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Comparison of hygrothermal measurements and calculations in a multi-family wooden house on the north-eastern coast of Sweden

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Total number of authors:

1

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8.14 Position 14-5n-air gap

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the air gap behind the façade panel in a wall that is facing north on the fifth floor.

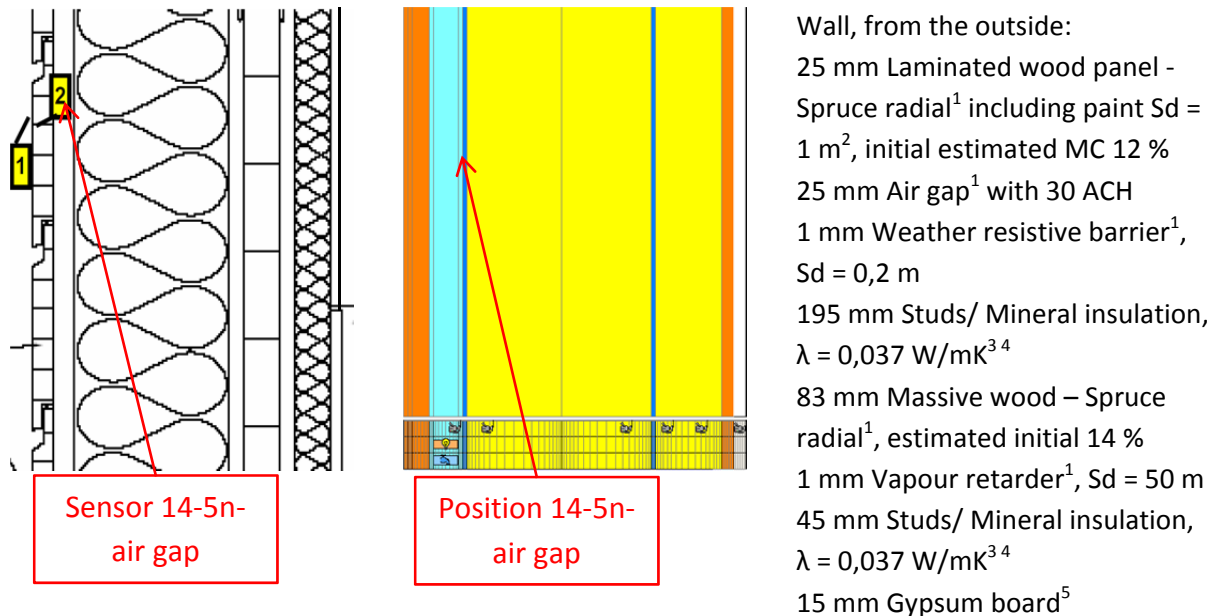


Figure 8.14-5n-air gap.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.



Figure 8.14-5n-air gap.2. Location of the studied position. Photo: SP Trä Skellefteå.

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 2009

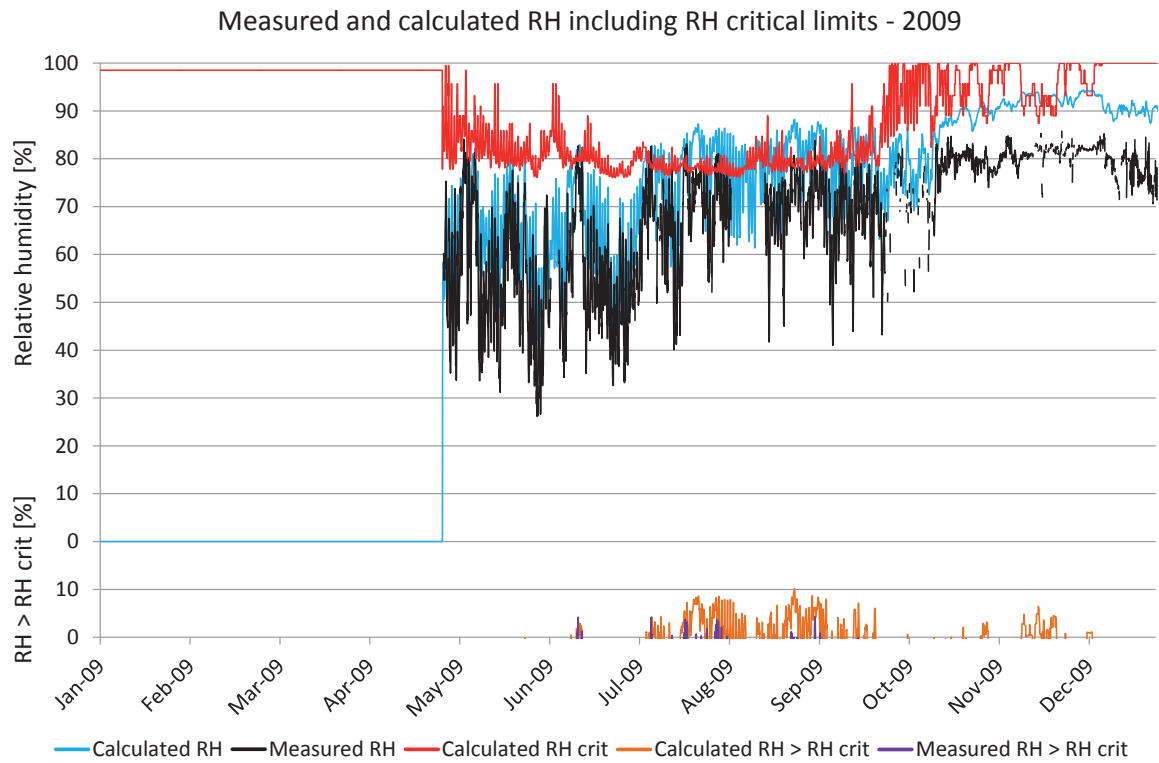


Figure 8.14-5n-air gap.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

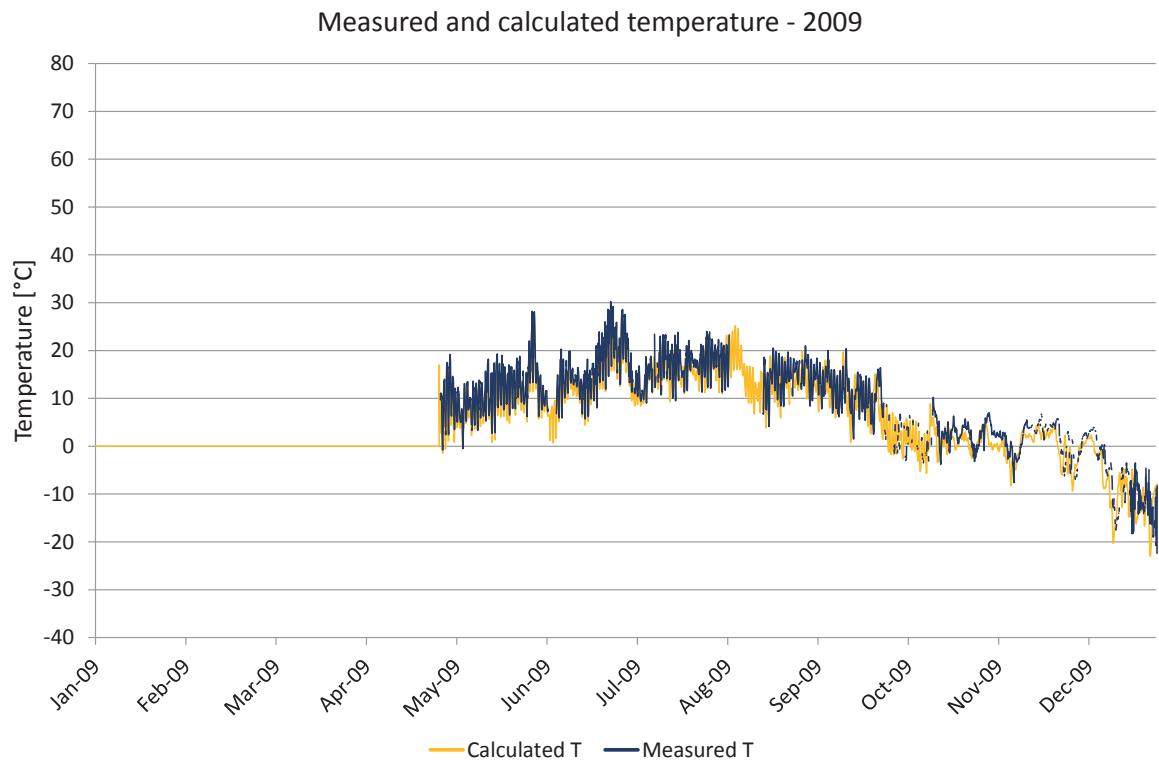


Figure 8.14-5n-air gap.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

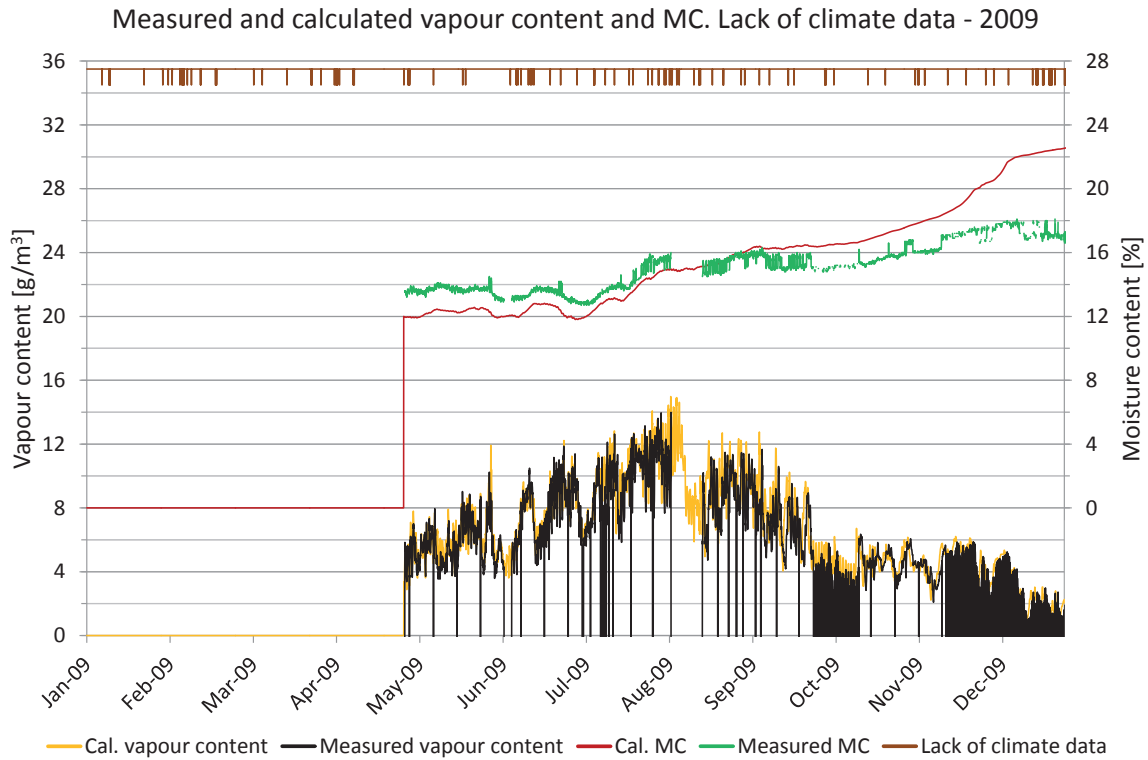


Figure 8.14-5n-air gap.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

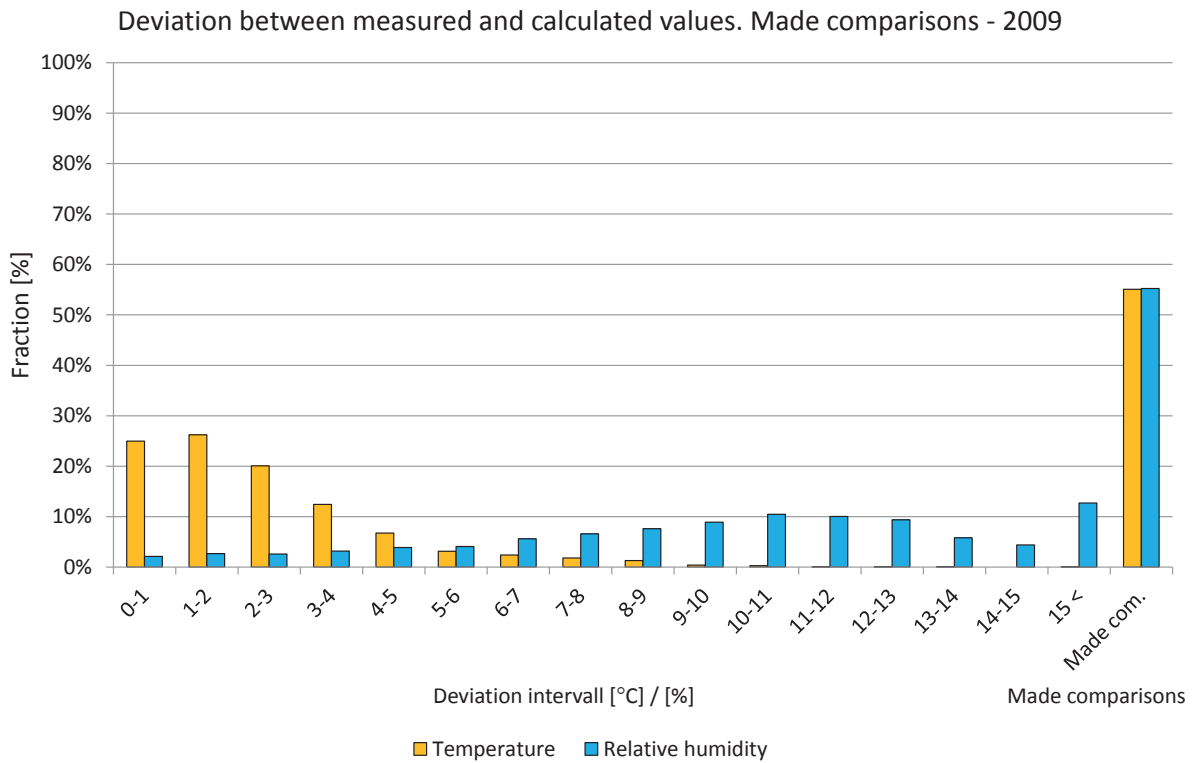


Figure 8.14-5n-air gap.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

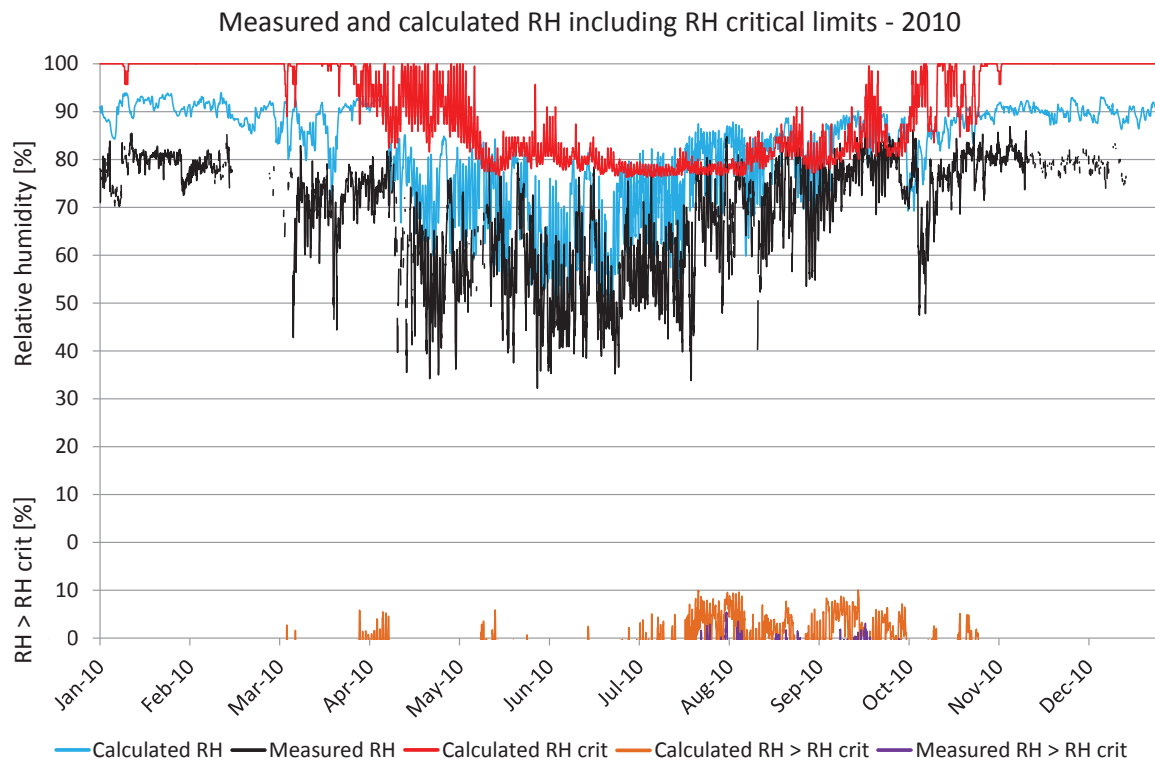


Figure 8.14-5n-air gap.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

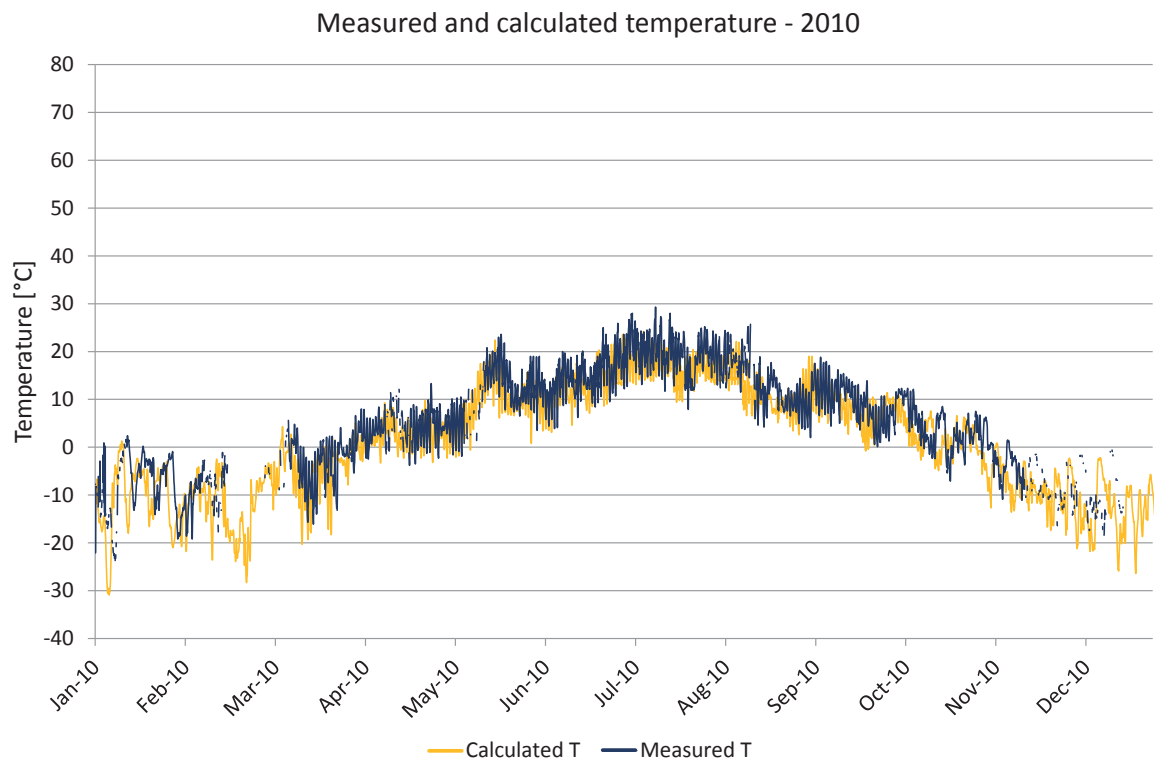


Figure 8.14-5n-air gap.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

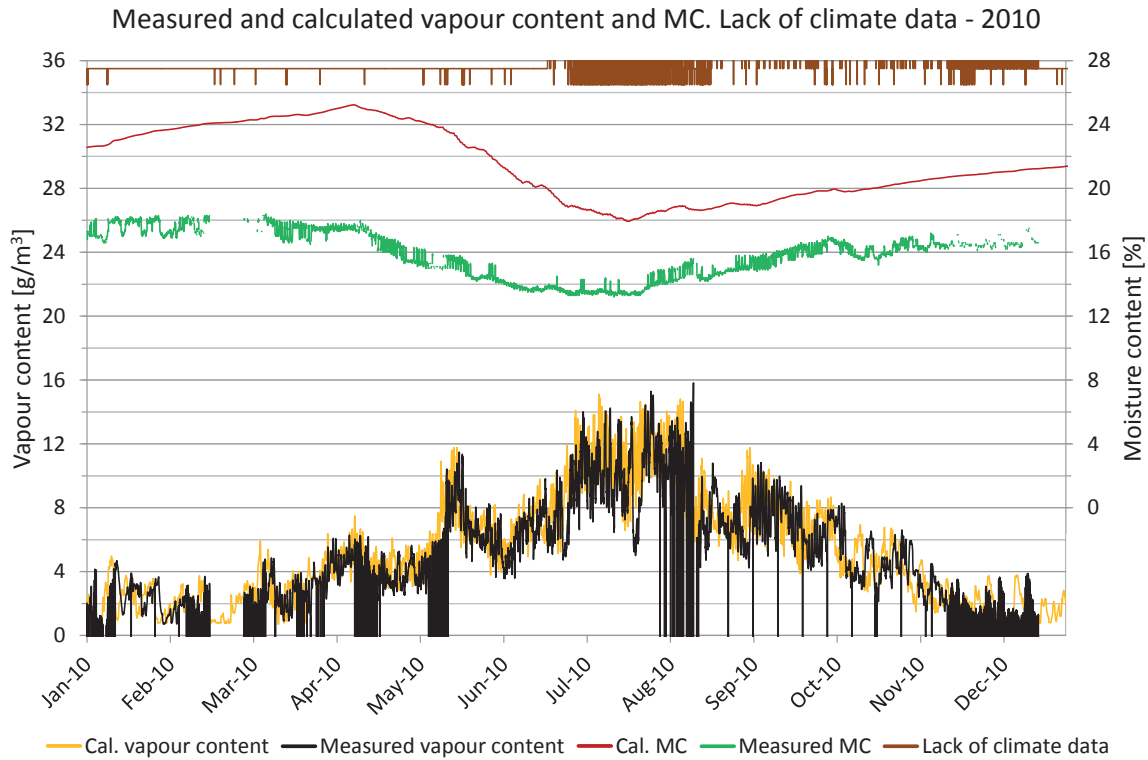


Figure 8.14-5n-air gap.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

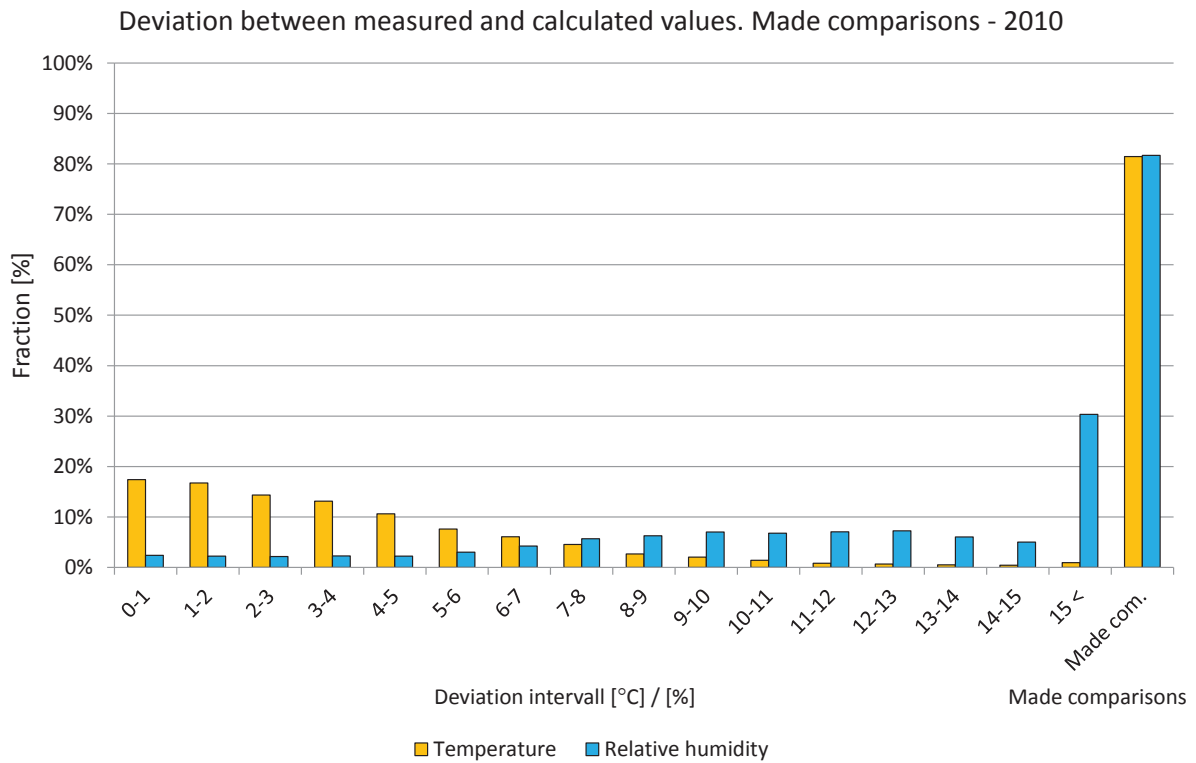


Figure 8.14-5n-air gap.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

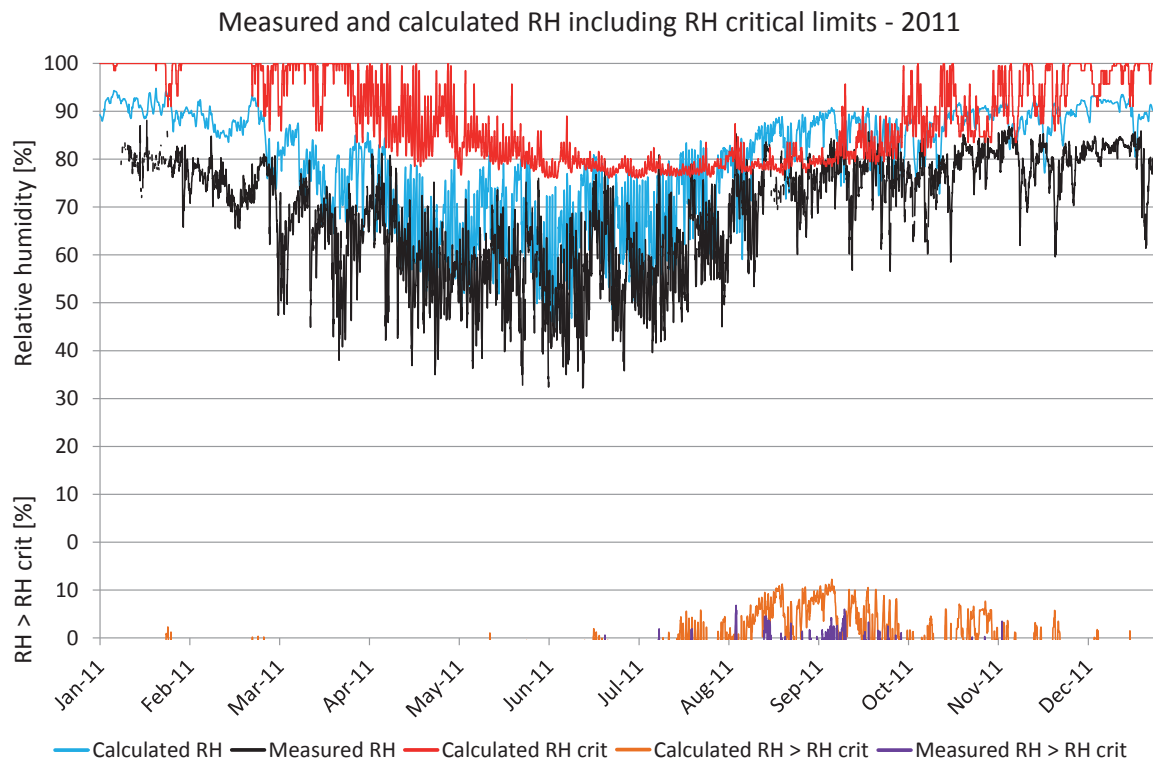


Figure 8.14-5n-air gap.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated RH > RH_{crit} (light brown), measured RH > RH_{crit} (purple).

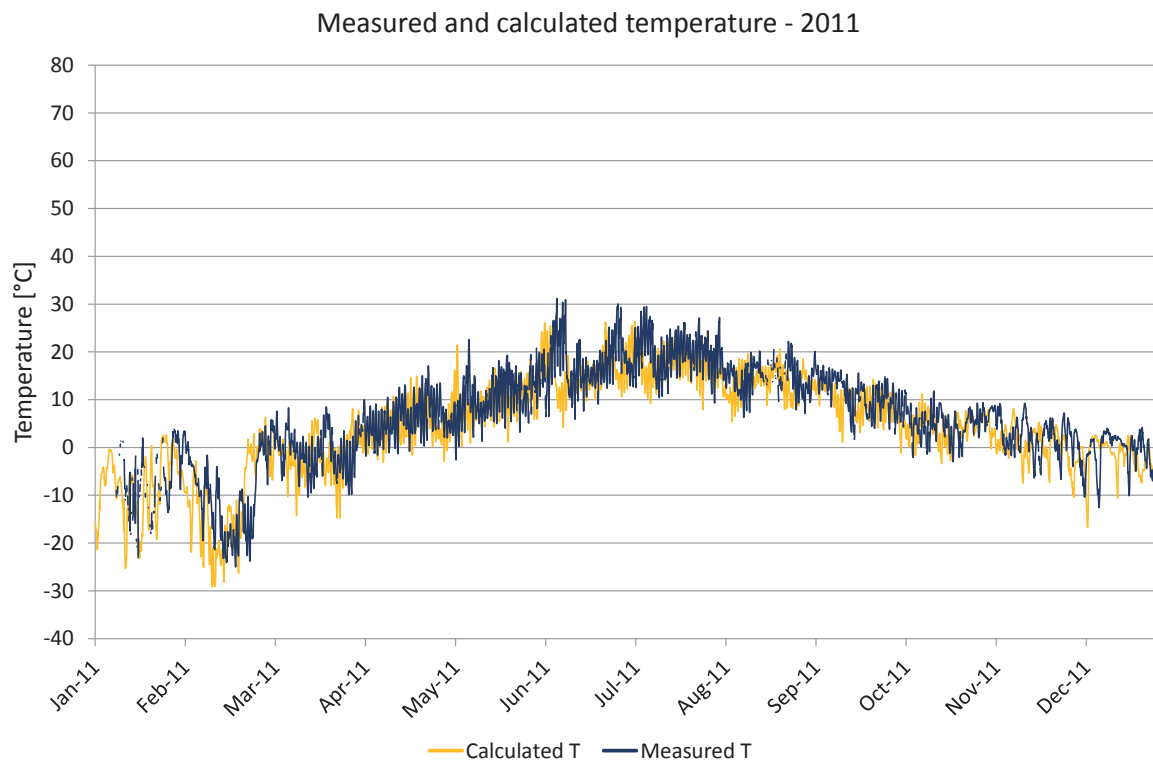


Figure 8.14-5n-air gap.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

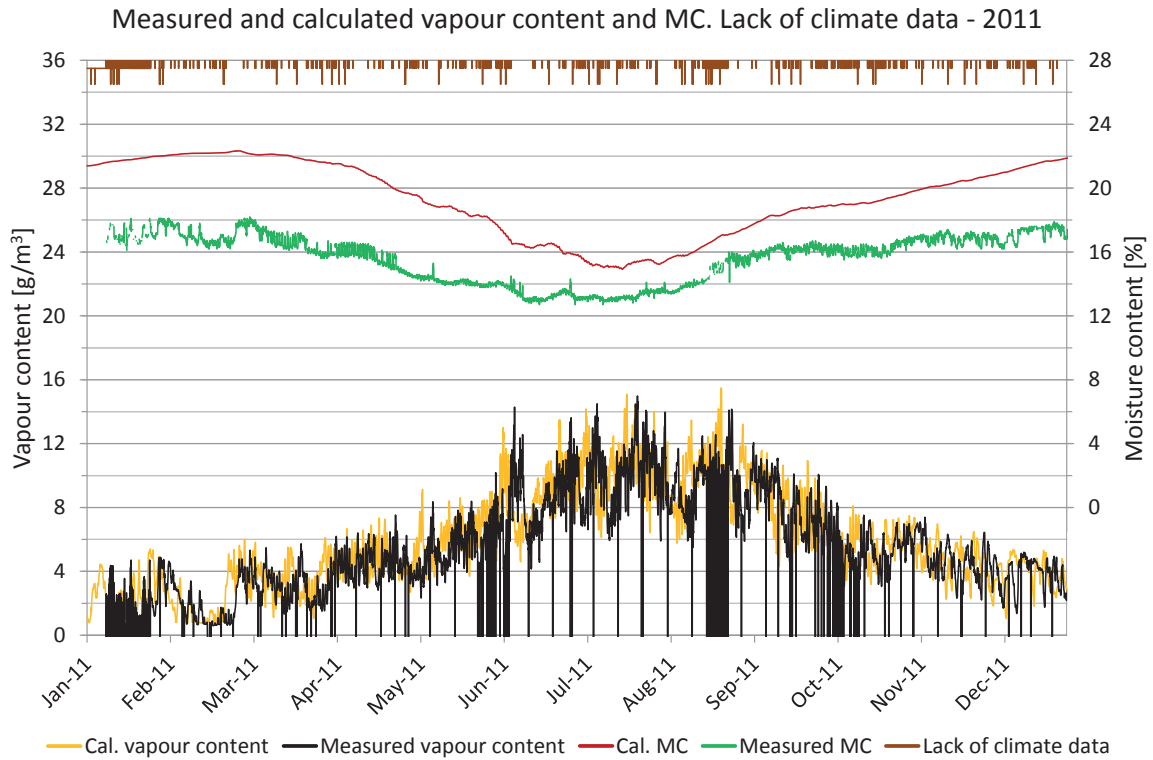


Figure 8.14-5n-air gap.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

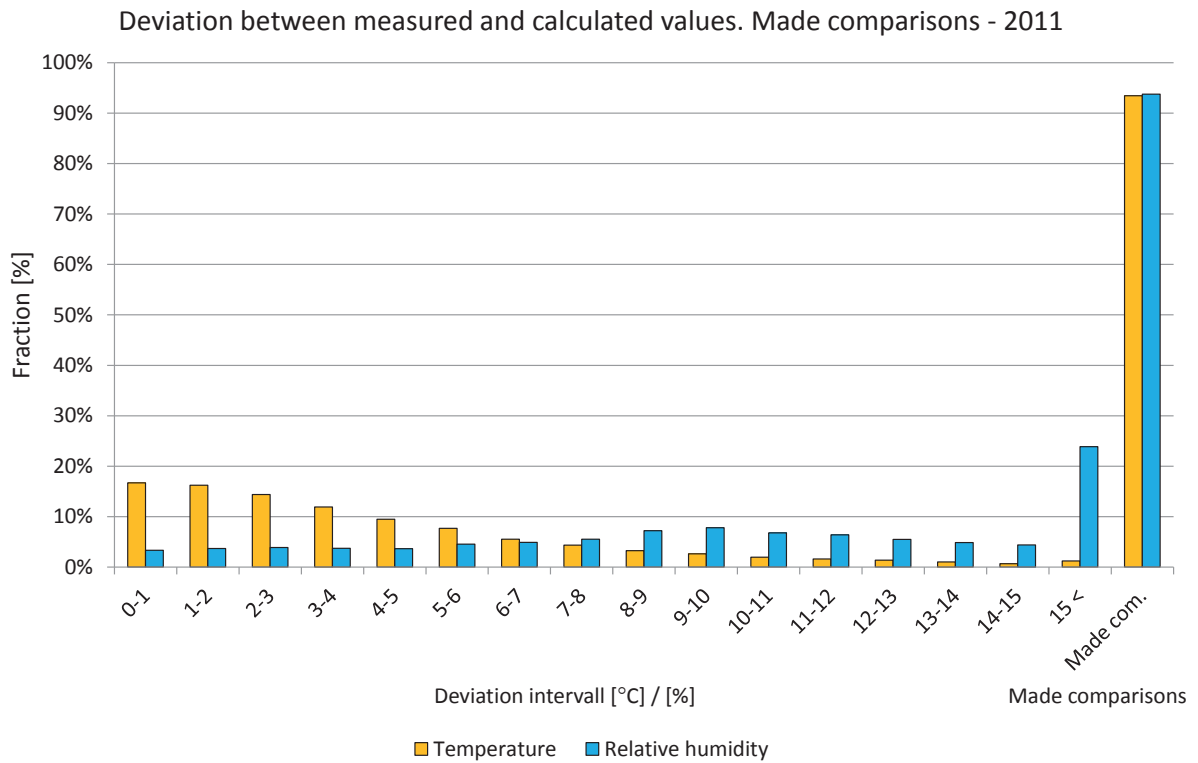


Figure 8.14-5n-air gap.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

8.15 Position 15-5ö-exterior façade

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located on the exterior façade panel in a wall that is facing east on the fifth floor.

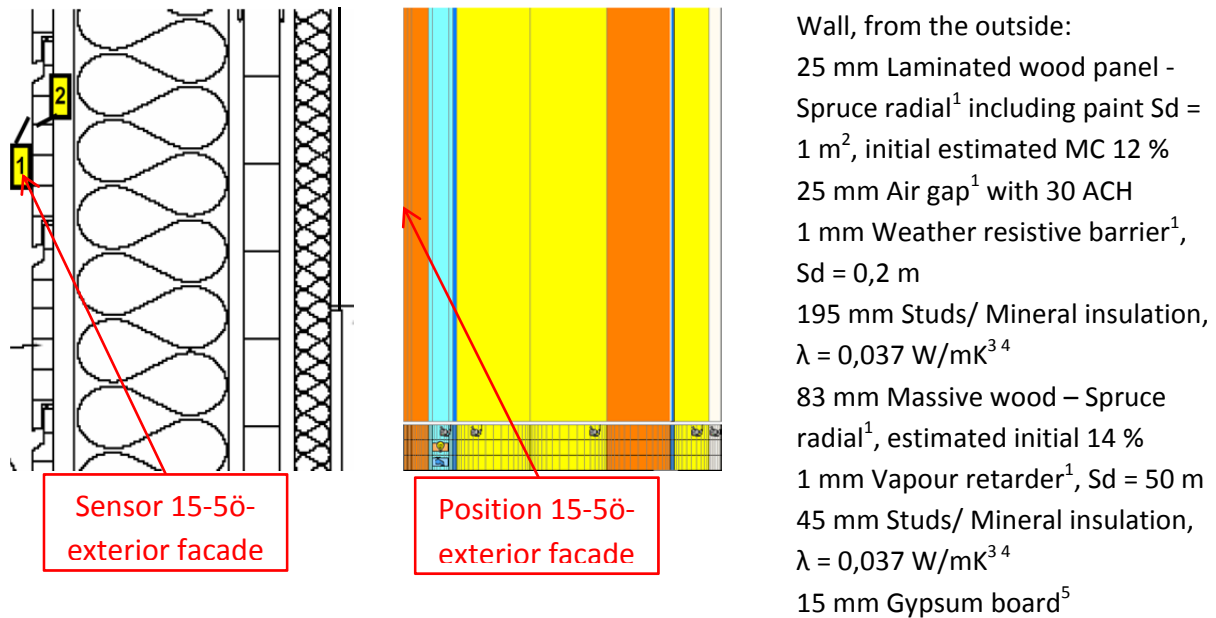


Figure 8.15-5ö-exterior.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.

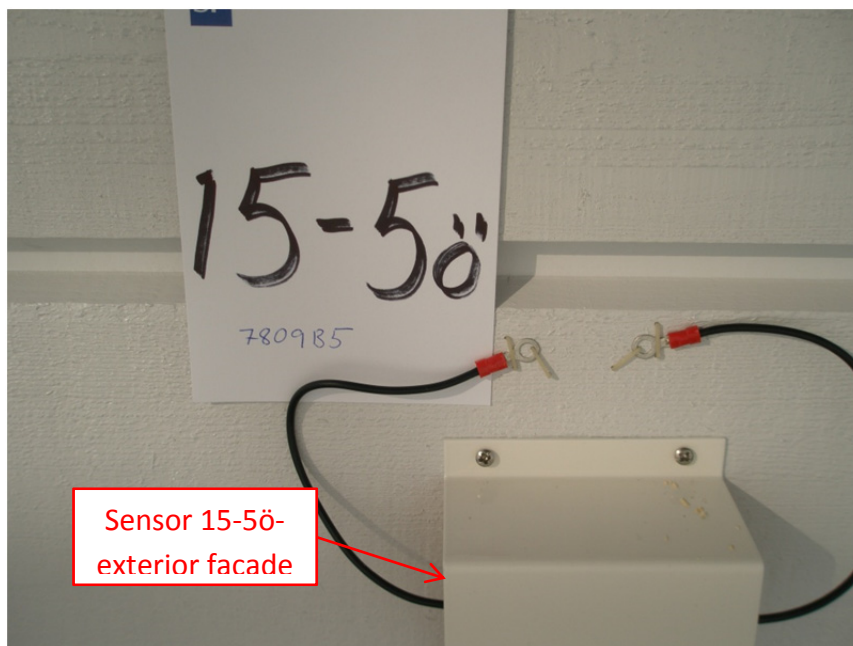


Figure 8.15-5ö-exterior.2. Location of the studied position. Photo: SP Trä Skellefteå.

