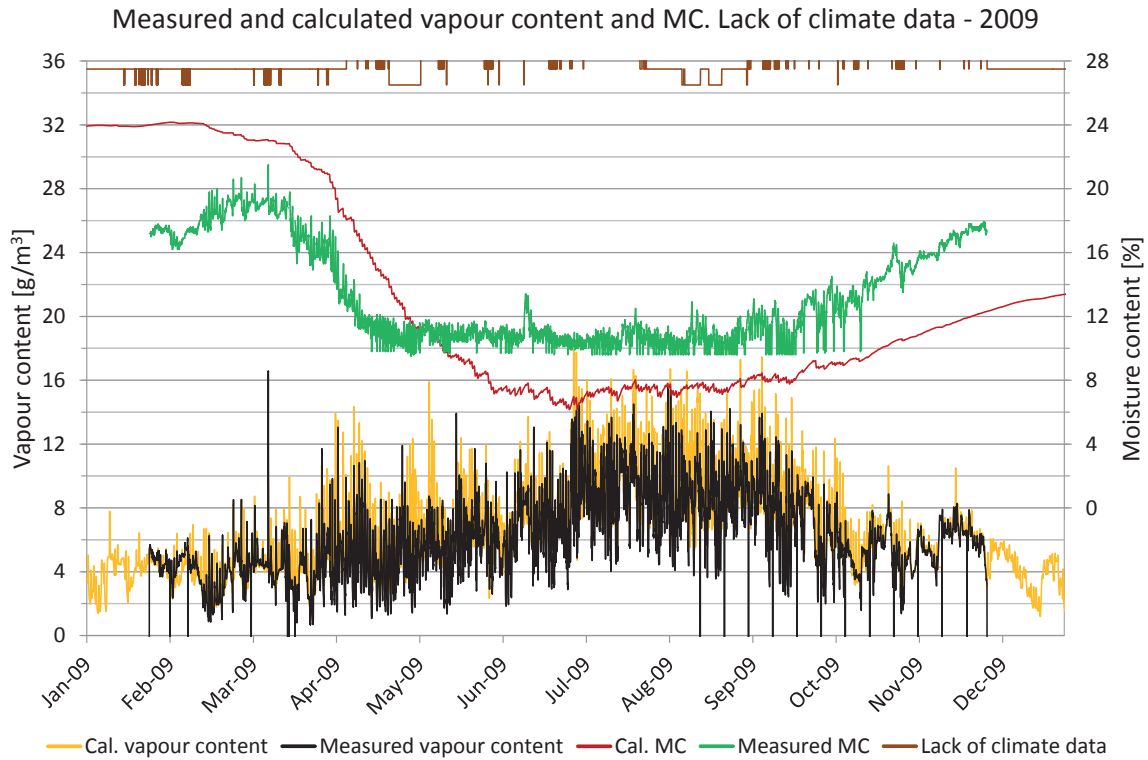


Figure 7.13.11. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

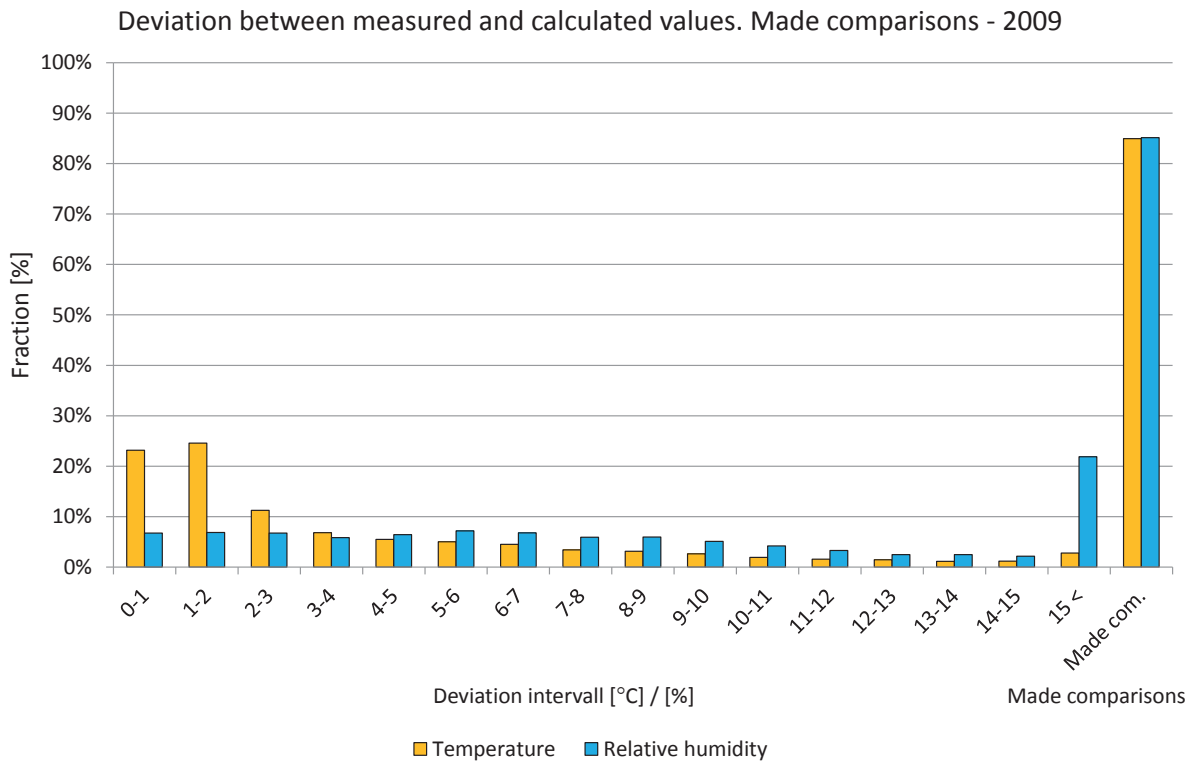


Figure 7.13.12. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

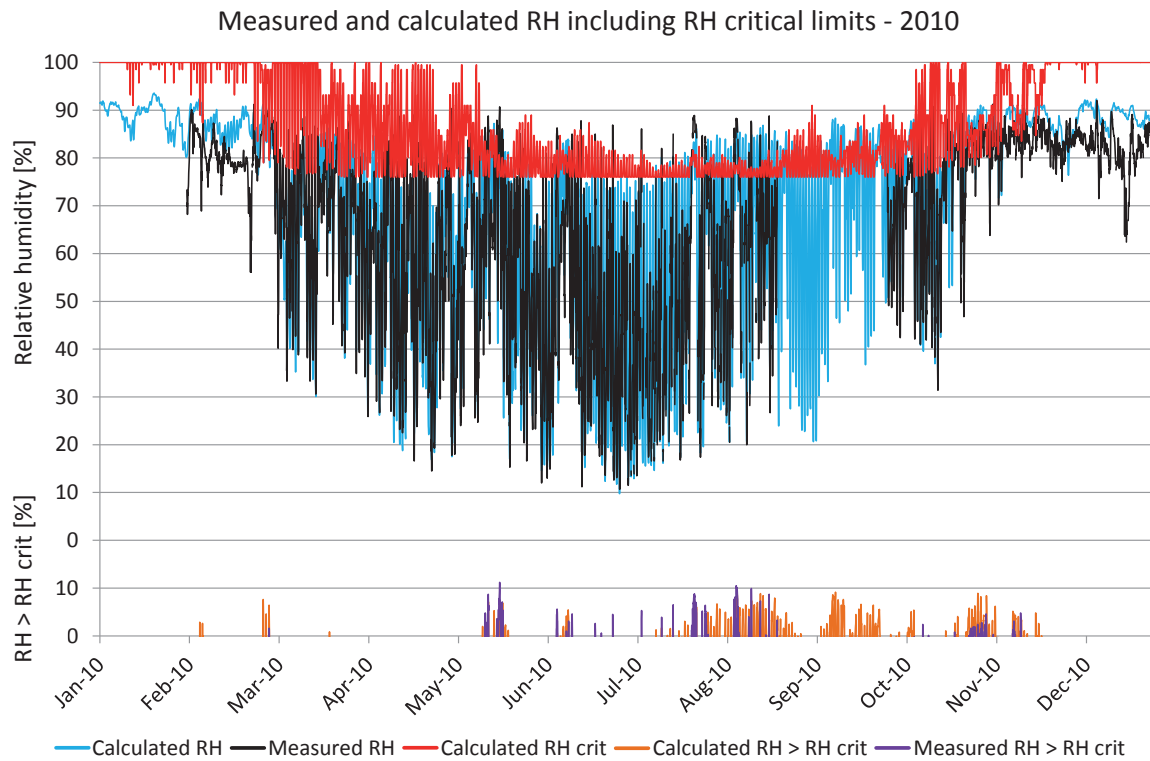


Figure 7.13.13. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

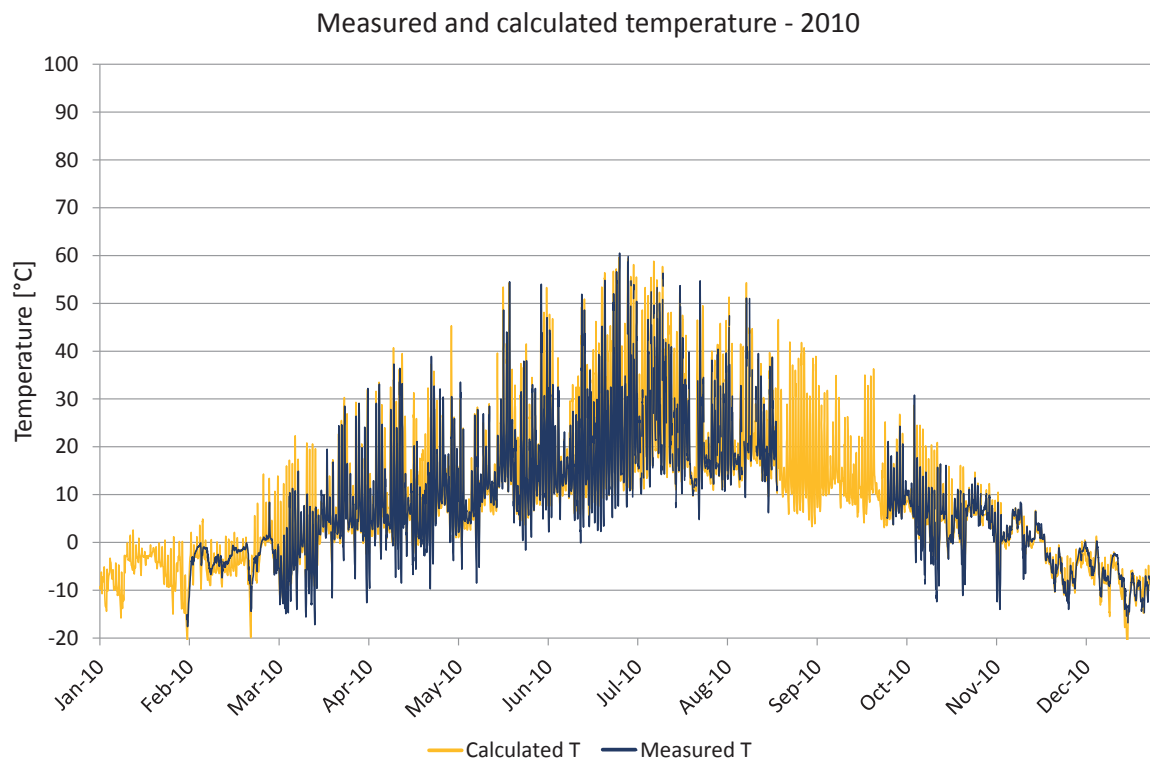


Figure 7.13.14. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

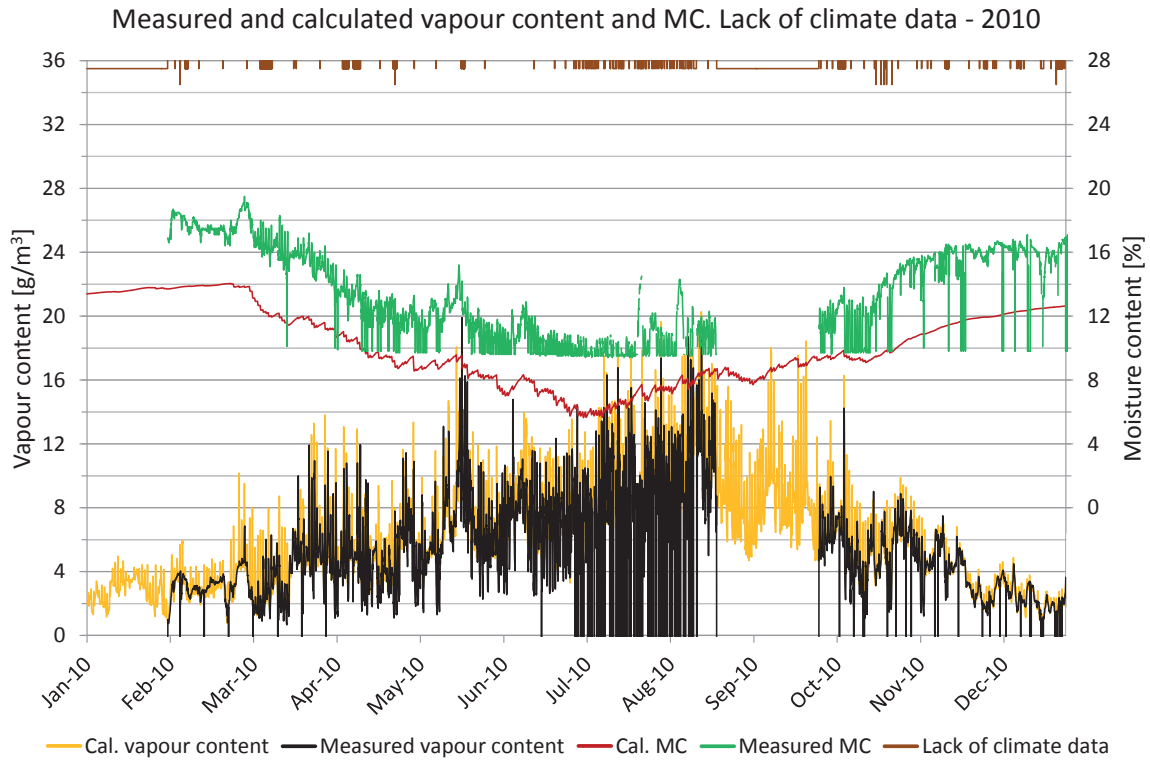


Figure 7.13.15. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

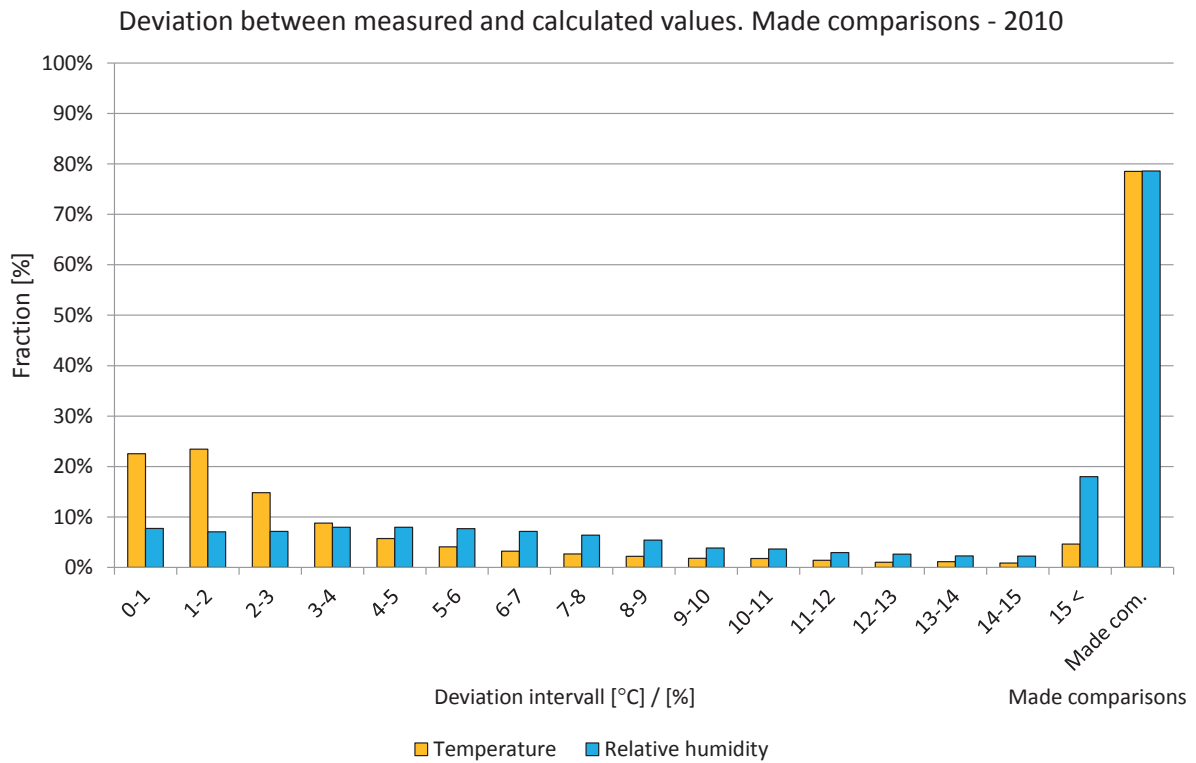


Figure 7.13.16. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

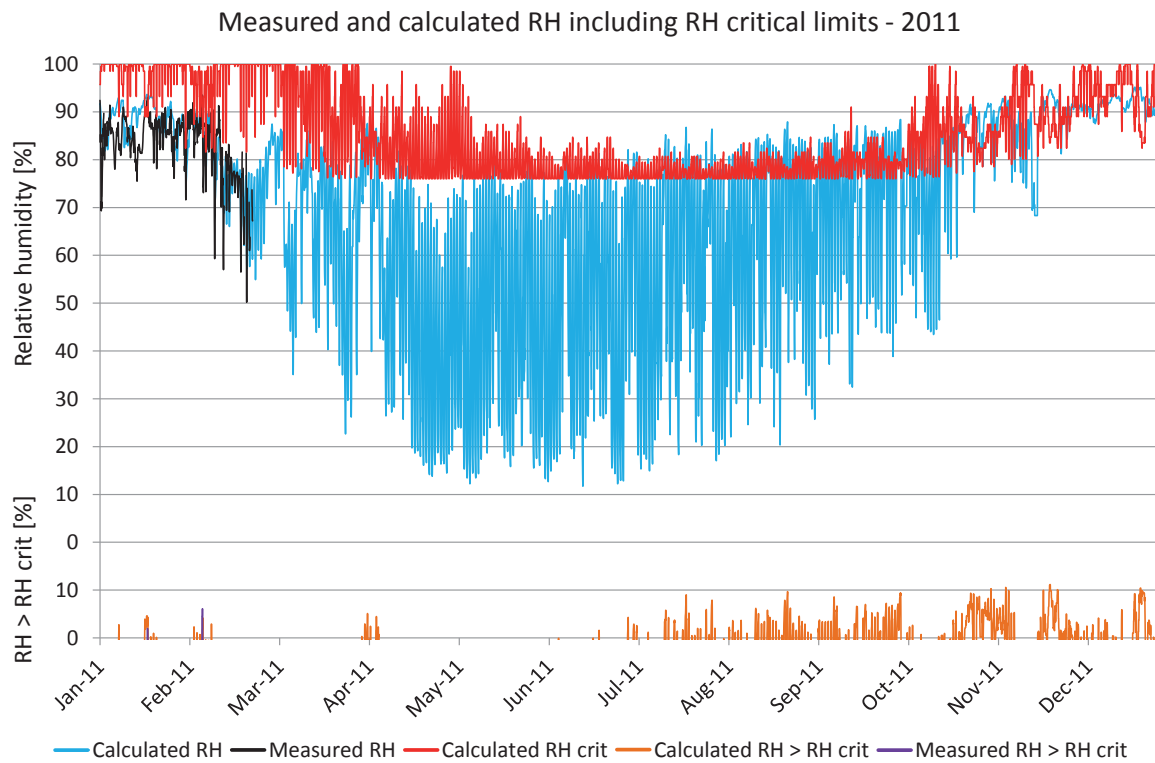


Figure 7.13.17. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

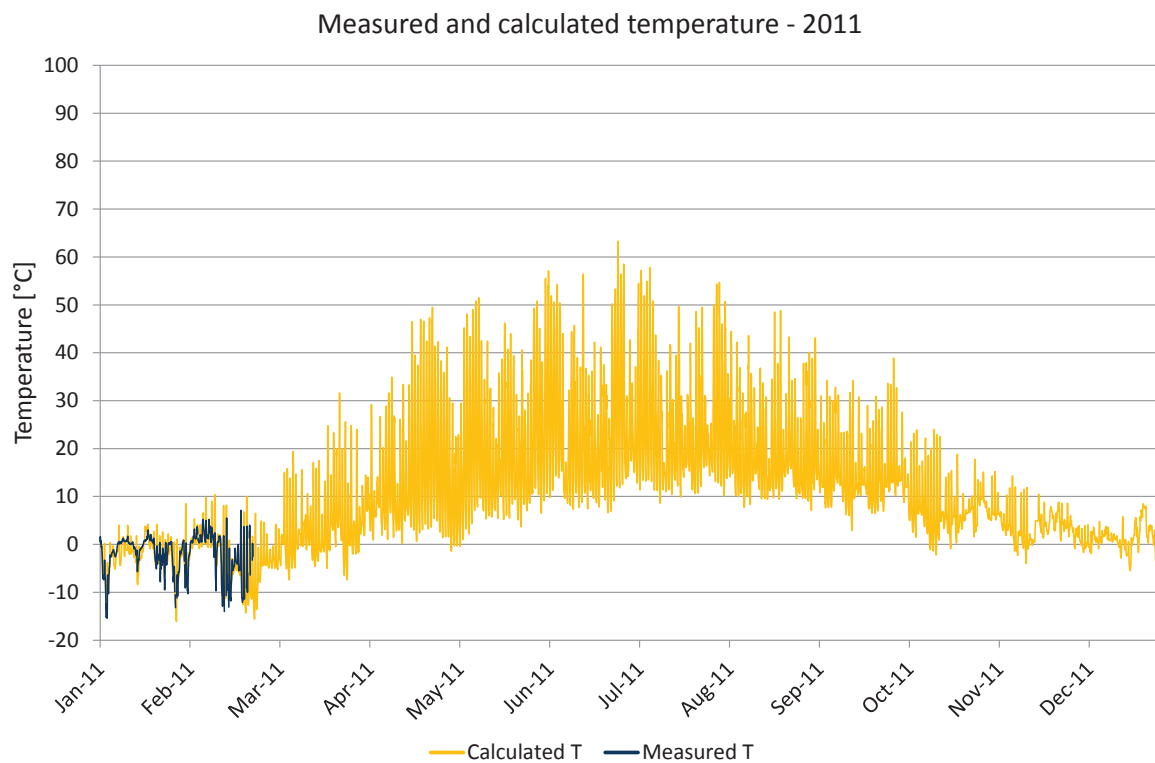


Figure 7.13.18. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

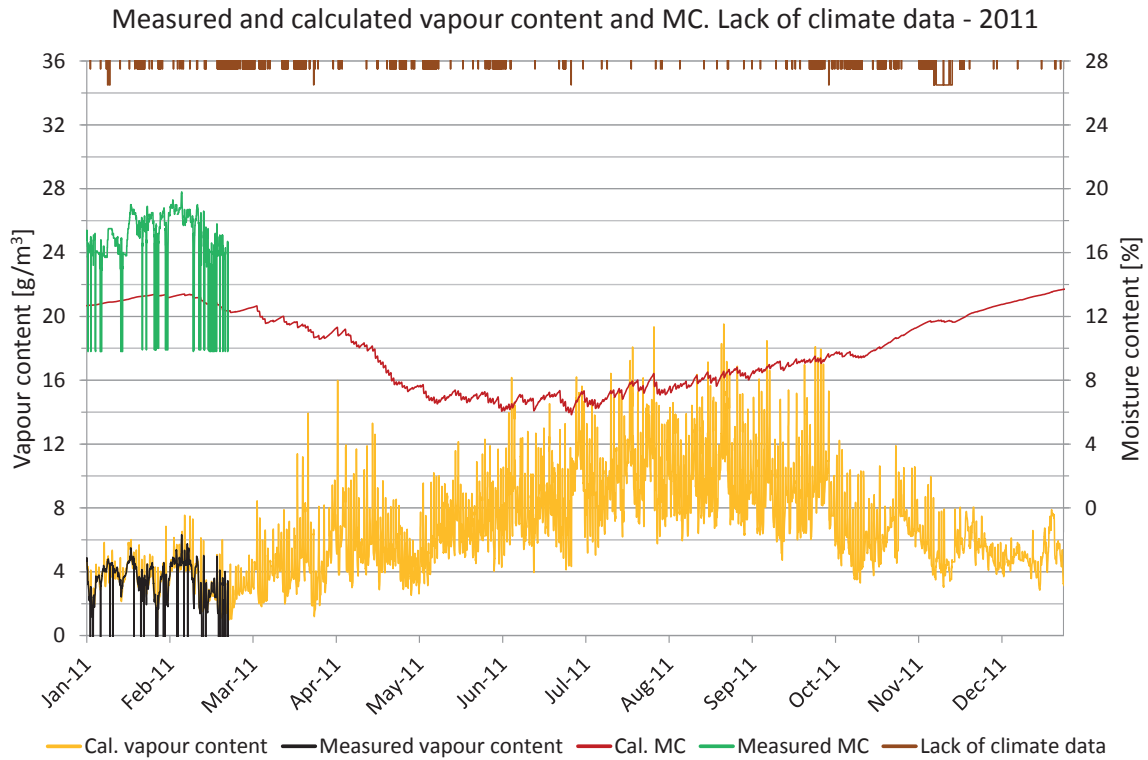


Figure 7.13.19. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

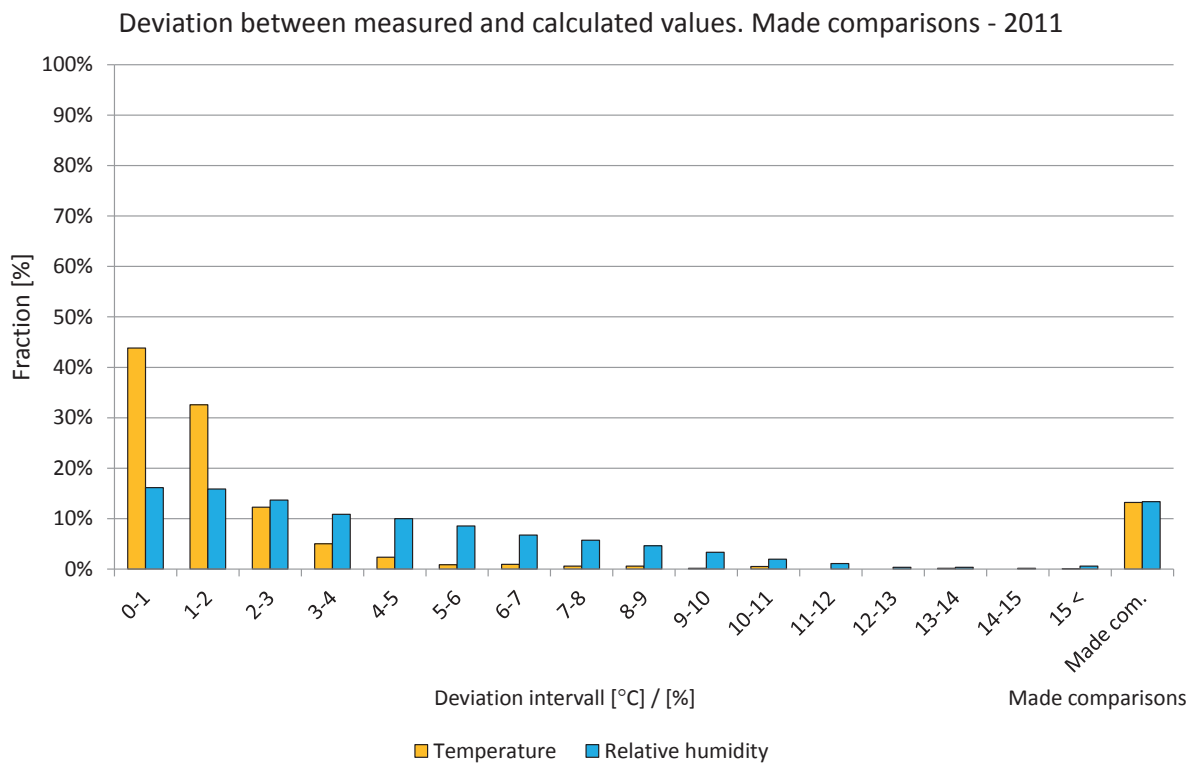
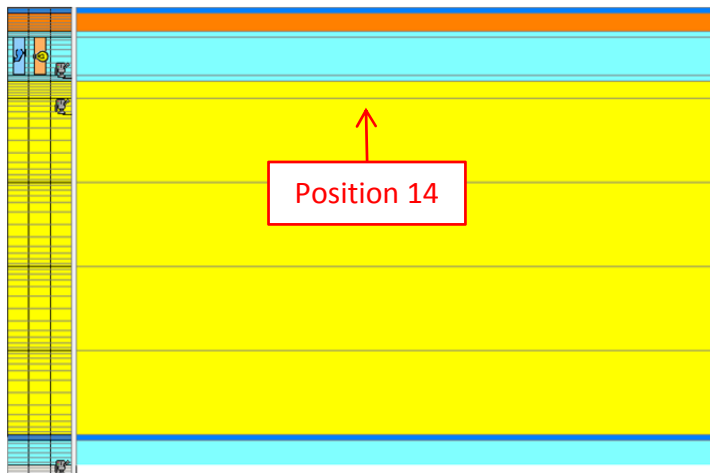


Figure 7.13.20. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.14 Position 14

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof.



Roof, from the outside:

- 1 mm PVC roof membrane¹, $S_d = 15$ m
- 22 mm Massive wood - Spruce radial¹
- 50 mm Air gap¹ with 30 ACH
- 20 mm EPS¹
- 400 mm Mineral insulation, $\lambda = 0,037$ W/mK^{3,4}, including roof beams
- 1 mm Vapour retarder¹, $S_d = 50$ m
- 30 mm Air gap¹, no ACH
- 13 mm Gypsum board²

Figure 7.14.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

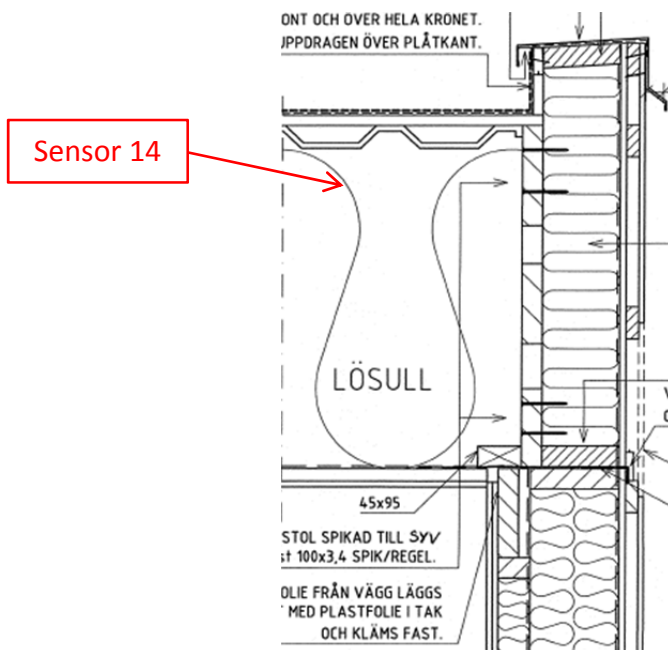


Figure 7.14.2. Location of the studied position.

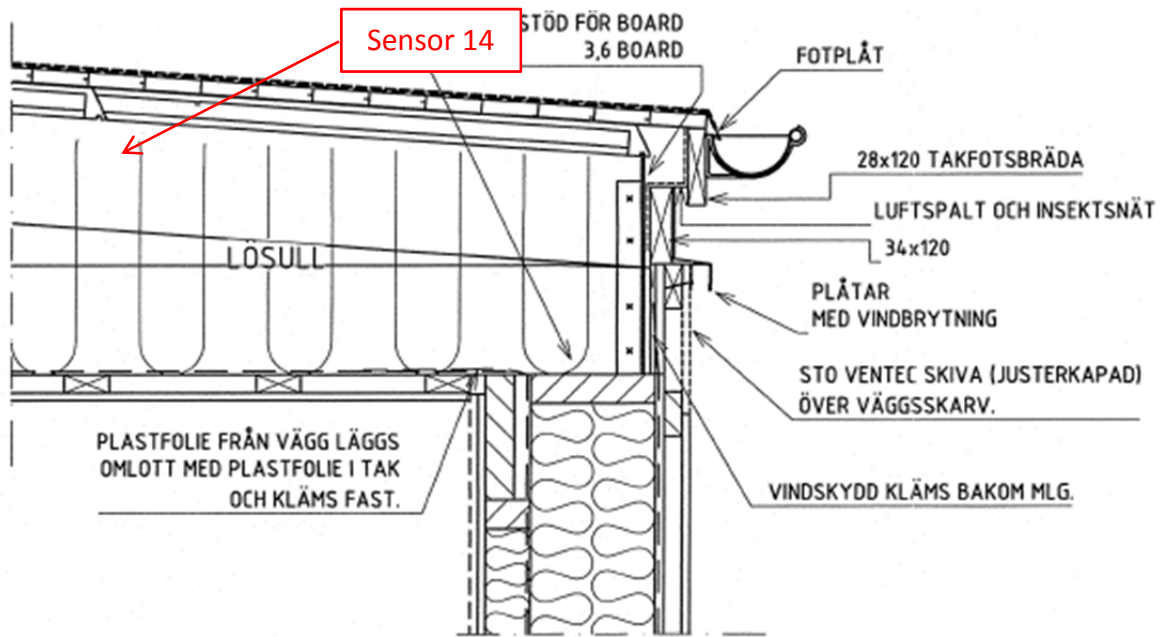


Figure 7.14.3. Location of the studied position.



Figure 7.14.4. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

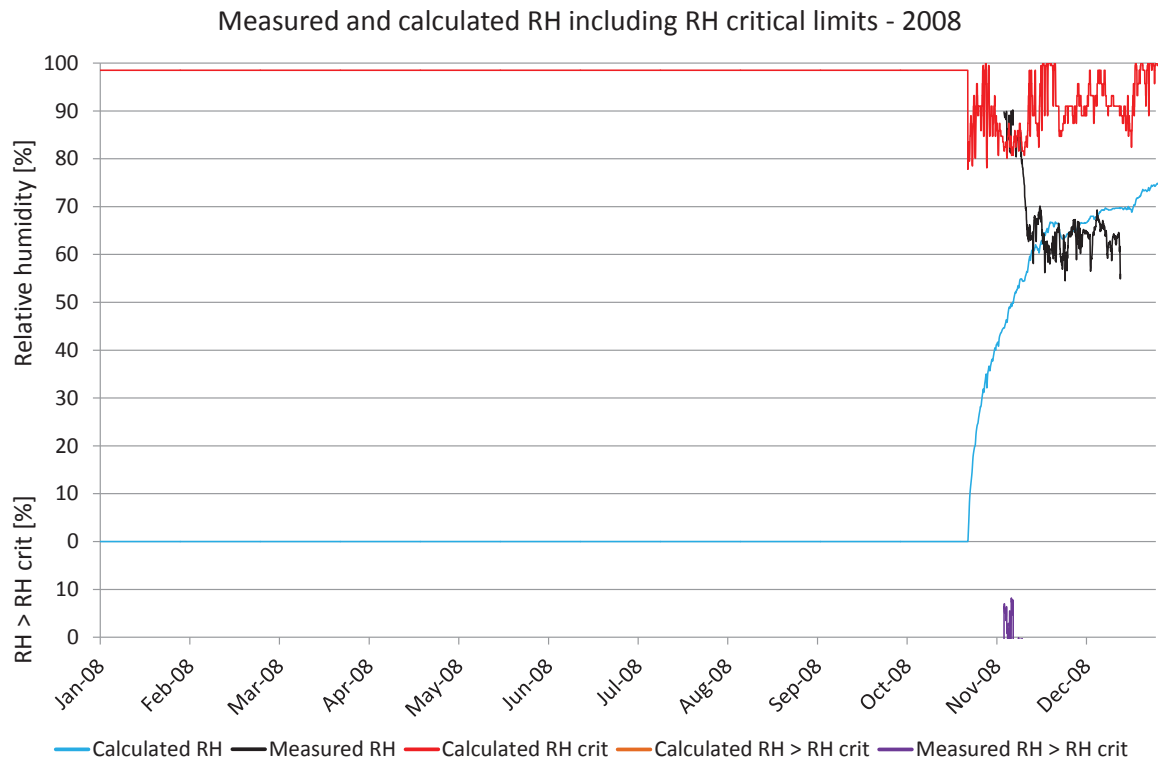


Figure 7.14.5. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

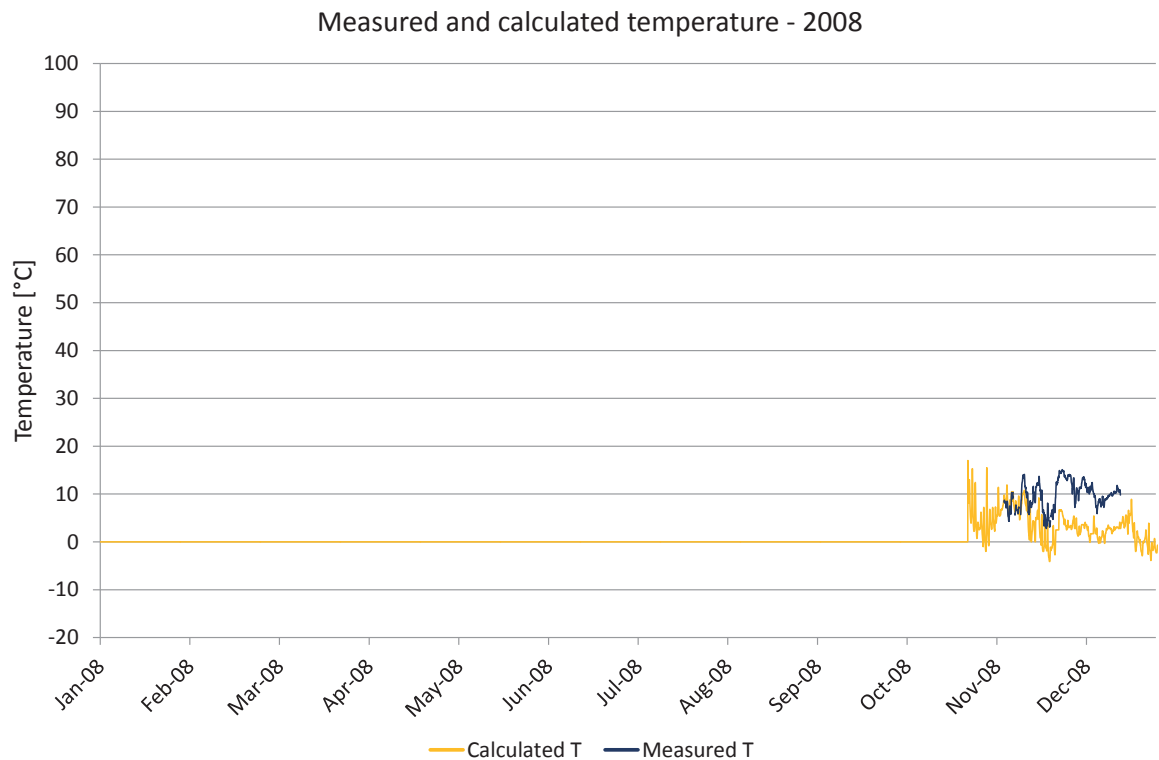


Figure 7.14.6. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

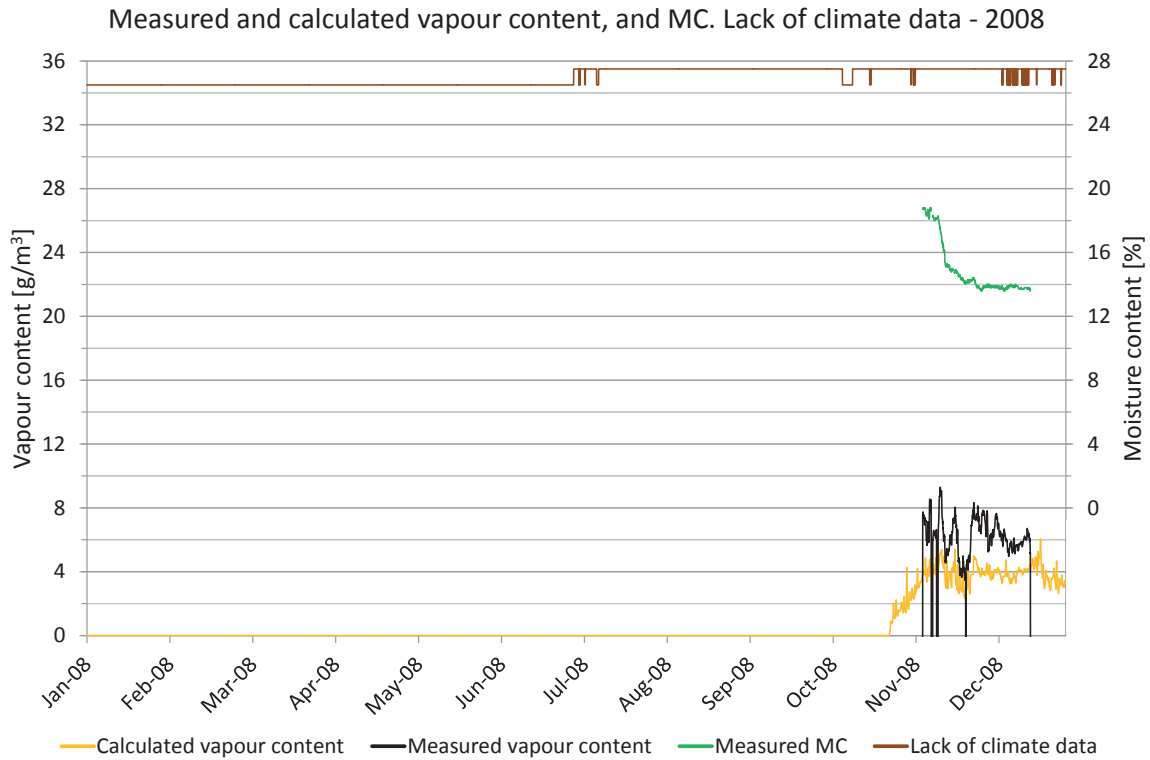


Figure 7.14.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

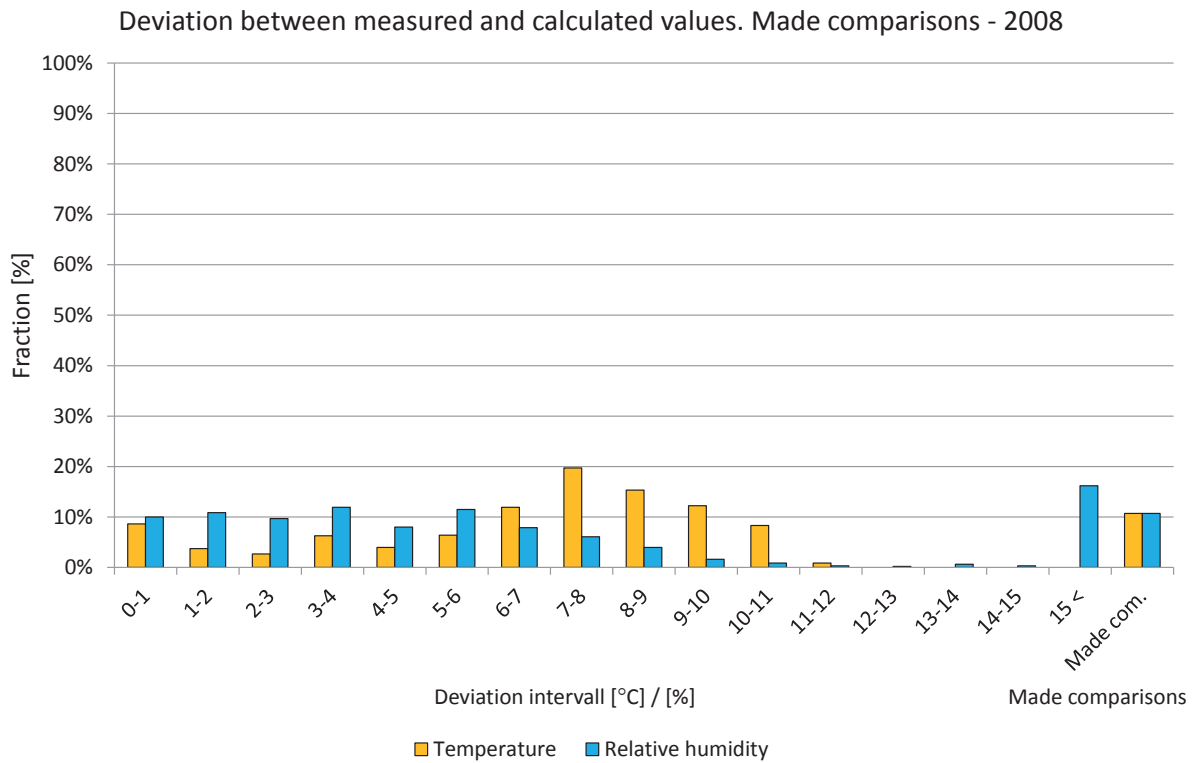


Figure 7.14.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

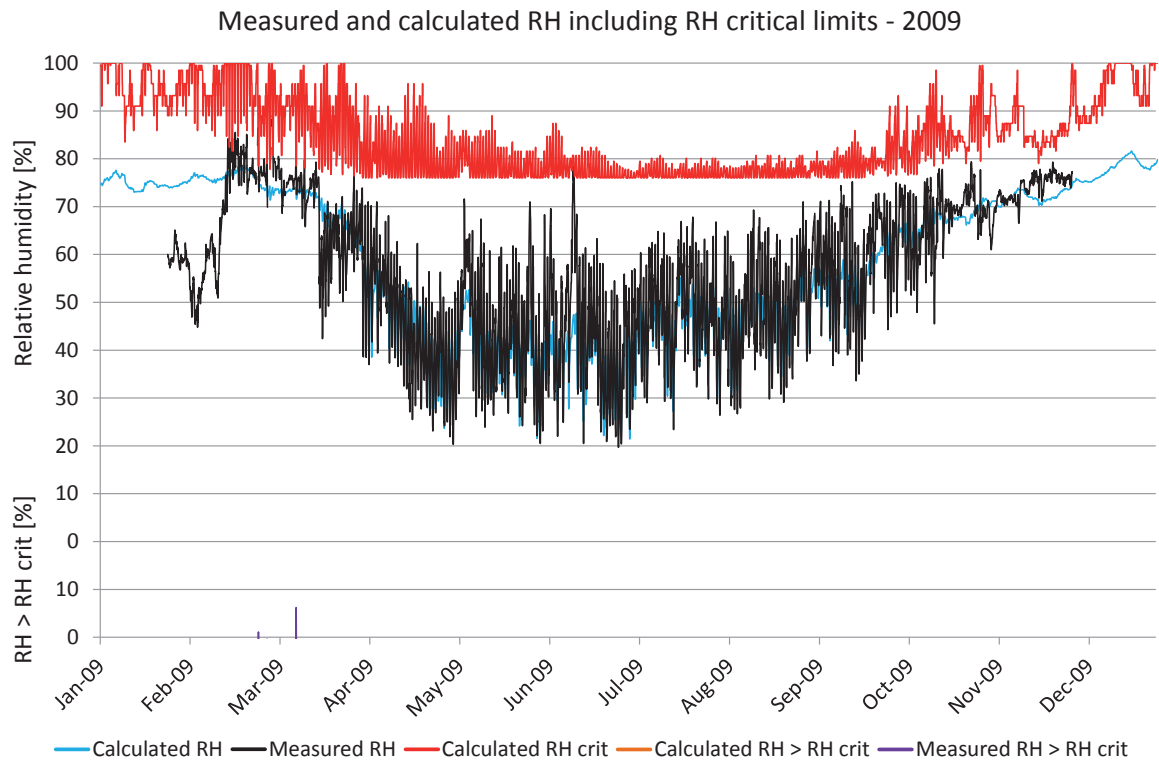


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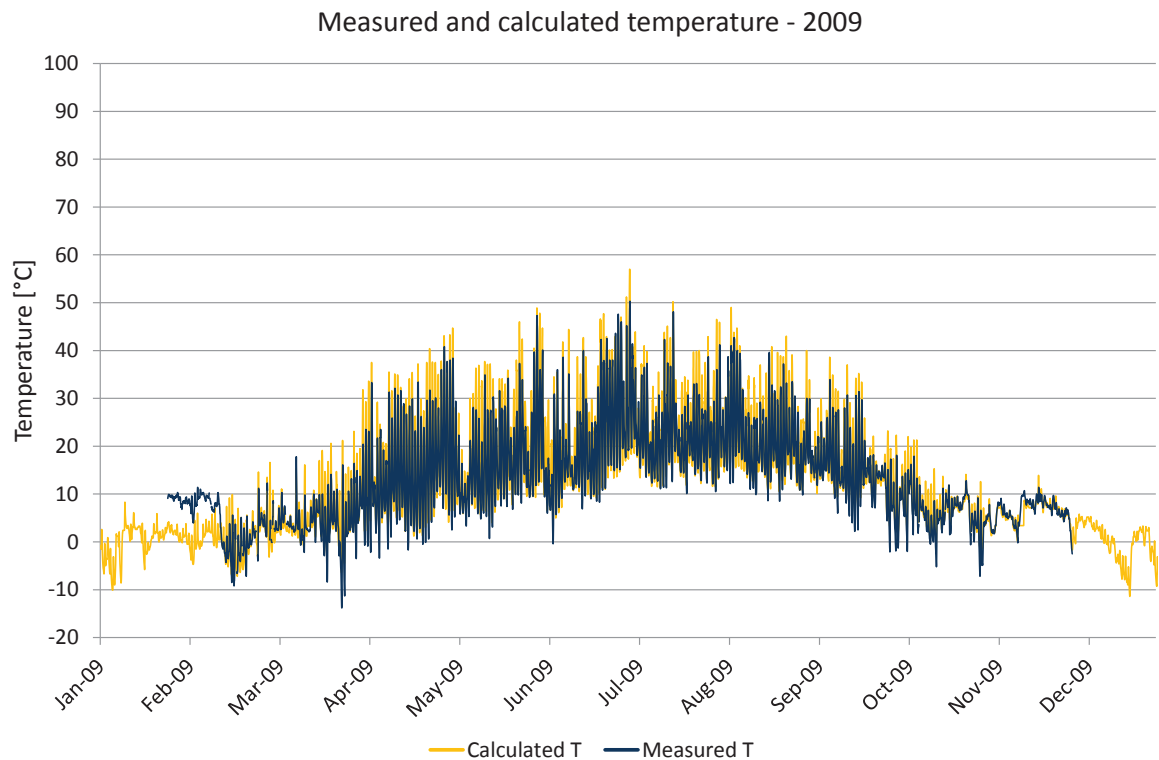


Figure 7.14.10. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

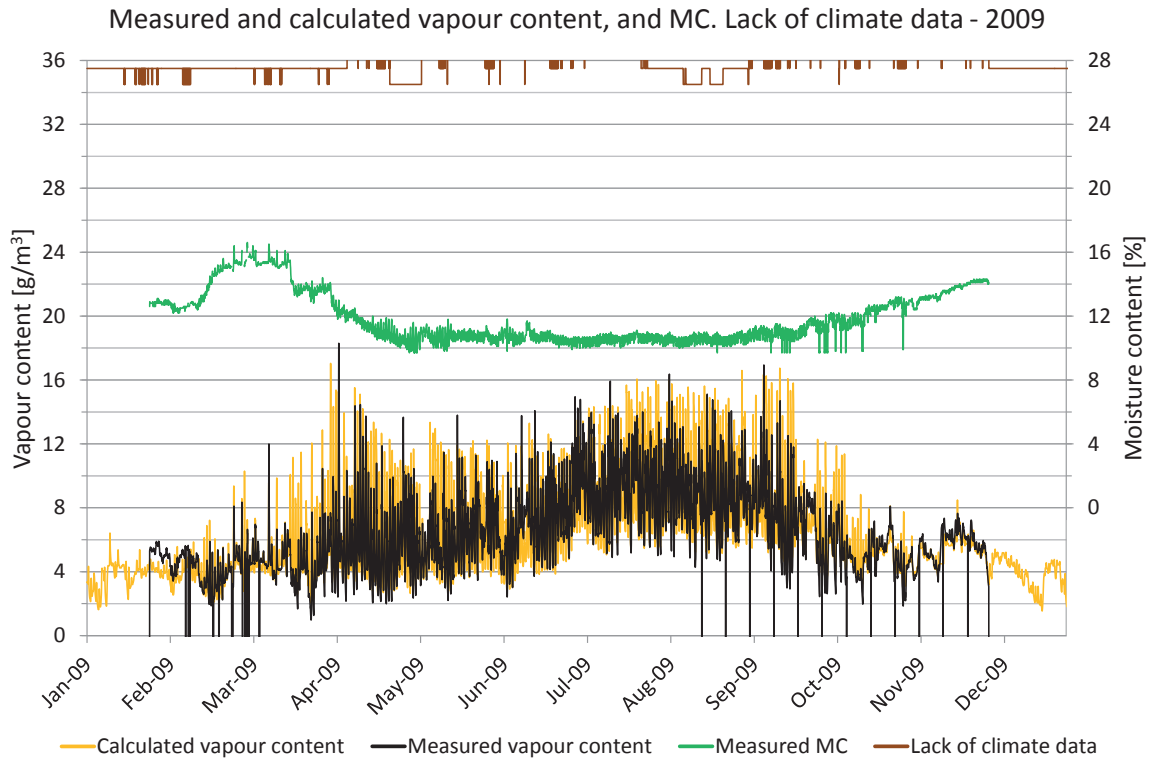


Figure 7.14.11. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

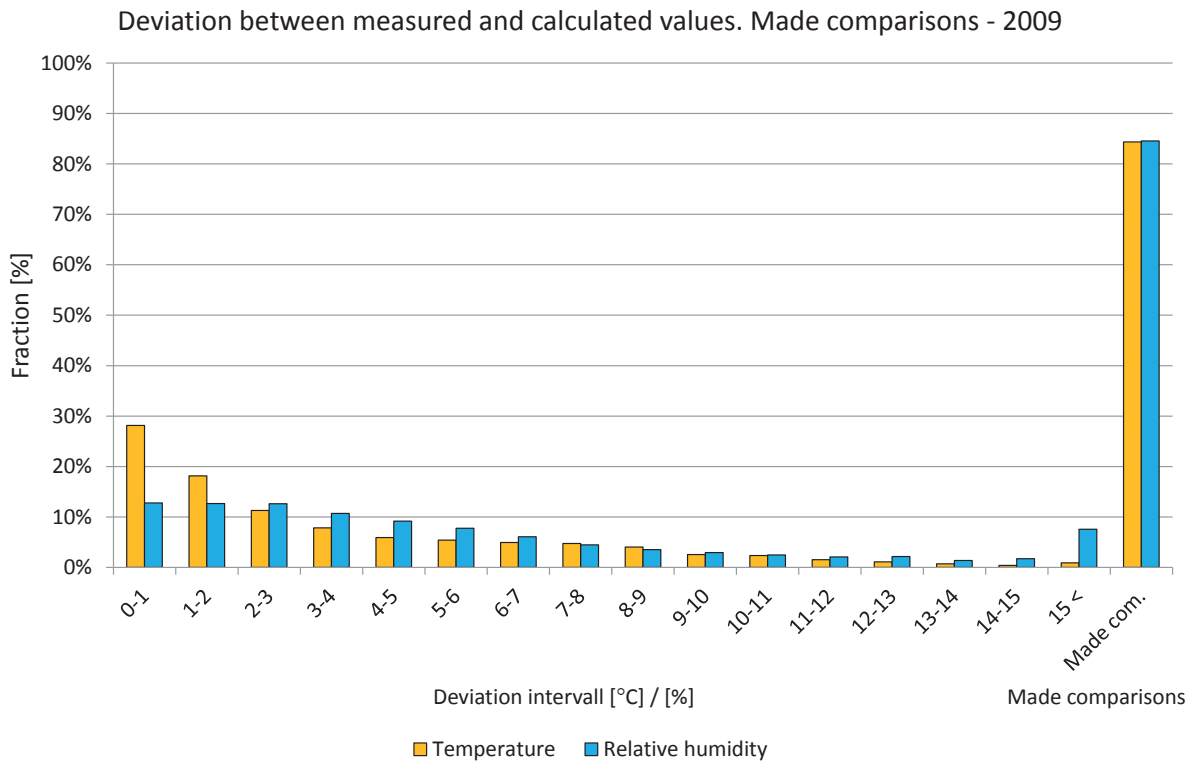


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Year 2010

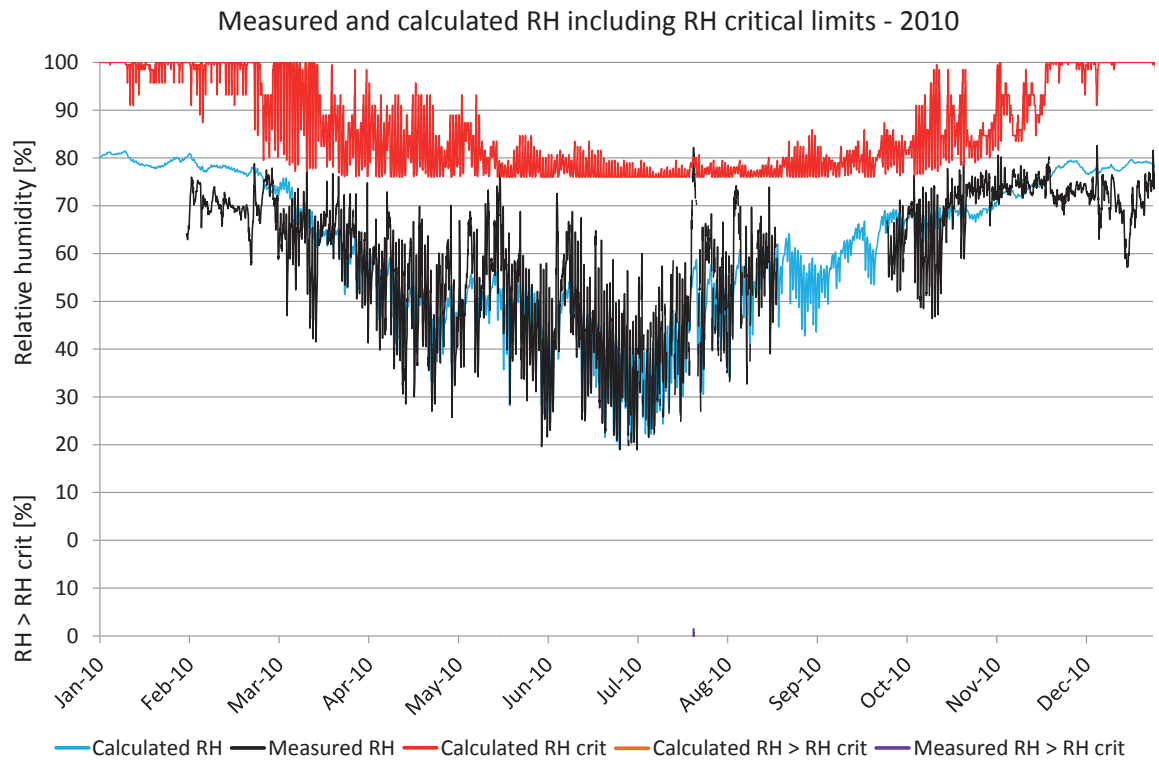


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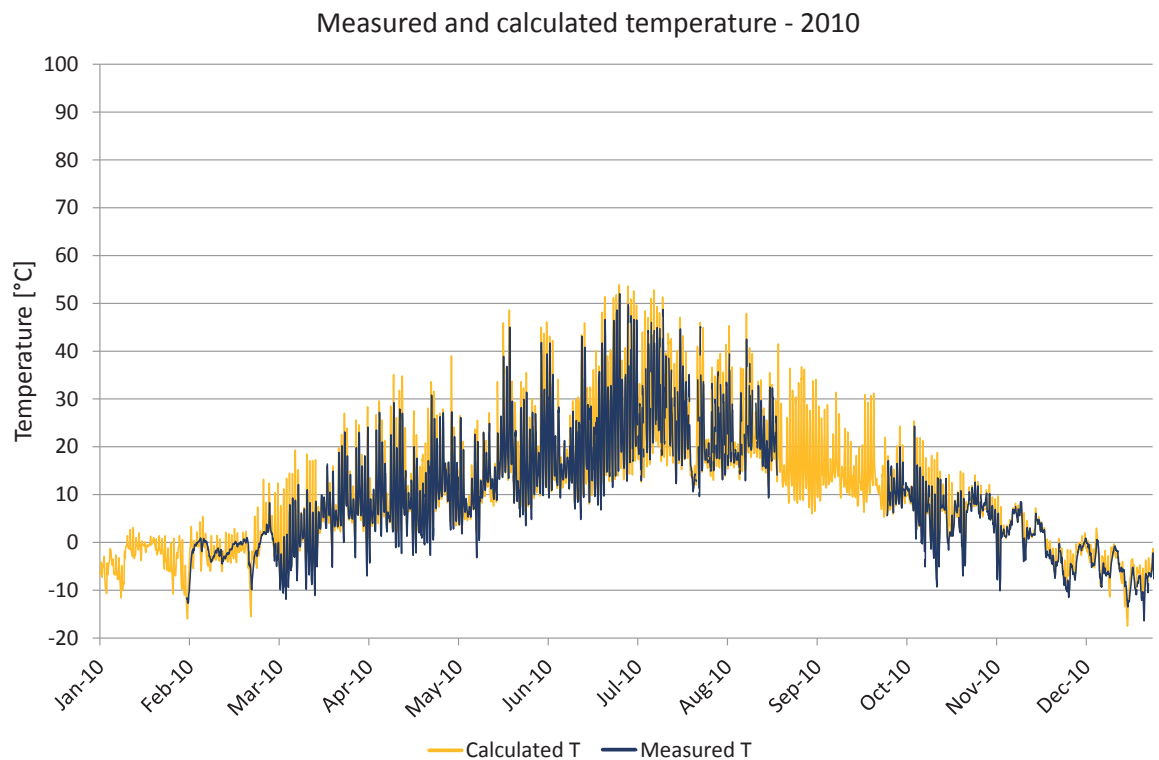


Figure 7.14.14. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

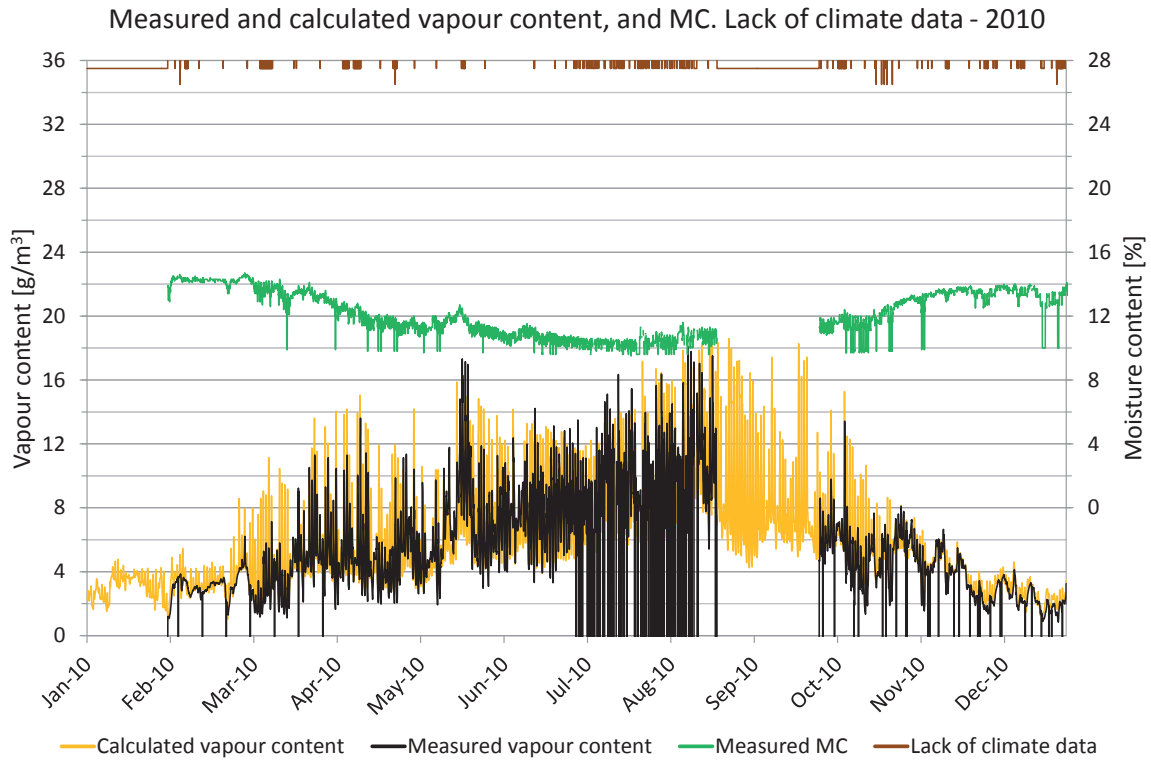


Figure 7.14.15. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

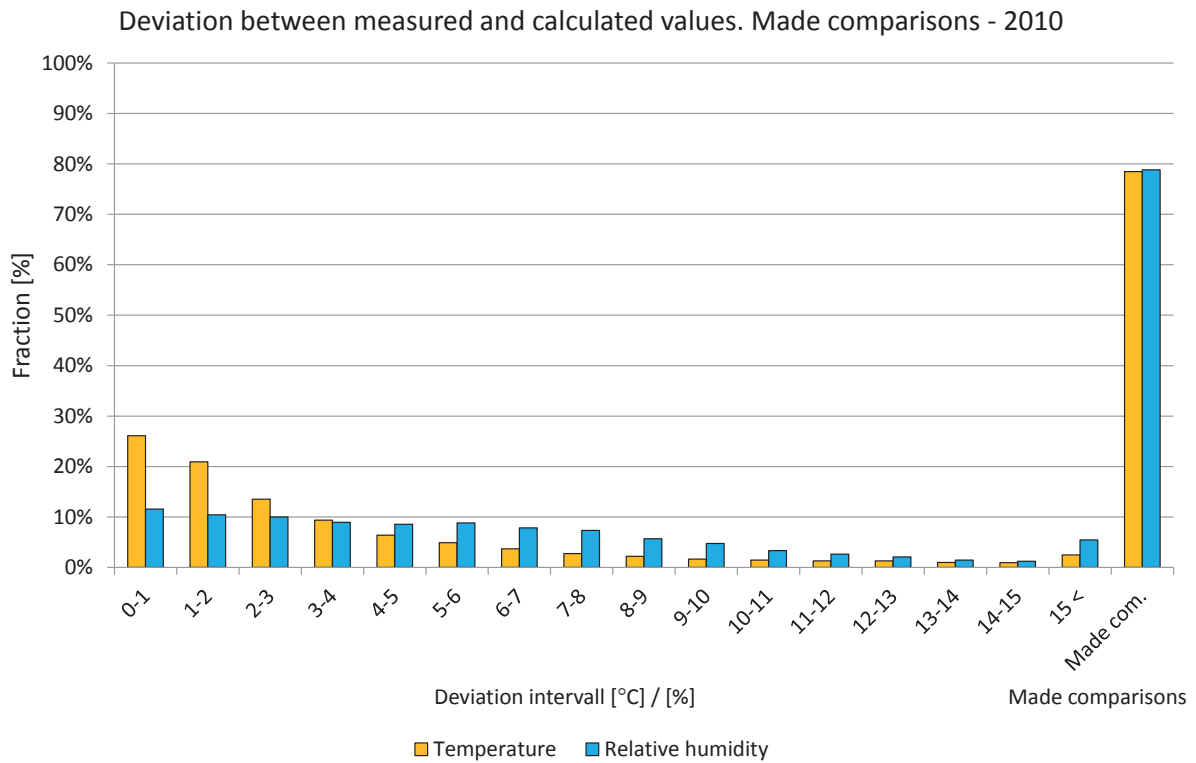


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Year 2011

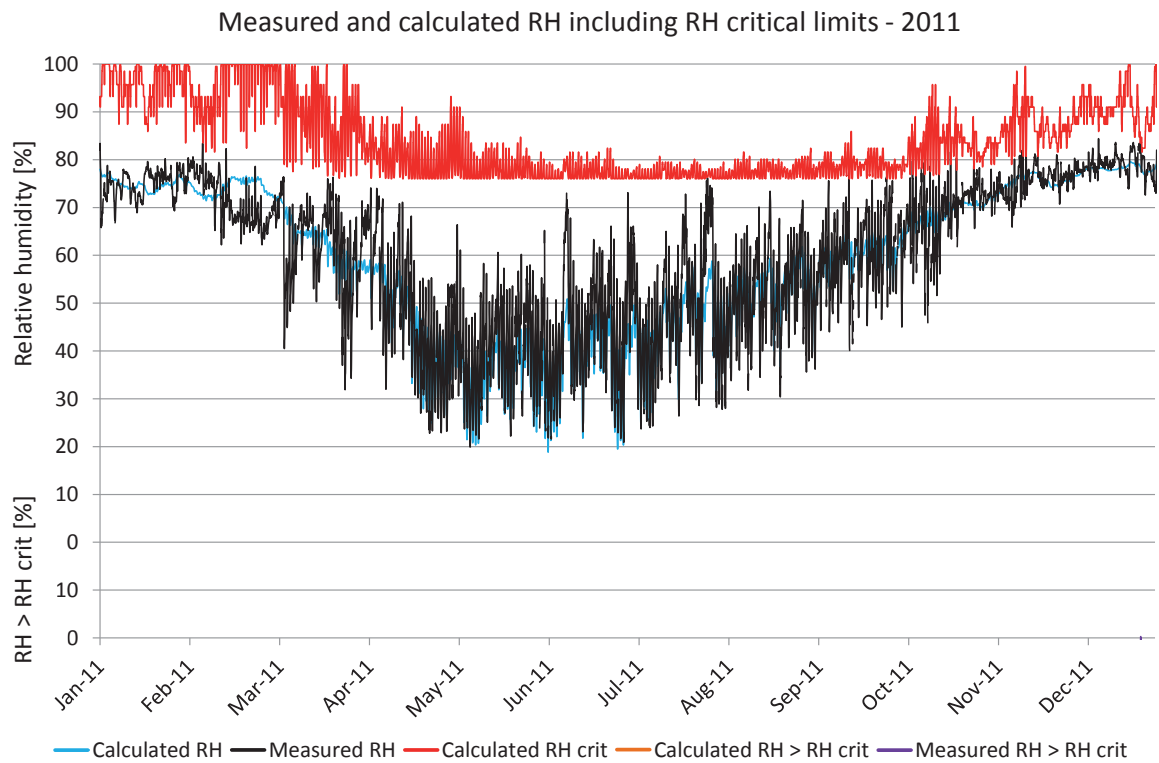


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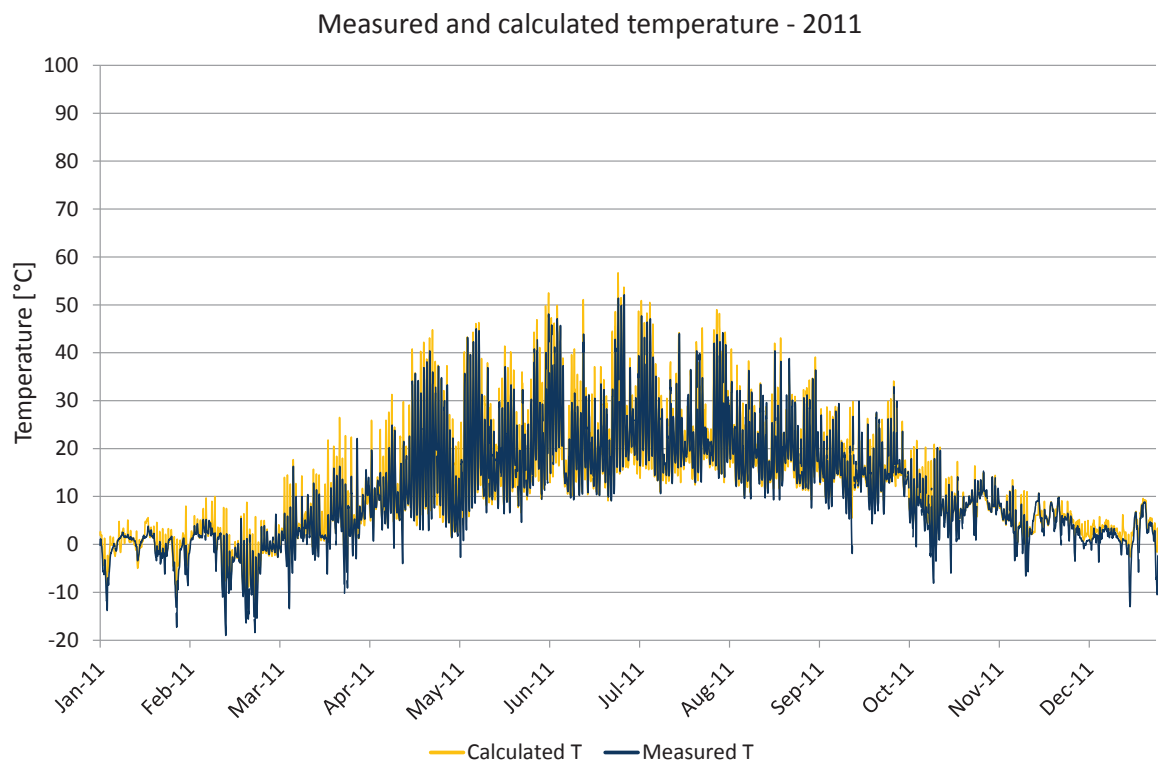


Figure 7.14.18. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

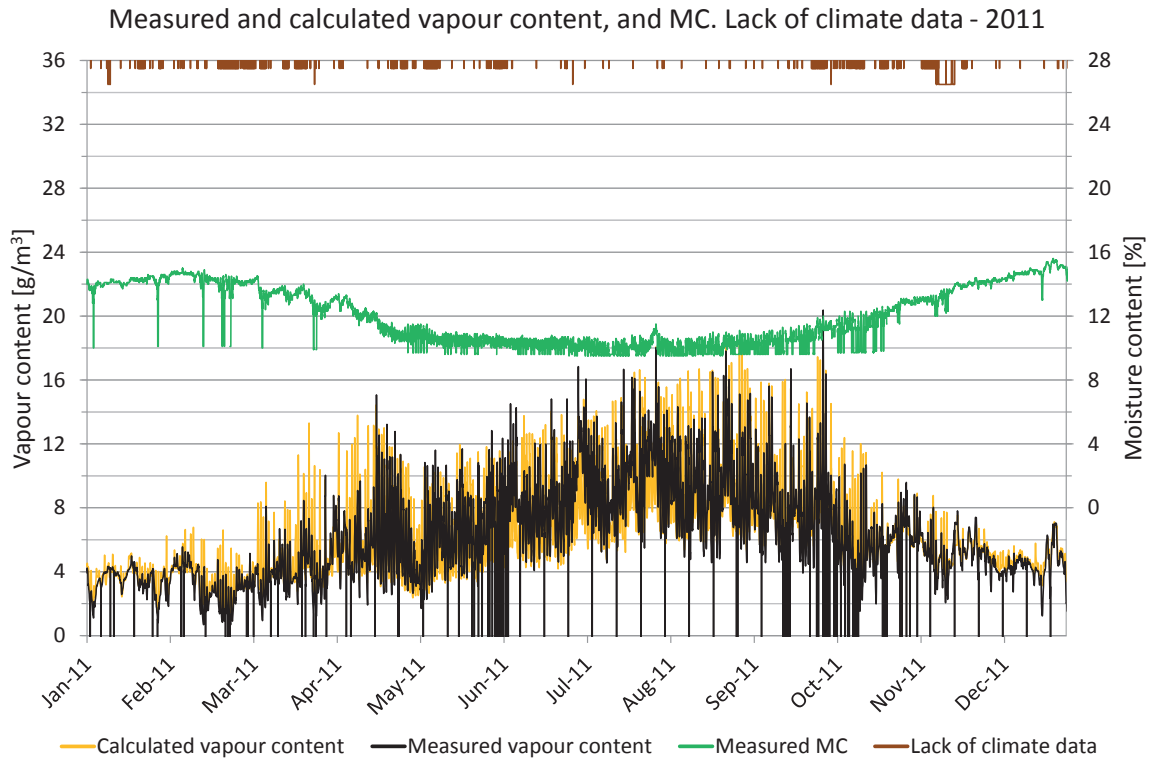


Figure 7.14.19. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

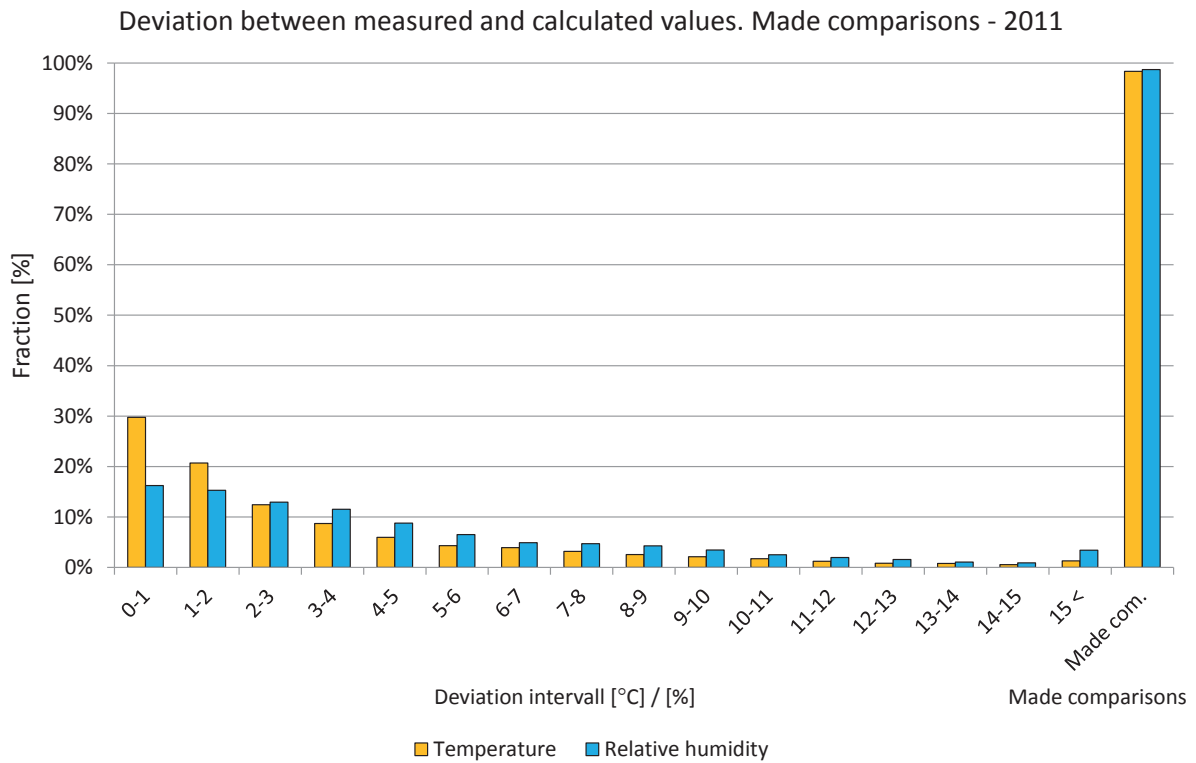


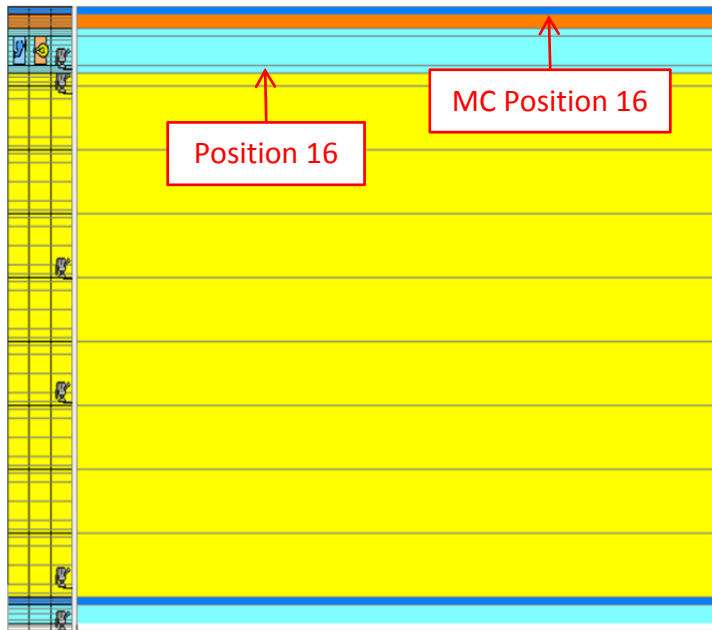
Figure 7.14.20. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.15 Position 15

No measurements and calculations in the position are shown since the measurement sensor was out of order from measurements start.

7.16 Position 16

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof.



Roof, from the outside:

1 mm PVC roof membrane¹, $S_d = 15$ m

22 mm Massive wood - Spruce radial¹,
estimated initial MC 23 %

50 mm Air gap¹ with 30 ACH

20 mm EPS¹

700 mm Mineral insulation, $\lambda = 0,037$
 $W/mK^{3,4}$, including roof beams

1 mm Vapour retarder¹, $S_d = 50$ m

30 mm Air gap¹, no ACH

13 mm Gypsum board²

Figure 7.16.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

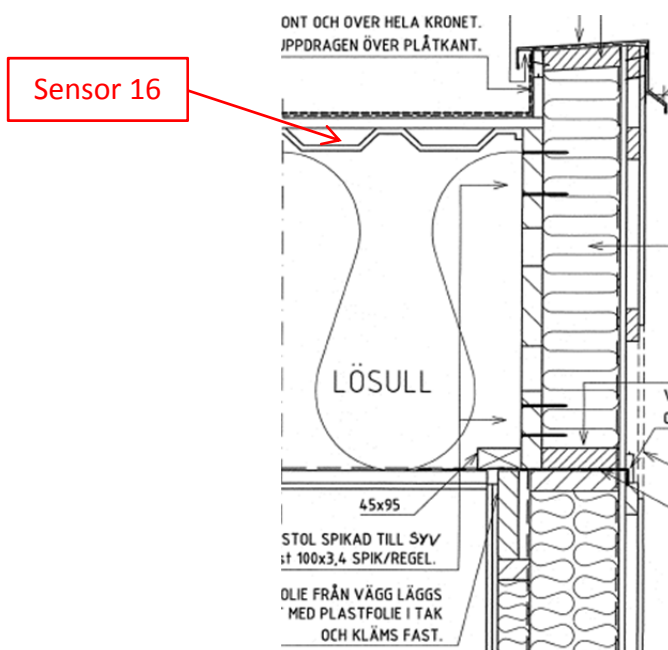


Figure 7.16.2. Location of the studied position.