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 2009

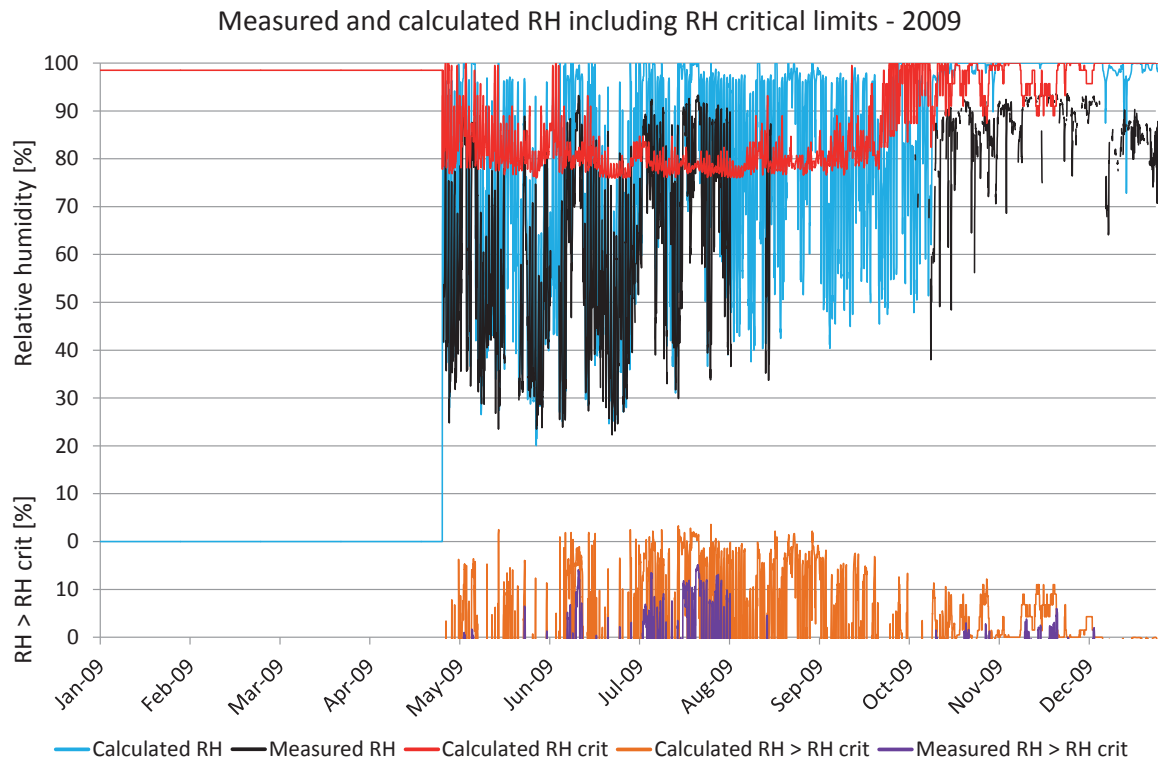


Figure 8.15-5ö-exterior.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

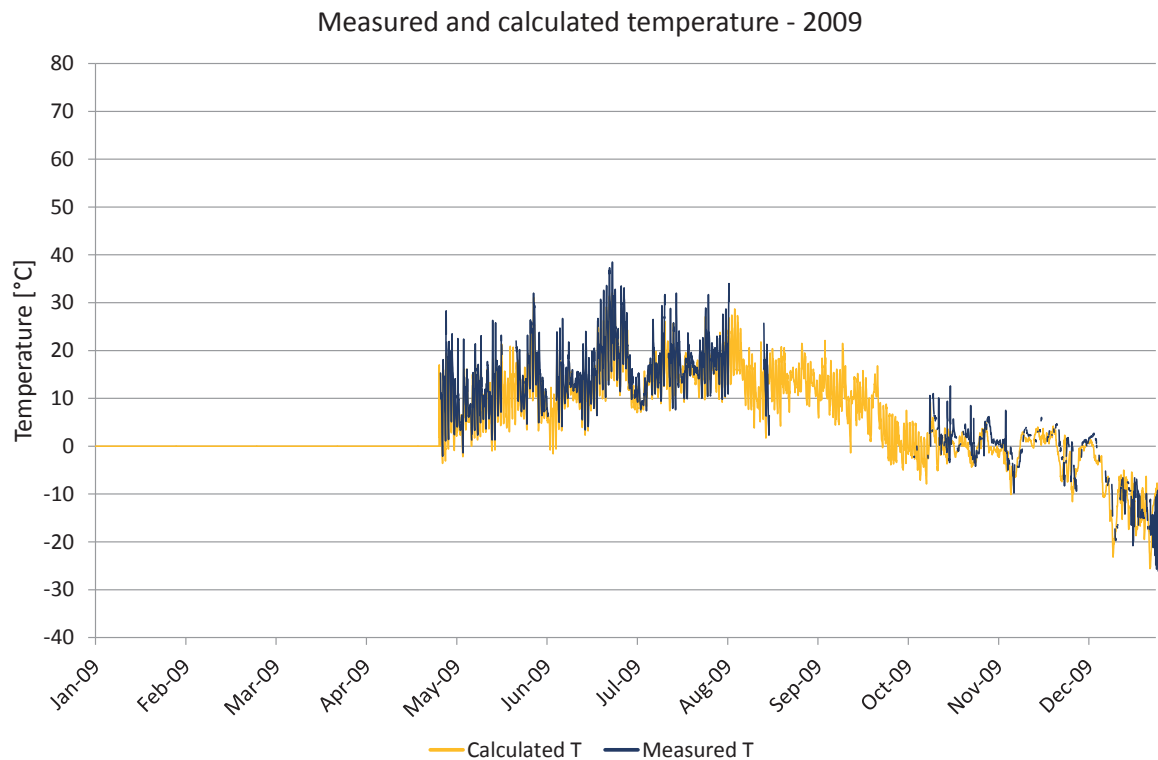


Figure 8.15-5ö-exterior.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

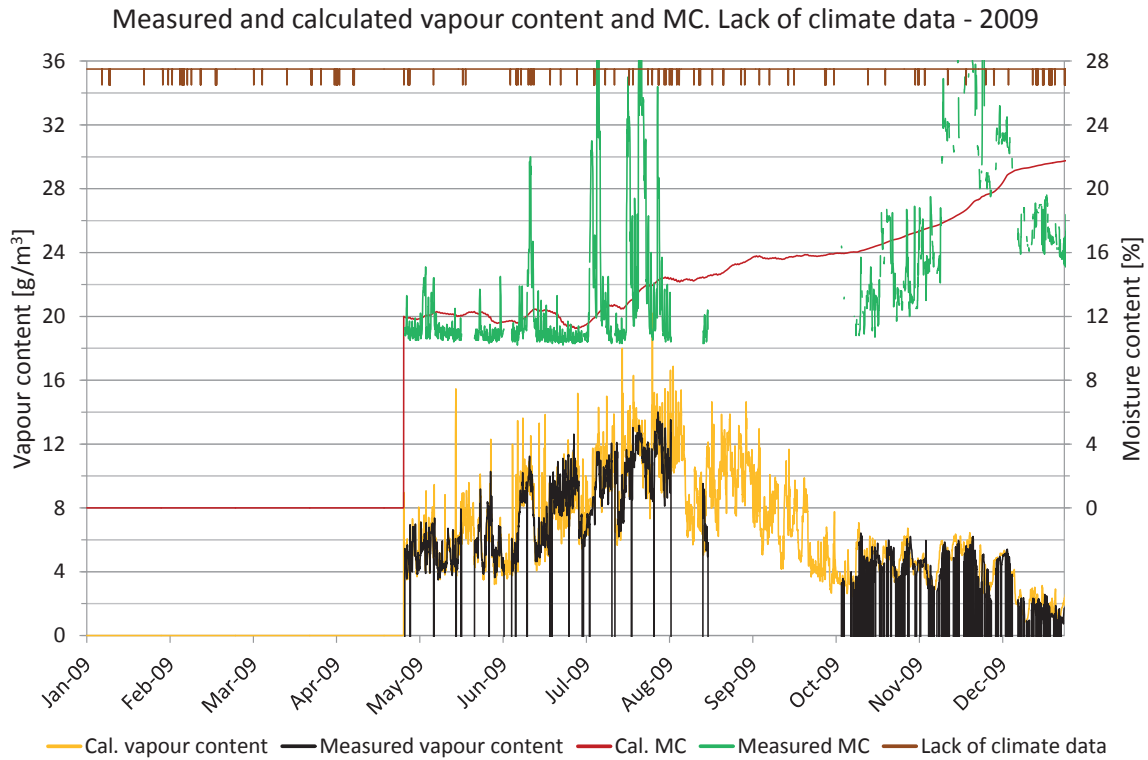


Figure 8.15-5ö-exterior.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

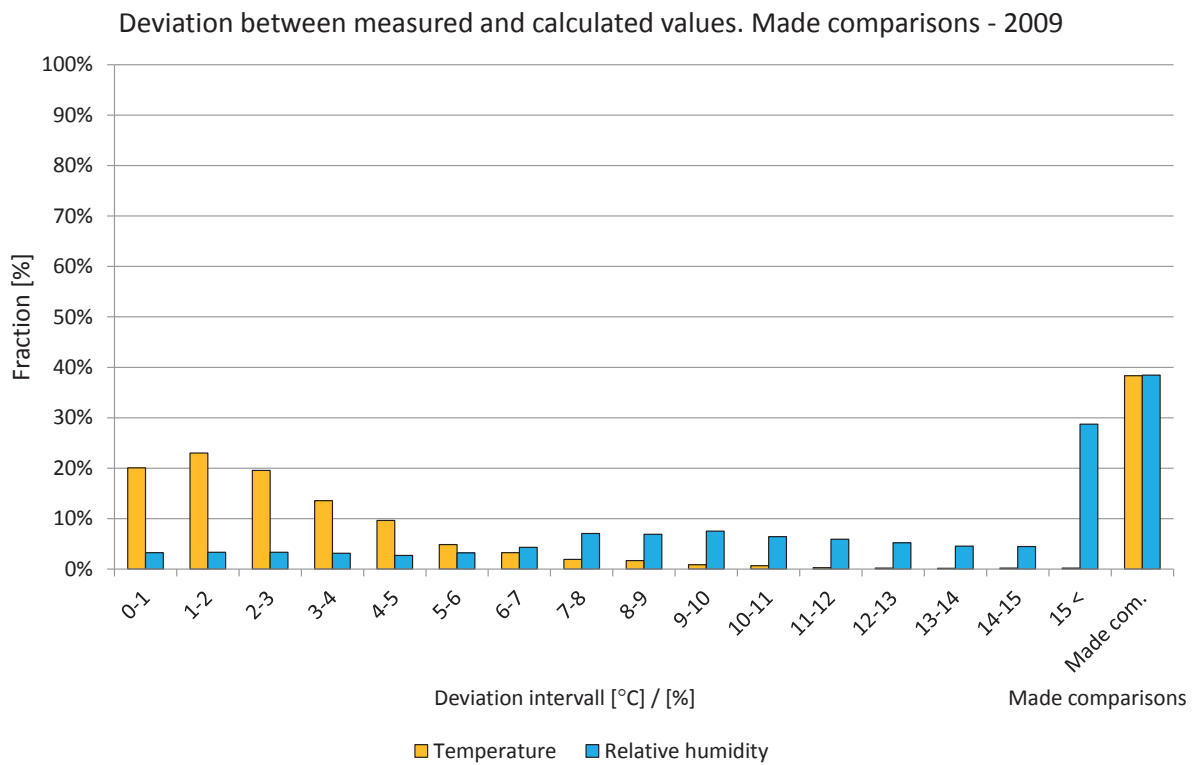


Figure 8.15-5ö-exterior.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

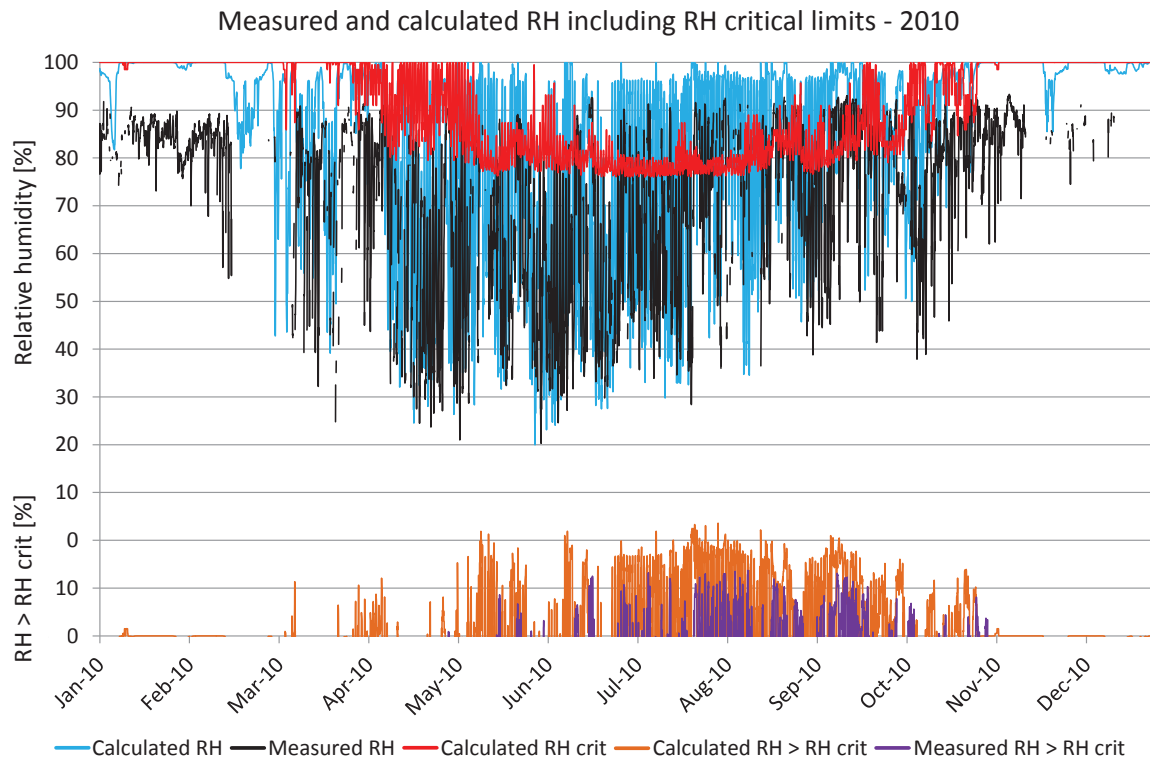


Figure 8.15-5ö-exterior.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

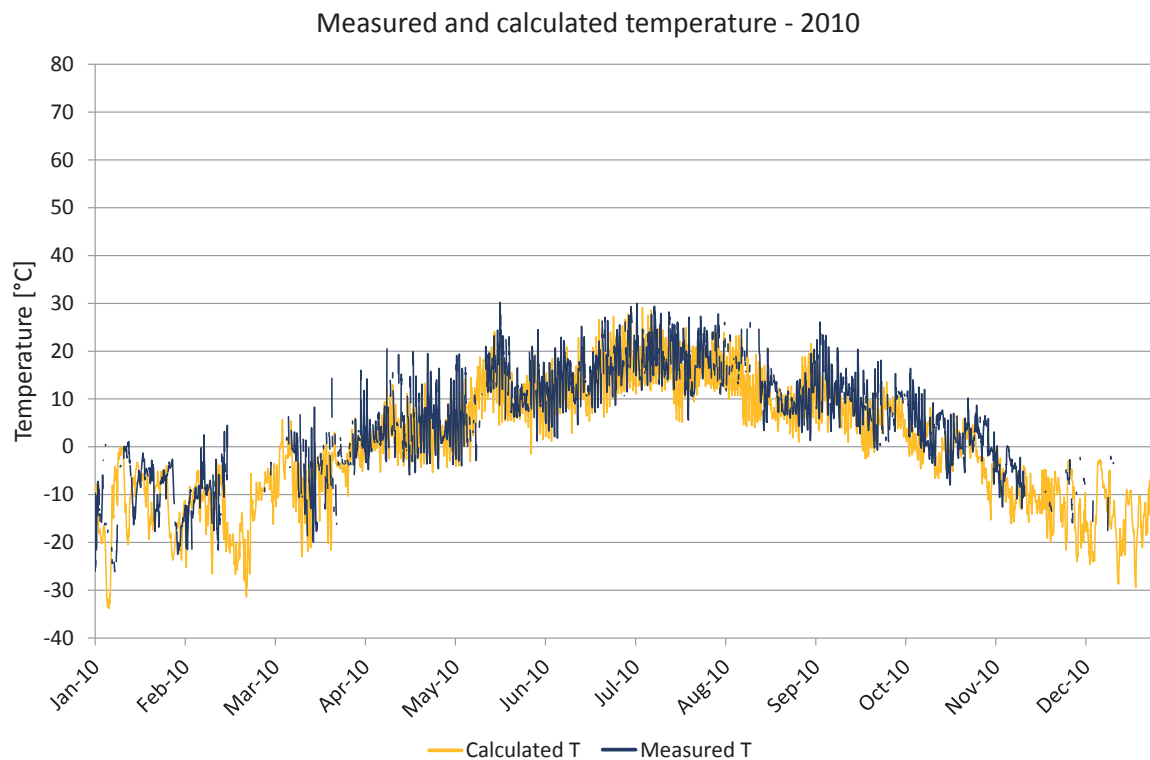


Figure 8.15-5ö-exterior.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

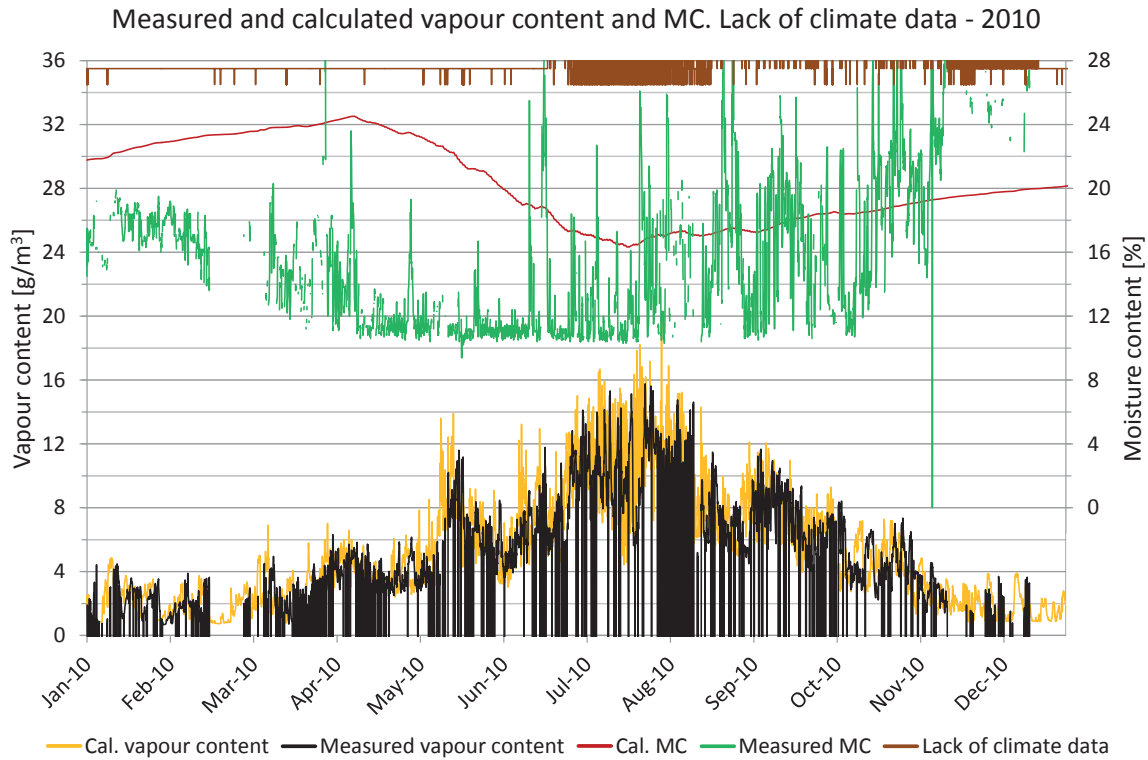


Figure 8.15-5ö-exterior.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

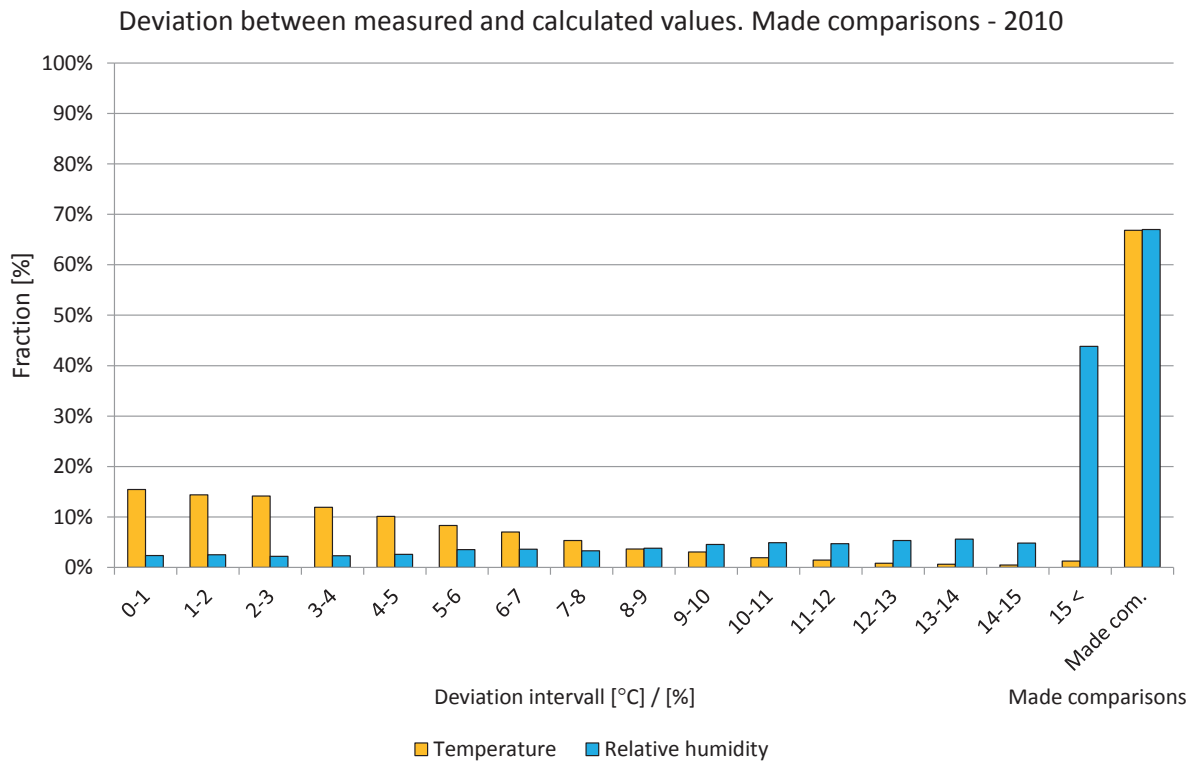


Figure 8.15-5ö-exterior.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

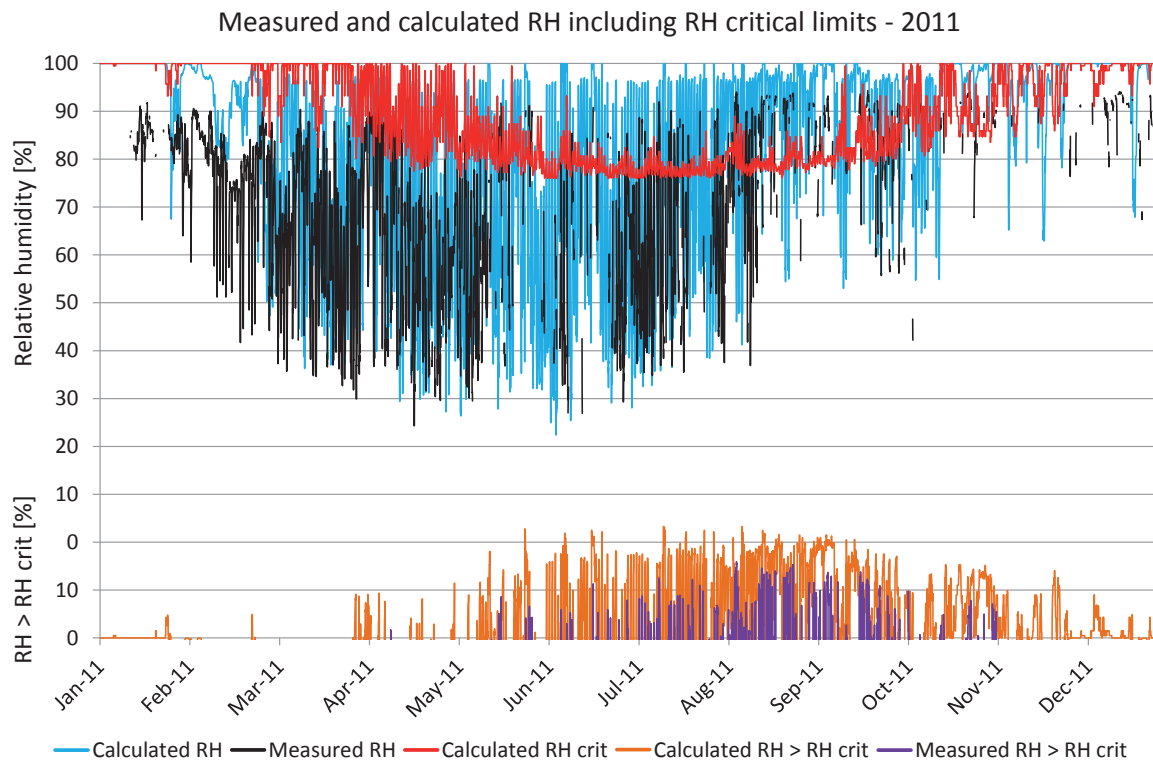


Figure 8.15-5ö-exterior.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

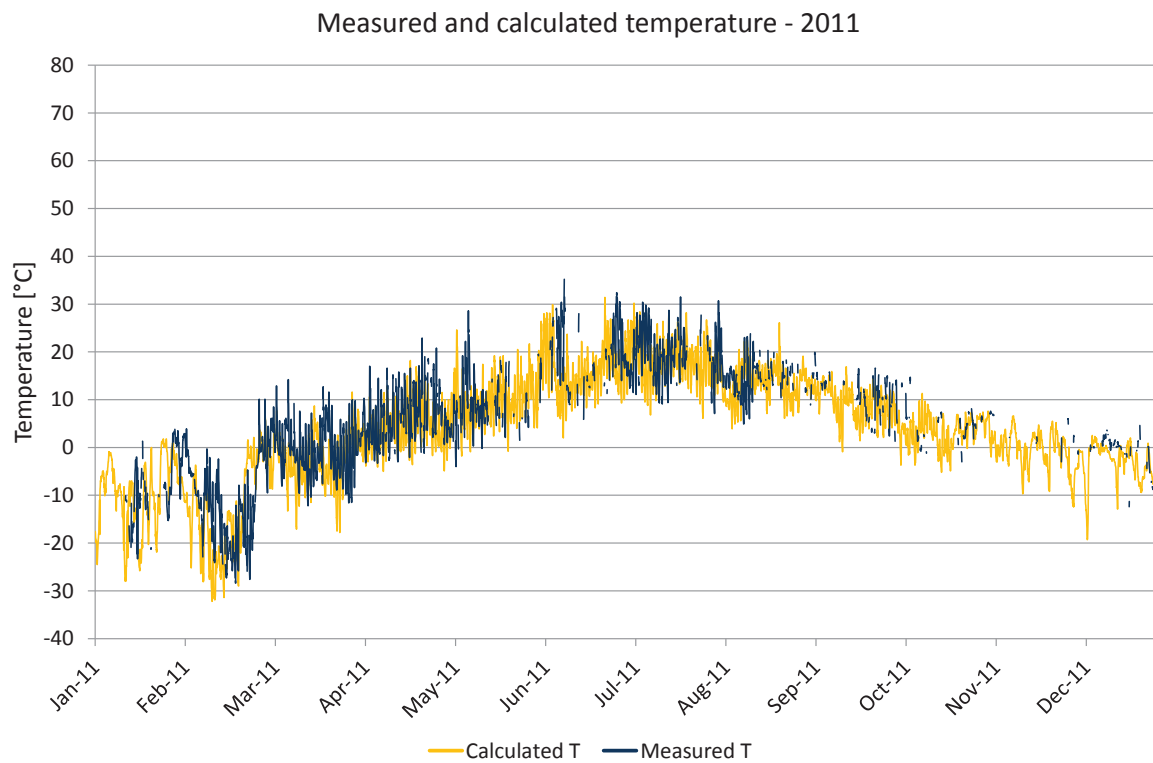


Figure 8.15-5ö-exterior.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

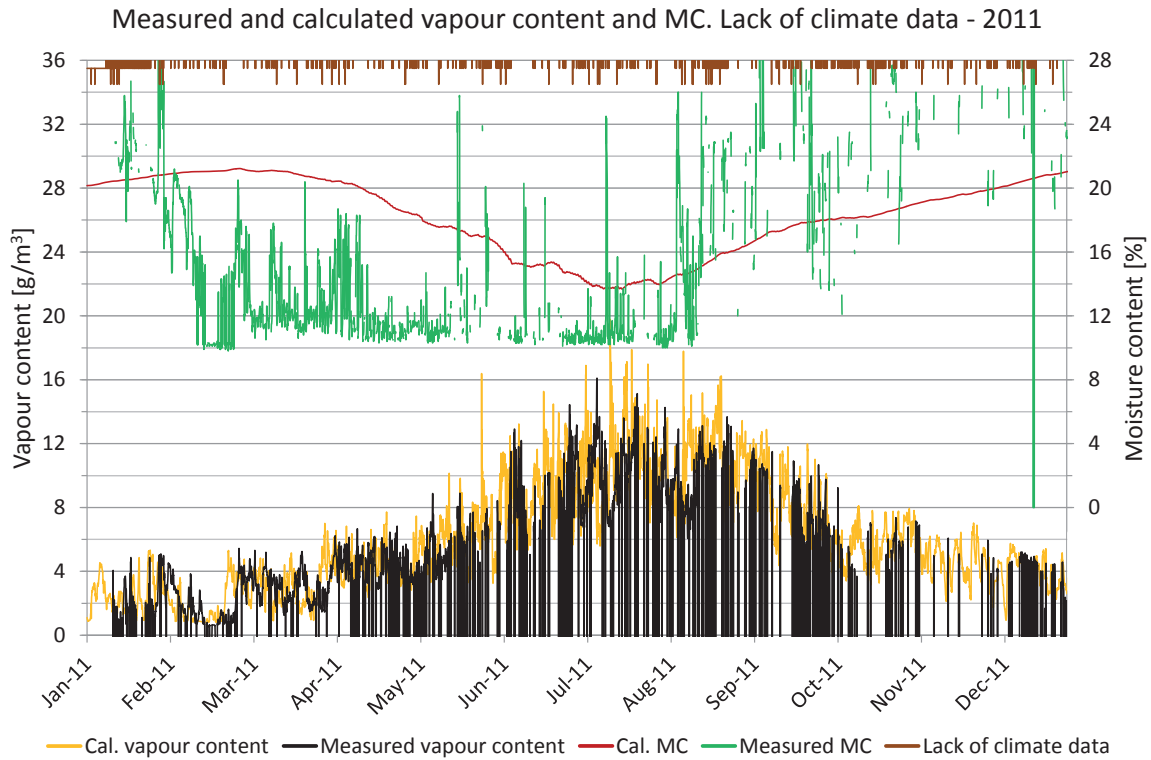


Figure 8.15-5ö-exterior.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

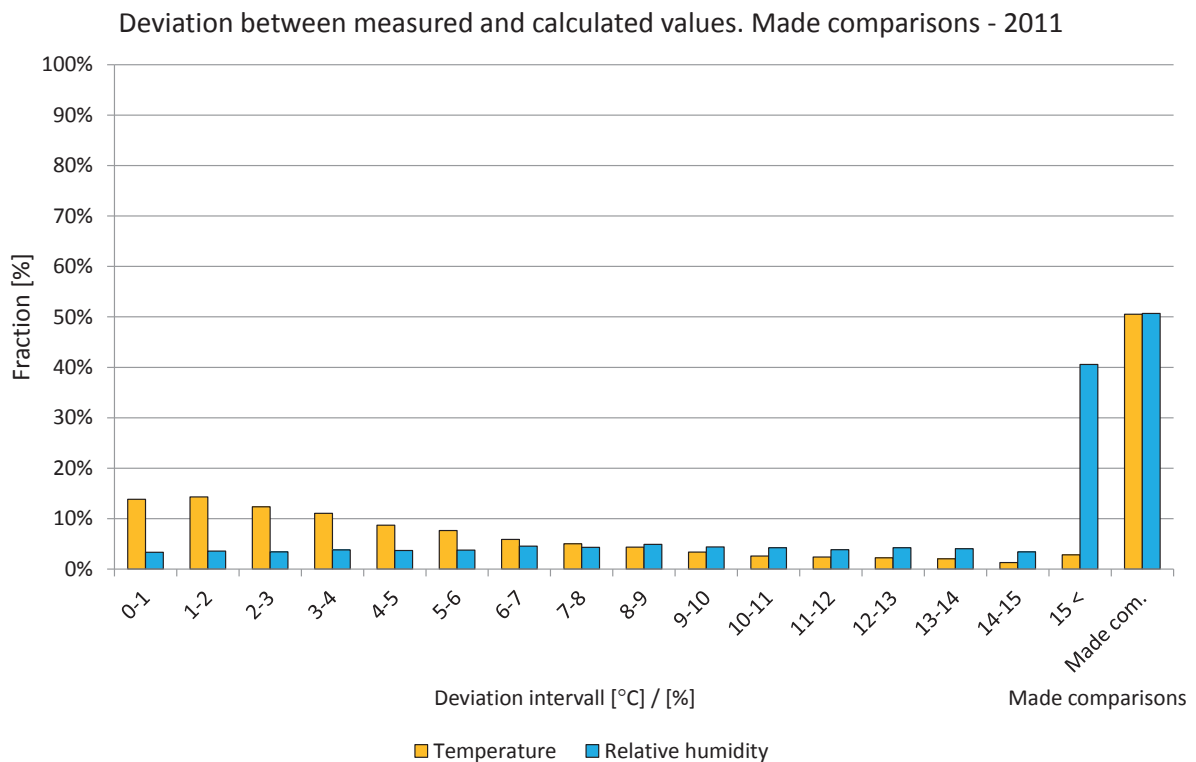


Figure 8.15-5ö-exterior.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

8.15 Position 15-5ö-air gap

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the air gap behind the façade panel in a wall that is facing north on the fifth floor.

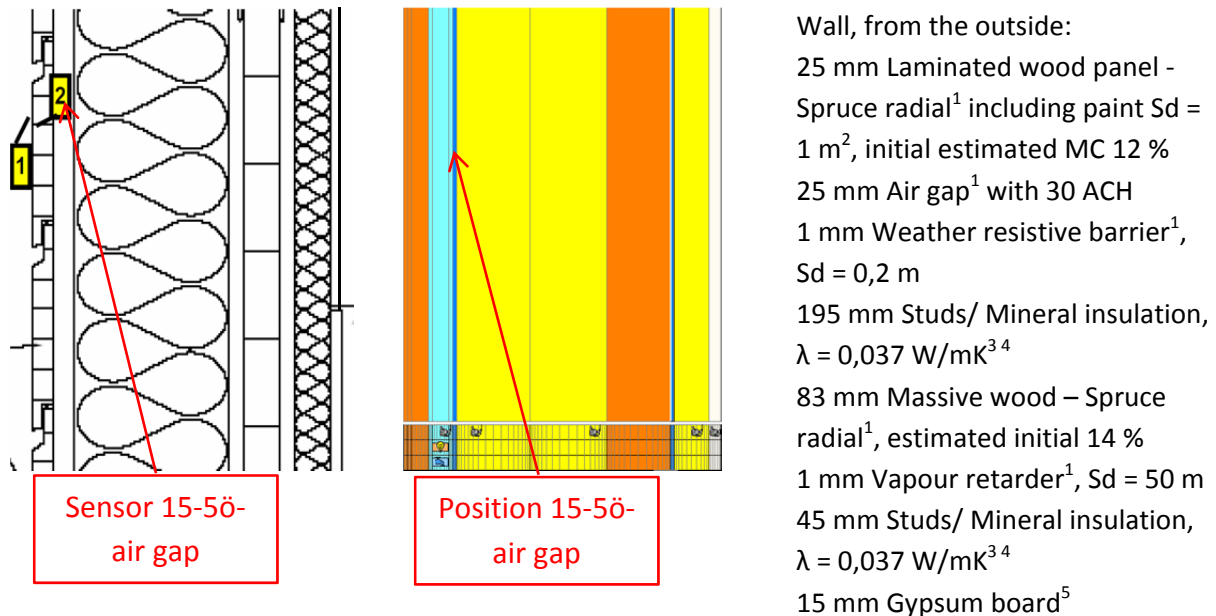


Figure 8.15-5ö-air gap.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.

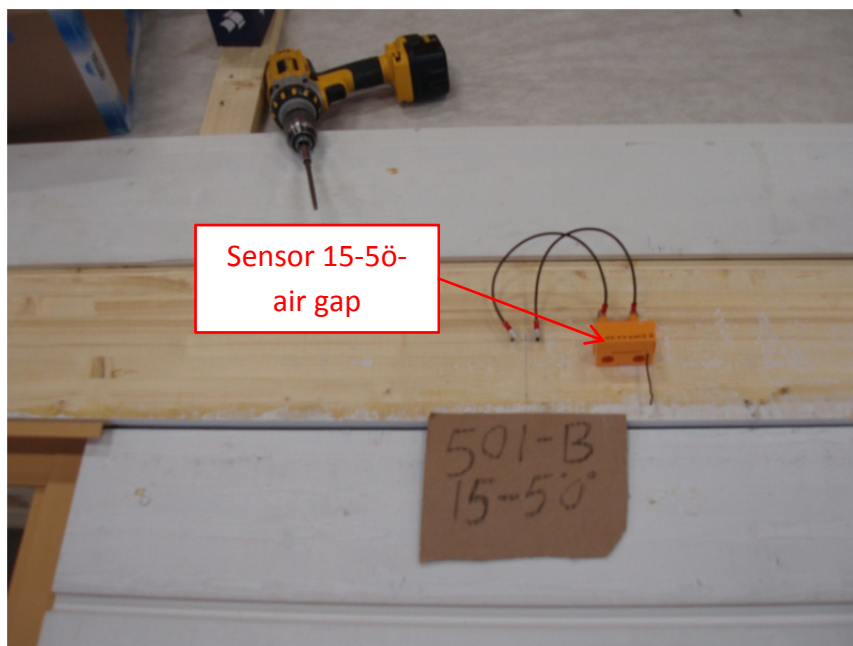


Figure 8.15-5ö-air gap.2. Location of the studied position. Photo: SP Trä Skellefteå.

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 2009

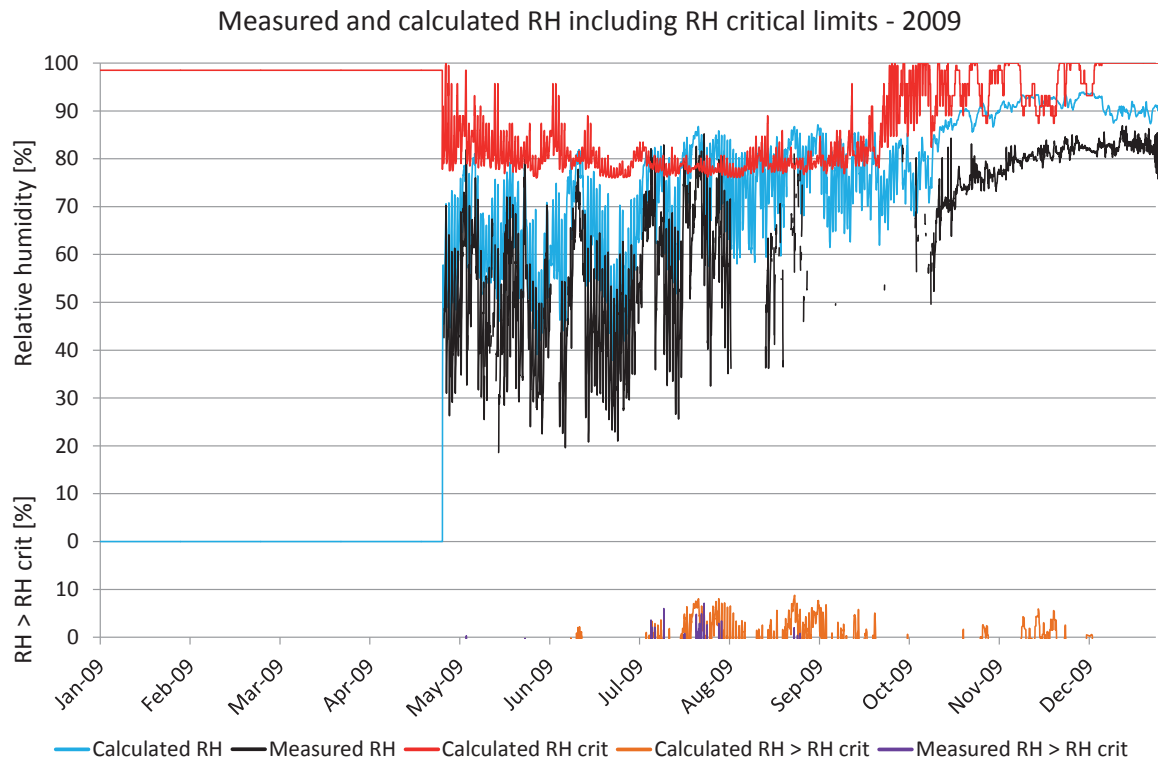


Figure 8.15-5ö-air gap.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

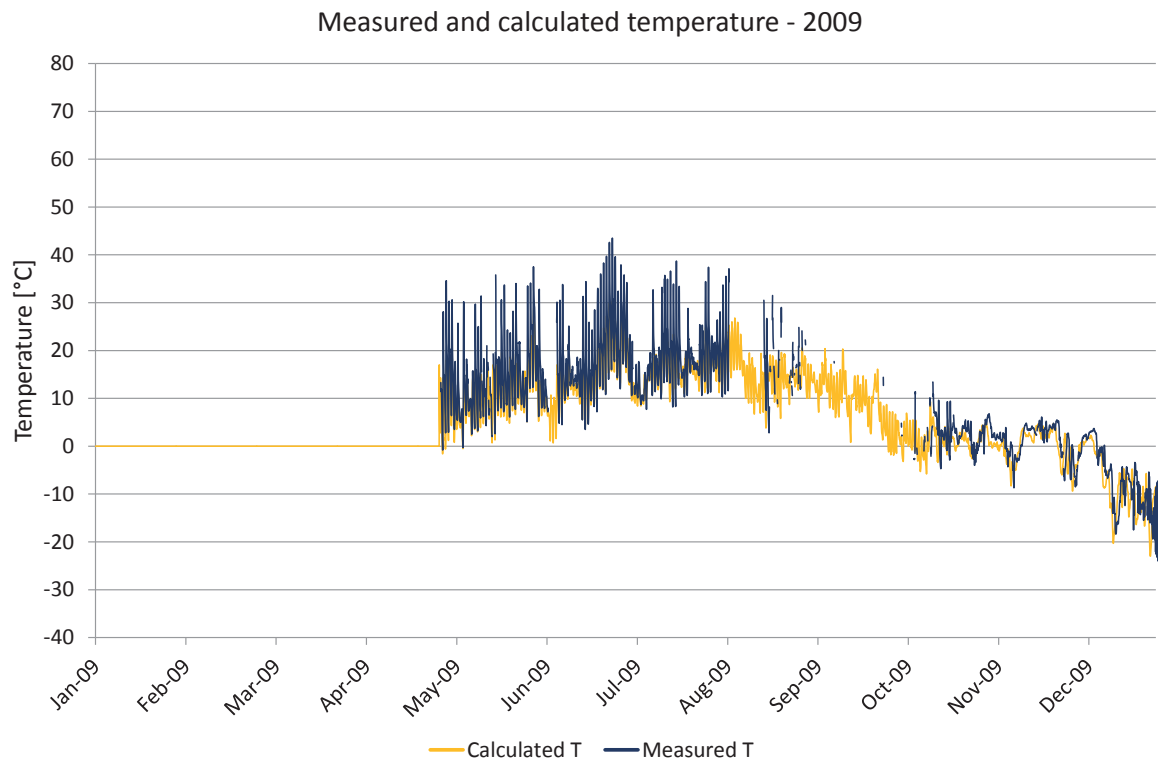


Figure 8.15-5ö-air gap.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

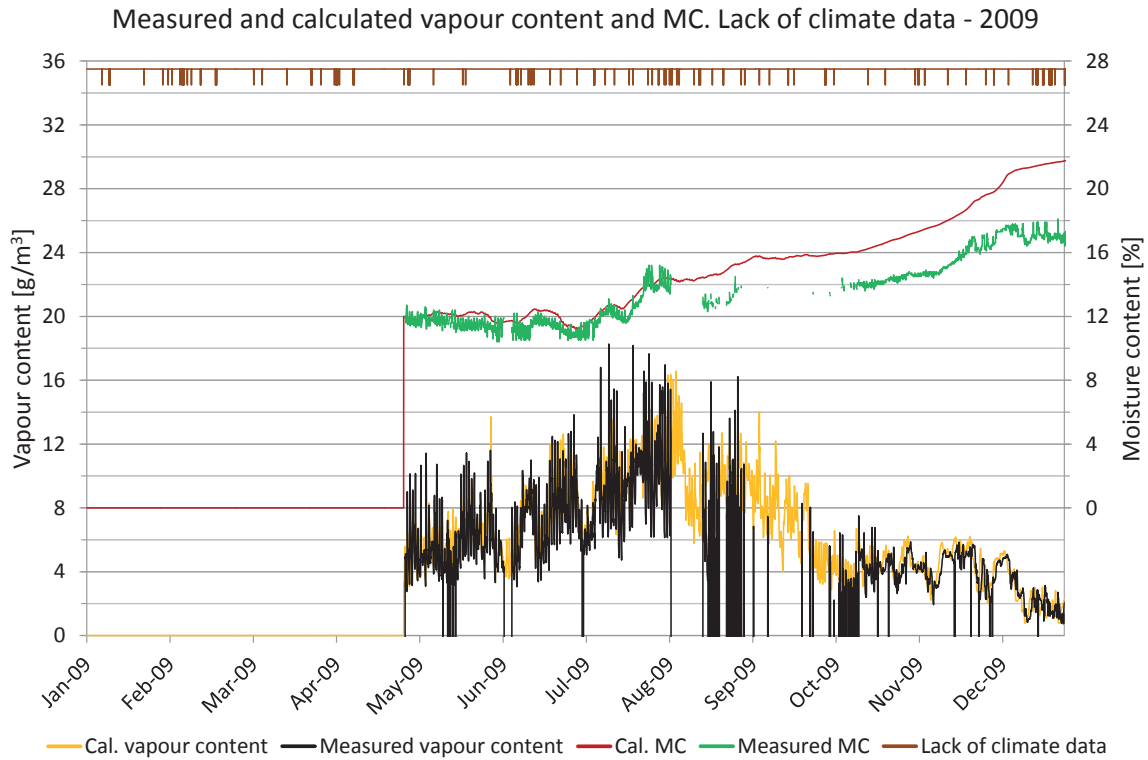


Figure 8.15-5ö-air gap.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

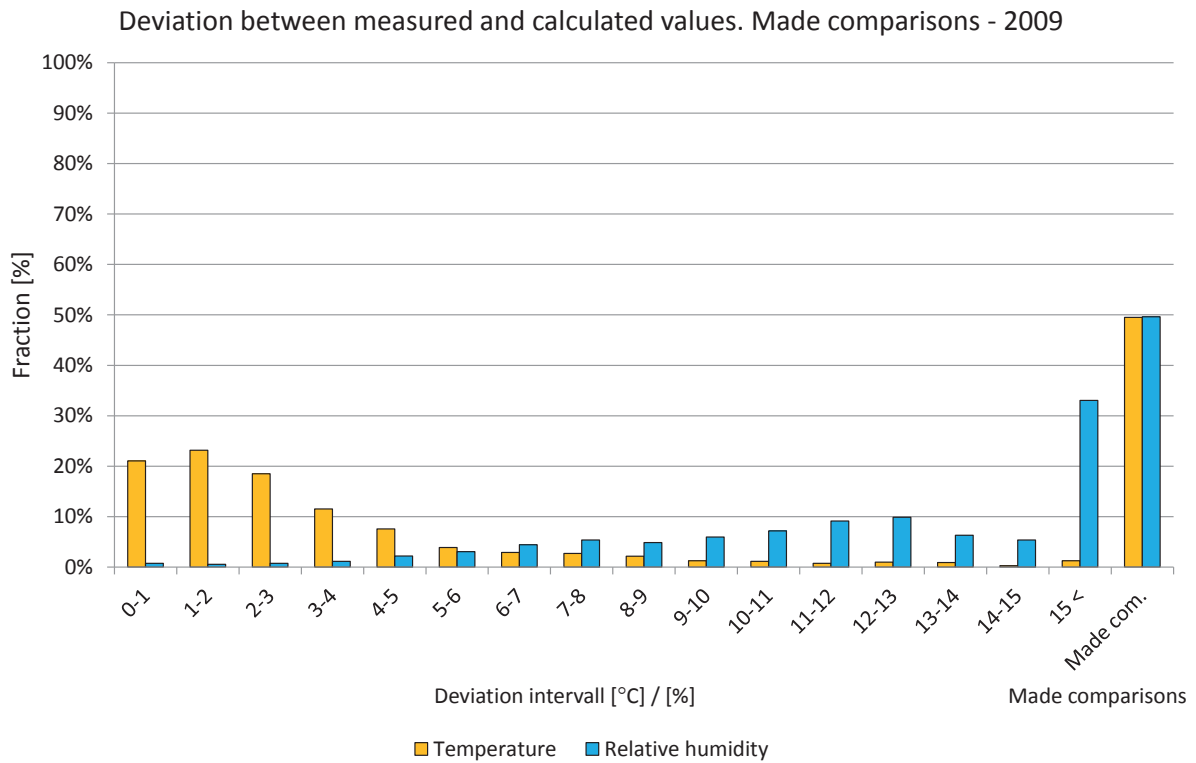


Figure 8.15-5ö-air gap.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

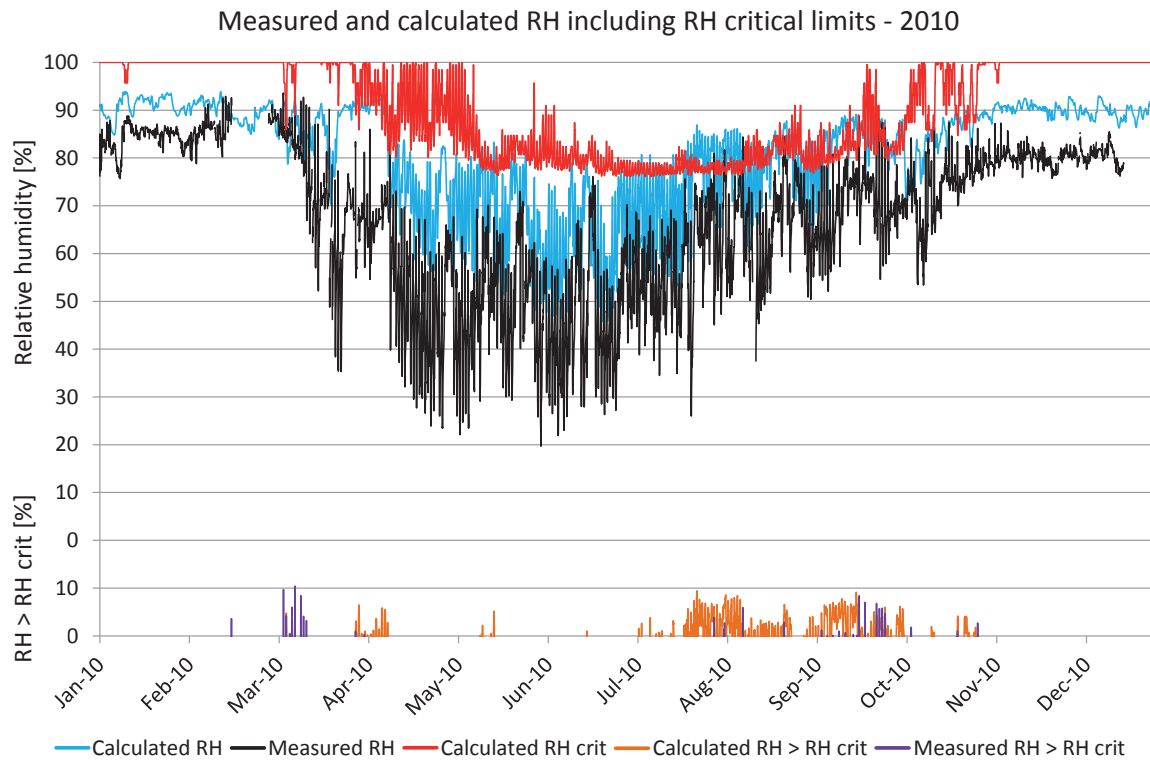


Figure 8.15-5ö-air gap.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

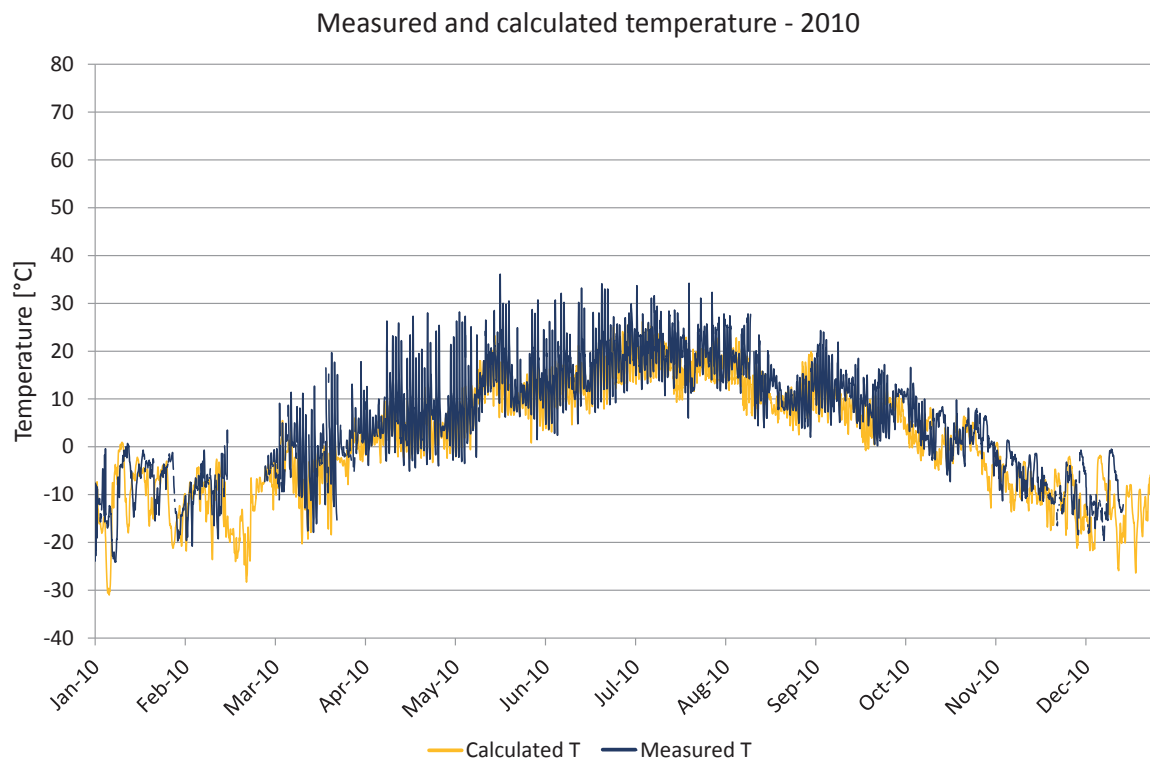


Figure 8.15-5ö-air gap.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

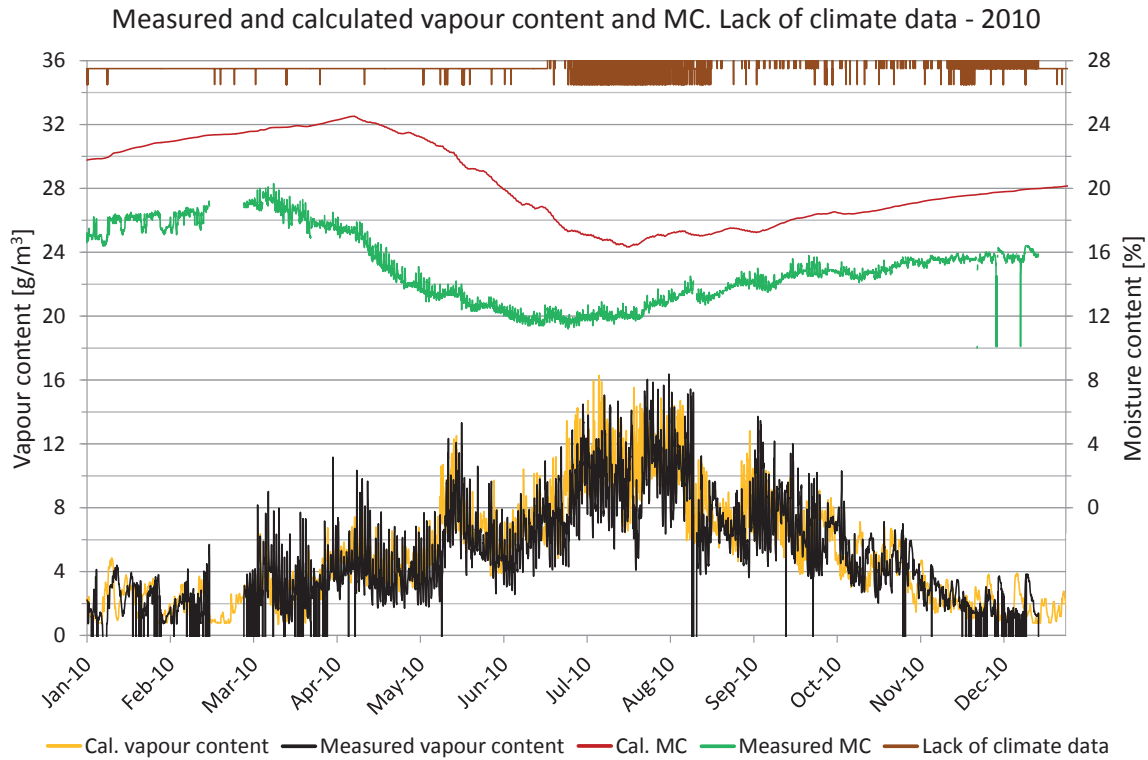


Figure 8.15-5ö-air gap.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

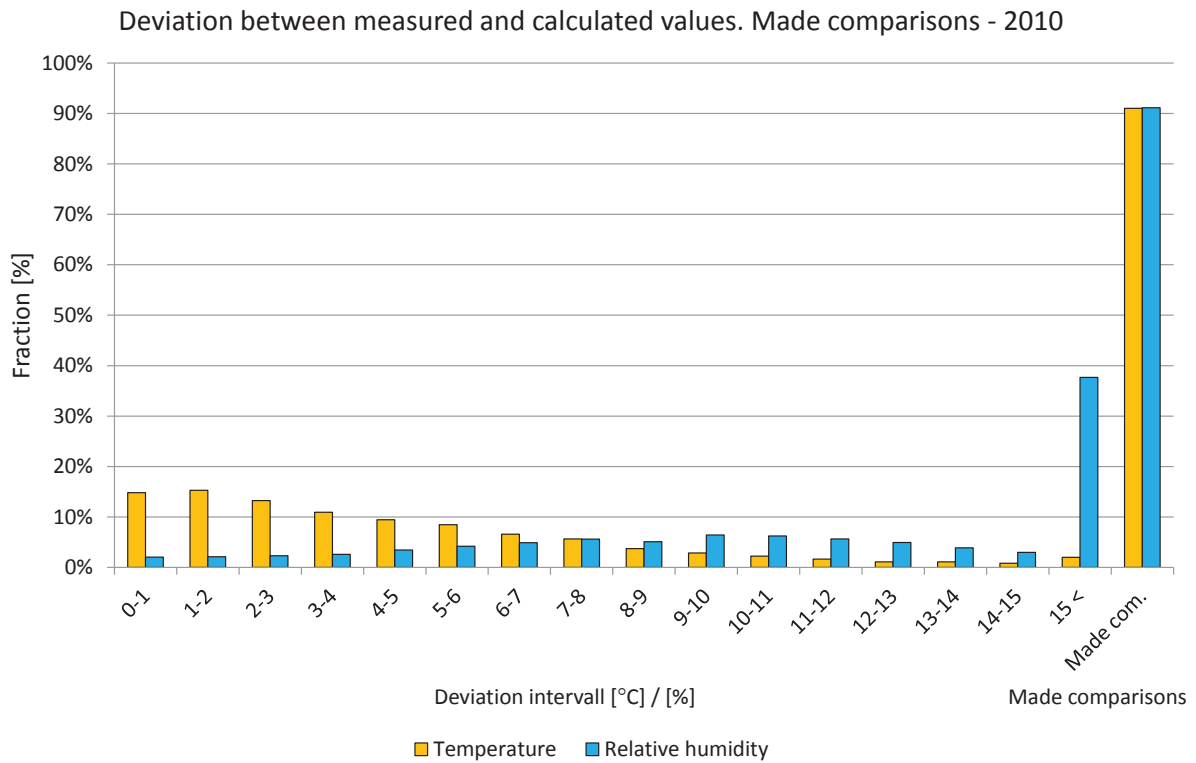


Figure 8.15-5ö-air gap.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

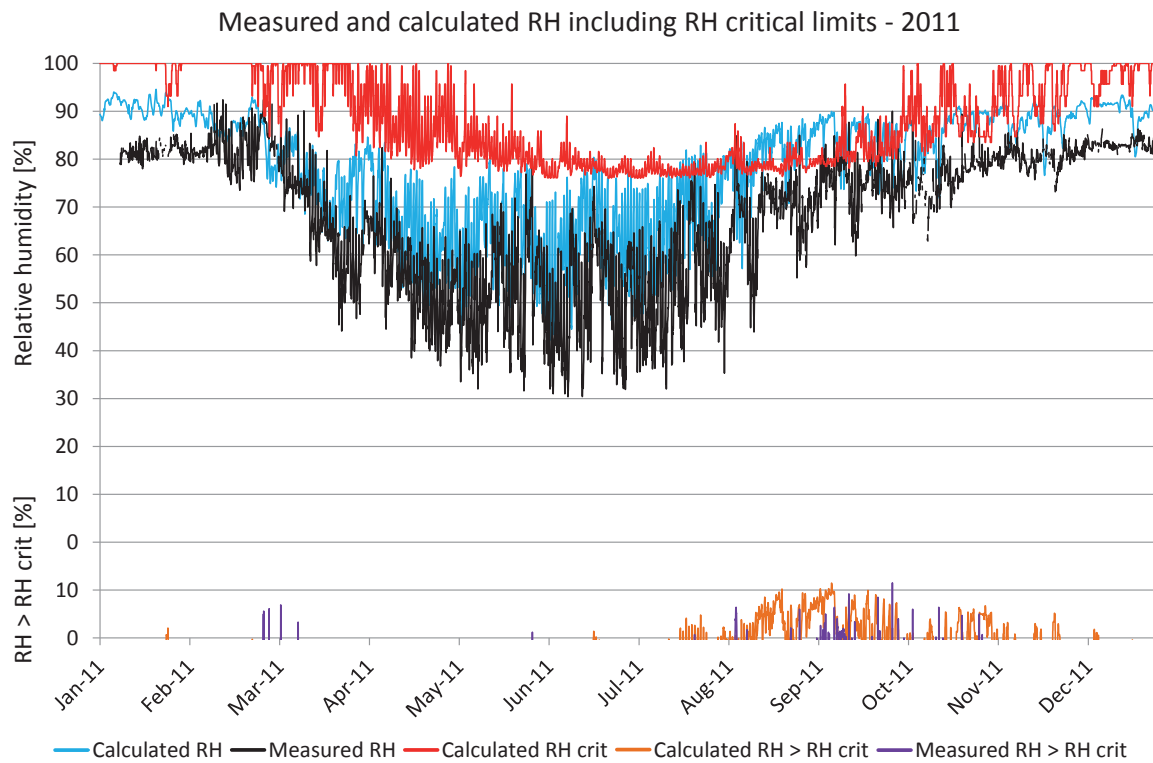


Figure 8.15-5ö-air gap.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

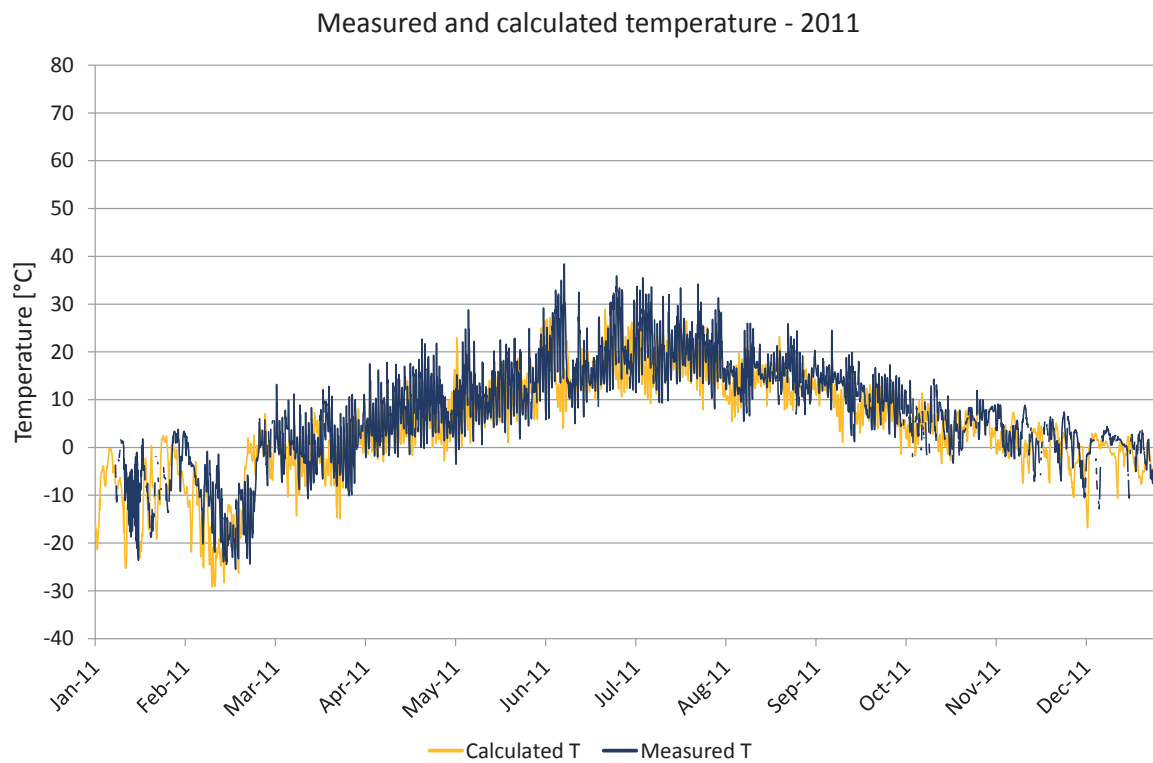


Figure 8.15-5ö-air gap.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

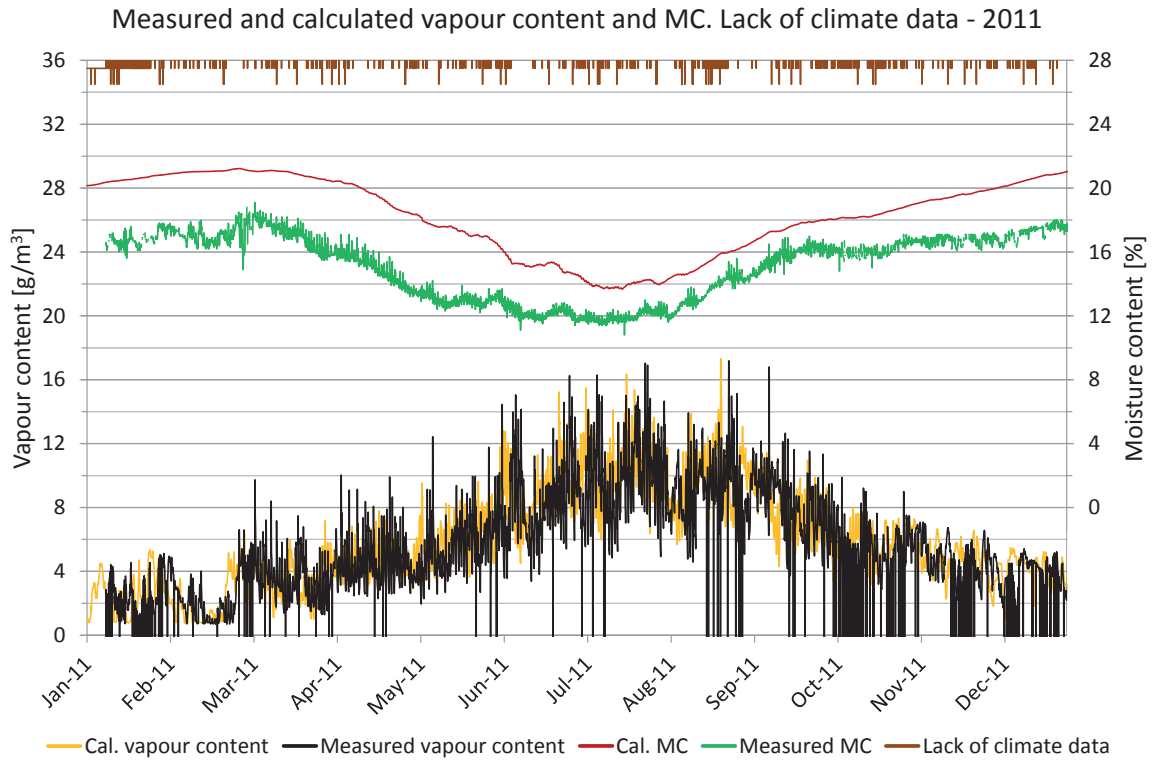


Figure 8.15-5ö-air gap.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

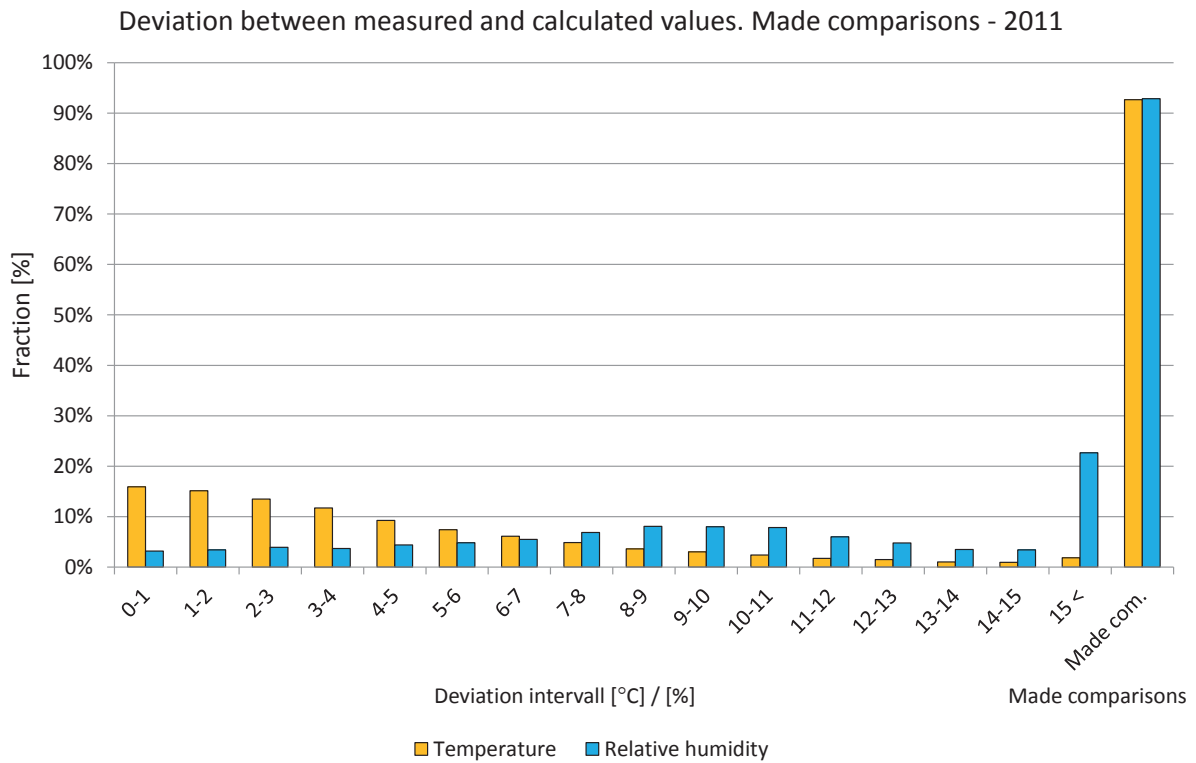


Figure 8.15-5ö-air gap.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

8.22 Position 22-6s-exterior façade

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located on the exterior façade panel on a wall that is facing south on the sixth floor.