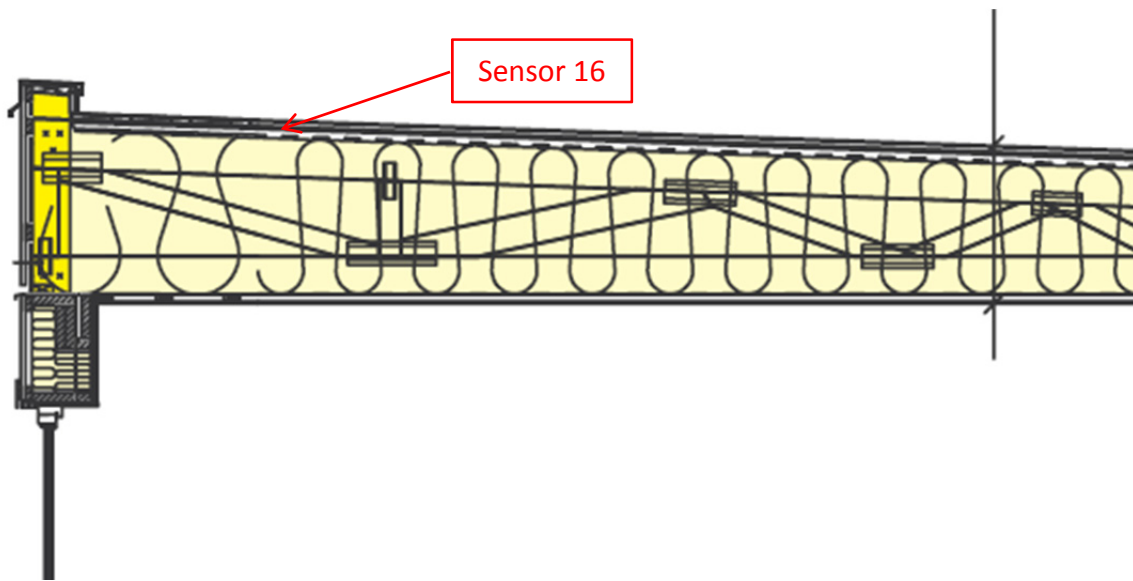


Figure 7.16.3. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

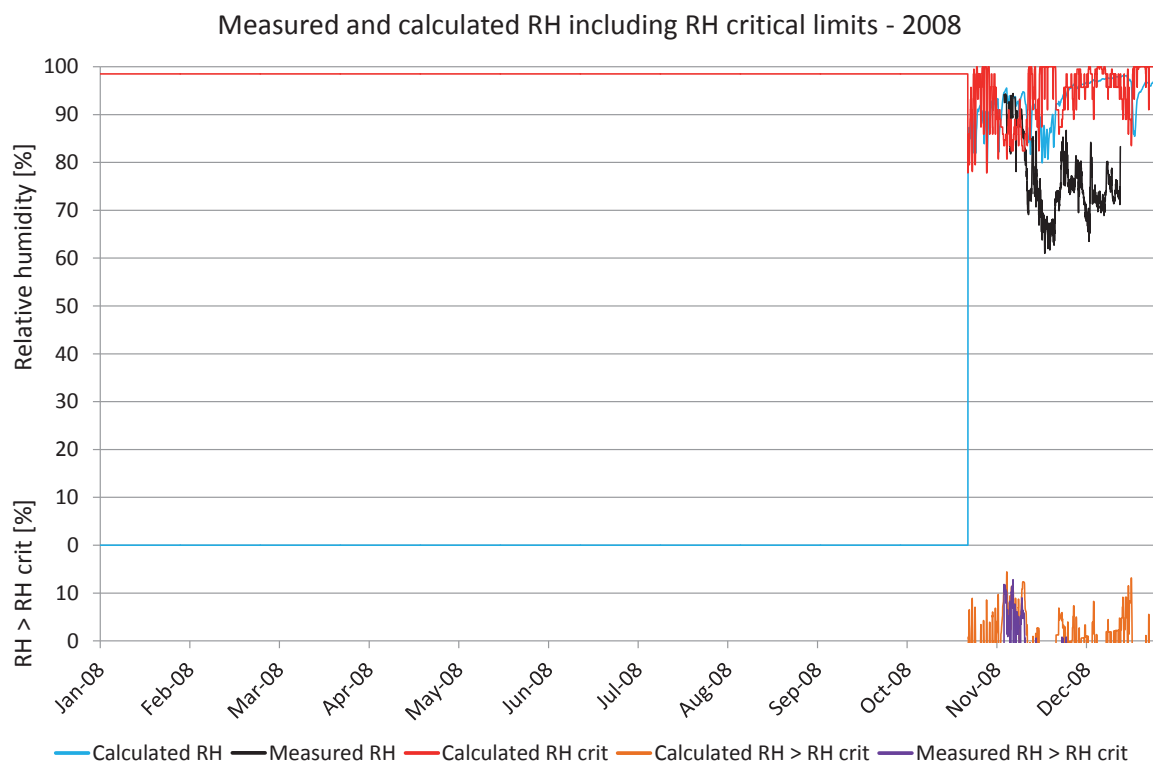


Figure 7.16.4. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

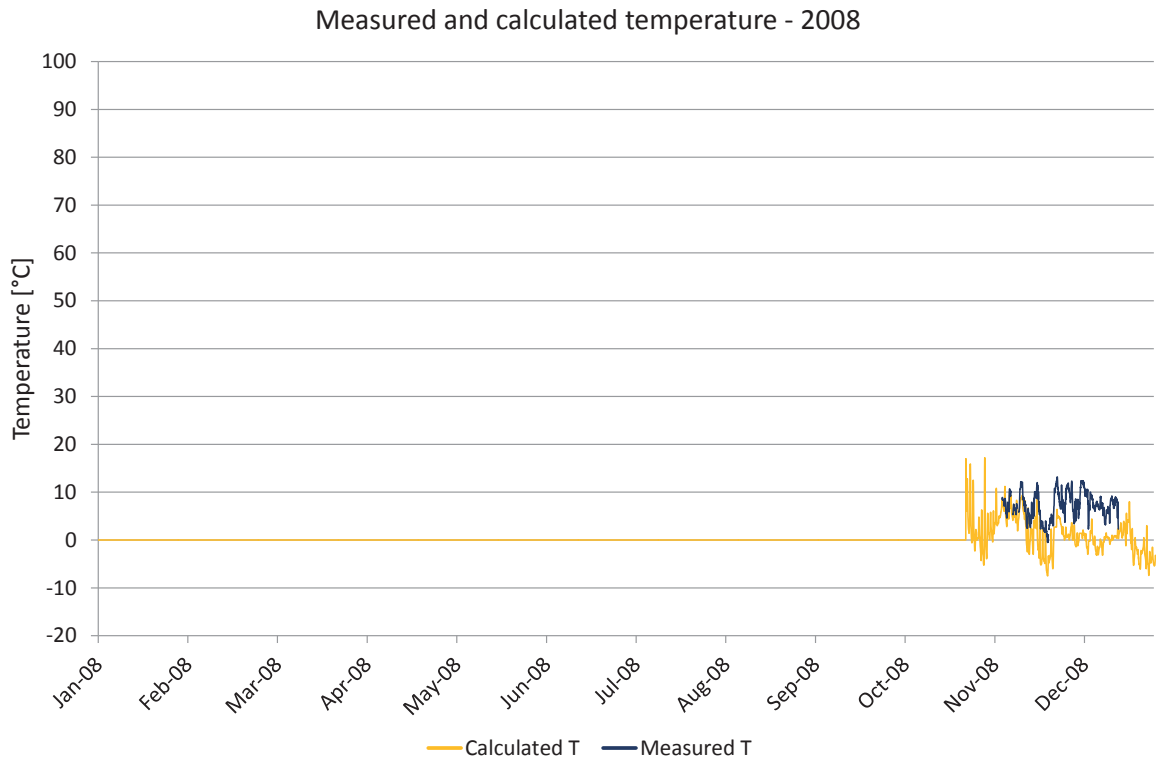


Figure 7.16.5. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

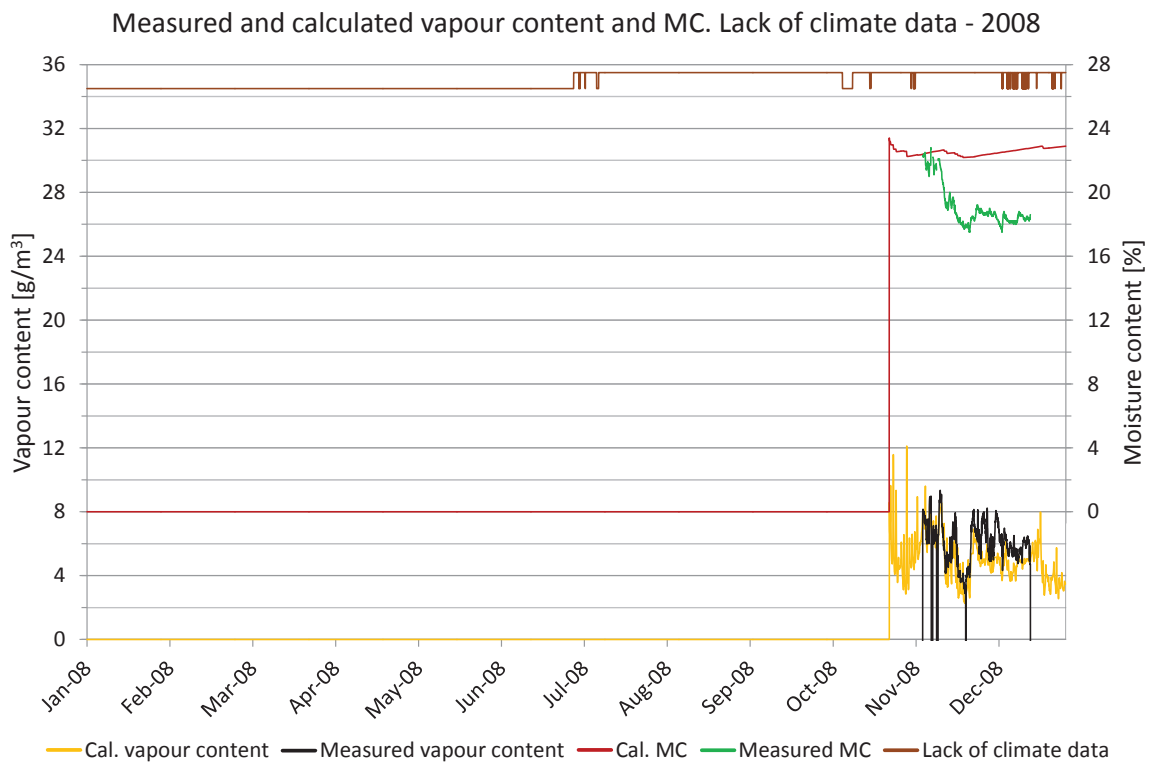


Figure 7.16.6. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

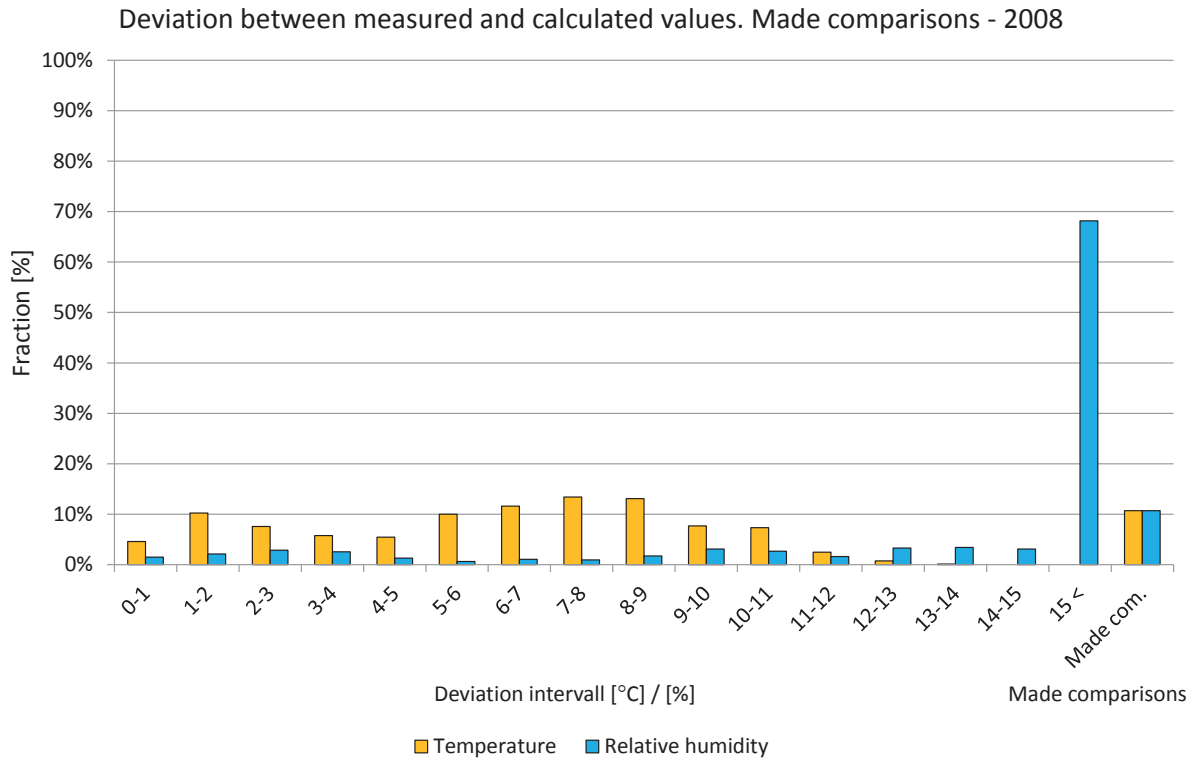


Figure 7.16.7. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

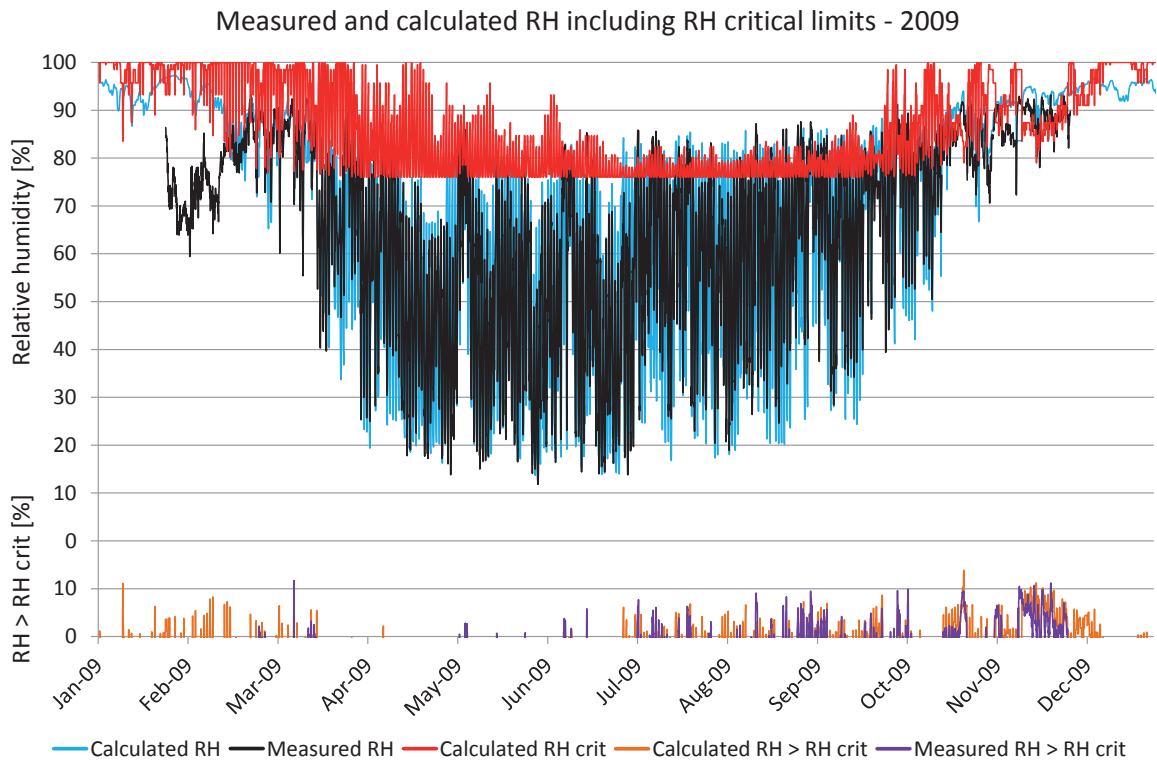


Figure 7.16.8. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

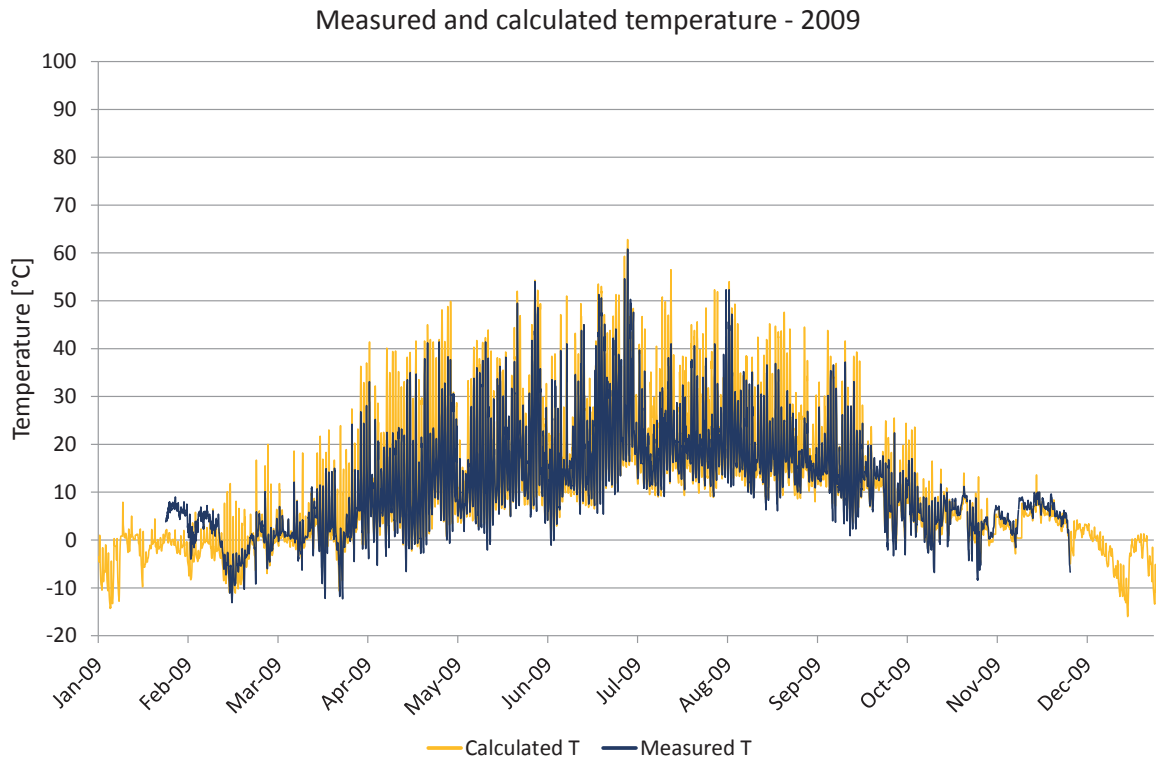


Figure 7.16.9. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

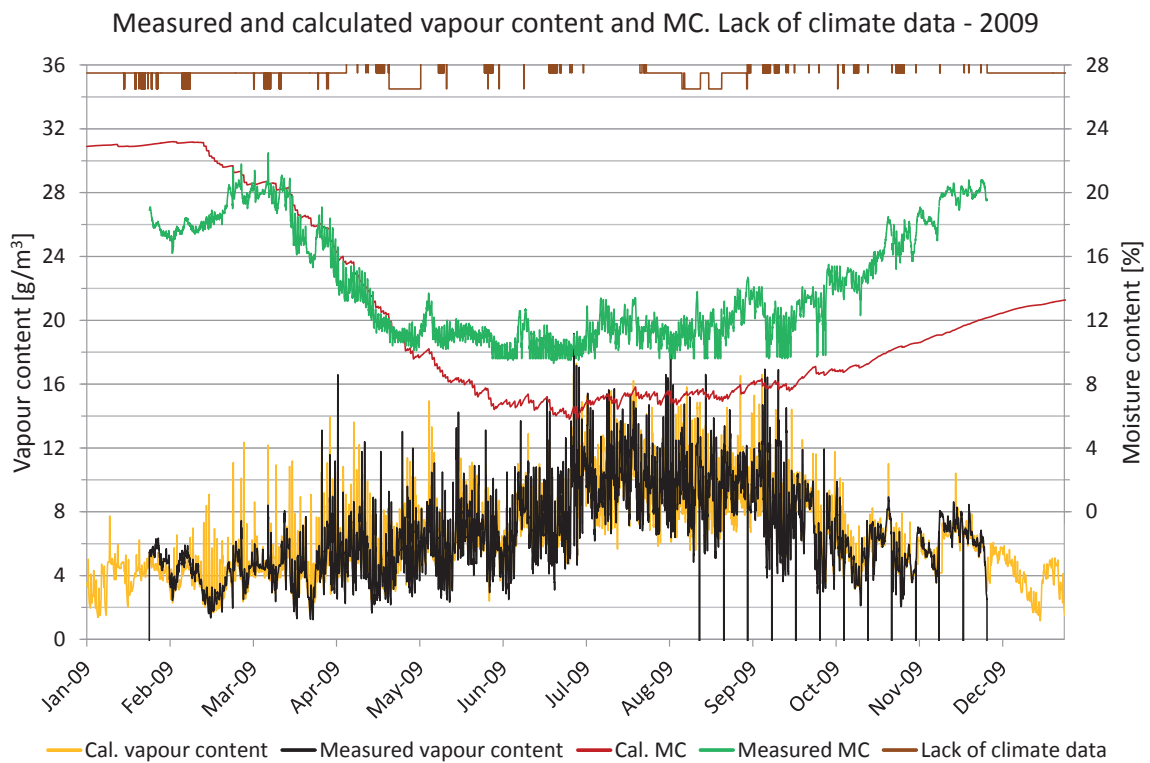


Figure 7.16.10. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

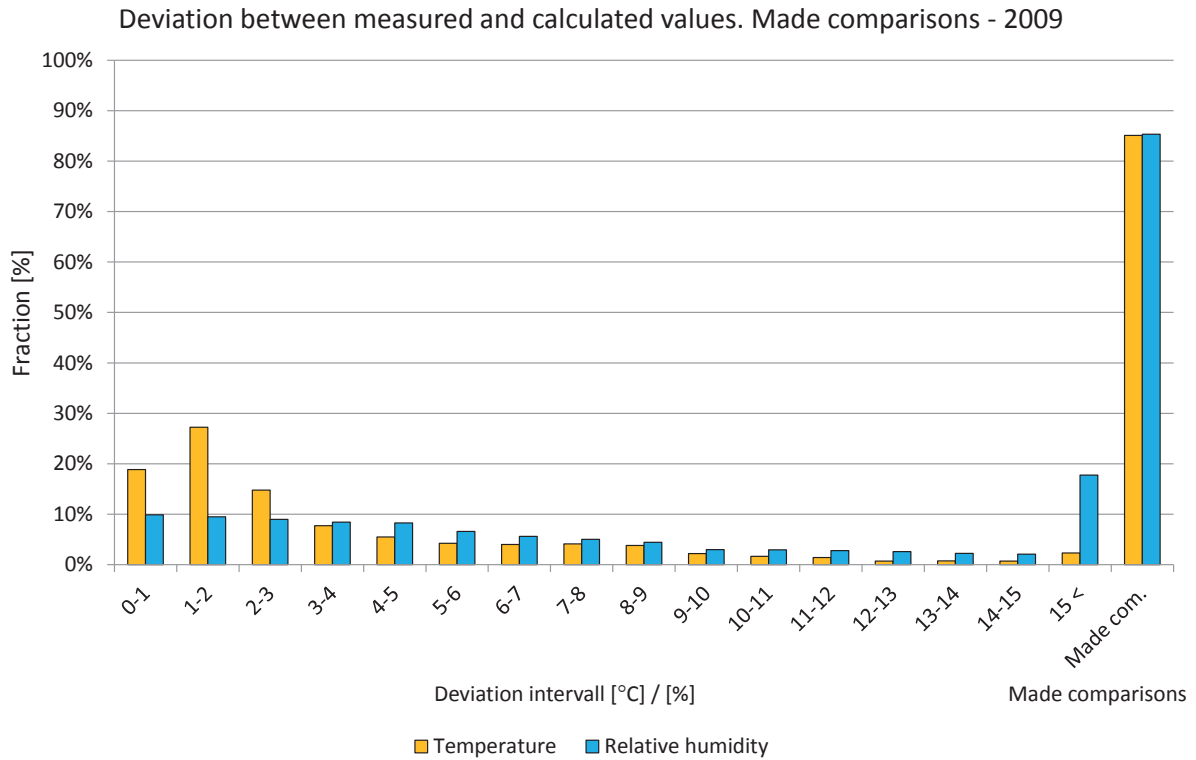


Figure 7.16.11. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

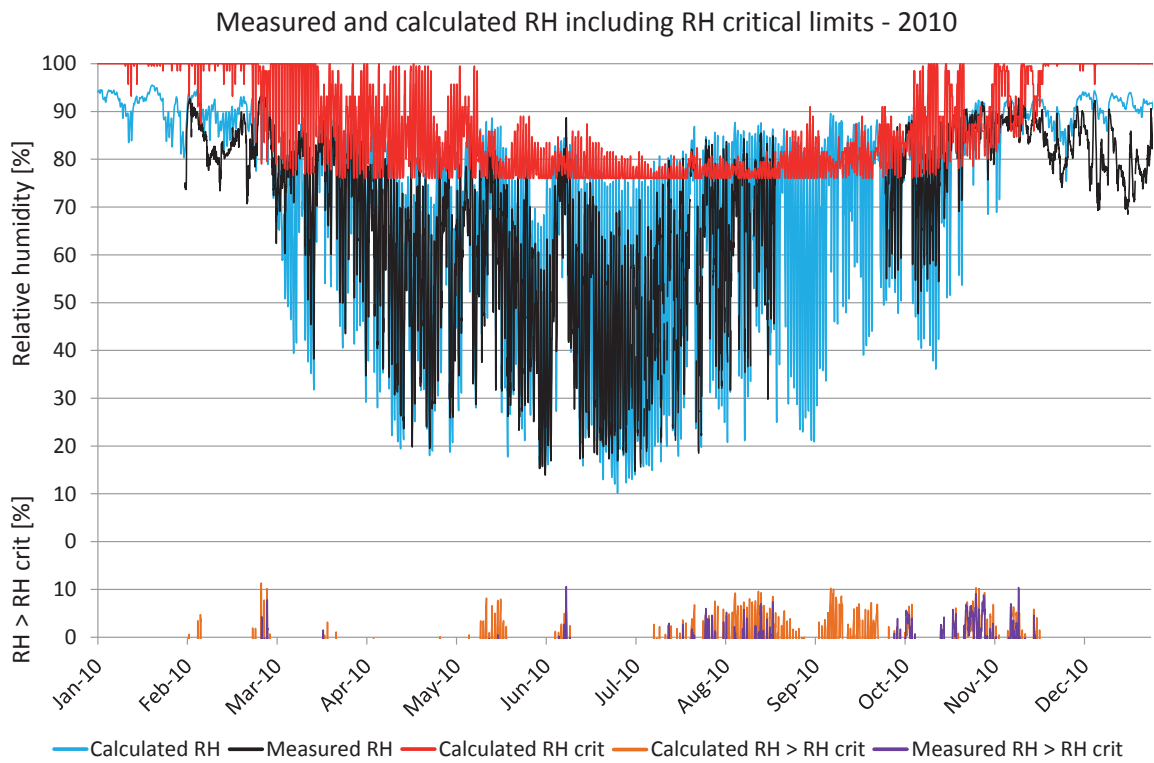


Figure 7.16.12. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

Measured and calculated temperature - 2010

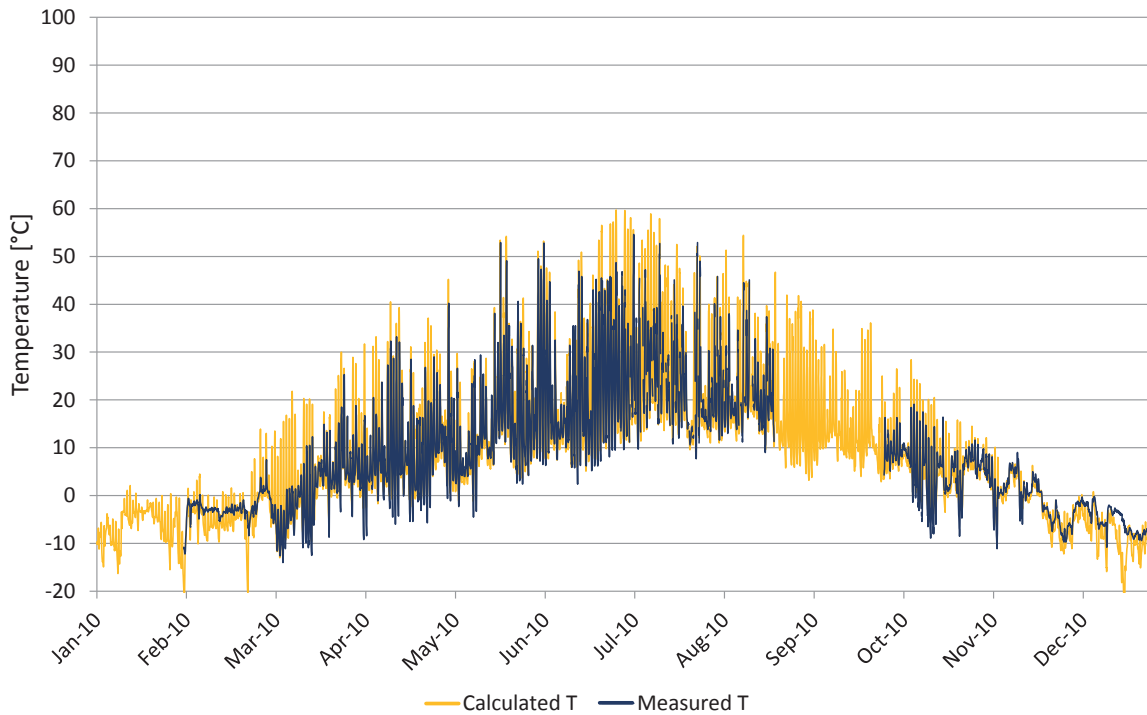


Figure 7.16.13. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

Measured and calculated vapour content and MC. Lack of climate data - 2010

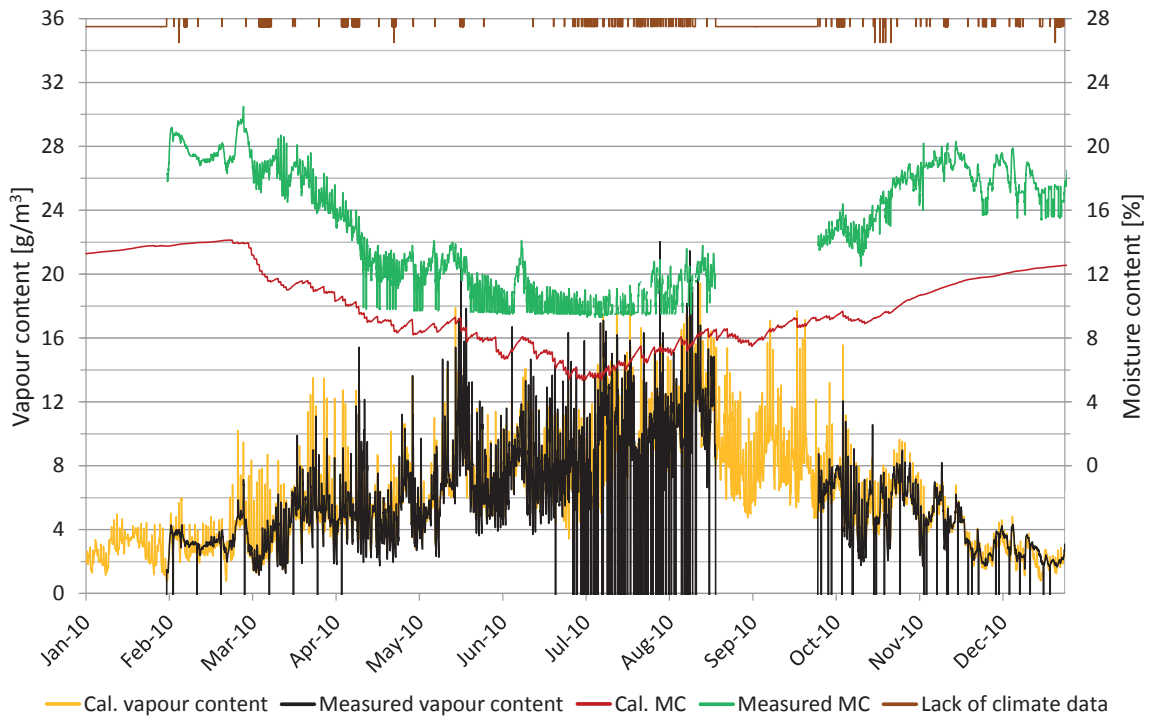


Figure 7.16.14. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

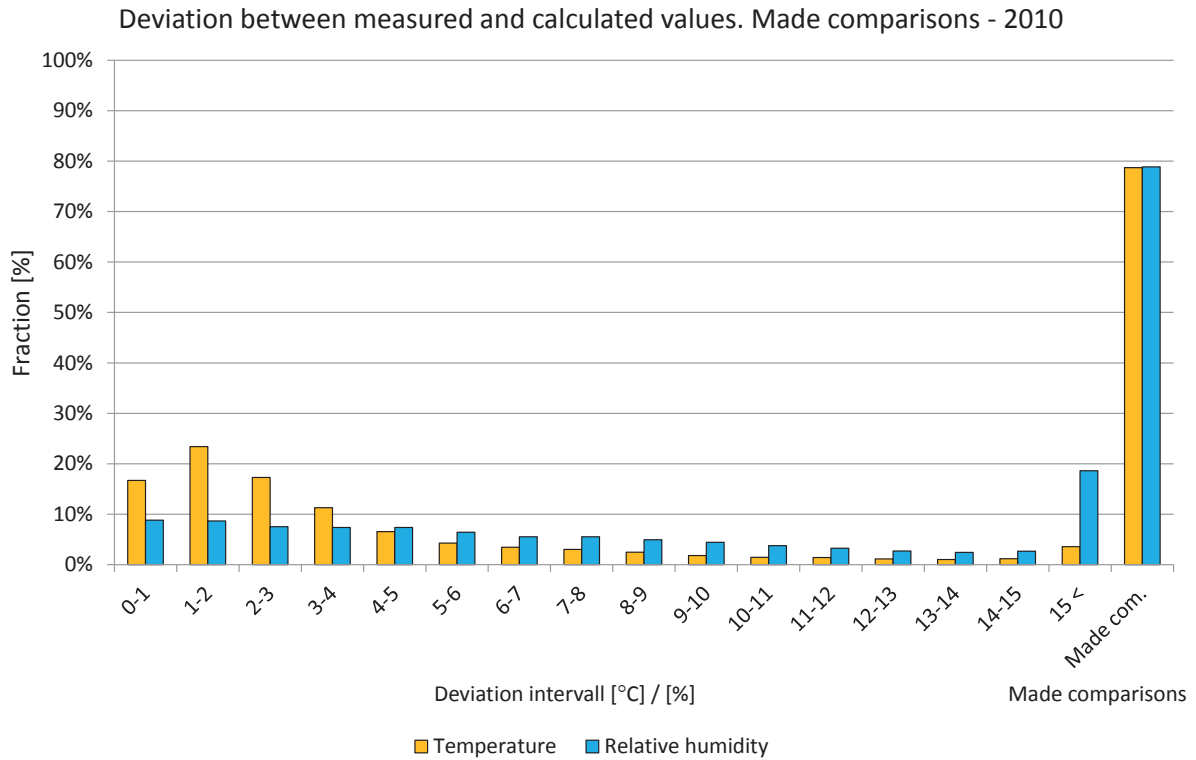


Figure 7.16.15. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

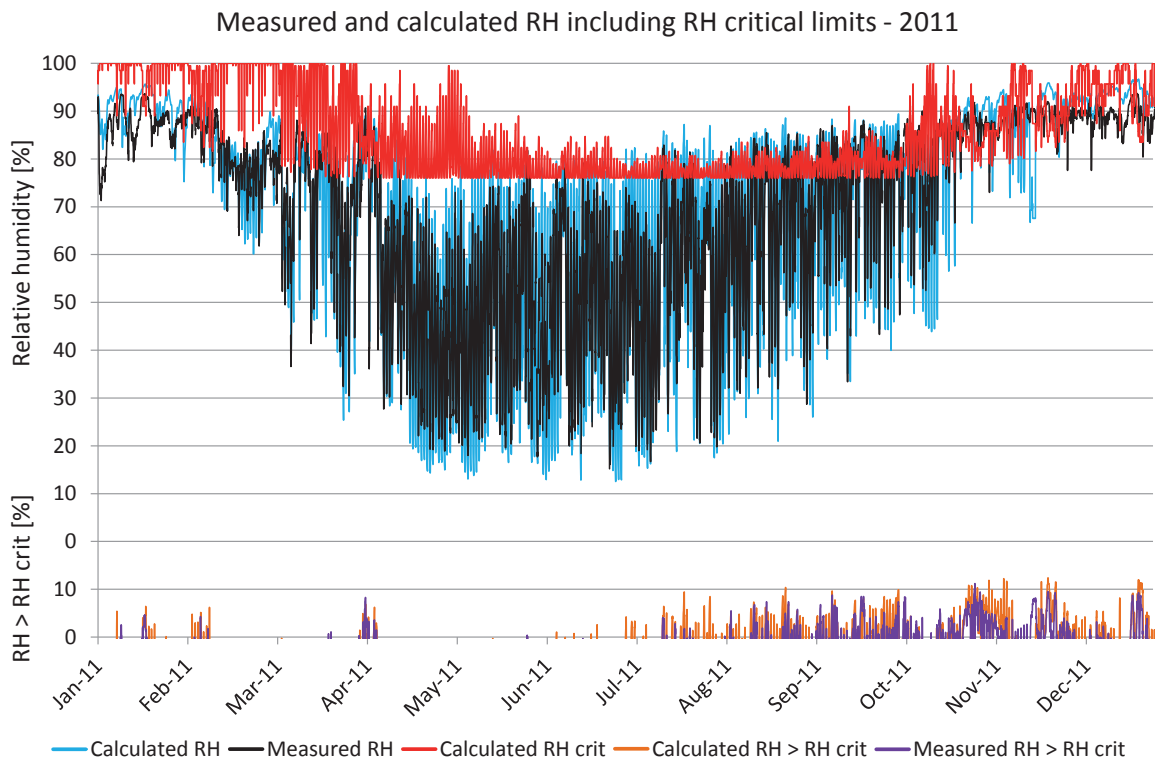


Figure 7.16.16. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

Measured and calculated temperature - 2011

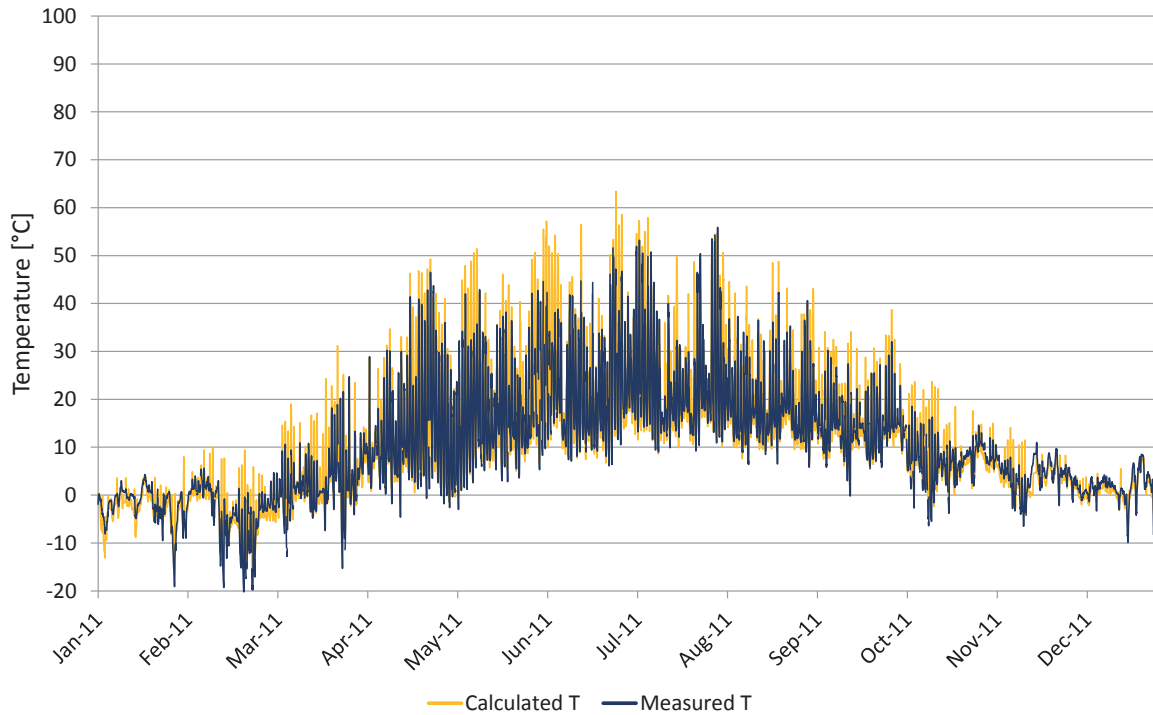


Figure 7.16.17. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

Measured and calculated vapour content and MC. Lack of climate data - 2011

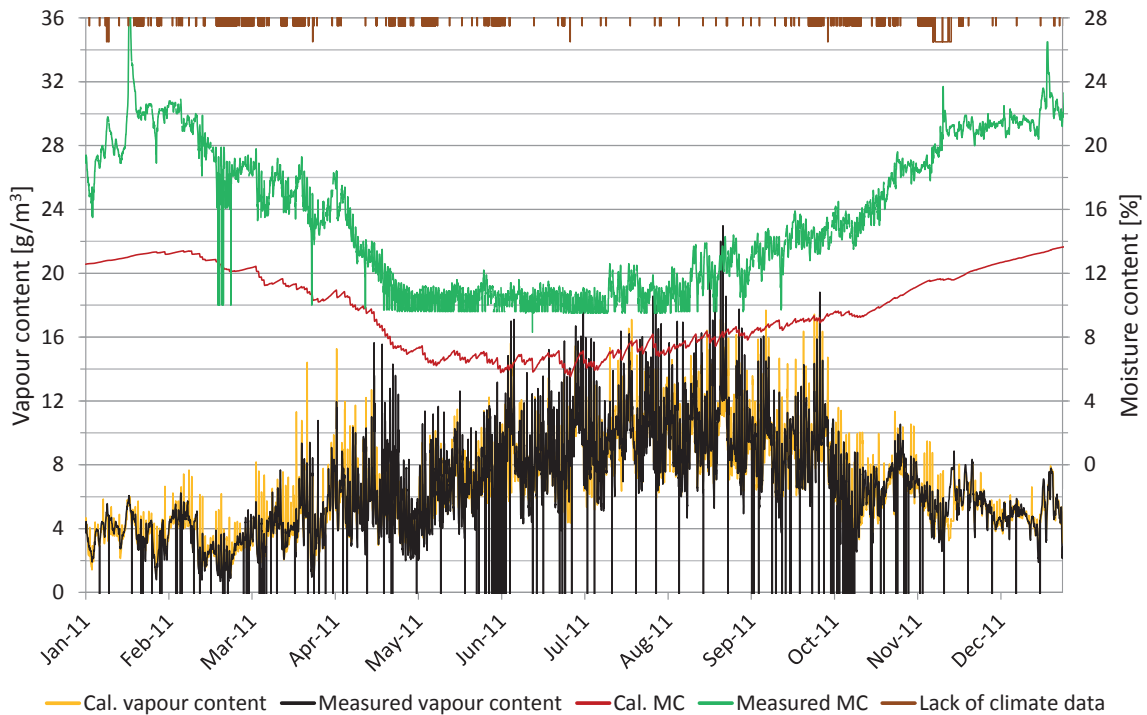


Figure 7.16.18. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

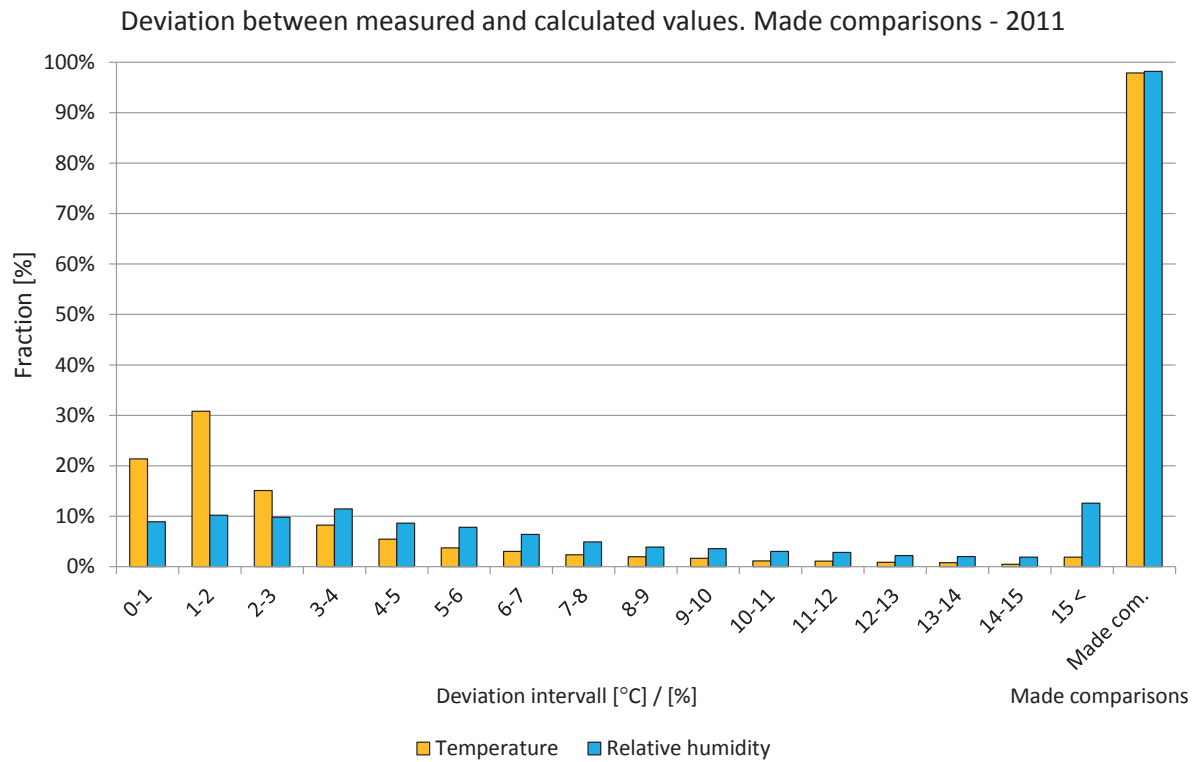


Figure 7.16.19. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.17 Position 17

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof. Unfortunately there was a complete lack of measured data during 2011. This means that only calculated data is shown for 2011 and no charts presenting deviations between measured and calculated values are presented.

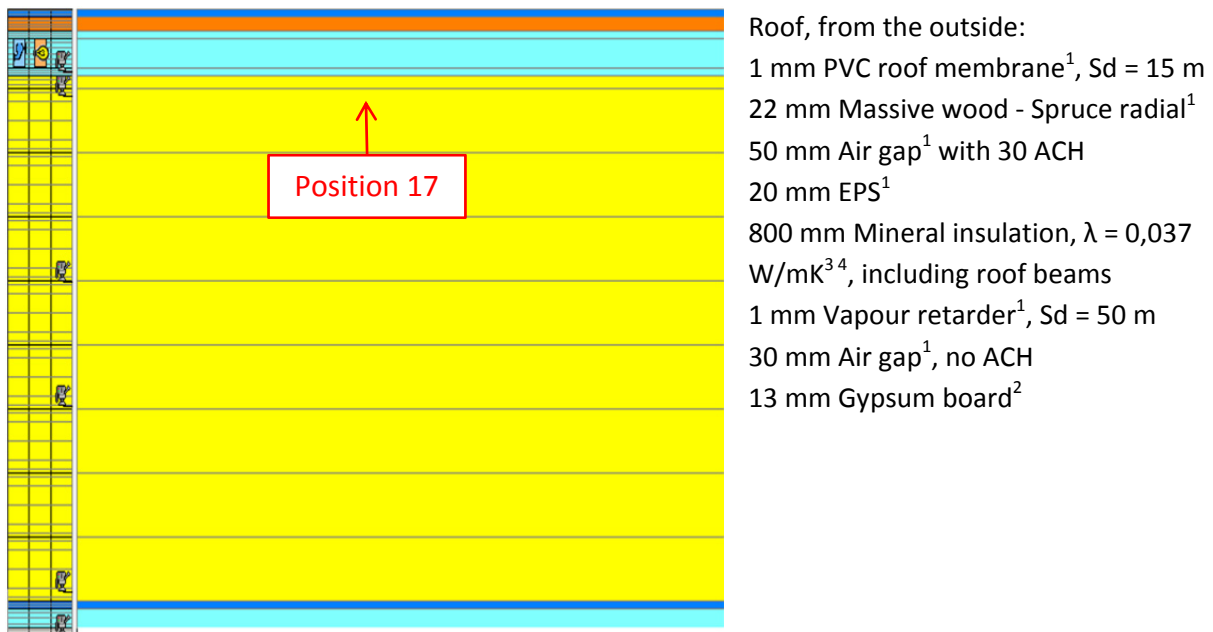


Figure 7.17.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

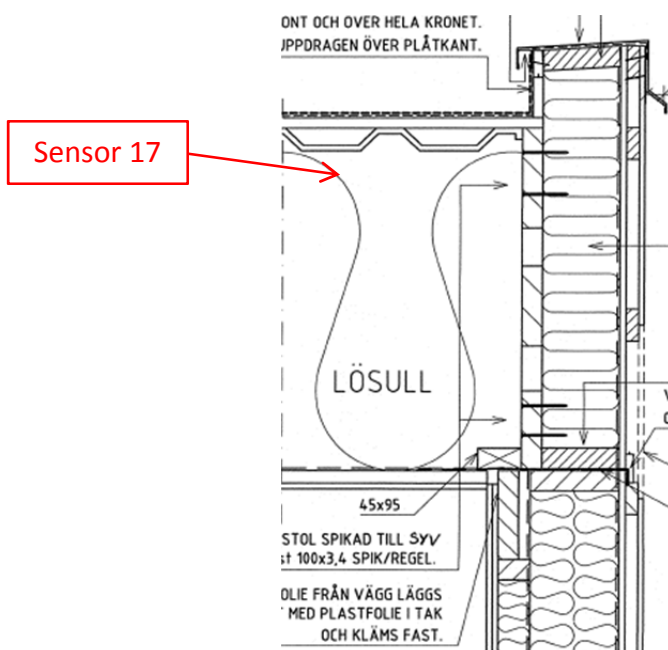


Figure 7.17.2. Location of the studied position.

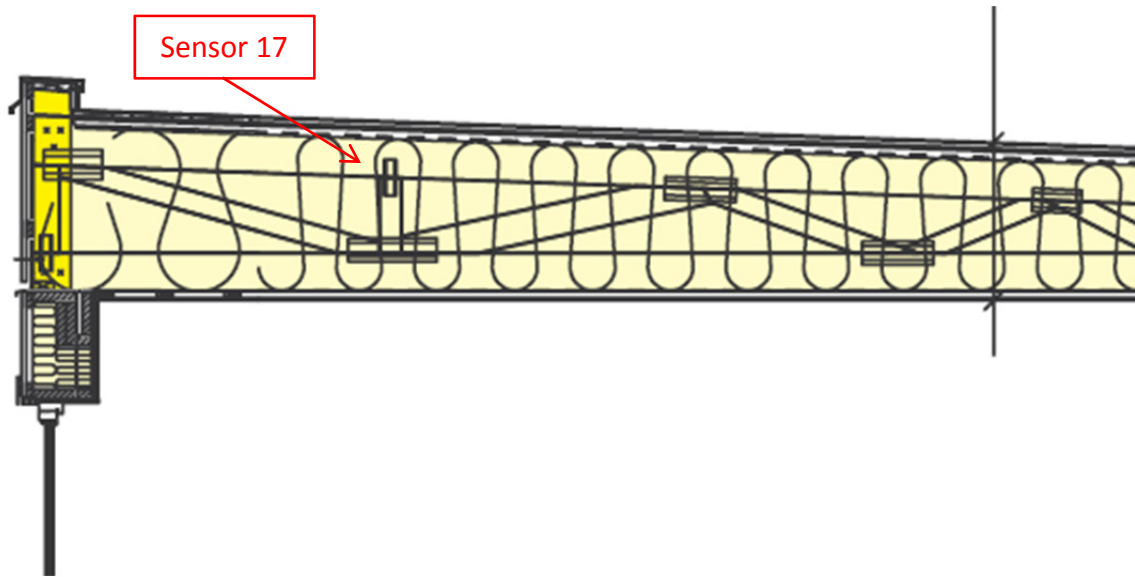


Figure 7.17.3. Location of the studied position.

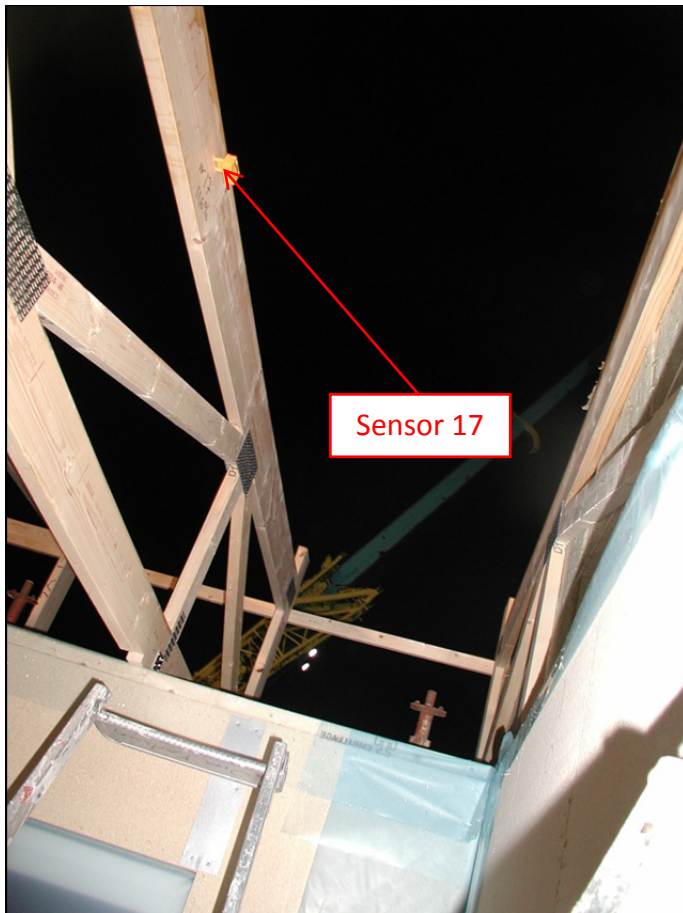


Figure 7.17.4. Location of the studied position.

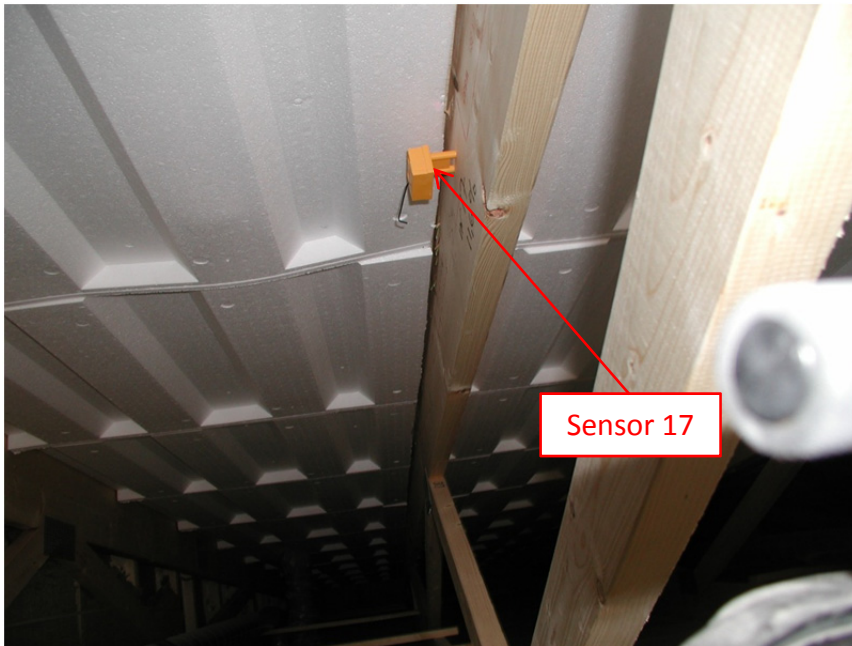


Figure 7.17.5. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

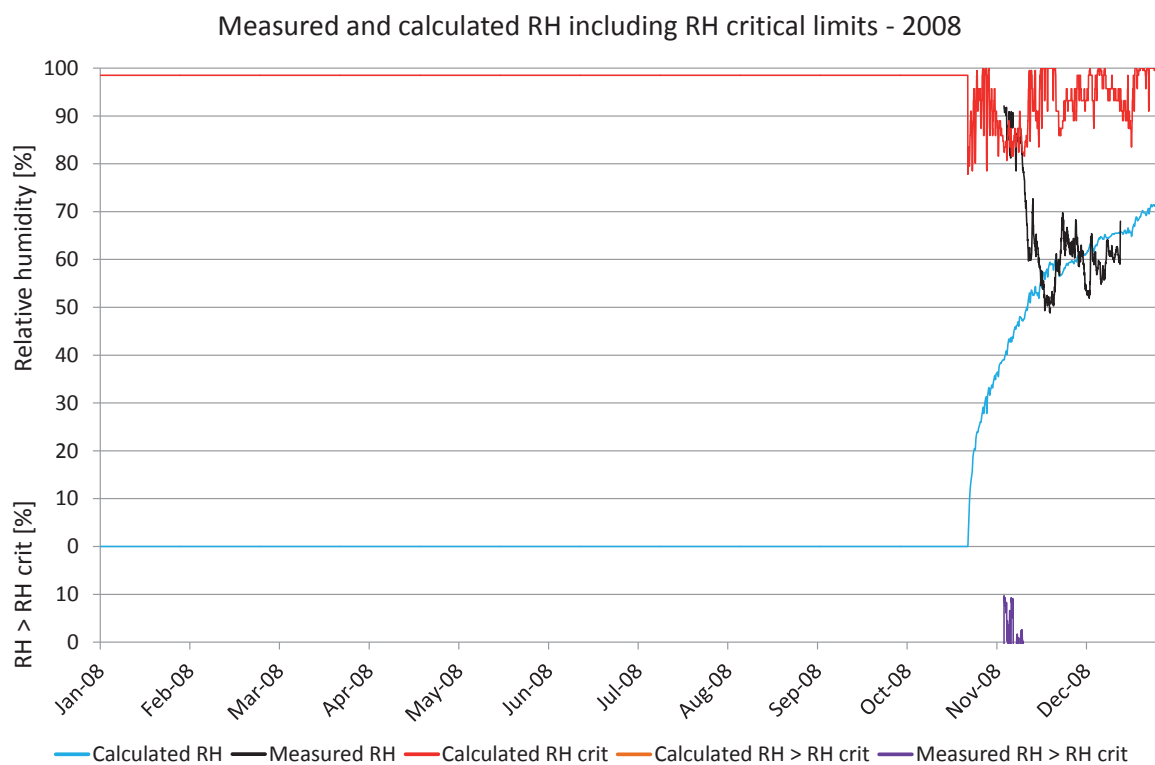


Figure 7.17.6. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

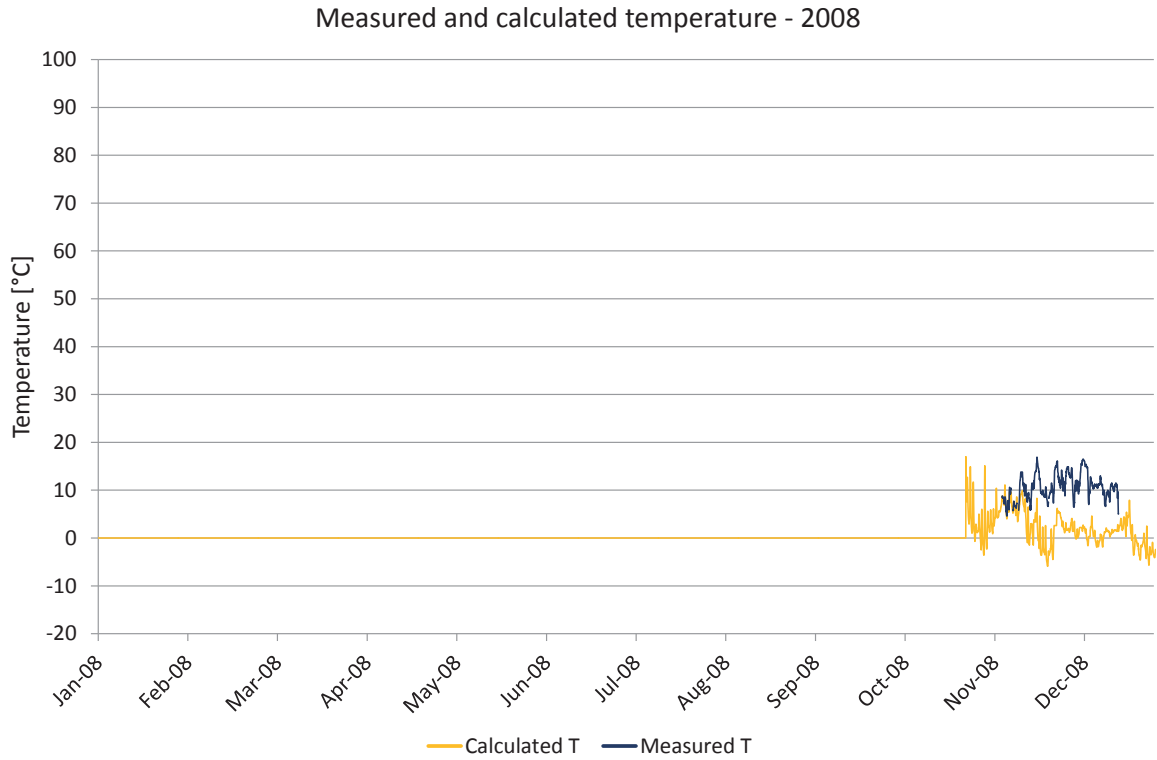


Figure 7.17.7. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

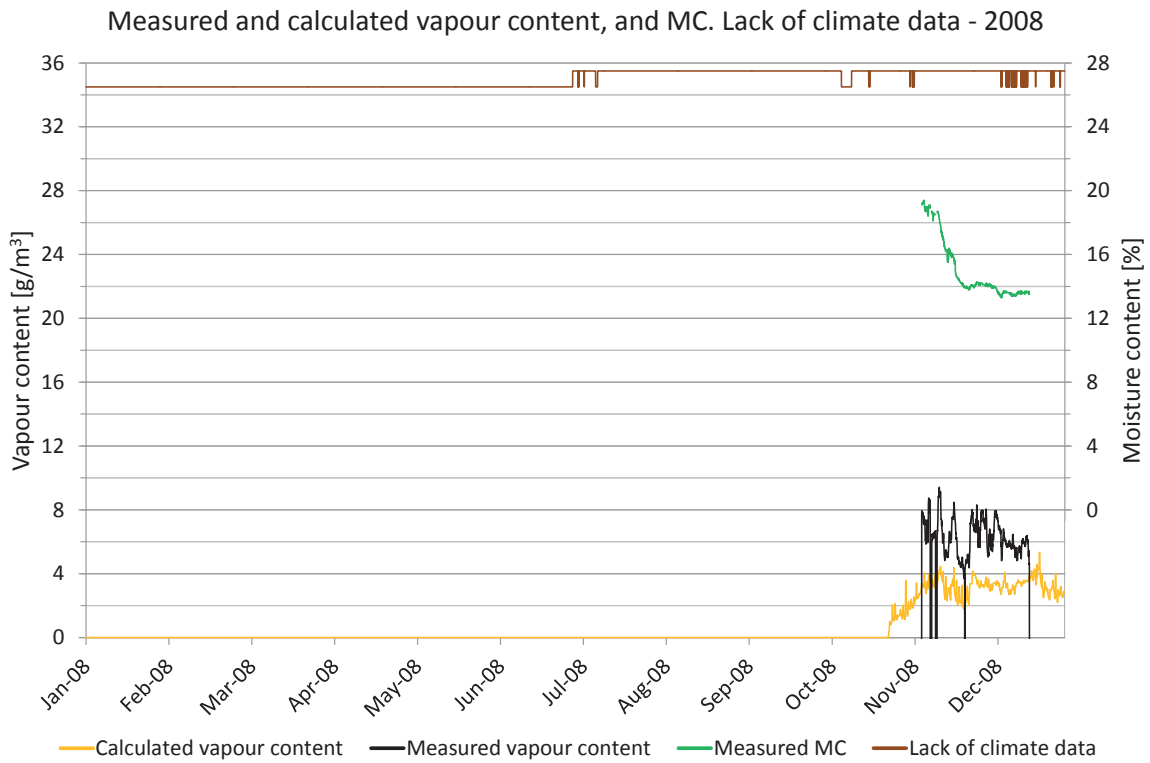


Figure 7.17.8. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

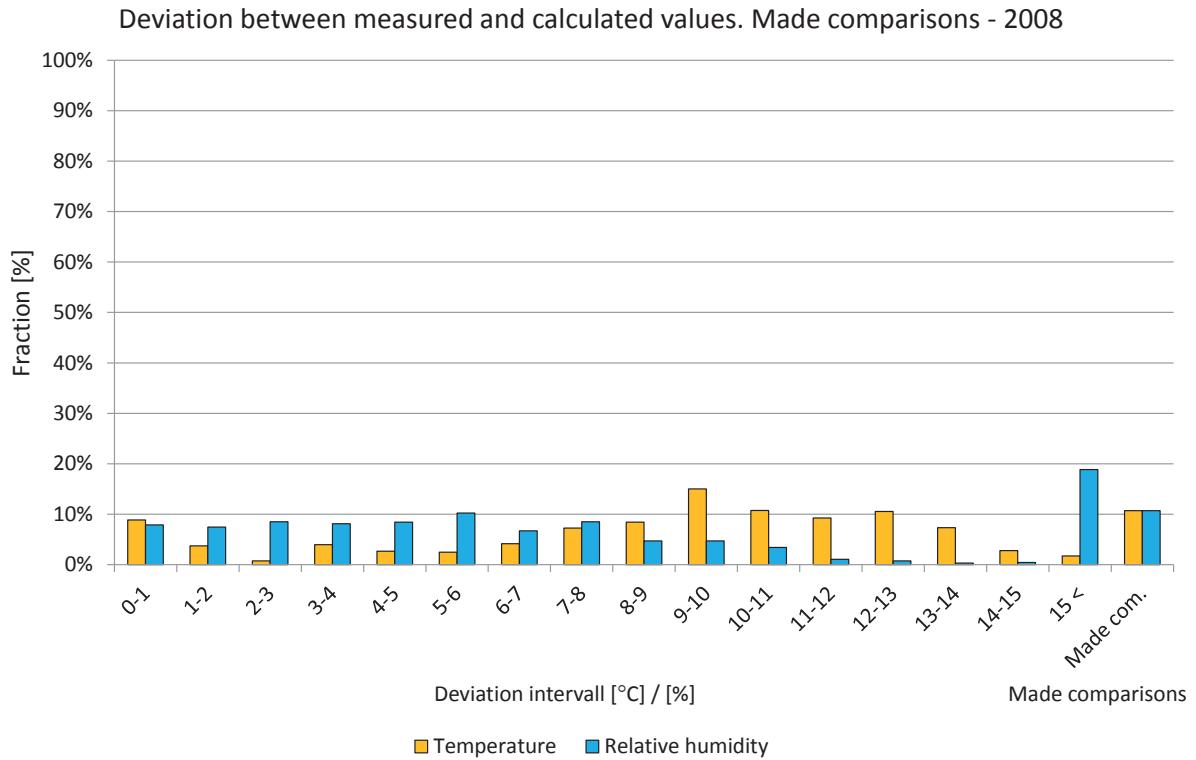


Figure 7.17.9. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

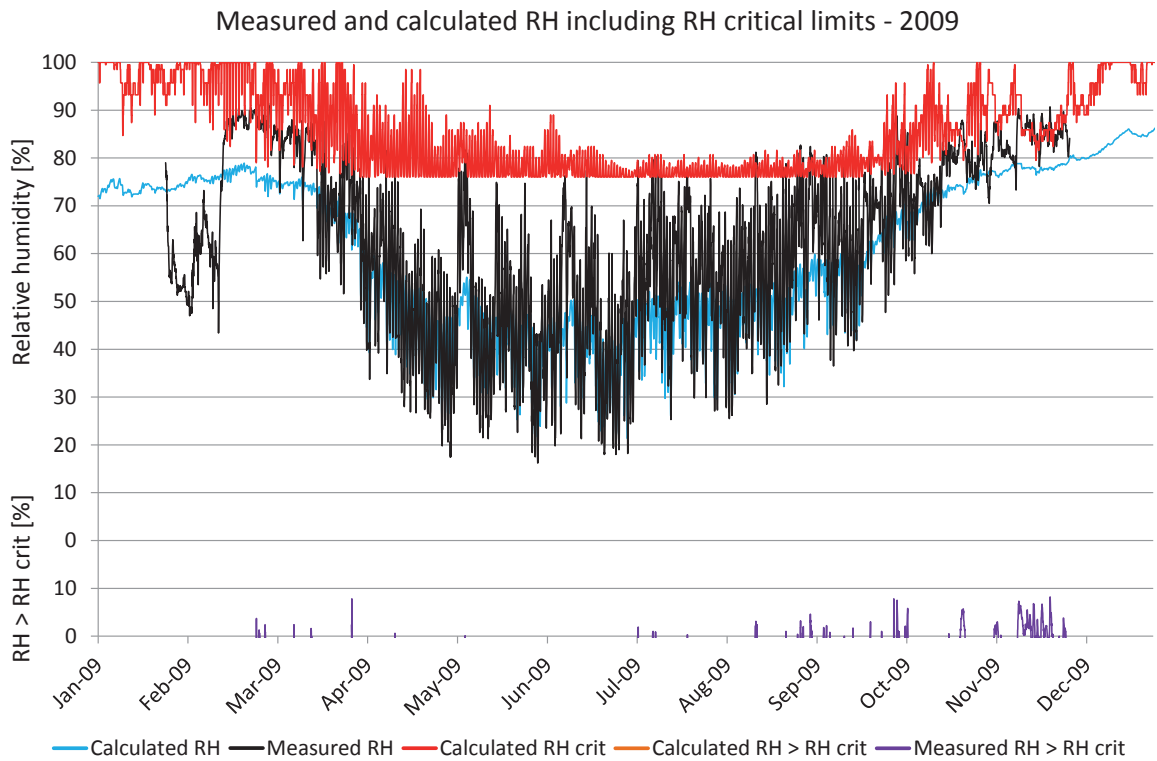


Figure 7.17.10. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

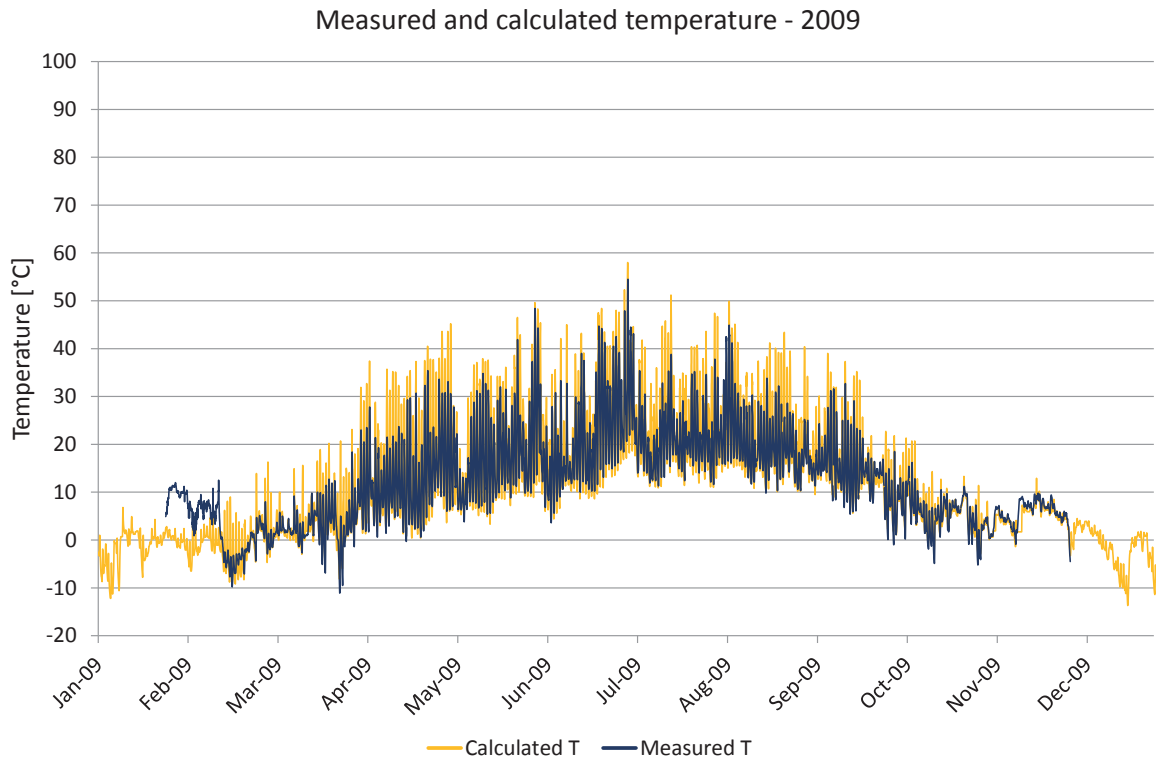


Figure 7.17.11. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

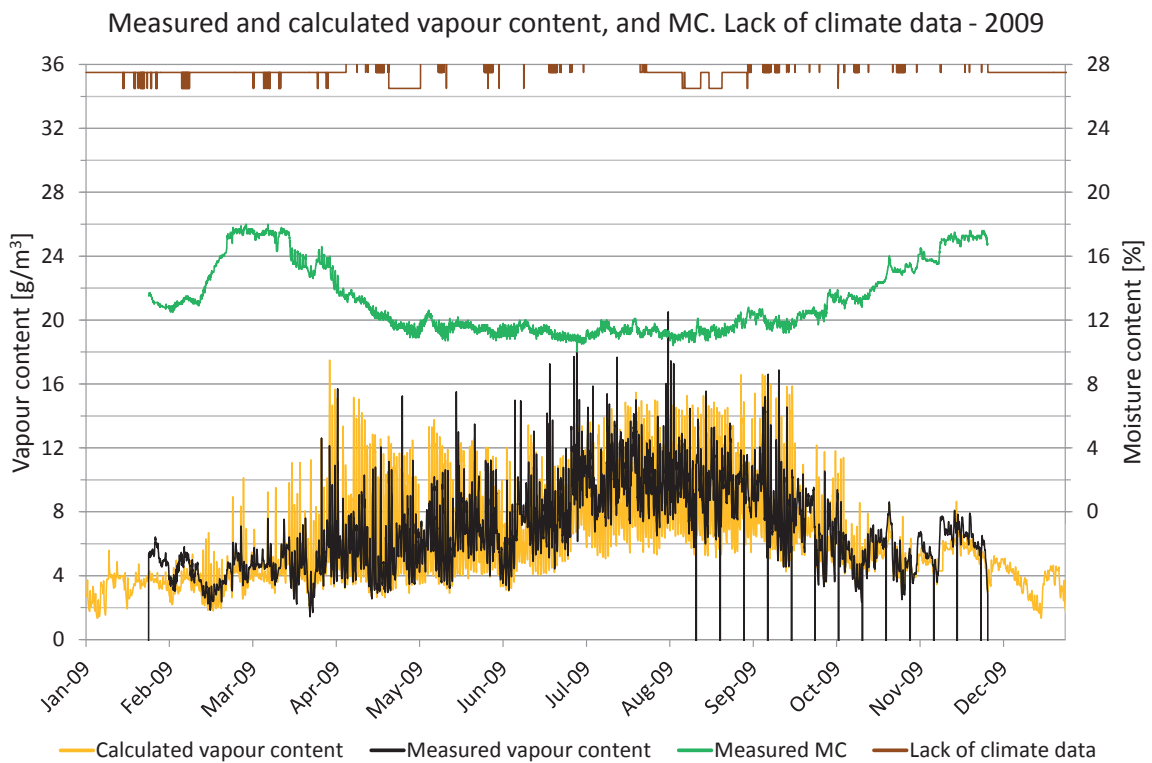


Figure 7.17.12. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

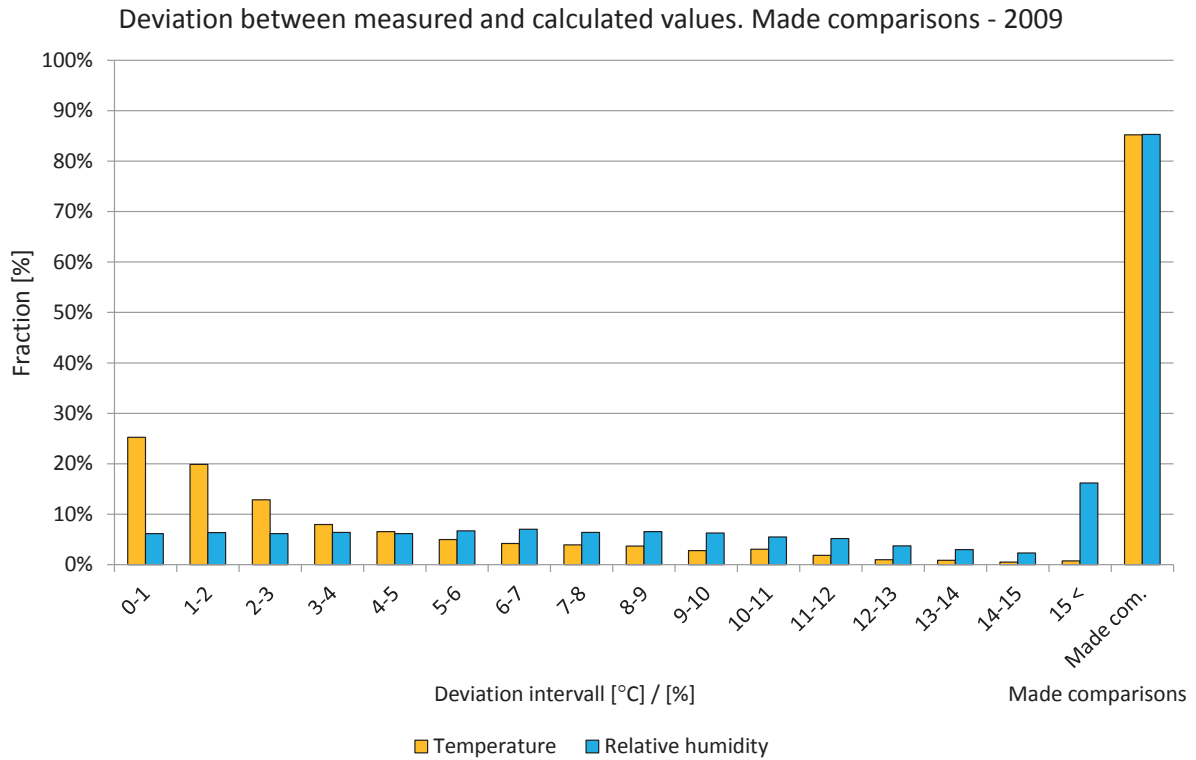


Figure 7.17.13. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

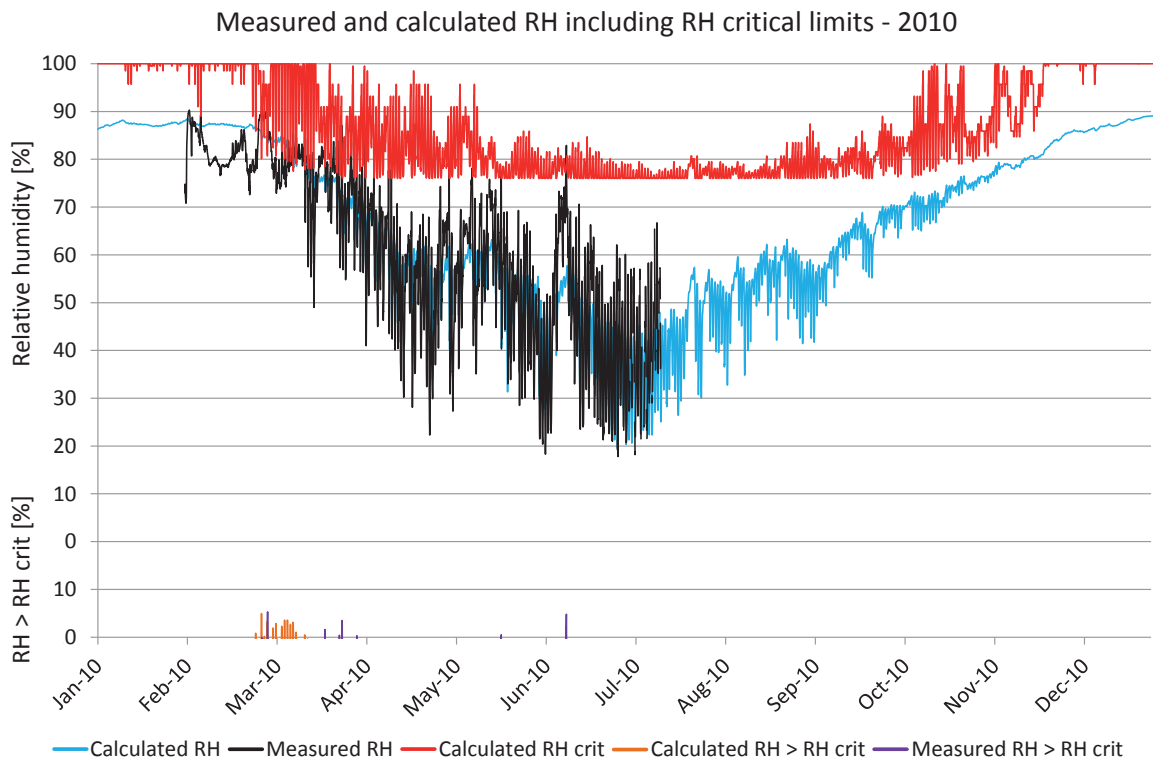


Figure 7.17.14. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

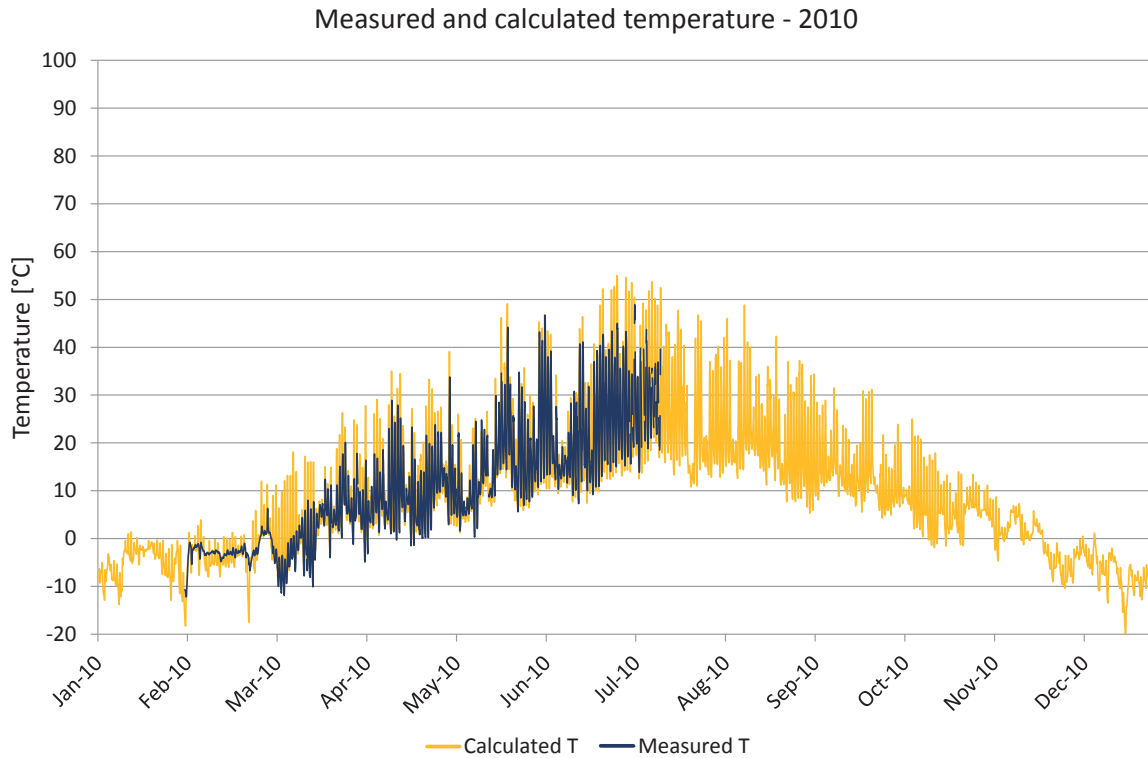


Figure 7.17.15. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

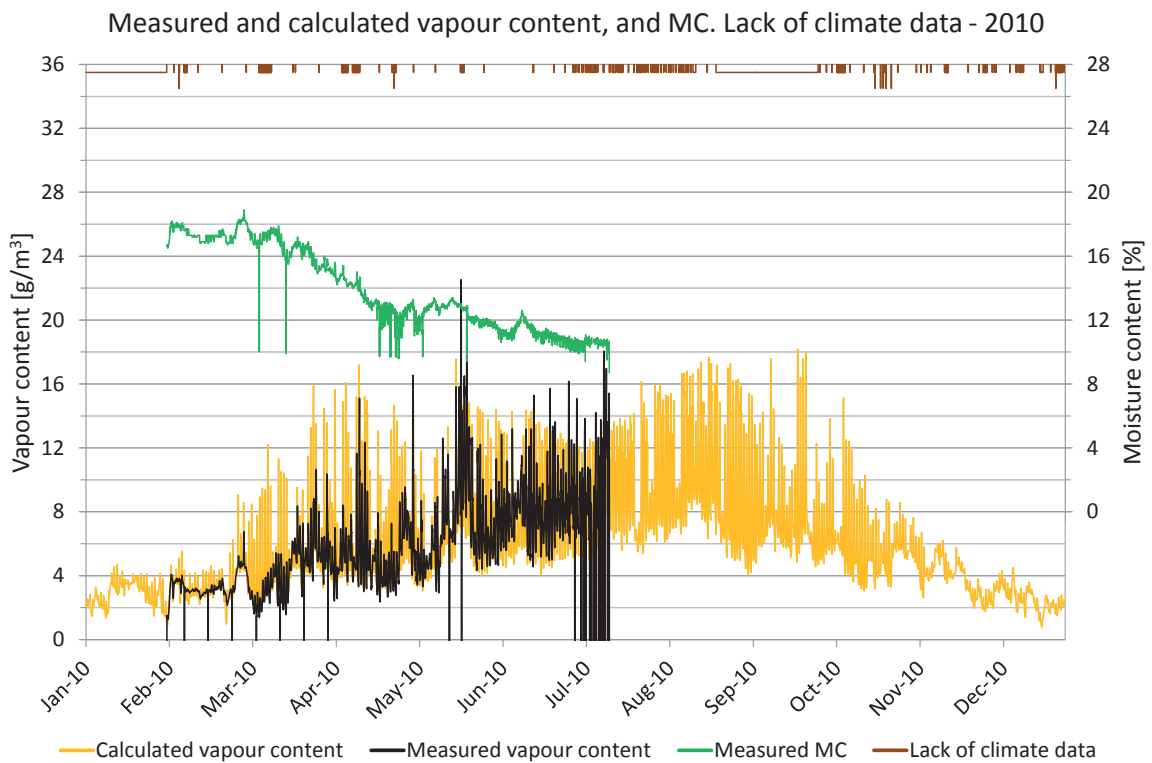


Figure 7.17.16. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

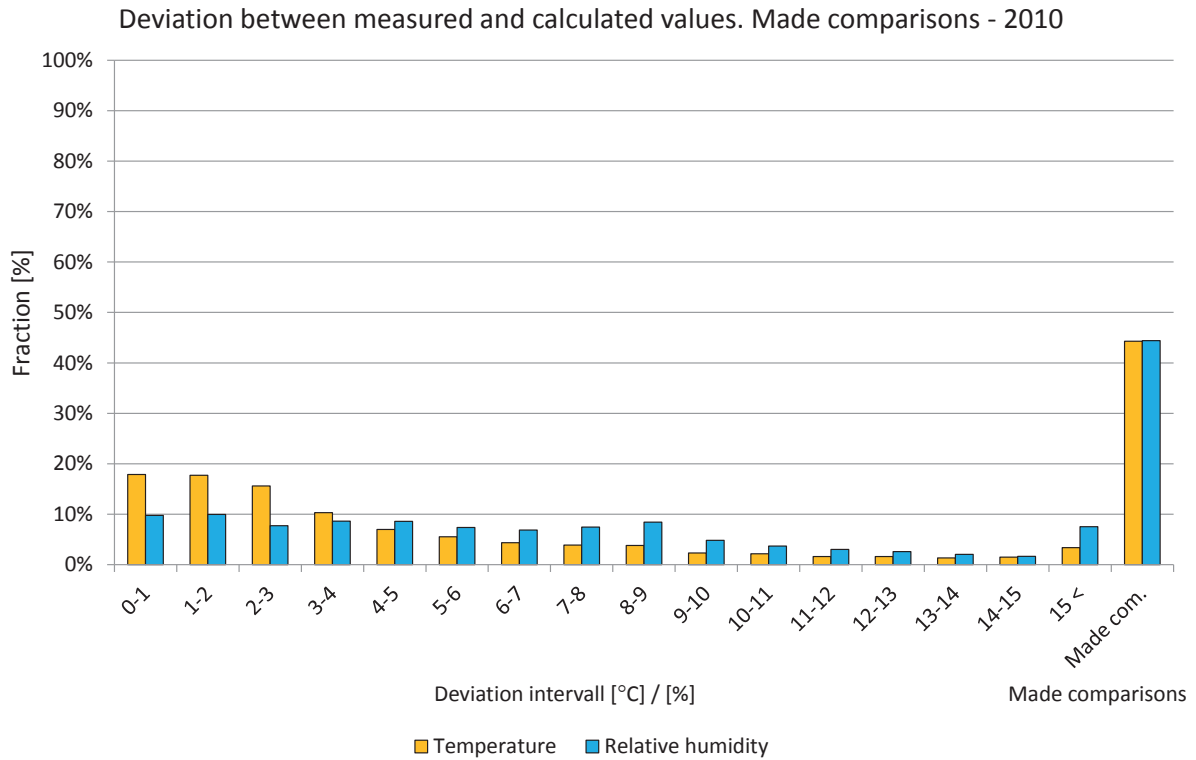


Figure 7.17.17. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

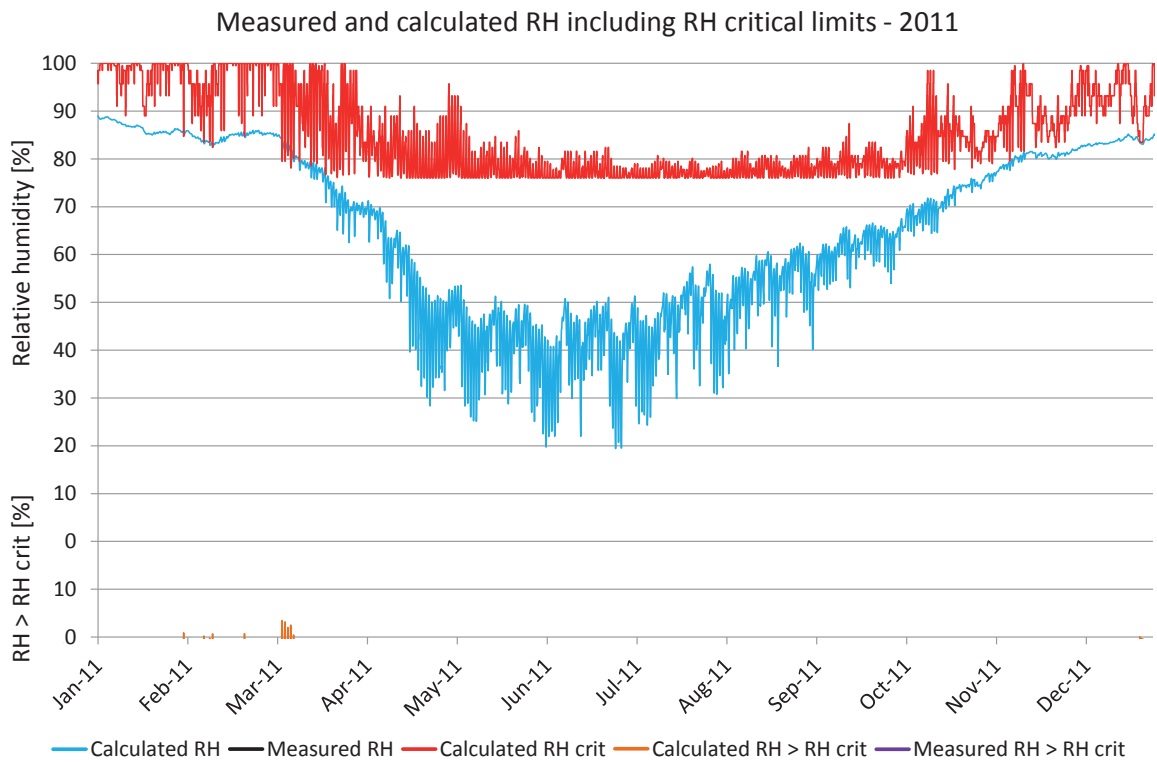


Figure 7.17.18. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

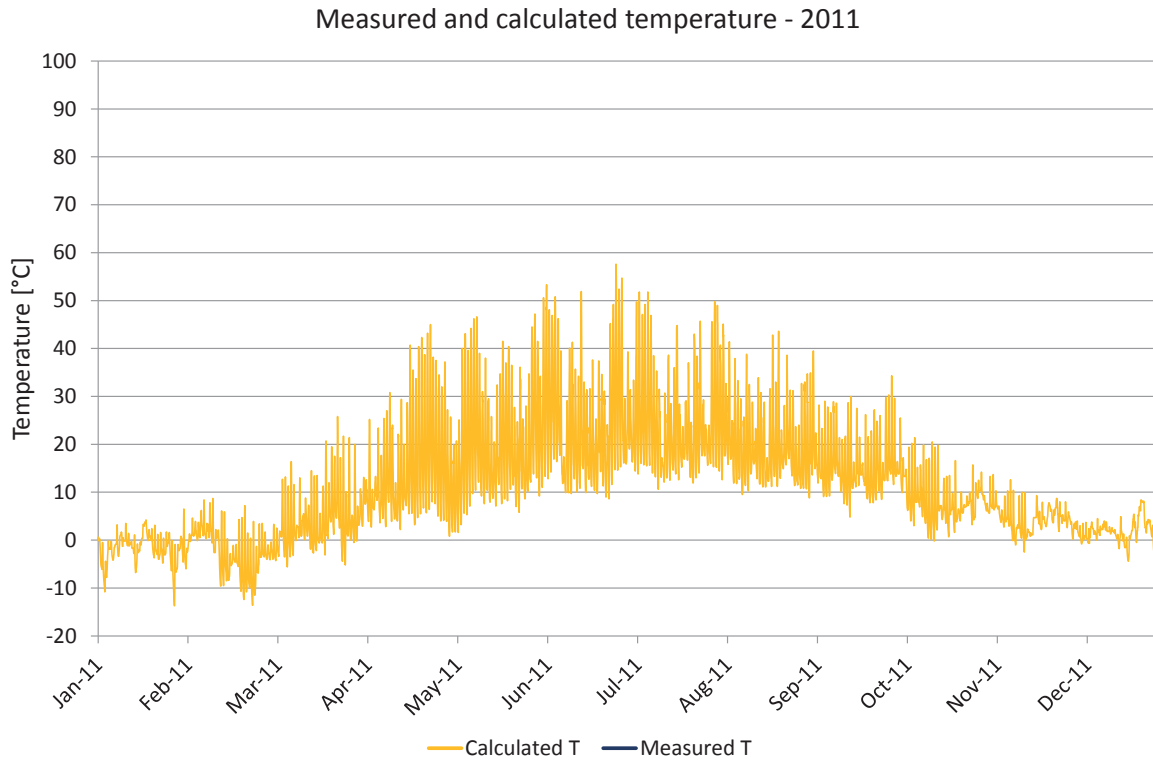


Figure 7.17.19. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

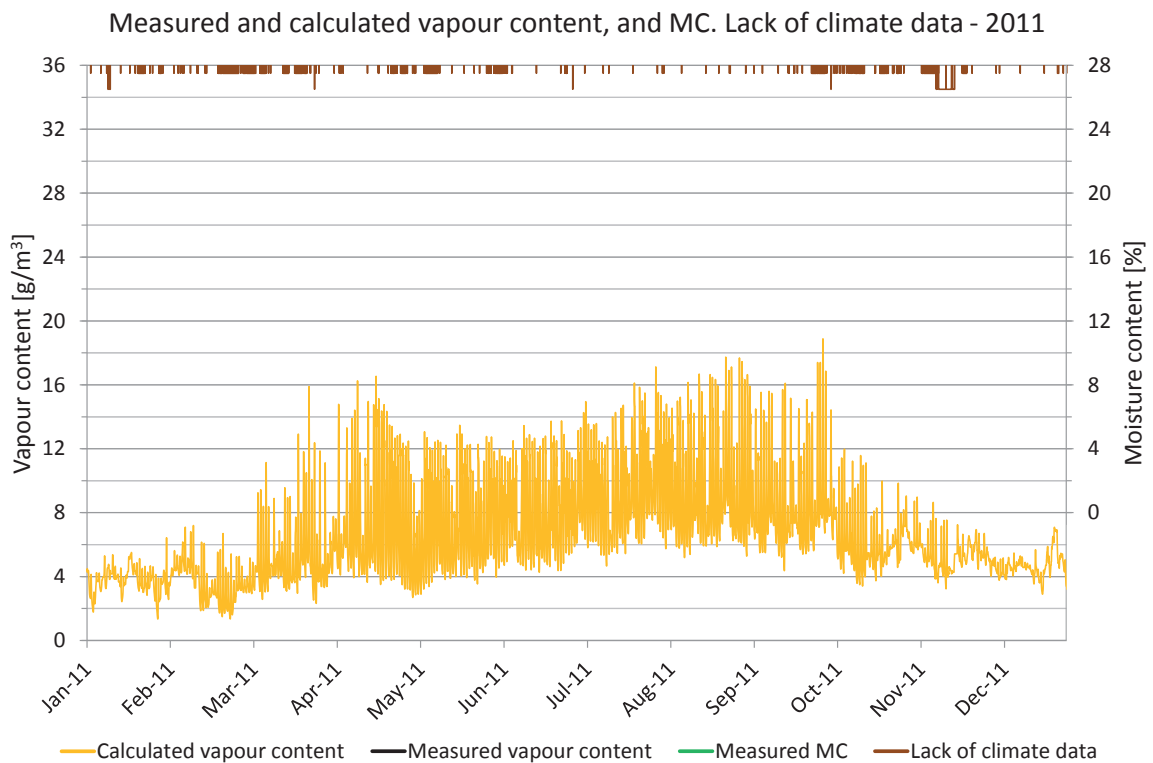


Figure 7.17.20. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

7.18 Position 18

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof close to the gable directed towards northeast.

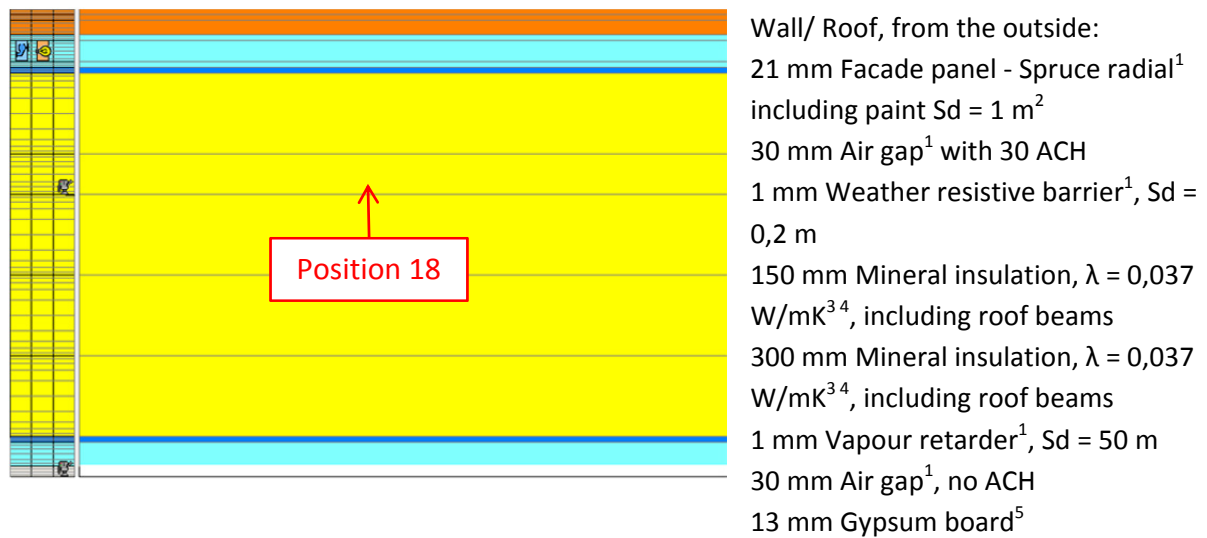


Figure 7.18.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.

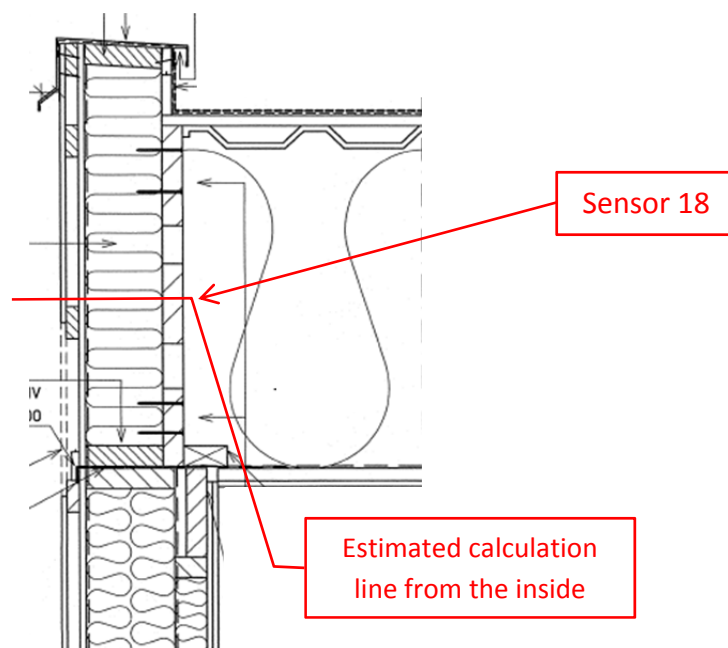


Figure 7.18.2. Location of the studied position.

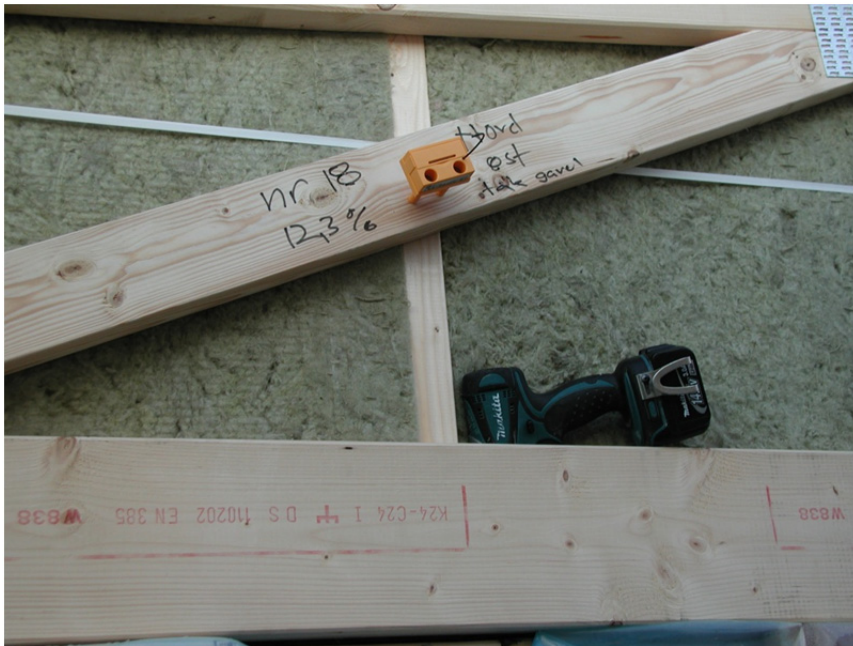


Figure 7.18.3. Location of the studied position.



Figure 7.18.4. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

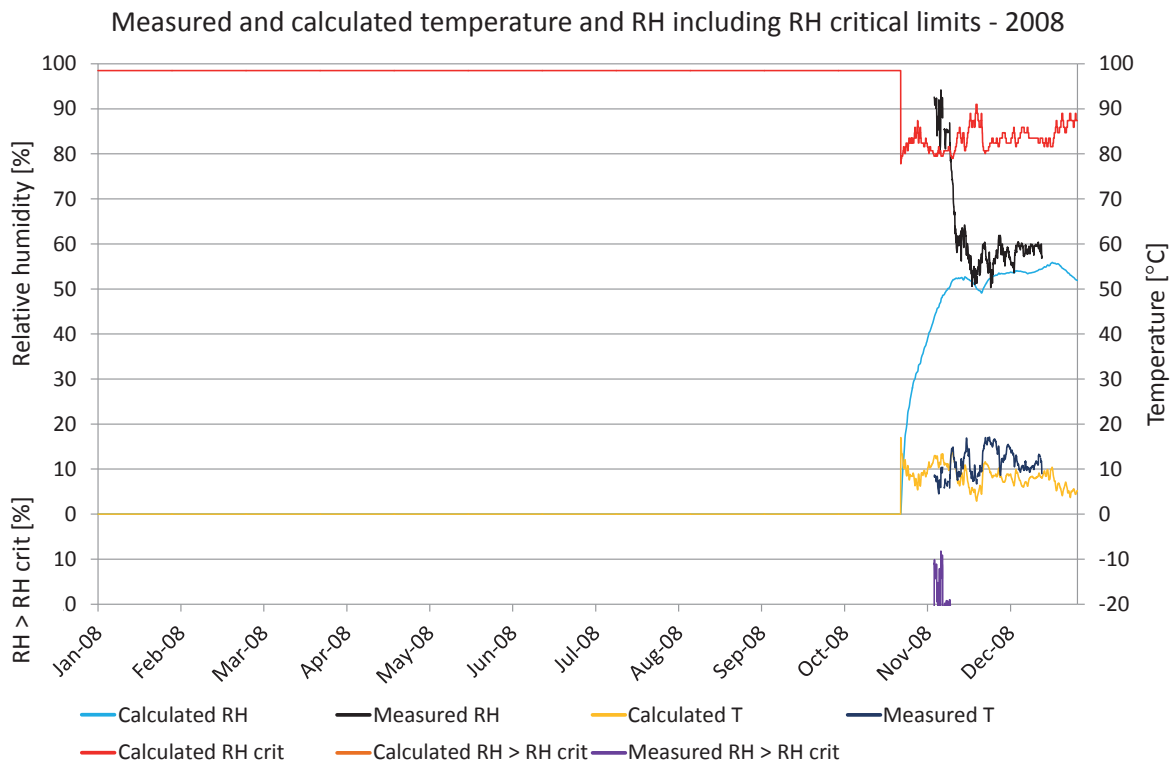


Figure 7.18.5. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

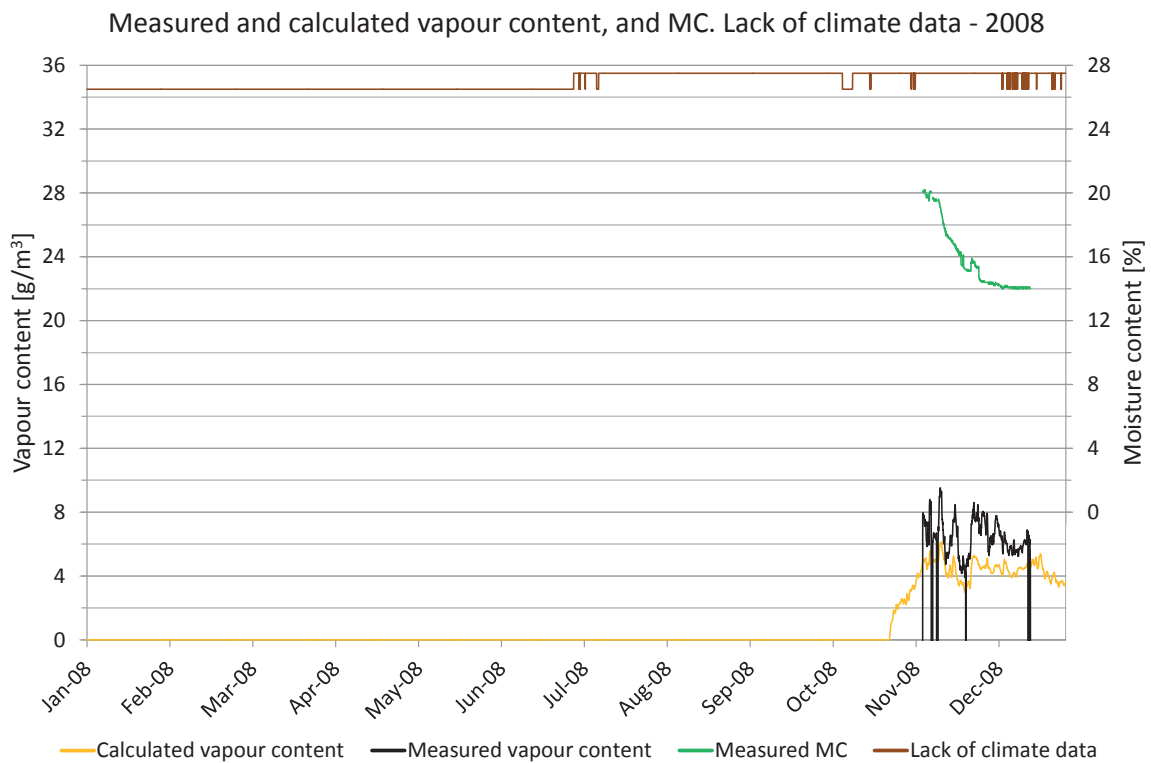


Figure 7.18.6. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

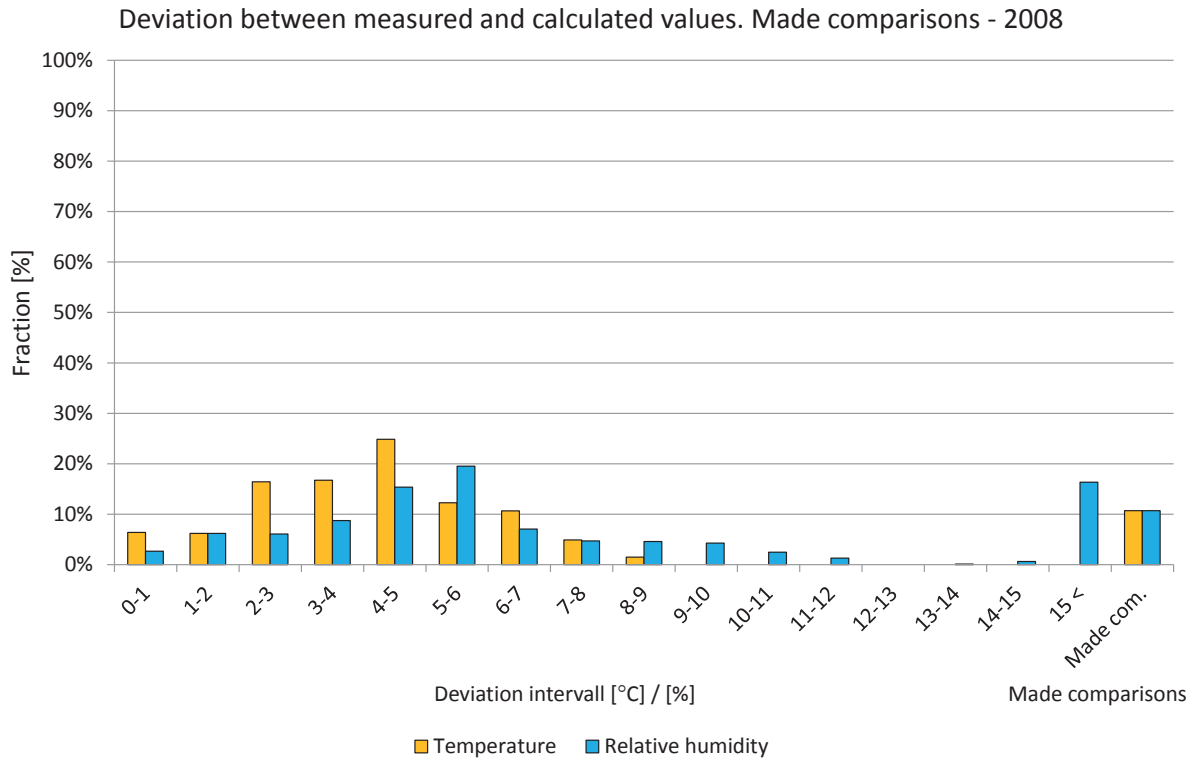


Figure 7.18.7. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

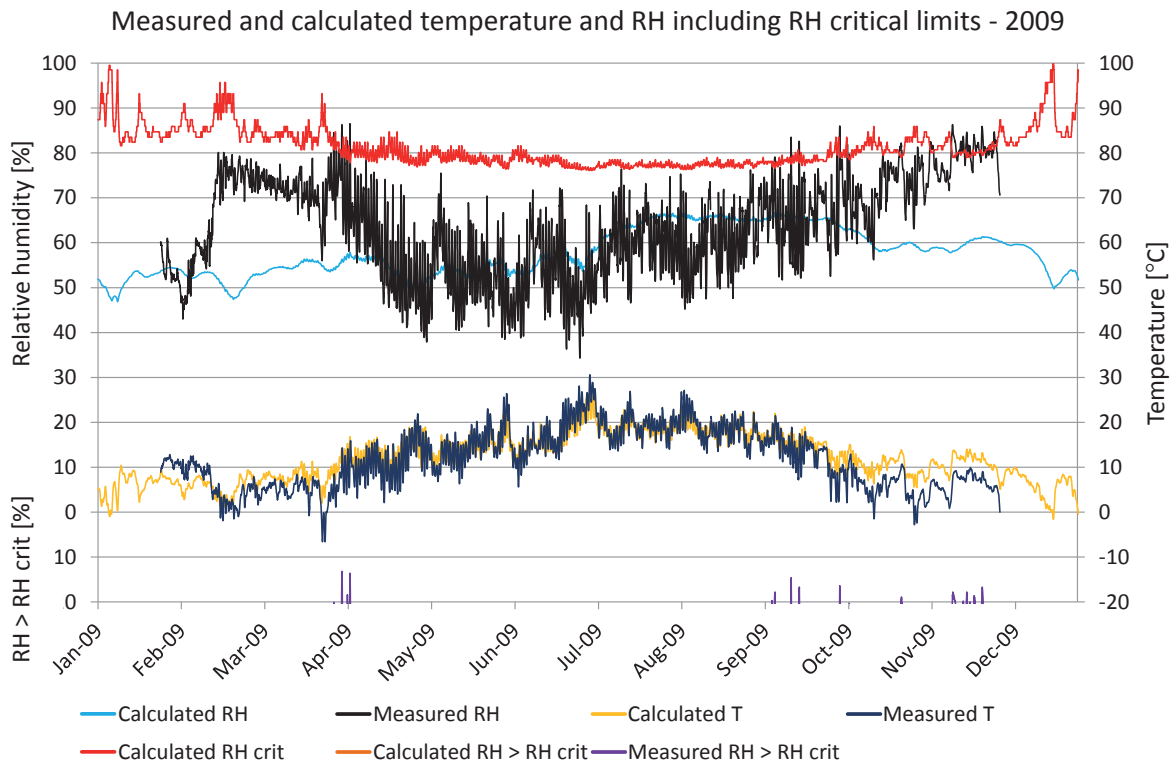


Figure 7.18.8. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

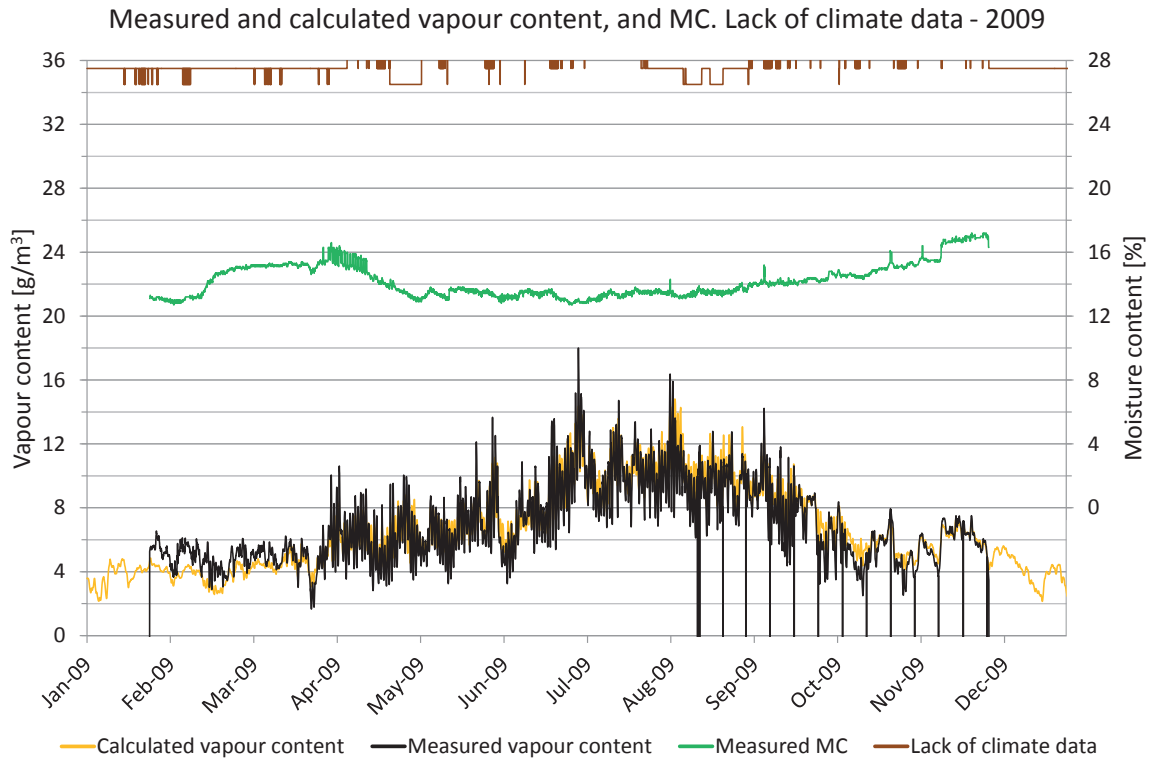


Figure 7.18.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

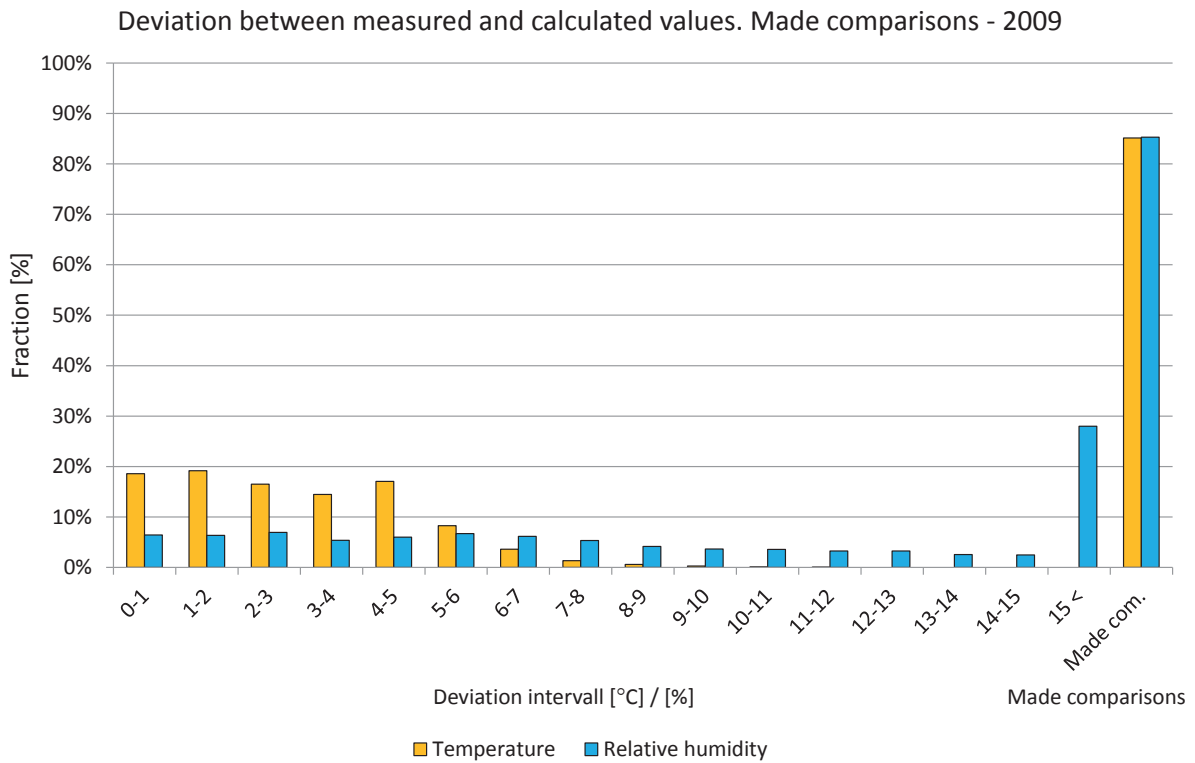


Figure 7.18.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

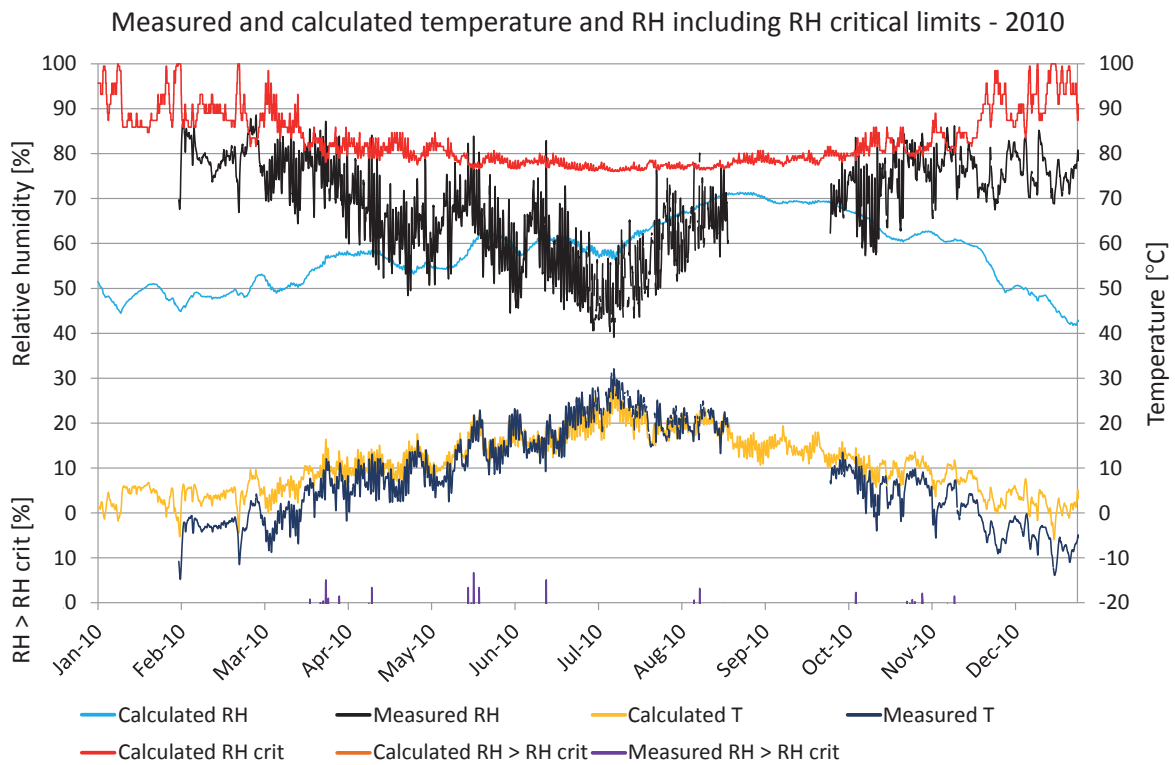


Figure 7.18.11. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

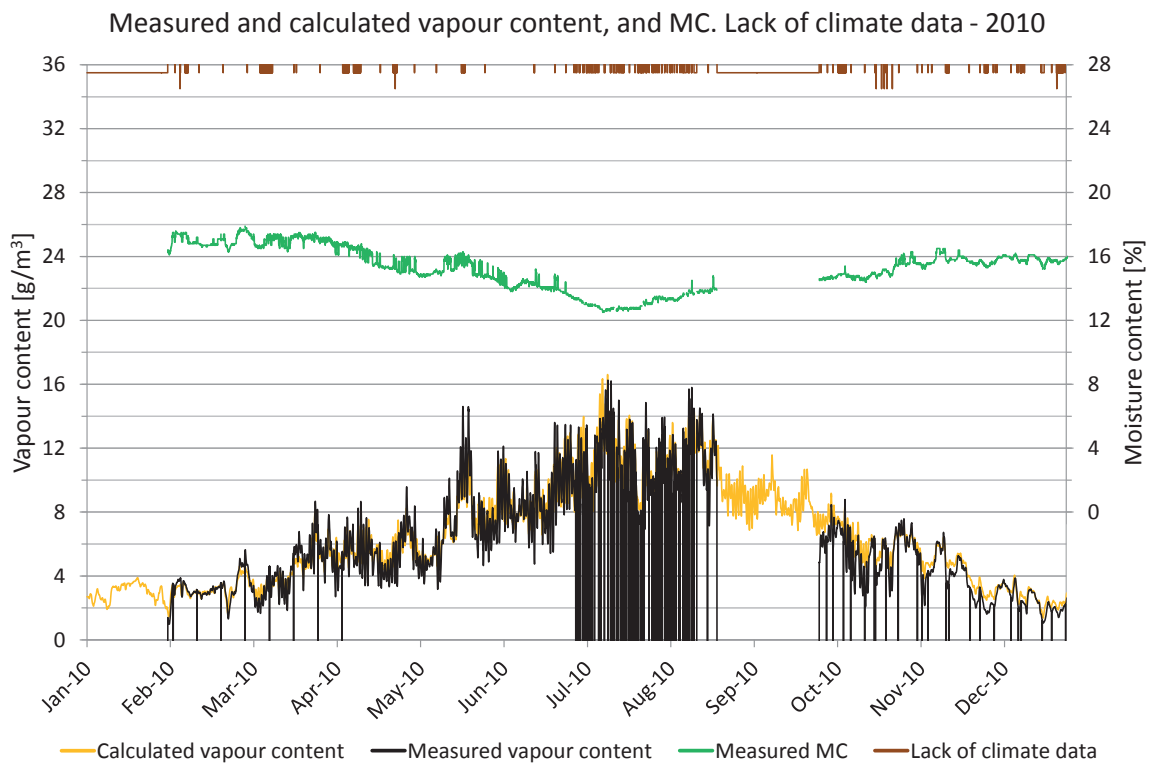


Figure 7.18.12. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

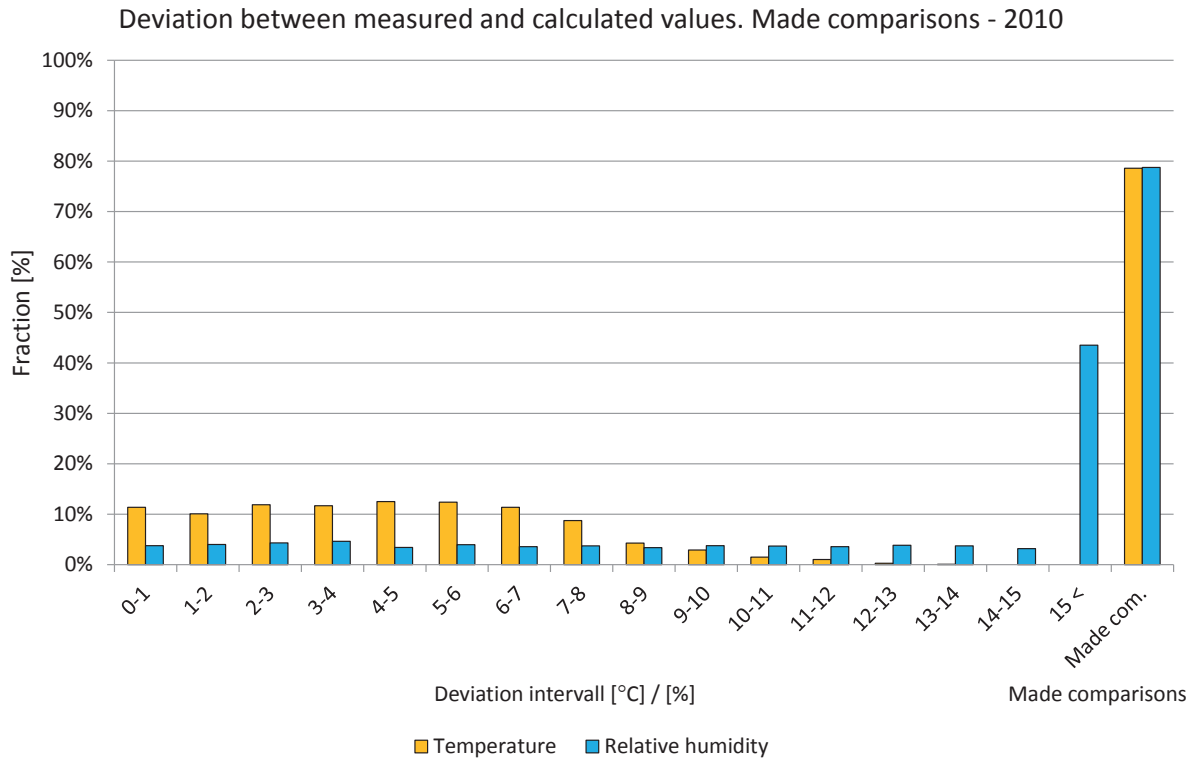


Figure 7.18.13. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

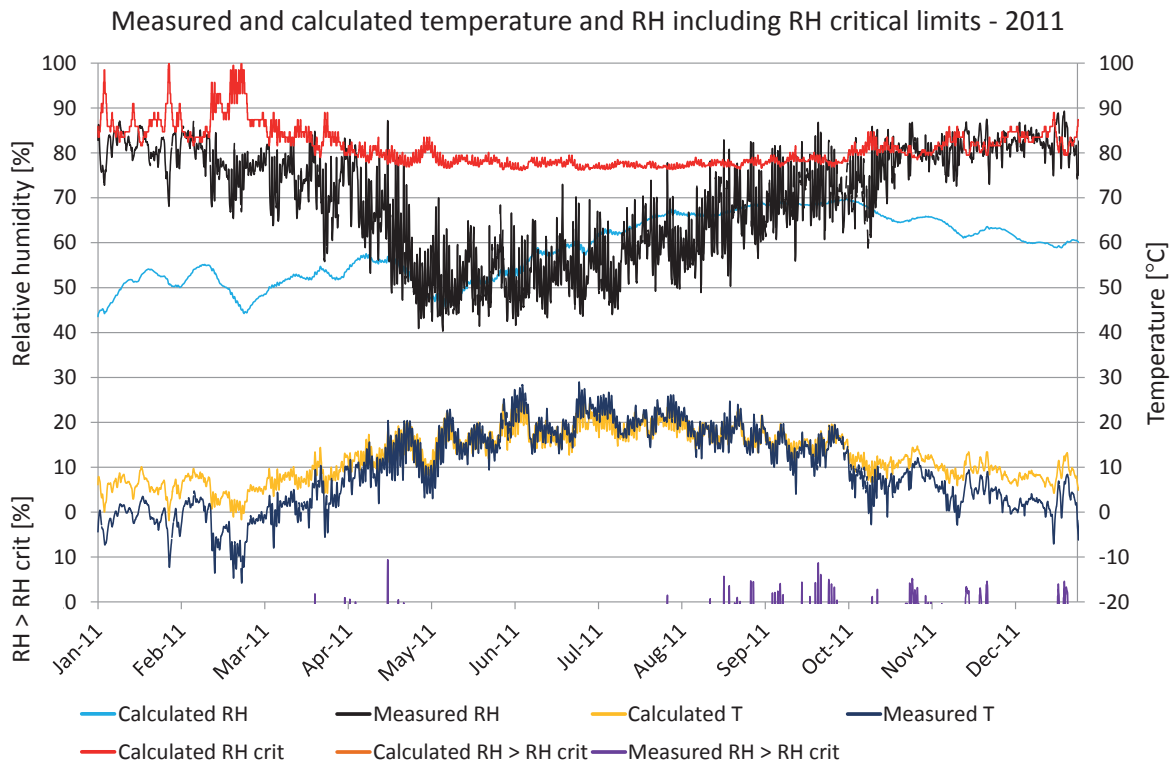


Figure 7.18.14. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

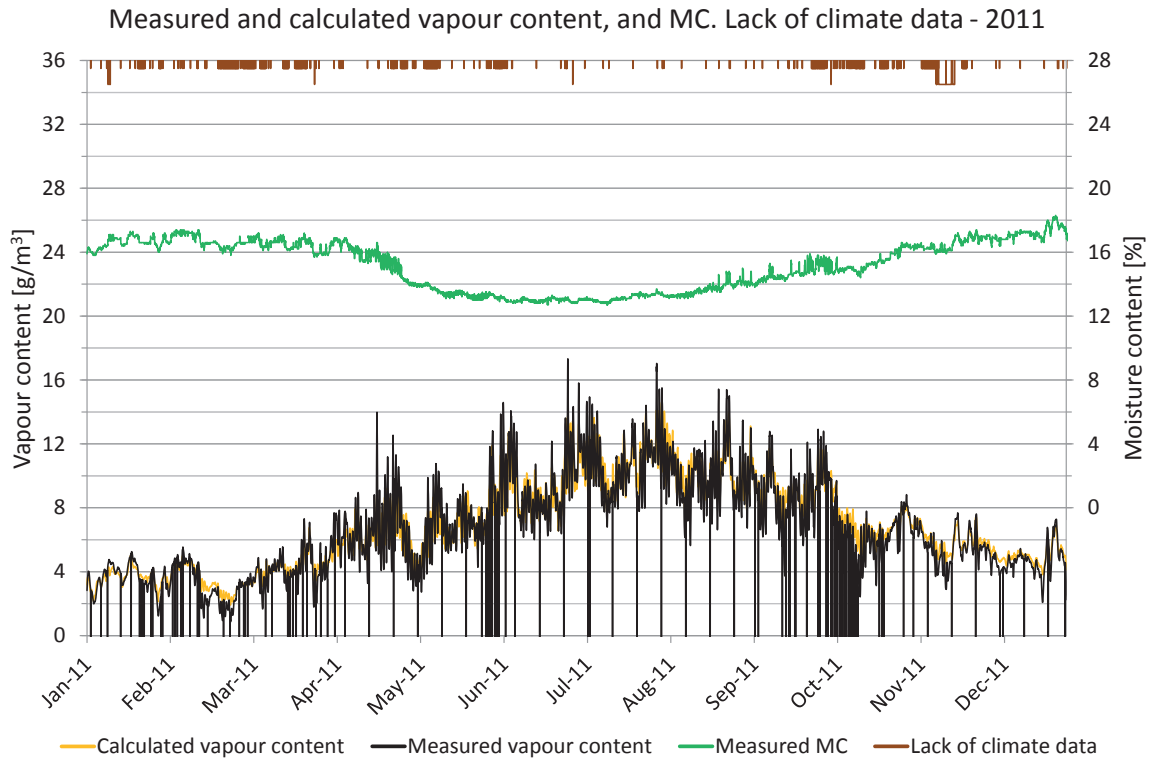


Figure 7.18.15. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

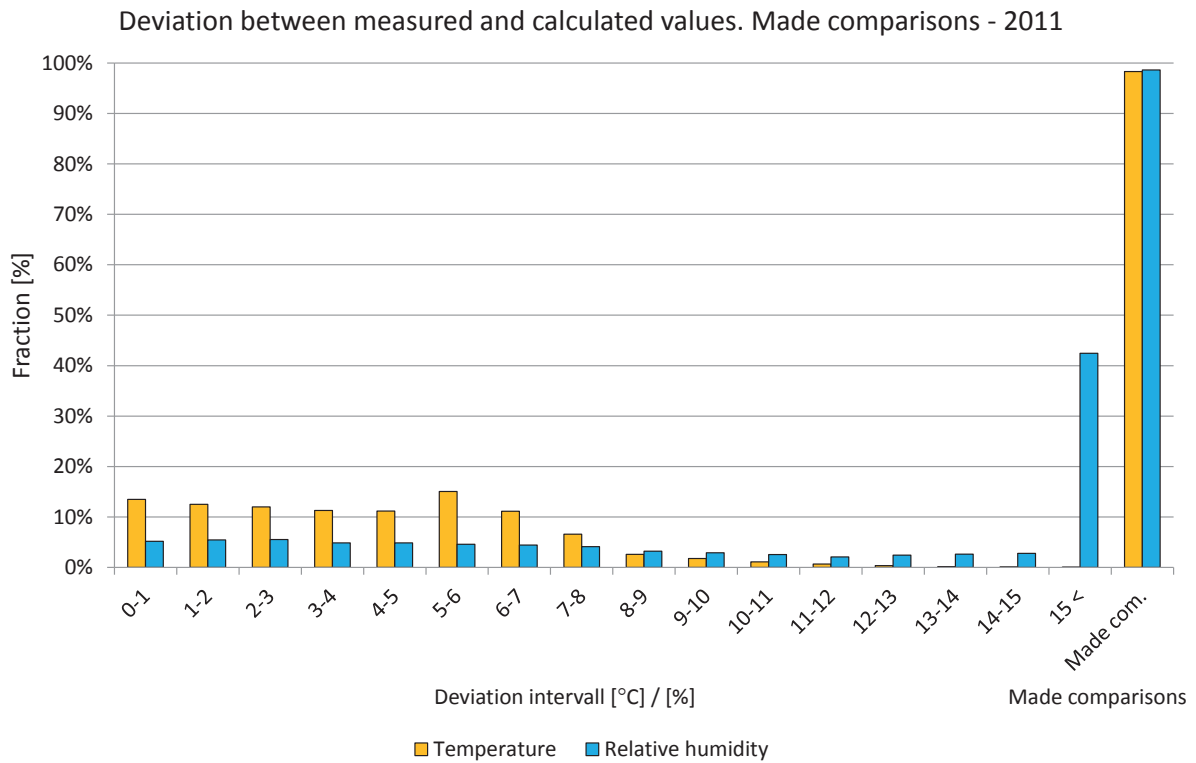
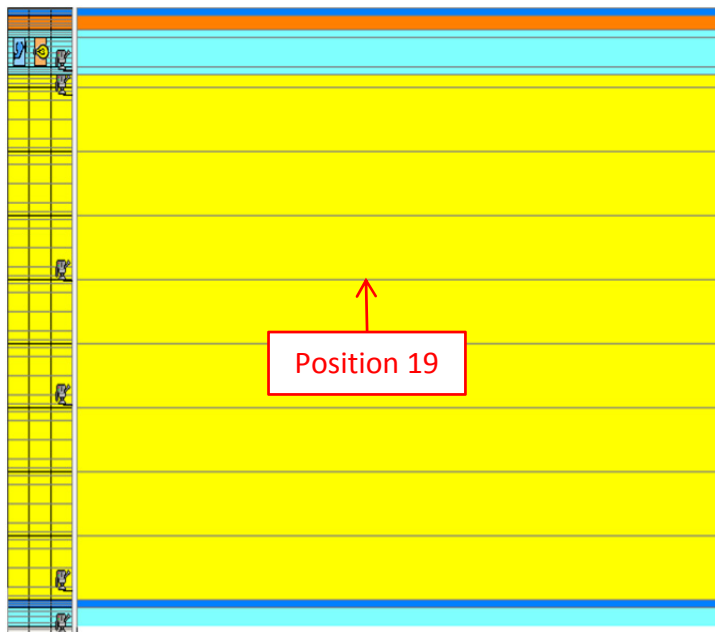


Figure 7.18.16. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.19 Position 19

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof.



Roof, from the outside:

- 1 mm PVC roof membrane¹, $S_d = 15$ m
- 22 mm Massive wood - Spruce radial¹
- 50 mm Air gap¹ with 30 ACH
- 20 mm EPS¹
- 800 mm Mineral insulation, $\lambda = 0,037$ $W/mK^{3,4}$, including roof beams
- 1 mm Vapour retarder¹, $S_d = 50$ m
- 30 mm Air gap¹, no ACH
- 13 mm Gypsum board²

Figure 7.19.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

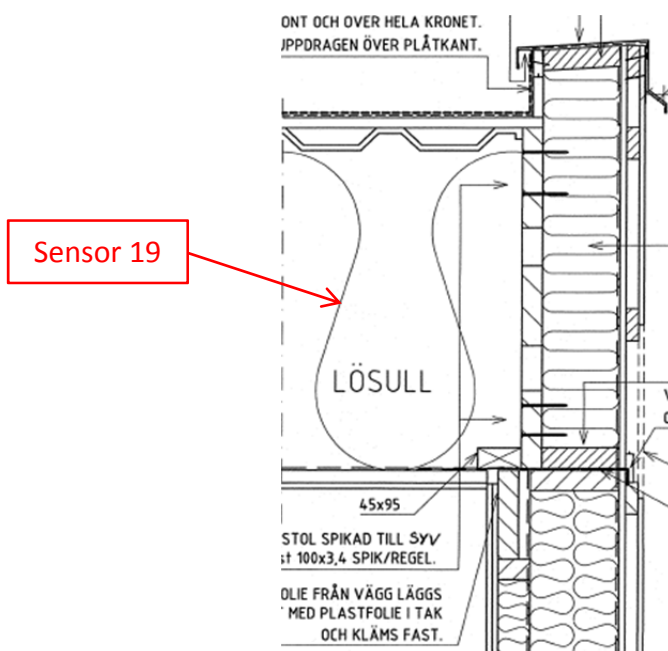


Figure 7.19.2. Location of the studied position.

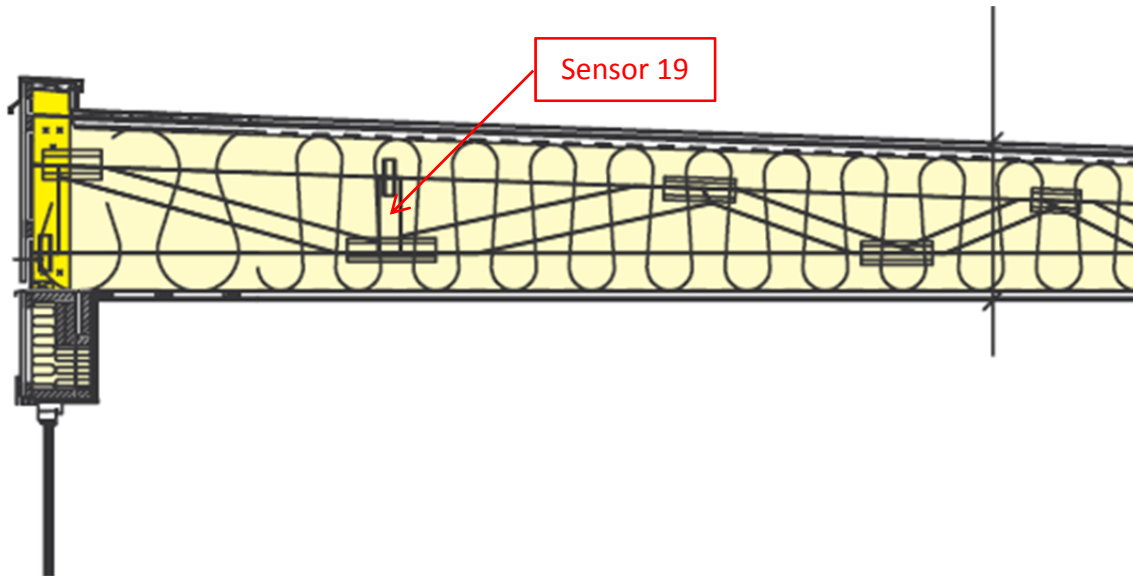


Figure 7.19.3. Location of the studied position.



Figure 7.19.4. Location of the studied position.