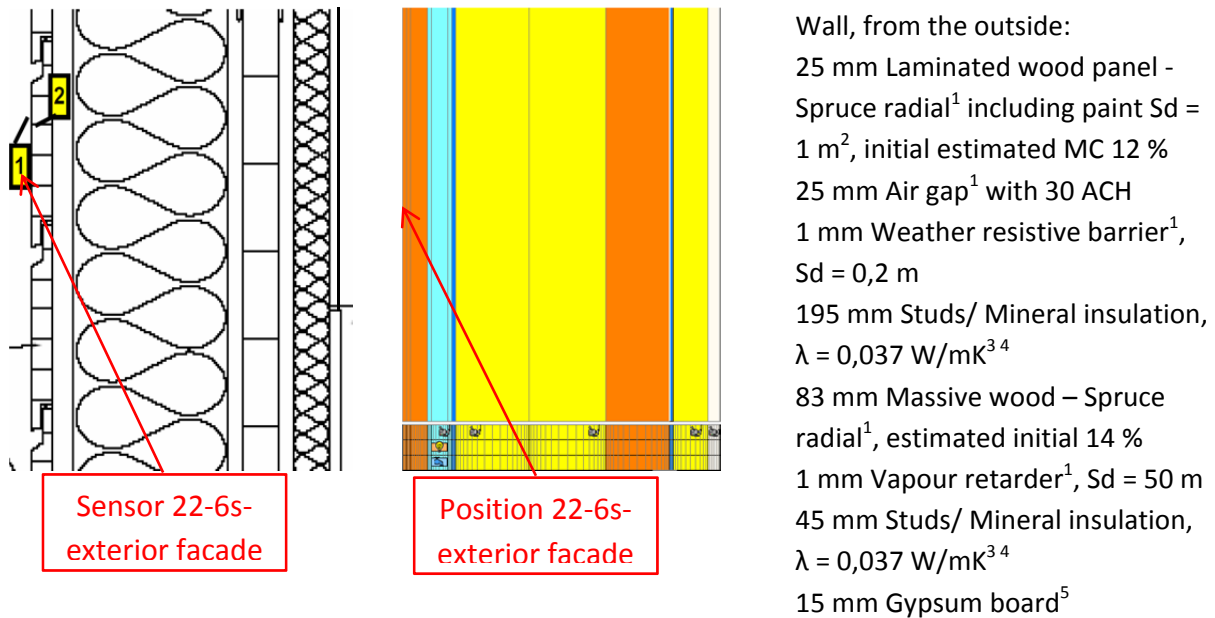


Figure 8.22-6s-exterior.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.

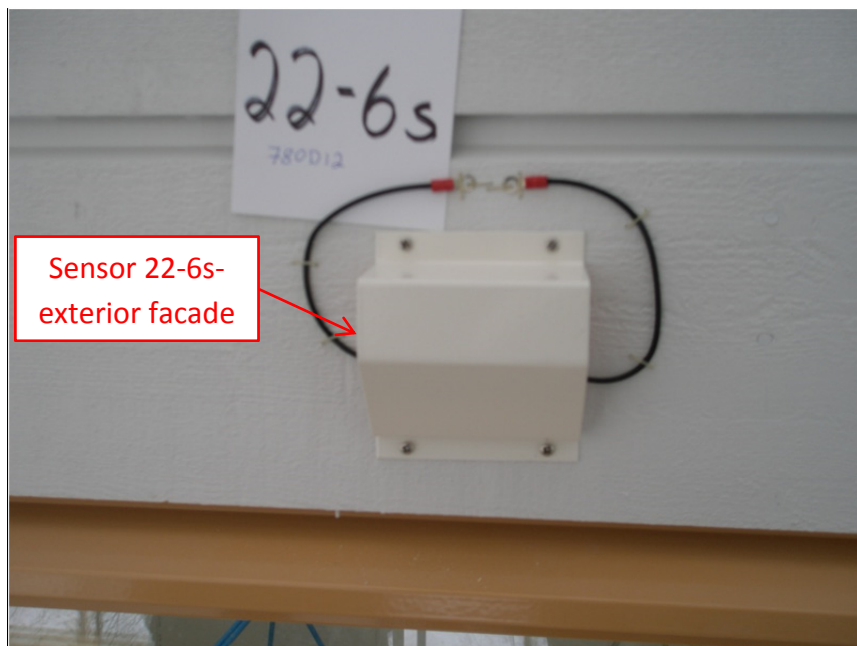


Figure 8.22-6s-exterior.2. Location of the studied position. Photo: SP Trä Skellefteå.

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 2009

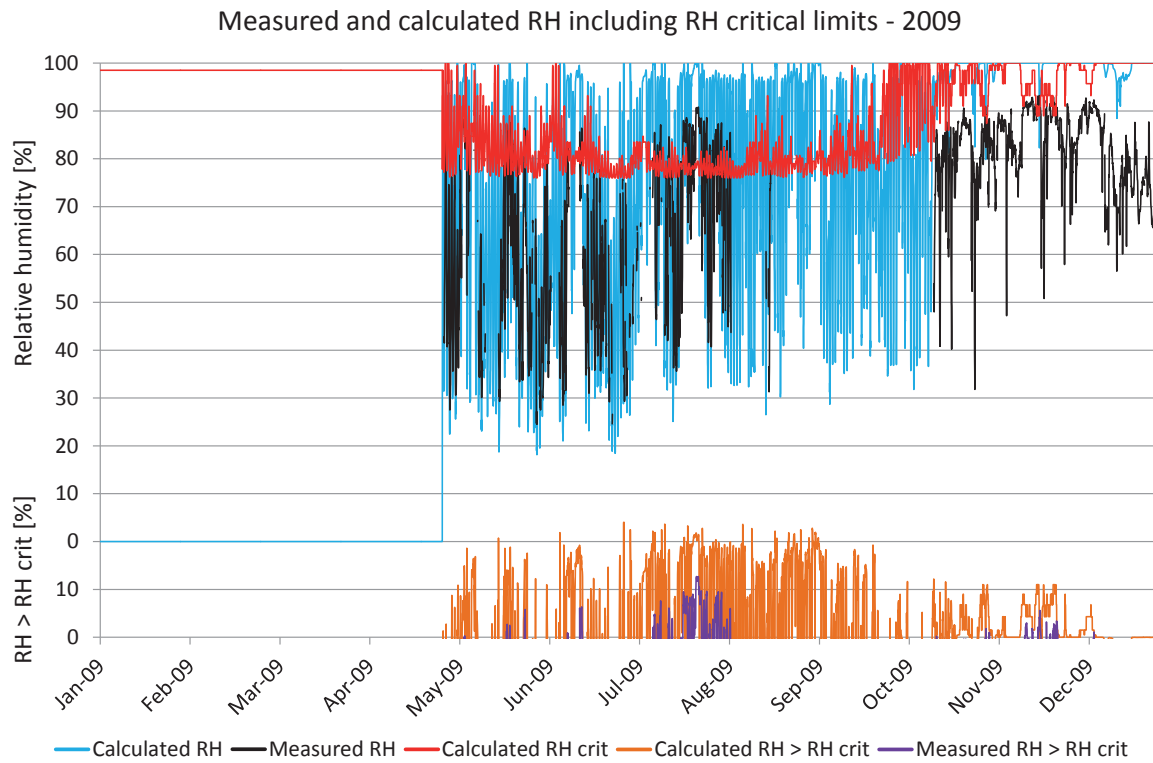


Figure 8.22-6s-exterior.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

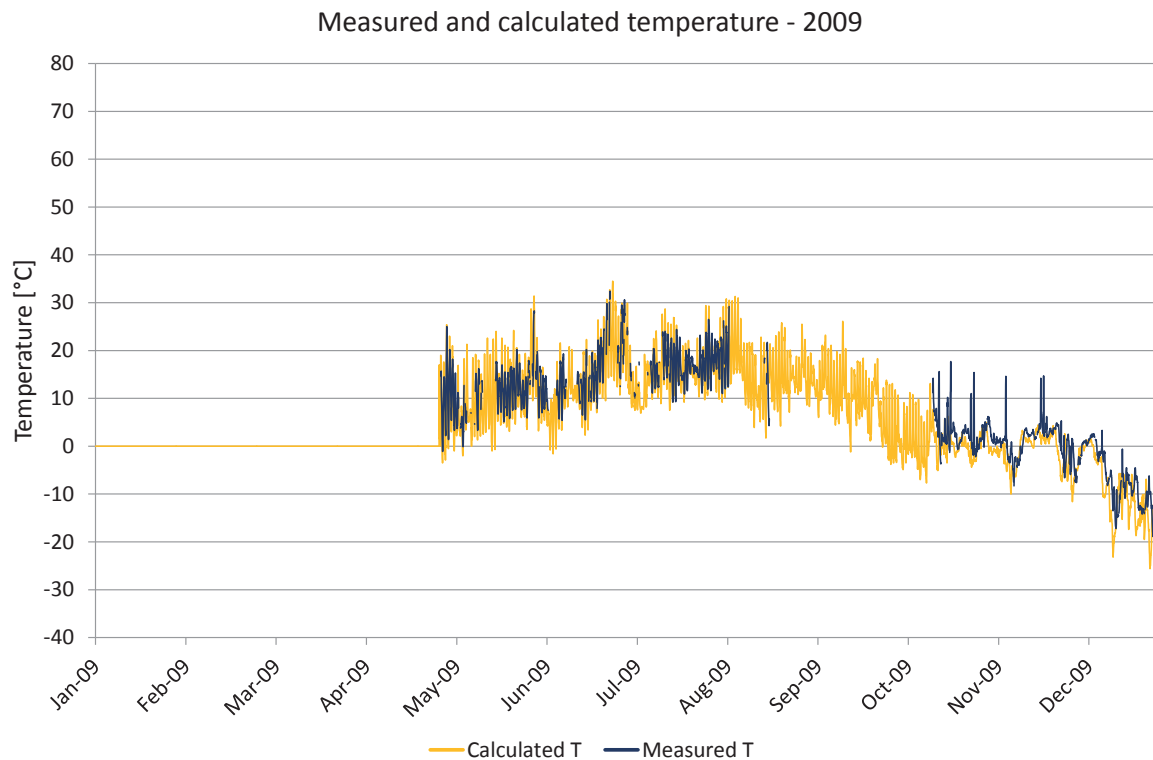


Figure 8.22-6s-exterior.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

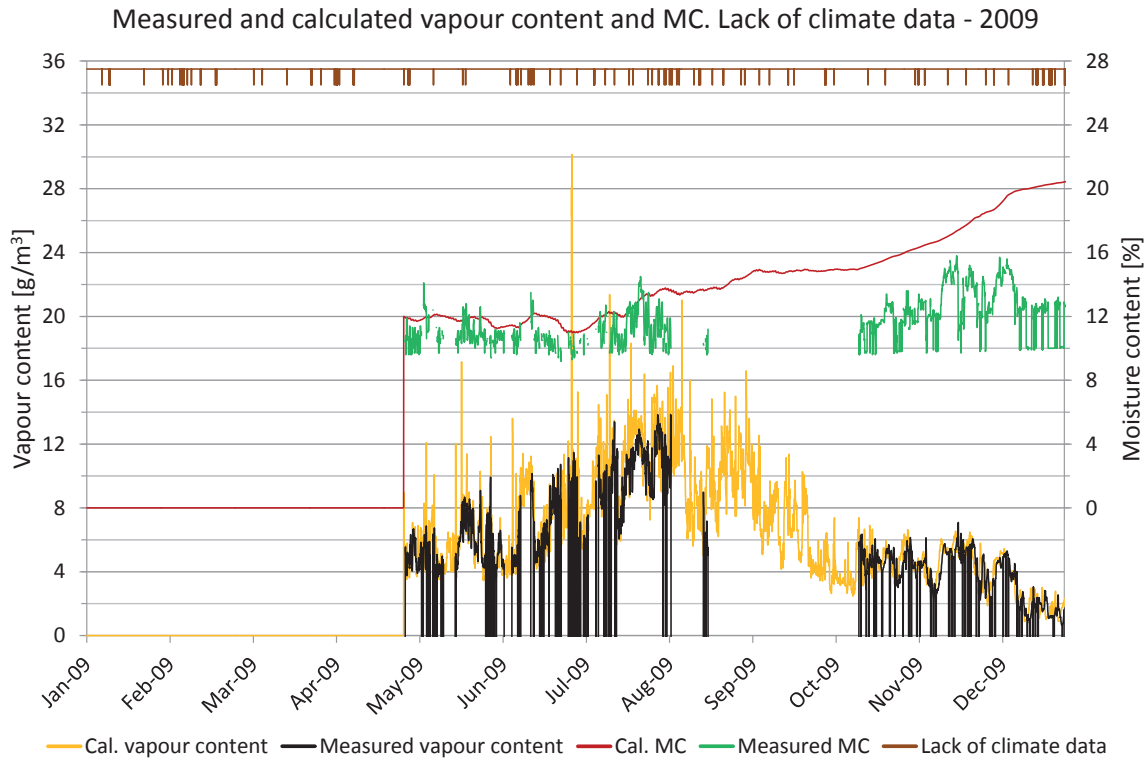


Figure 8.22-6s-exterior.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

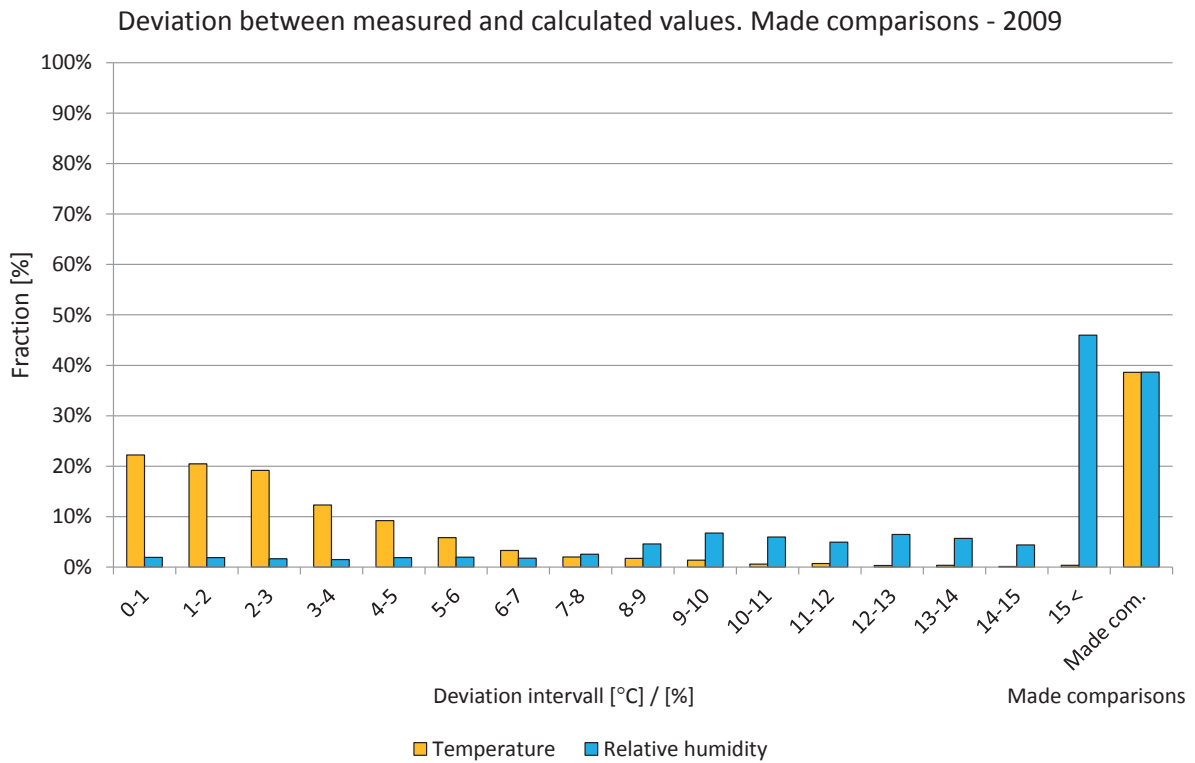


Figure 8.22-6s-exterior.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

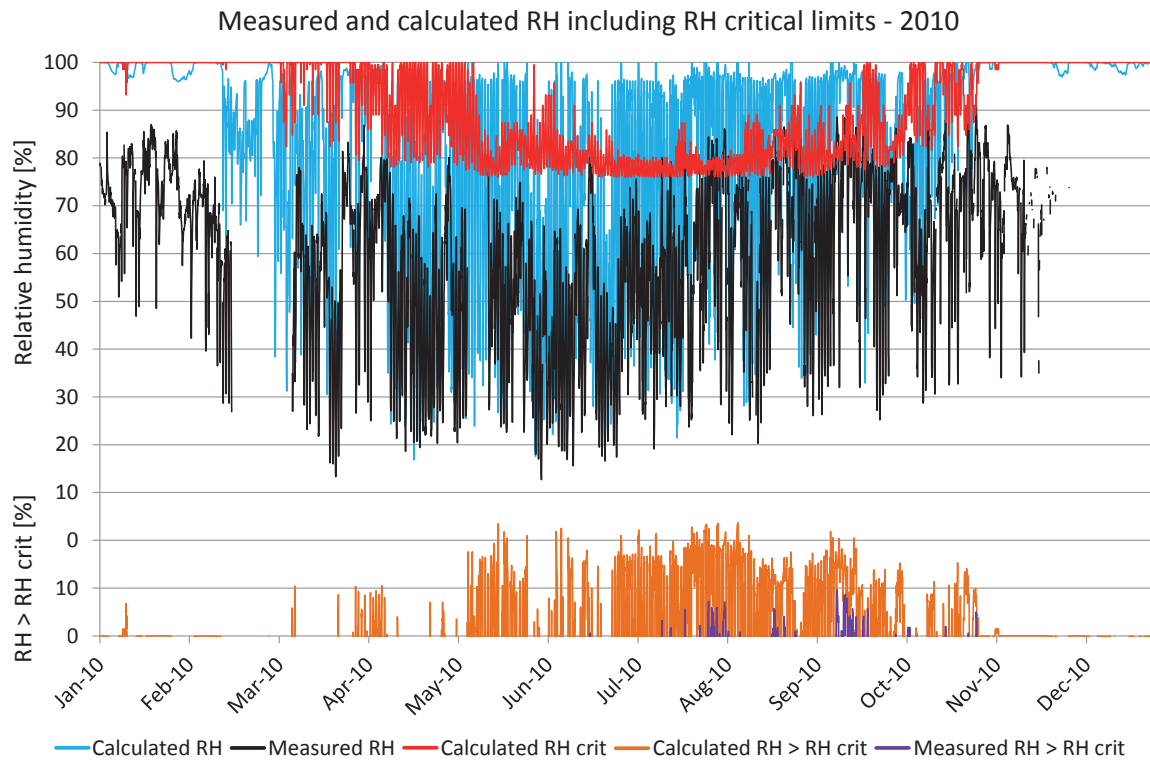


Figure 8.22-6s-exterior.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

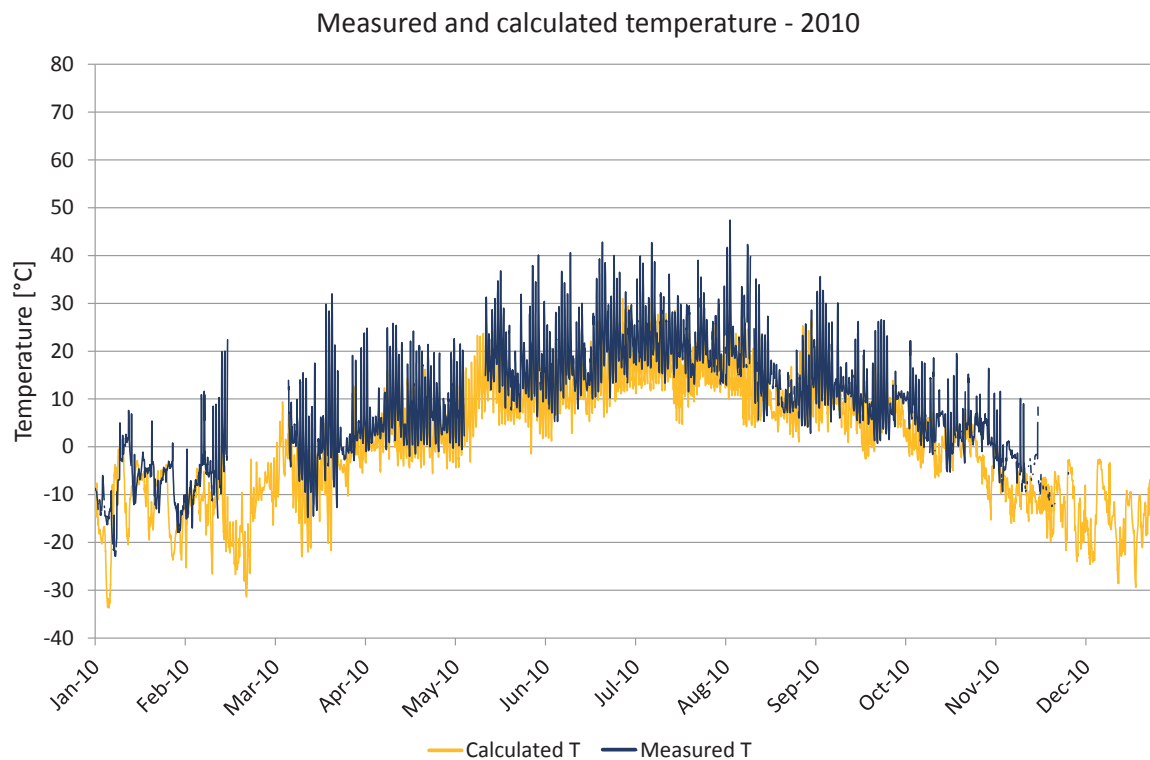


Figure 8.22-6s-exterior.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

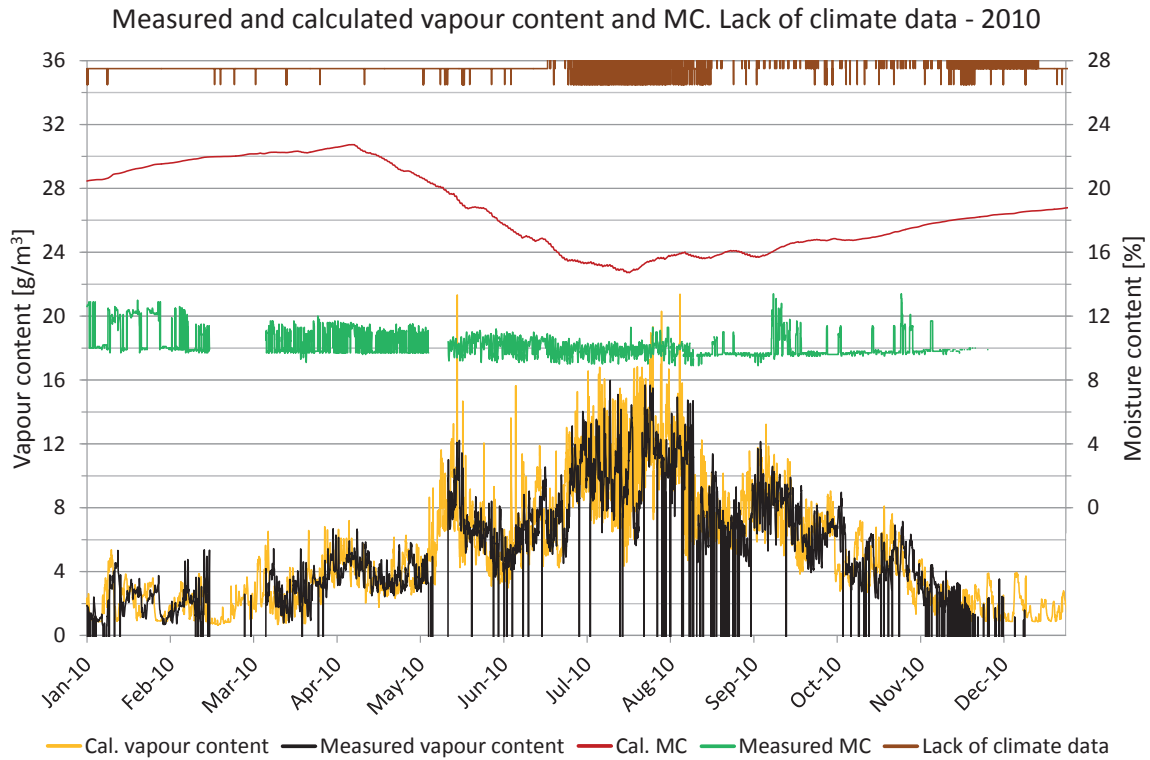


Figure 8.22-6s-exterior.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

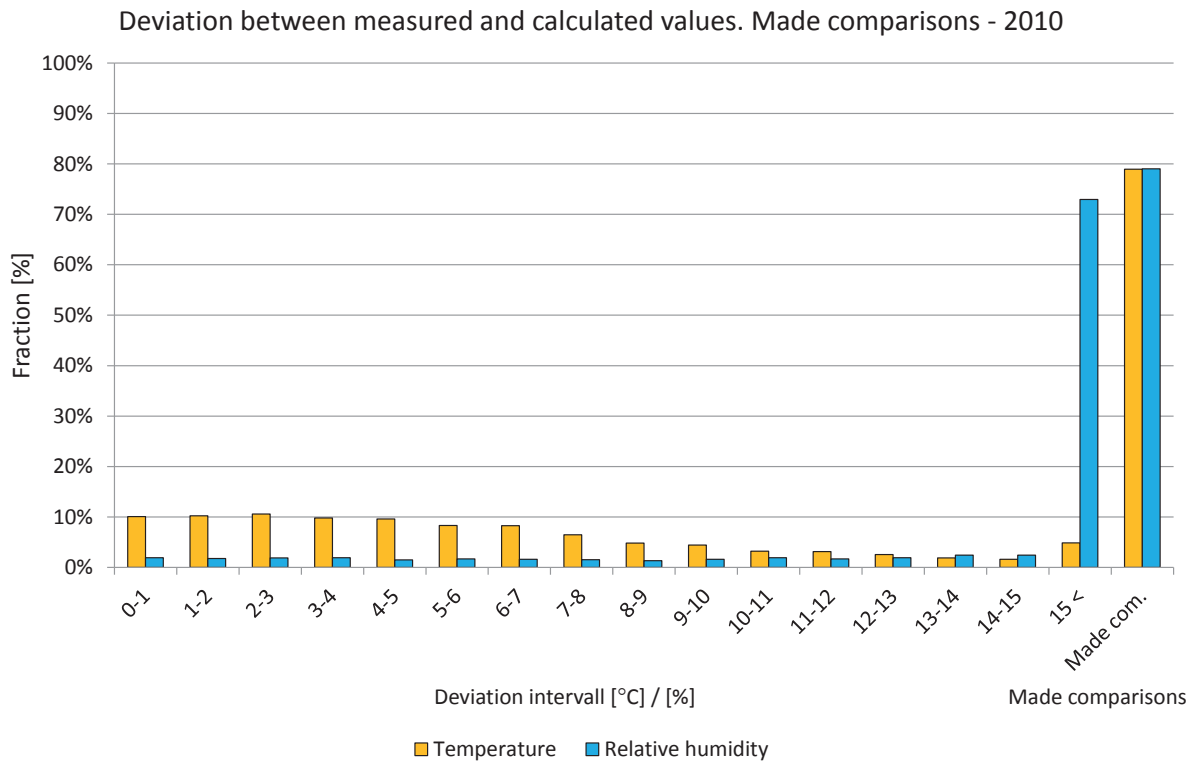


Figure 8.22-6s-exterior.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

Measured and calculated RH including RH critical limits - 2011

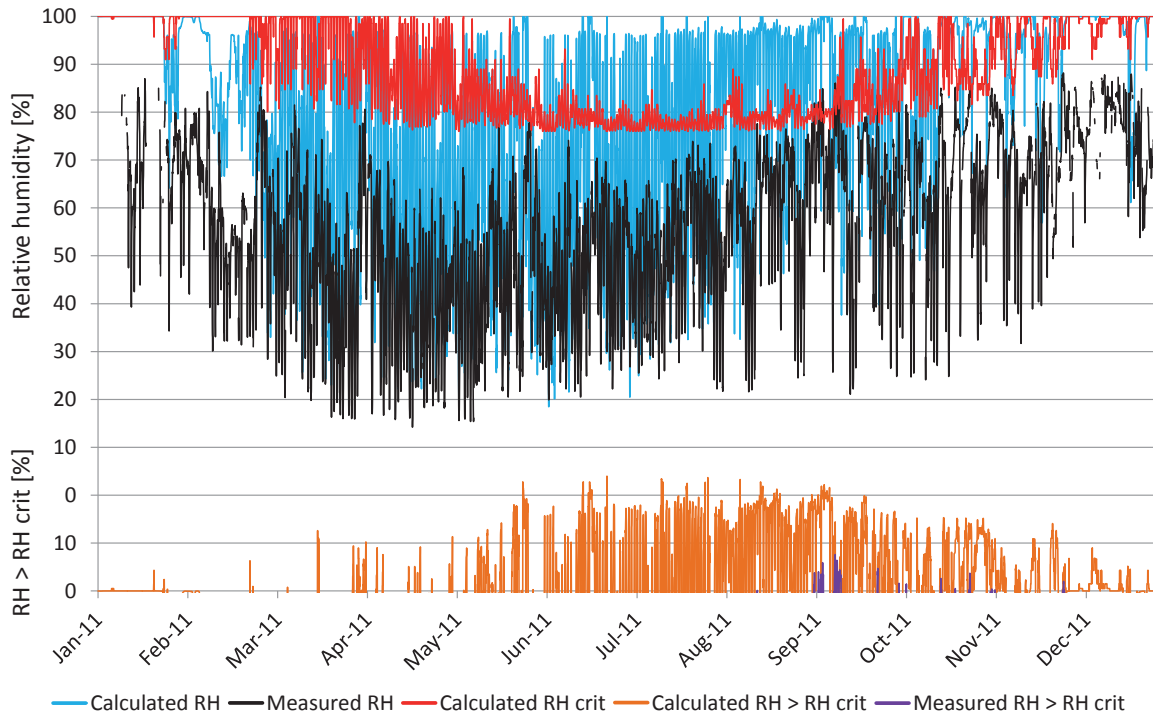


Figure 8.22-6s-exterior.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

Measured and calculated temperature - 2011

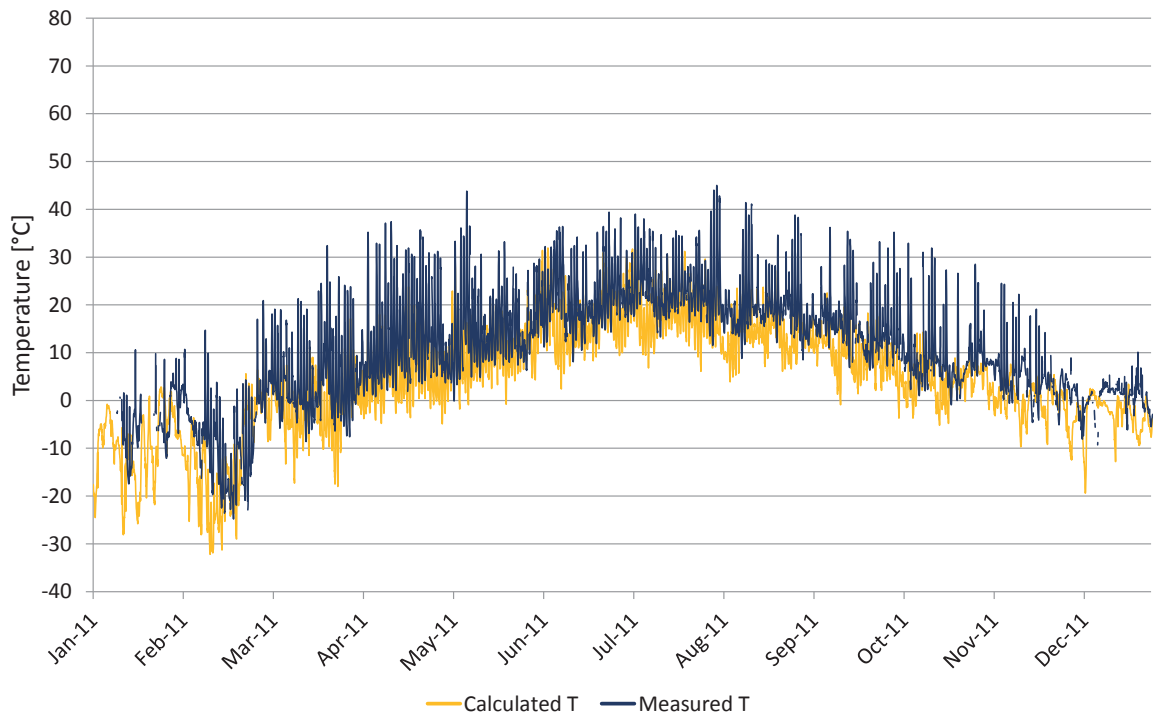


Figure 8.22-6s-exterior.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

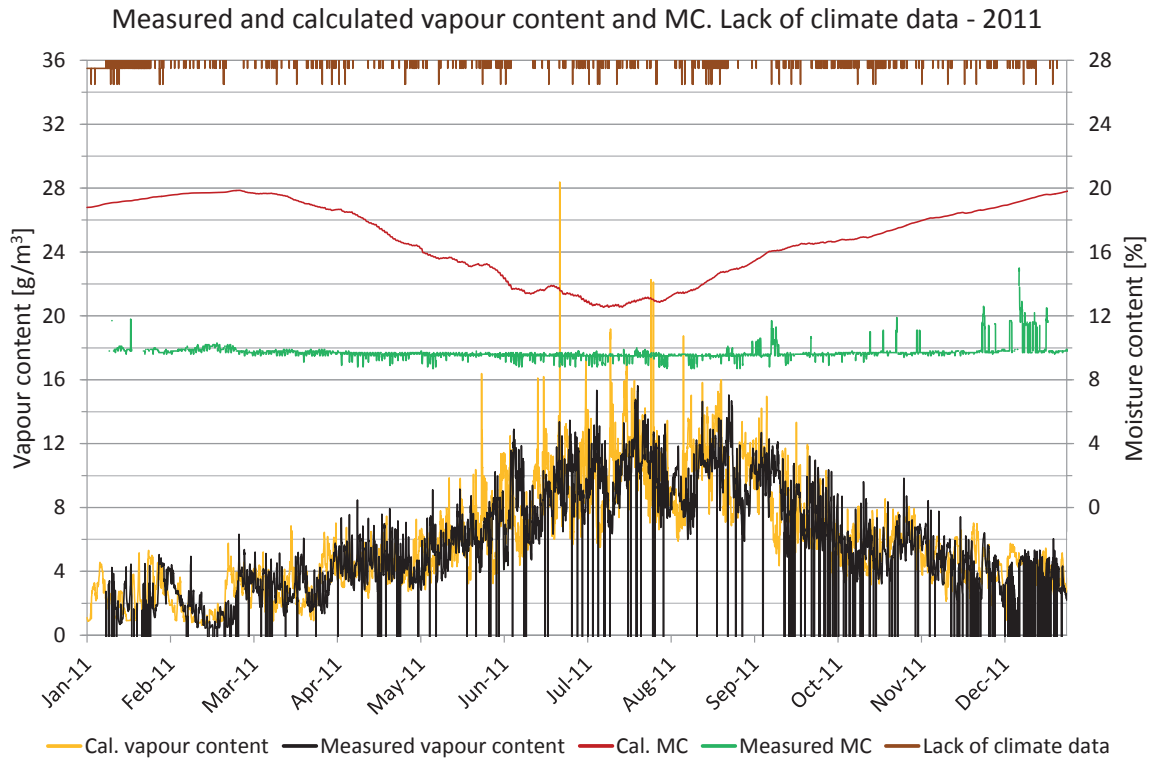


Figure 8.22-6s-exterior.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

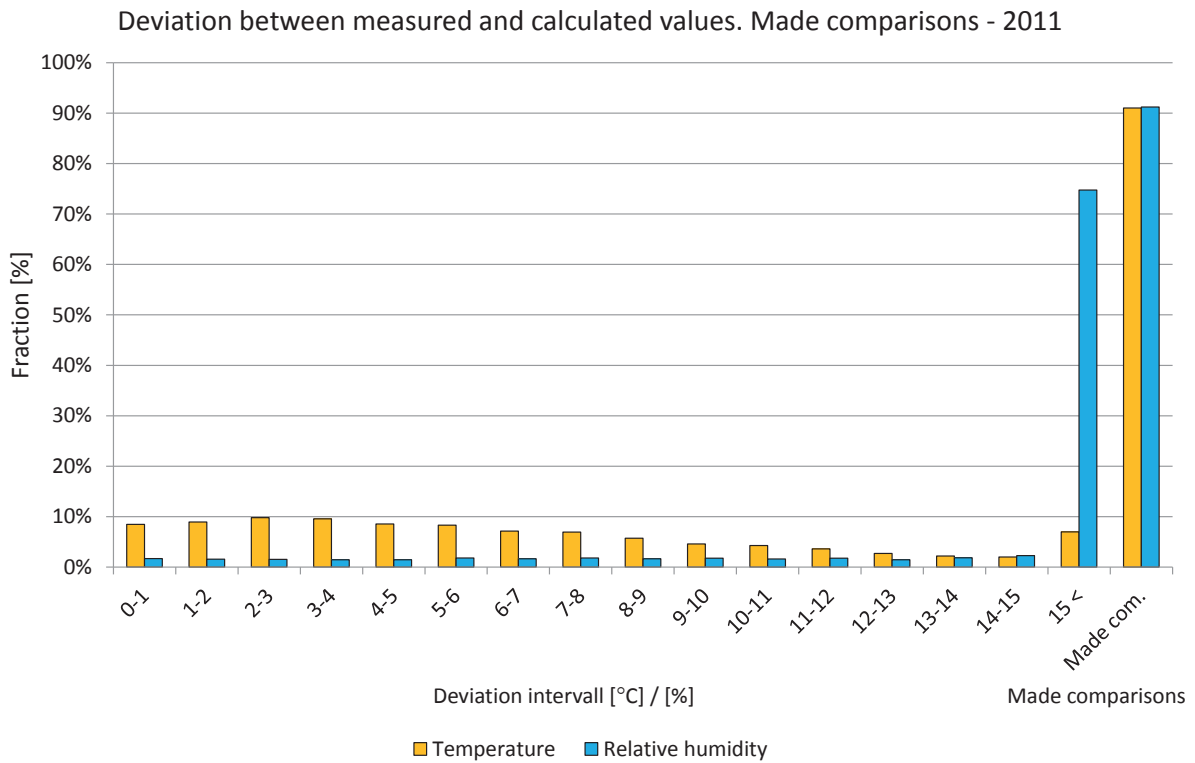


Figure 8.22-6s-exterior.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

8.22 Position 22-6s-air gap

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the air gap behind the façade panel in a wall that is facing south on the sixth floor.

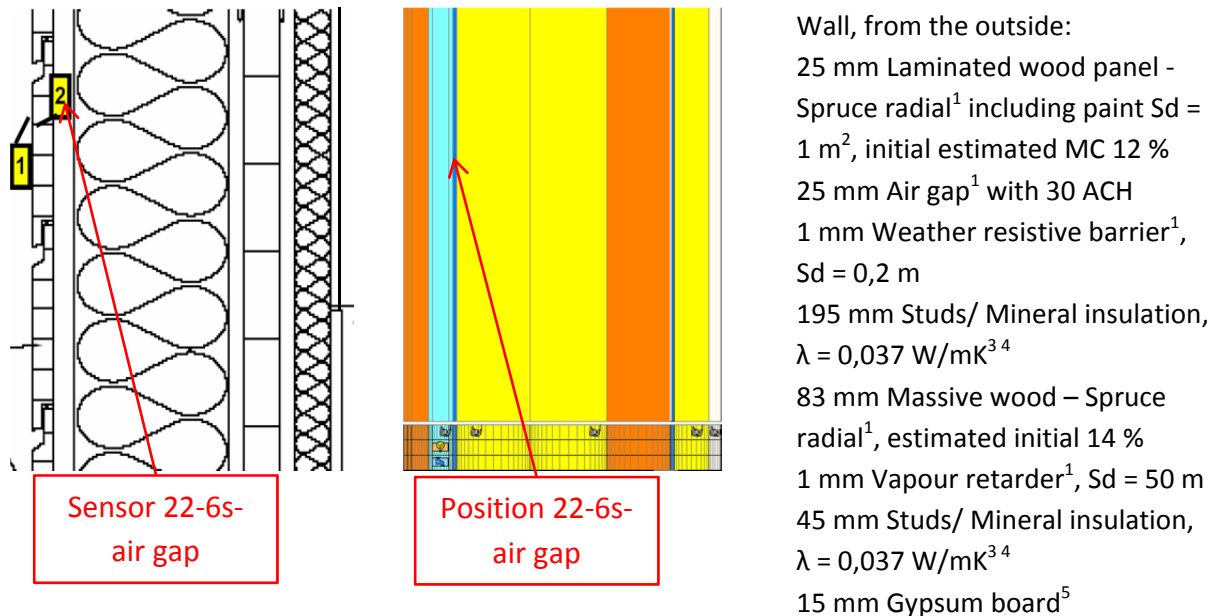


Figure 8.22-6s-air gap.1. Vertical cross sectional drawing and WUFI calculation model showing the studied position. 1. IBP, 2012, 2. Nevander, L-E., 1994, 3. IEA Annex 24, 1996, 4. Paroc, 2002, 5. Krus, M., 1996.



Figure 8.22-6s-air gap.2. Location of the studied position. Photo: SP Trä Skellefteå.