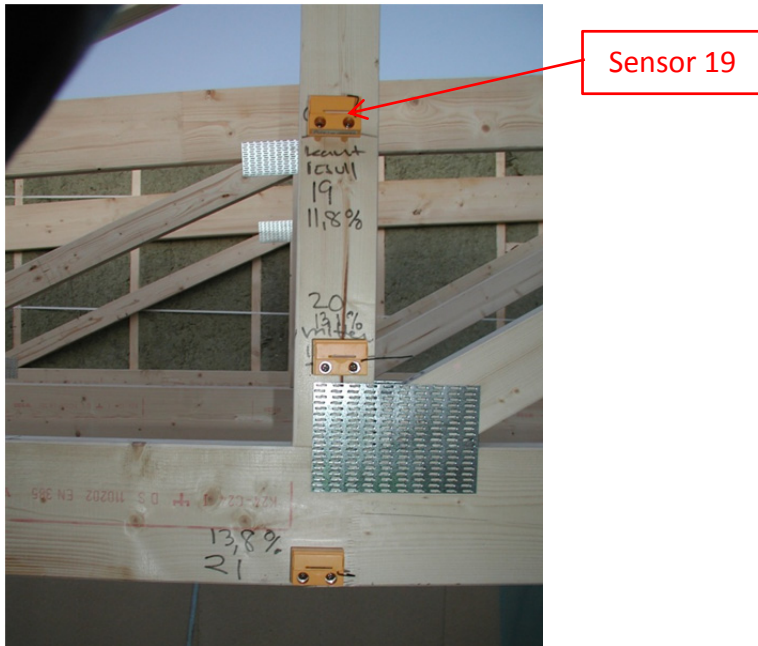


Figure 7.19.5. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

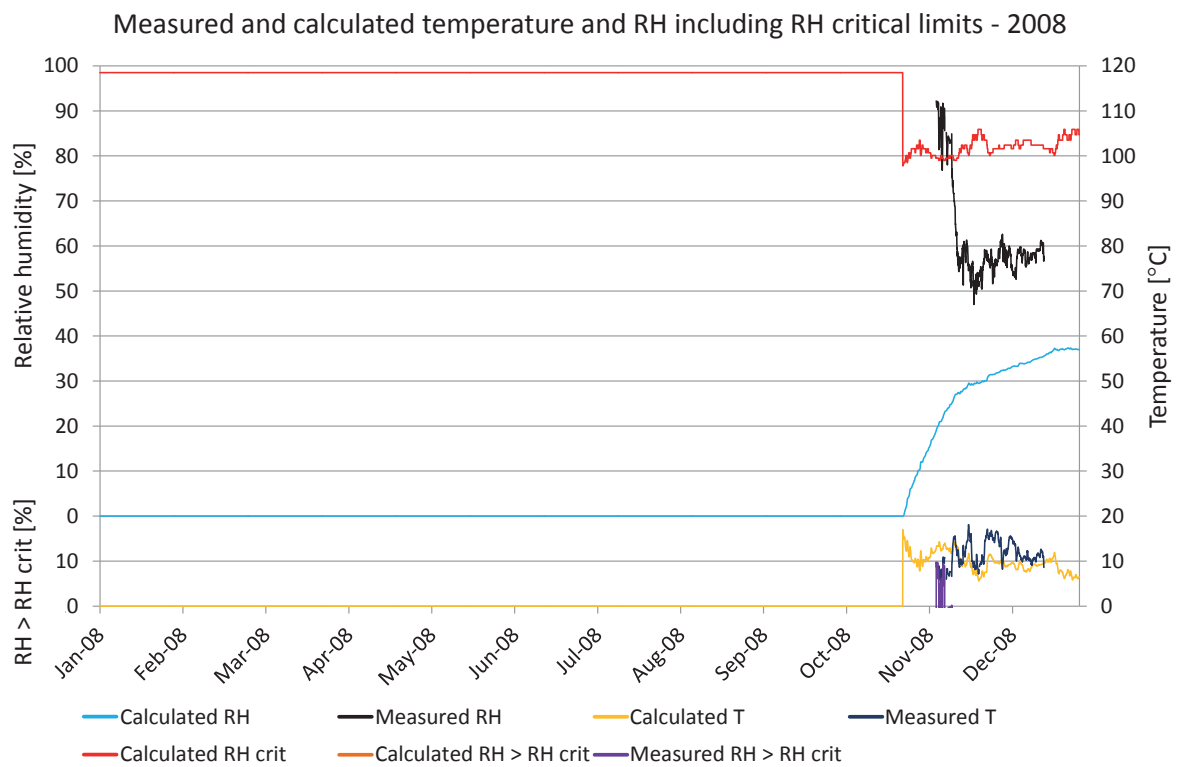


Figure 7.19.6. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

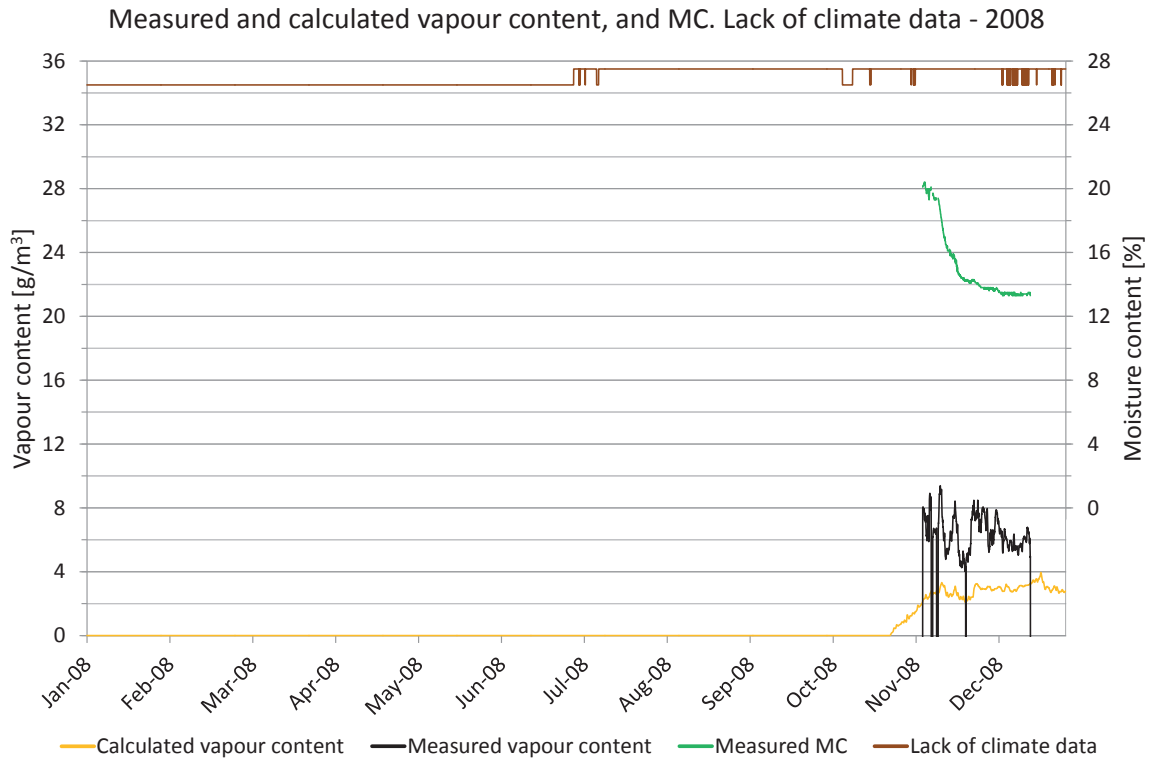


Figure 7.19.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

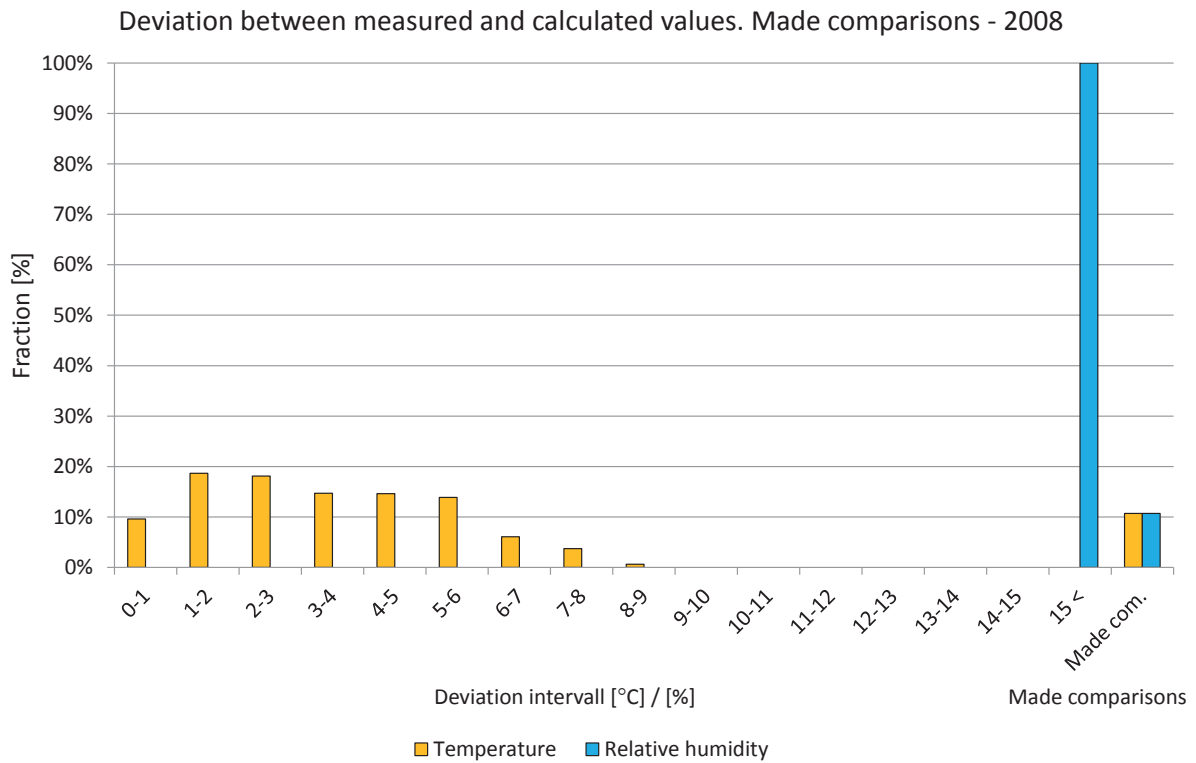


Figure 7.19.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

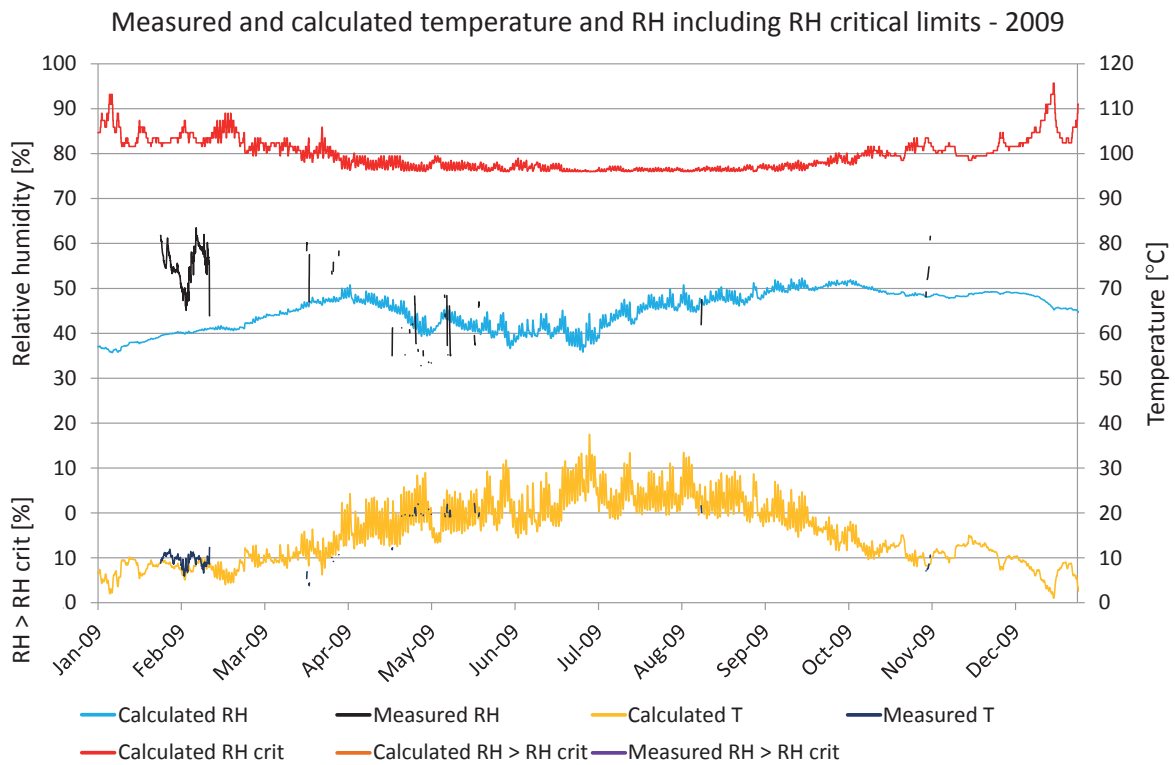


Figure 7.19.9. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

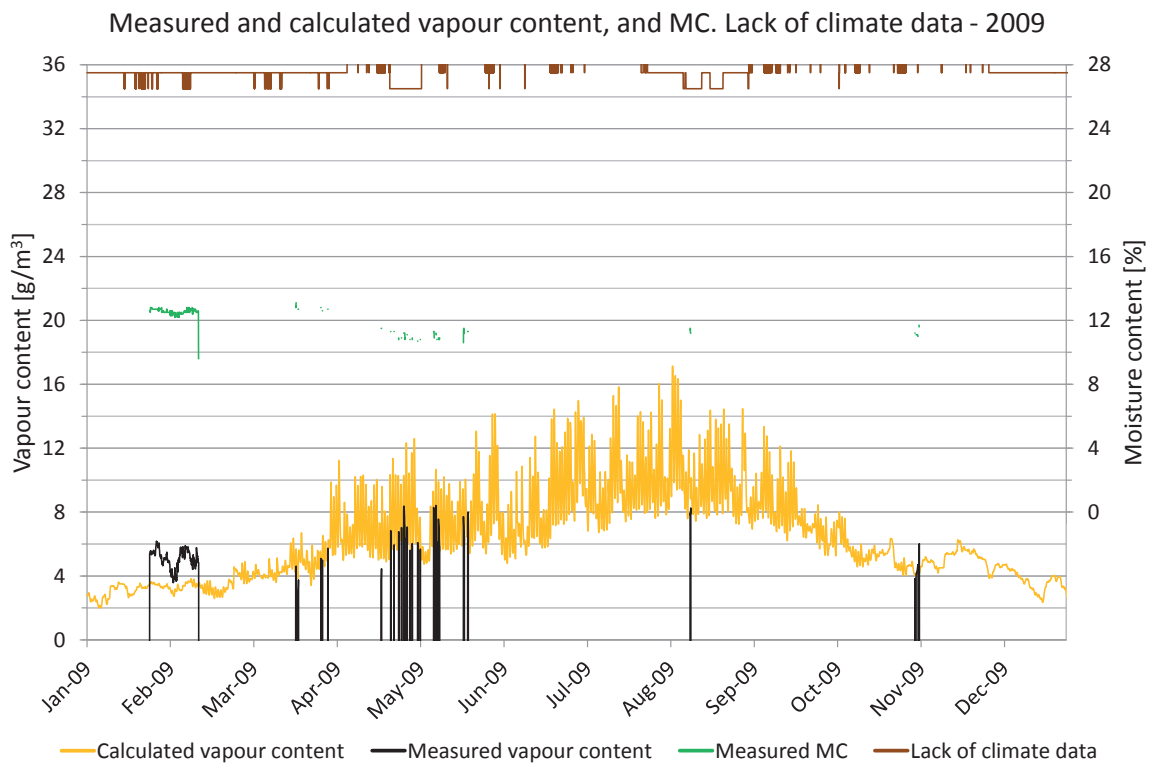


Figure 7.19.10. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

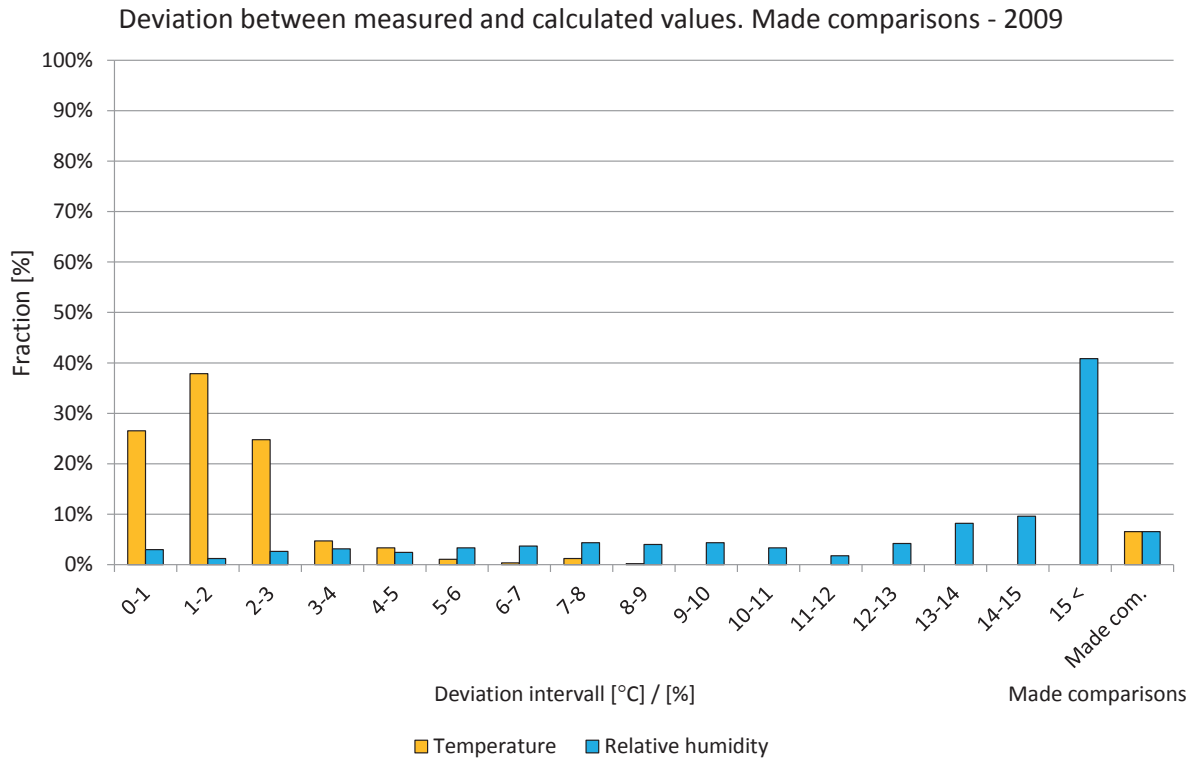


Figure 7.19.11. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

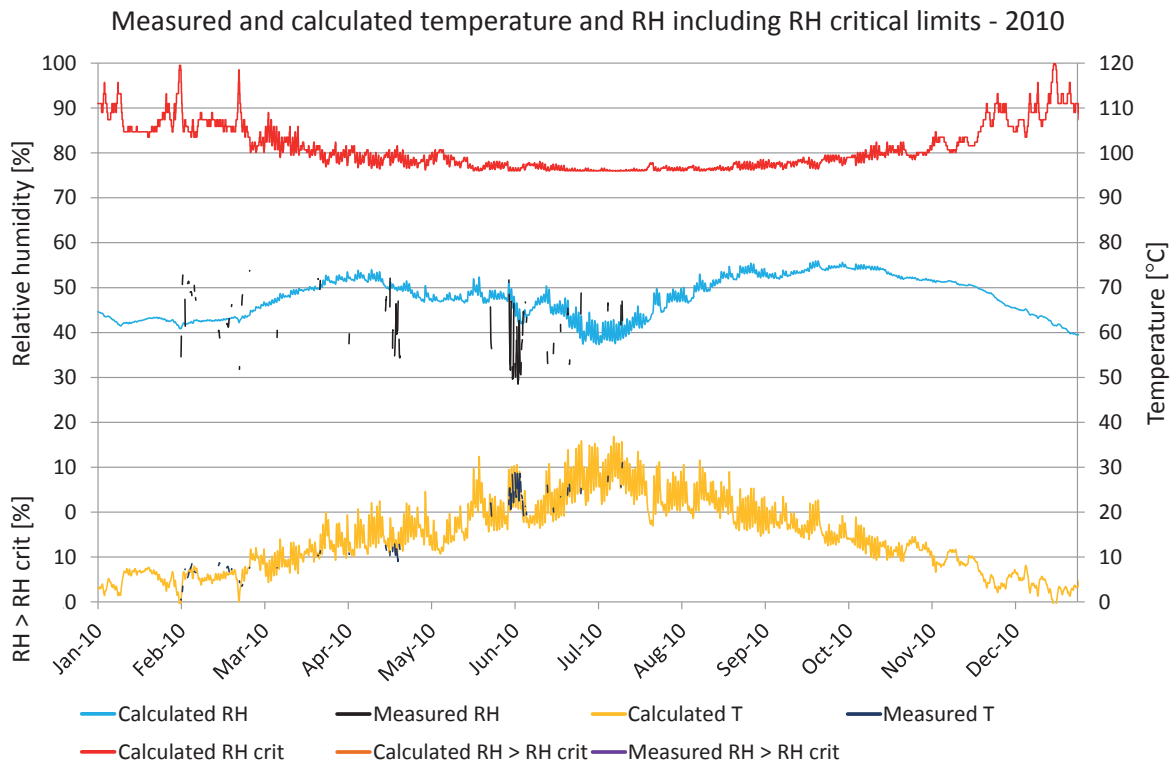


Figure 7.19.12. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated RH > RH_{crit} (light brown), measured RH > RH_{crit} (purple).

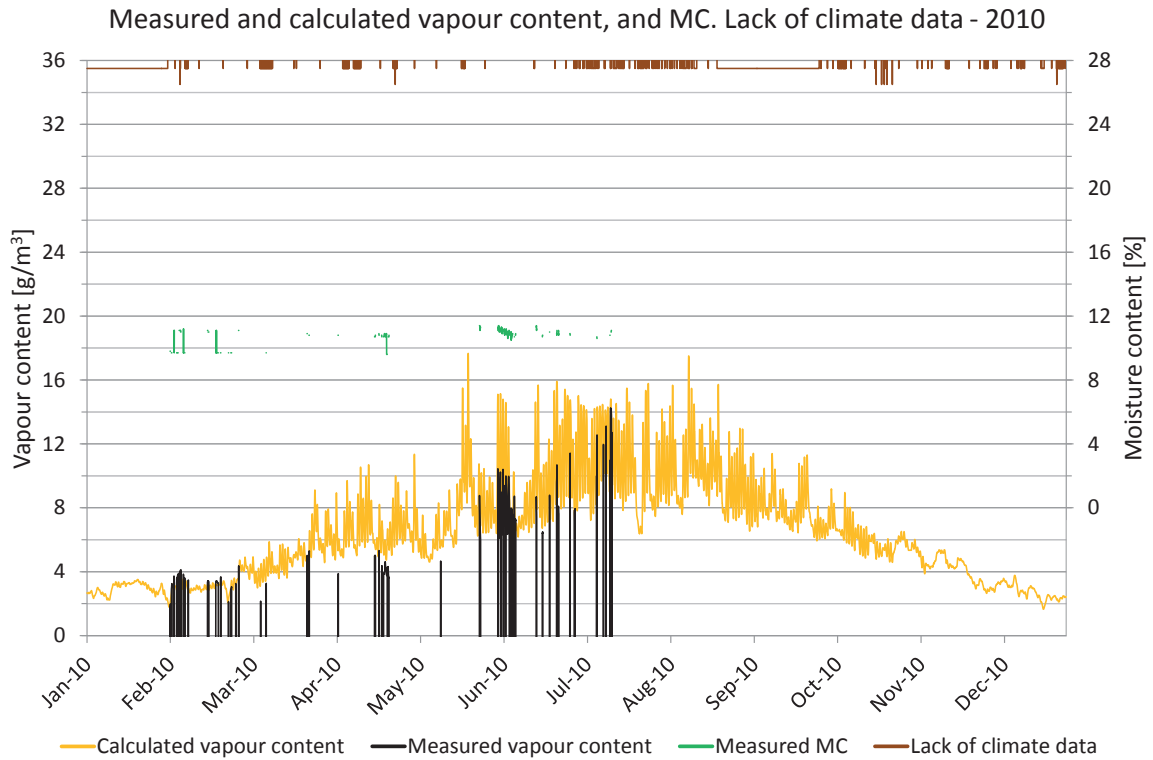


Figure 7.19.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

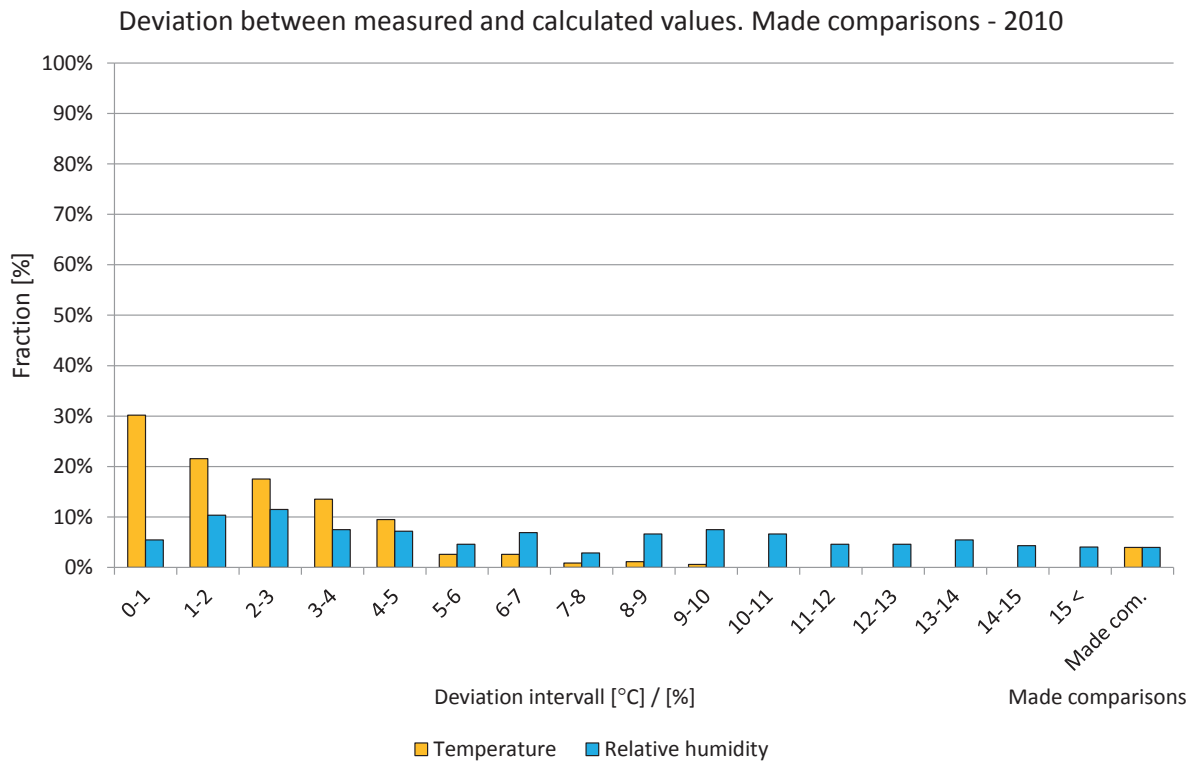


Figure 7.19.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

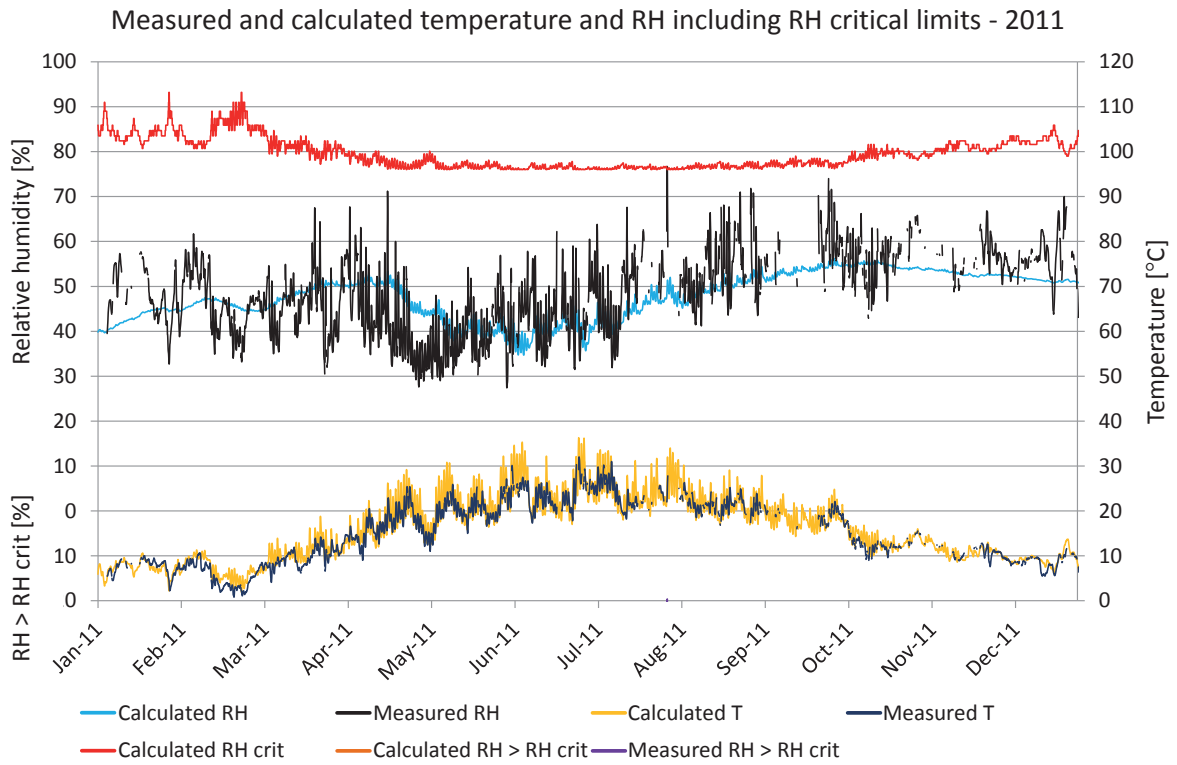


Figure 7.19.15. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated RH > RH_{crit} (light brown), measured RH > RH_{crit} (purple).

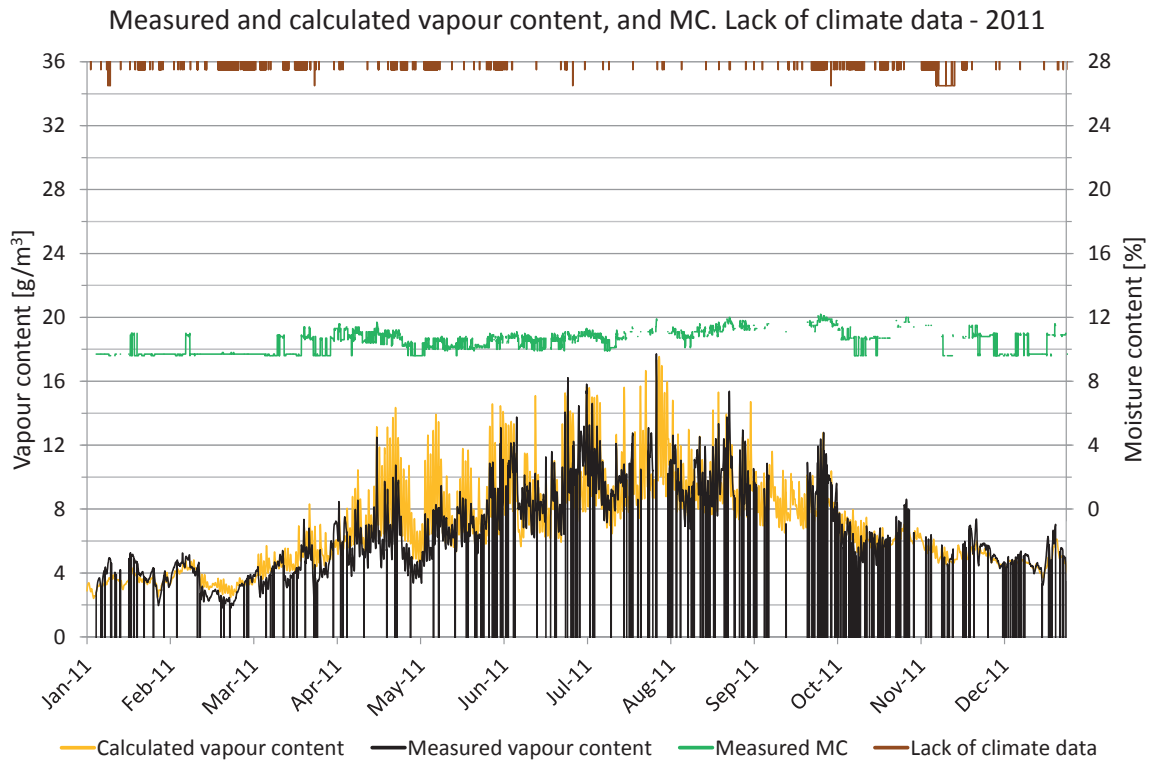


Figure 7.19.16. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

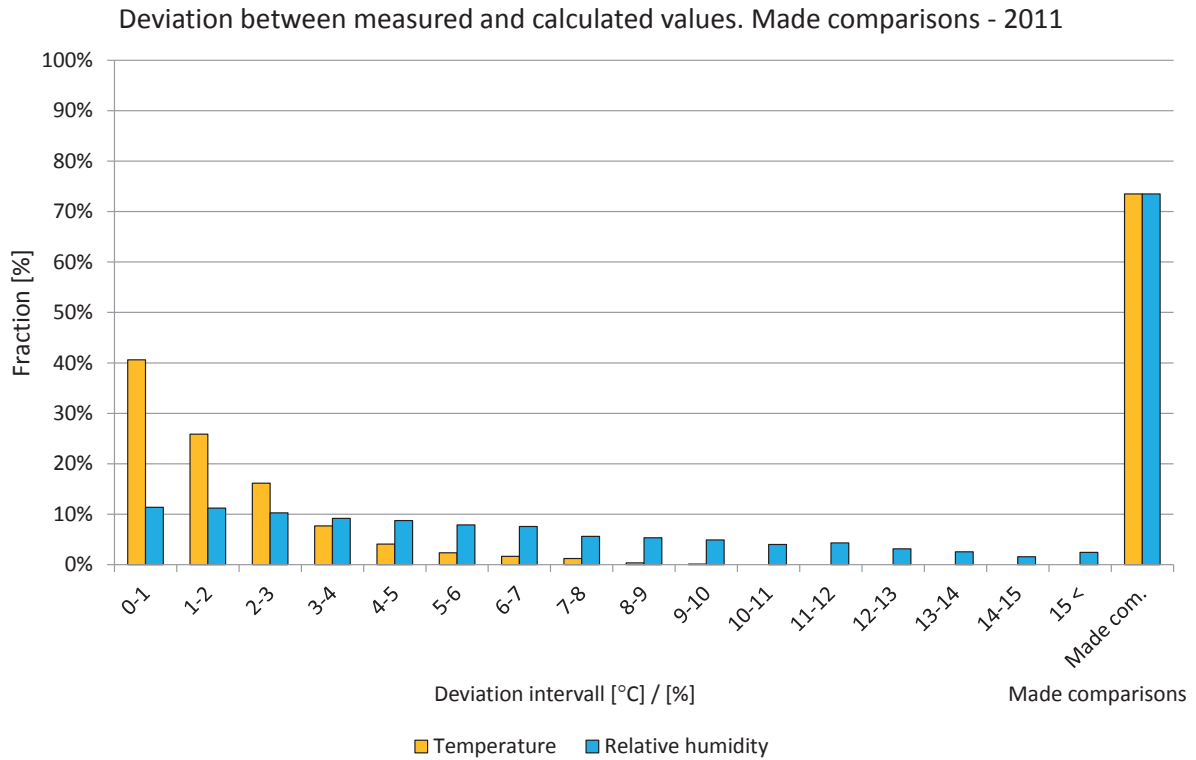
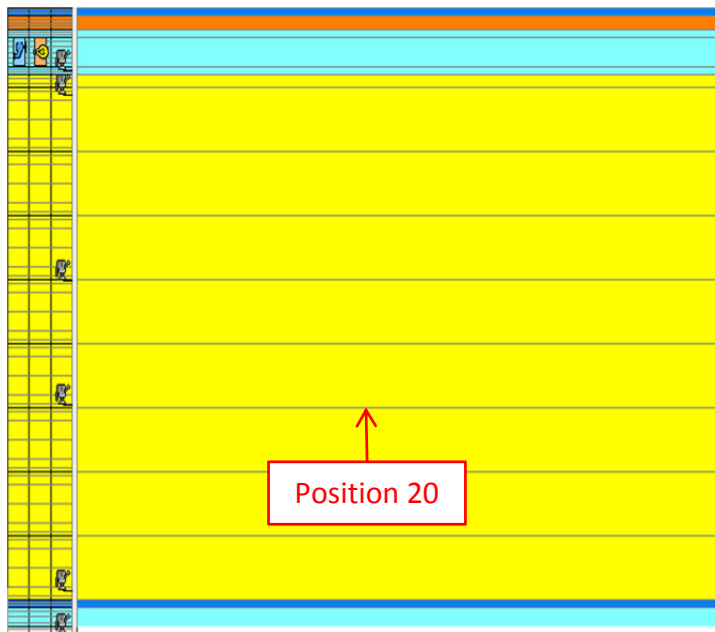


Figure 7.19.17. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.20 Position 20

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof.



Roof, from the outside:

1 mm PVC roof membrane¹, $S_d = 15$ m

22 mm Massive wood - Spruce radial¹

50 mm Air gap¹ with 30 ACH

20 mm EPS¹

800 mm Mineral insulation, $\lambda = 0,037$

$W/mK^{3,4}$, including roof beams

1 mm Vapour retarder¹, $S_d = 50$ m

30 mm Air gap¹, no ACH

13 mm Gypsum board²

Figure 7.20.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

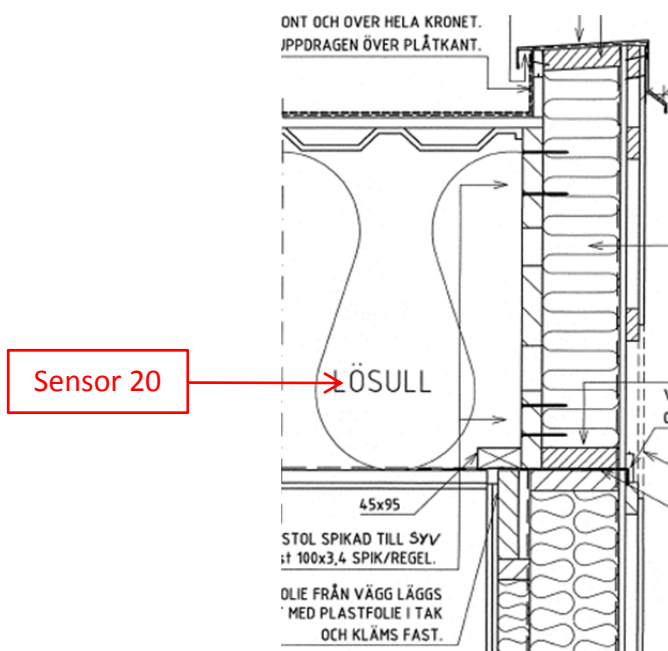


Figure 7.20.2. Location of the studied position.

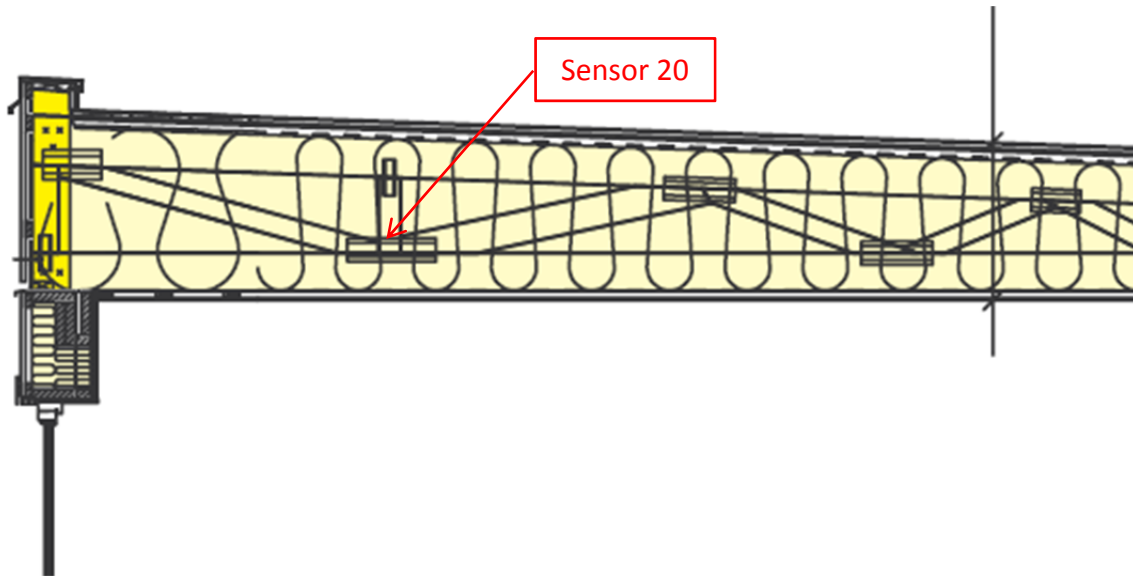


Figure 7.20.3. Location of the studied position.



Figure 7.20.4. Location of the studied position.

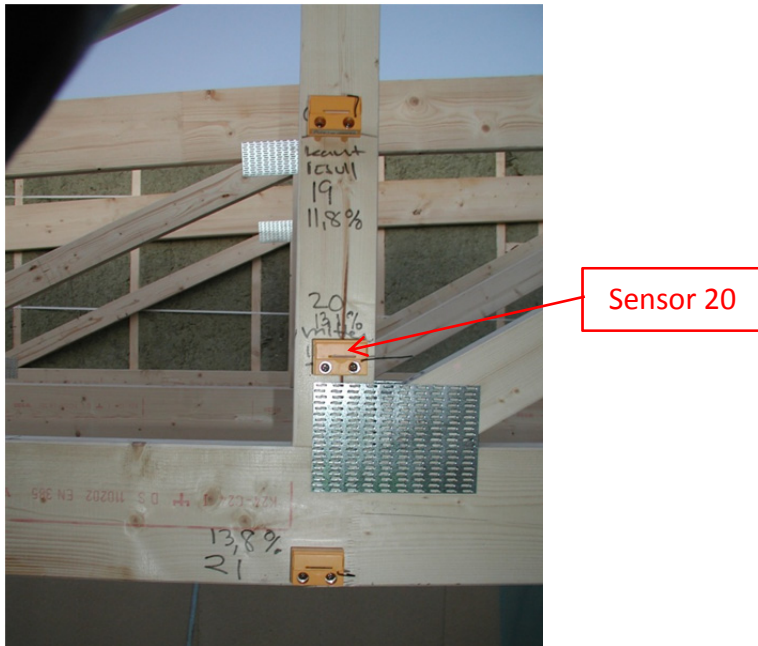


Figure 7.20.5. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

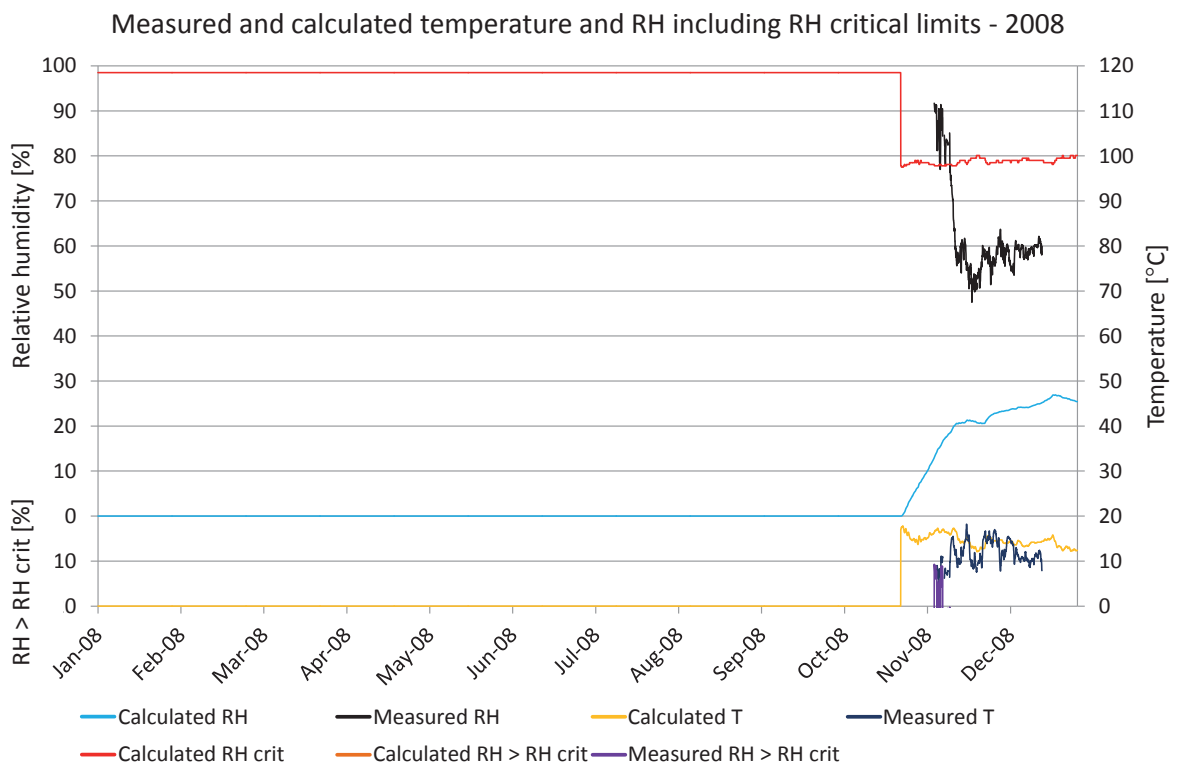


Figure 7.20.6. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

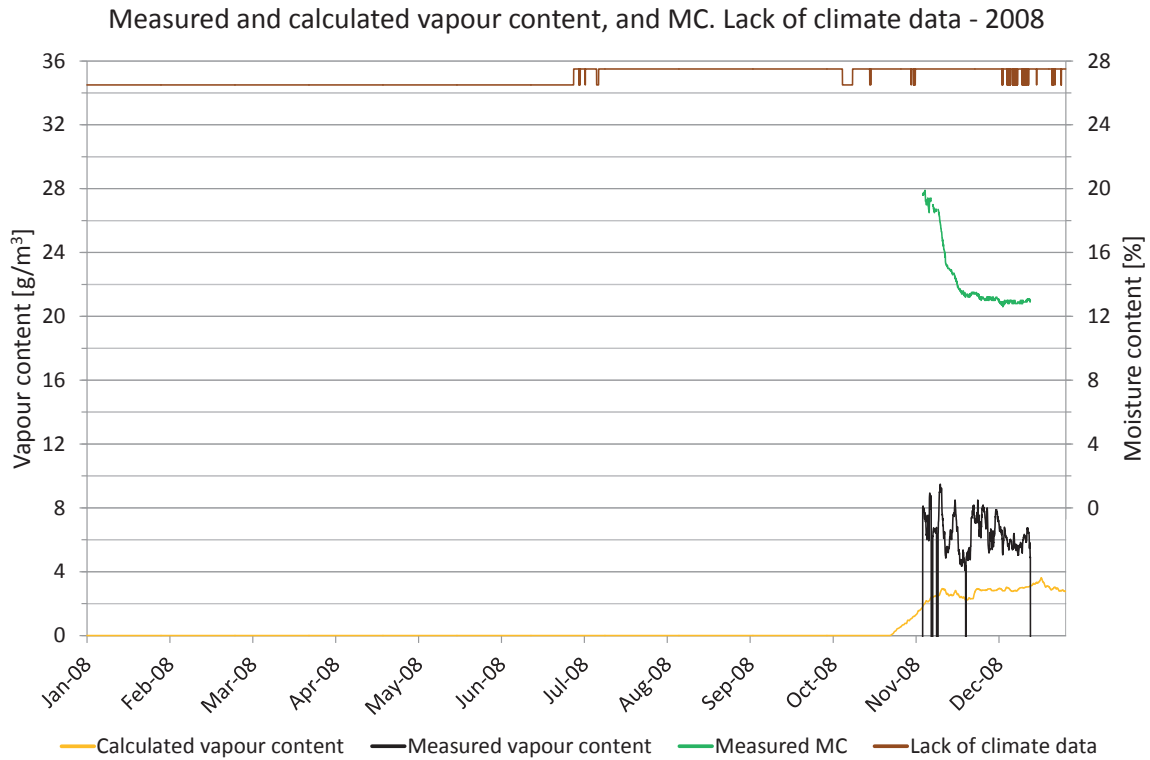


Figure 7.20.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

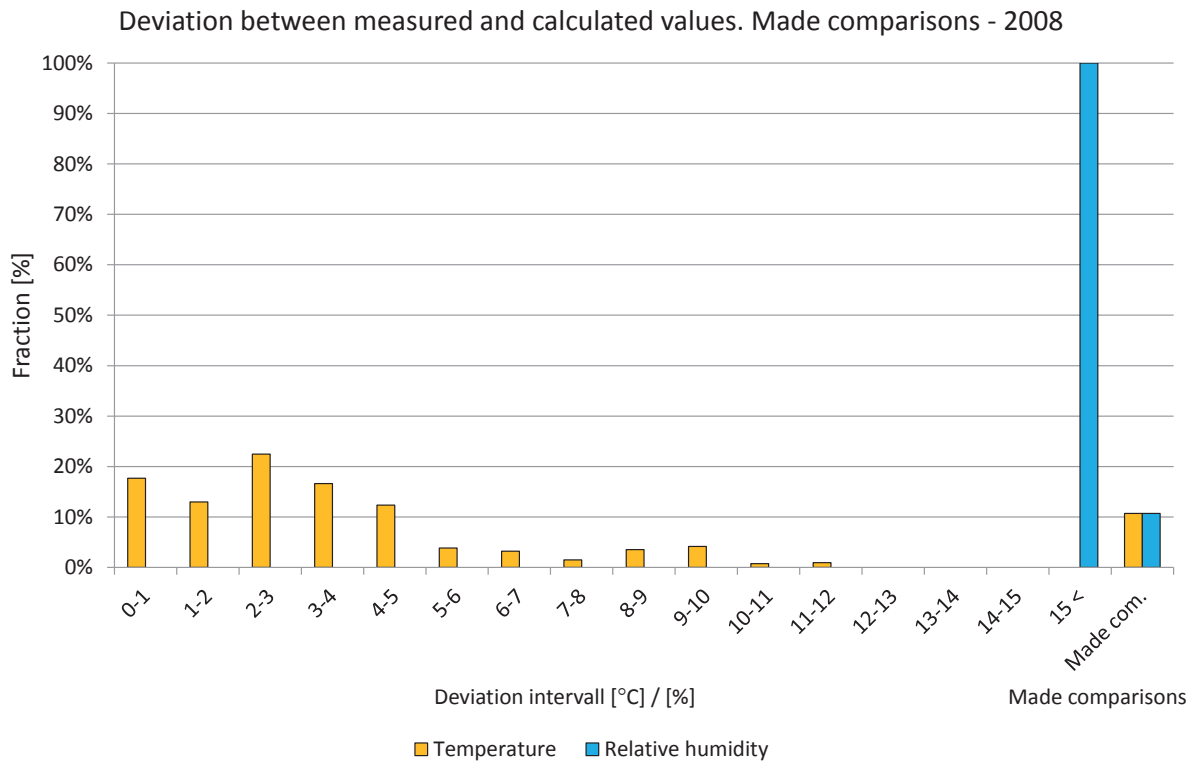


Figure 7.20.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

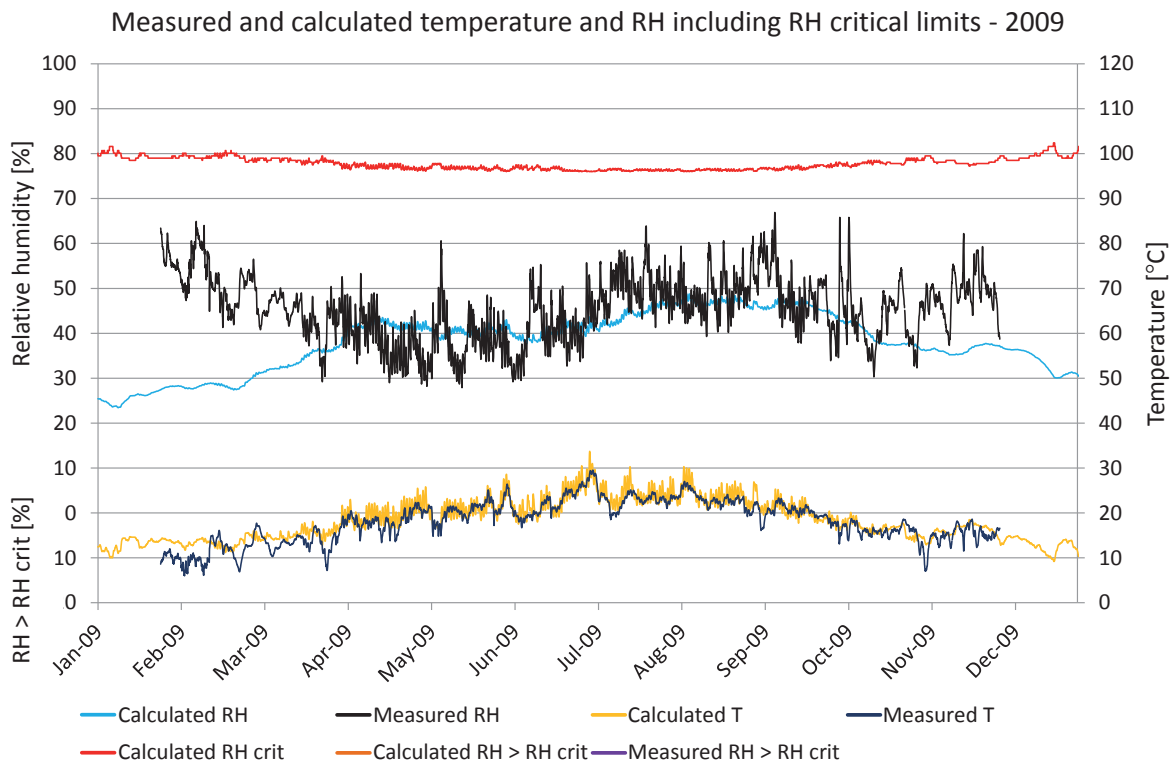


Figure 7.20.9. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

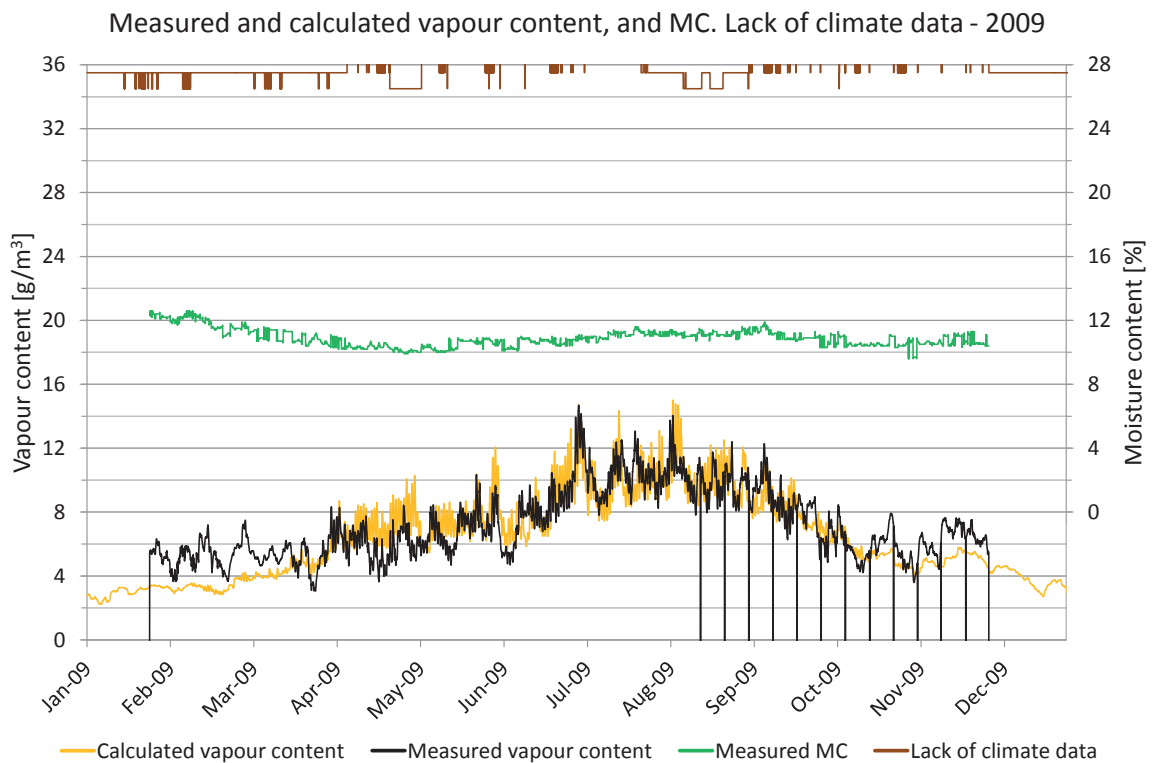


Figure 7.20.10. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

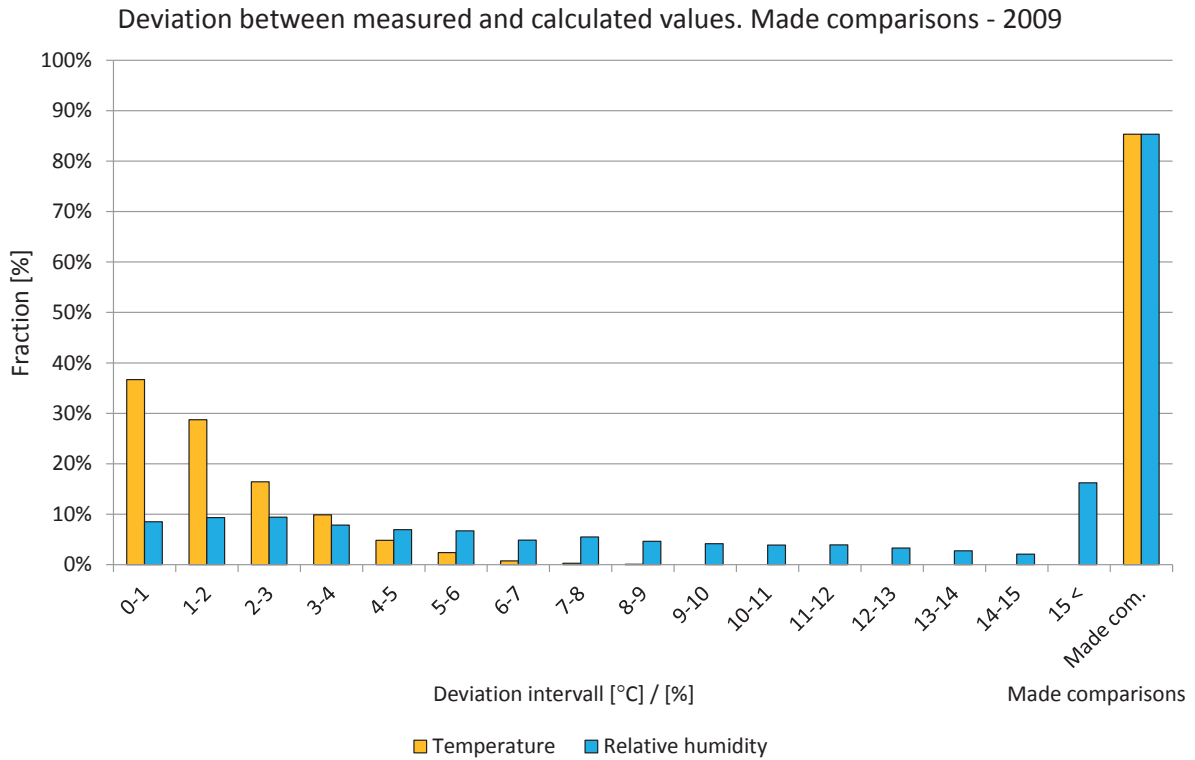


Figure 7.20.11. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

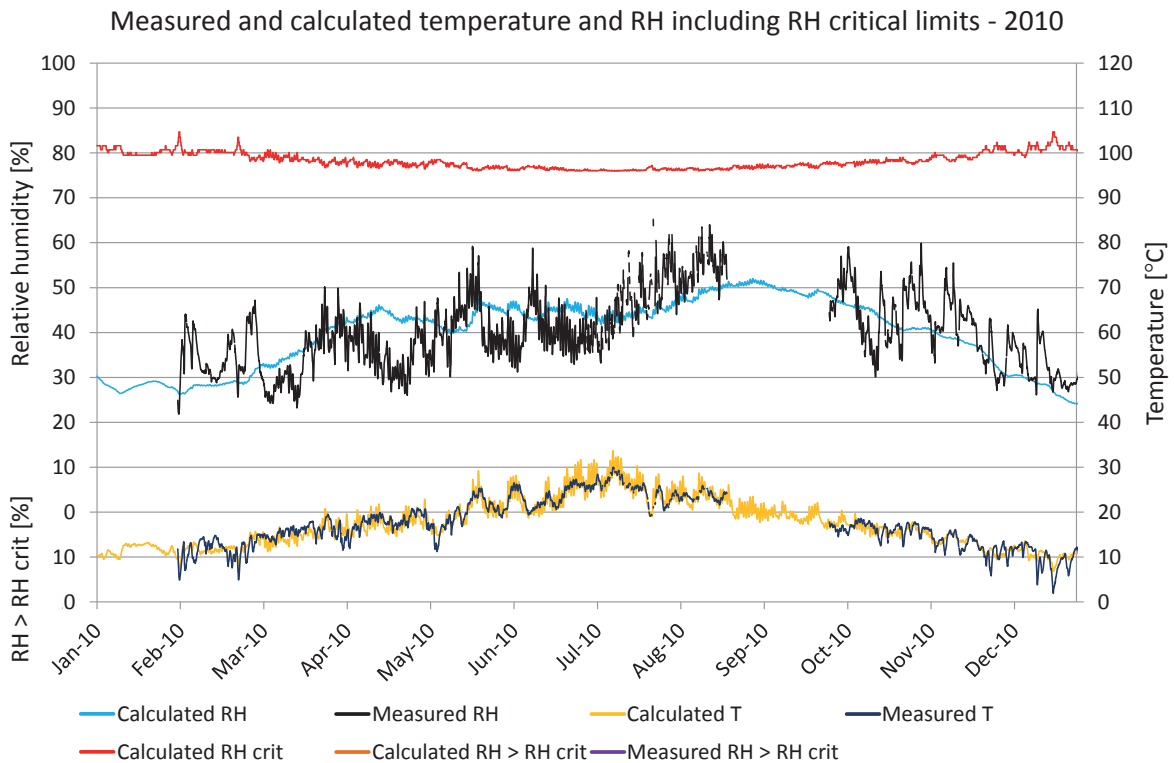


Figure 7.20.12. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

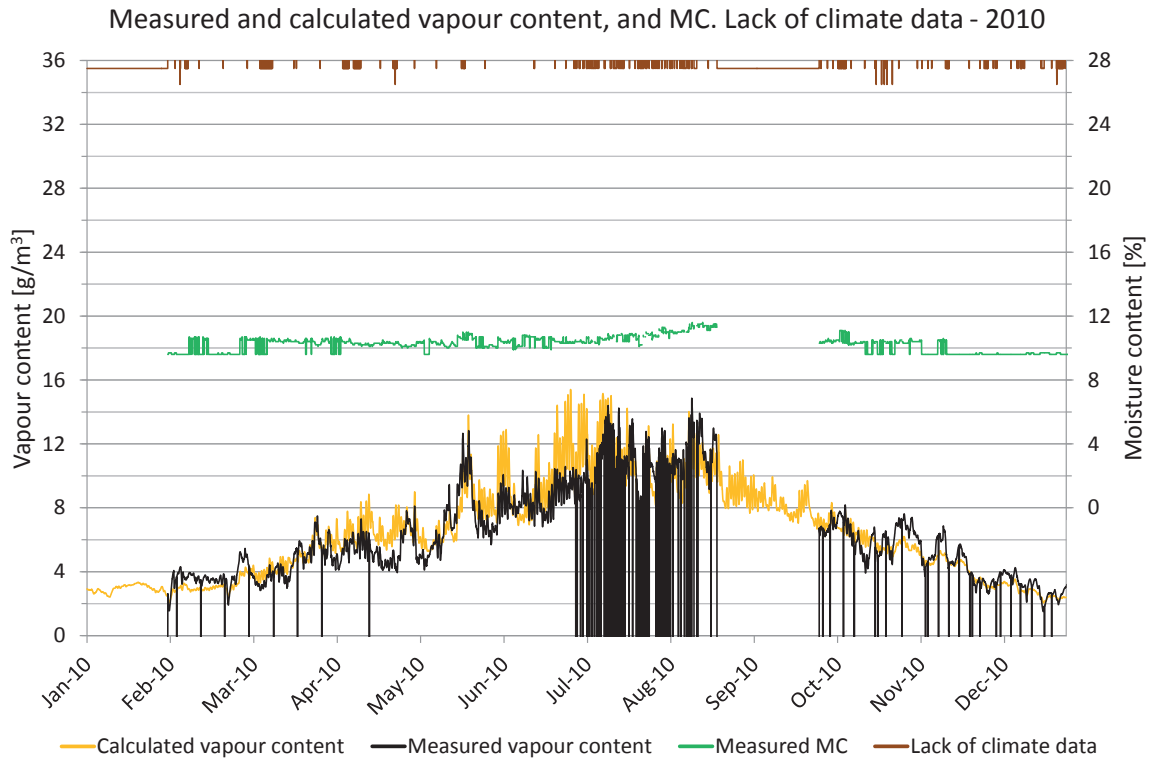


Figure 7.20.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

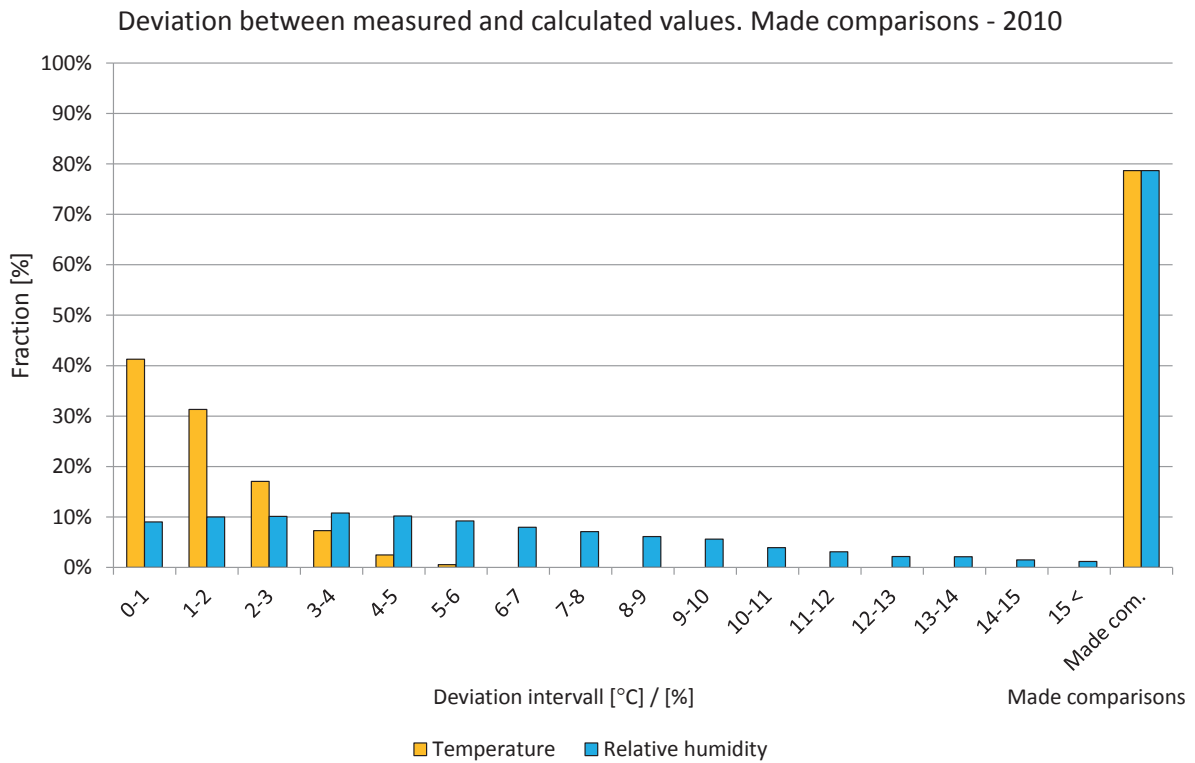


Figure 7.20.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

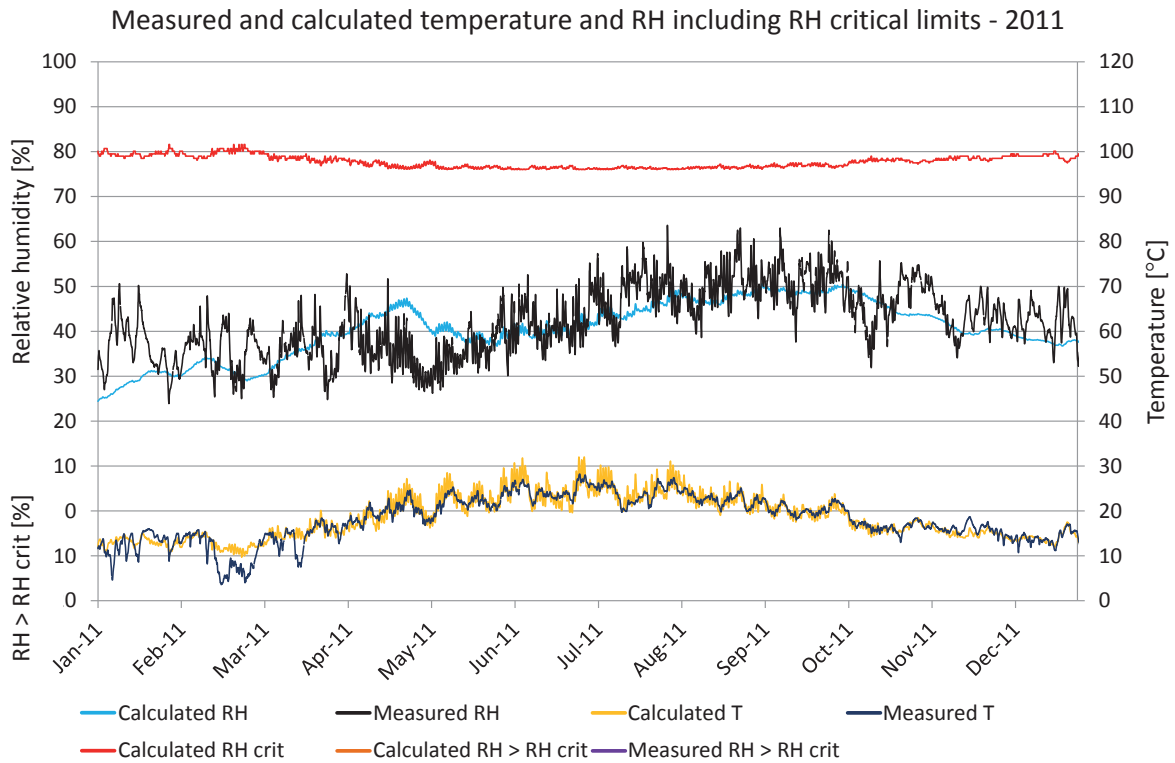


Figure 7.20.15. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

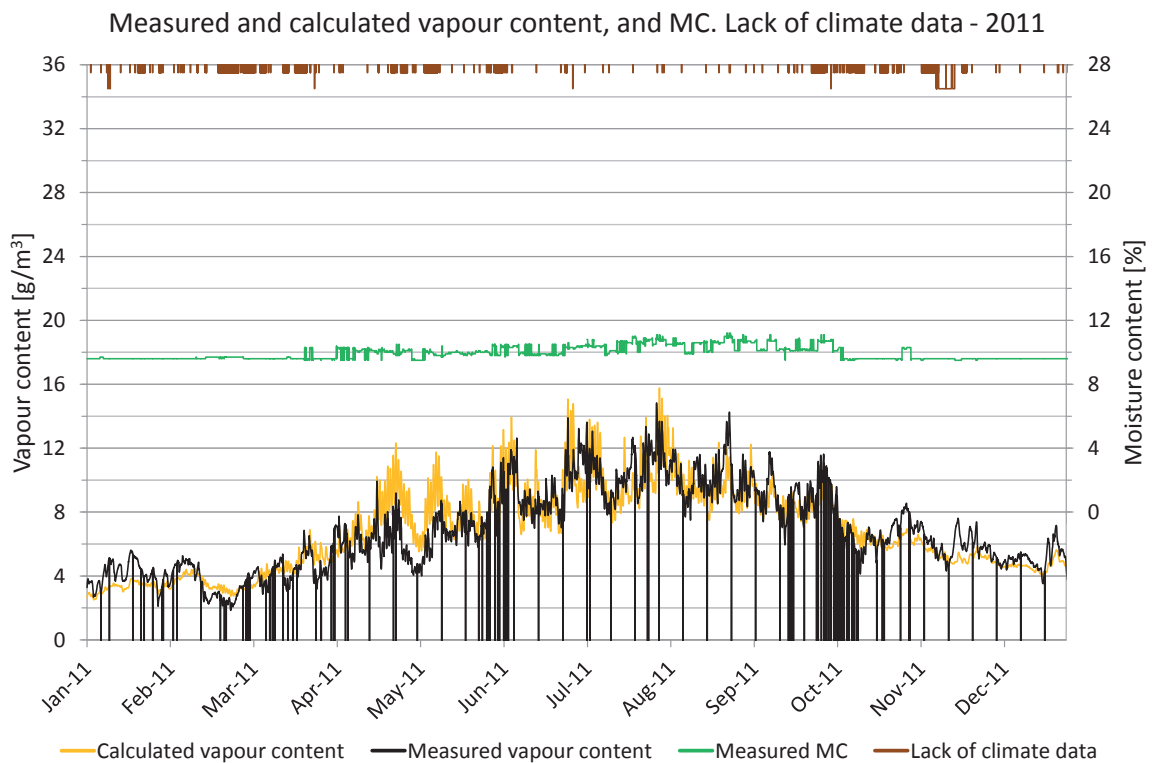


Figure 7.20.16. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

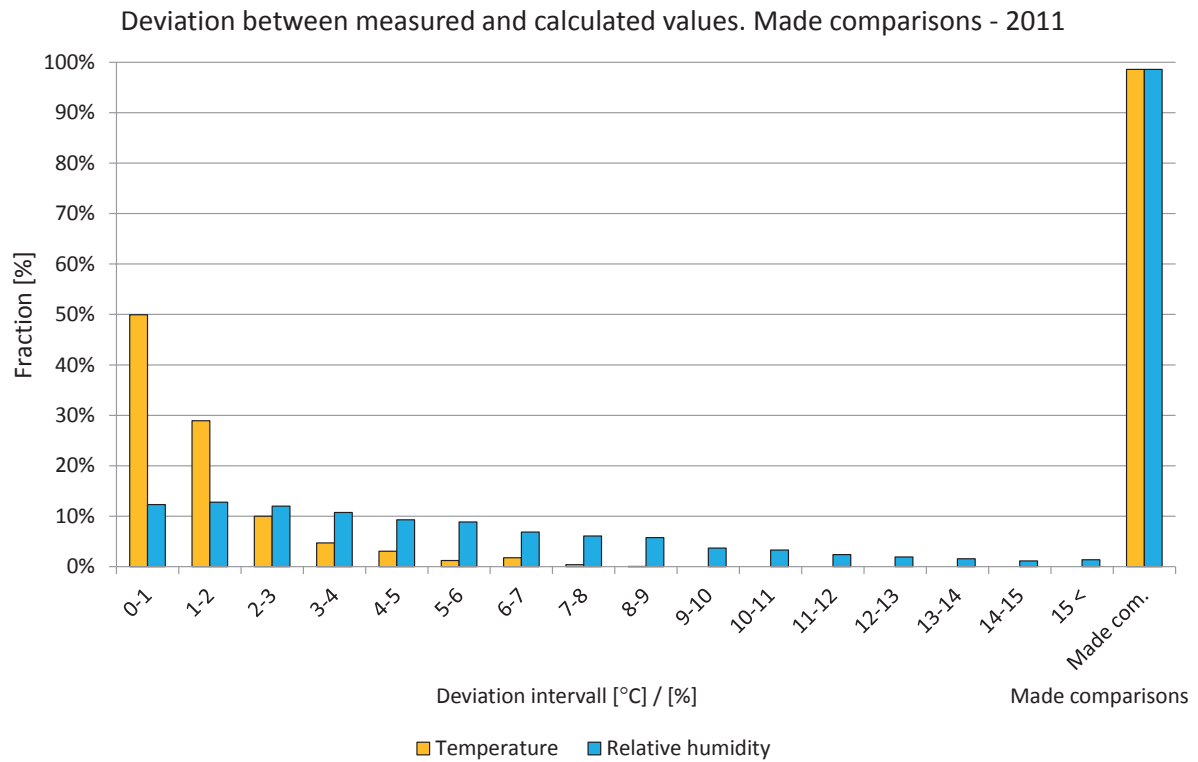
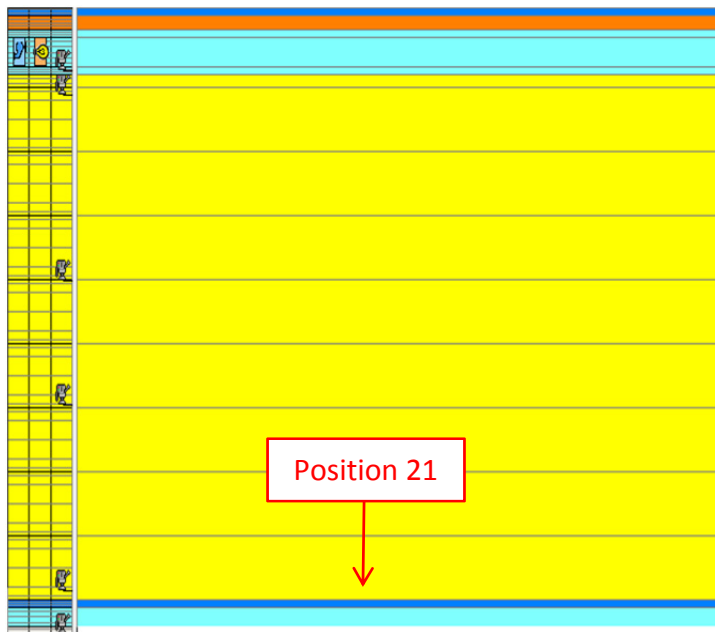


Figure 7.20.17. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.21 Position 21

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the roof.



Roof, from the outside:

- 1 mm PVC roof membrane¹, $S_d = 15$ m
- 22 mm Massive wood - Spruce radial¹
- 50 mm Air gap¹ with 30 ACH
- 20 mm EPS¹
- 800 mm Mineral insulation, $\lambda = 0,037$ W/mK^{3,4}, including roof beams
- 1 mm Vapour retarder¹, $S_d = 50$ m
- 30 mm Air gap¹, no ACH
- 13 mm Gypsum board²

Figure 7.21.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Krus, M. 1996, 3. IEA Annex 24, 1996, 4. Paroc, 2002.

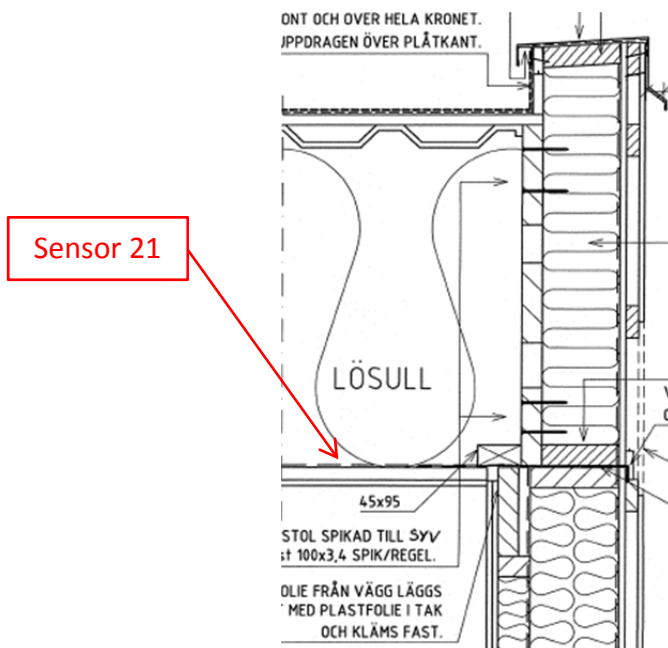


Figure 7.21.2. Location of the studied position.

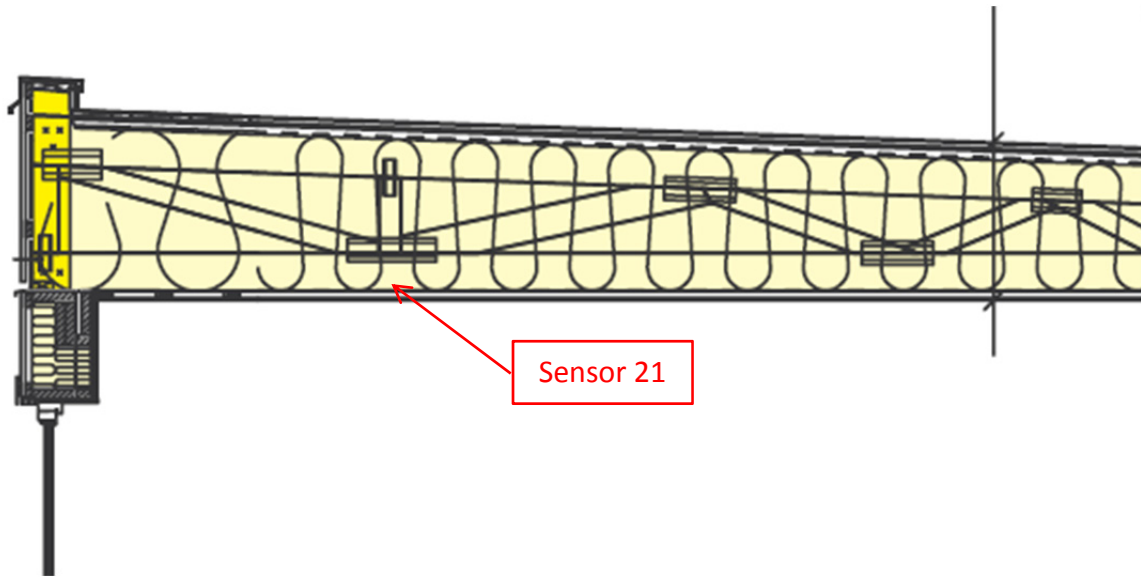


Figure 7.21.3. Location of the studied position.



Figure 7.21.4. Location of the studied position.

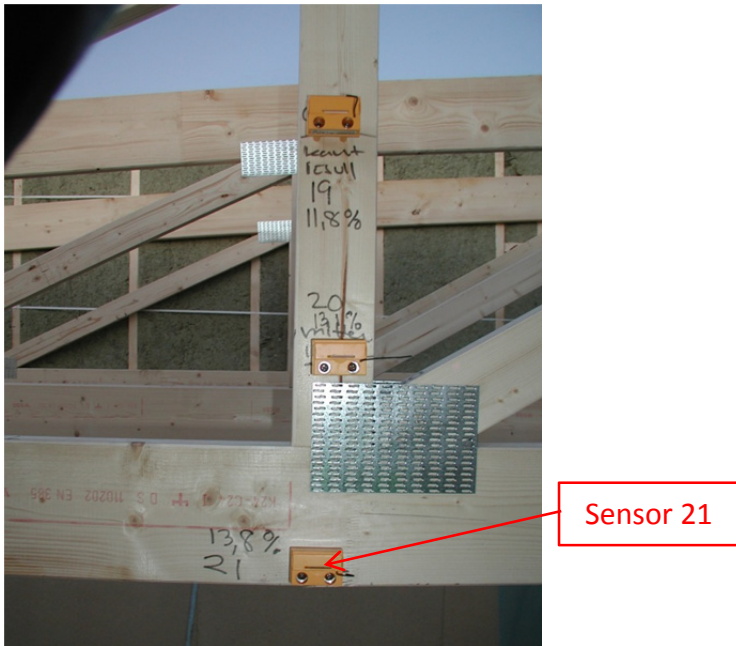


Figure 7.21.5. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

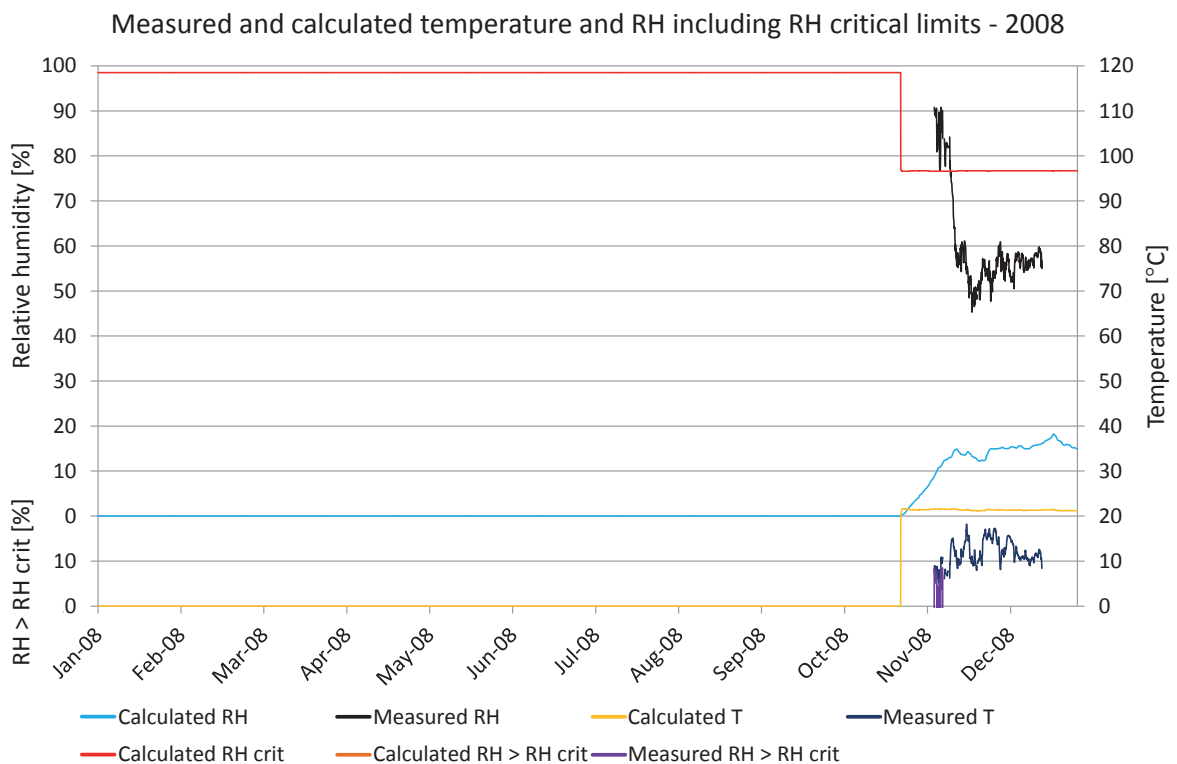


Figure 7.21.6. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

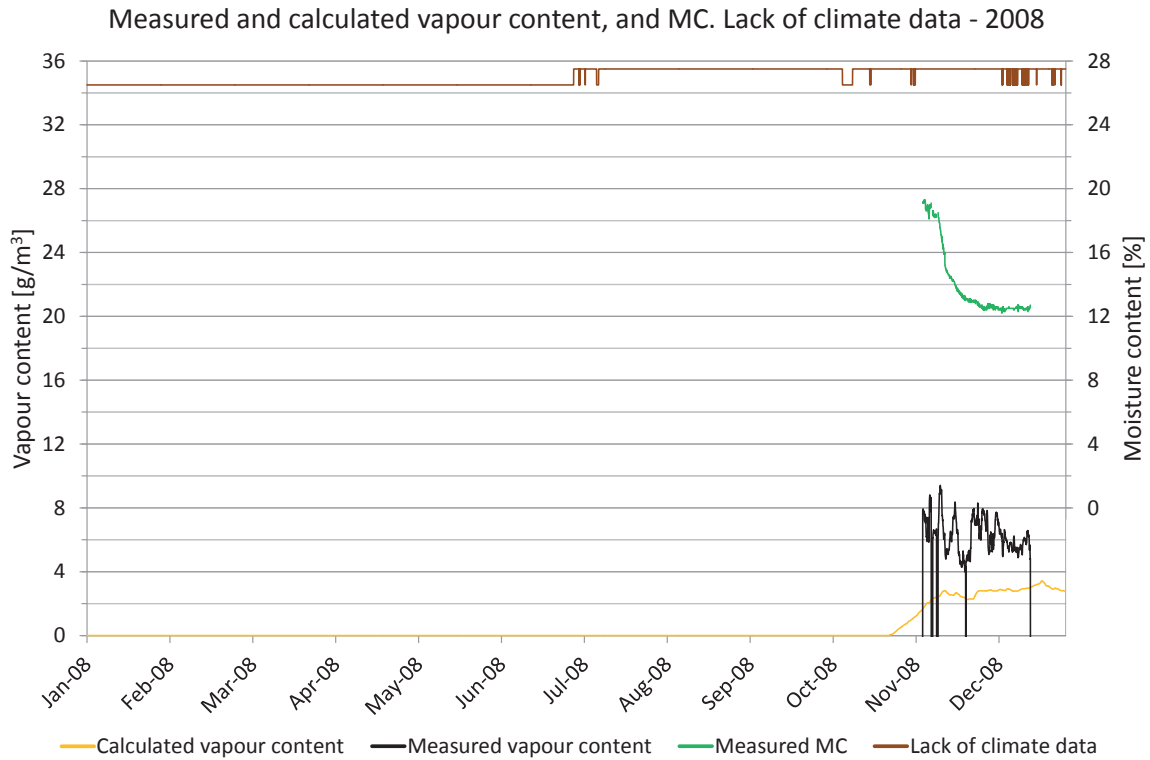


Figure 7.21.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

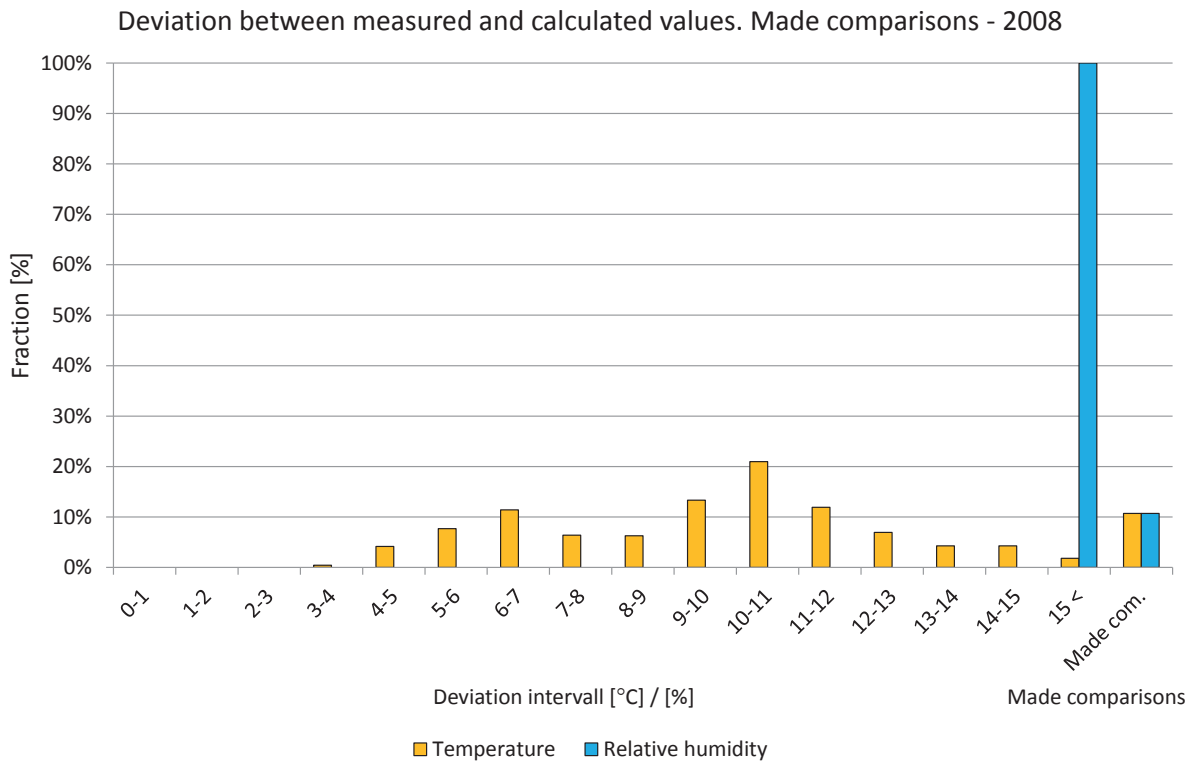


Figure 7.21.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

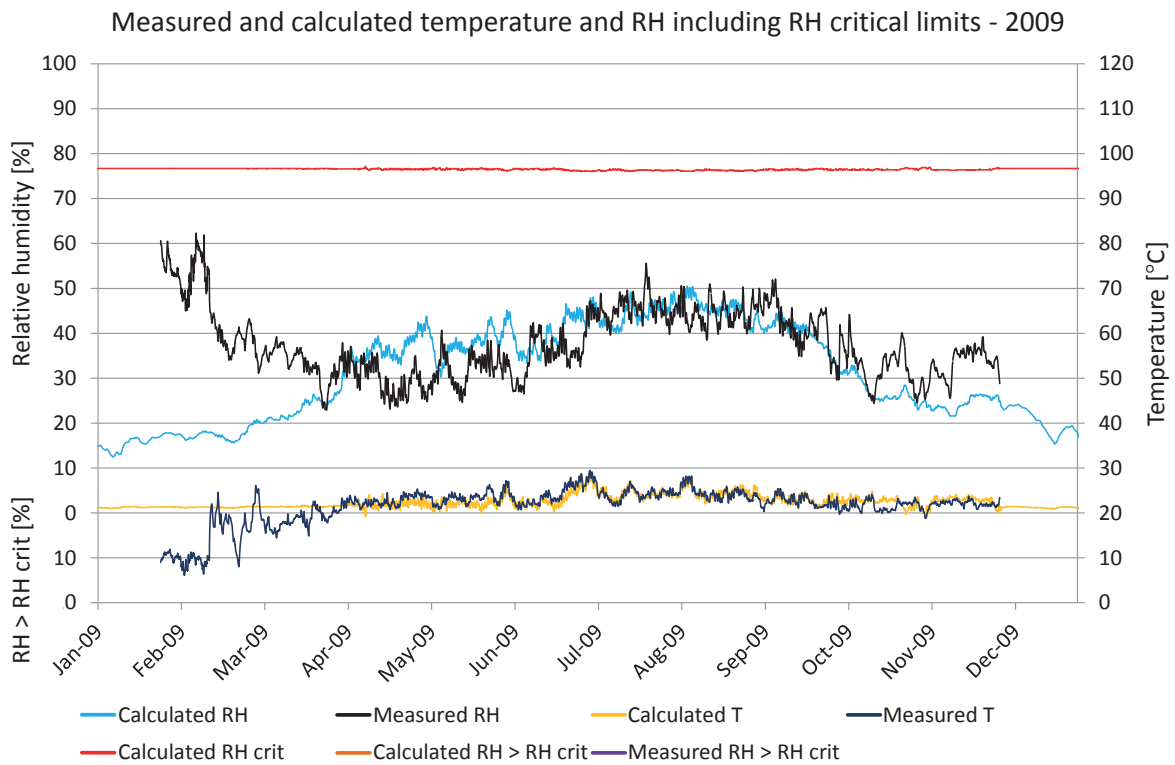


Figure 7.21.9. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

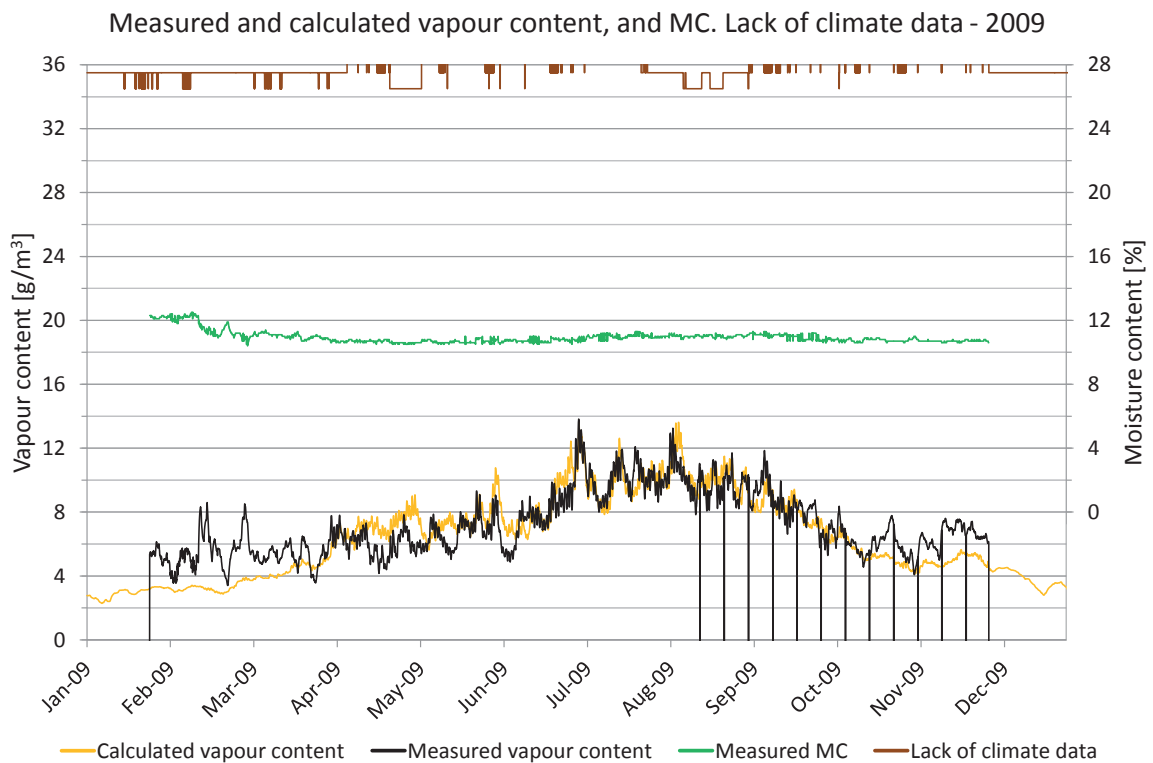


Figure 7.21.10. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

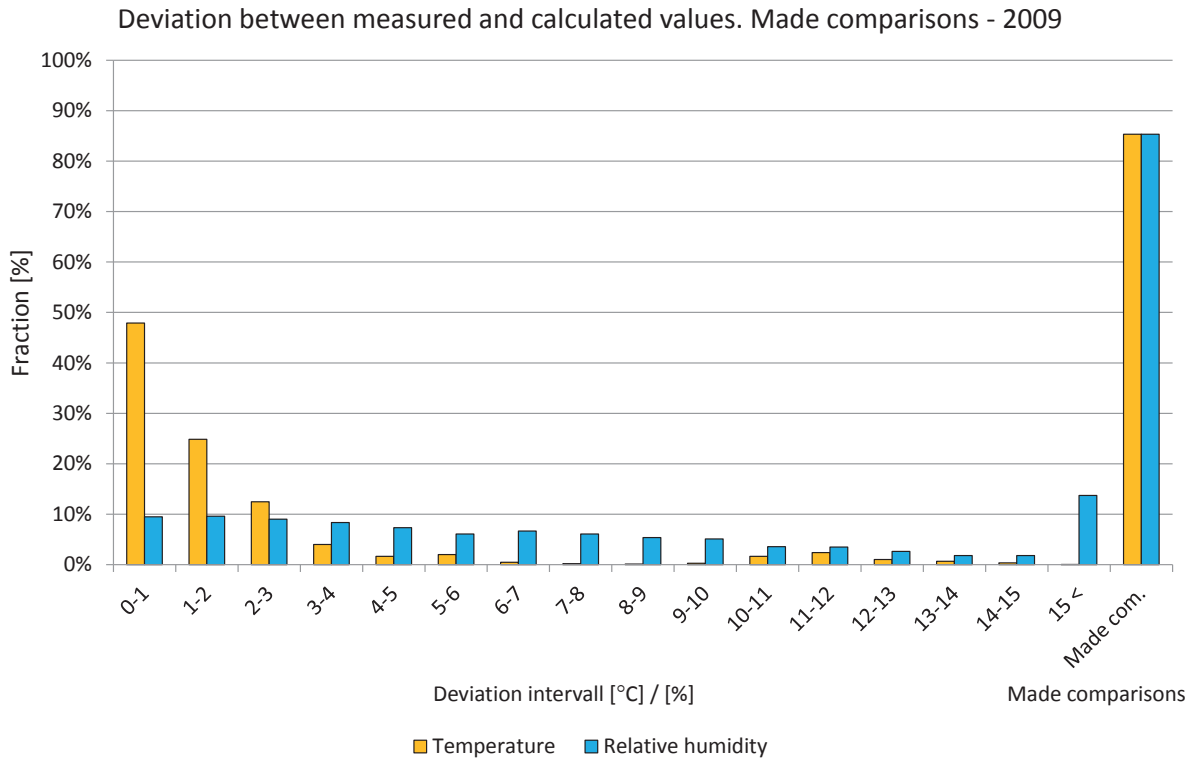


Figure 7.21.11. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

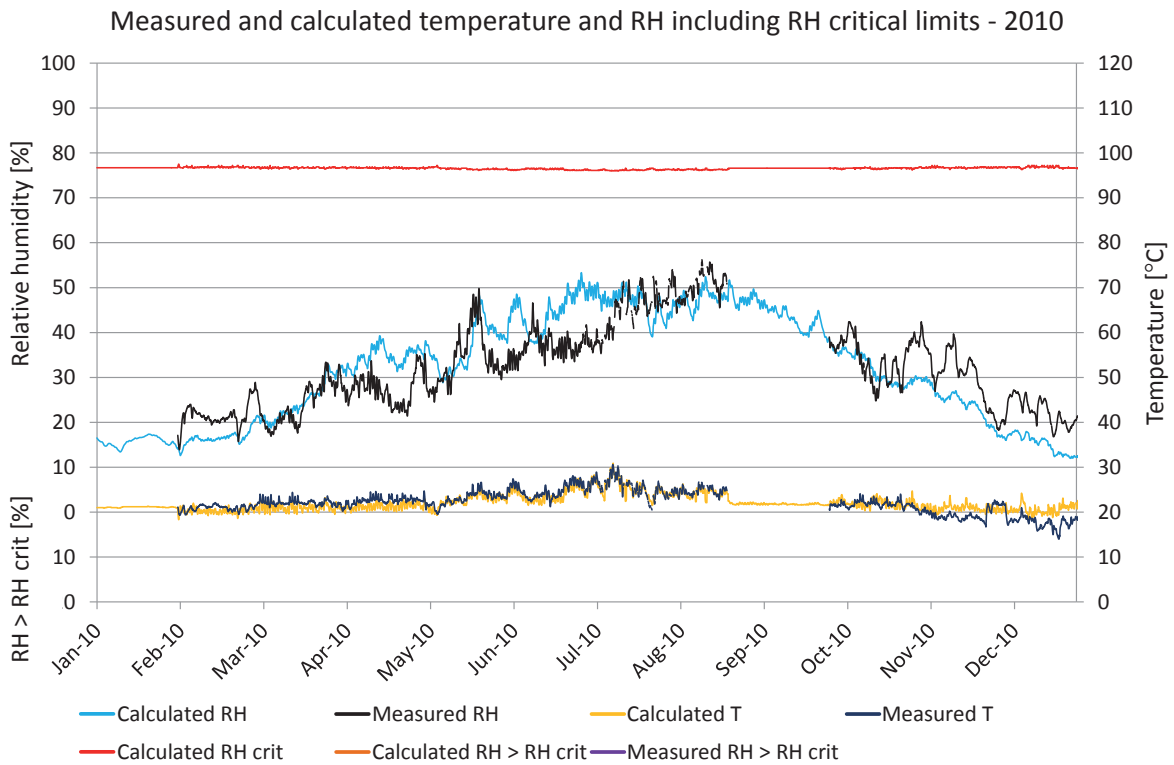


Figure 7.21.12. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

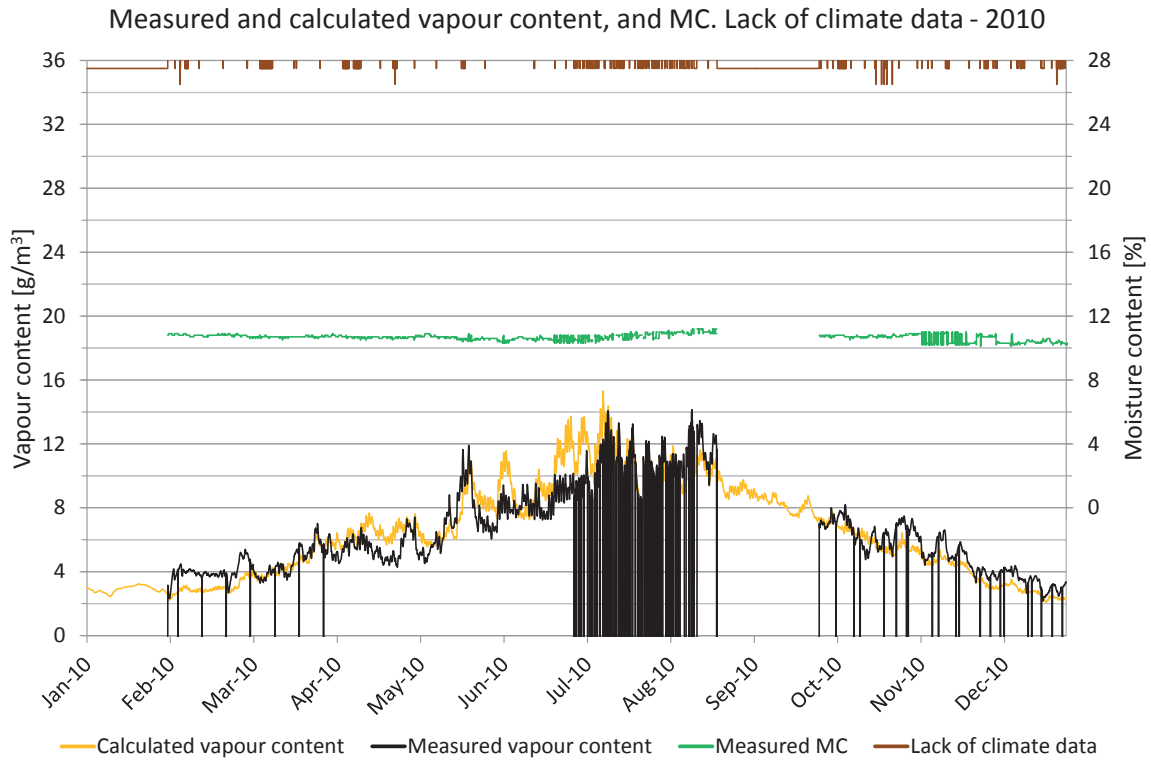


Figure 7.21.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

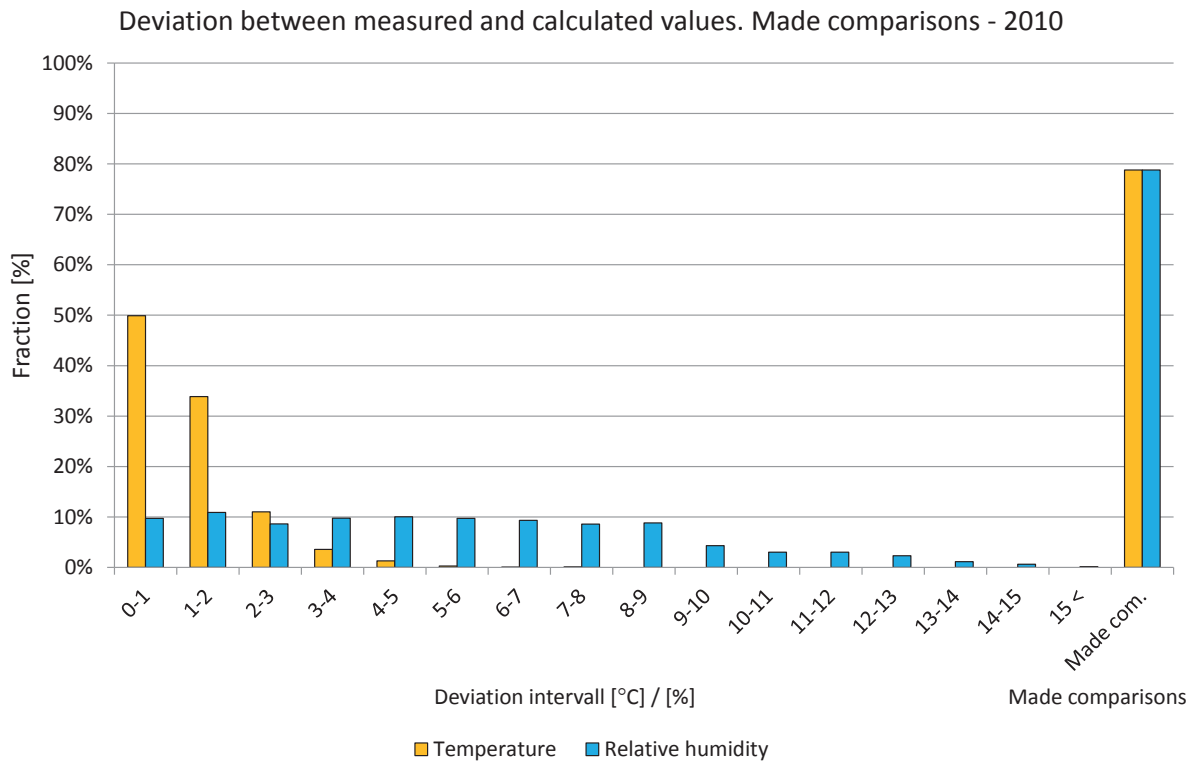


Figure 7.21.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

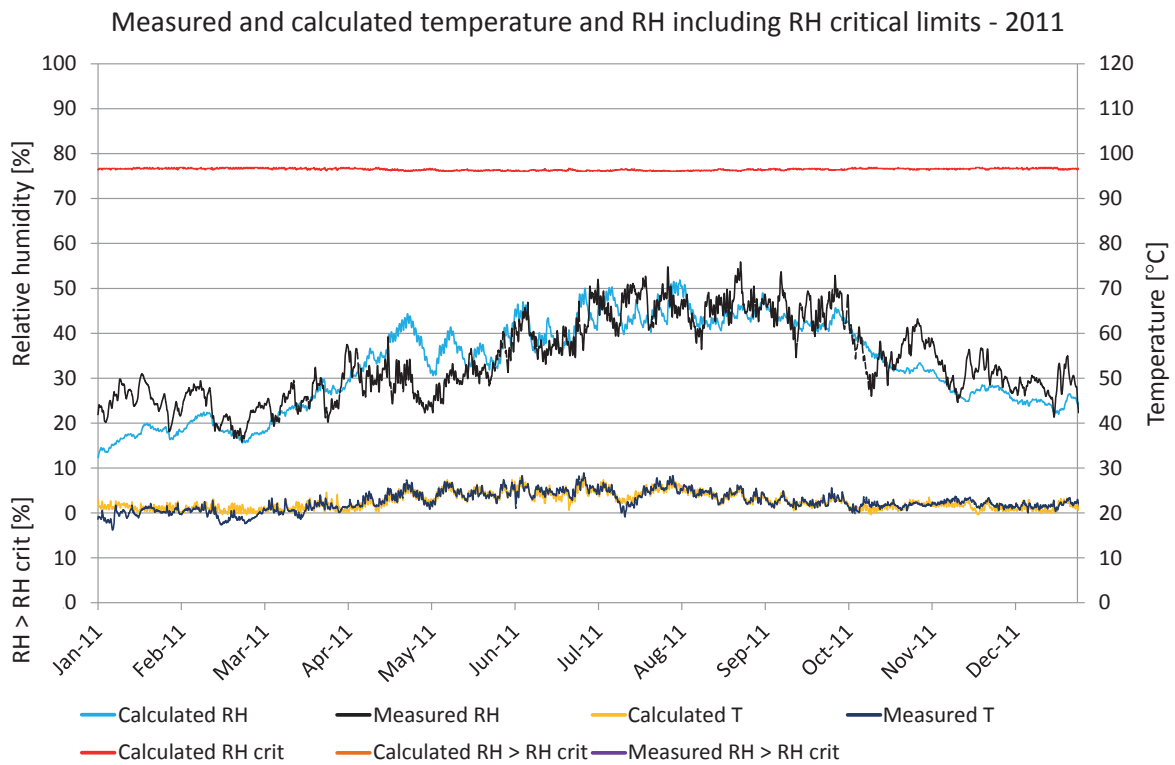


Figure 7.21.15. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

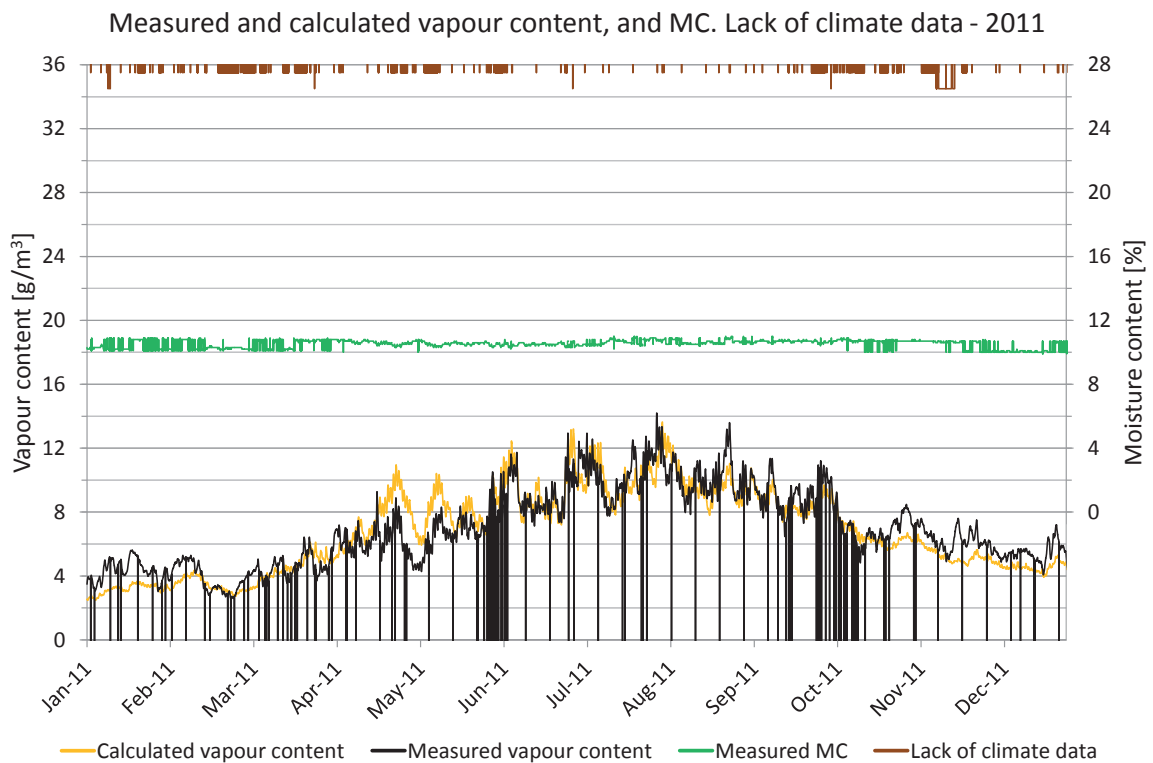


Figure 7.21.16. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

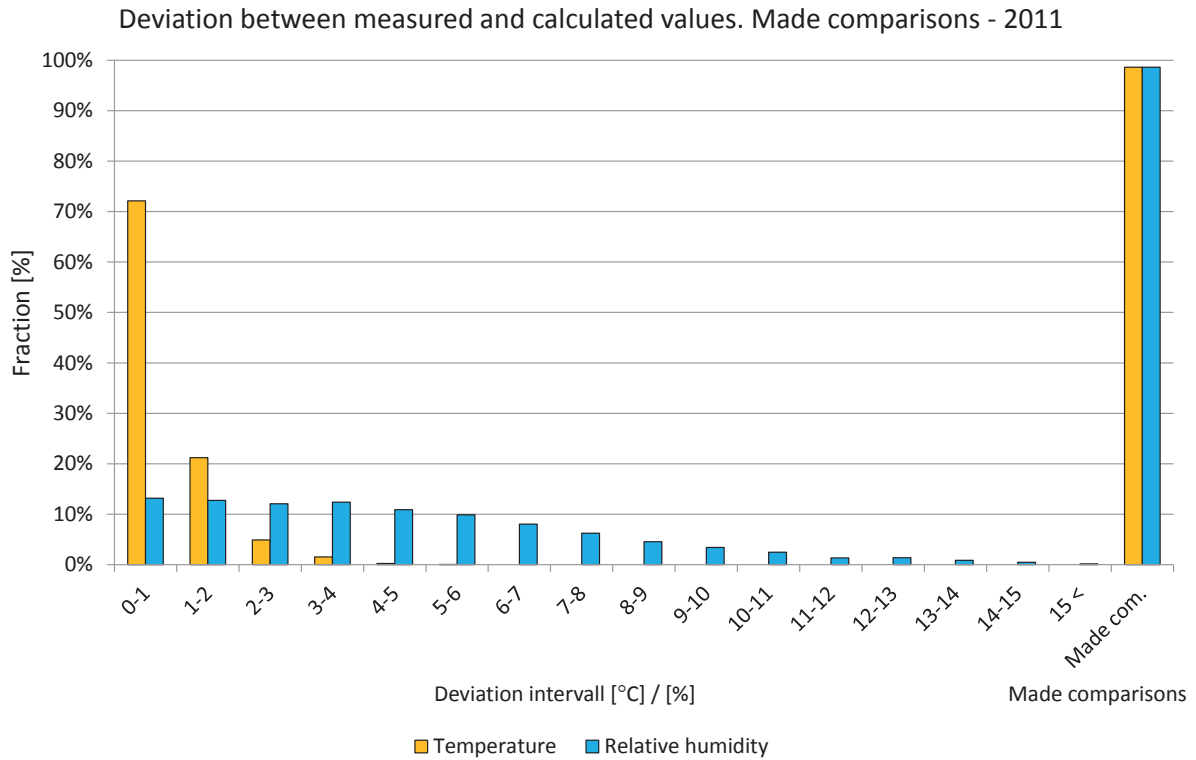


Figure 7.21.17. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.22 Position 22

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in a wall facing northeast close to an iron beam in the connection between the slab and the wall.