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 2009

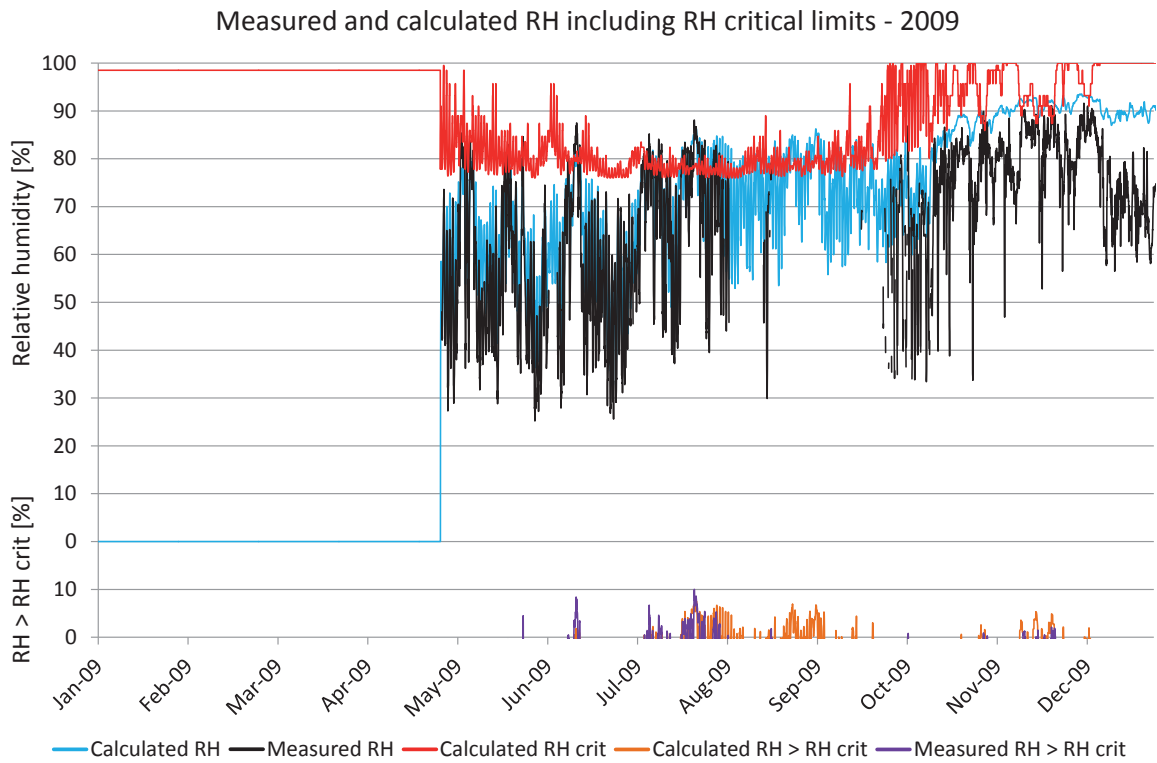


Figure 8.22-6s-air gap.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

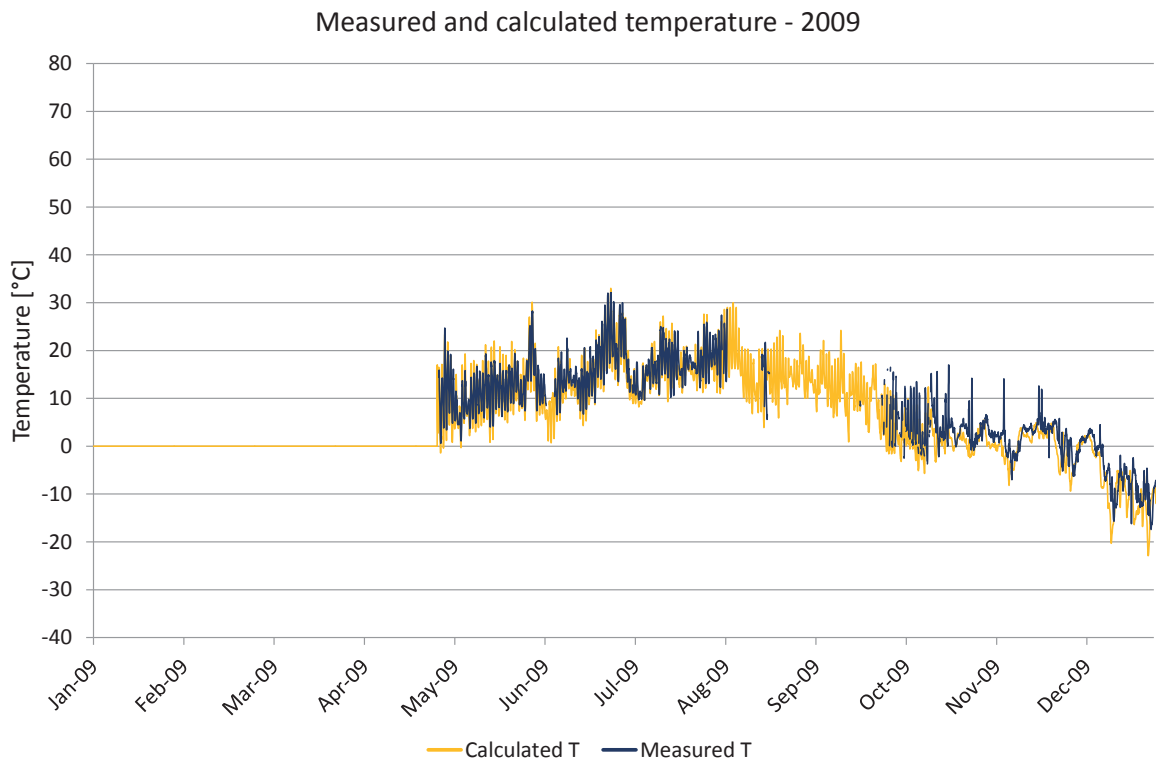


Figure 8.22-6s-air gap.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

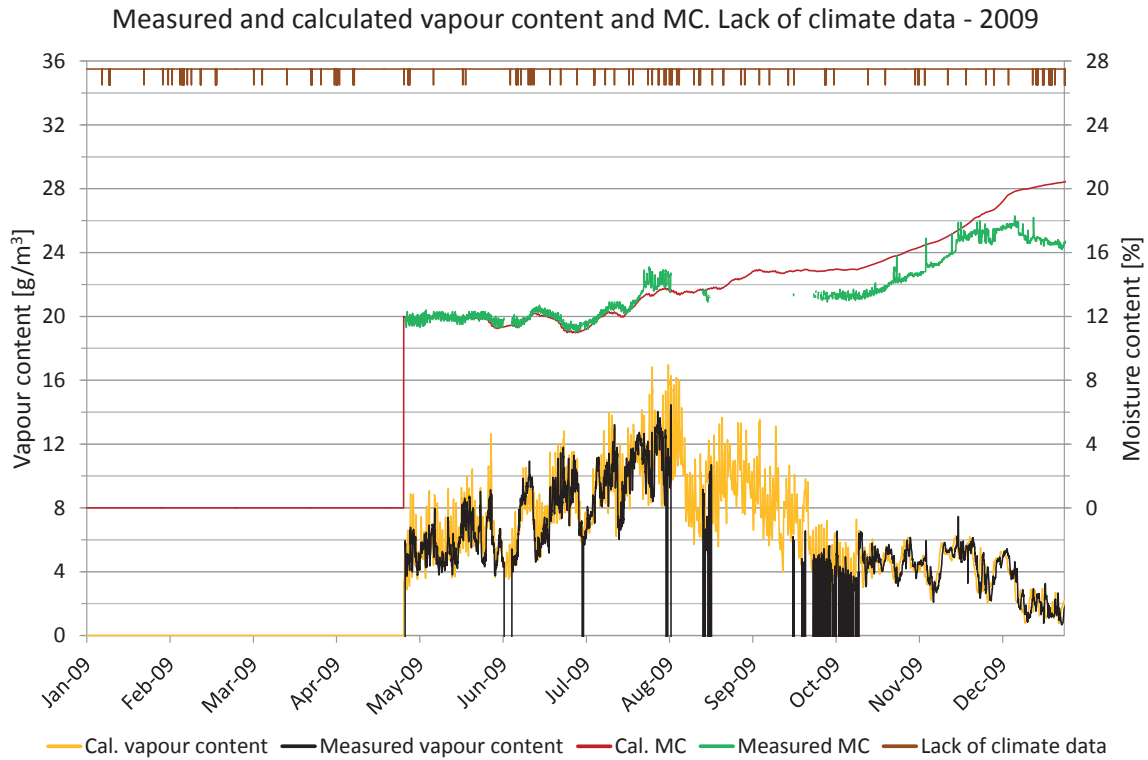


Figure 8.22-6s-air gap.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

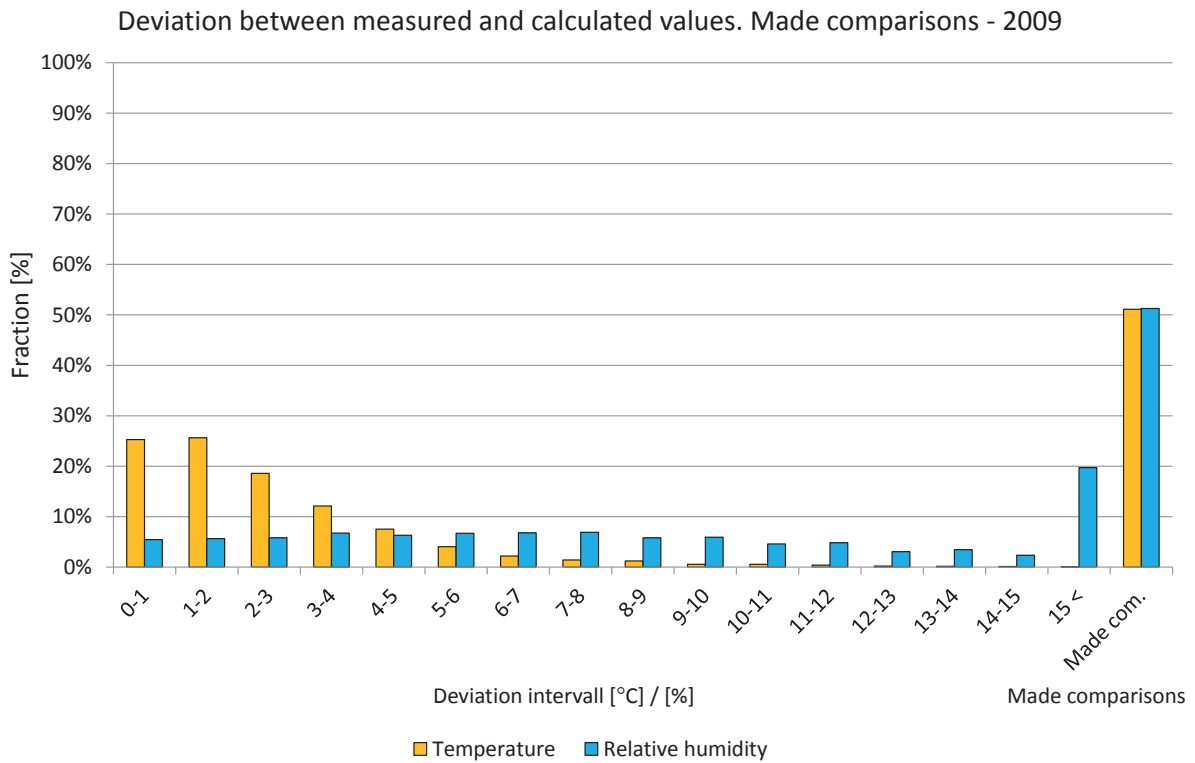


Figure 8.22-6s-air gap.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

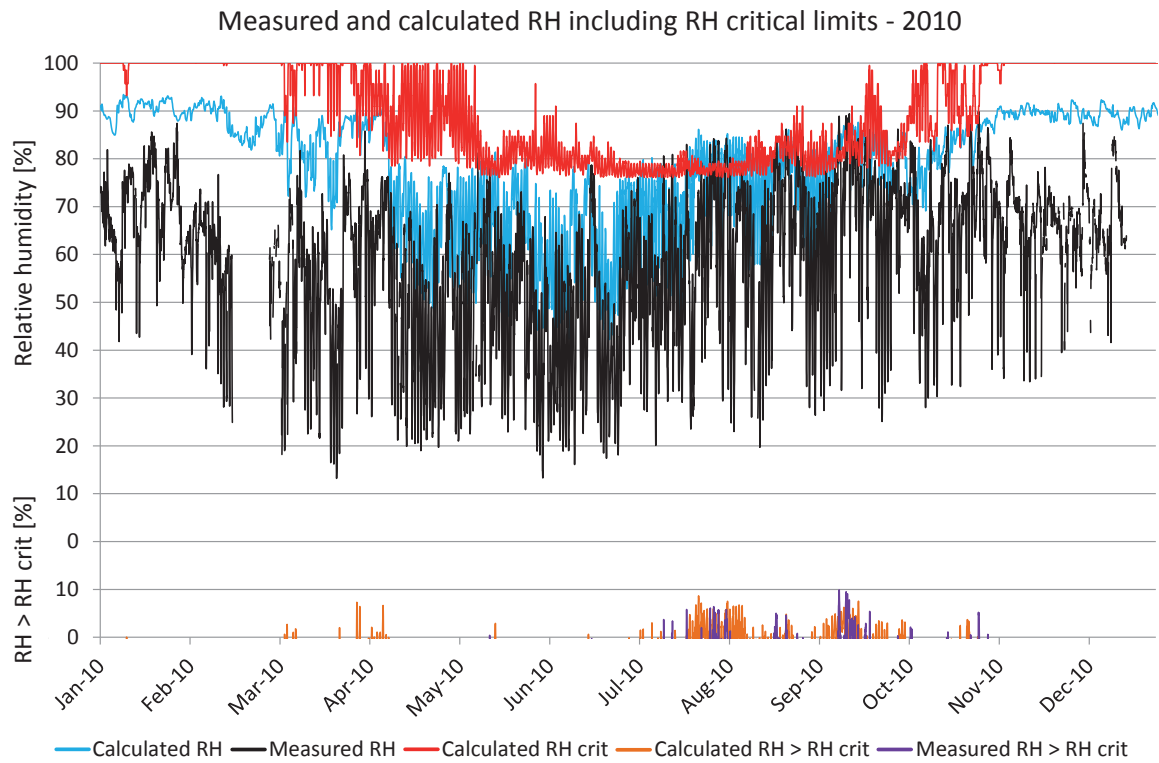


Figure 8.22-6s-air gap.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

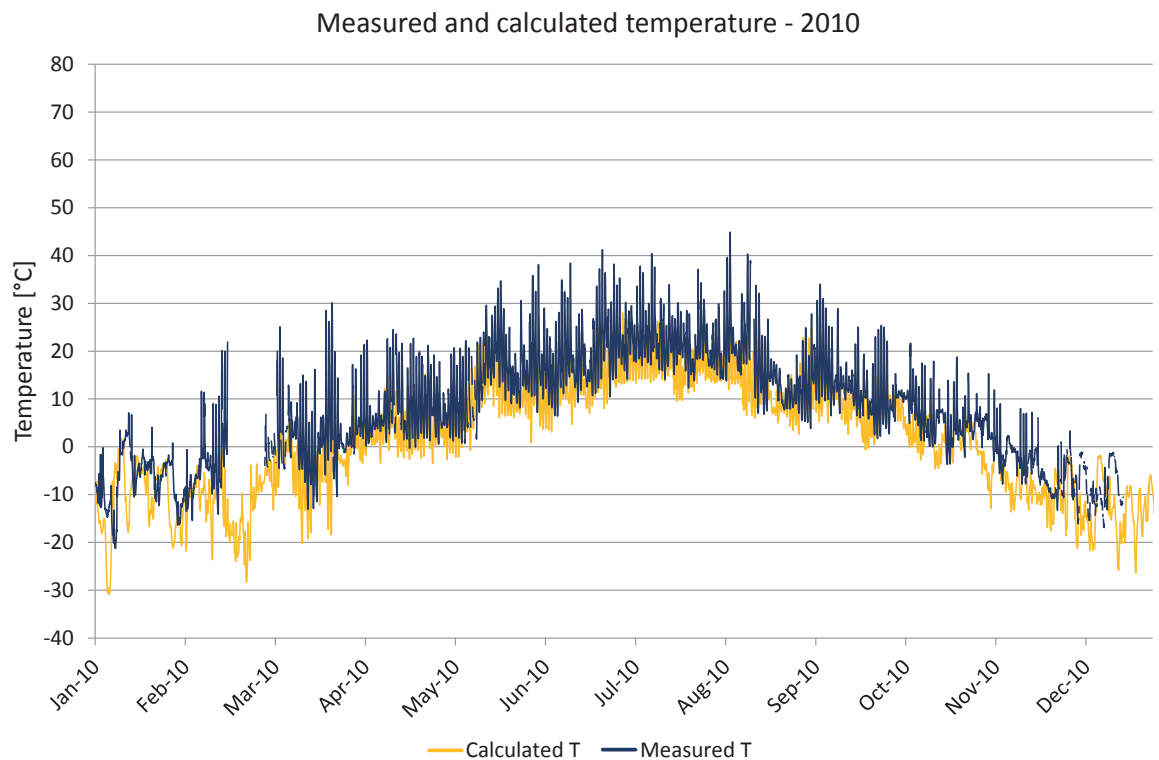


Figure 8.22-6s-air gap.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

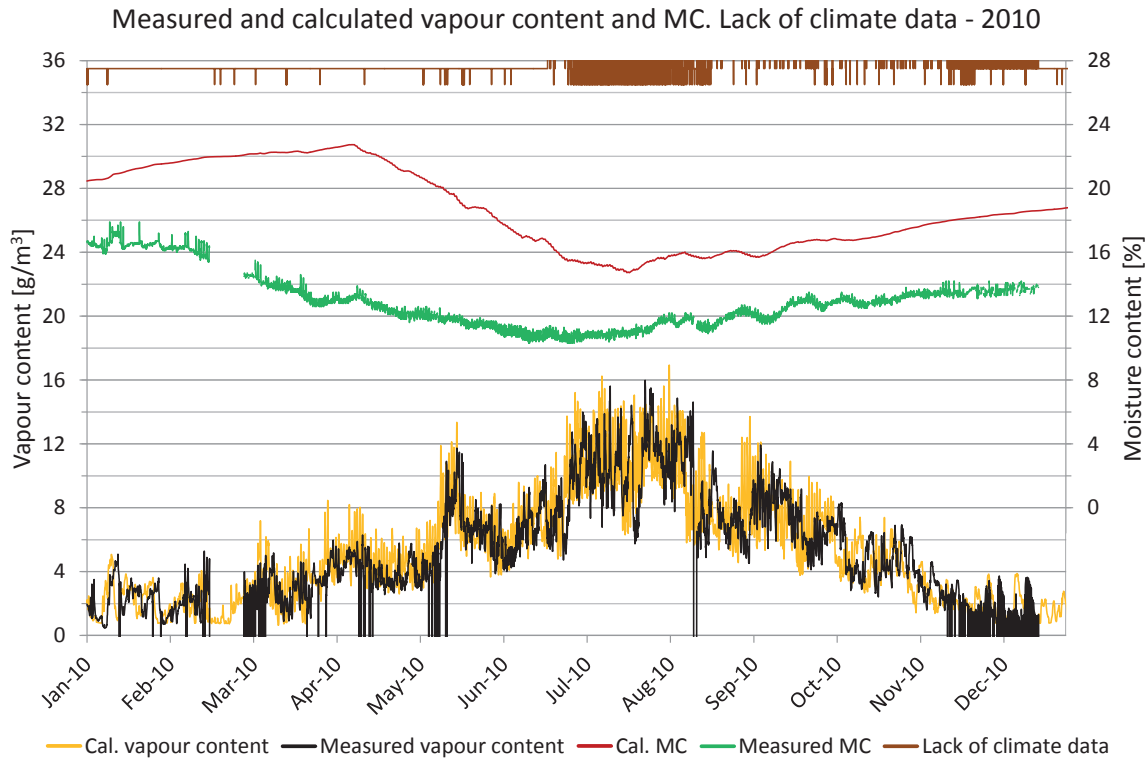


Figure 8.22-6s-air gap.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

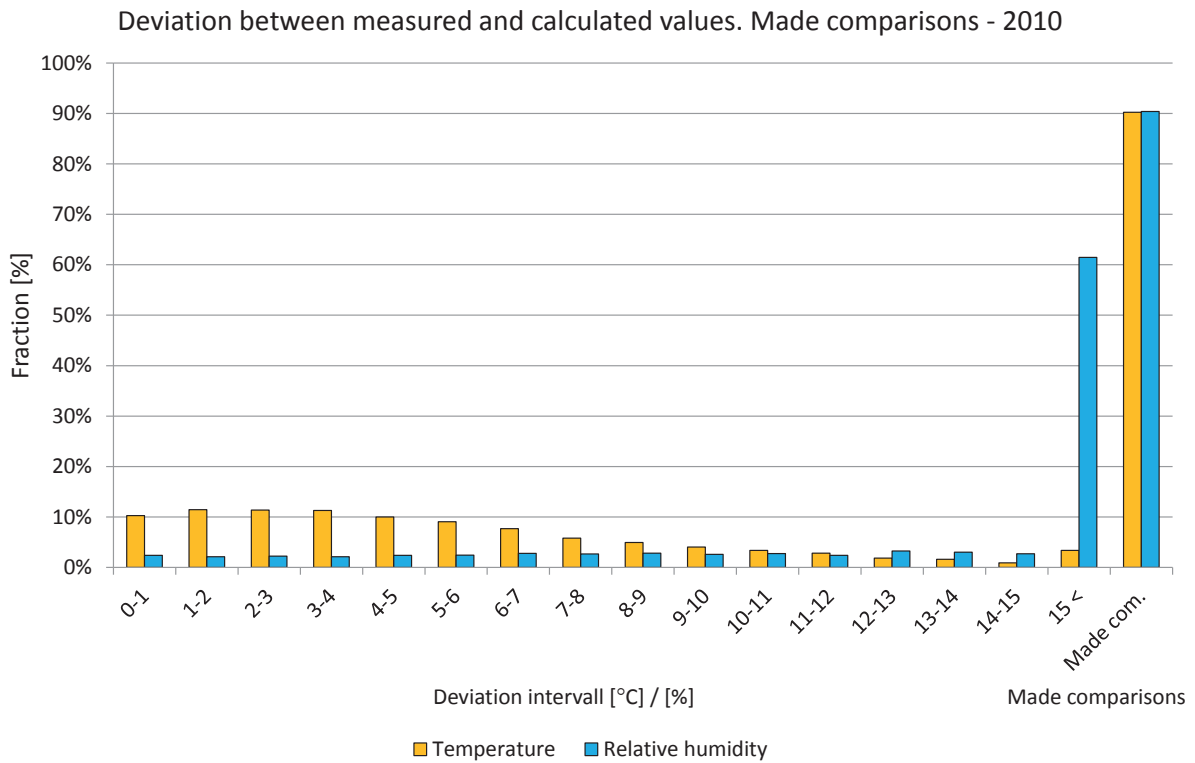


Figure 8.22-6s-air gap.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

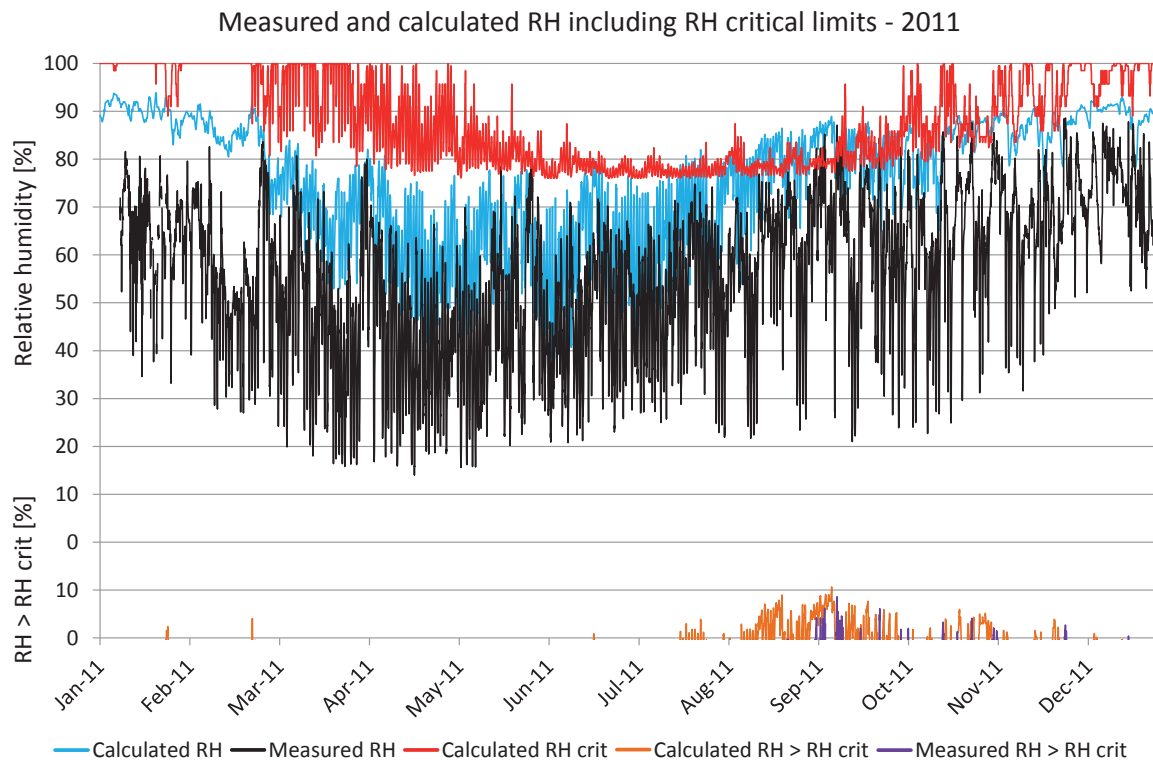


Figure 8.22-6s-air gap.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

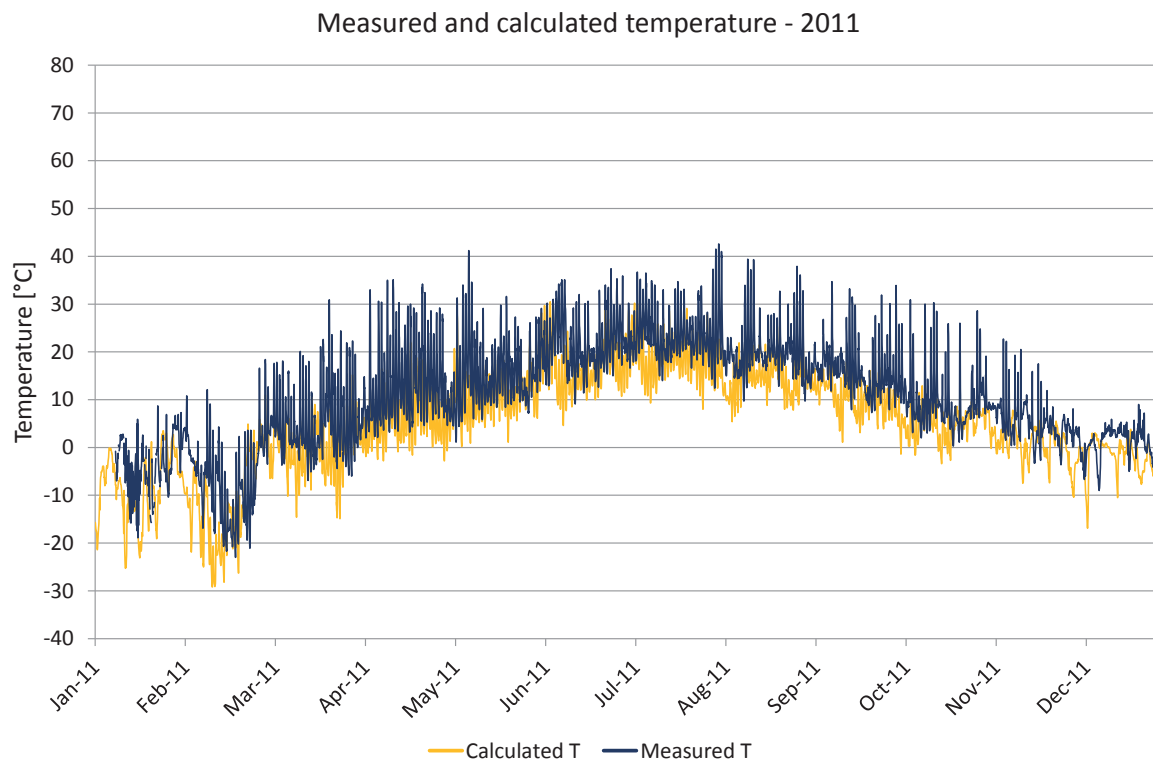


Figure 8.22-6s-air gap.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

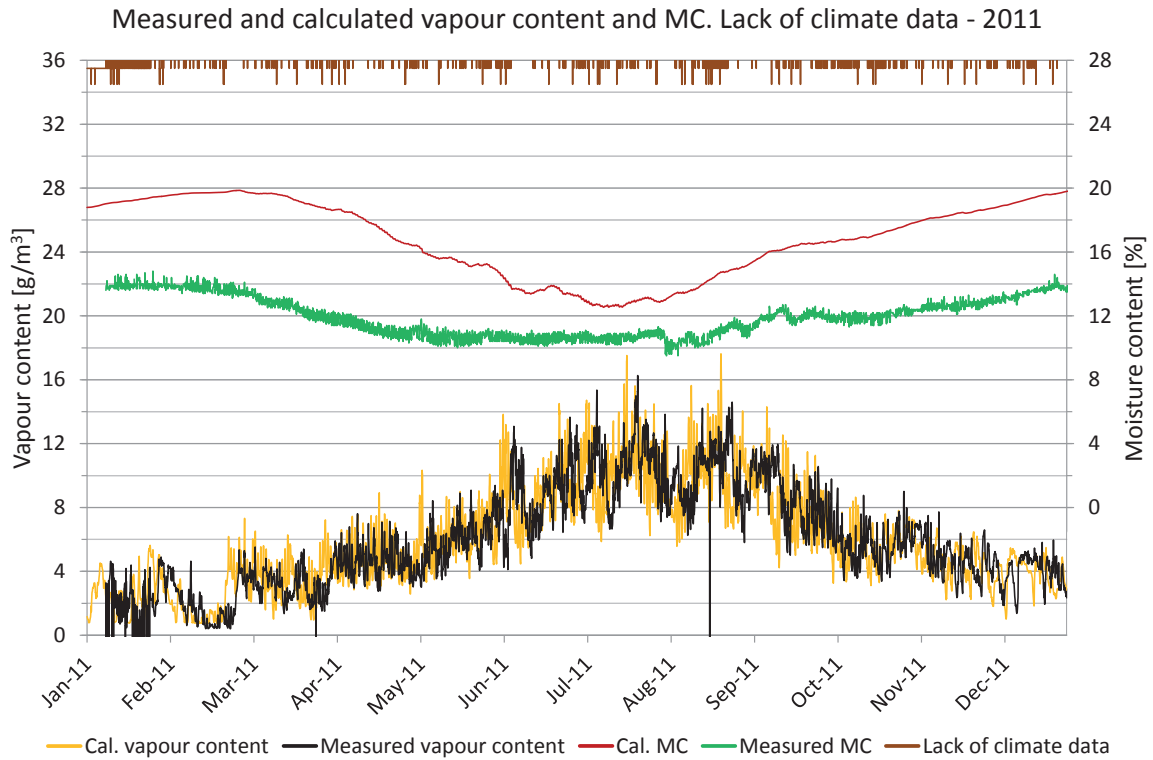


Figure 8.22-6s-air gap.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

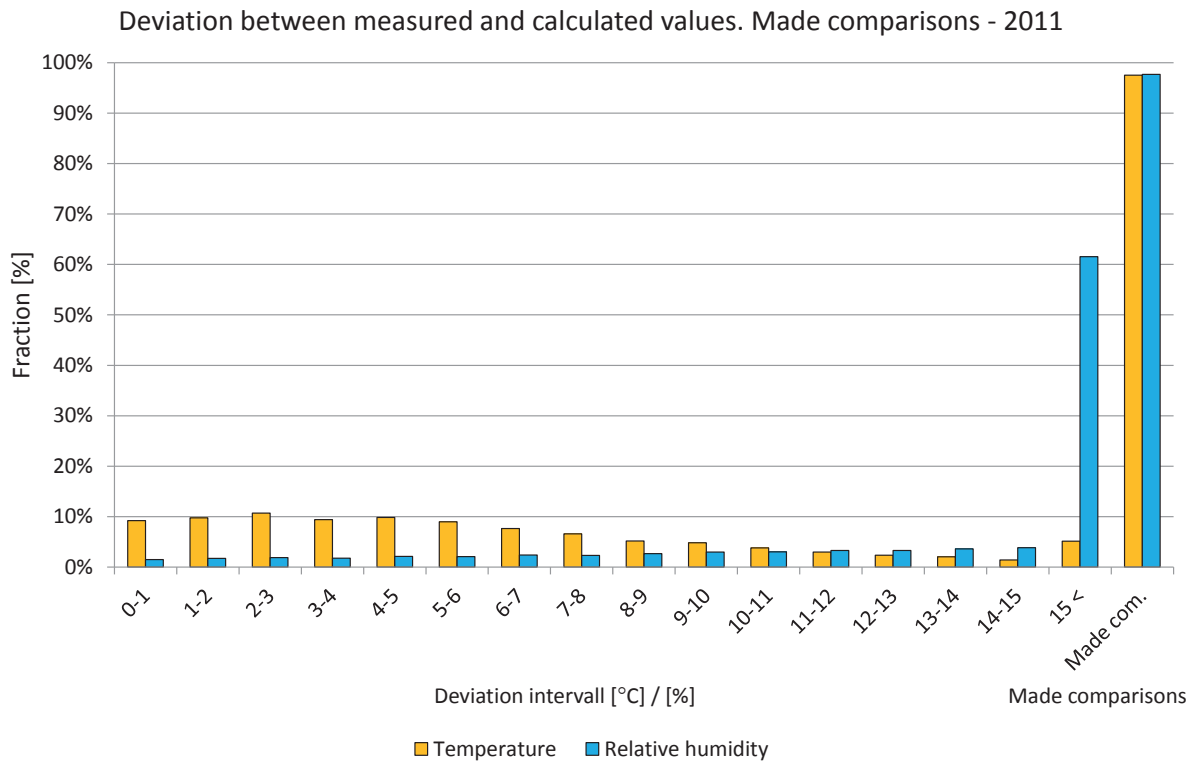


Figure 8.22-6s-air gap.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

9 Results – Cold attic space on top of the sixth floor

9.D Position D

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the cold attic space in the roof with 3.5 degrees roof angle facing south above the sixth floor.

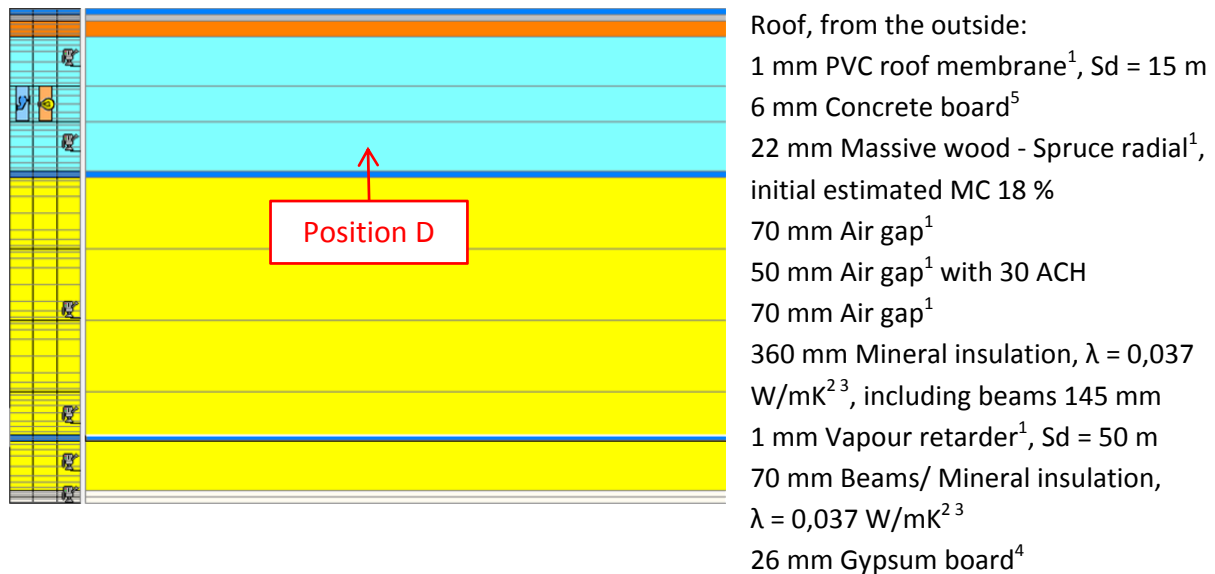


Figure 9.D.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996, 5. Hedenblad, G., 1996.

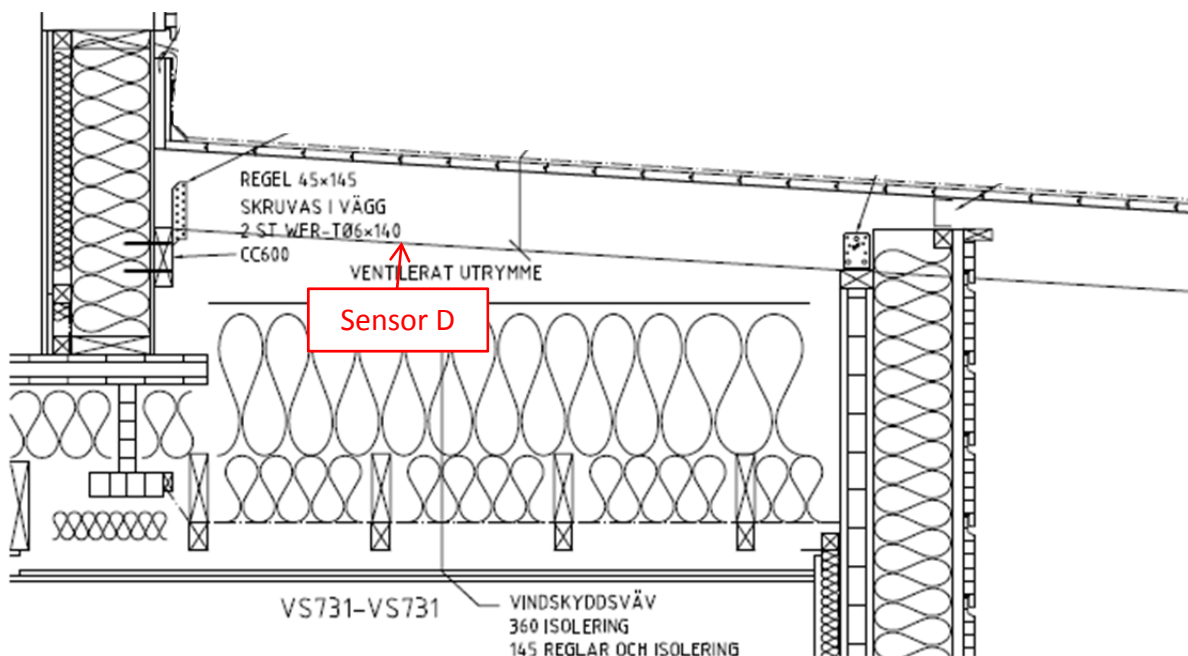


Figure 9.D.2. Location of the studied position.