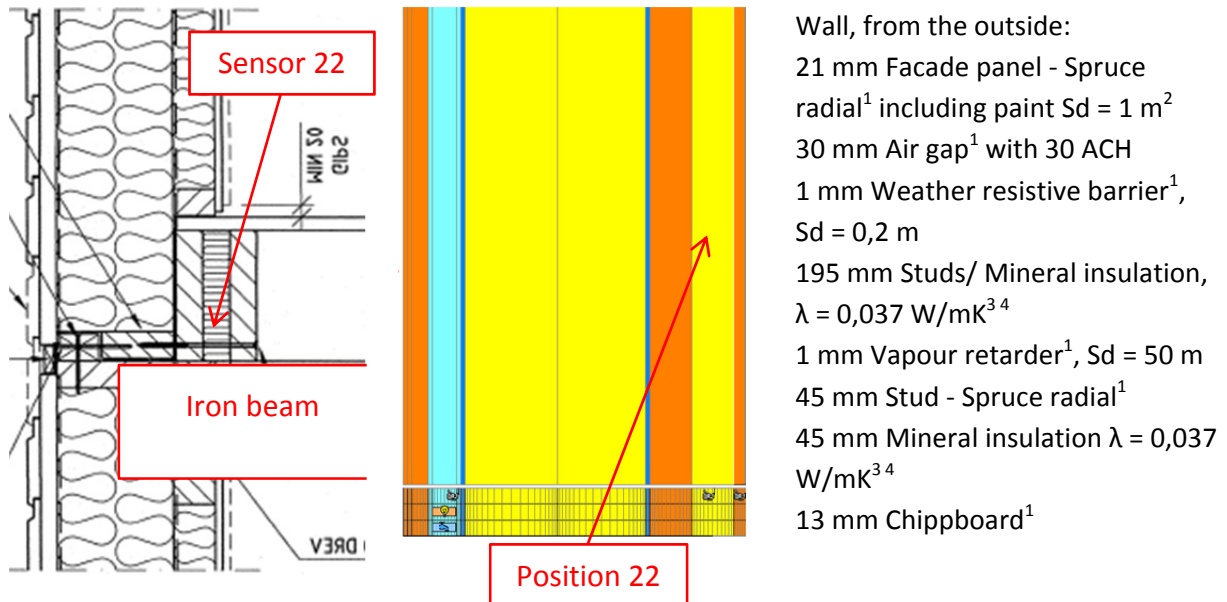


Figure 7.11.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002.



Figure 7.22.2. Location of the studied position before the sensor, the iron beam, the slab and the wall on the second floor was mounted.



Figure 7.22.3. Location of the studied position before the sensor, the iron beam, the slab and the wall on the second floor was mounted.

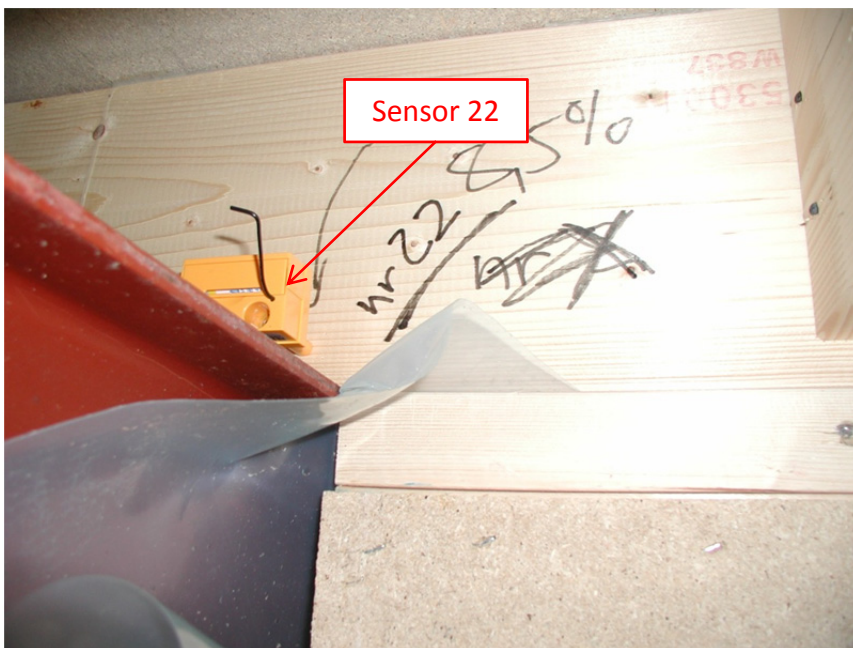


Figure 7.22.4. Location of the studied position.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

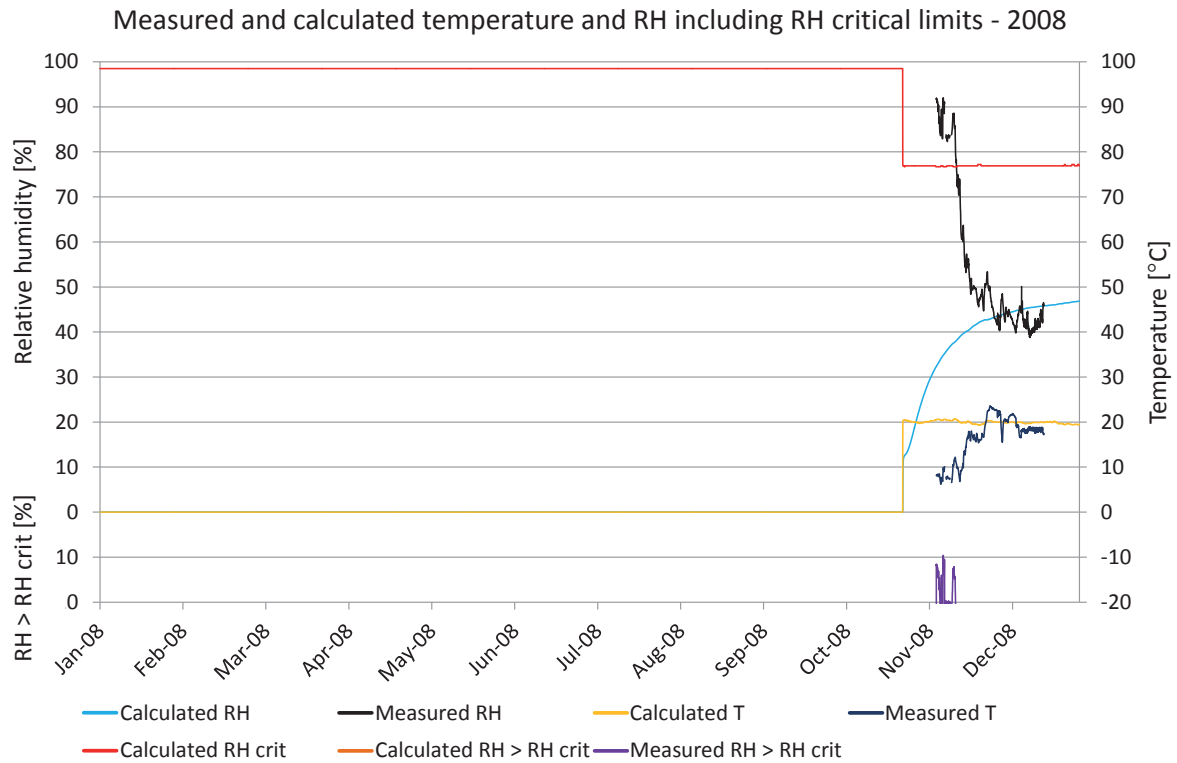


Figure 7.22.5. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

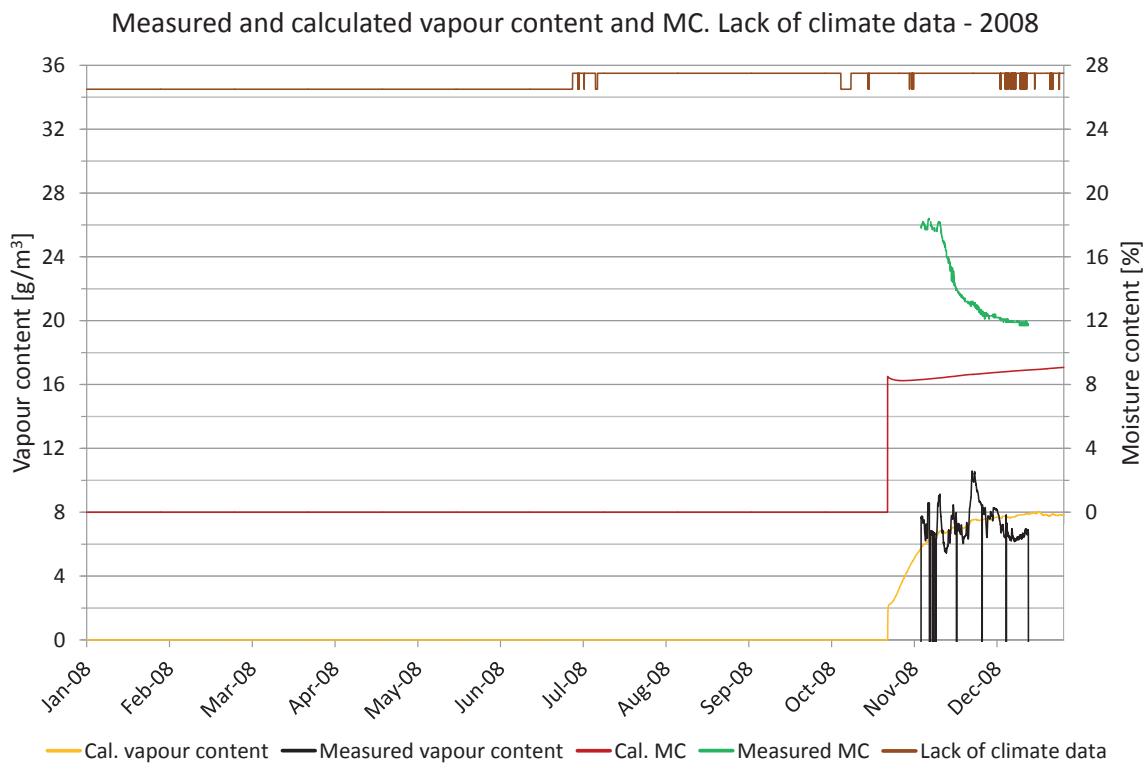


Figure 7.22.6. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

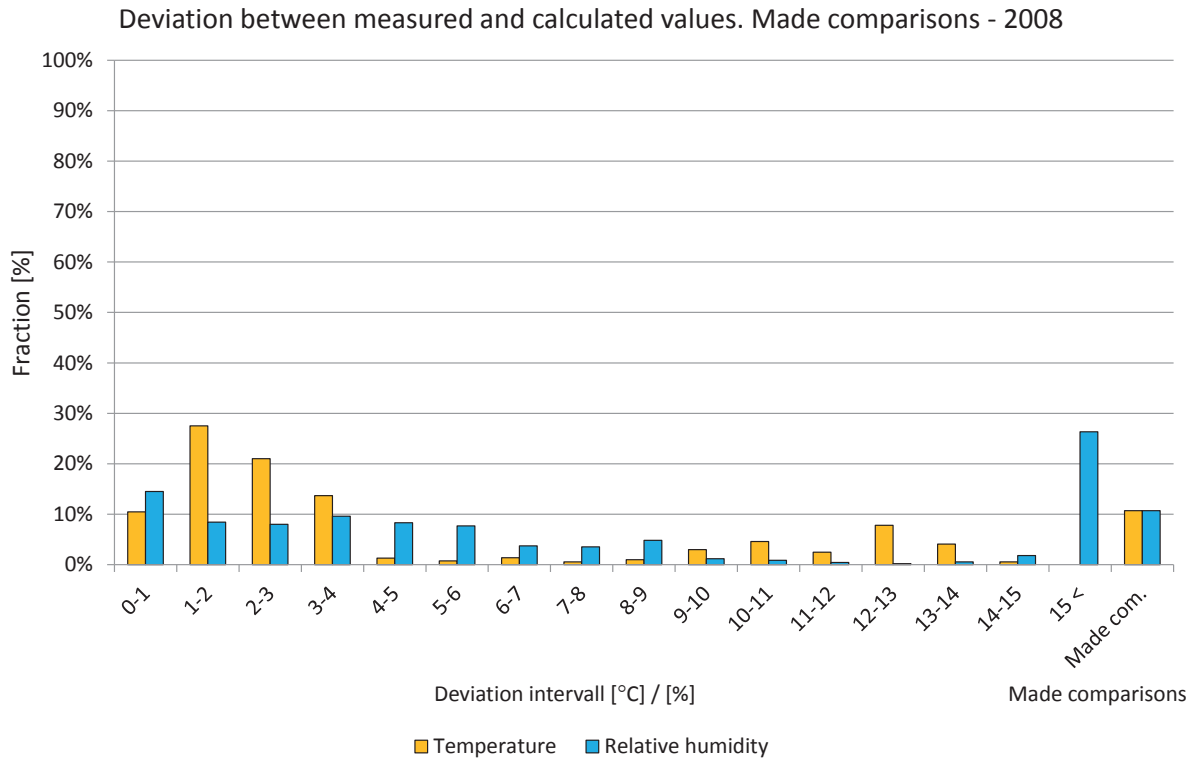


Figure 7.22.7. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

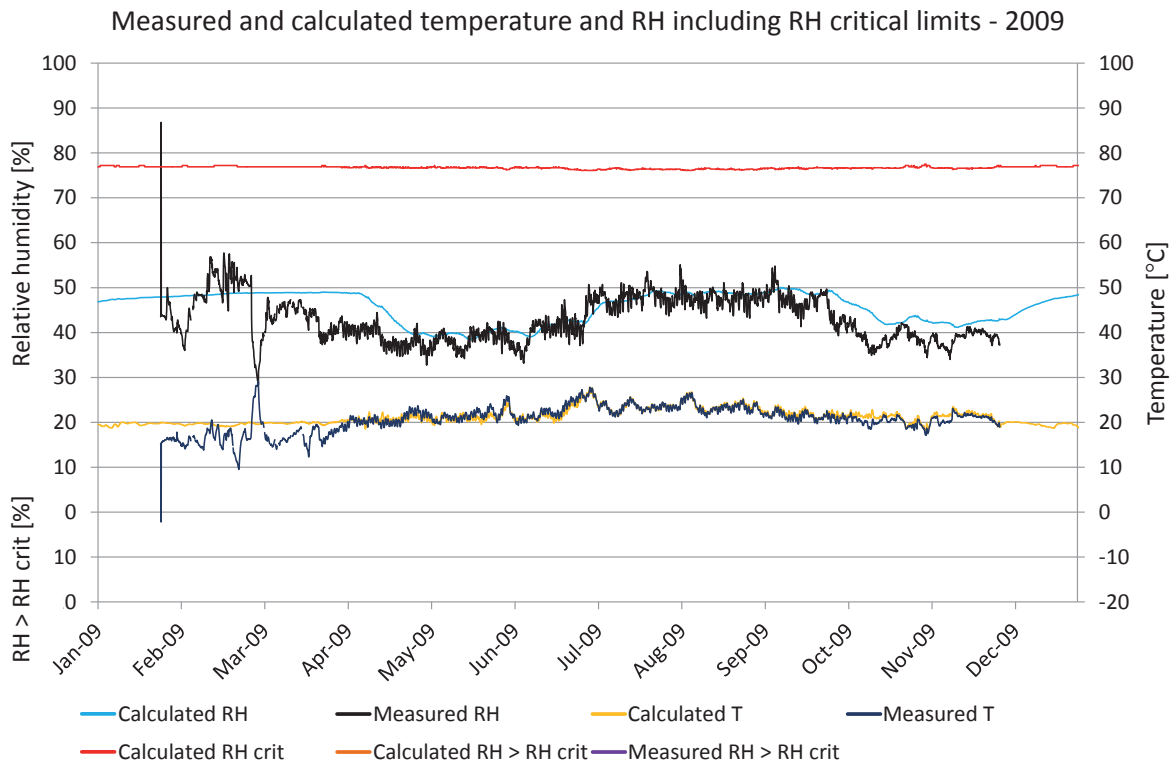


Figure 7.22.8. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

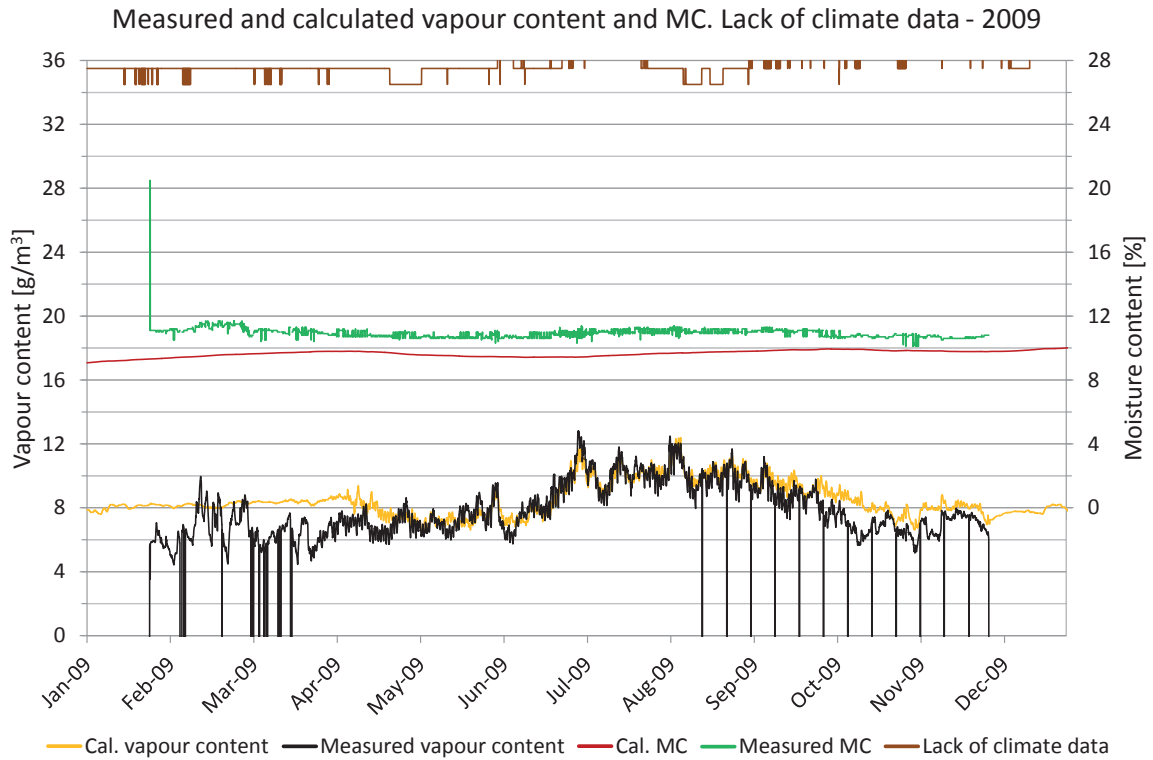


Figure 7.22.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

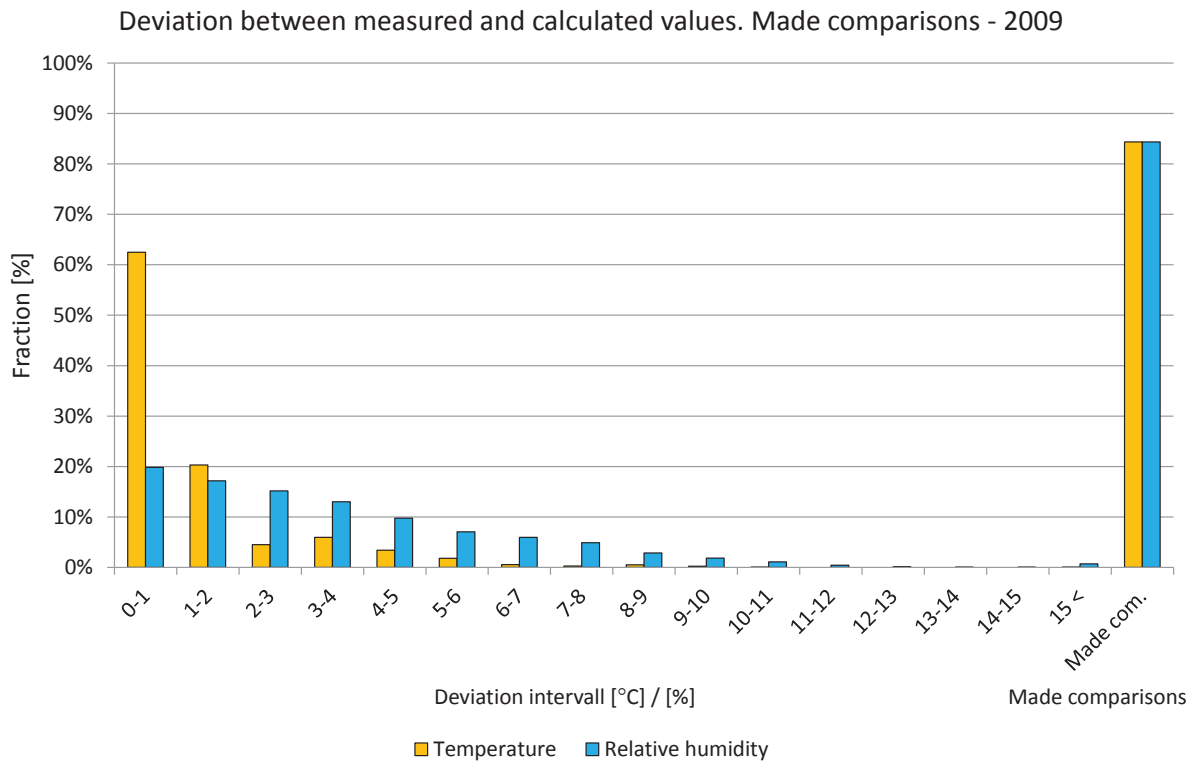


Figure 7.22.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

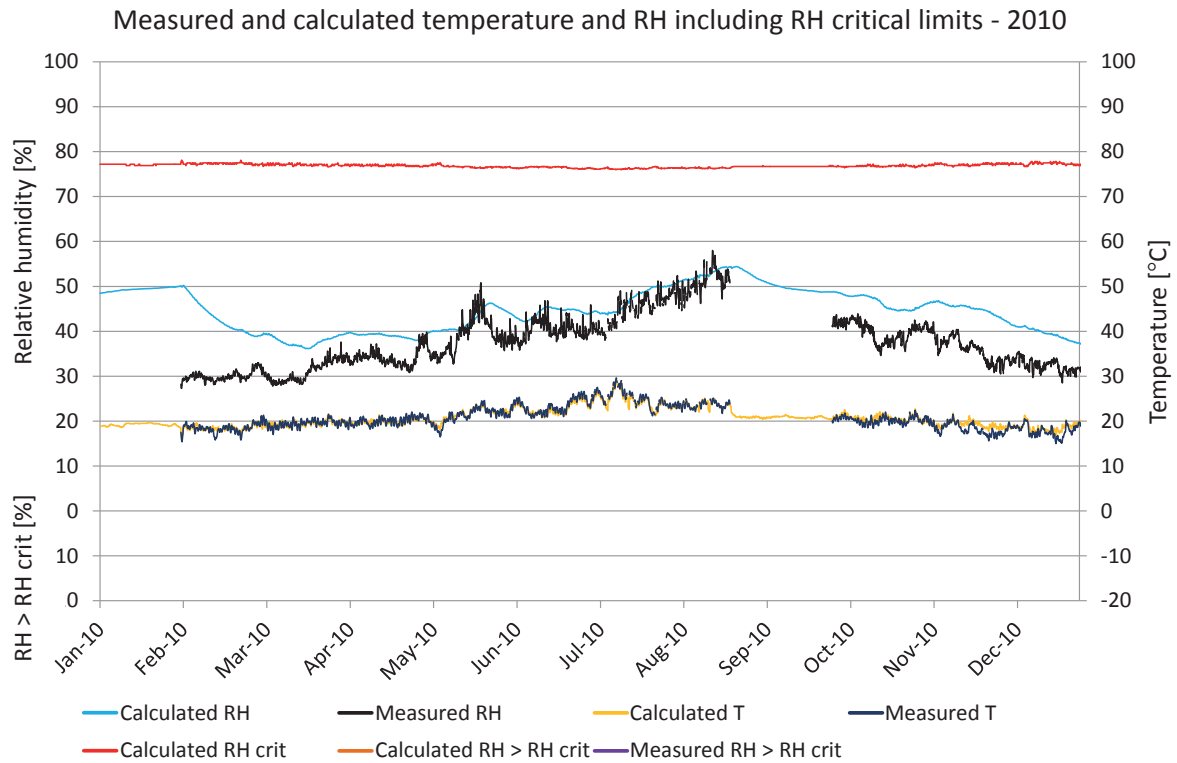


Figure 7.22.11. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

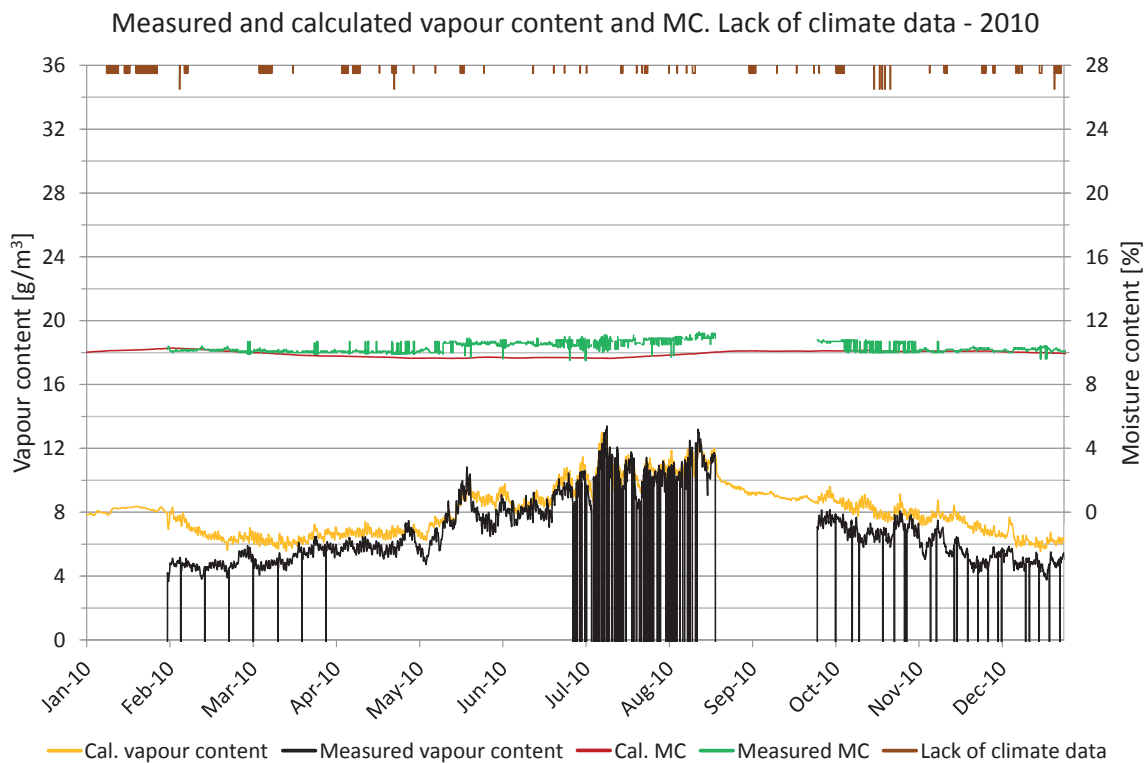


Figure 7.22.12. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

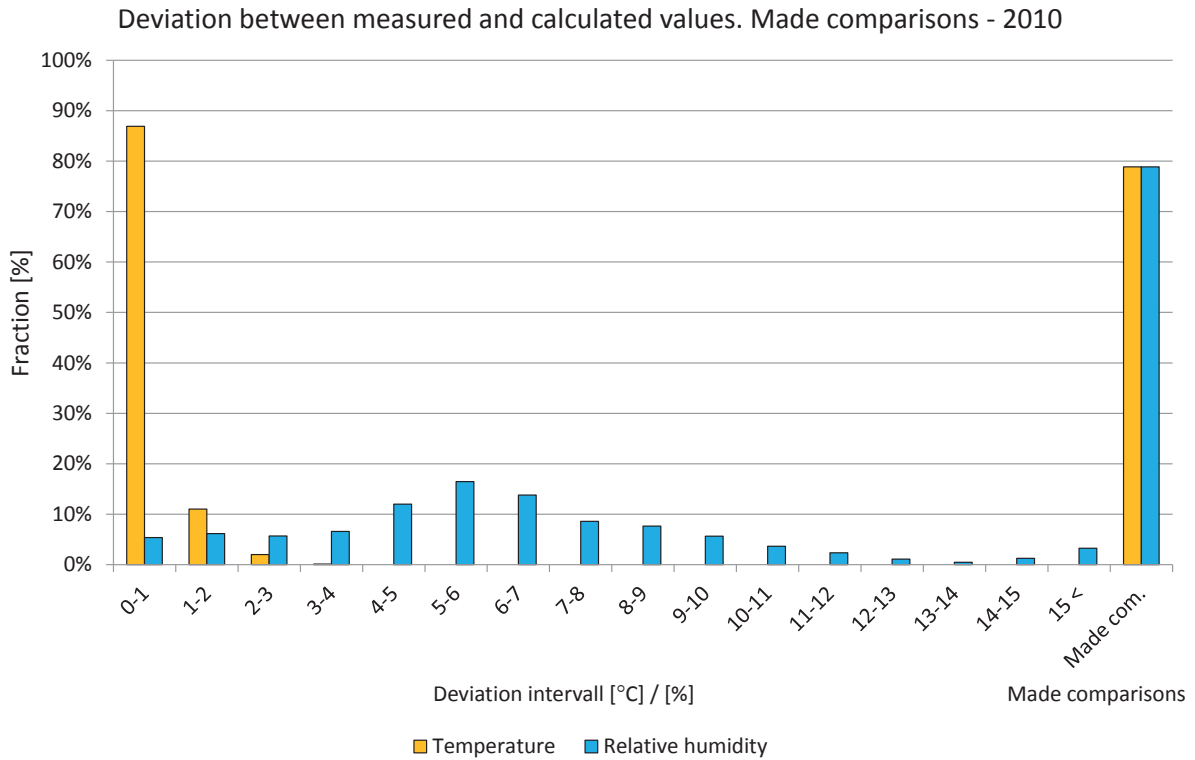


Figure 7.22.13. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

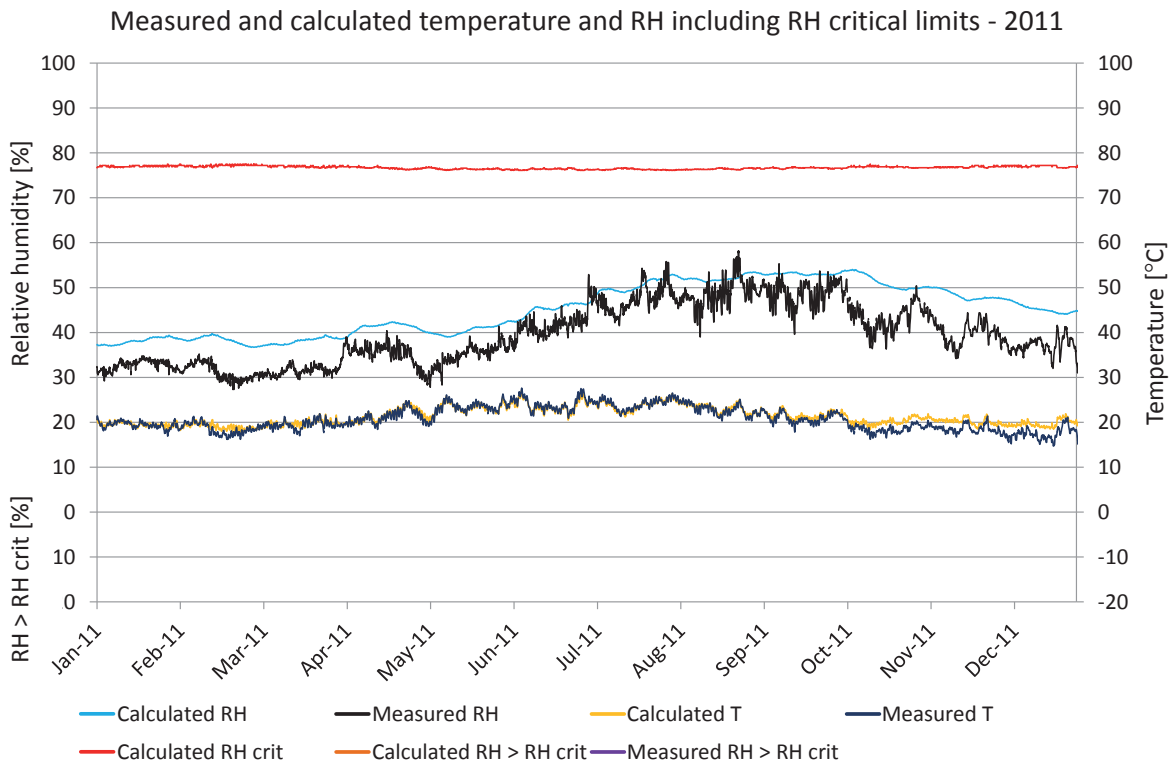


Figure 7.22.14. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

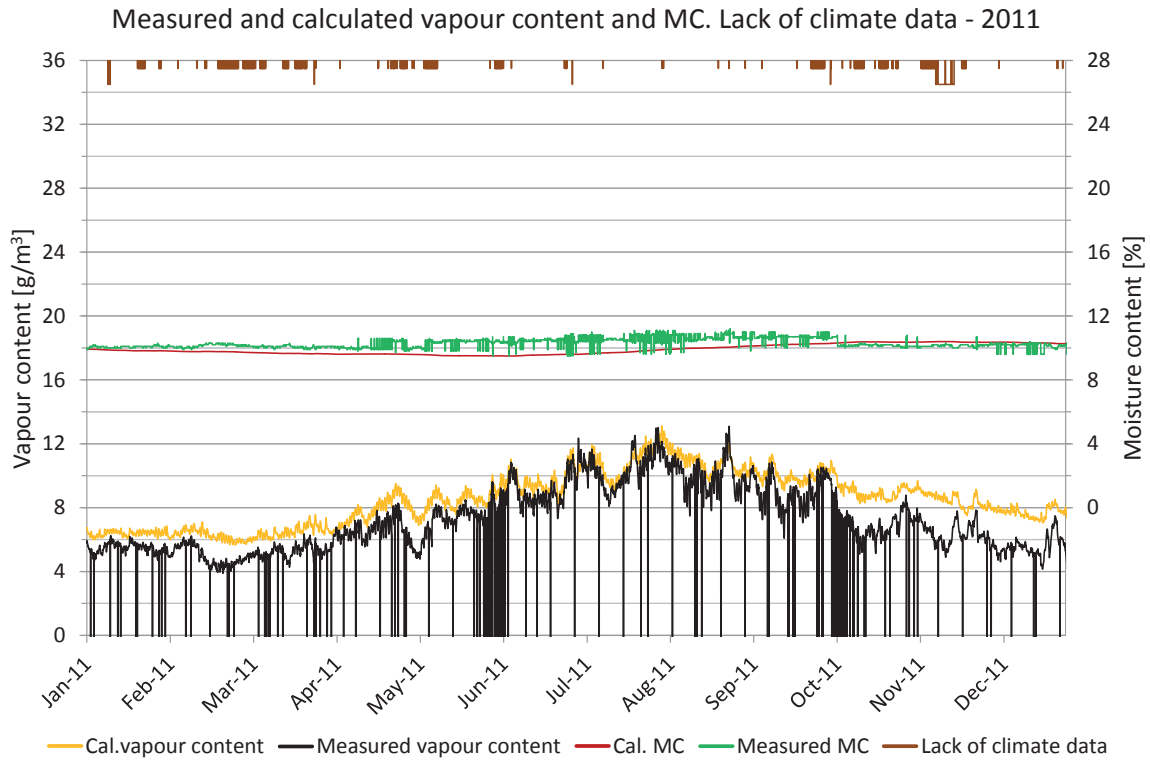


Figure 7.22.15. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

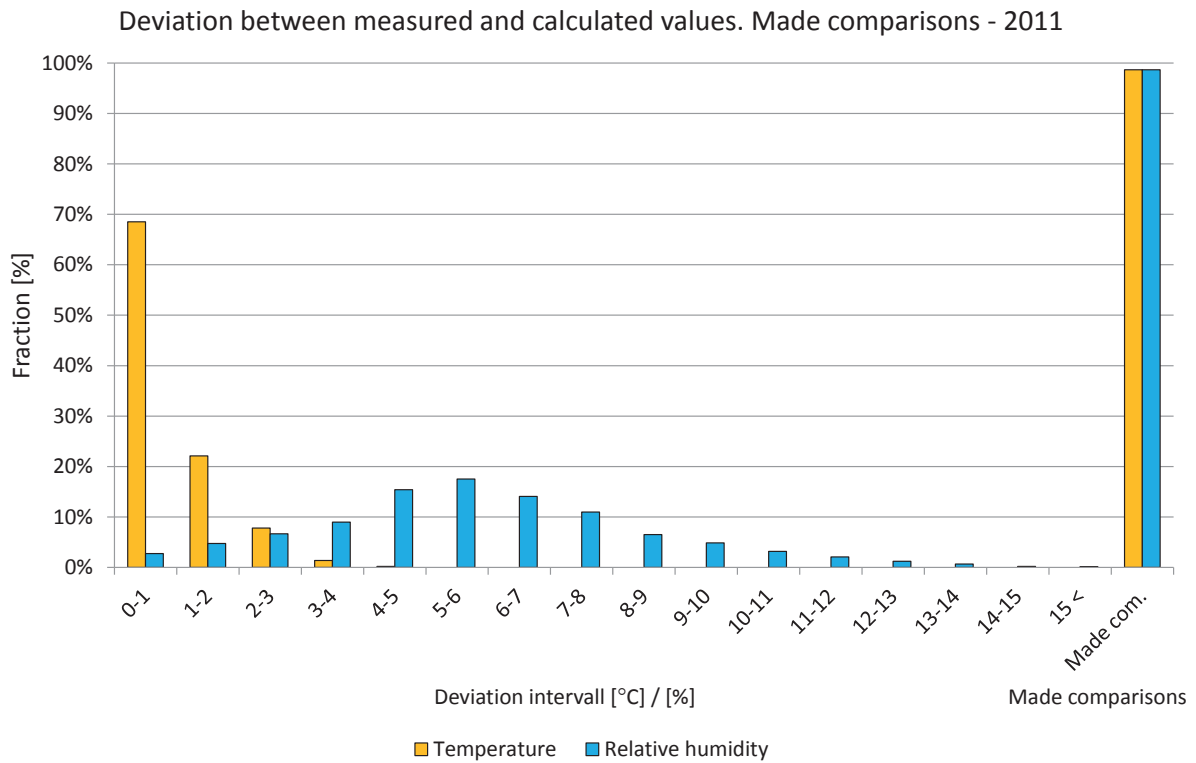


Figure 7.22.16. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.23 Position 23

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the exterior bathroom wall facing southwest on the first floor.

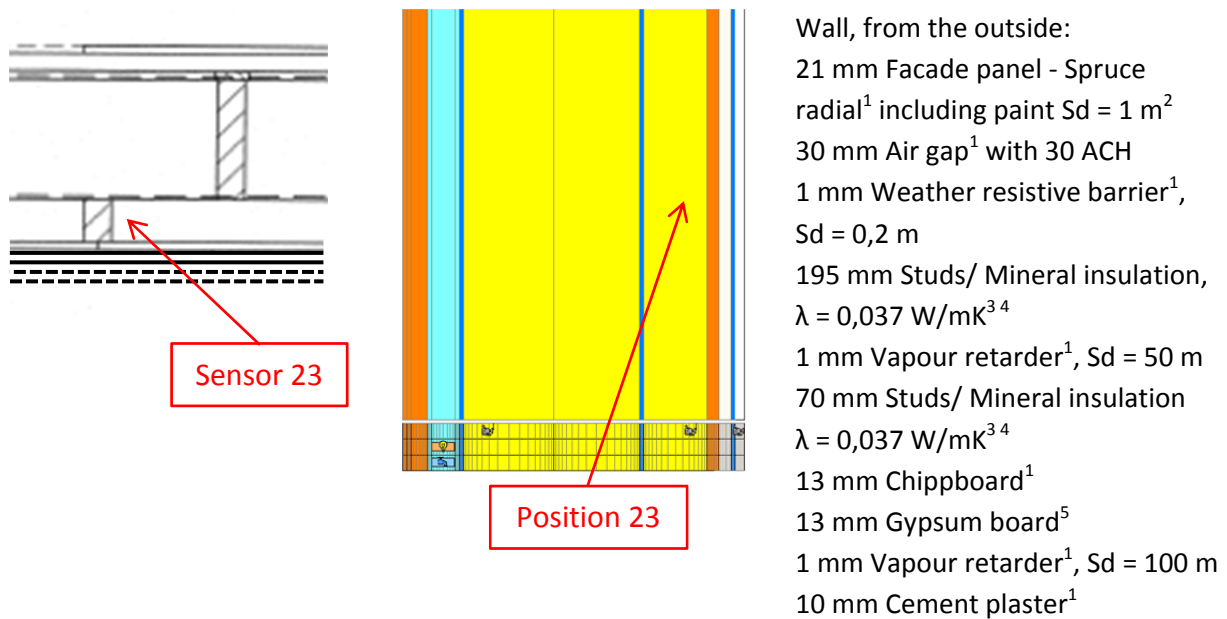


Figure 7.23.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

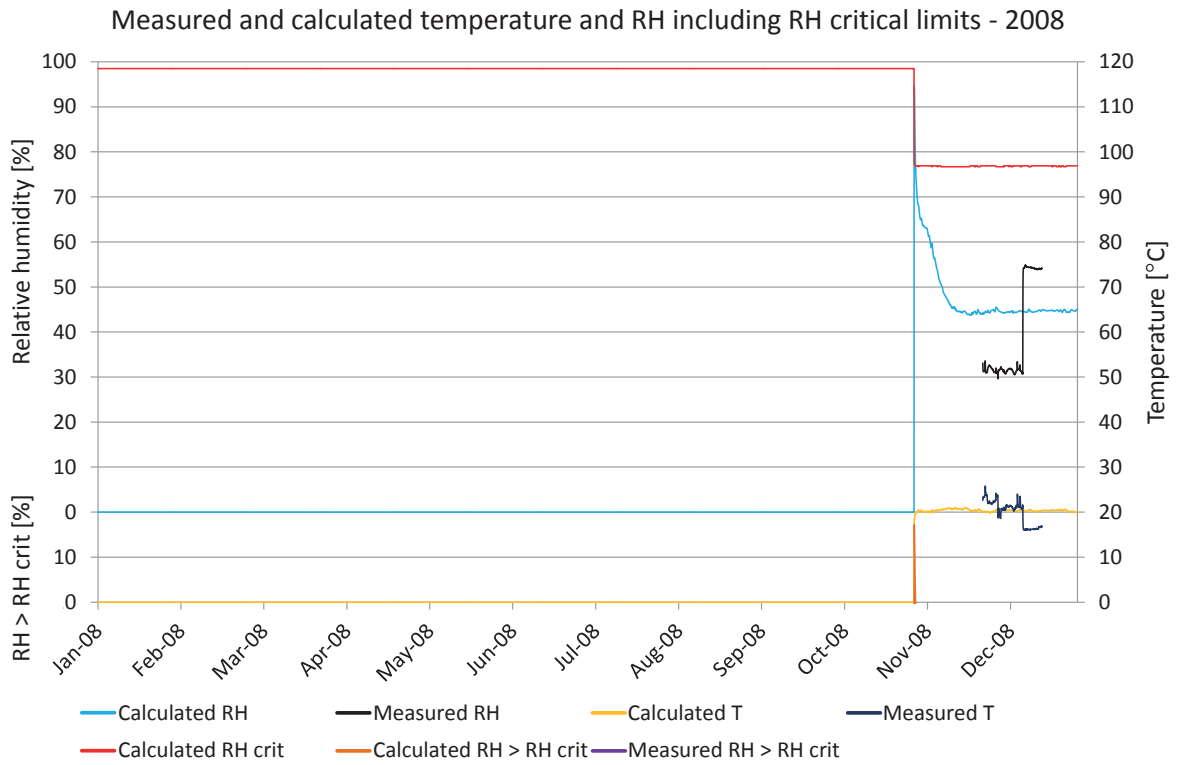


Figure 7.23.2. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

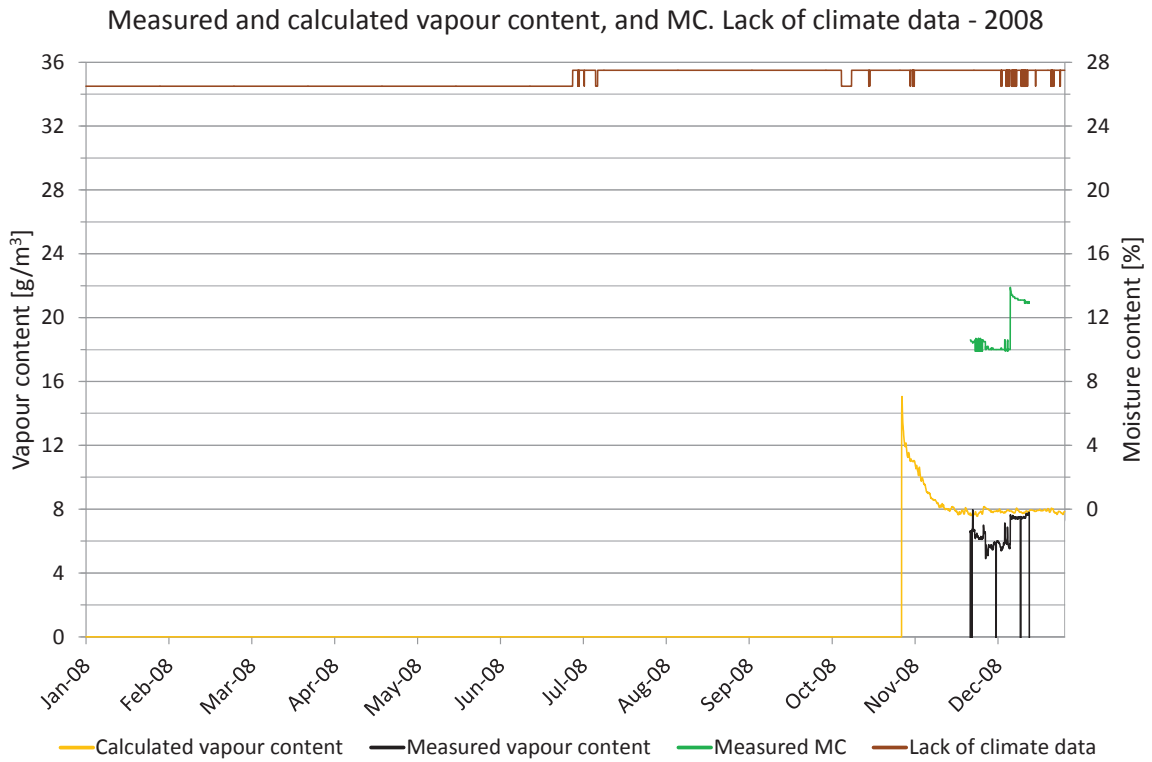


Figure 7.23.3. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

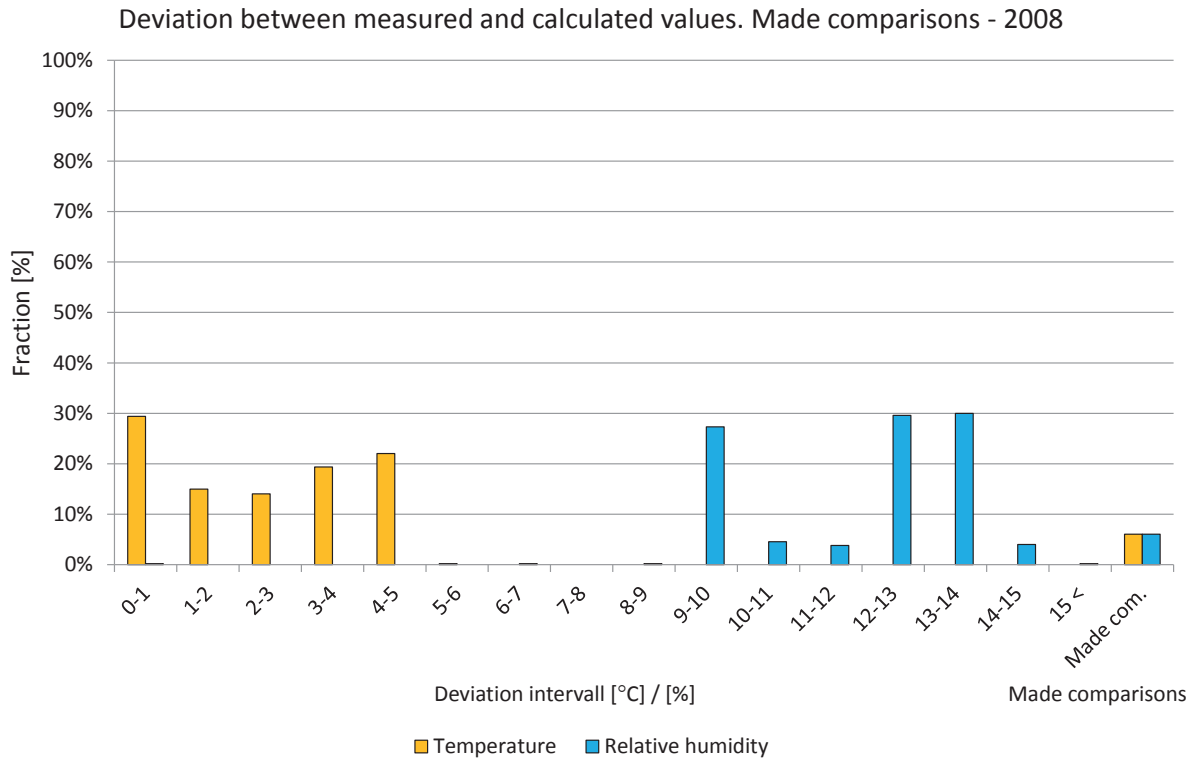


Figure 7.23.4. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

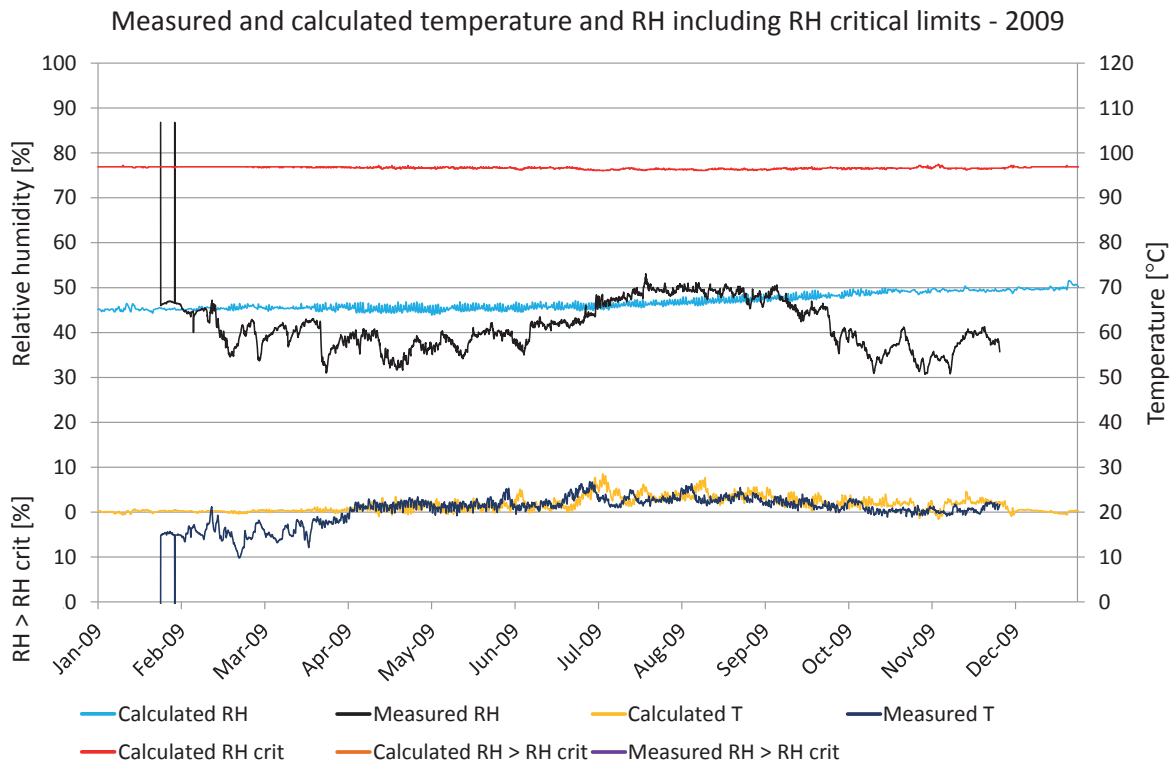


Figure 7.23.5. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

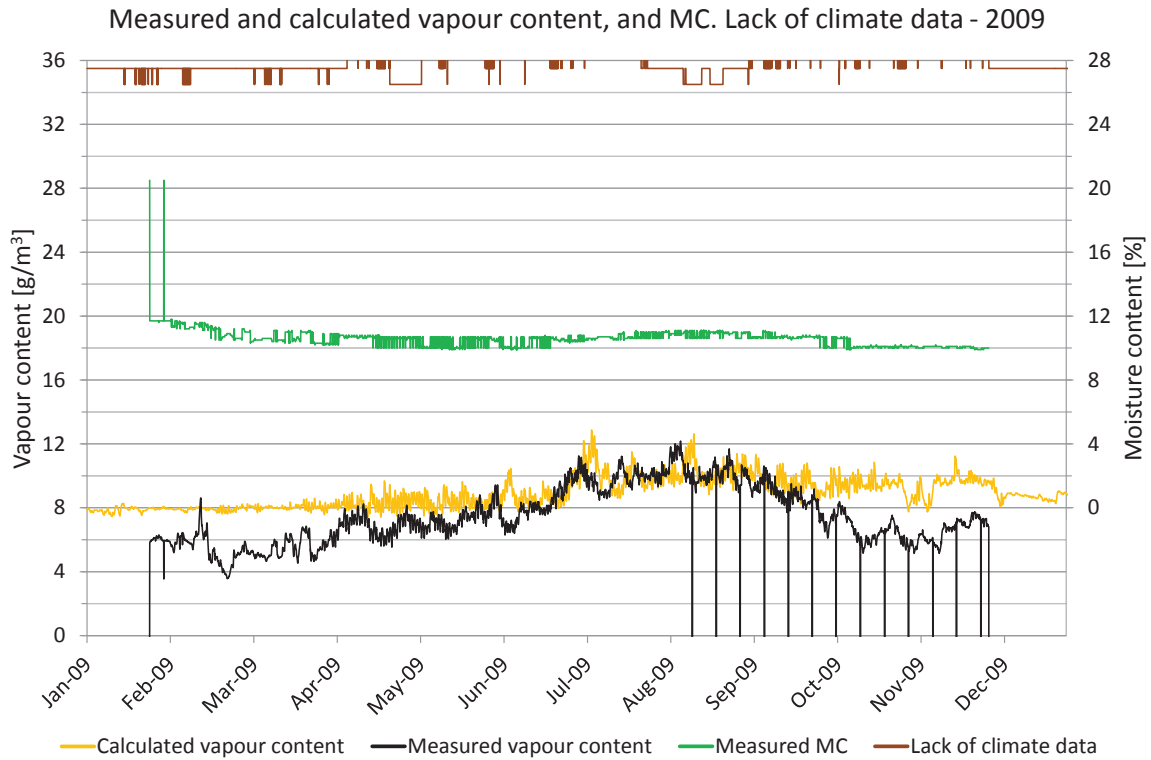


Figure 7.23.6. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

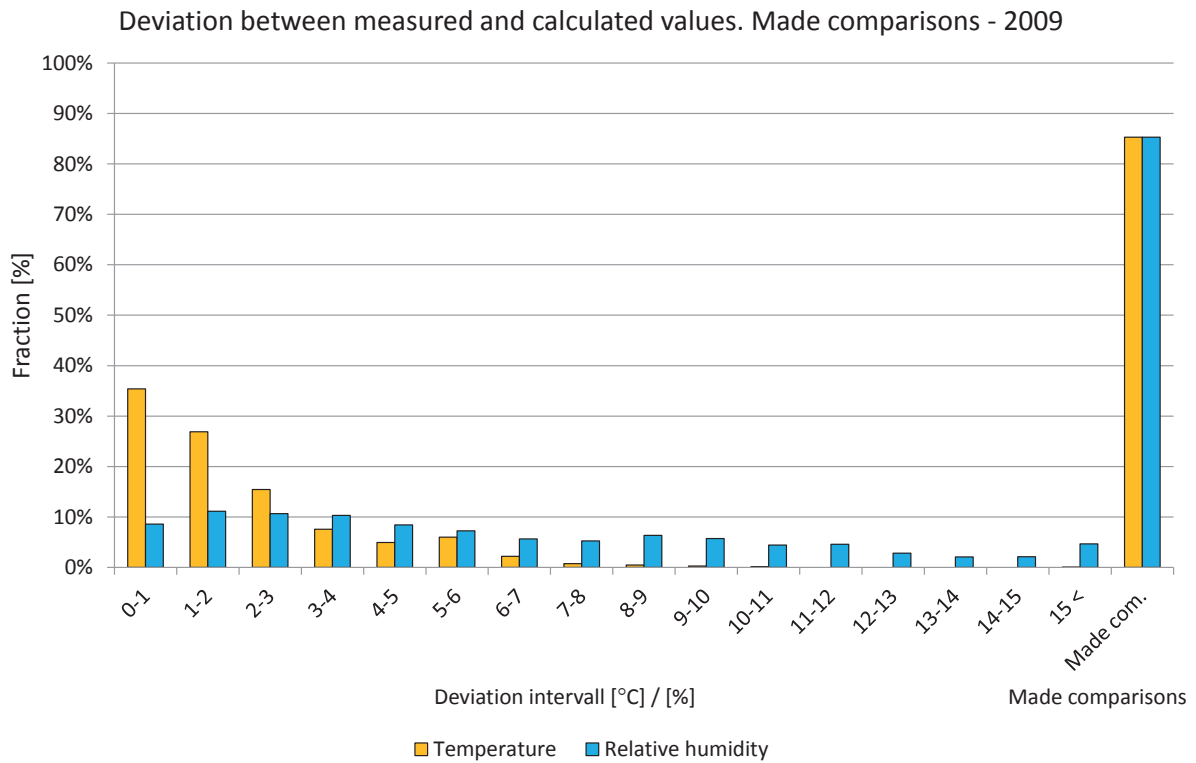


Figure 7.23.7. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

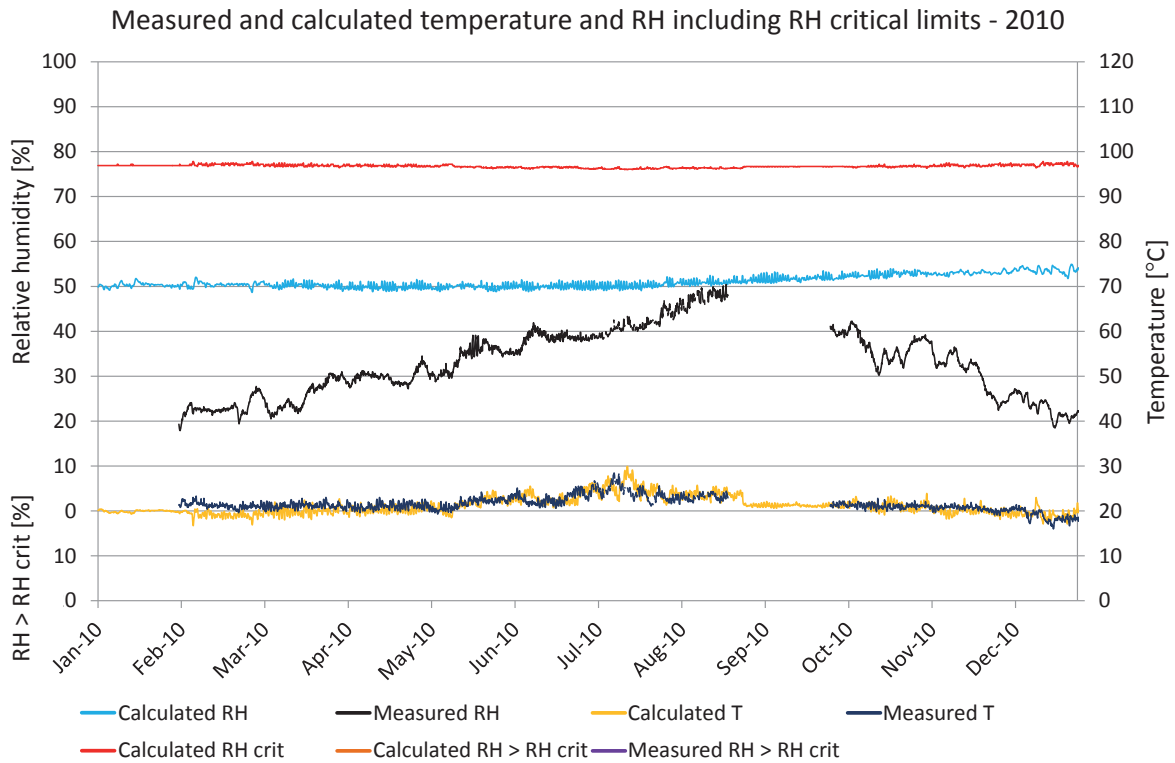


Figure 7.23.8. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

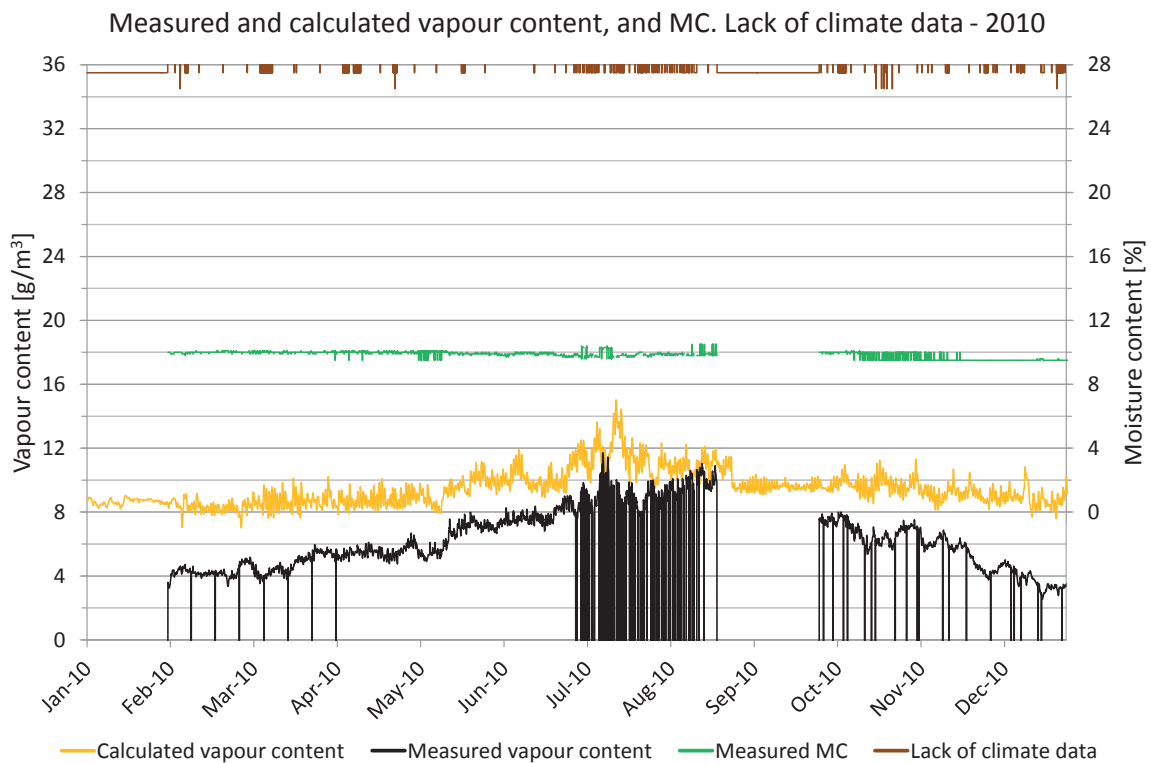


Figure 7.23.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

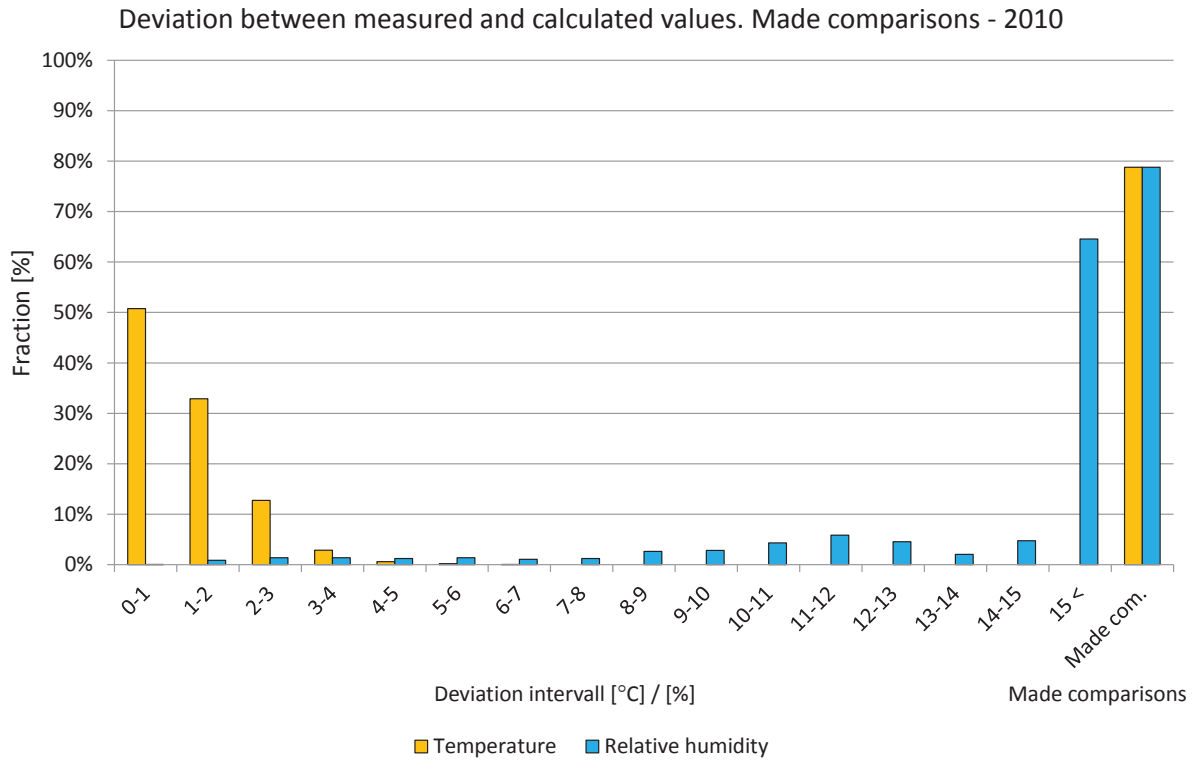


Figure 7.23.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

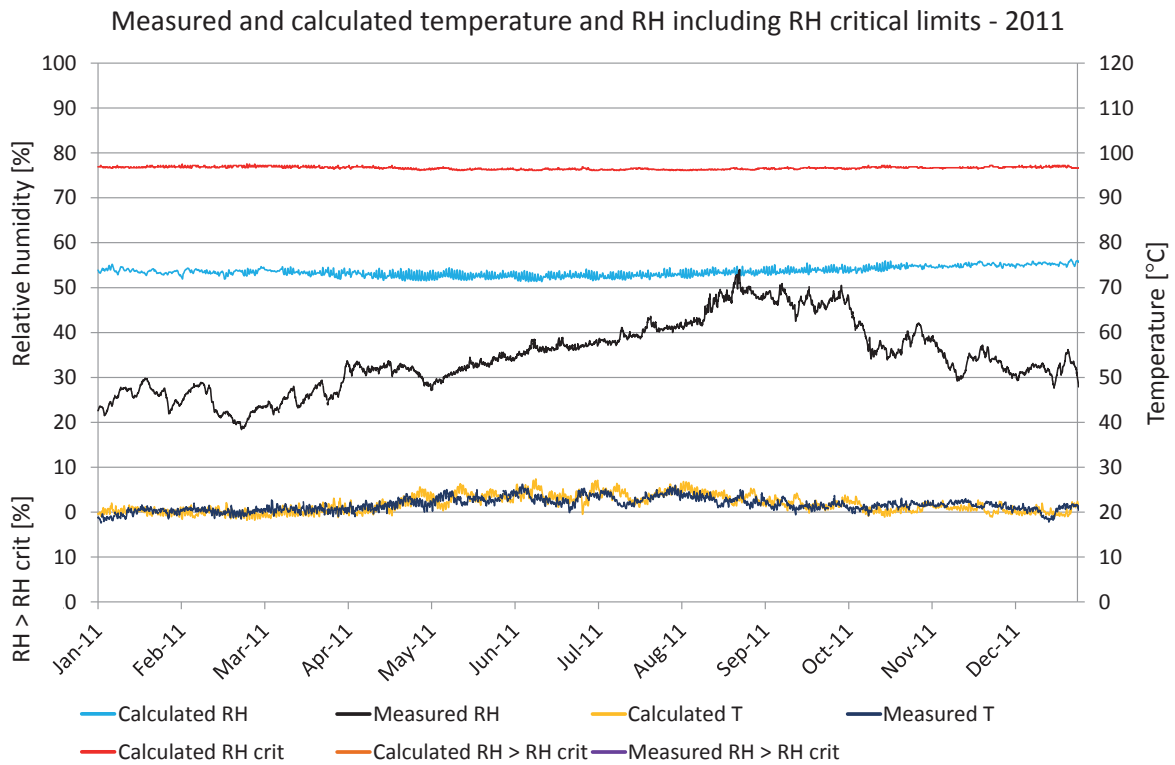


Figure 7.23.11. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated RH > RH_{crit} (light brown), measured RH > RH_{crit} (purple).

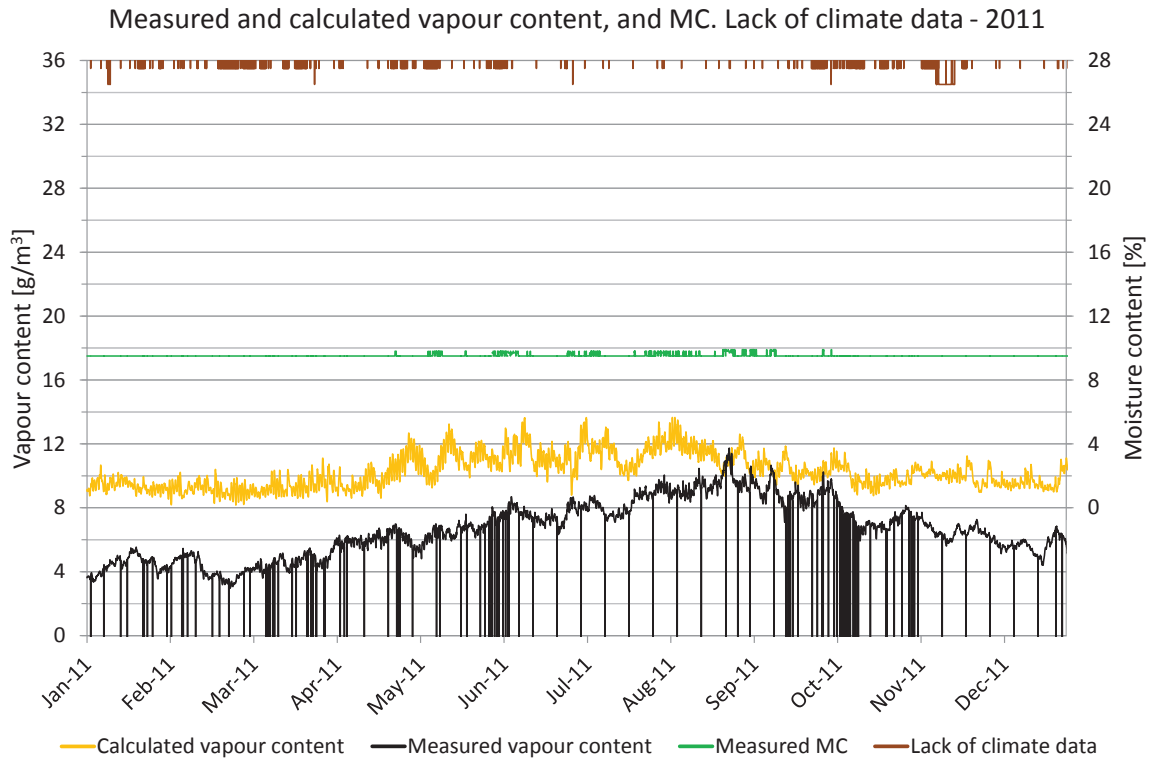


Figure 7.23.12. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

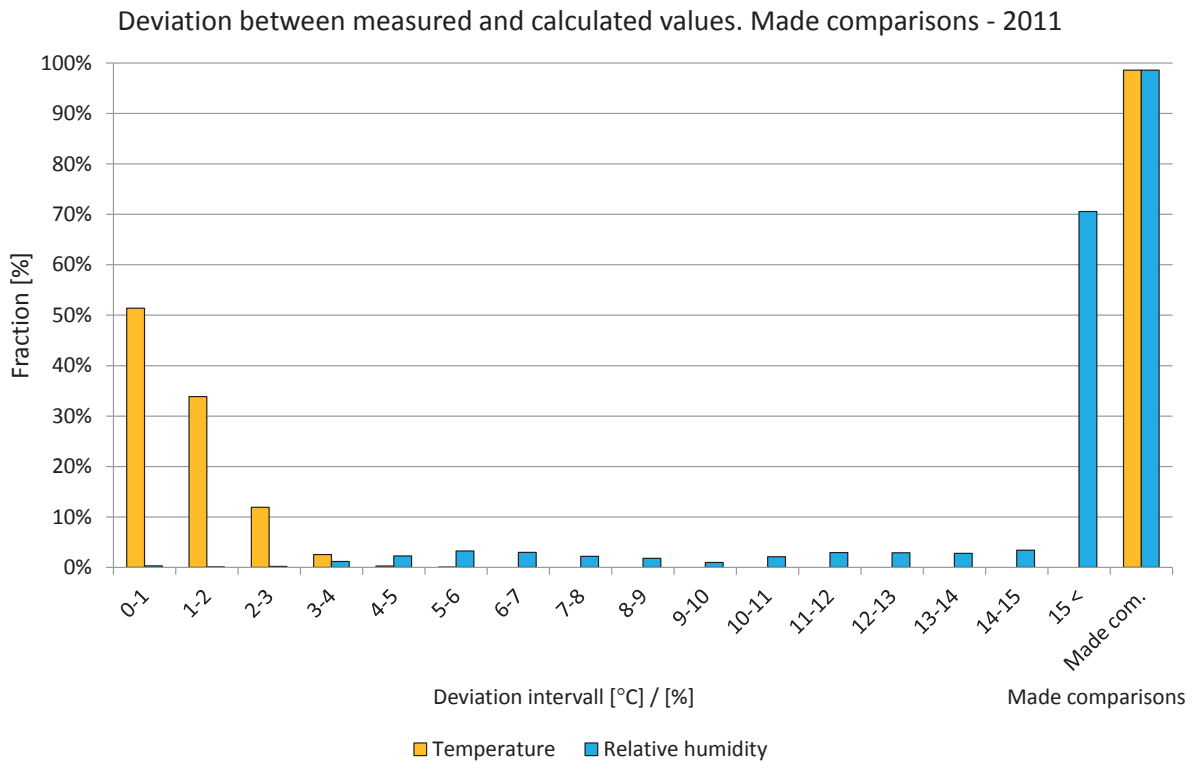


Figure 7.23.13. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

7.24 Position 24

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the exterior bathroom wall facing northeast on the second floor.

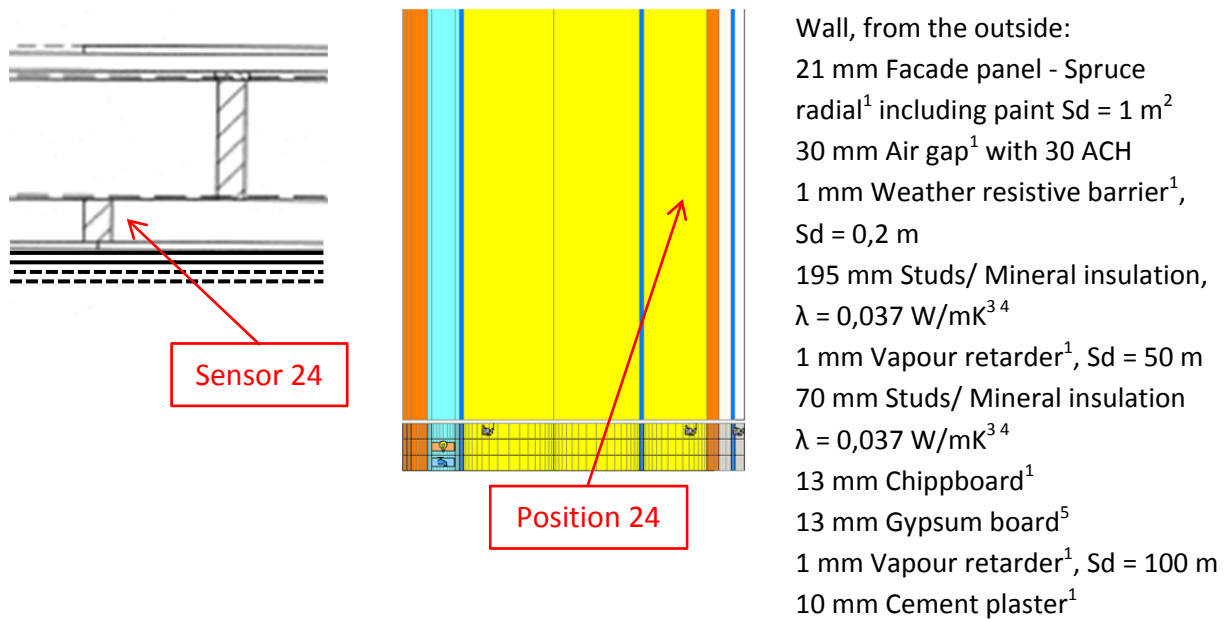


Figure 7.24.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.

A perfect match between the measured and calculated values cannot be expected due to e.g. the influence of two- and three-dimensional effects and the accuracy of the sensors.

Year 2008

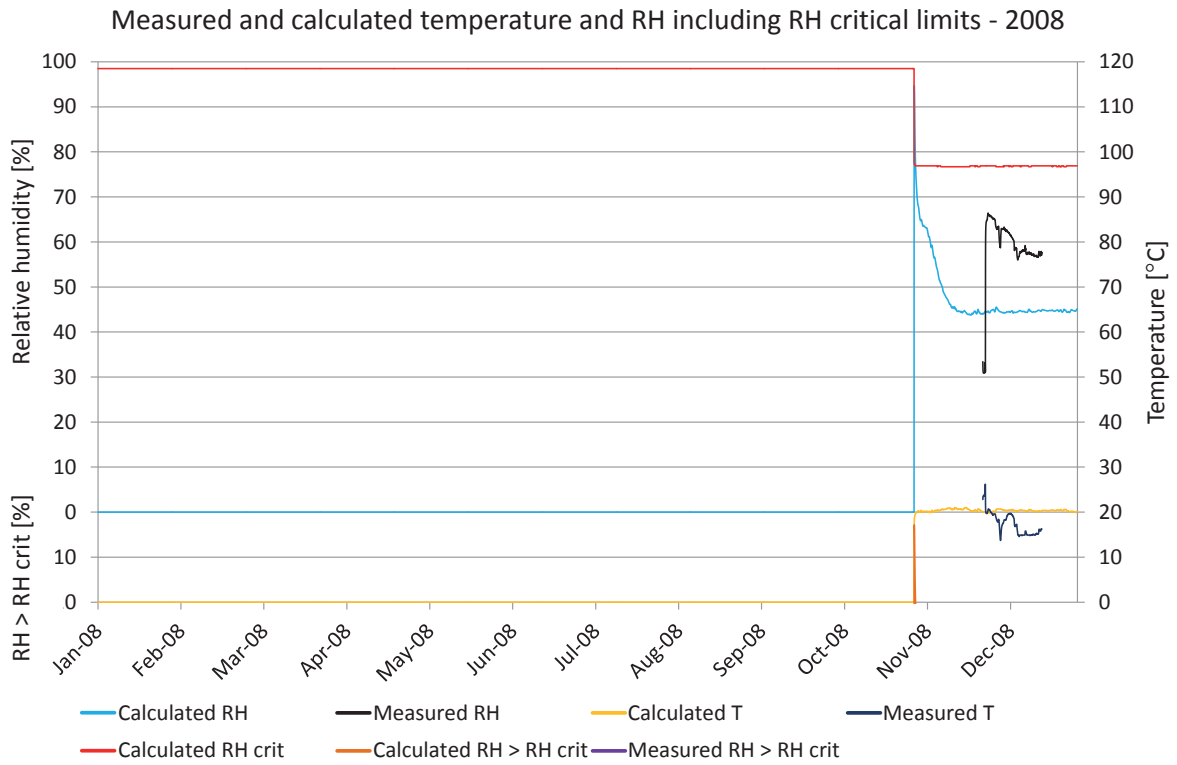


Figure 7.24.2. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

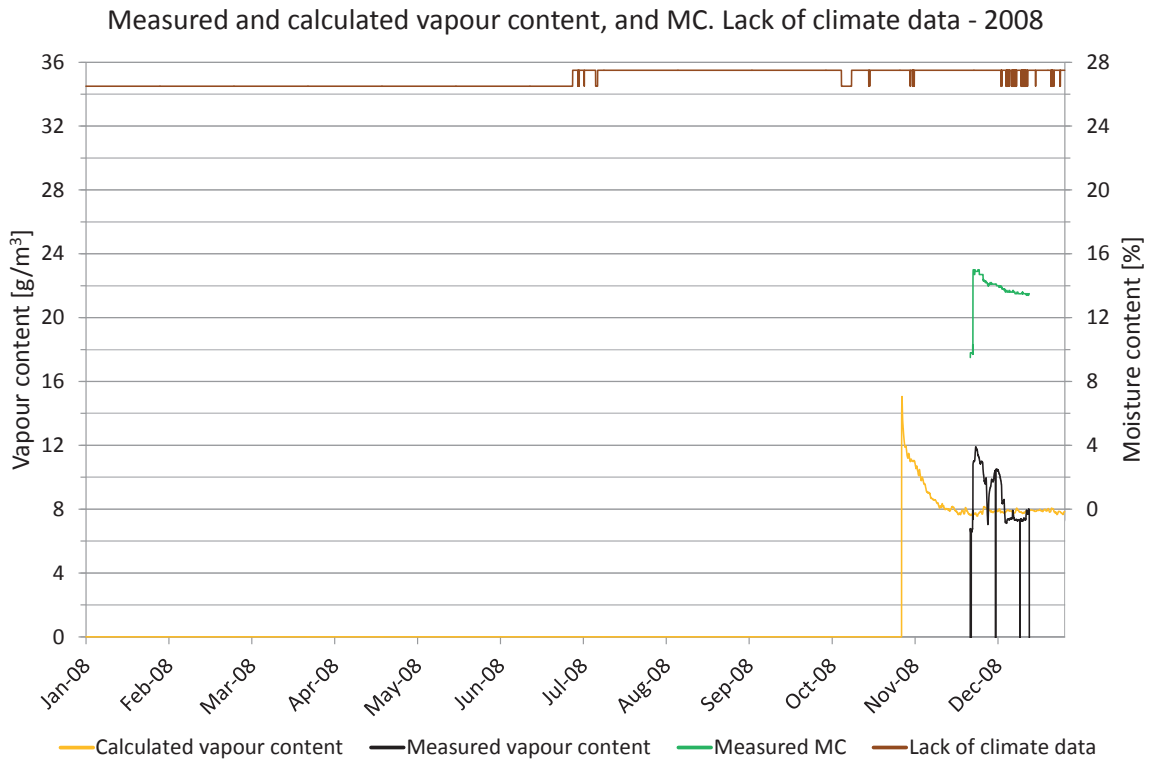


Figure 7.24.3. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

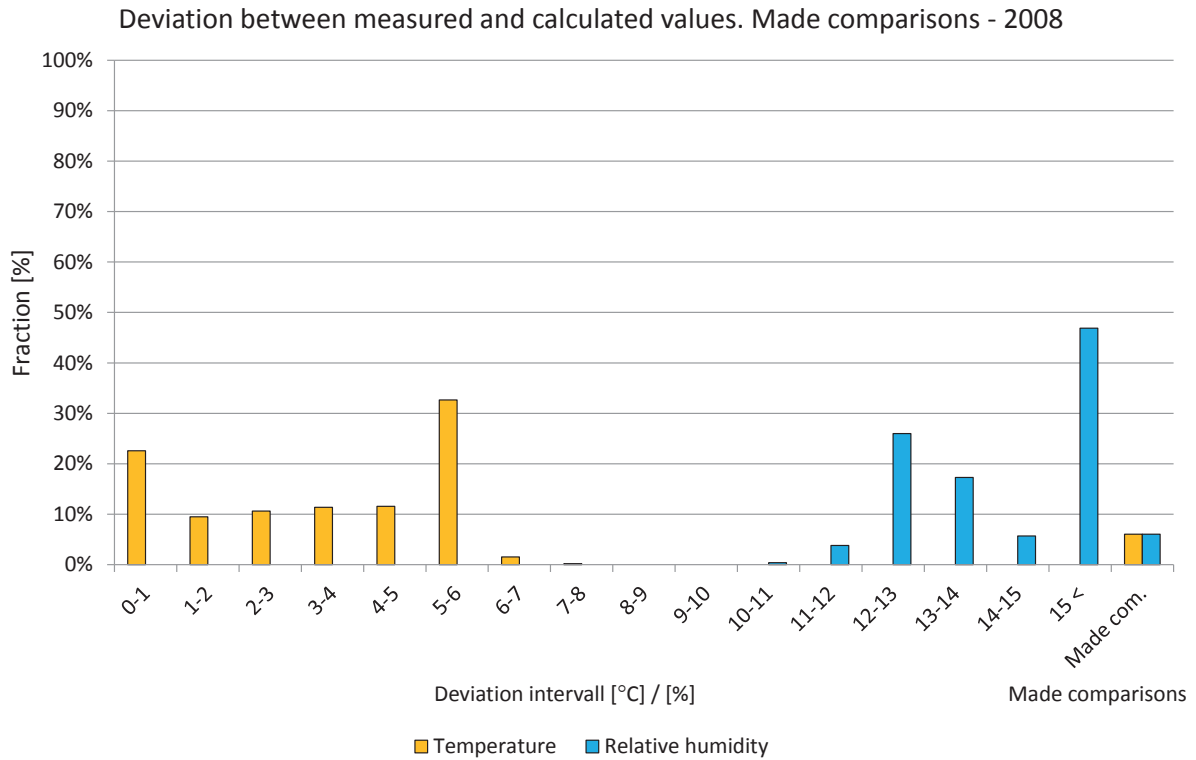


Figure 7.24.4. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2009

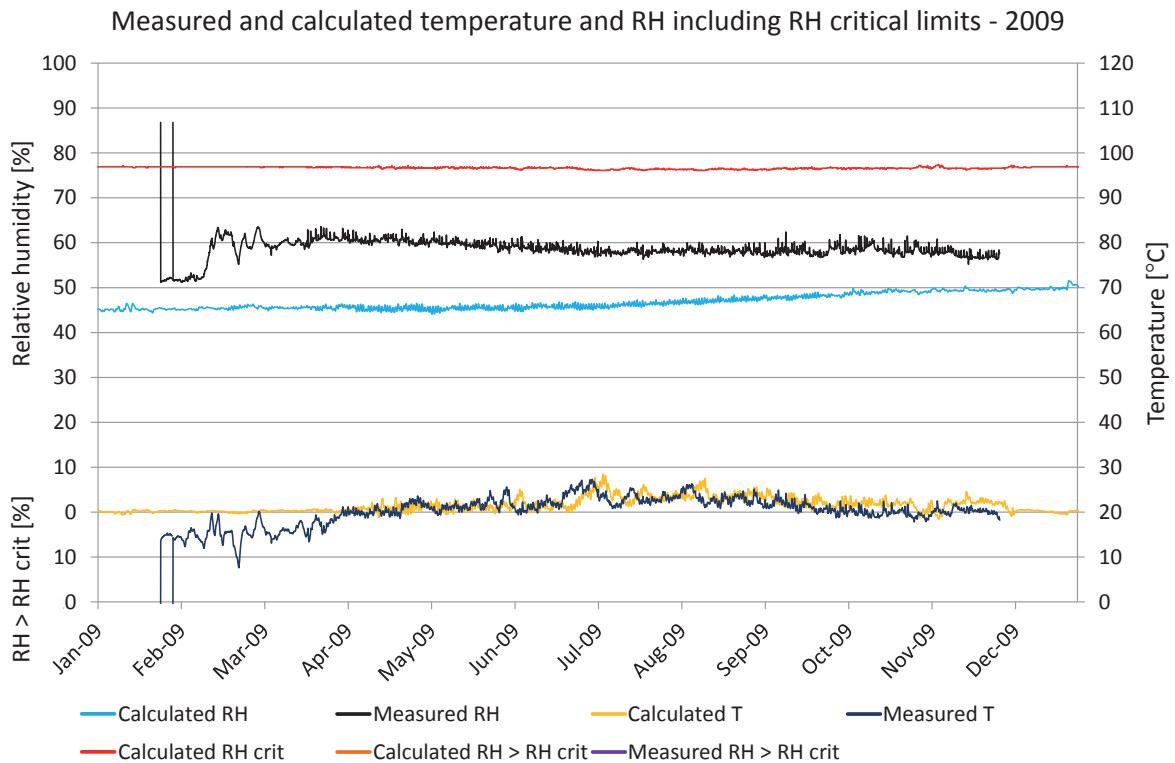


Figure 7.24.5. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

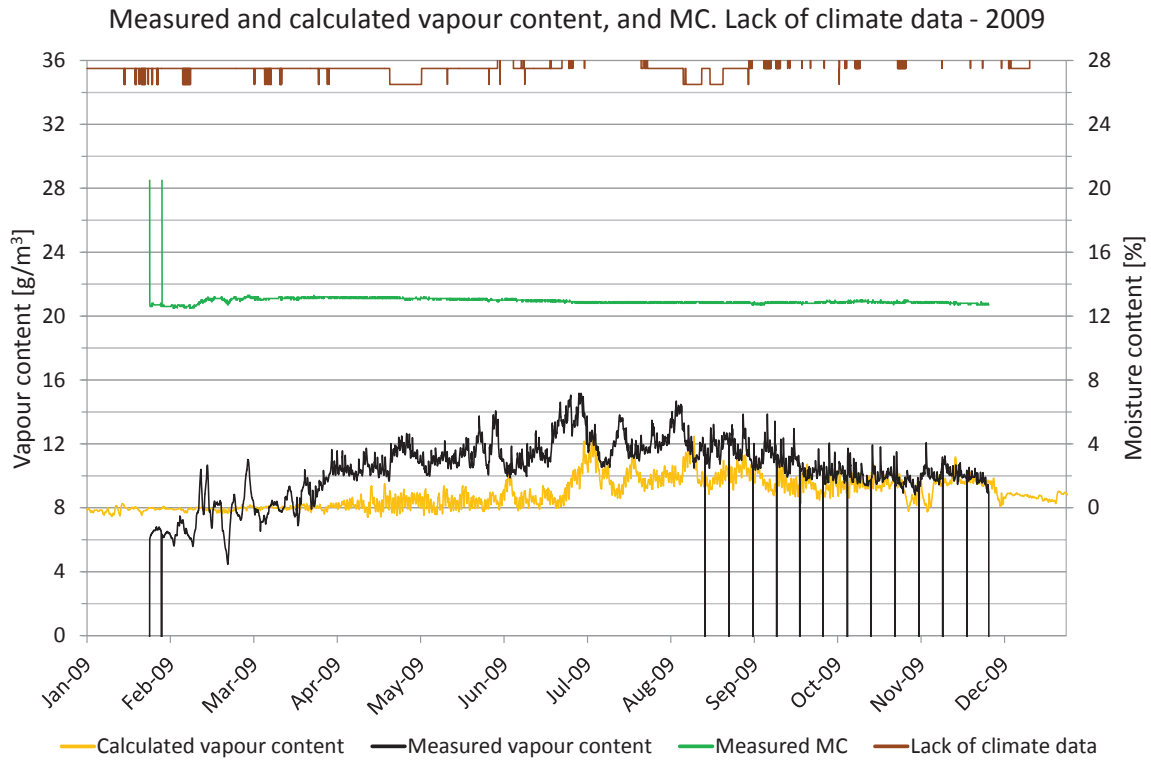


Figure 7.24.6. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

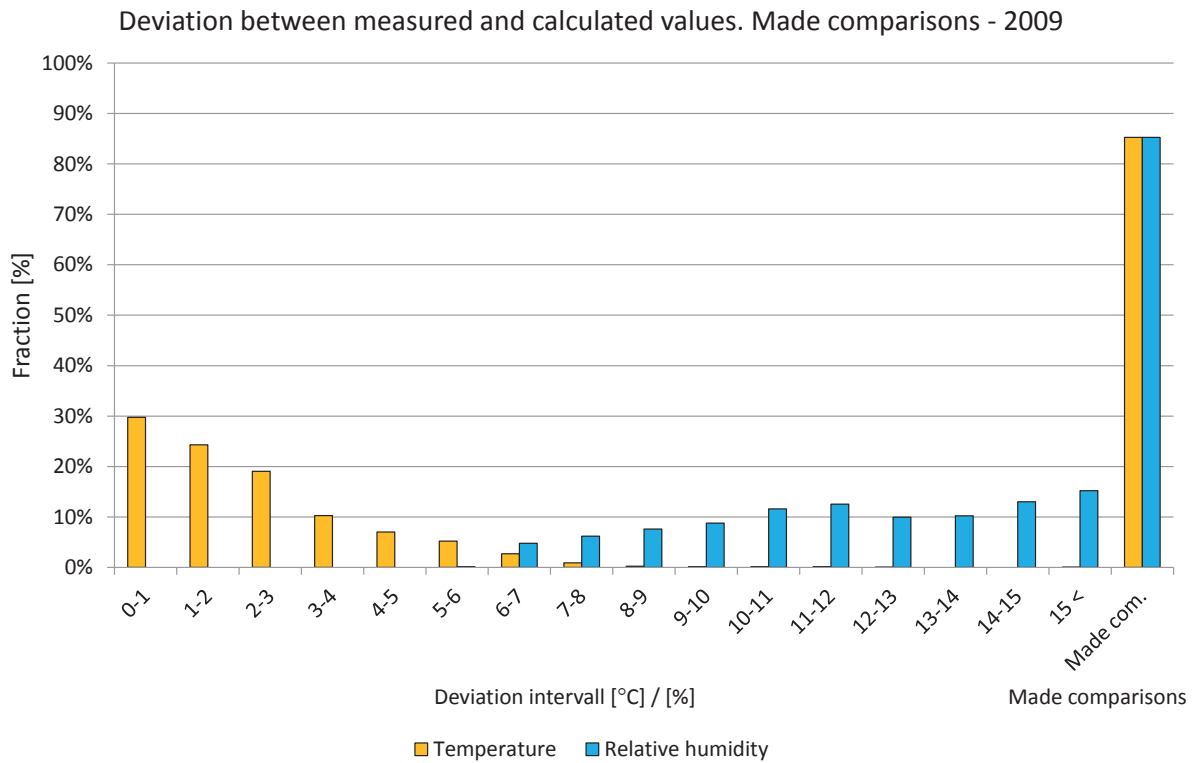


Figure 7.24.7. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

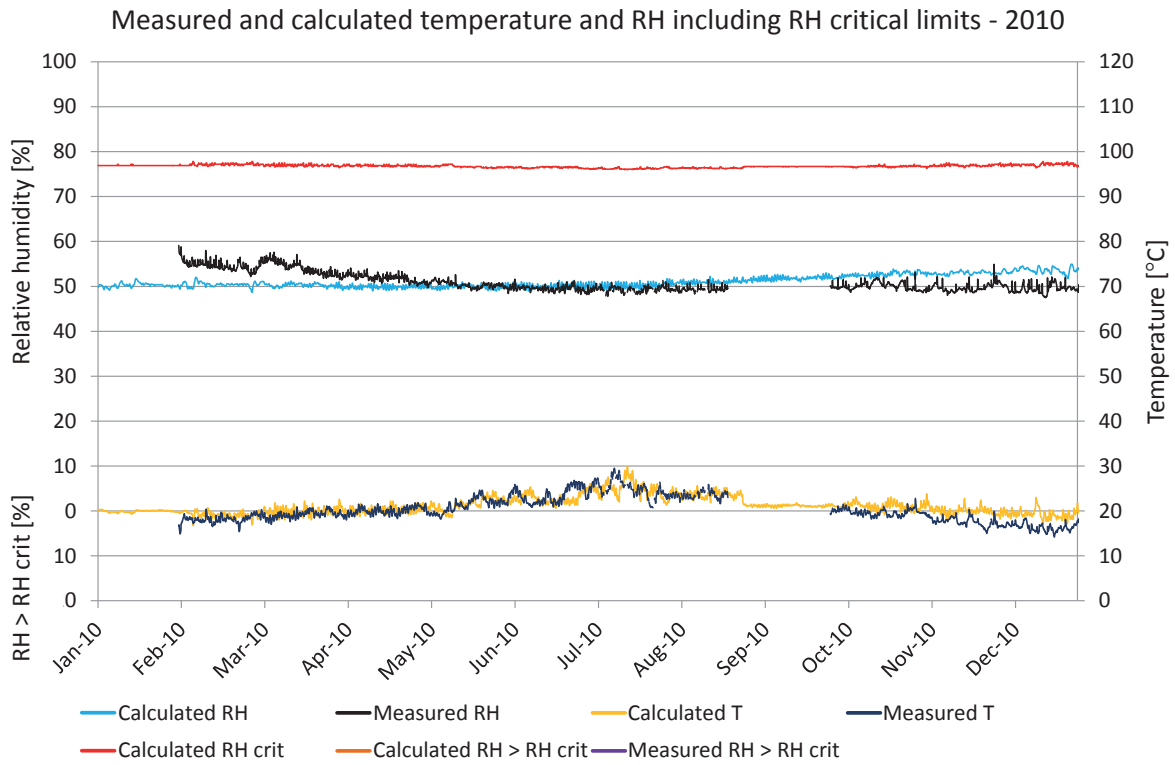


Figure 7.24.8. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

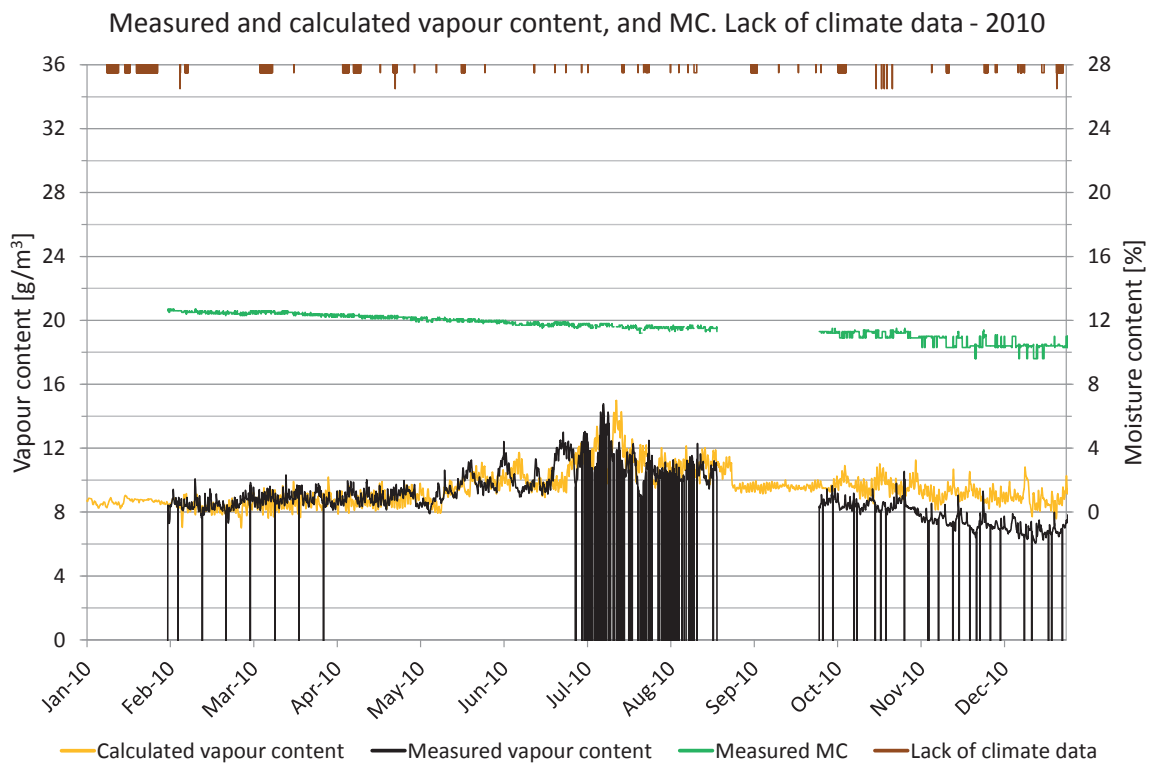


Figure 7.24.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

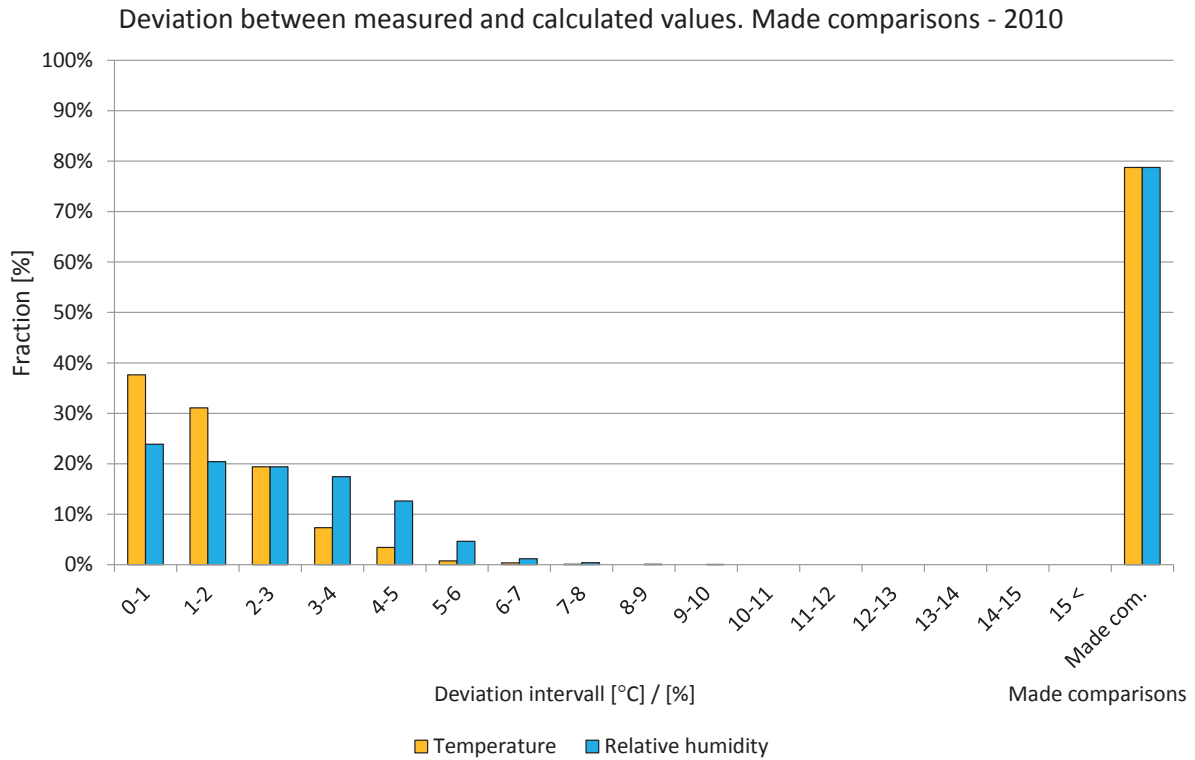


Figure 7.24.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

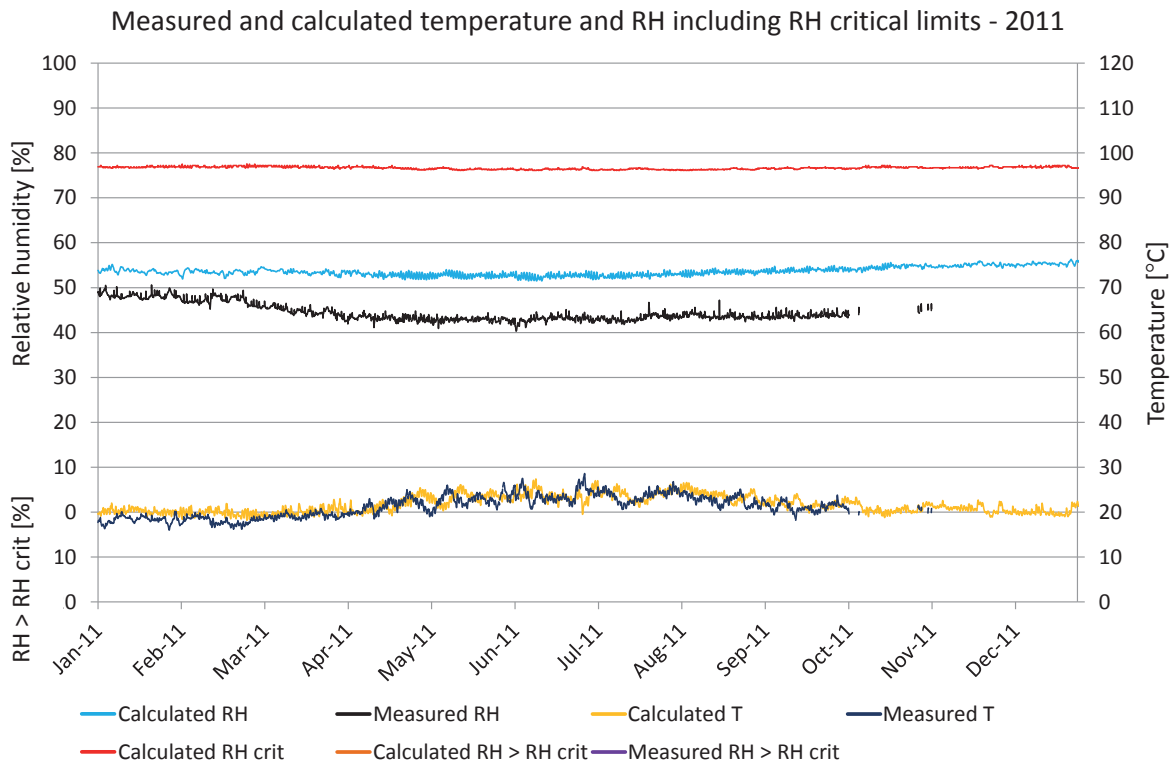


Figure 7.24.11. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated RH > RH_{crit} (light brown), measured RH > RH_{crit} (purple).

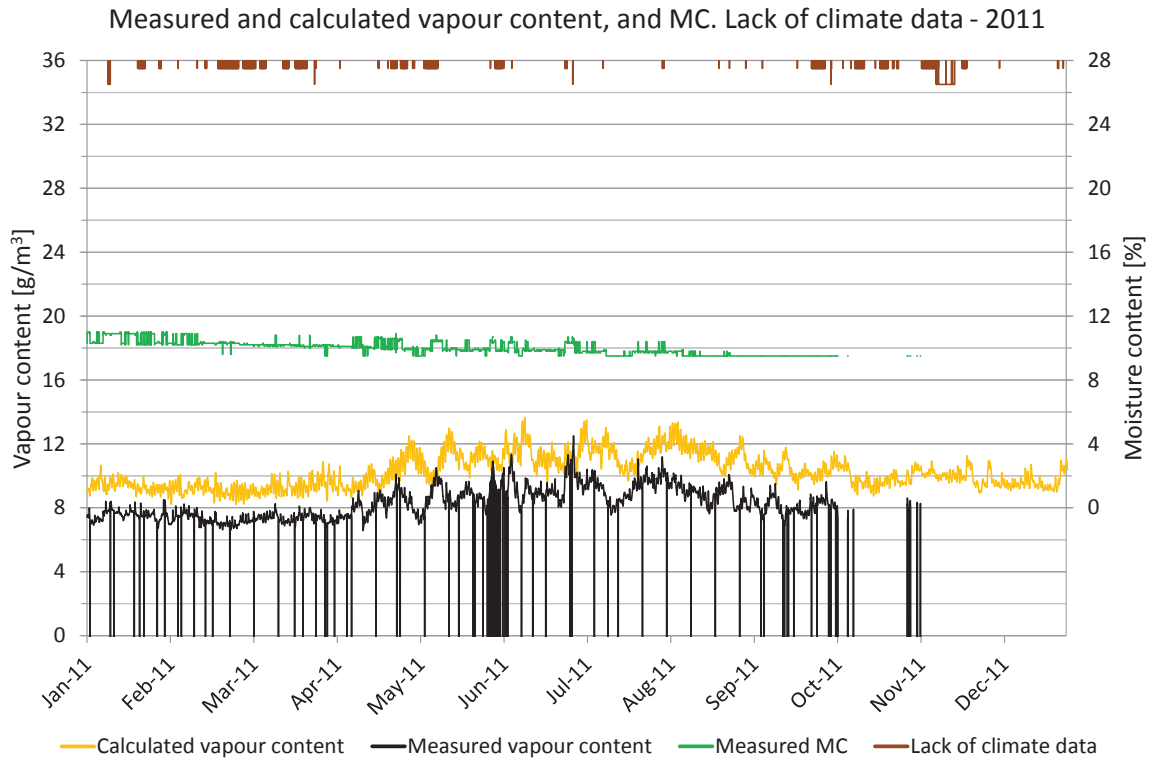


Figure 7.24.12. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

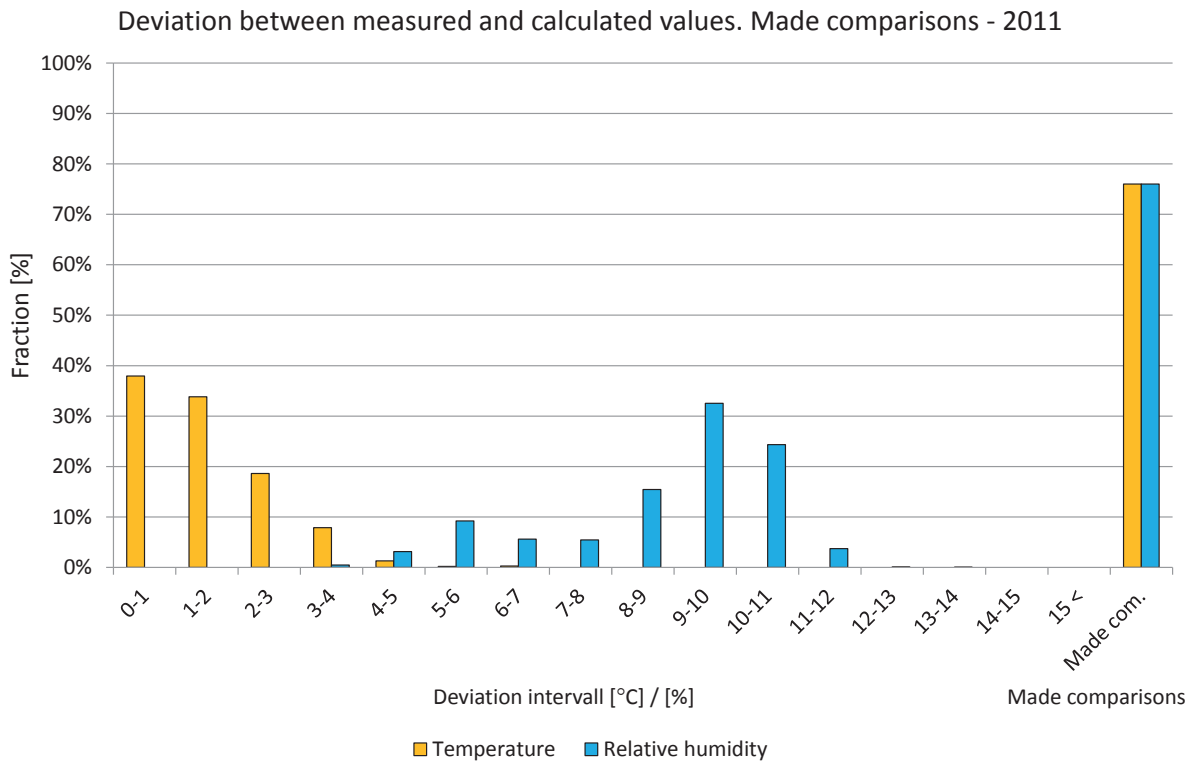


Figure 7.24.13. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

8 Discussion and analysis of the results

The general results from the comparisons of measured and calculated values in the studied positions are briefly summarized and discussed below.

8.1 Walls

In general, there was a clear correlation between the measured and blindly calculated values in most of the studied positions in the walls. In some of the studied positions the correlations were rather good. In other positions the measured values did not match the calculated values although they displayed similar behavior or similar daily amplitudes. However, there were significant differences between the measured and blindly calculated values in some positions. These differences are analyzed and discussed below. Possible factors influencing these differences are also discussed.

Blind calculations in the air gap and in the exterior part of the wall, on the inside of the weather resistive barrier, provided results that followed the measured values. In some positions there were good correlations. However, there were positions with more or less constant deviations of 10 to 20 percent lower than the measured relative humidity. The differences, between the measured and blindly calculated relative humidity, seem to depend on differences between the measured and blindly calculated temperatures. I.e. the vapor content was the same but different measured and blindly calculated temperatures indicate different vapor contents at saturation. Consequently this creates differences between the measured and blindly calculated relative humidity.

Less important differences between measured and blind calculated values in the inner part of some studied walls, mainly in the installation layer inside the vapour barrier, occurs during the winter. These deviations are difficult to explain since it should not been possible to record that both measured temperature and relative humidity were below the calculated values at the same time. The reason may be the influence of the moisture capacity of the stud in the installation layer or flaws in the measurements or calculation models. The location of the measured indoor climate boundary conditions, remote from the studied wall, might also have created the anomalous result. However, this was not common and does not have as big an influence as the differences in temperatures have on the relative humidity.

Measurements in the installation layers in bathrooms, between the vapour barrier and the interior water proof membrane, indicate a faster dry out process compared to calculations. One of the two sensors also shows a behaviour that indicates that the vapour barrier in the wall might be damaged.

The daily variations in temperature and relative humidity in the air gap are, on the whole, the same when the measured and blindly calculated values were compared. However, on the inside of the weather resistive barrier, there were larger amplitudes in the measured temperature and relative humidity than in the blindly calculated values in the construction. Close to the inside of the wall the amplitudes were mainly low in both the measured and blindly calculated values. In the middle of the wall, the amplitudes were slightly larger, mainly those of the measured values. Closer to the air gap, the amplitudes, mainly of the measured values, became significantly greater. These variations and differences in amplitude may have depended on several factors. However, the variations in relative humidity could mainly be connected to the differences in temperature.

8.2 Roofs

In general there was a clear correlation between the measured and blindly calculated values in most of the studied positions in the roof, after the house had become occupied in April 2009. Similarly to the results from the walls, some positions show better correlations and other positions poorer correlations between the measured and blindly calculated values. The differences between the measured and blindly calculated values are analyzed and discussed below. Possible factors influencing the differences are also discussed.

There were some minor deviations in between the measured and blindly calculated relative humidity close to the interior, on the outside of the vapour barrier. These deviations in relative humidity were caused by differences in both the temperature and the vapour content.

Measurements in the middle of the roof insulation show lower relative humidity, compared to the calculated values. This was caused by lower vapour content and mainly occurs in the spring during April and May.

There were clear correlations between the measured and blindly calculated temperature and relative humidity in the air gap, on the inside of the tongued and grooved wood. In these positions it was also possible to compare measured and calculated moisture content. Blind calculated moisture content provided results that followed the measured values but were mainly 4 to 8 percent higher. These deviations might depend on the wood density that was used in the recalculation to moisture content might be incorrectly assumed. Furthermore, moisture critical conditions could be observed in the air gap.

The sensor located in the roof close to the walls show poor correlations between the measured and blindly calculated values during the winter. The deviations of 20 percent relative humidity might depend on incorrect estimations in the one-dimensional calculation model. It could also be noticed that the measurements show critical conditions during several of periods.

Similarly to the walls, the daily variations in temperature and relative humidity in the air gap, below the tongued and grooved wood, were mainly the same when the measured and blindly calculated values were compared. However, on the inside of EPS insulation board below the air gap, there were larger amplitude in the measured temperature and relative humidity than in the blindly calculated values in the construction.

9 Conclusions

Although there are a number of differences between the measured and blindly calculated values most of the blind comparisons show significantly close correlations between the measured and blindly calculated temperature and relative humidity.

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