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 2009

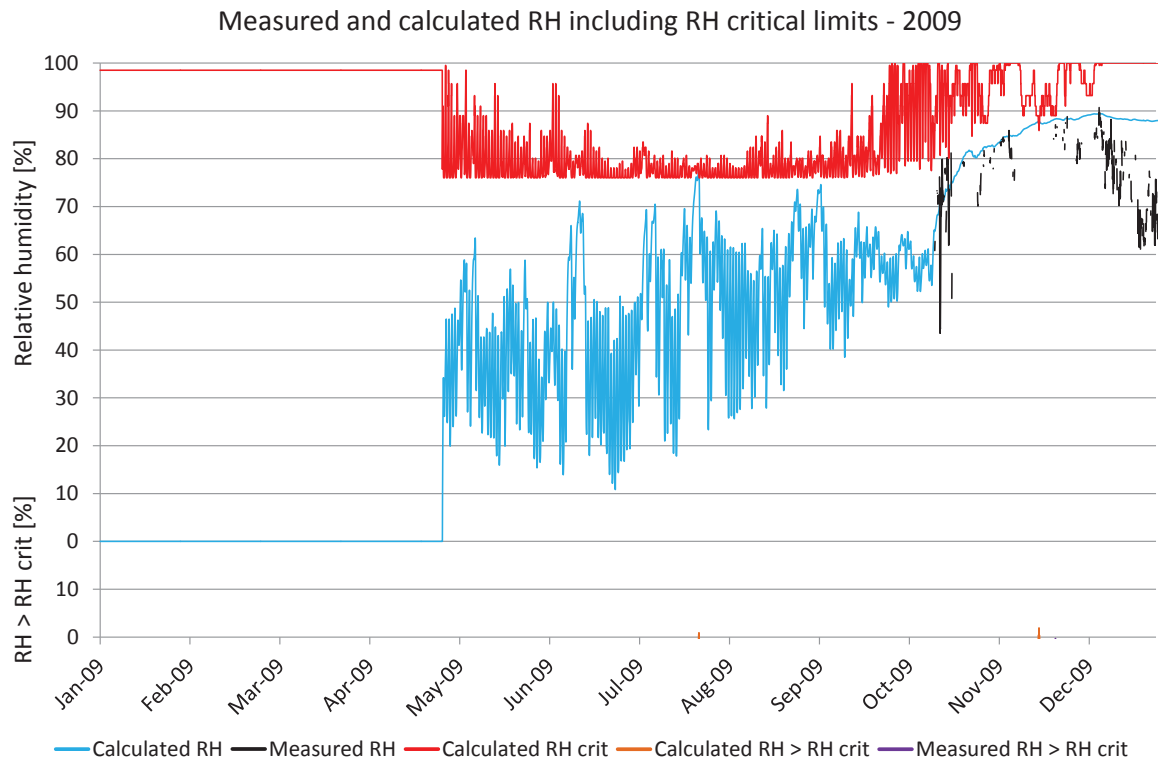


Figure 9.D.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

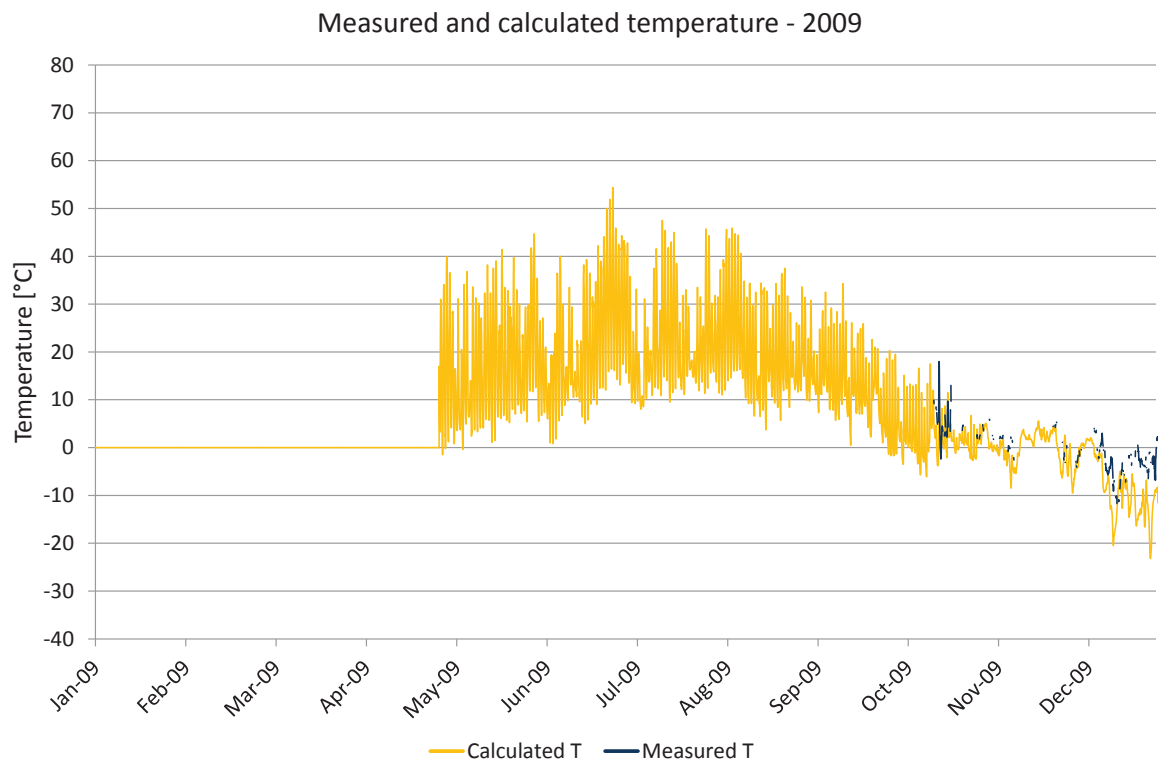


Figure 9.D.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

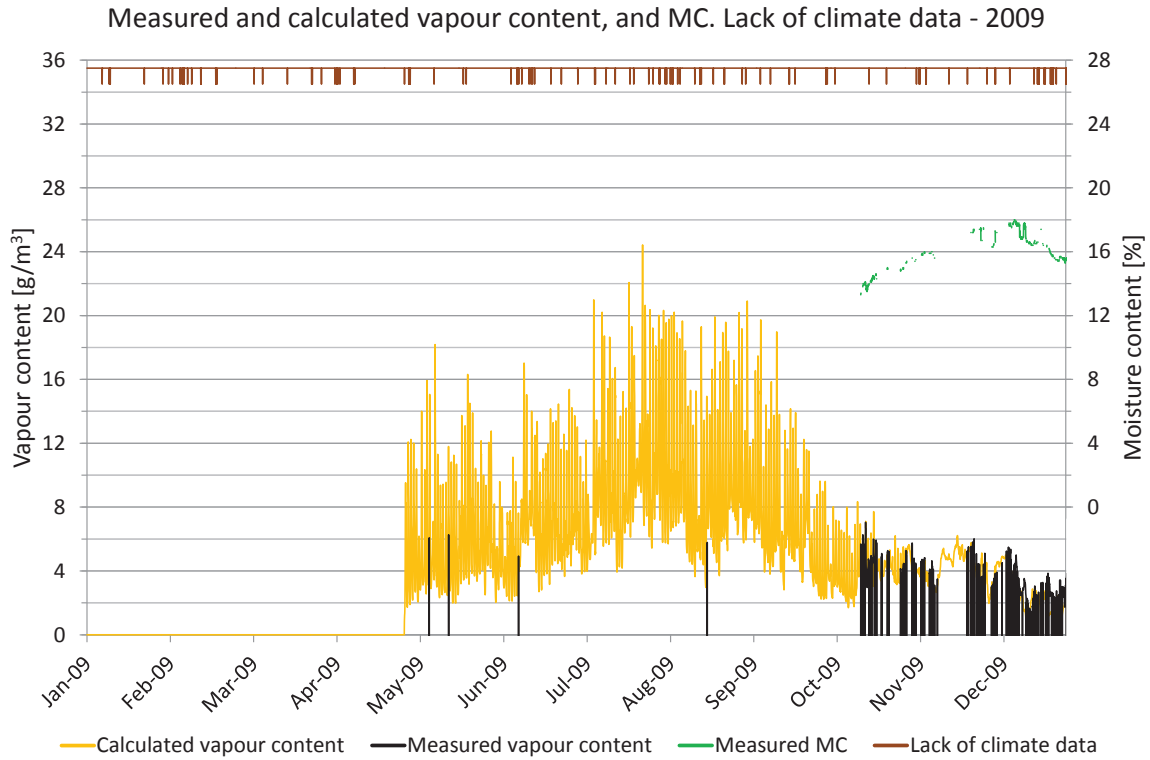


Figure 9.D.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

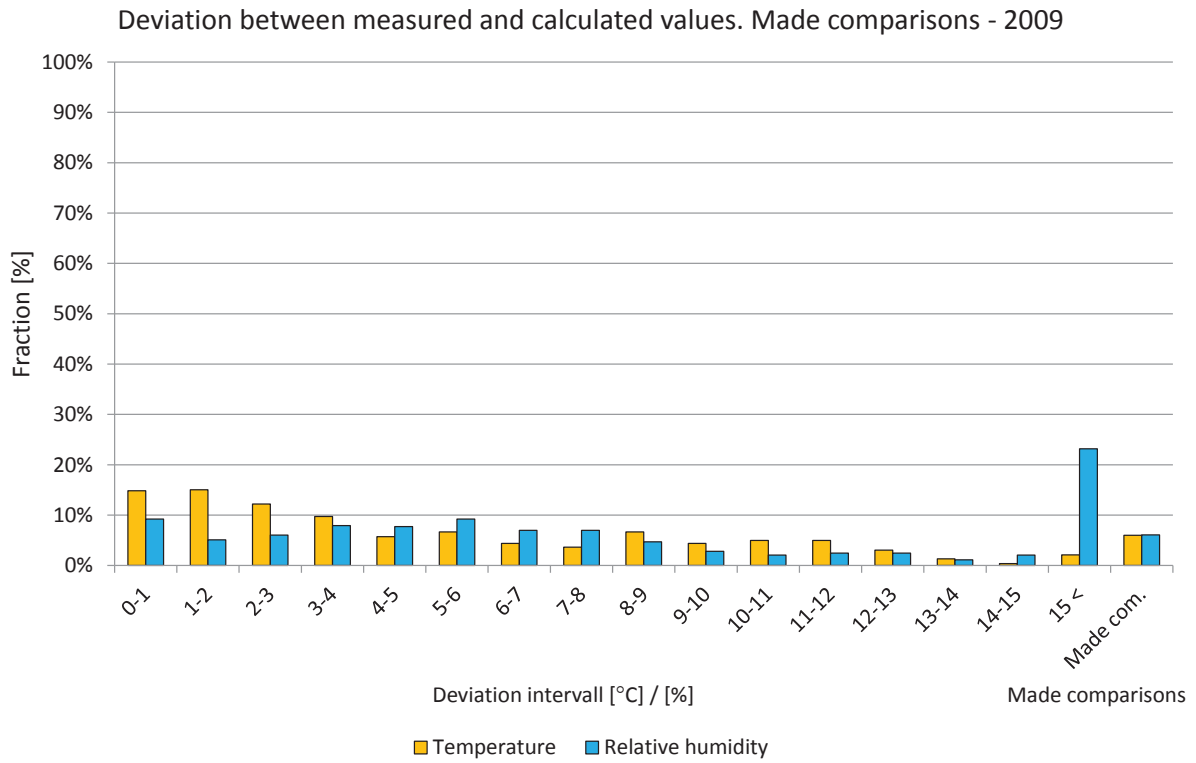


Figure 9.D.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

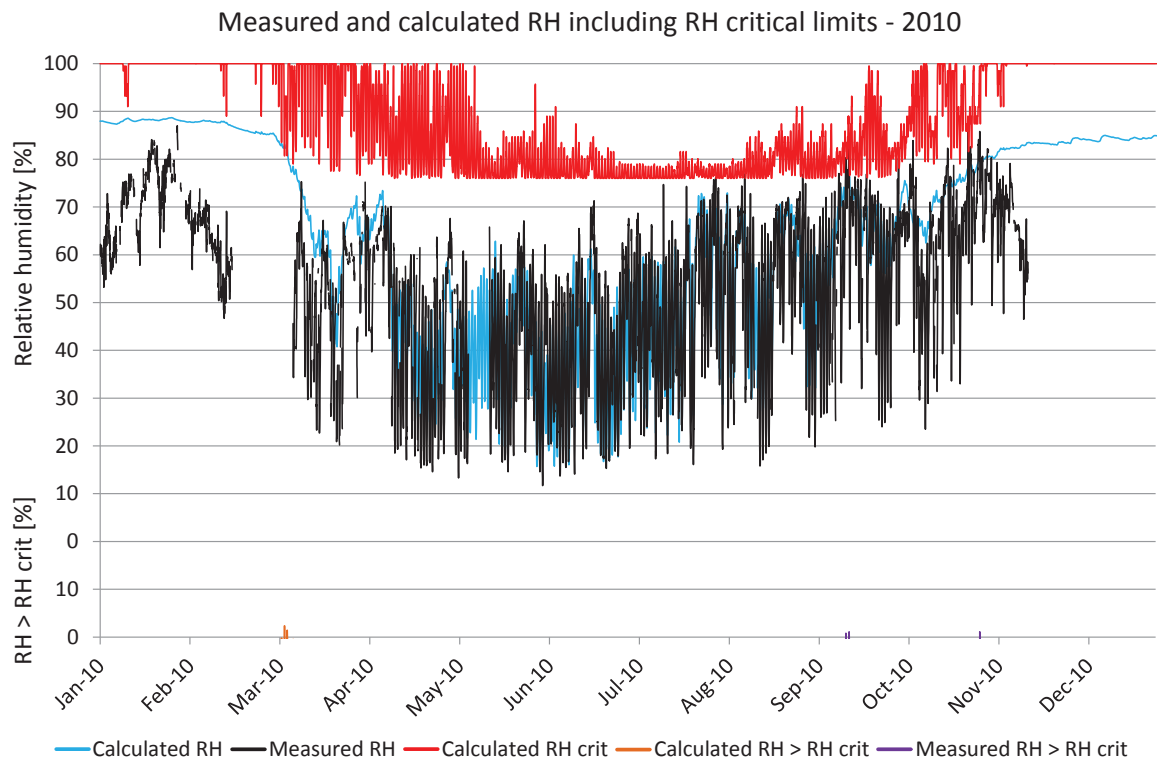


Figure 9.D.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

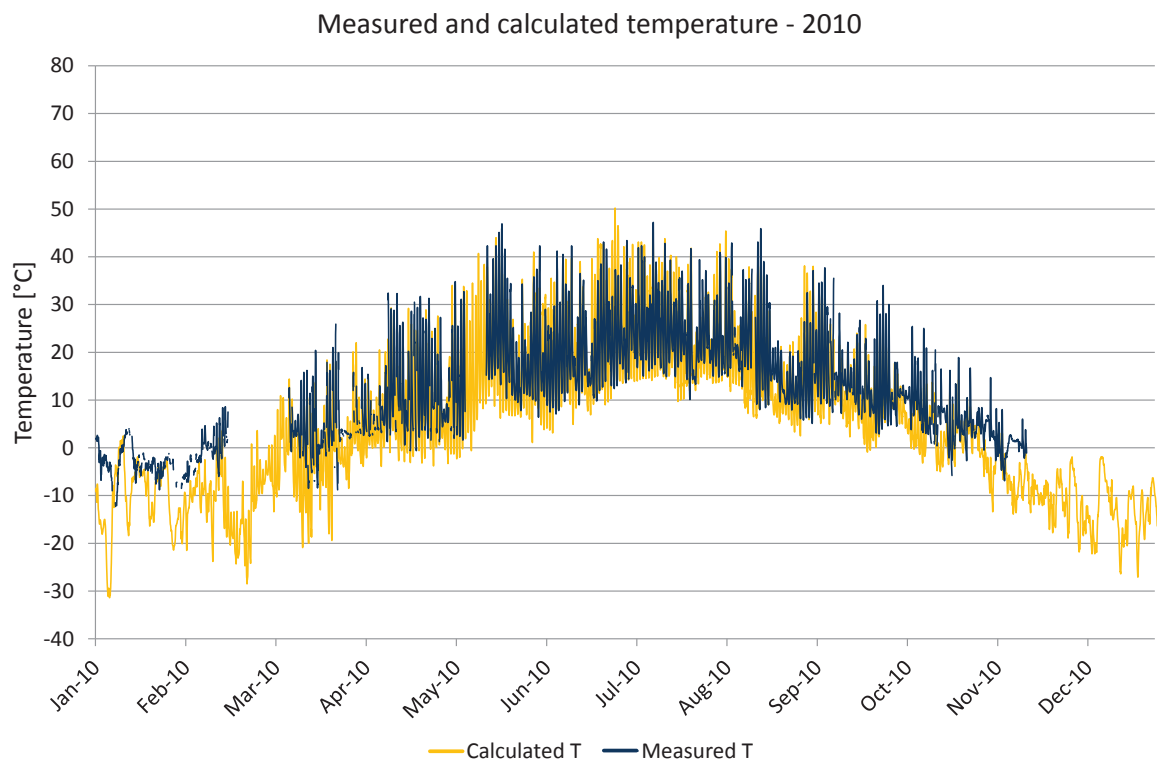


Figure 9.D.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

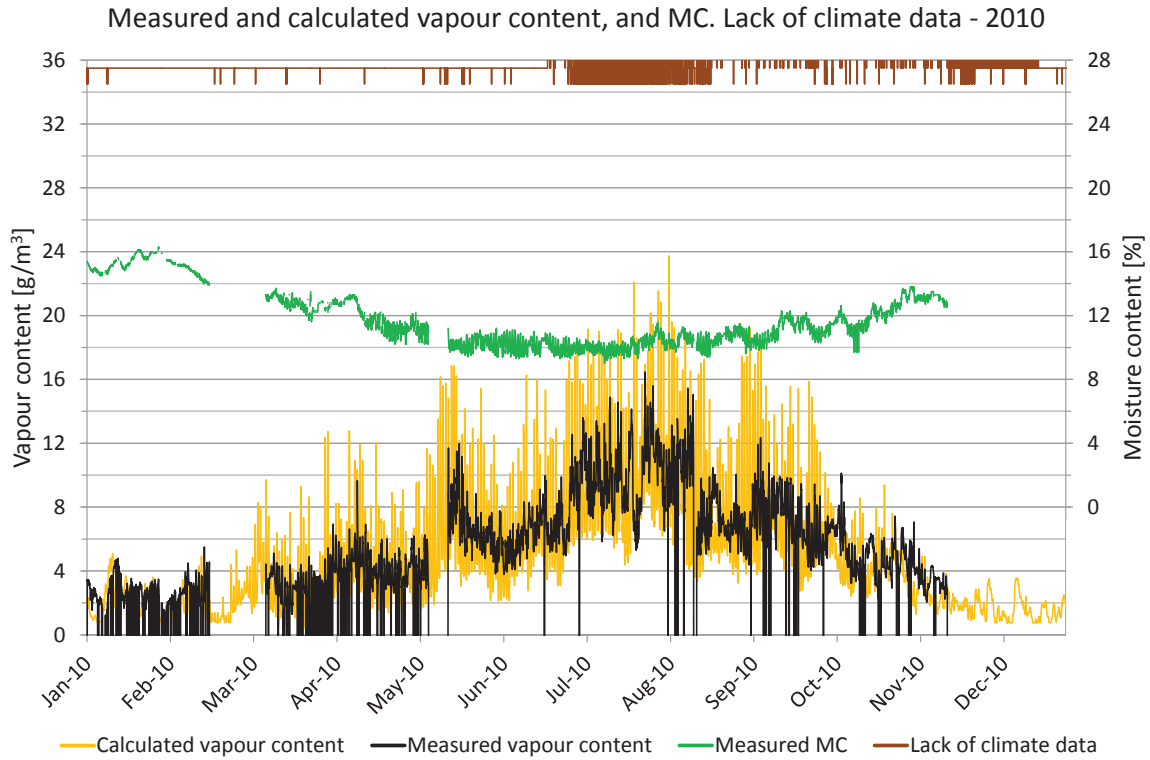


Figure 9.D.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

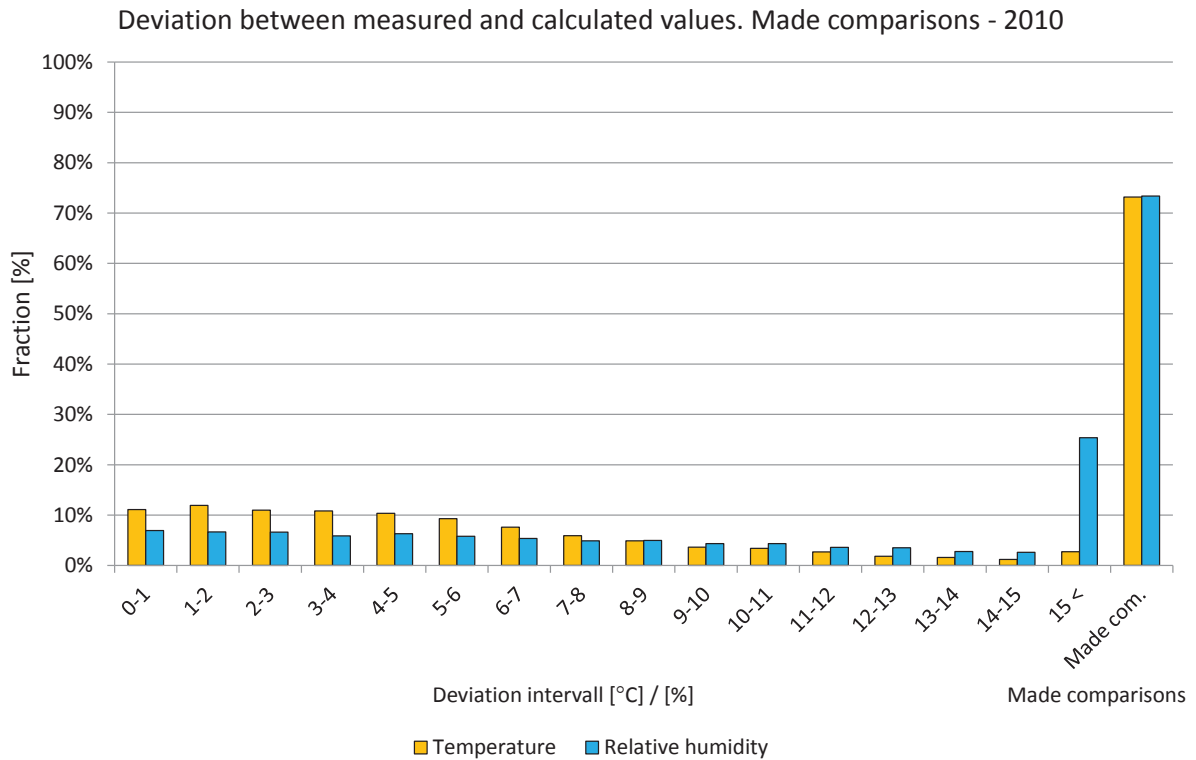


Figure 9.D.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

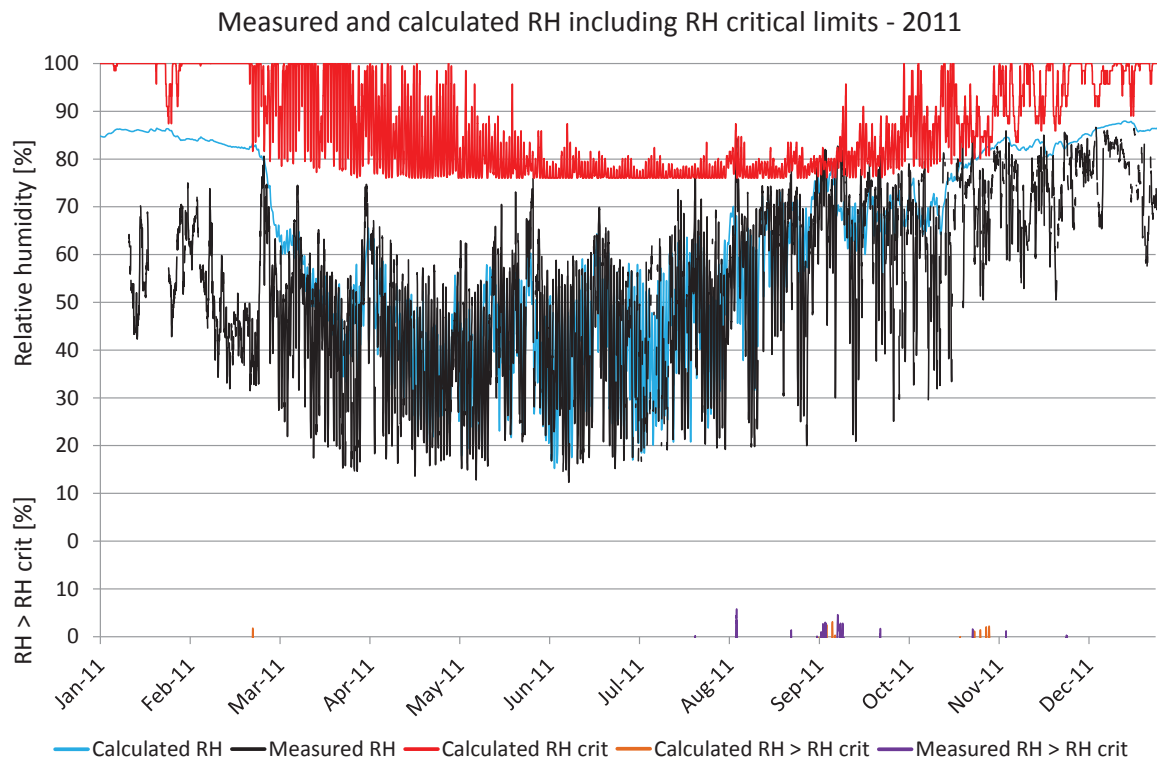


Figure 9.D.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

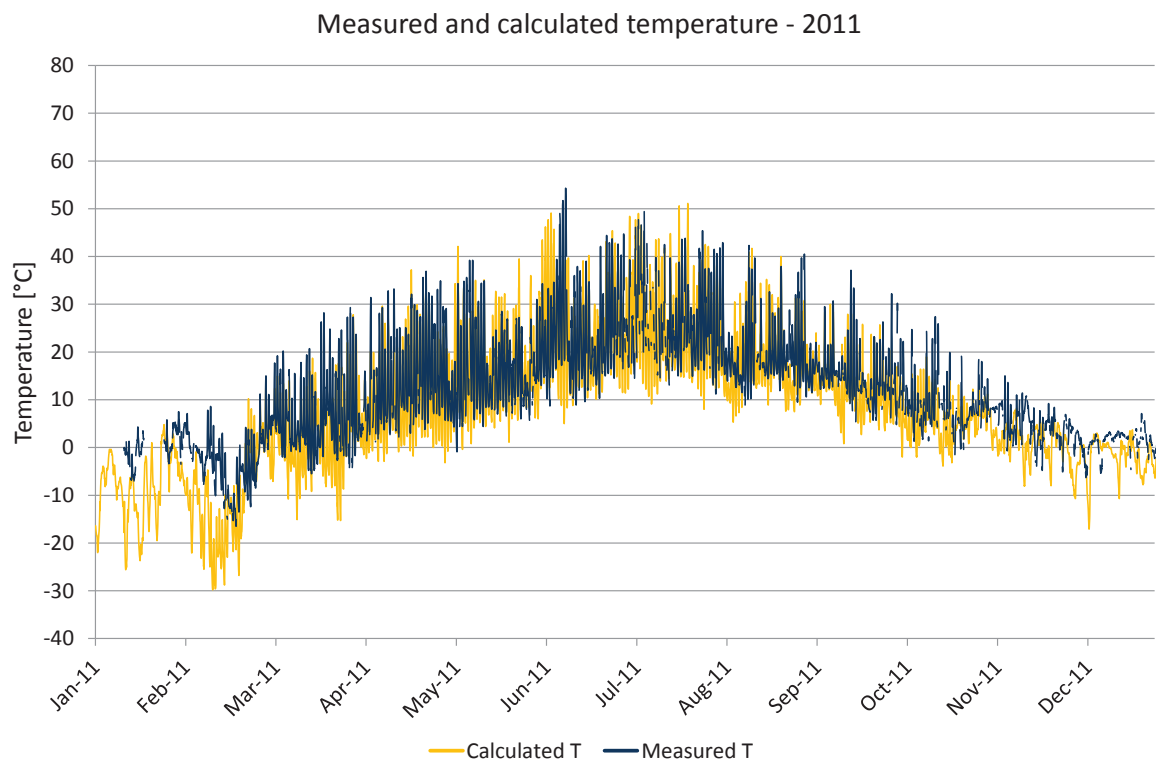


Figure 9.D.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

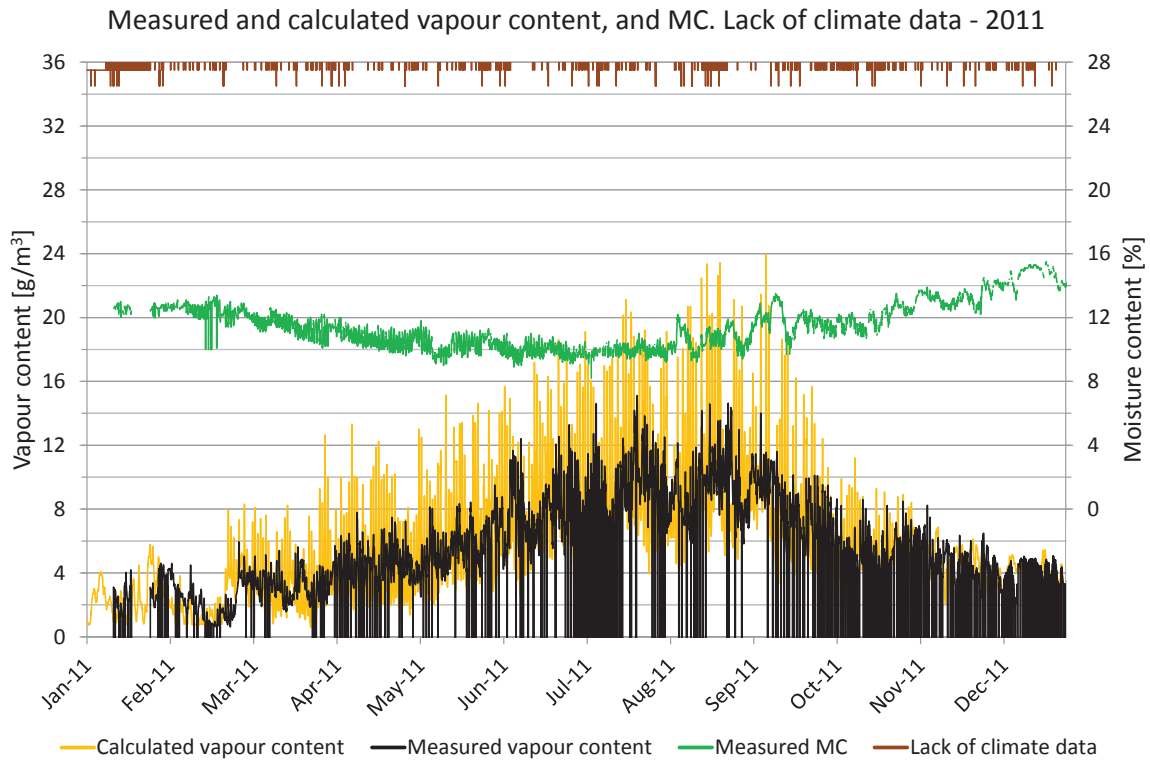


Figure 9.D.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

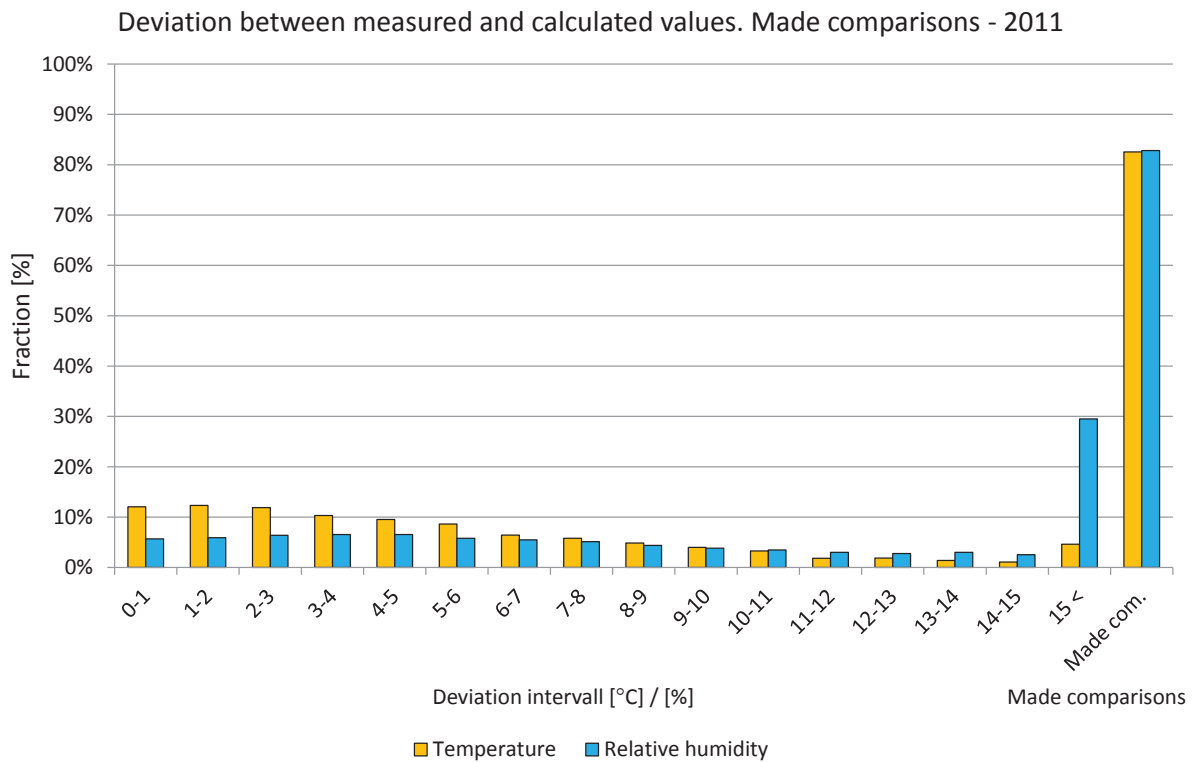


Figure 9.D.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

9.E Position E

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the cold attic space in the roof with 3.5 degrees roof angle facing south above the sixth floor.

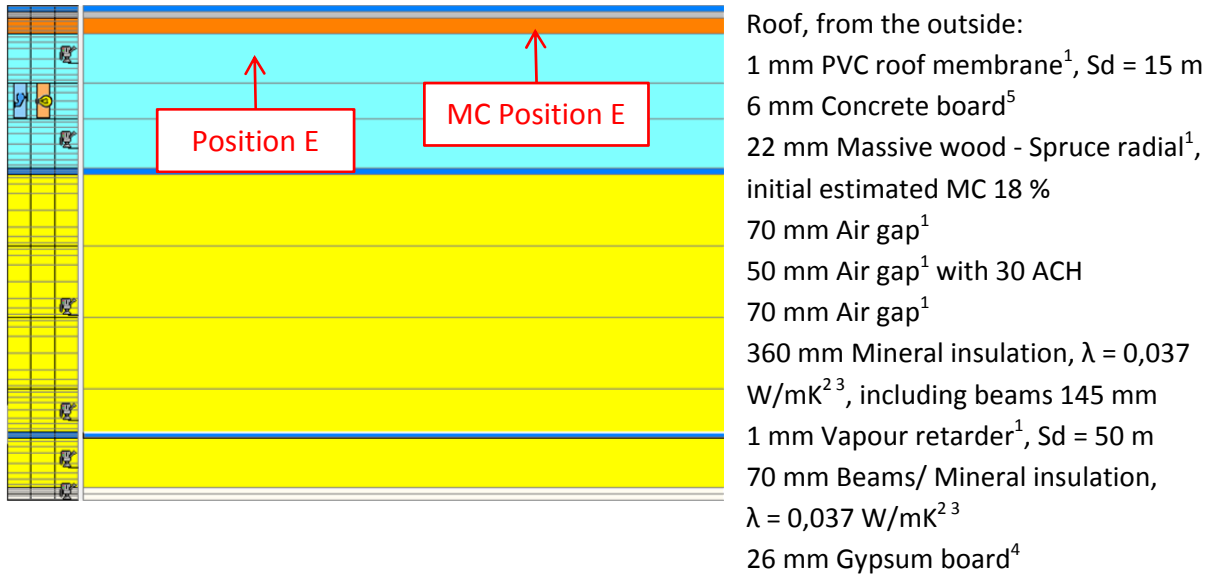


Figure 9.D.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996, 5. Hedenblad, G., 1996.

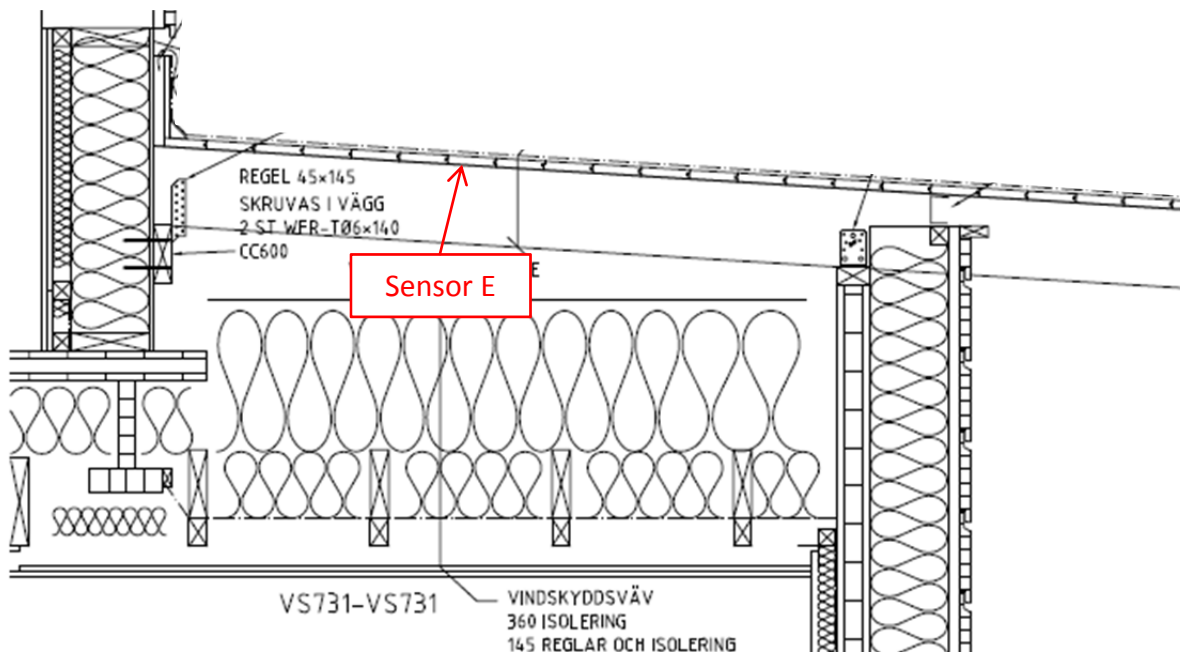


Figure 9.E.2. Location of the studied position.

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 2009

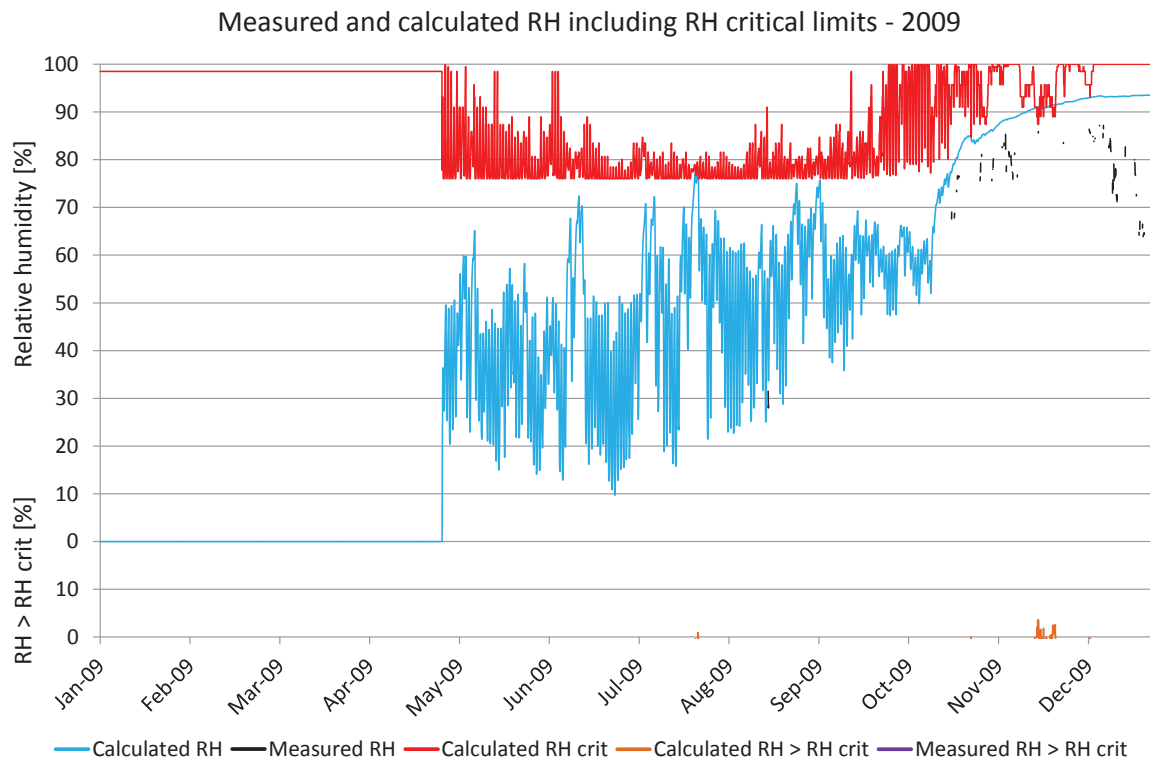


Figure 9.E.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

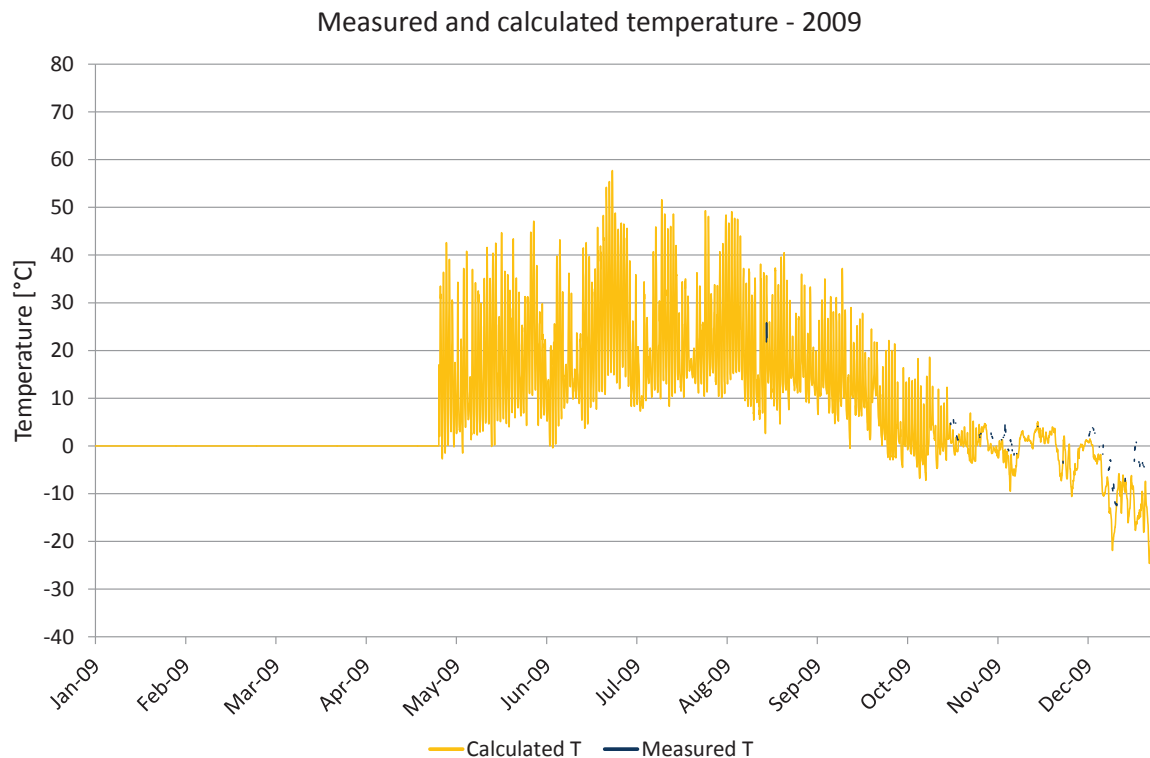


Figure 9.E.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

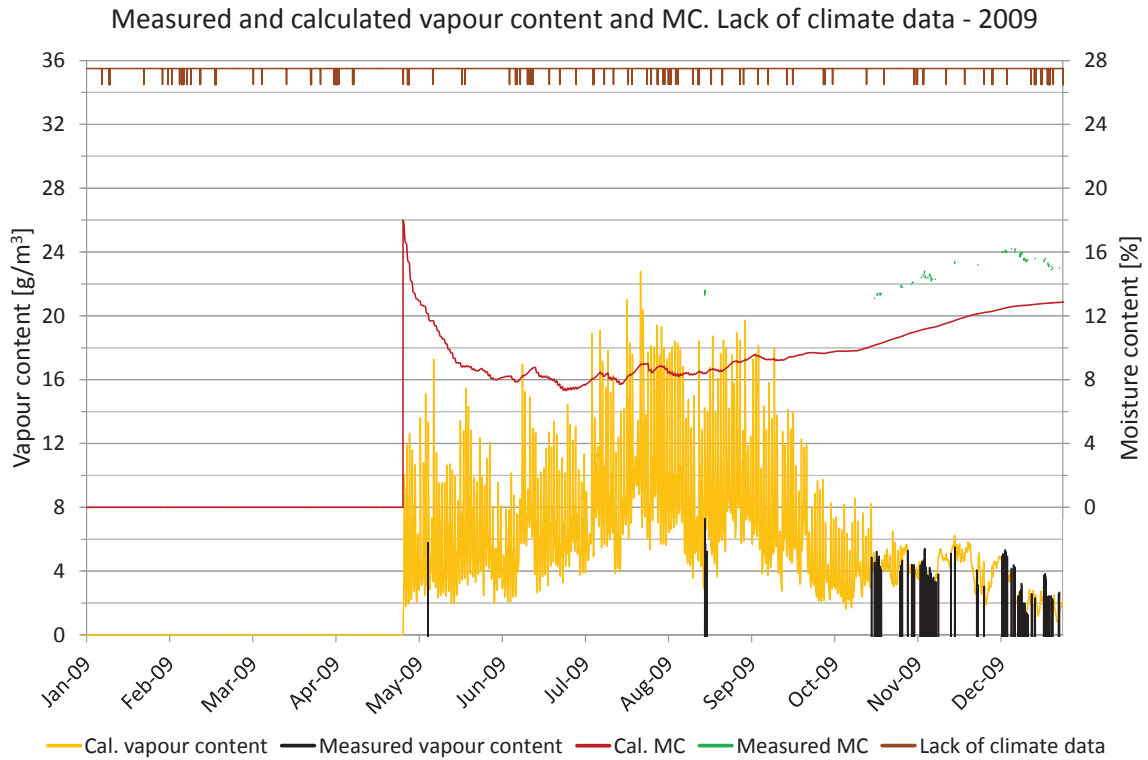


Figure 9.E.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

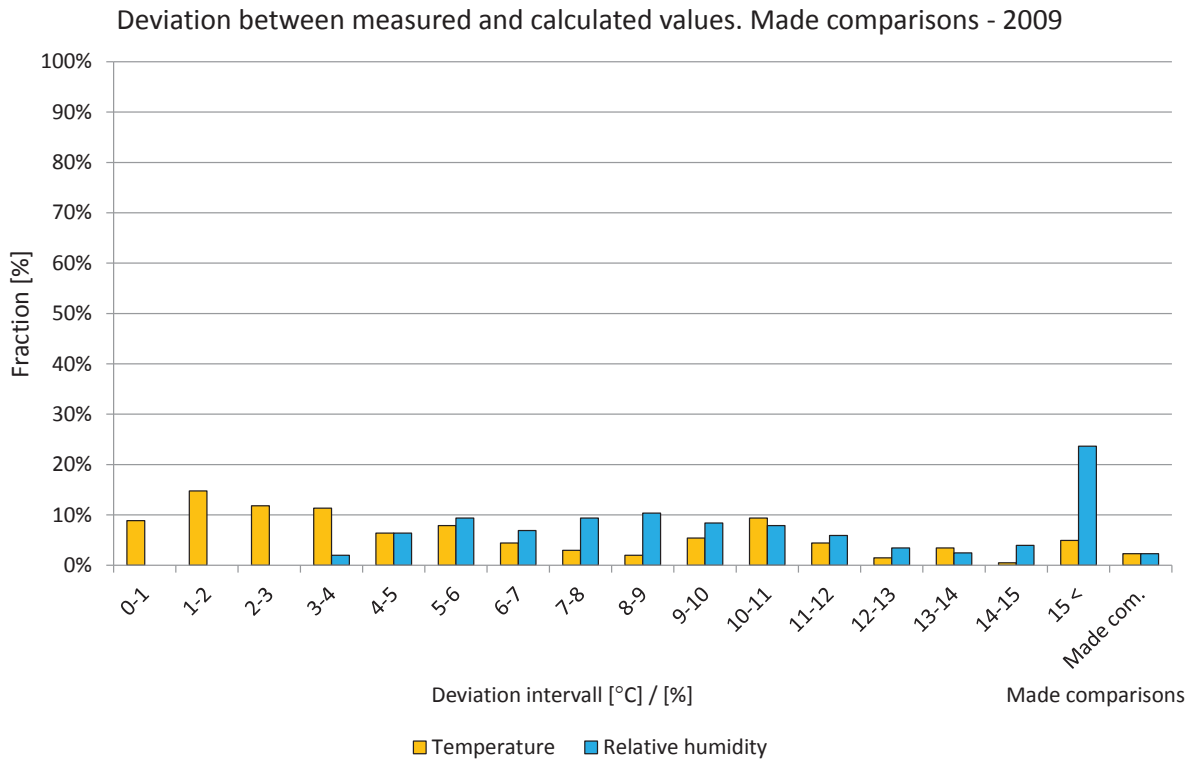


Figure 9.E.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

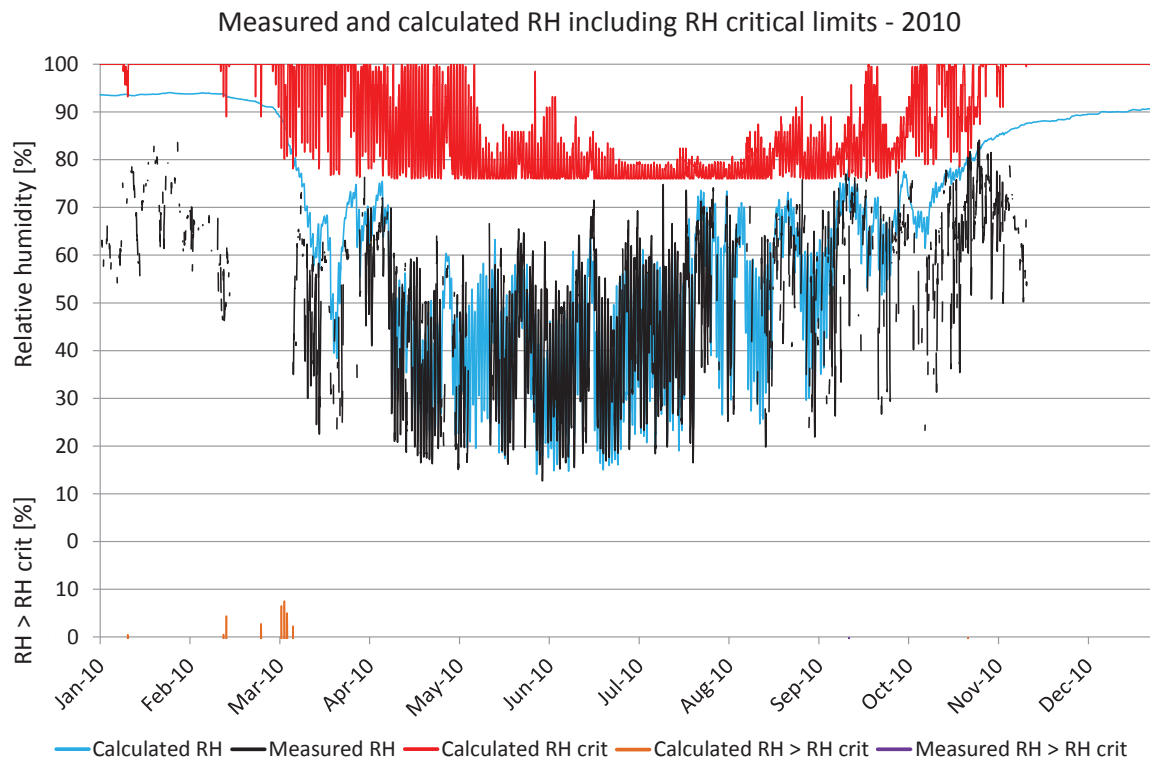


Figure 9.E.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

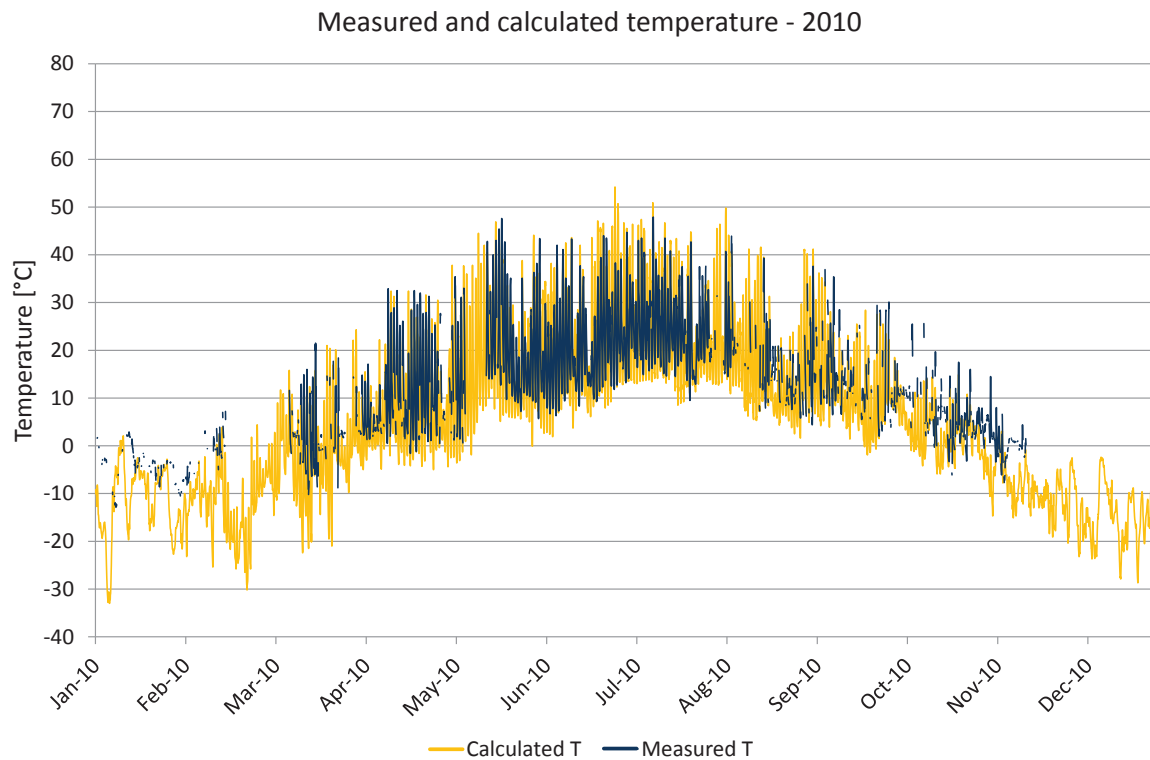


Figure 9.E.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

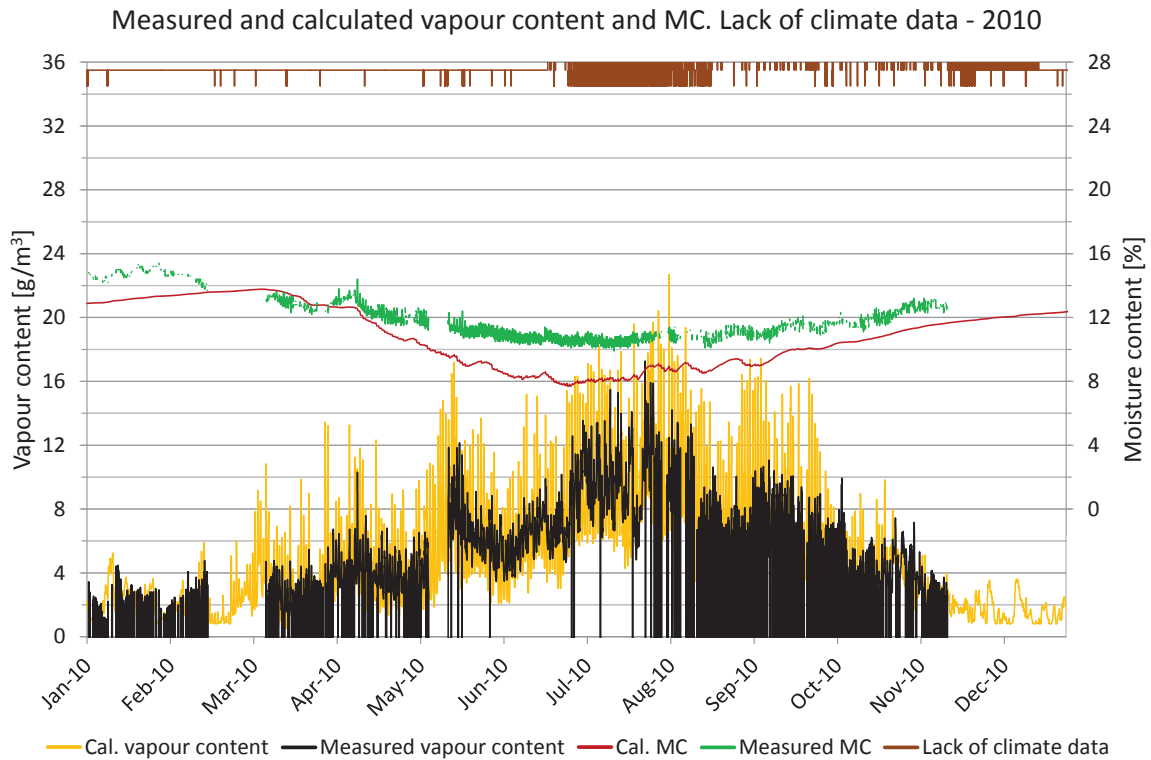


Figure 9.E.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

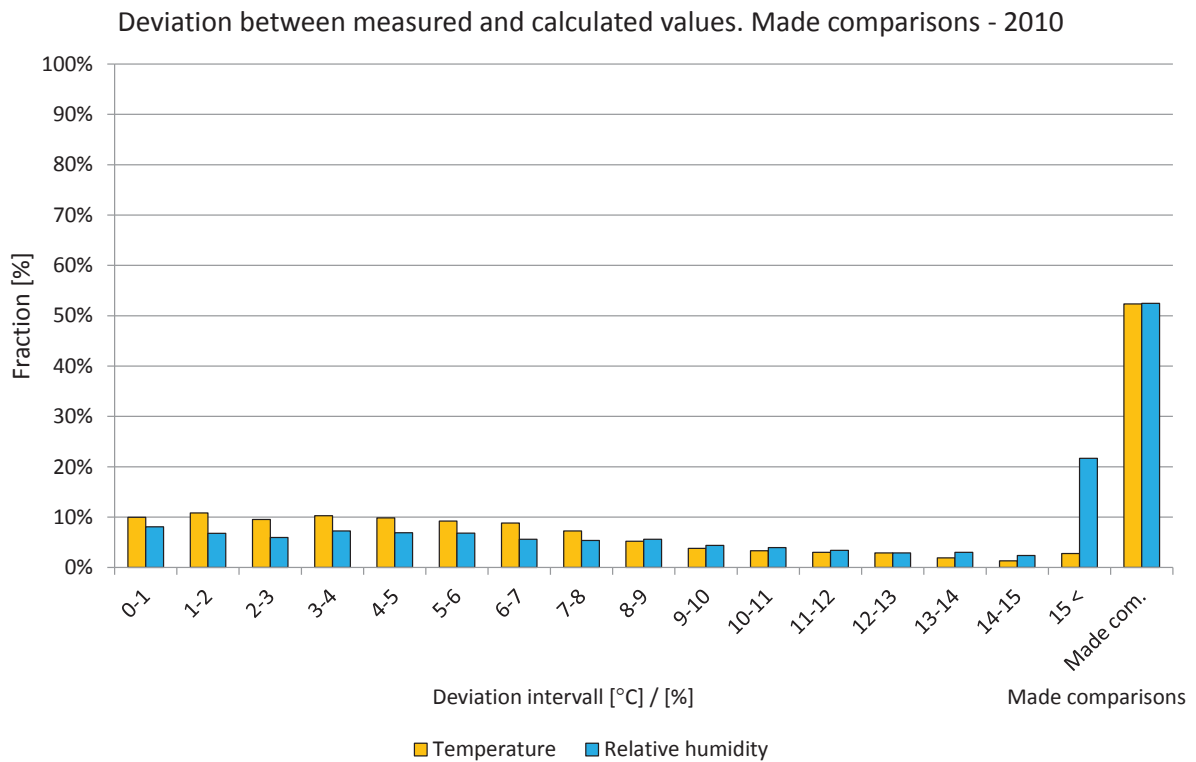


Figure 9.E.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

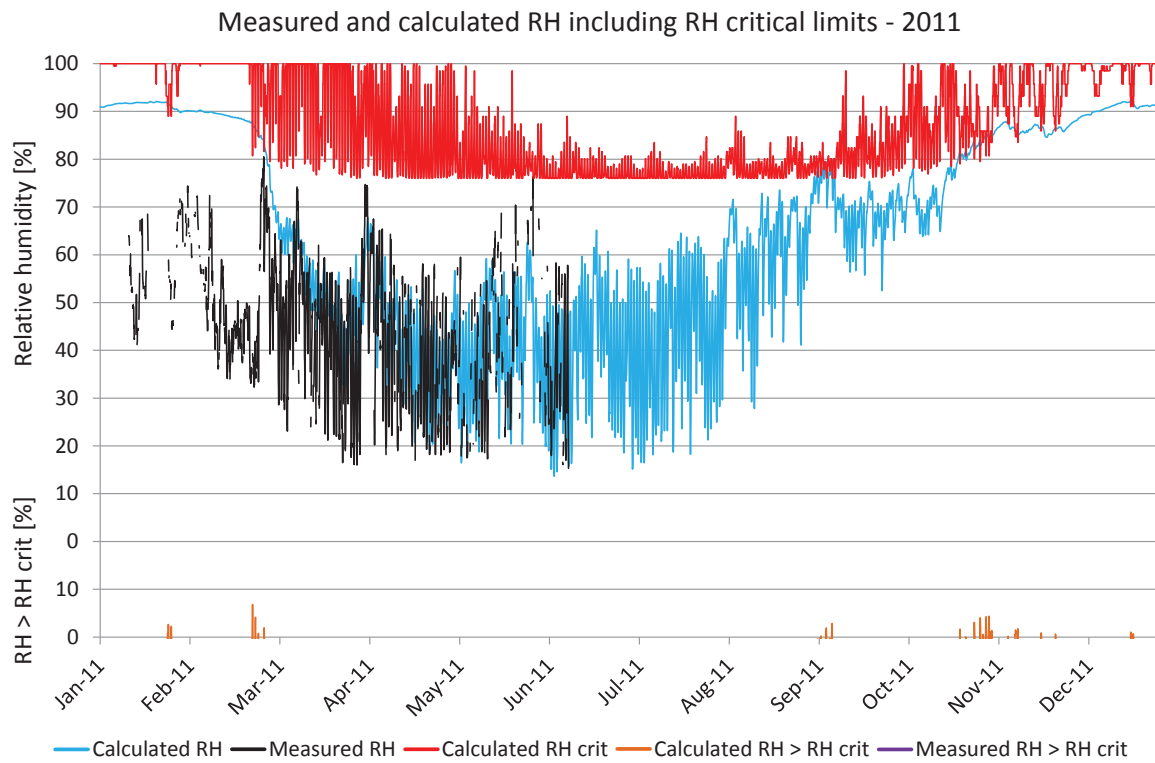


Figure 9.E.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

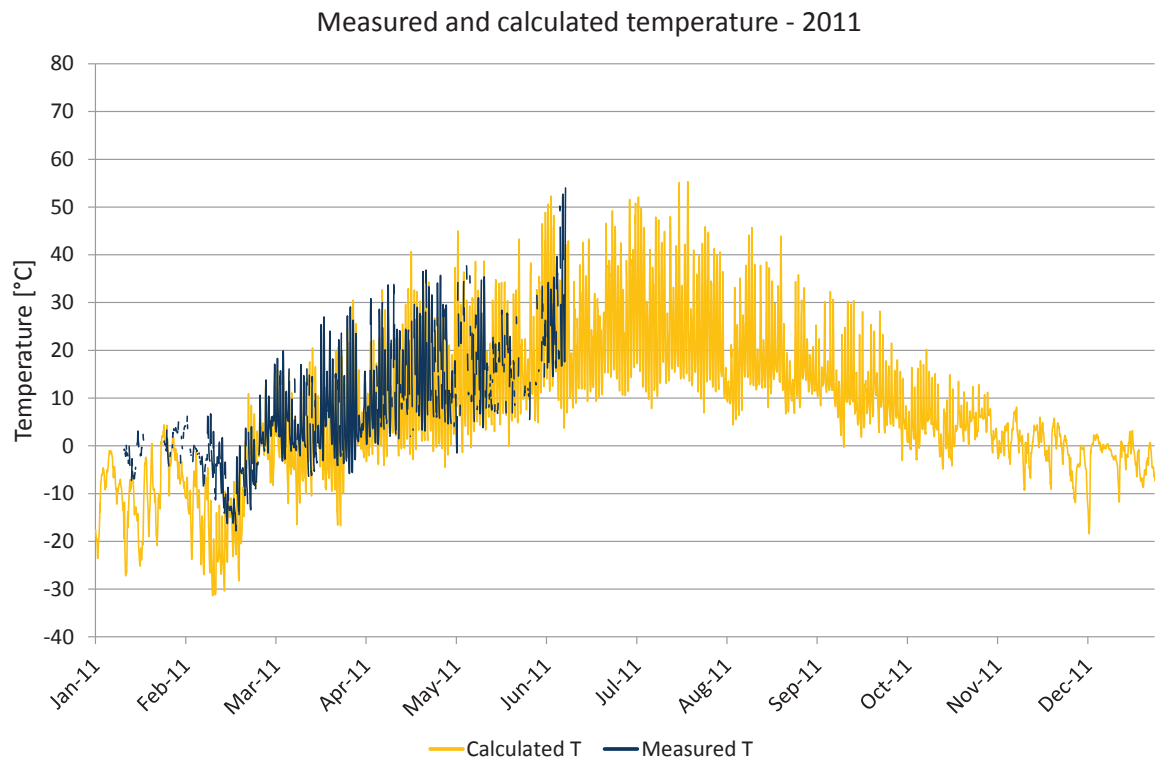


Figure 9.E.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

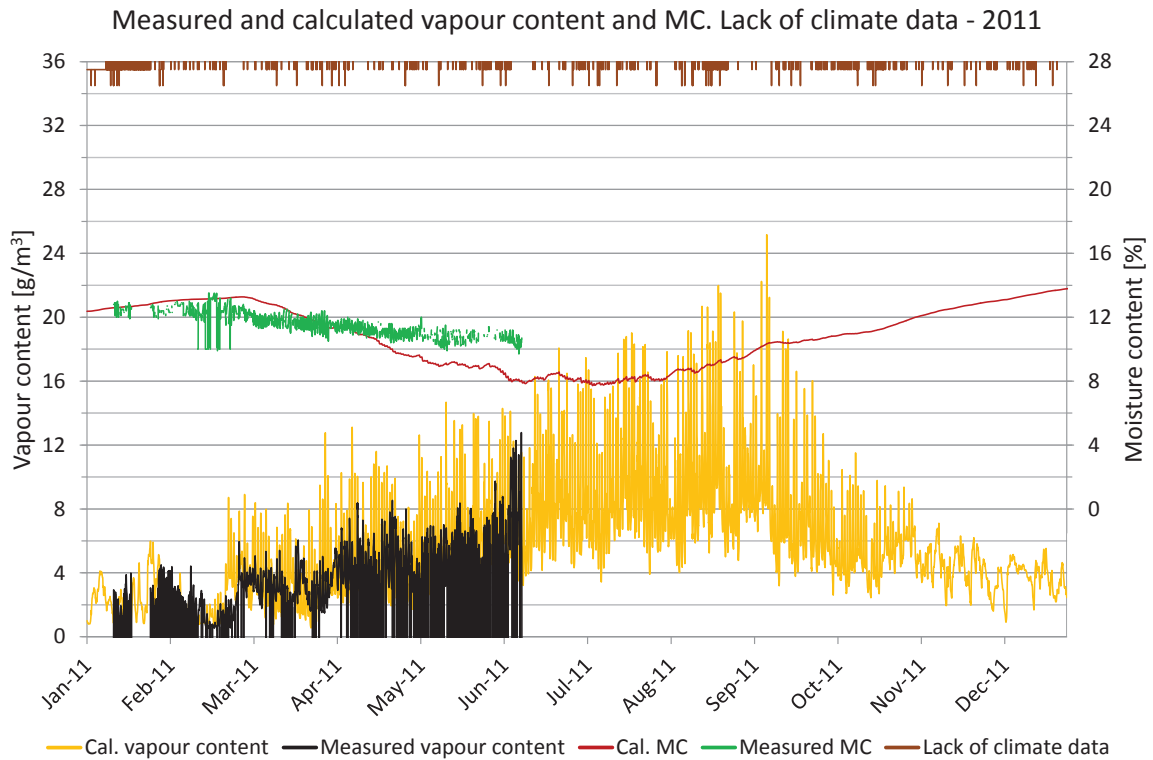


Figure 9.E.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

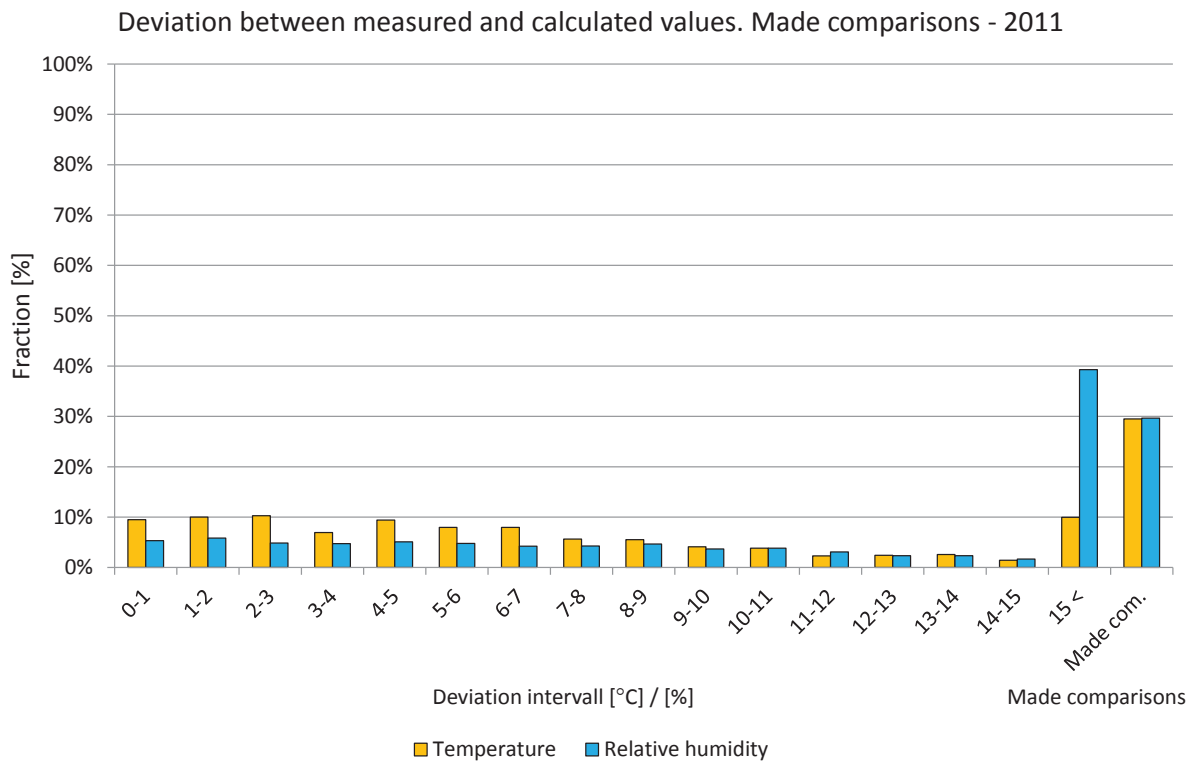


Figure 9.E.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

9.1 Position I

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the cold attic space in the roof with 3.5 degrees roof angle facing north above the sixth floor. 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.

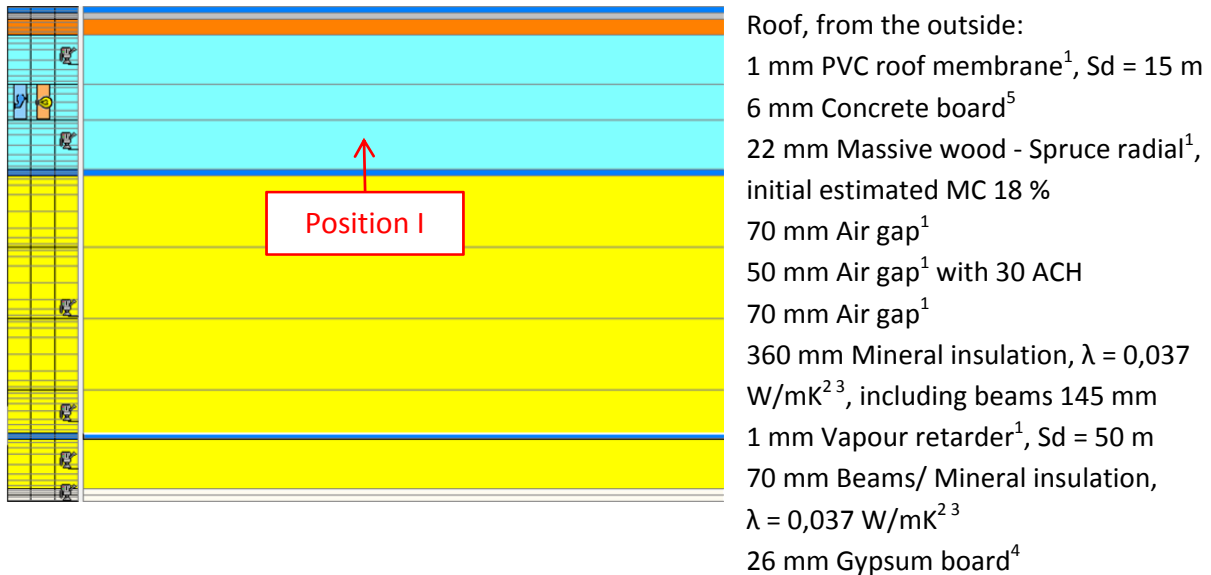


Figure 9.D.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996, 5. Hedenblad, G., 1996.

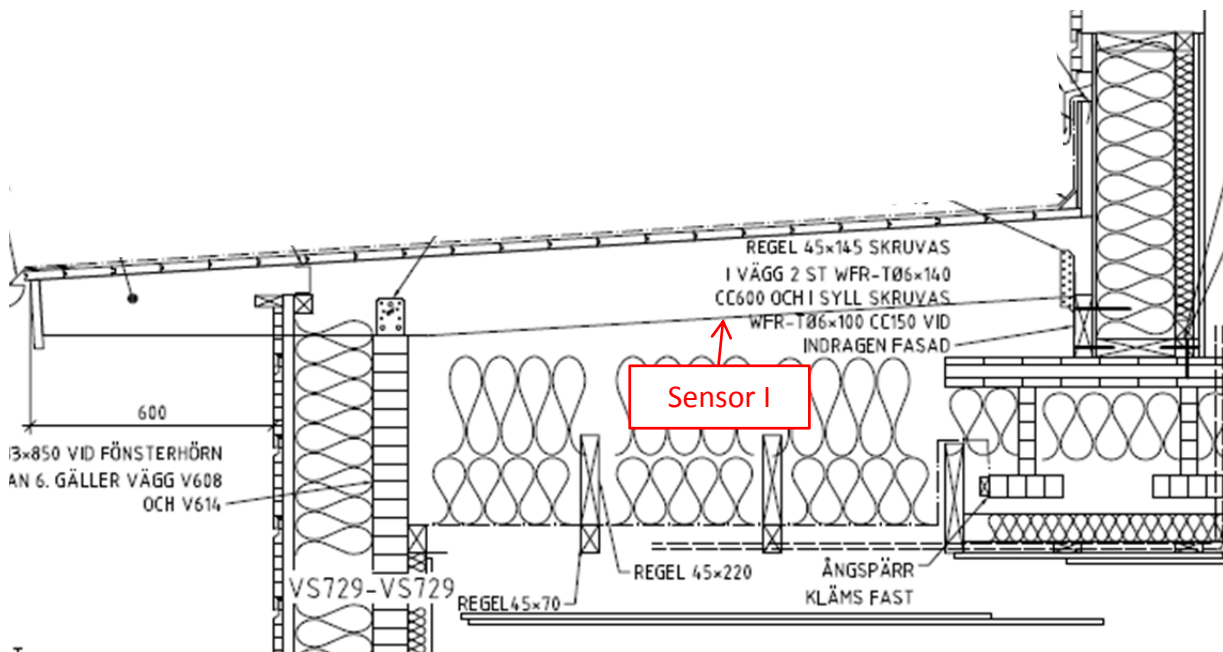


Figure 9.I.2. Location of the studied position.

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 2009

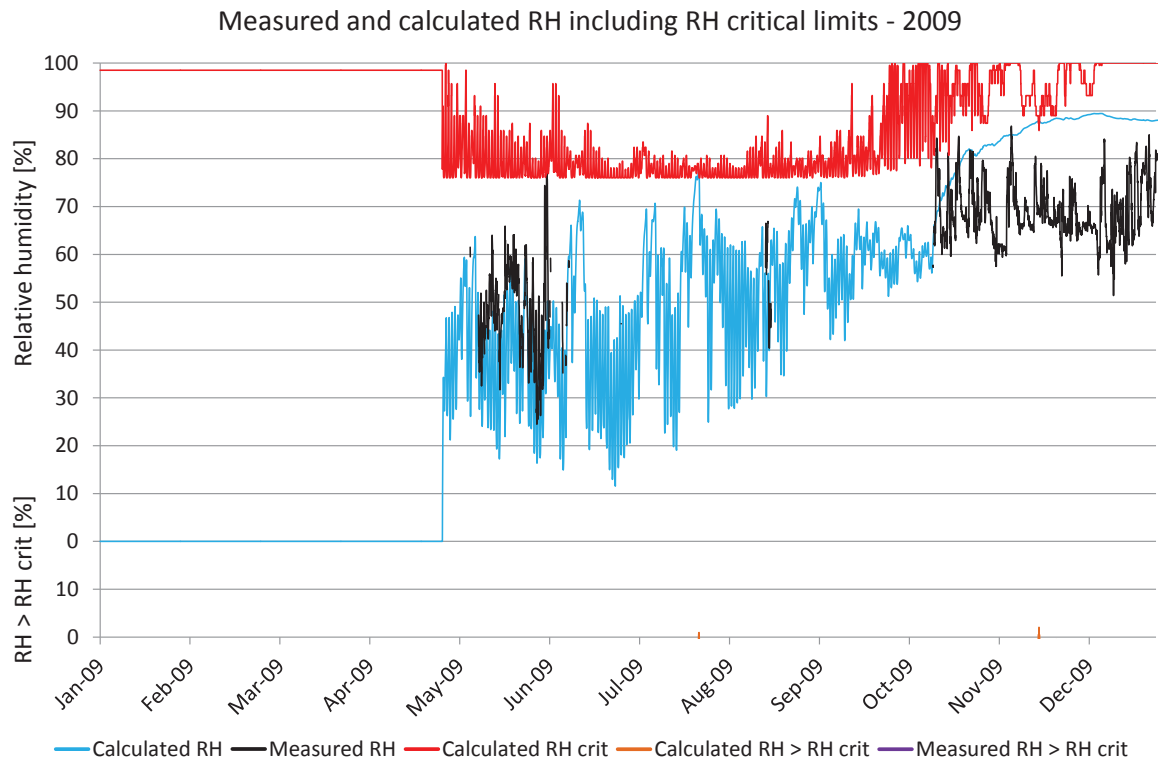


Figure 9.1.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

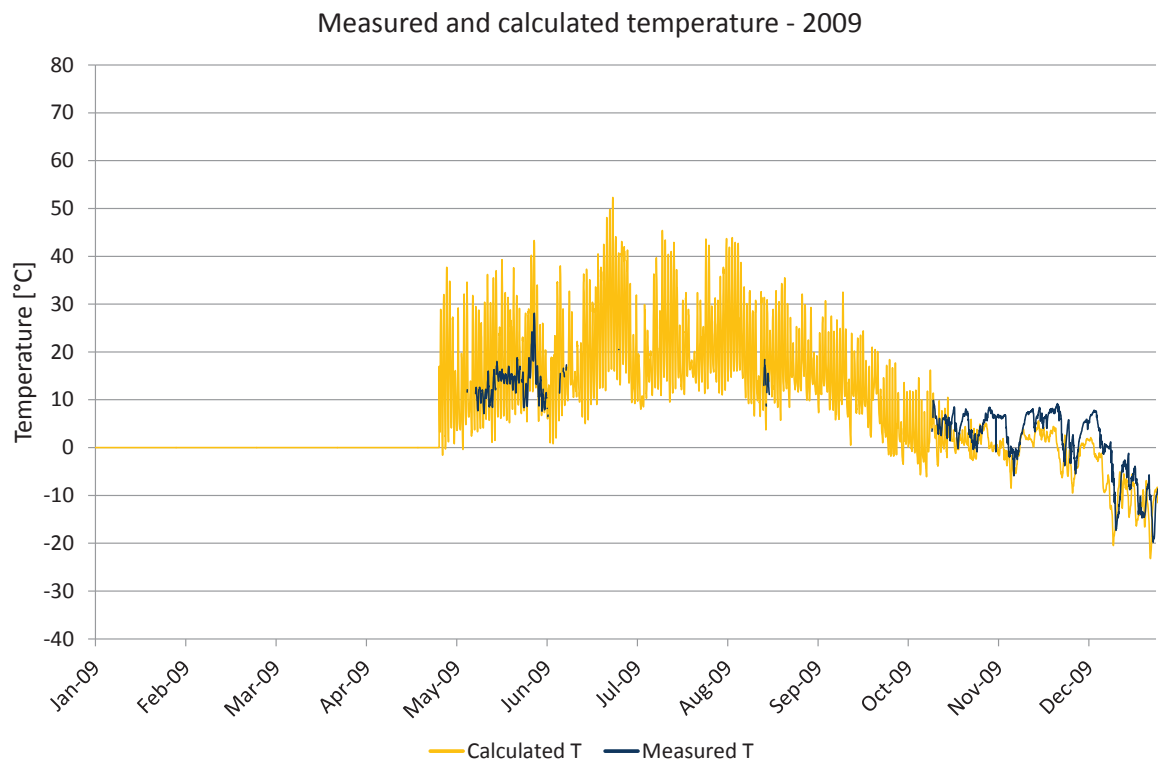


Figure 9.1.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

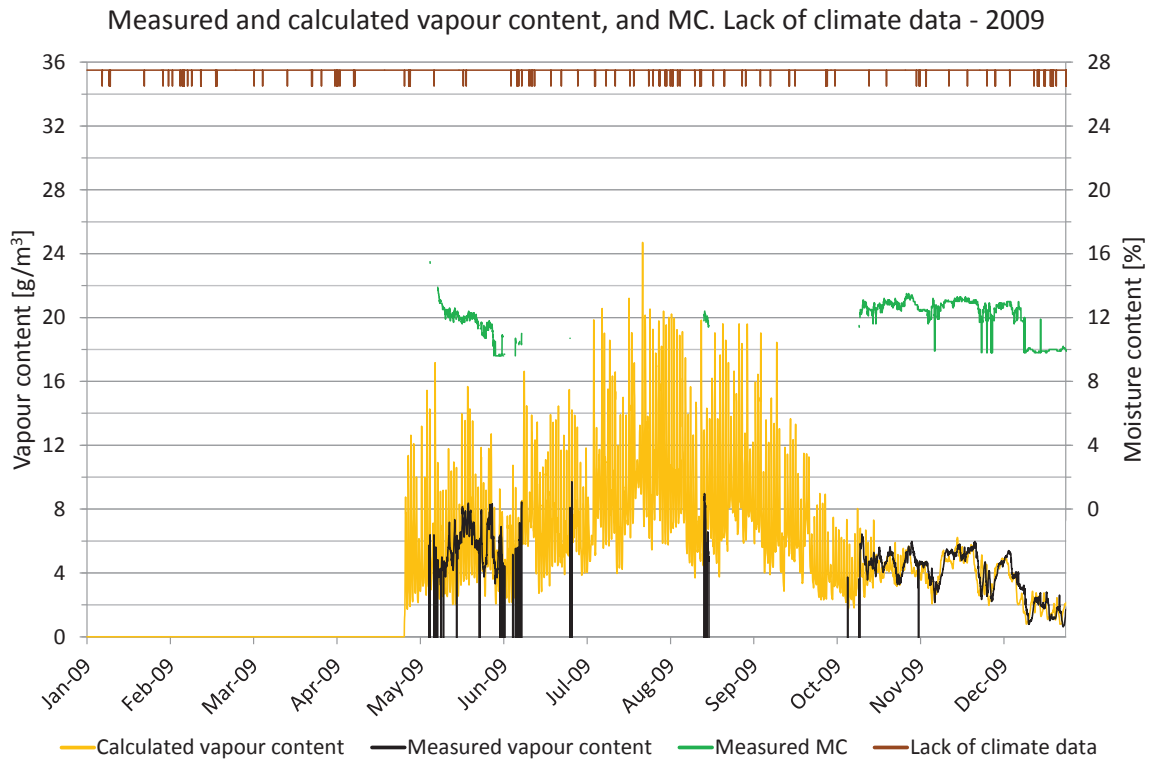


Figure 9.1.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

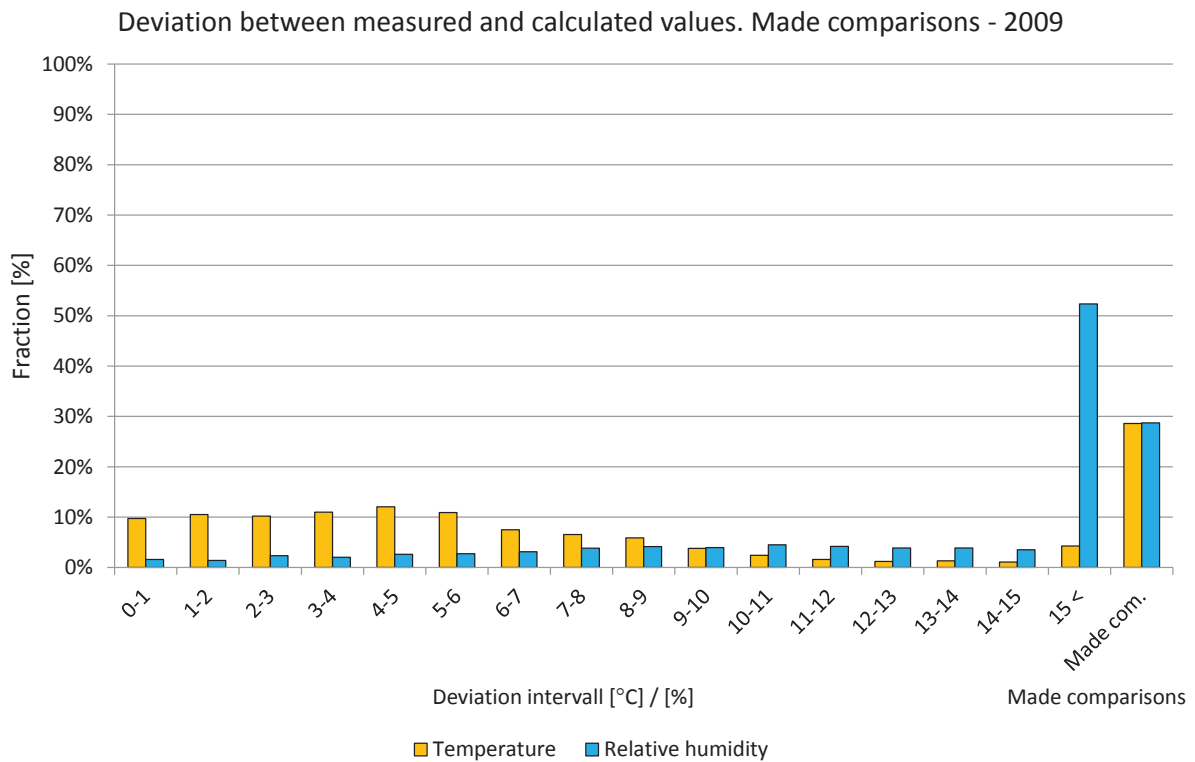


Figure 9.1.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

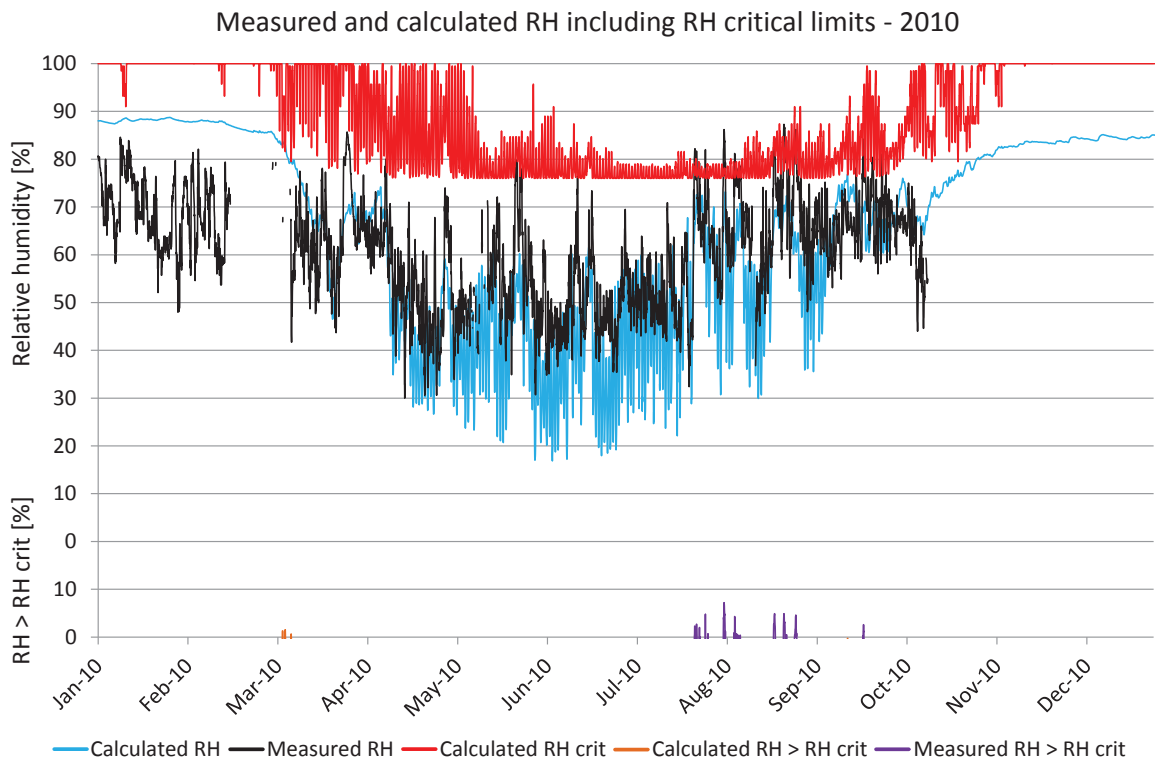


Figure 9.1.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

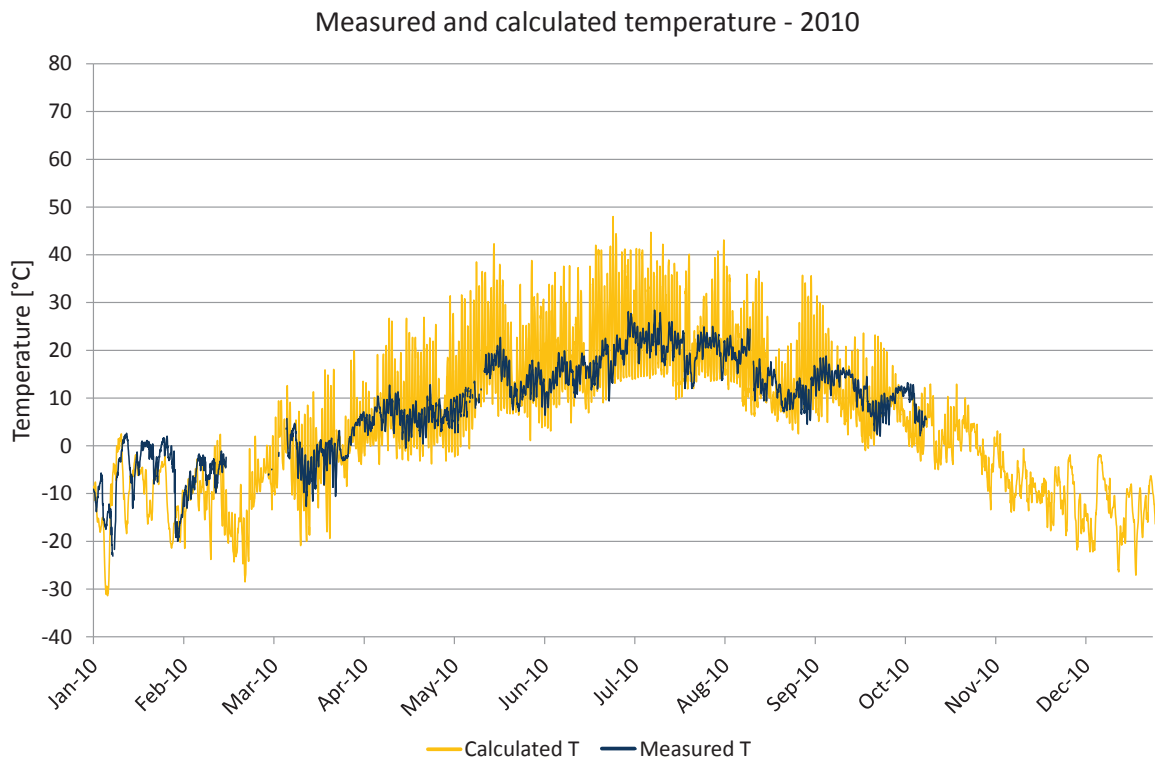


Figure 9.1.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

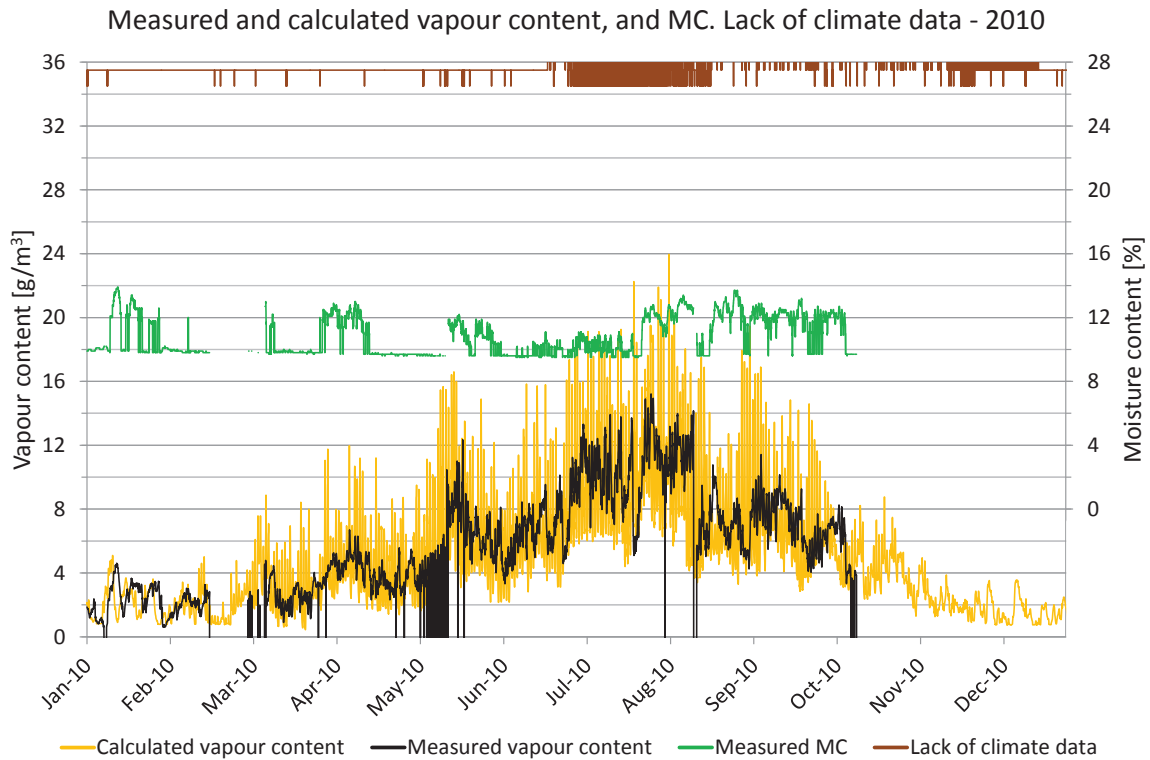


Figure 9.I.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

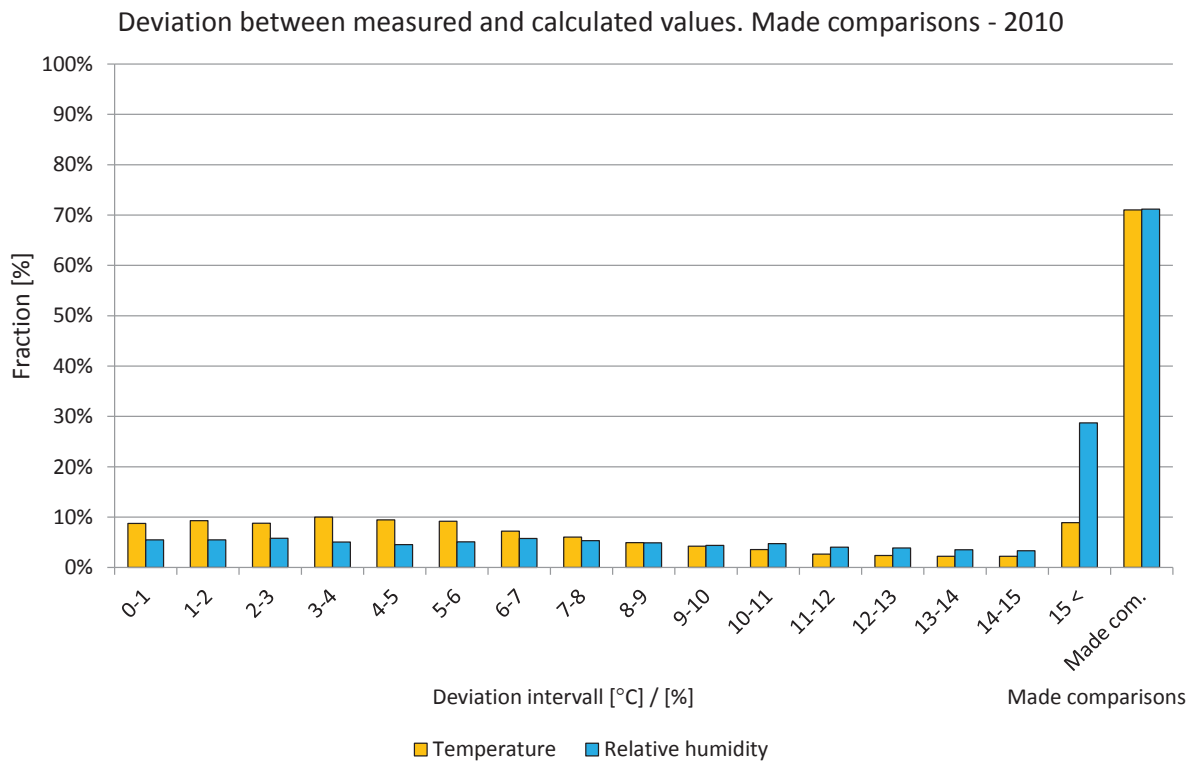


Figure 9.I.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

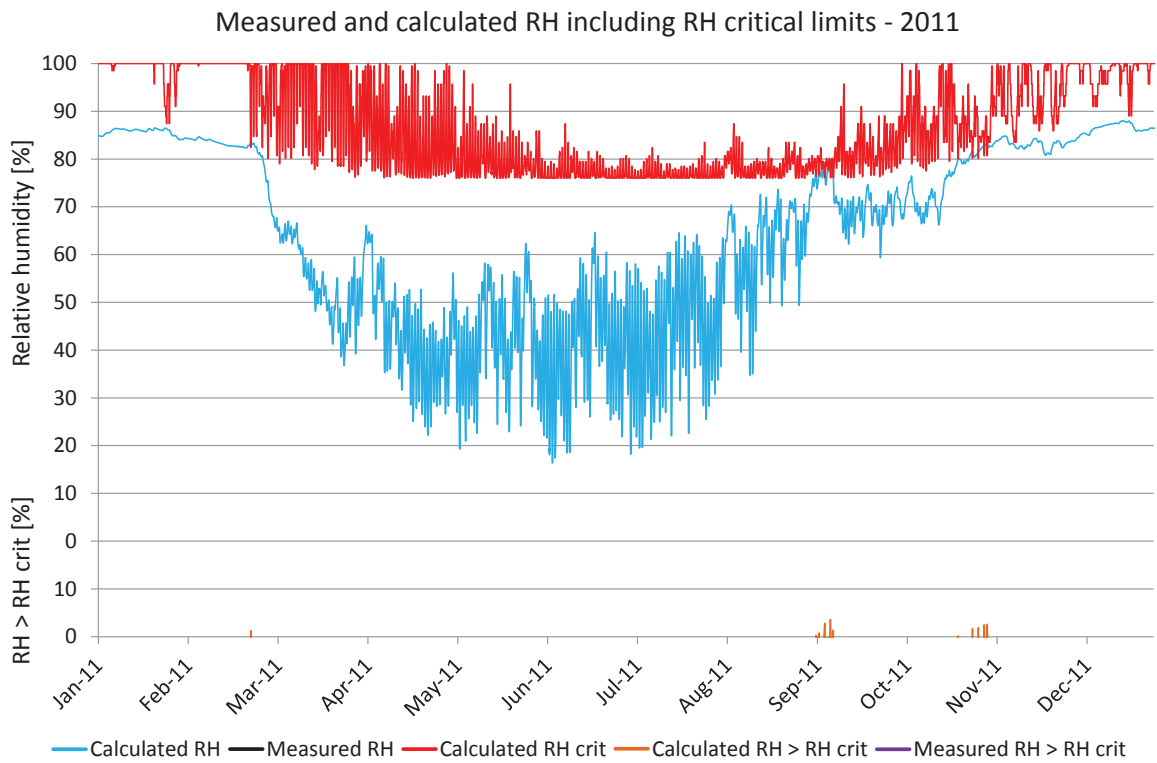


Figure 9.I.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

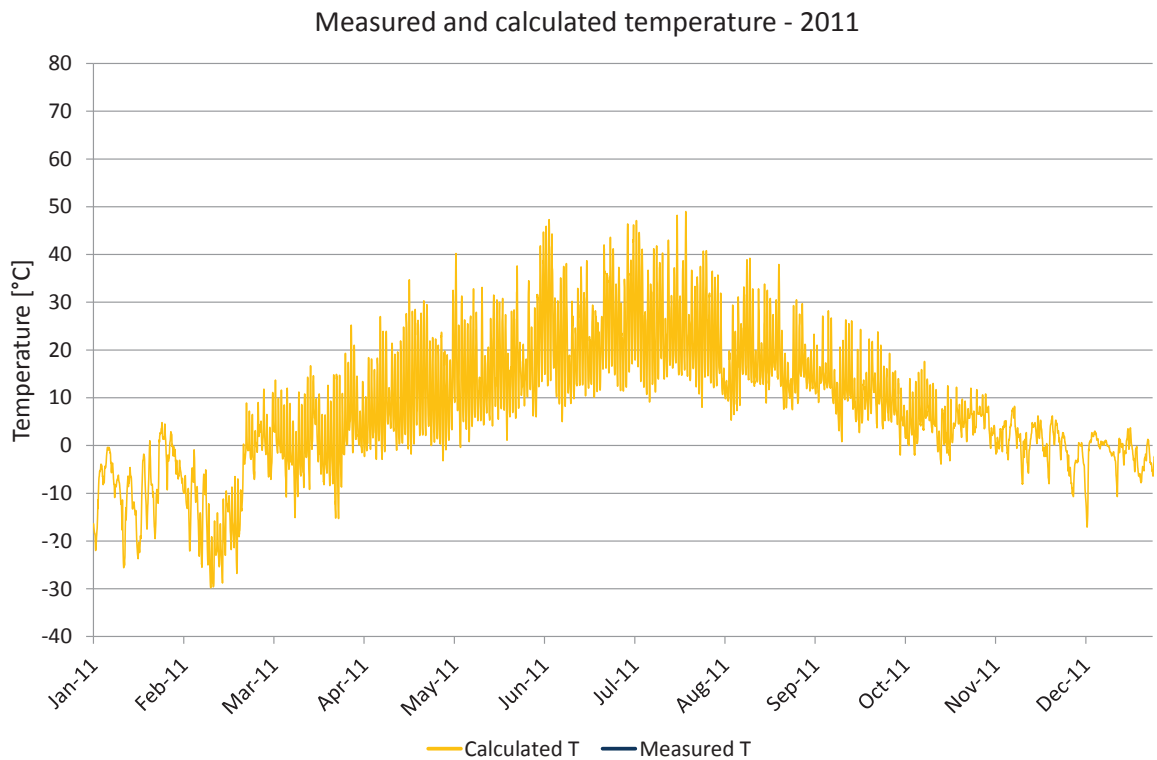


Figure 9.I.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

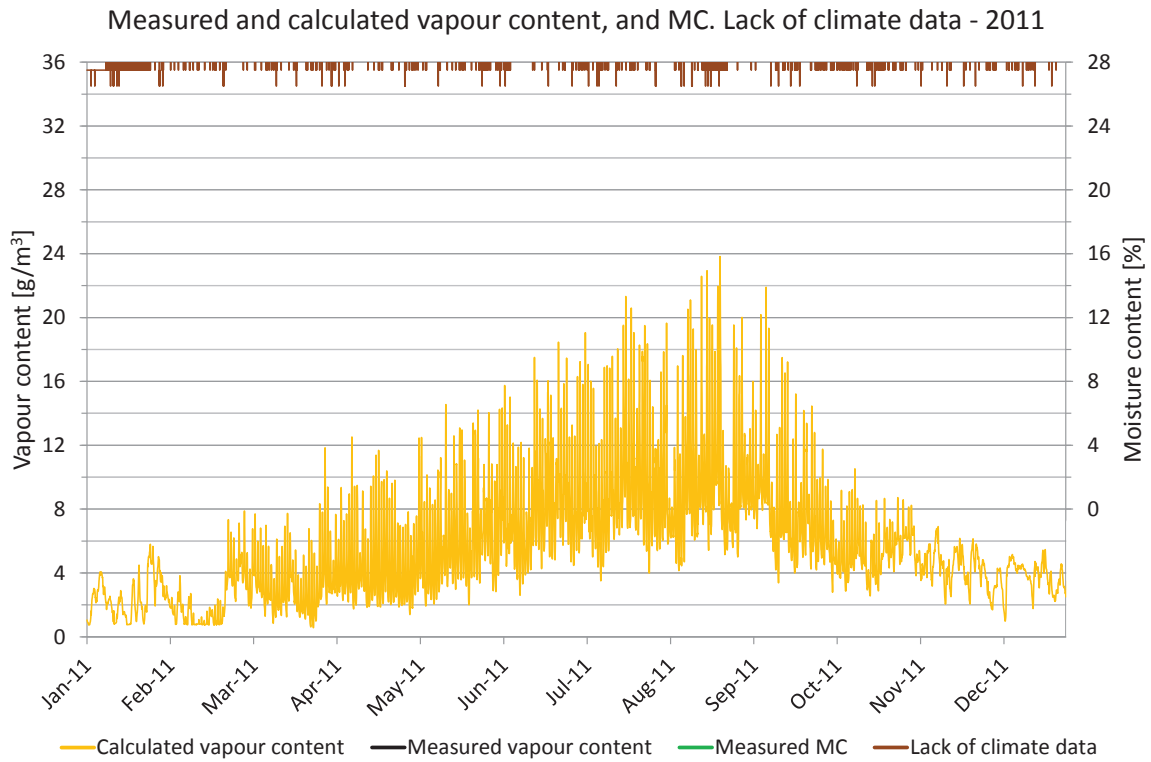


Figure 9.I.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

9.J Position J

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the cold attic space in the roof with 3.5 degrees roof angle facing north above the sixth floor.

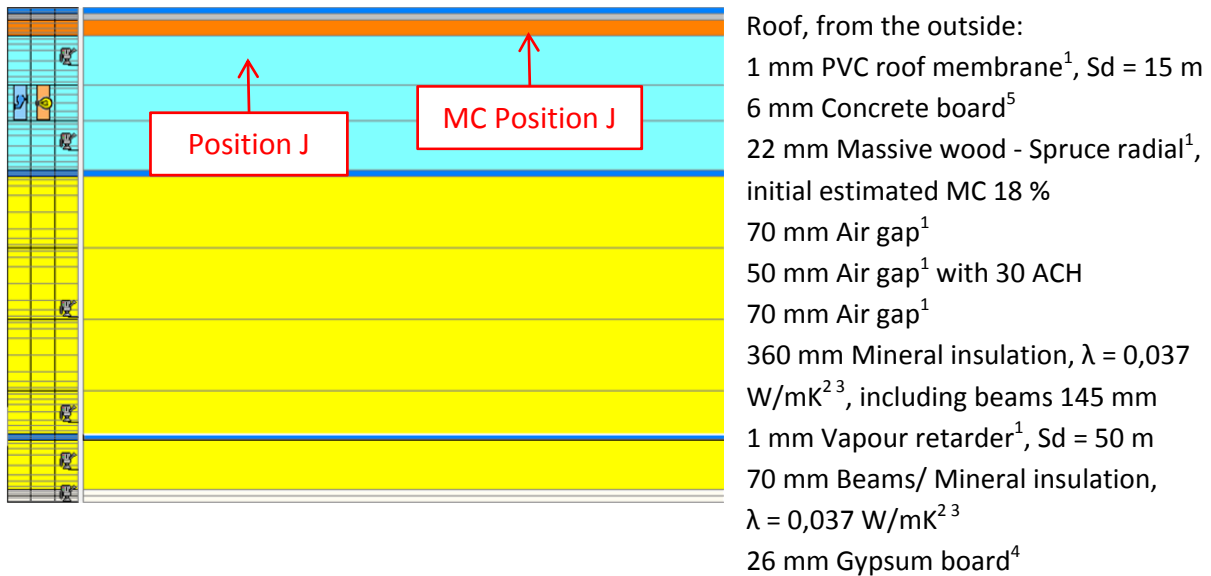


Figure 9.D.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996, 5. Hedenblad, G., 1996.

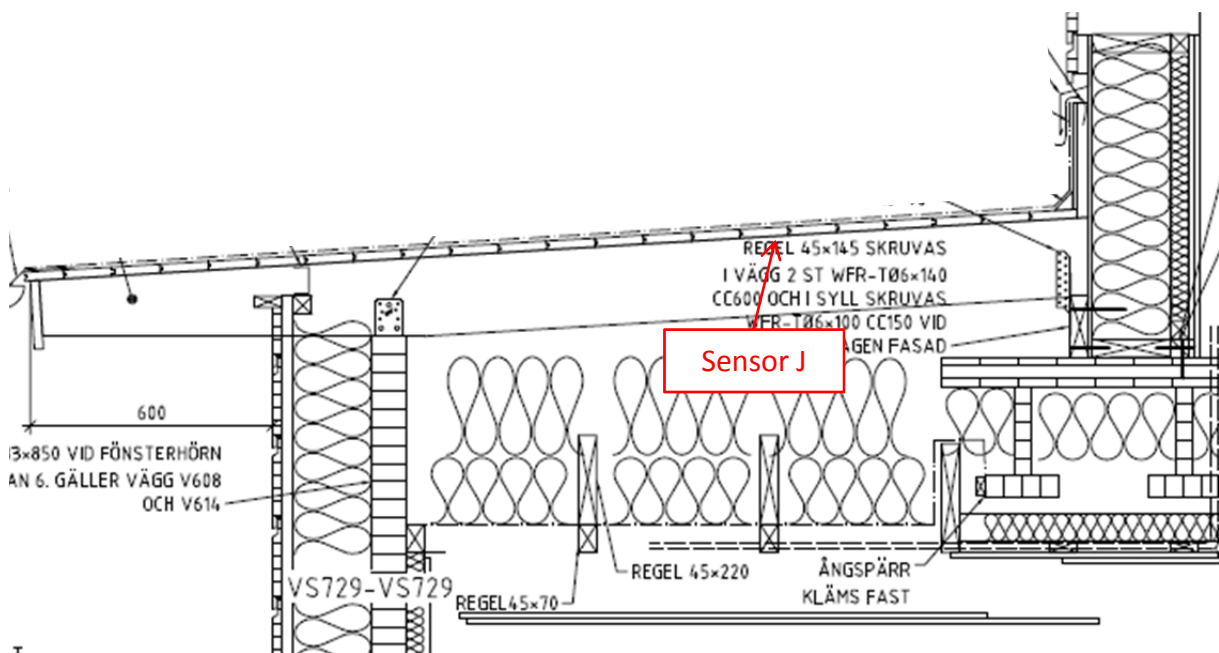


Figure 9.J.2. Location of the studied position.

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 2009

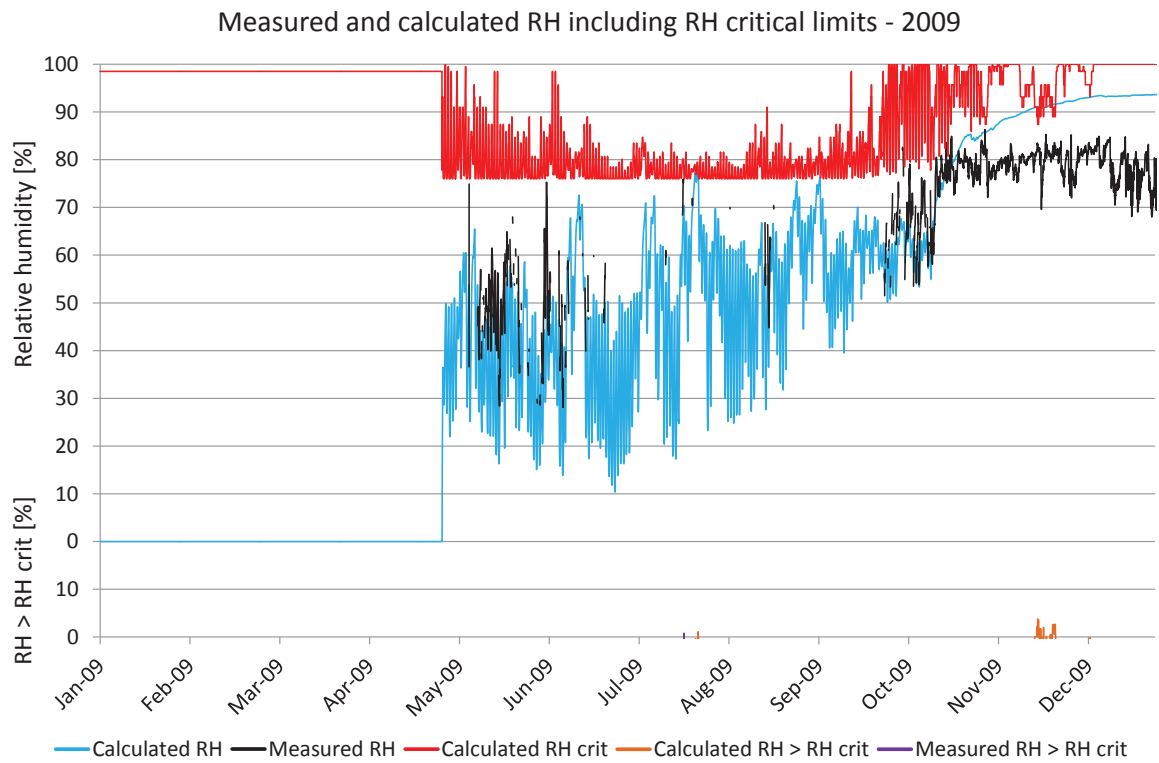


Figure 9.J.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

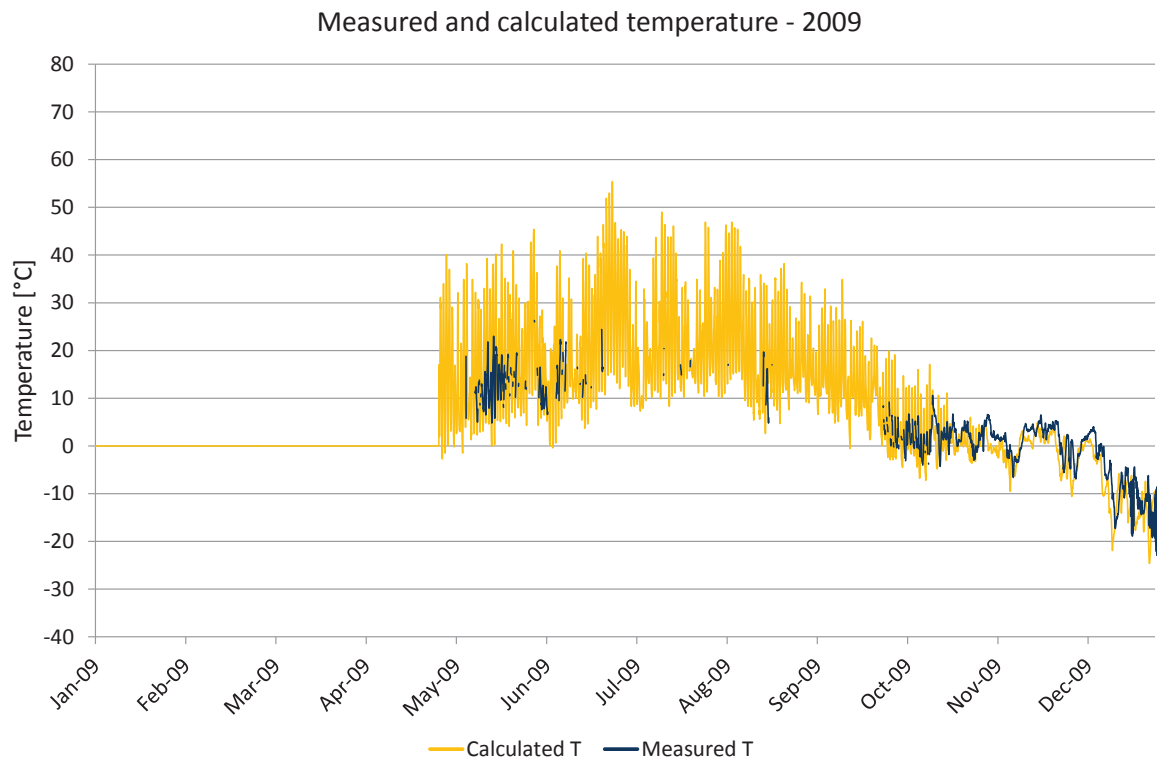


Figure 9.J.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

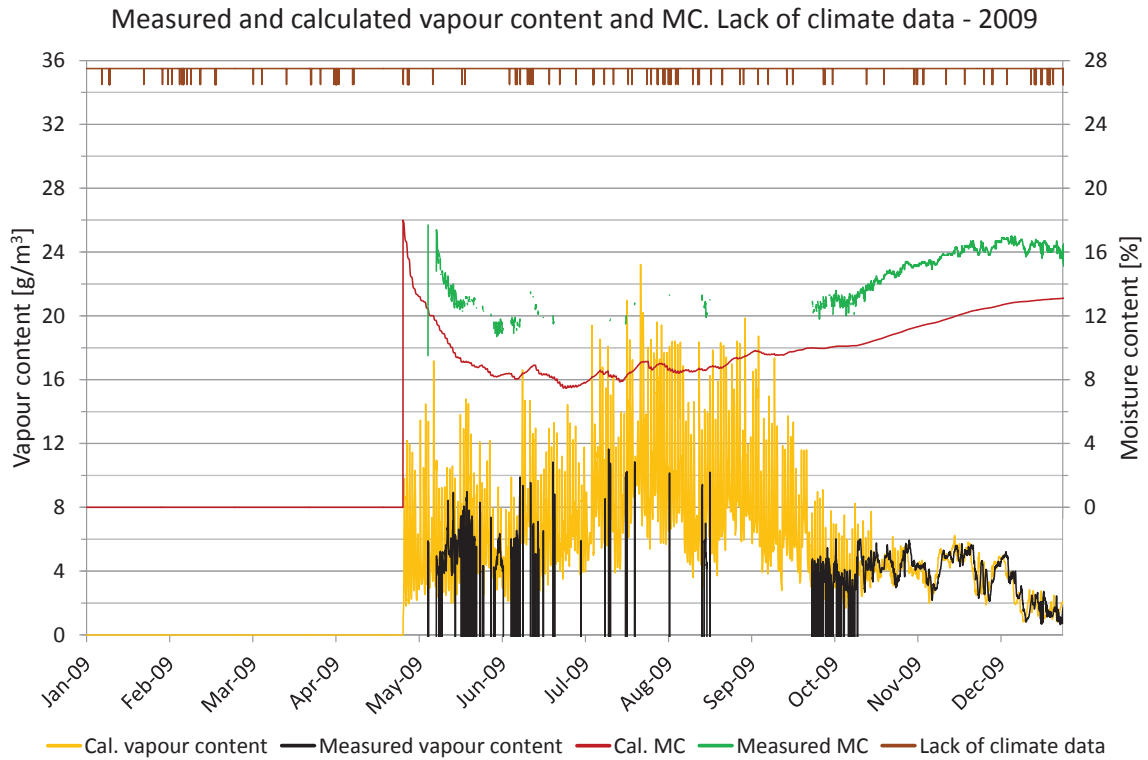


Figure 9.J.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

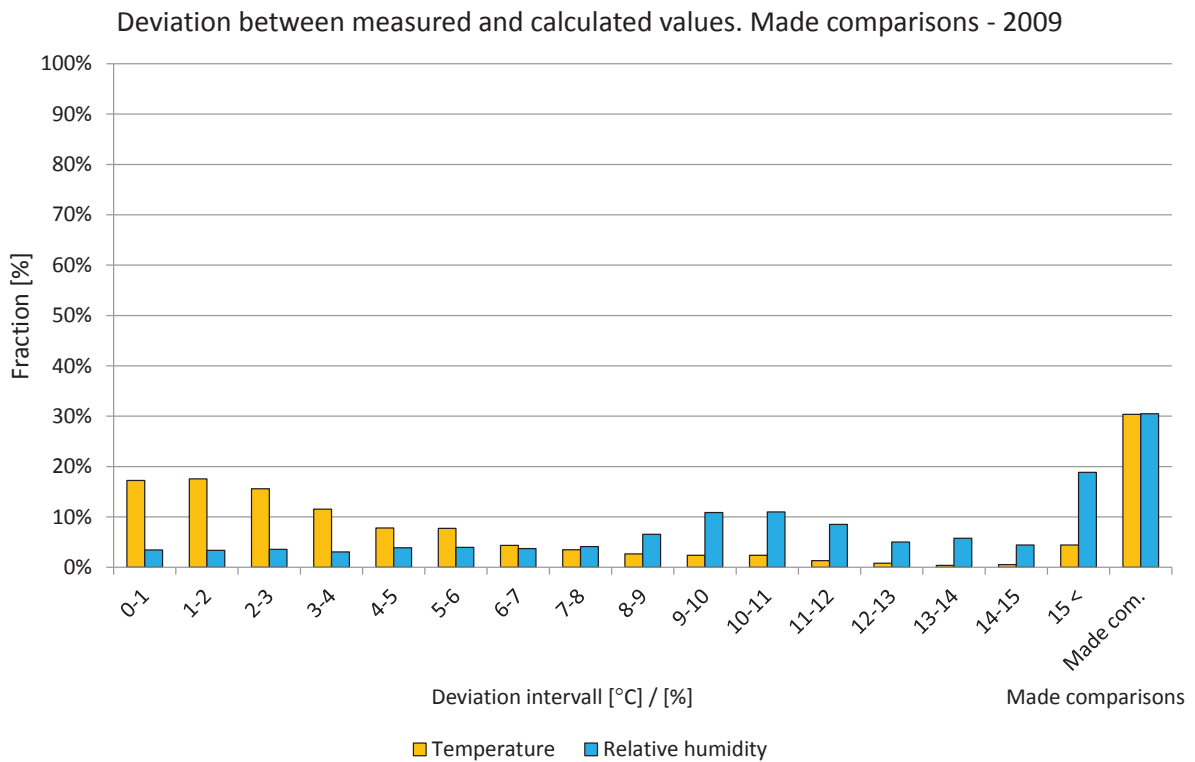


Figure 9.J.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

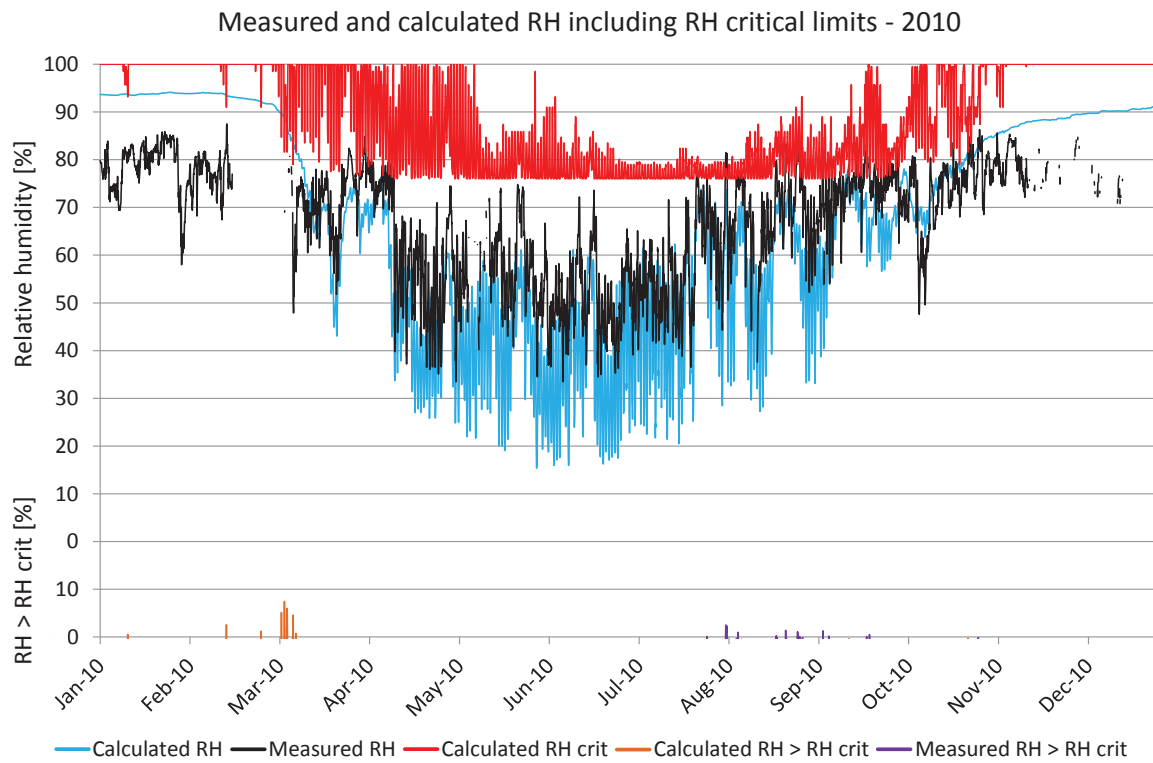


Figure 9.J.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

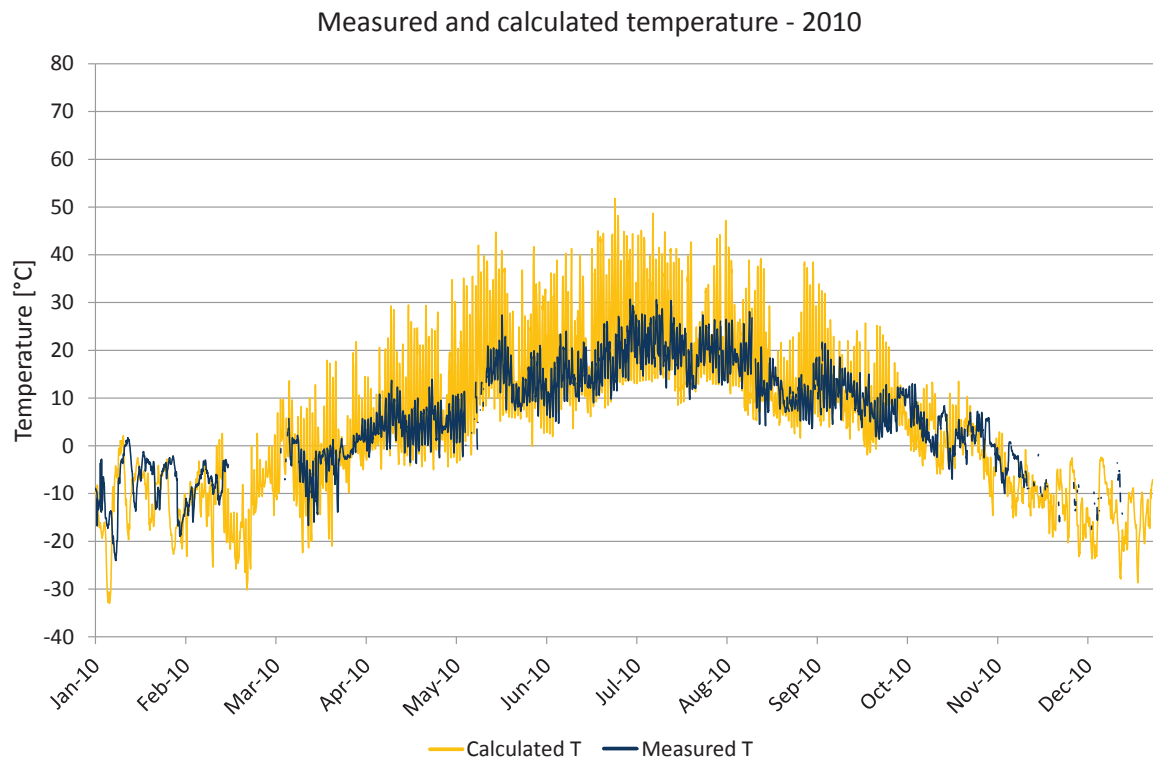


Figure 9.J.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

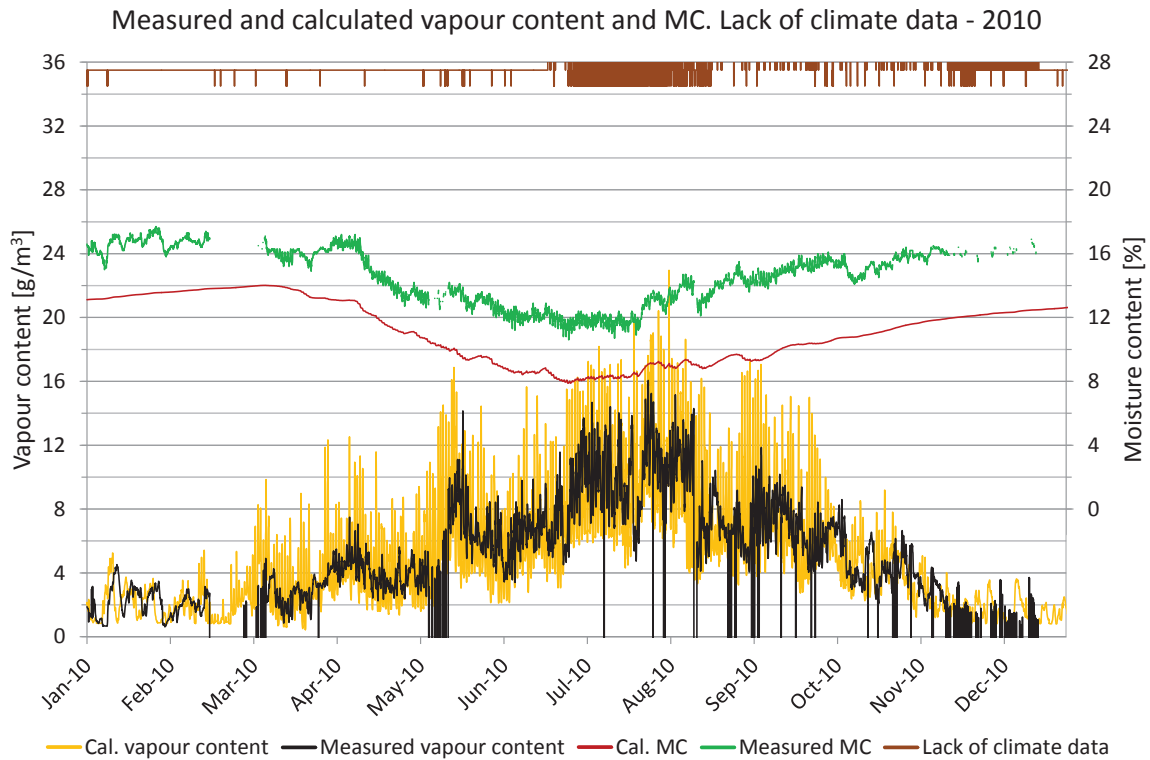


Figure 9.J.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

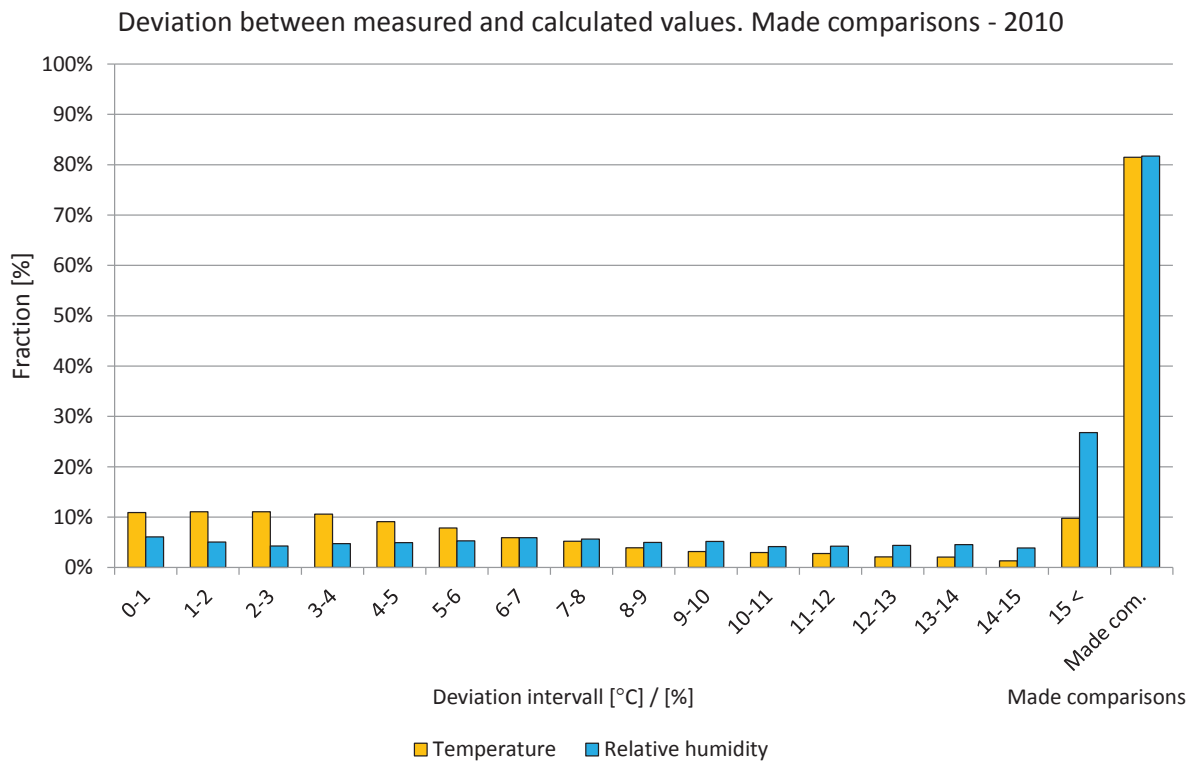


Figure 9.J.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

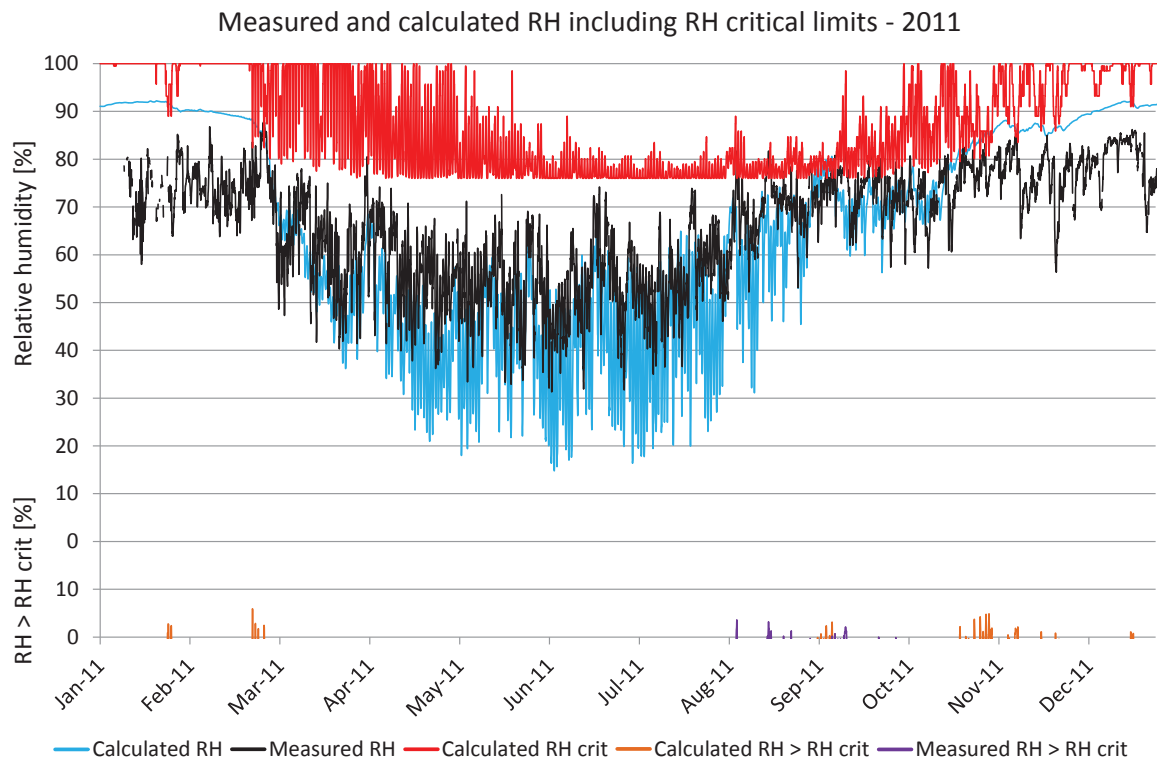


Figure 9.J.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

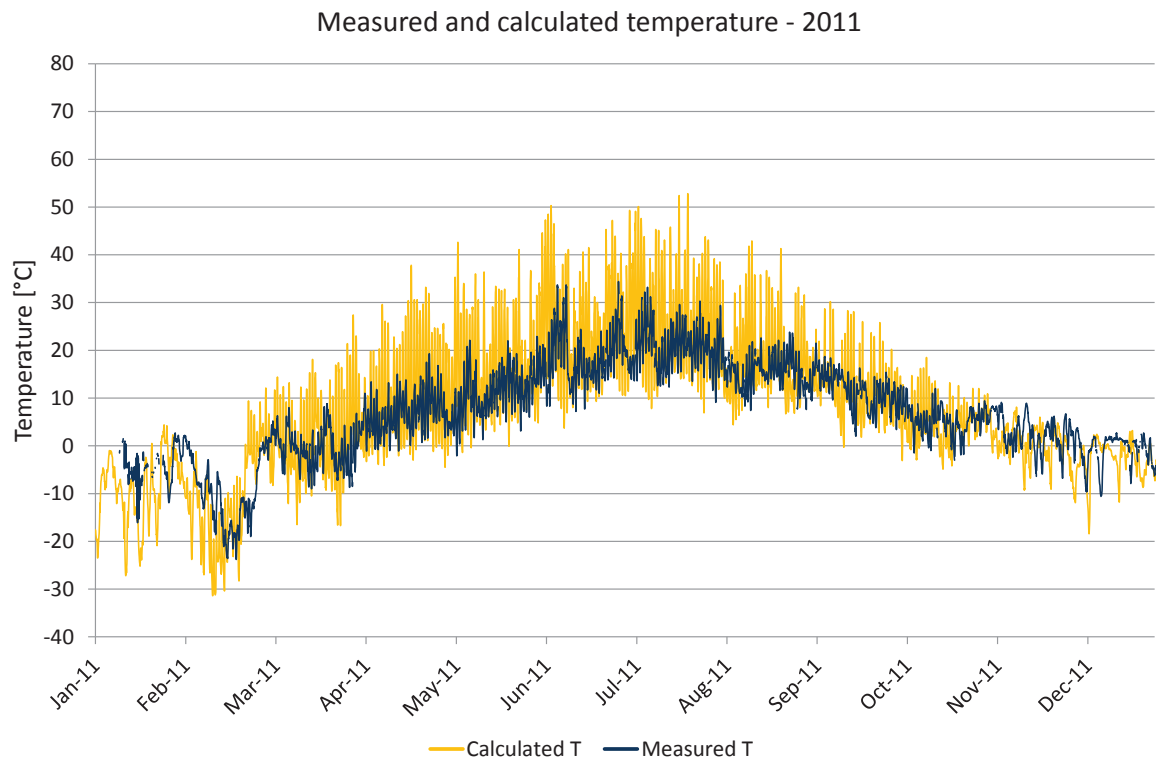


Figure 9.J.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

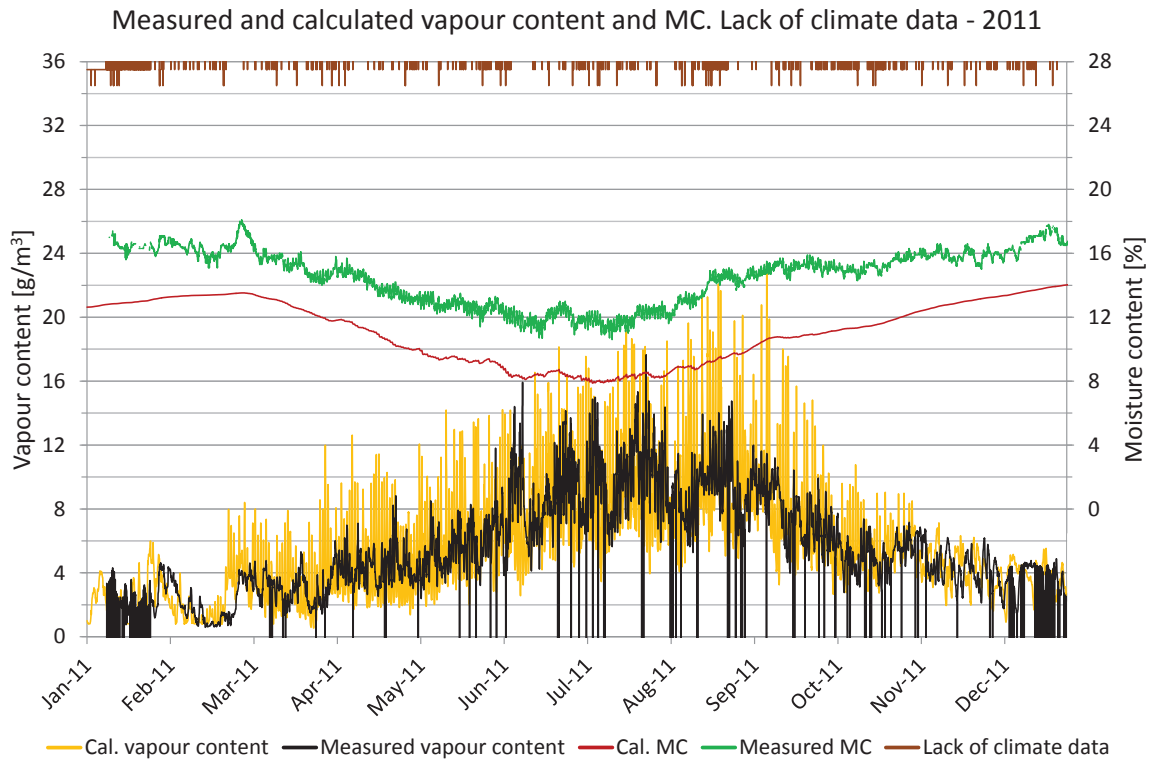


Figure 9.J.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

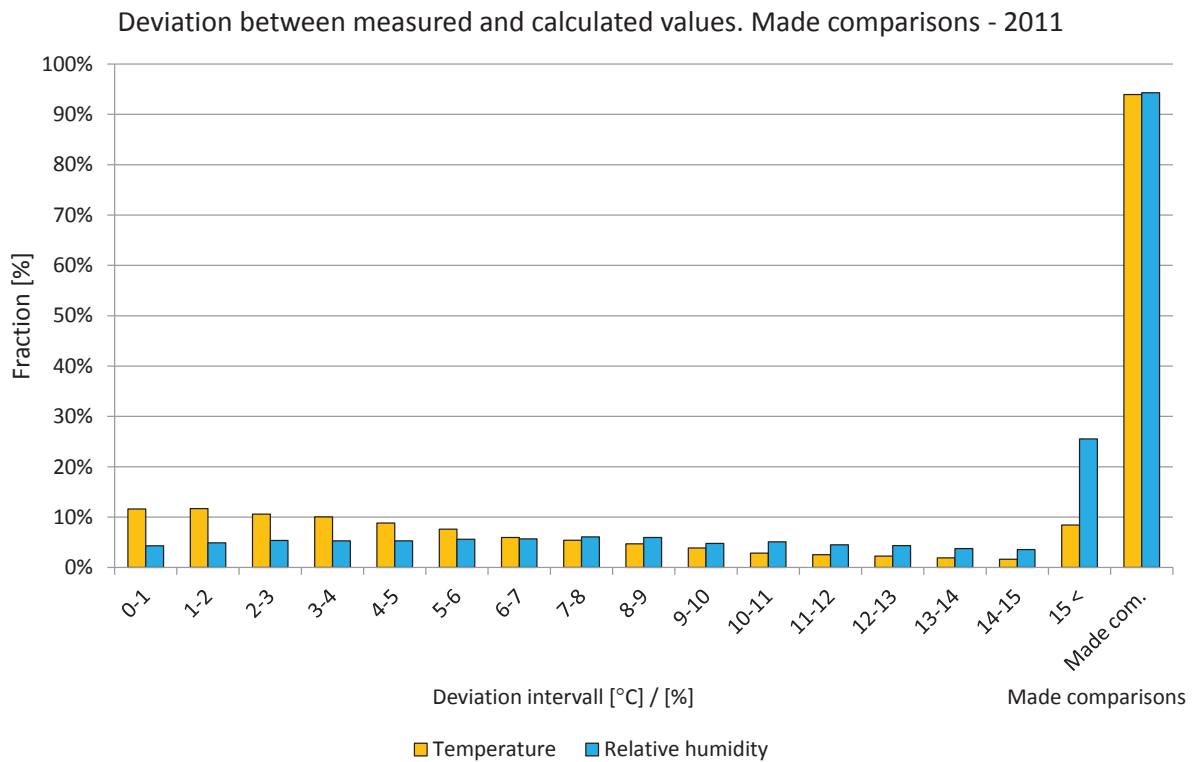


Figure 9.J.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

10 Results – Parallel roof on top of the seventh floor

10.K Position K

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the parallel roof with 14 degrees roof angle facing north above the seventh floor.

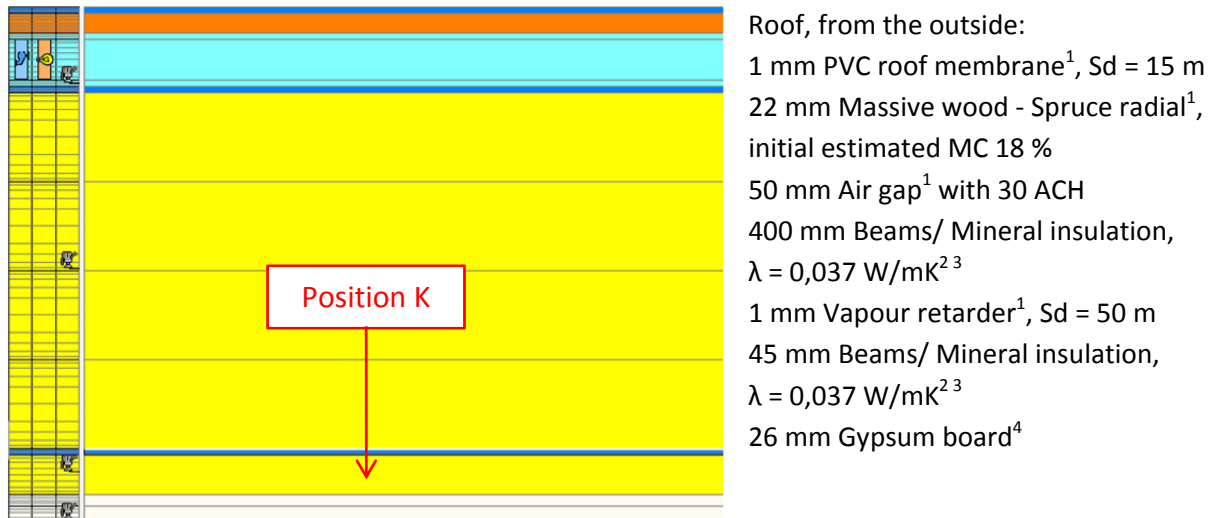


Figure 9.K.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996.

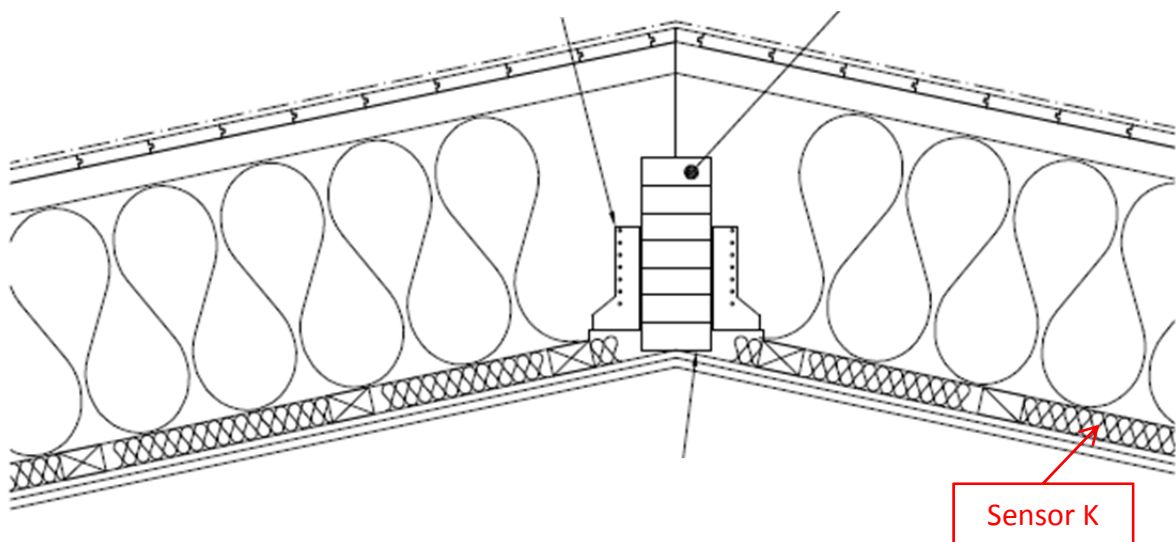


Figure 9.K.2. Location of the studied position.

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 2009

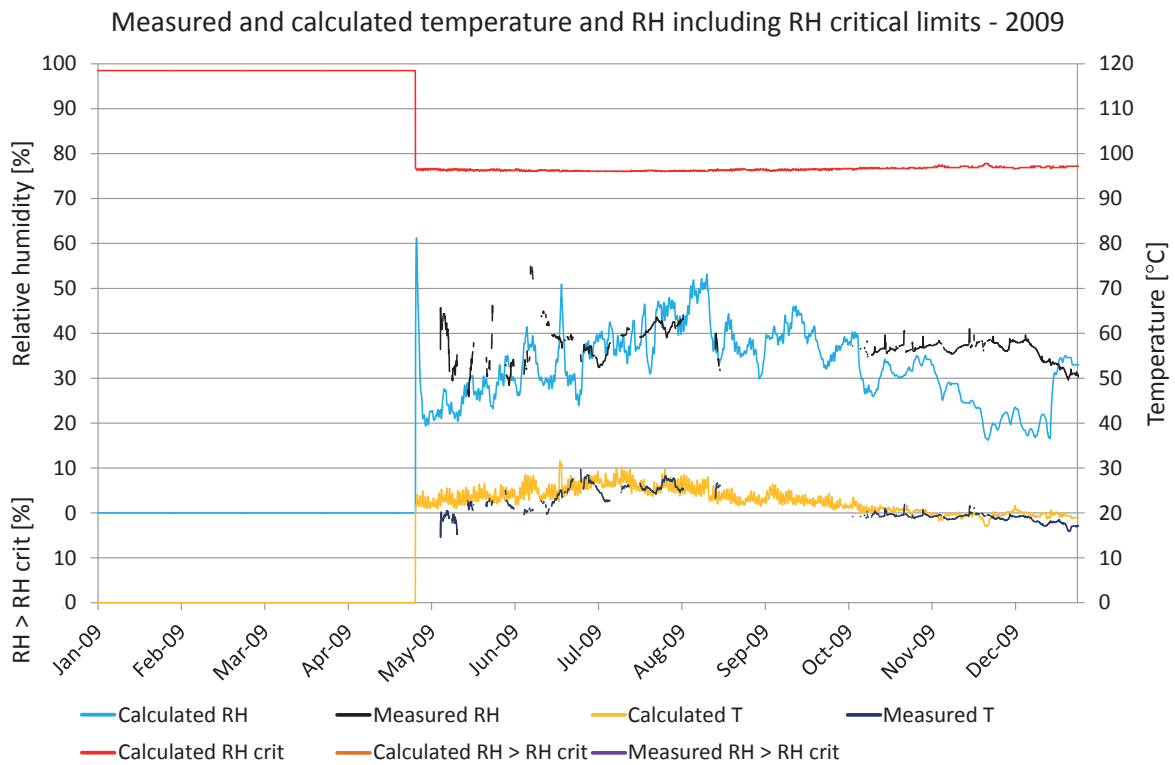


Figure 9.K.3. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

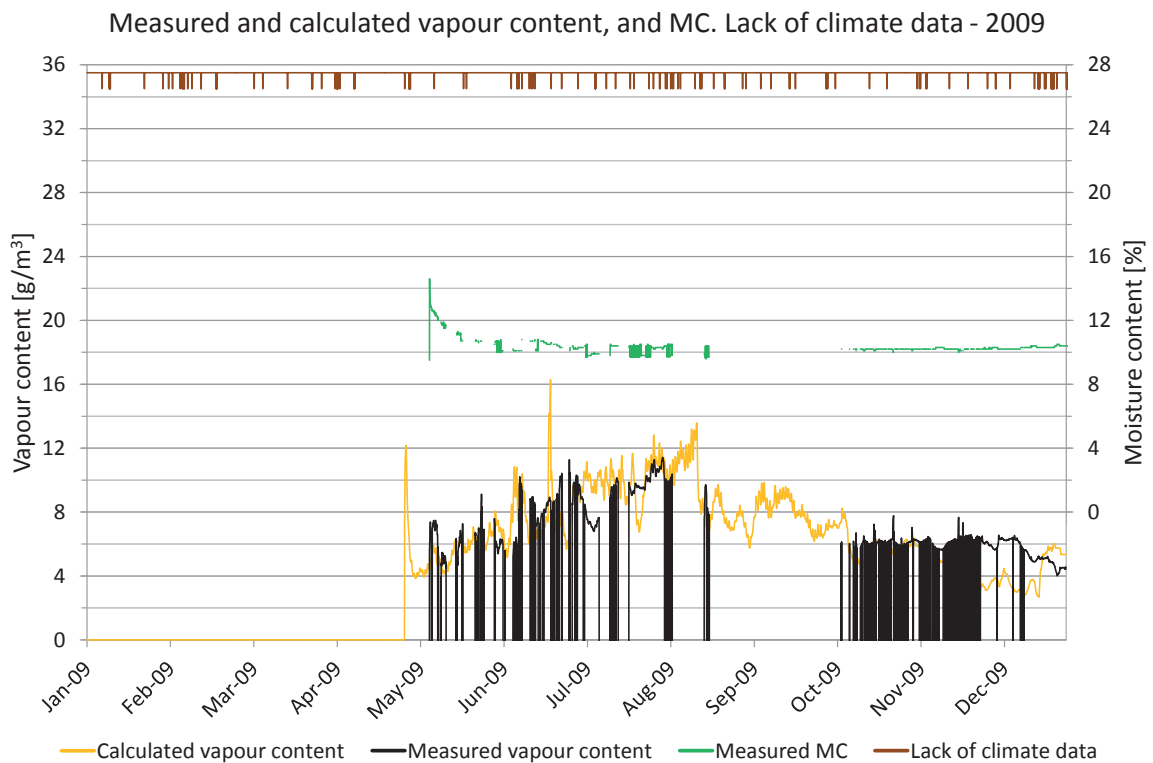


Figure 9.K.4. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

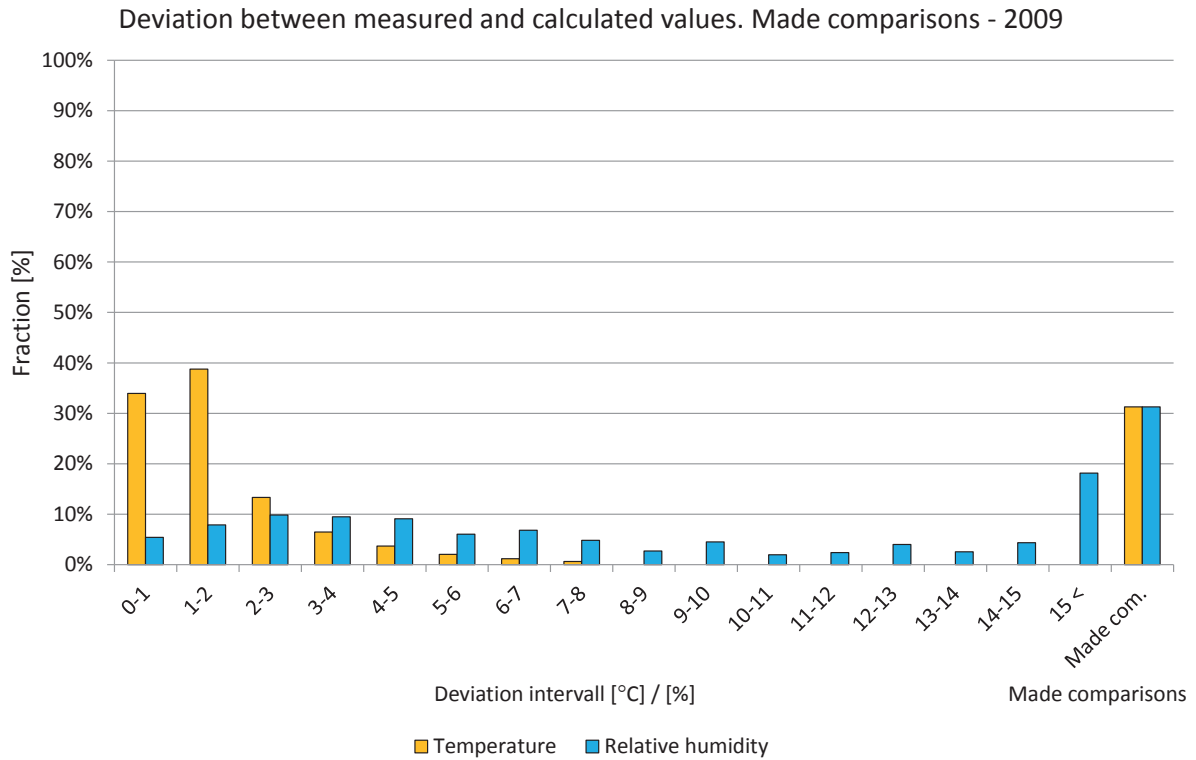


Figure 9.K.5. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

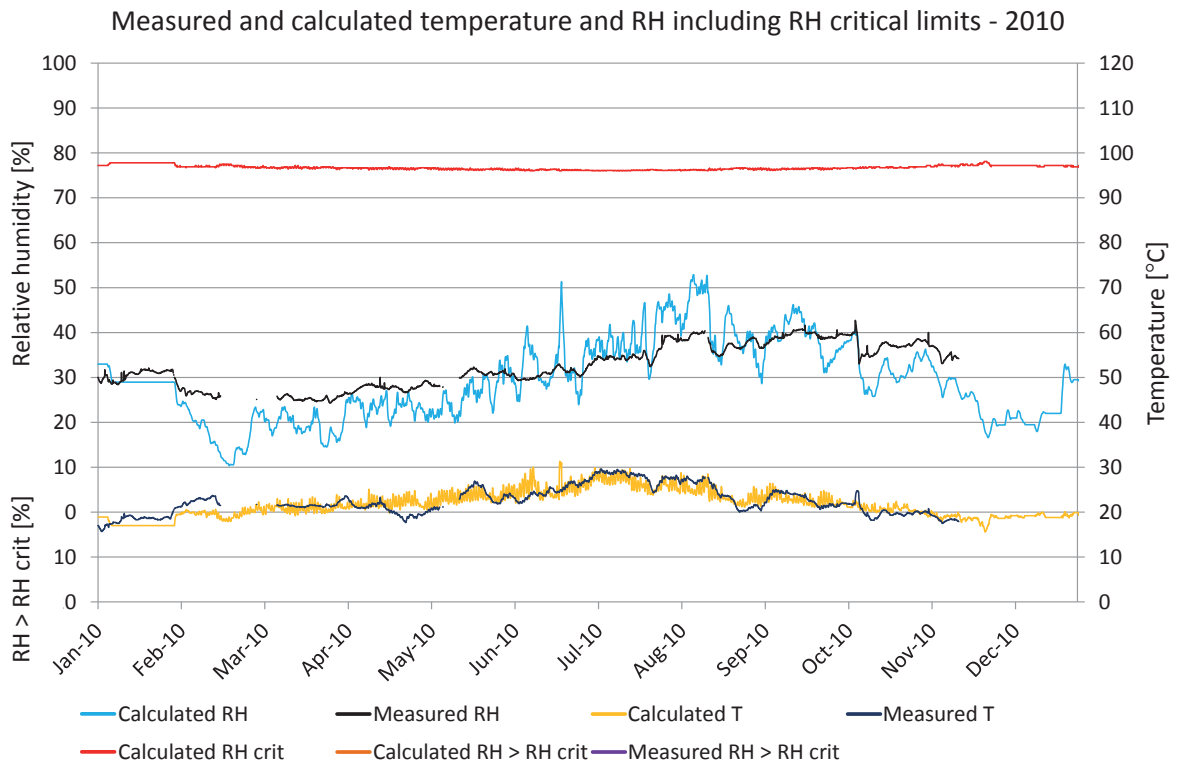


Figure 9.K.6. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

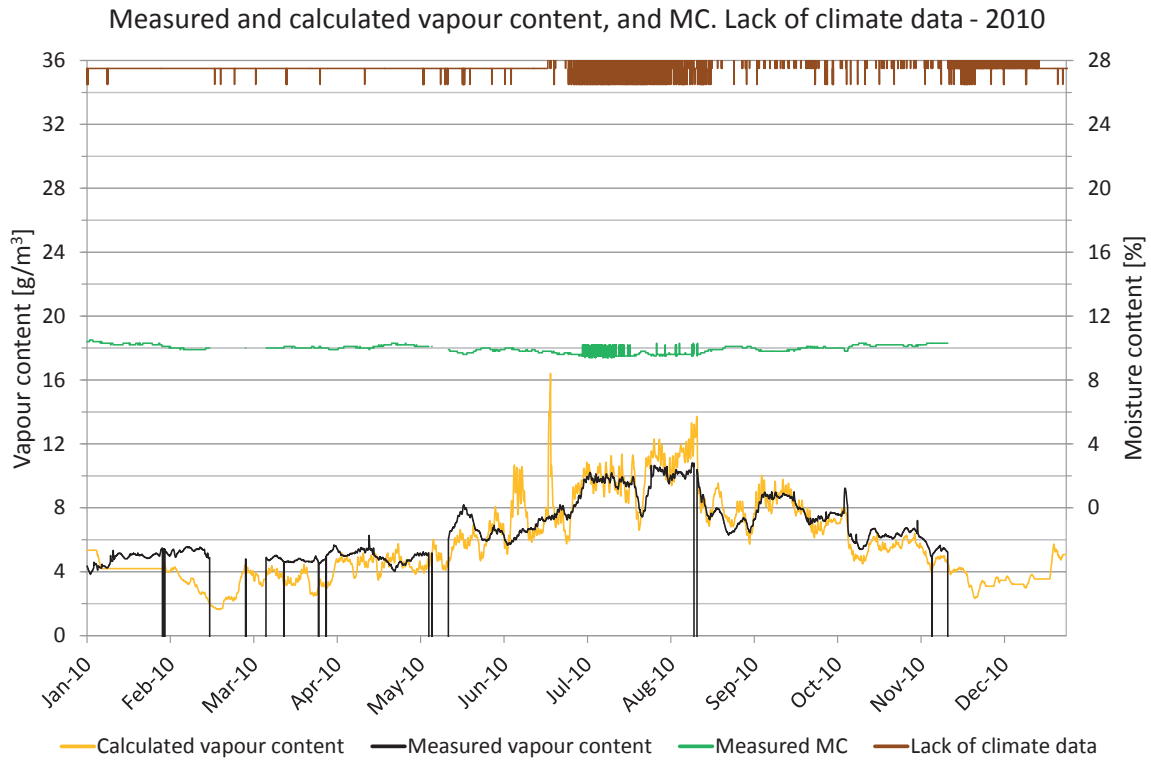


Figure 9.K.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

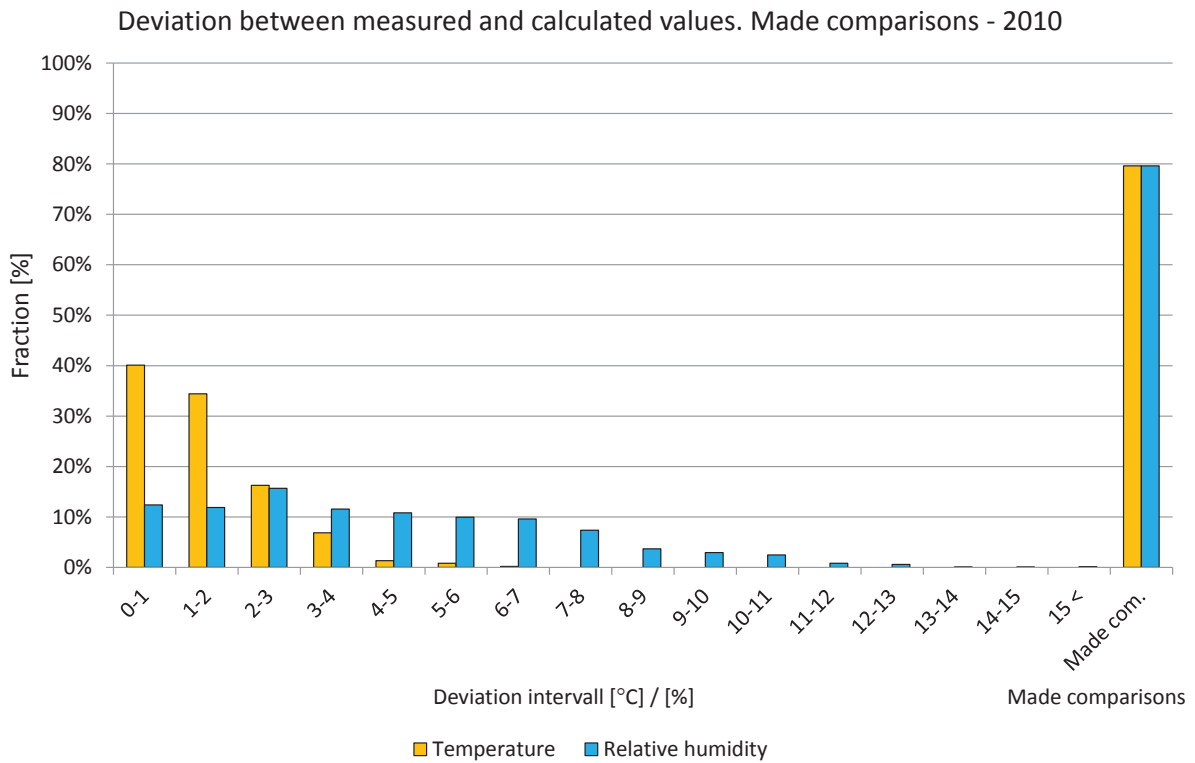


Figure 9.K.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

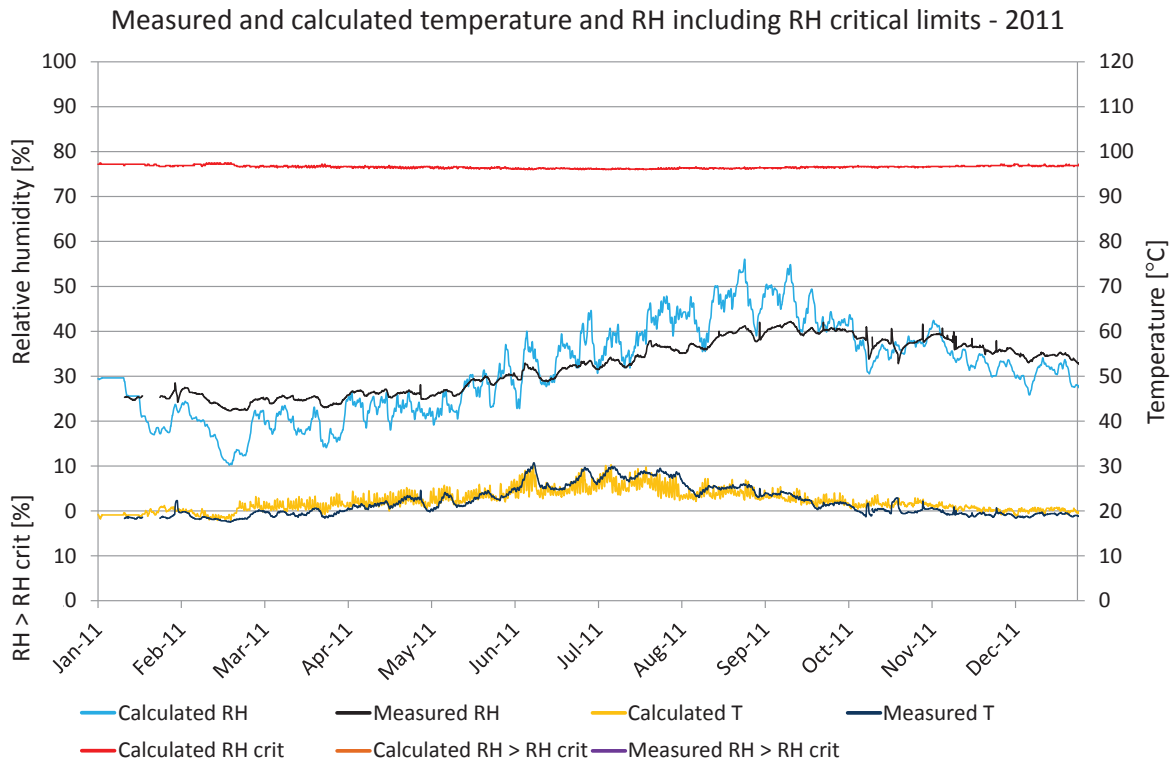


Figure 9.K.9. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

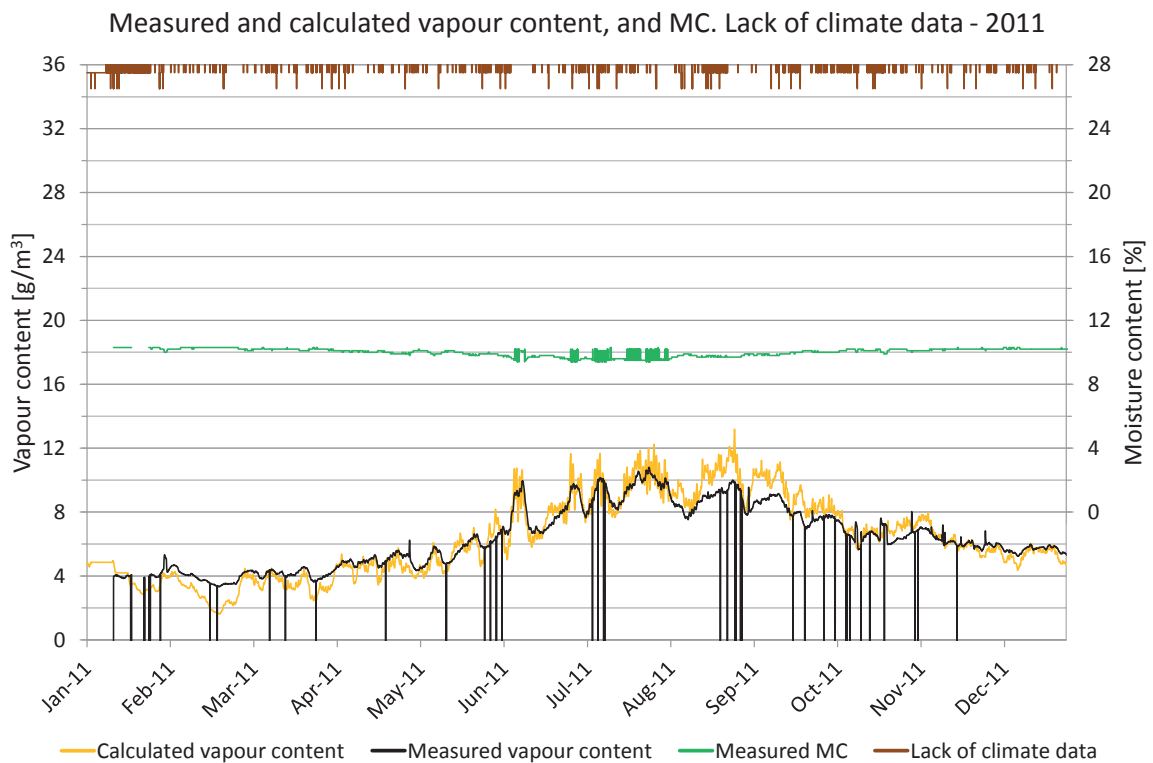


Figure 9.K.10. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

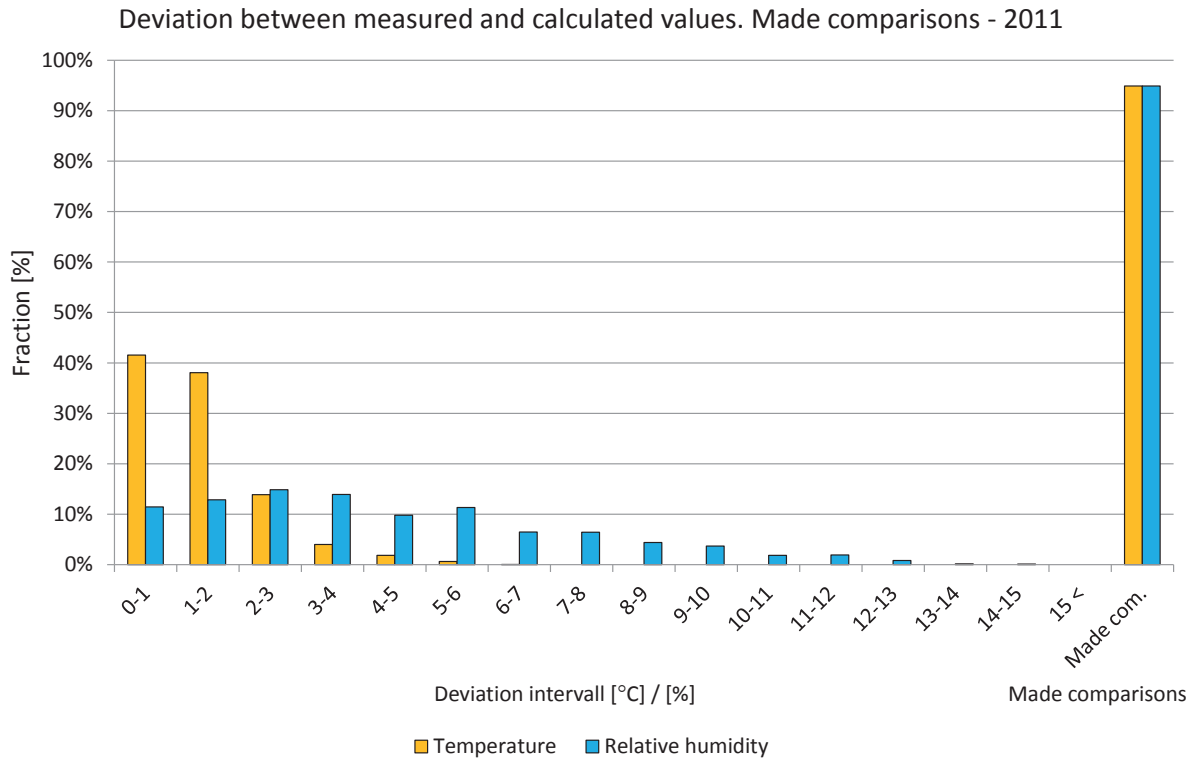


Figure 9.K.11. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

10.L Position L

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the parallel roof with 14 degrees roof angle facing north above the seventh floor.

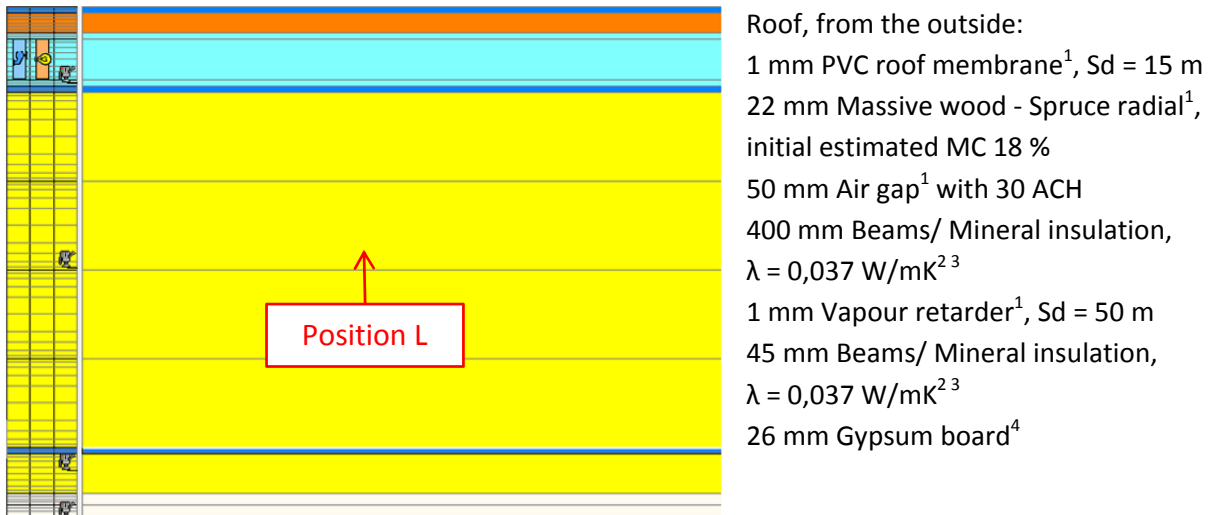


Figure 9.K.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996.

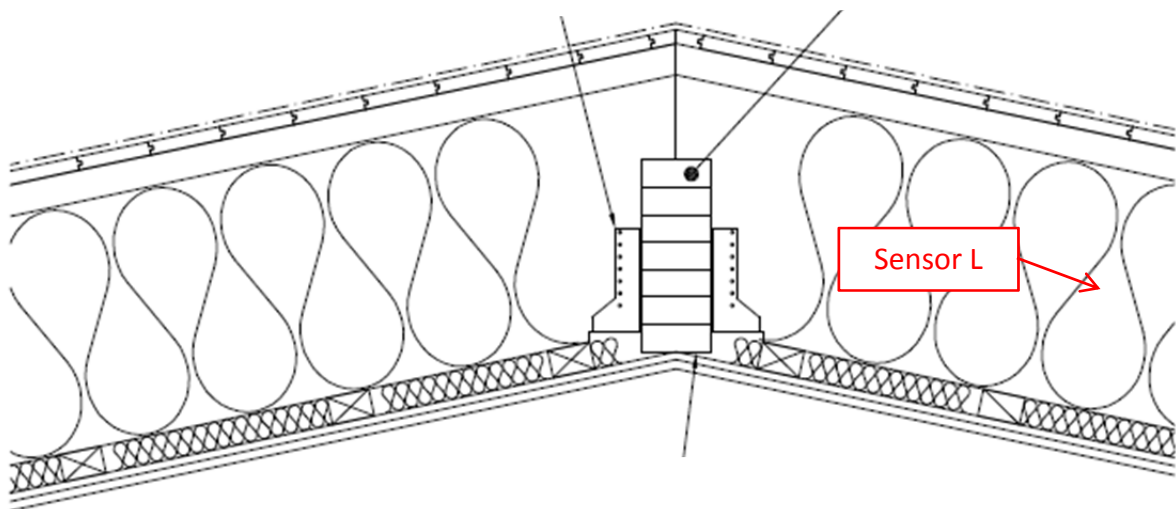


Figure 9.L.2. Location of the studied position.

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 2009

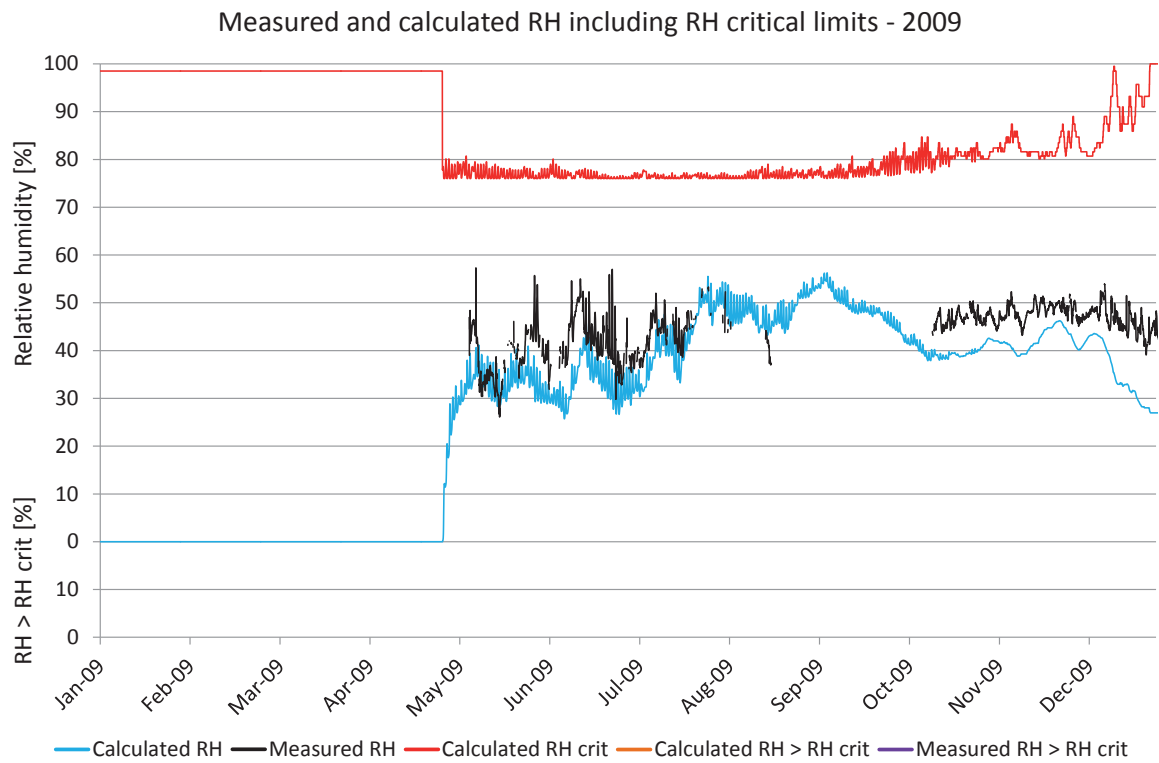


Figure 9.L.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

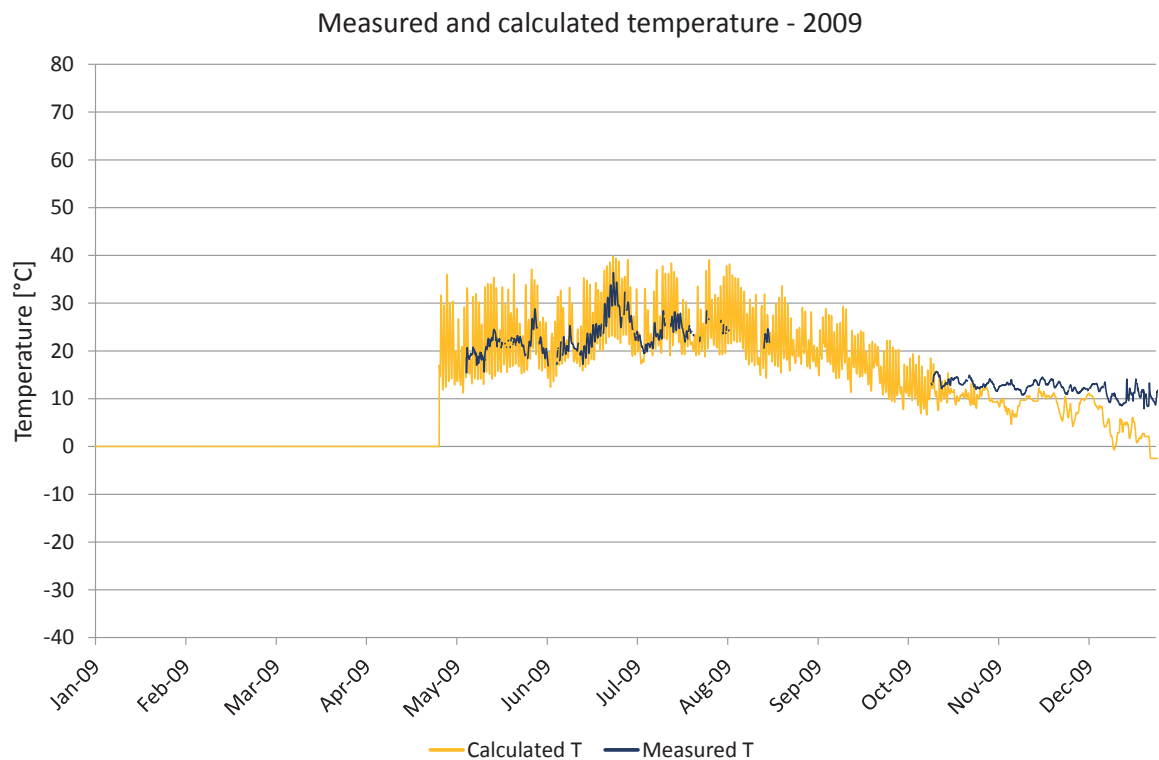


Figure 9.L.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

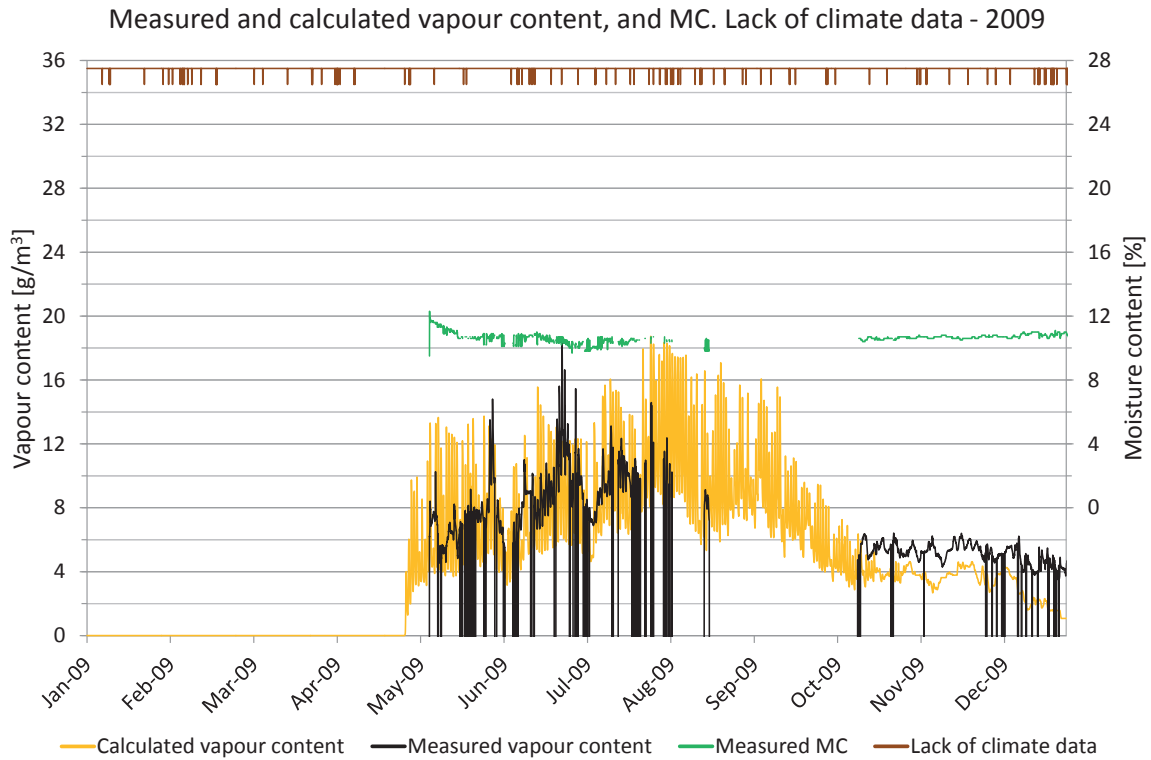


Figure 9.L.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

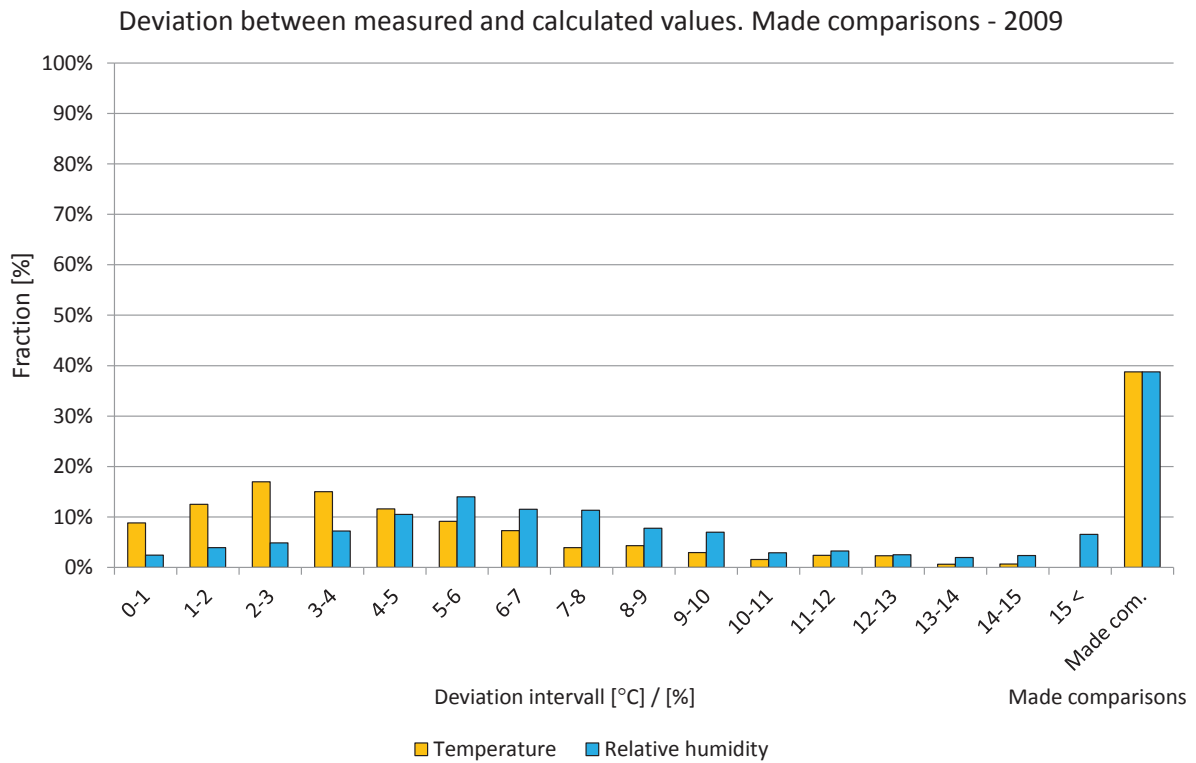


Figure 9.L.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

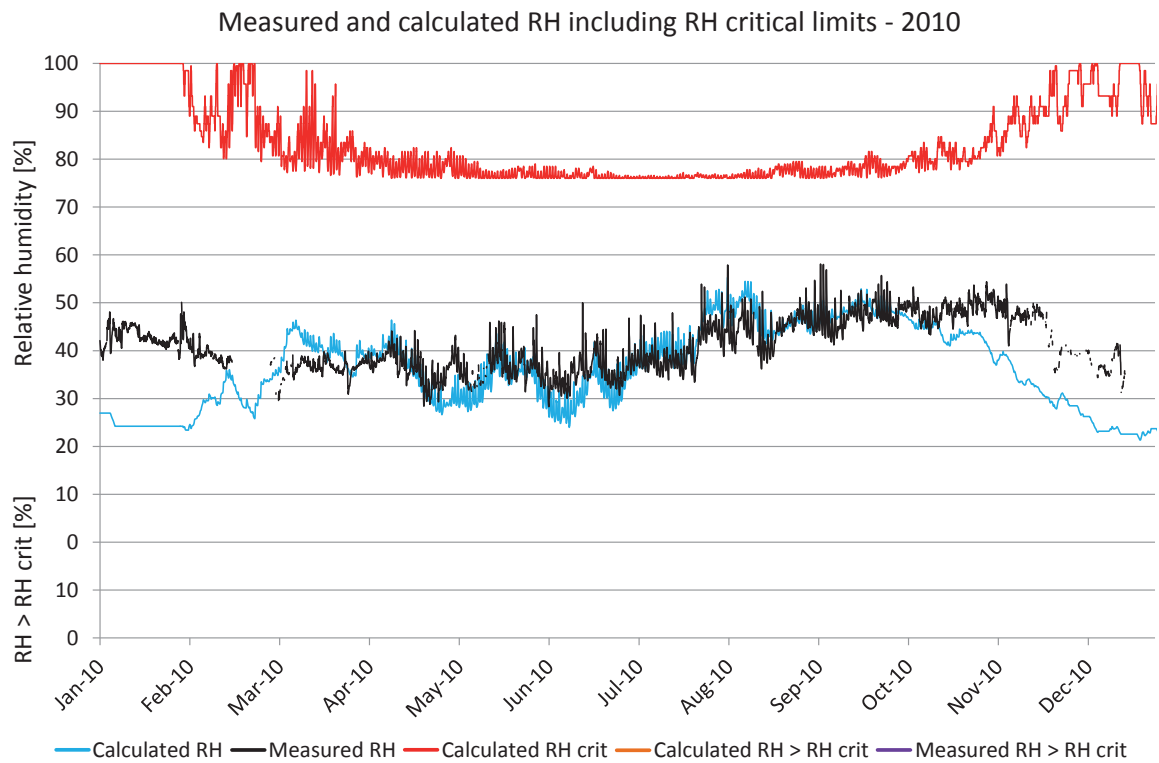


Figure 9.L.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

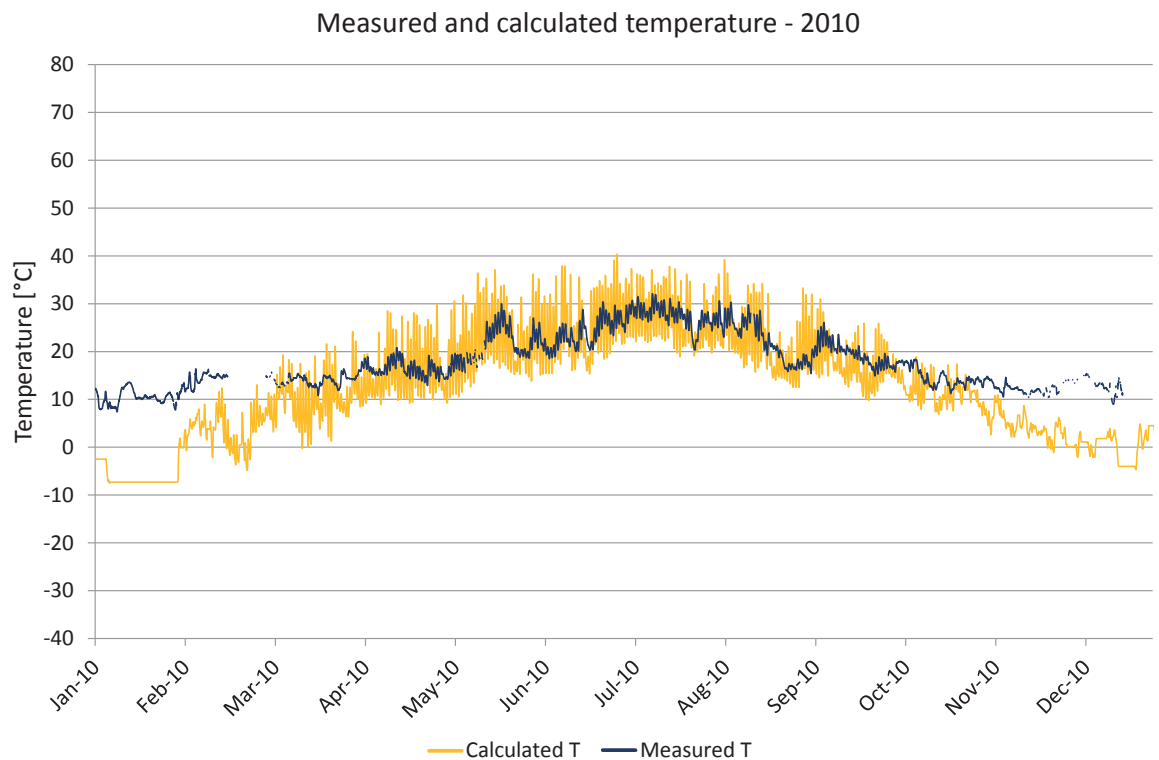


Figure 9.L.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

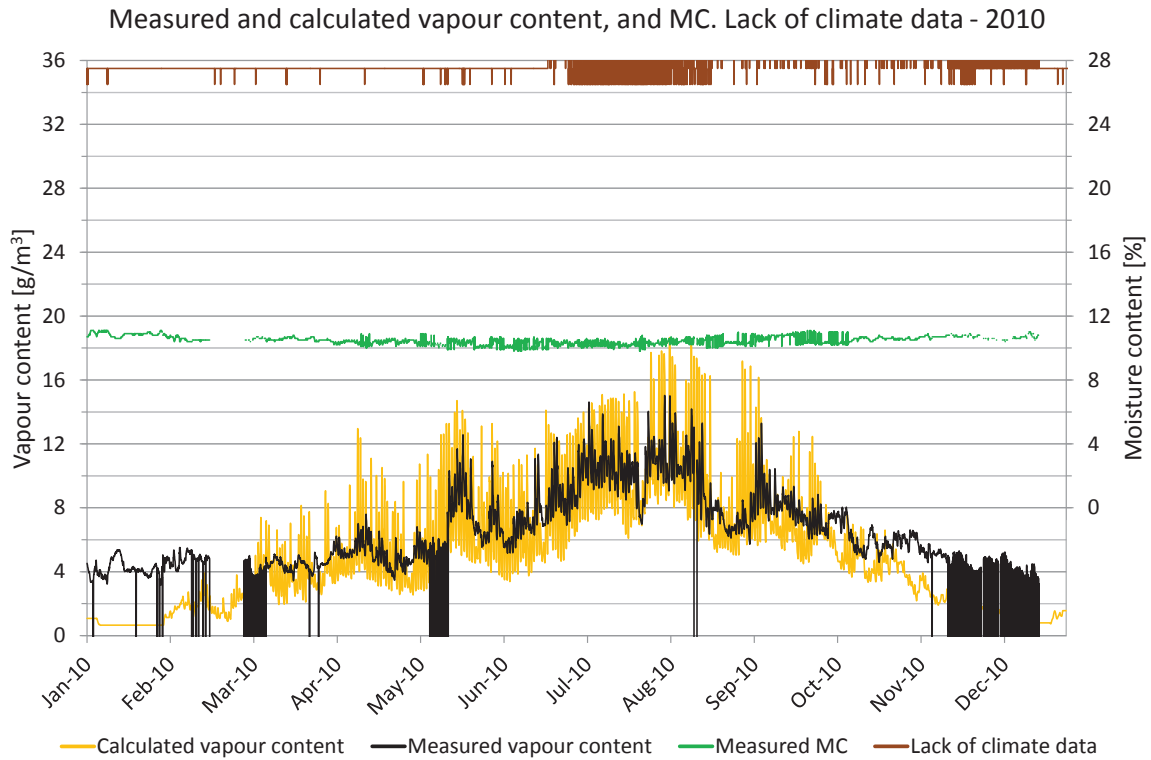


Figure 9.L.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

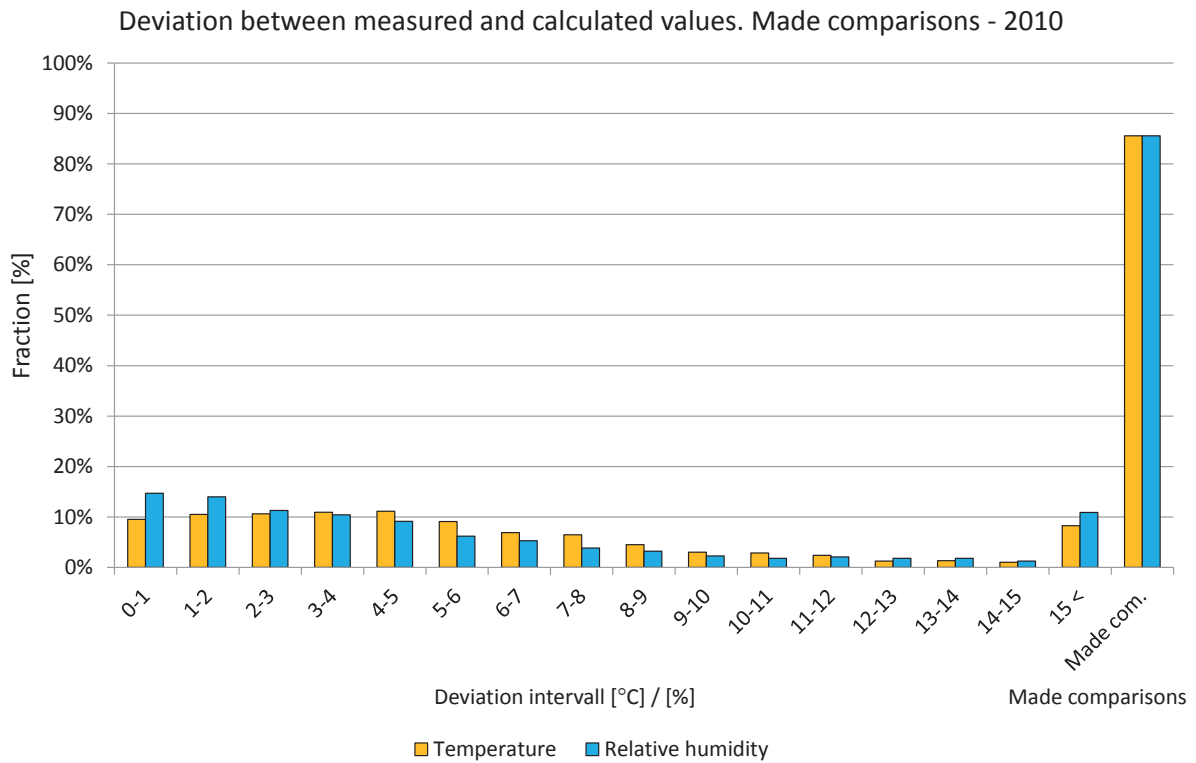


Figure 9.L.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

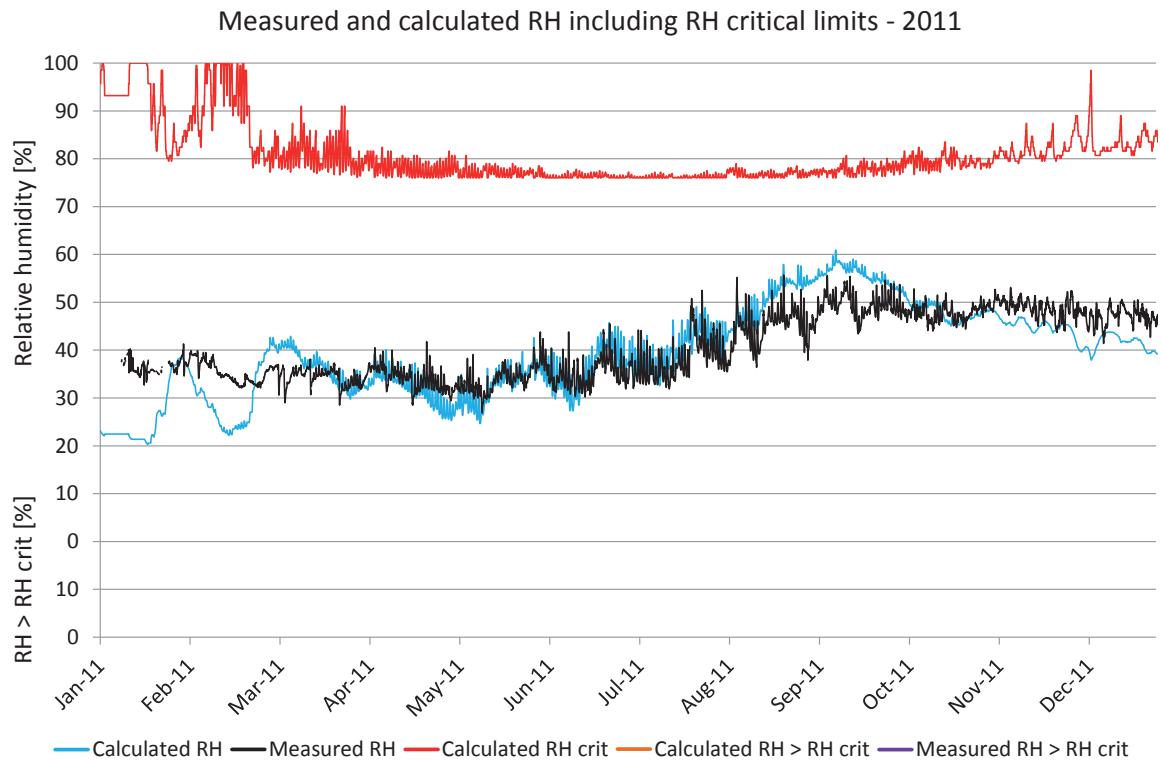


Figure 9.L.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

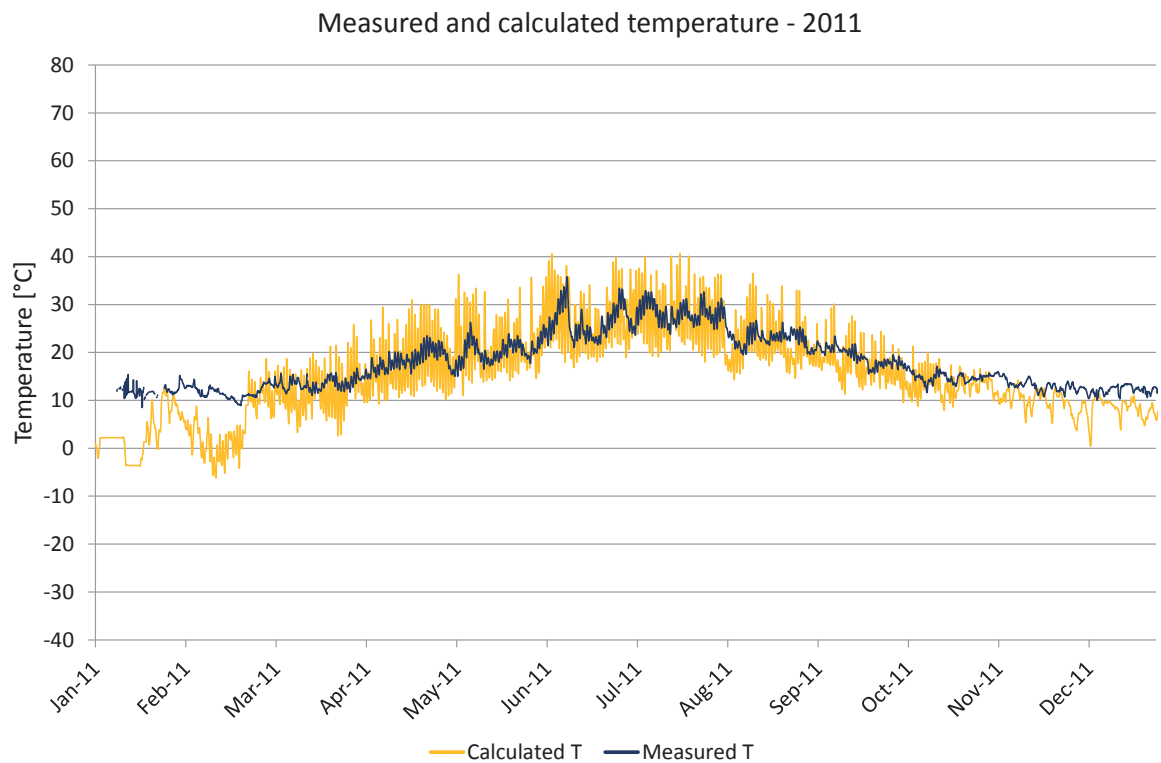


Figure 9.L.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

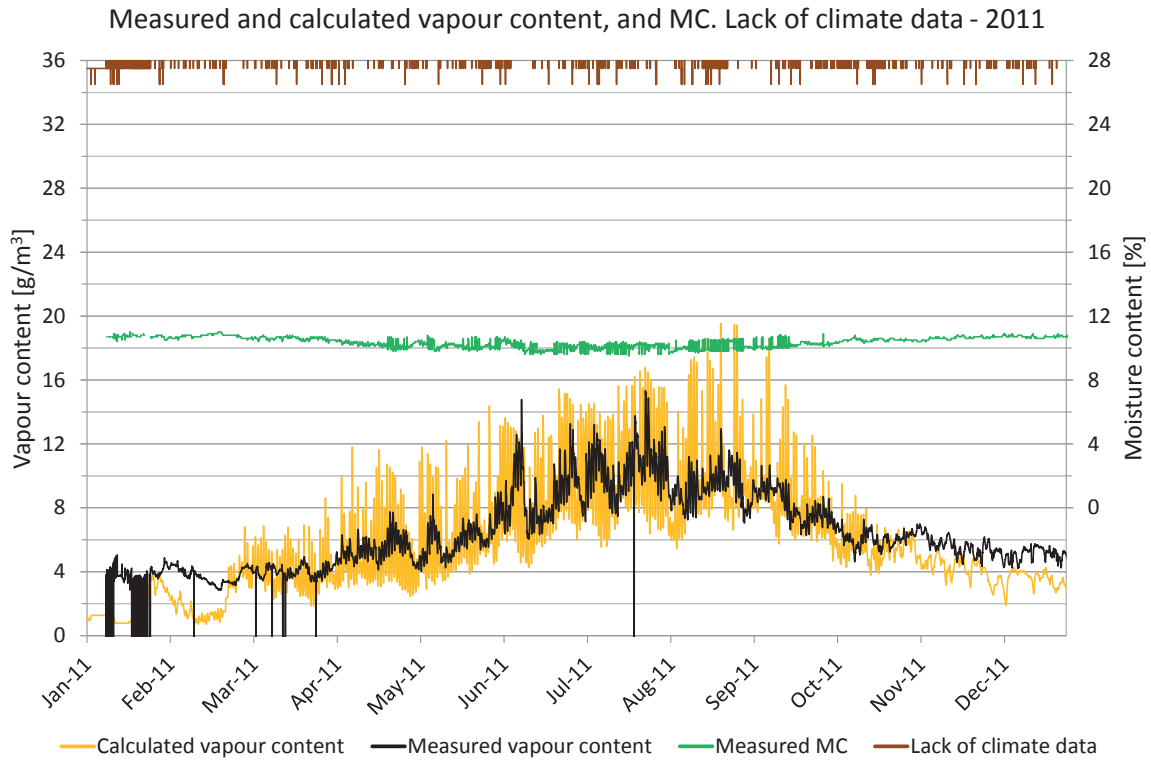


Figure 9.L.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

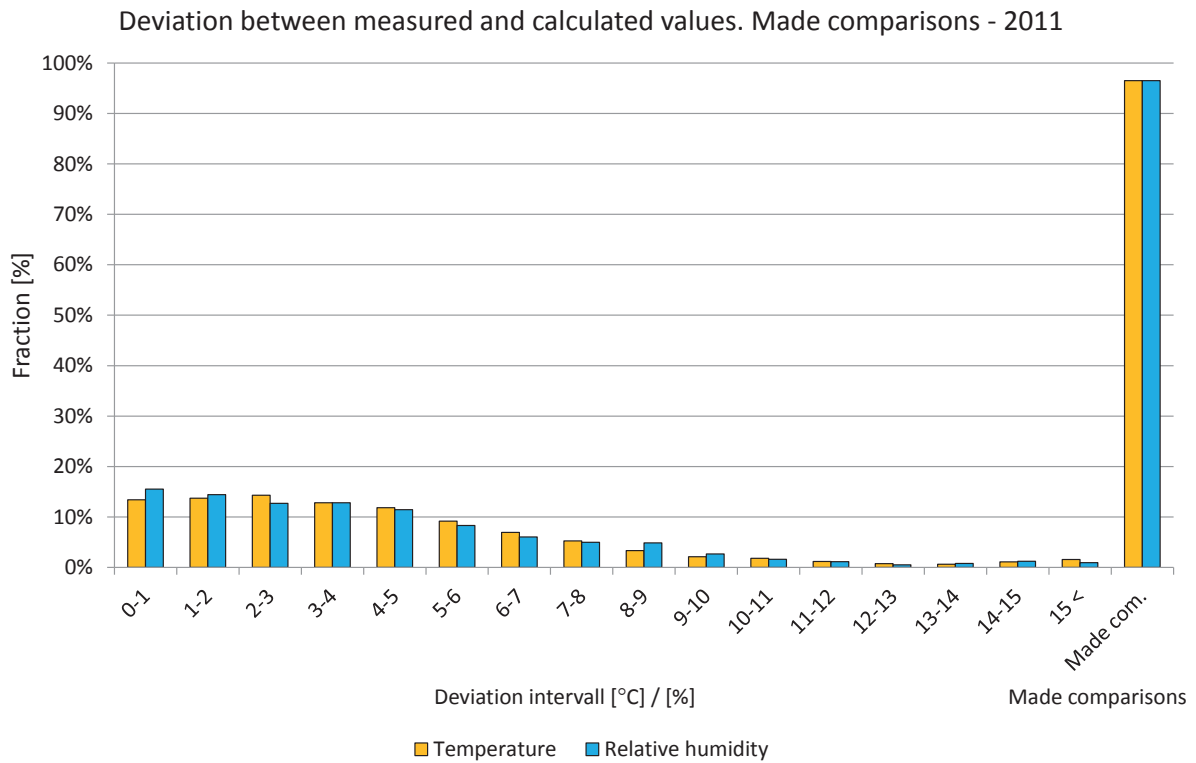


Figure 9.L.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

10.M Position M

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the parallel roof with 14 degrees roof angle facing south above the seventh floor.

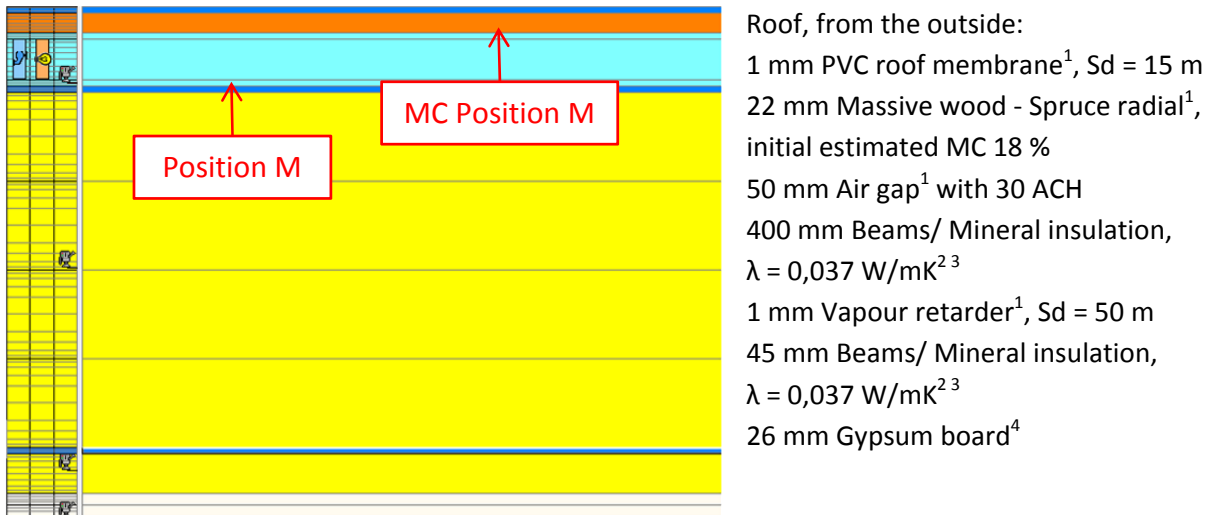


Figure 9.K.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996.

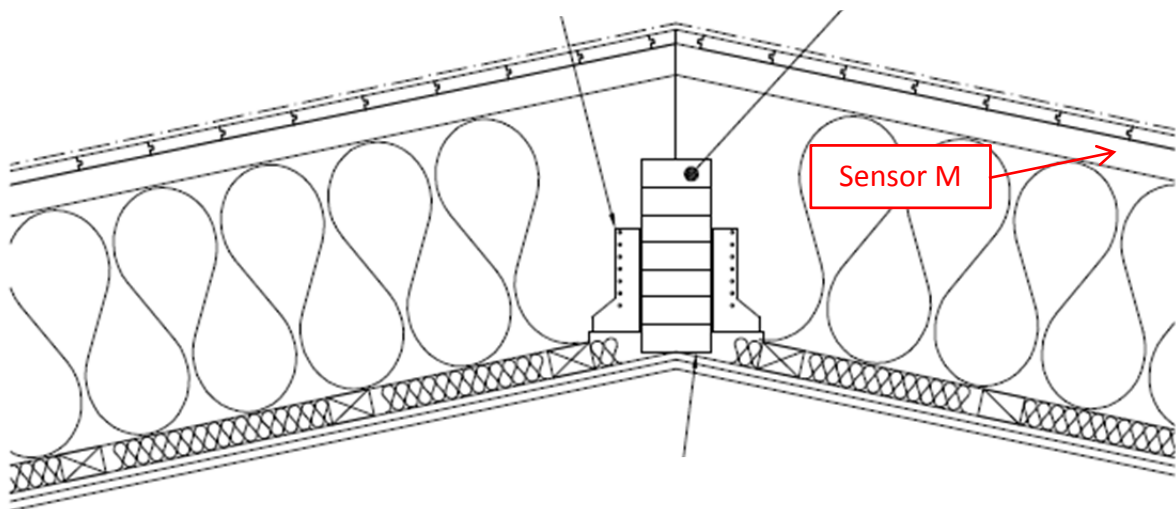


Figure 9.M.2. Location of the studied position.

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 2009

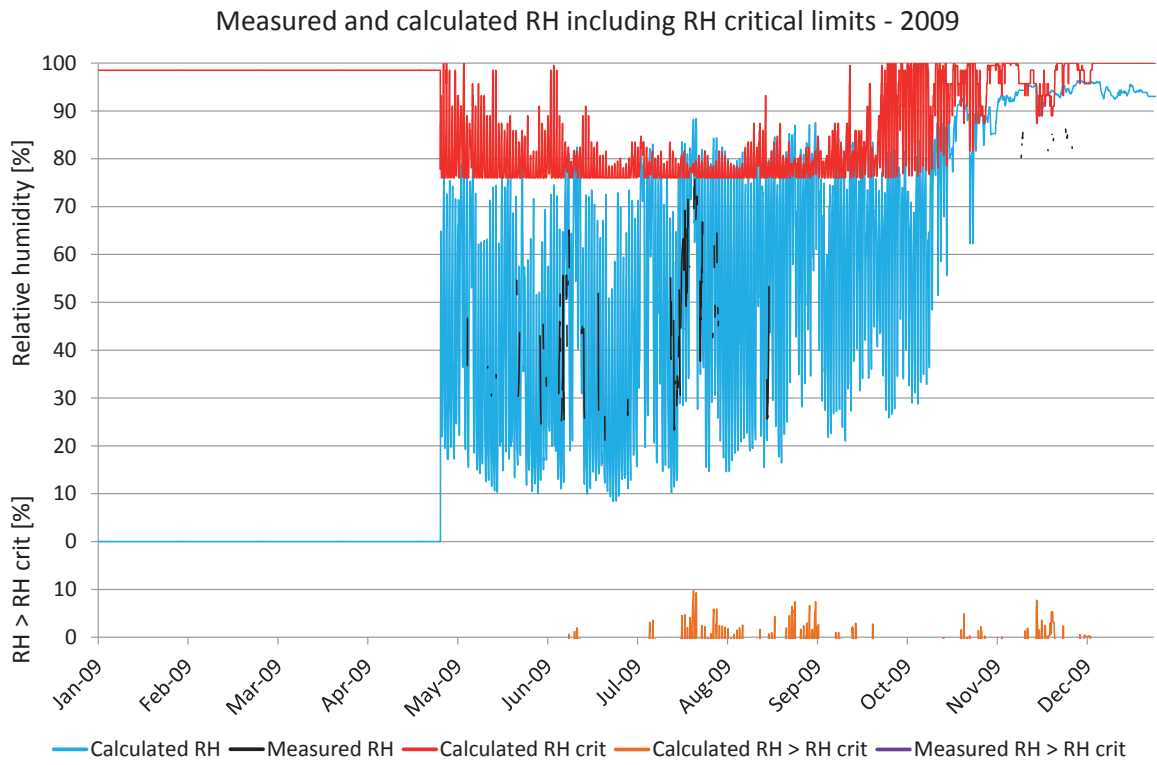


Figure 9.M.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

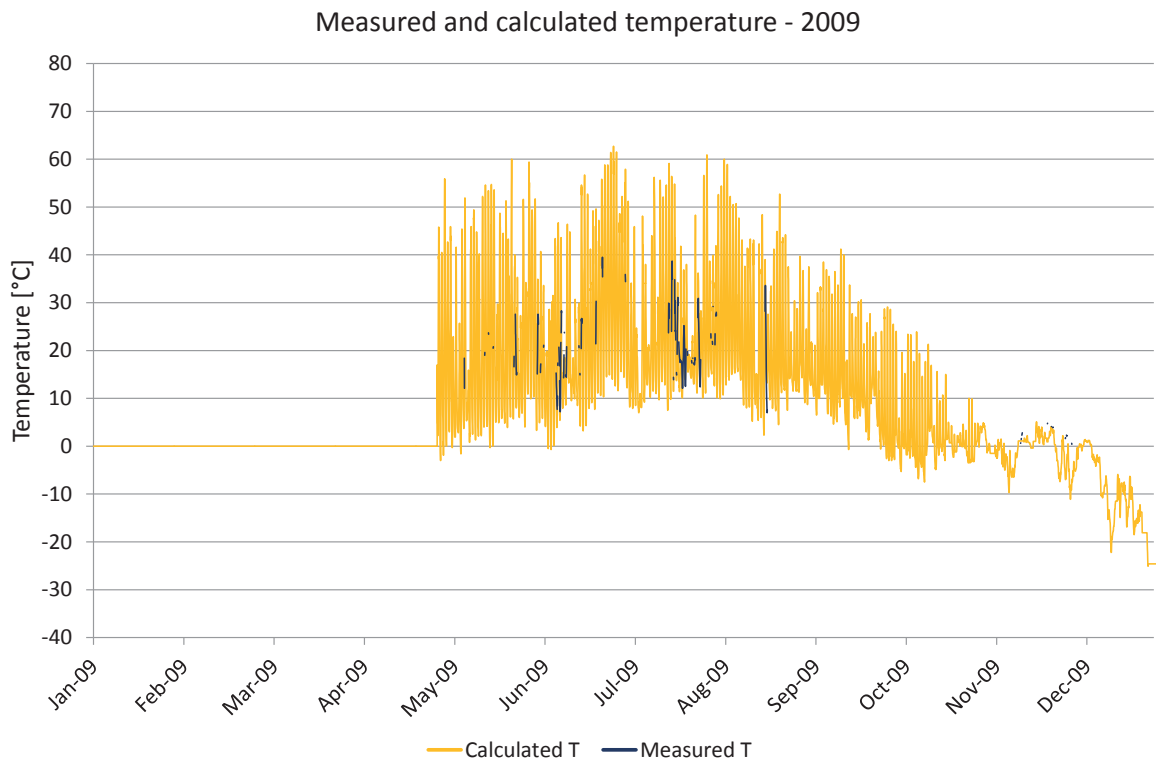


Figure 9.M.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

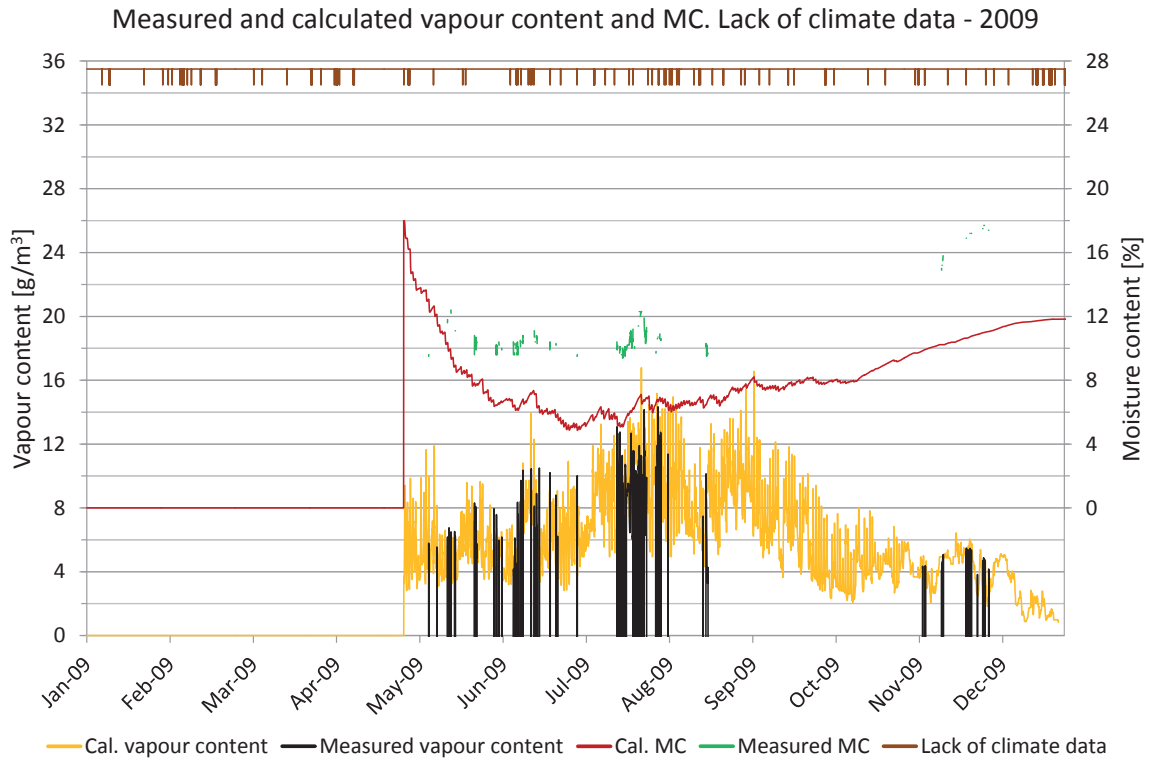


Figure 9.M.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

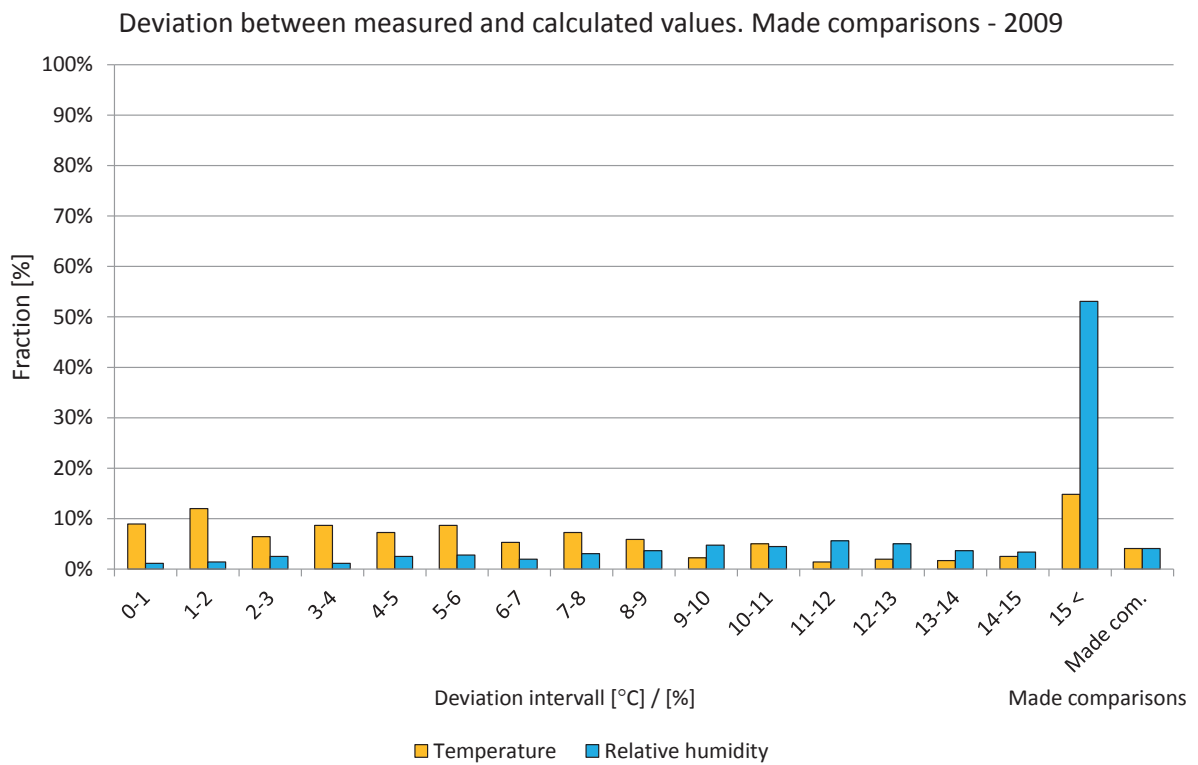


Figure 9.M.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

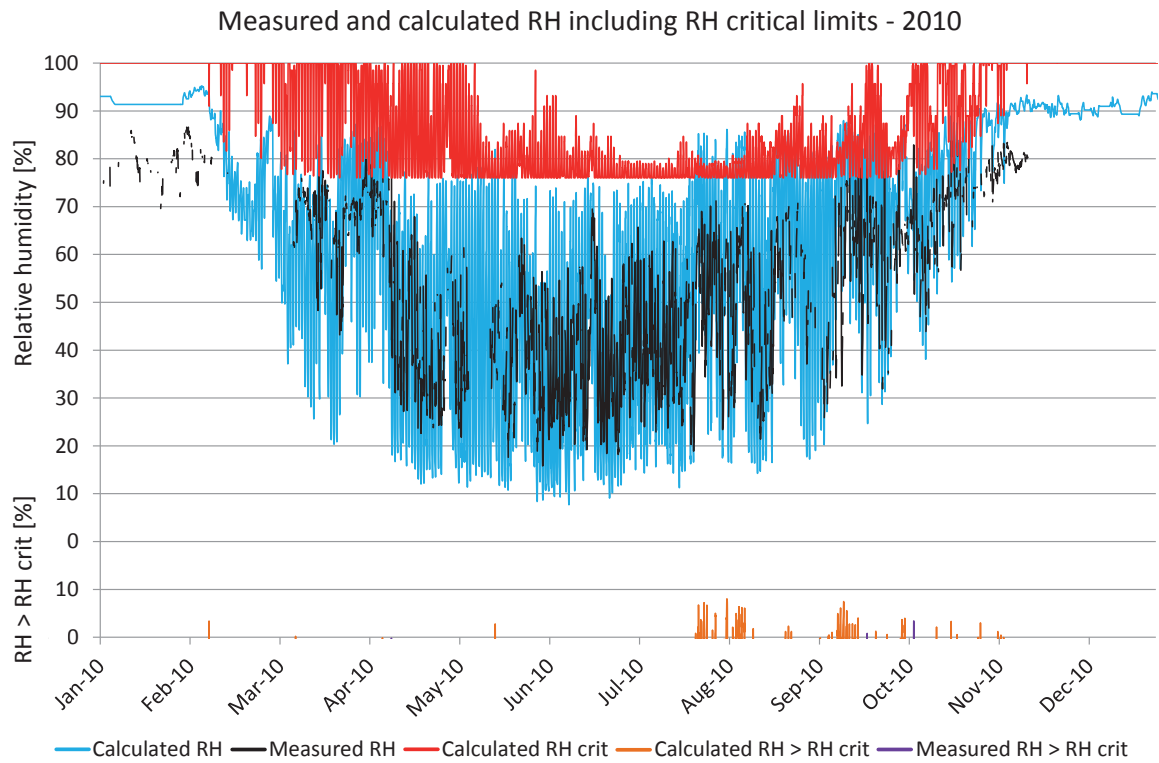


Figure 9.M.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

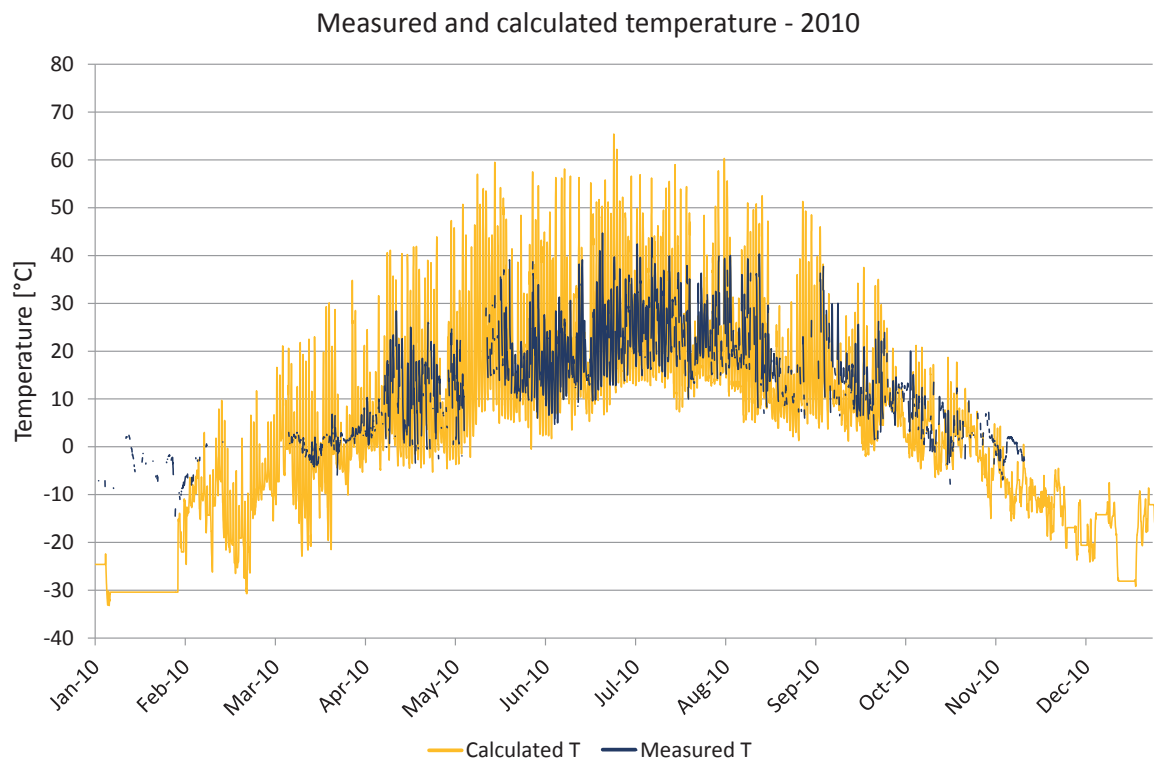


Figure 9.M.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

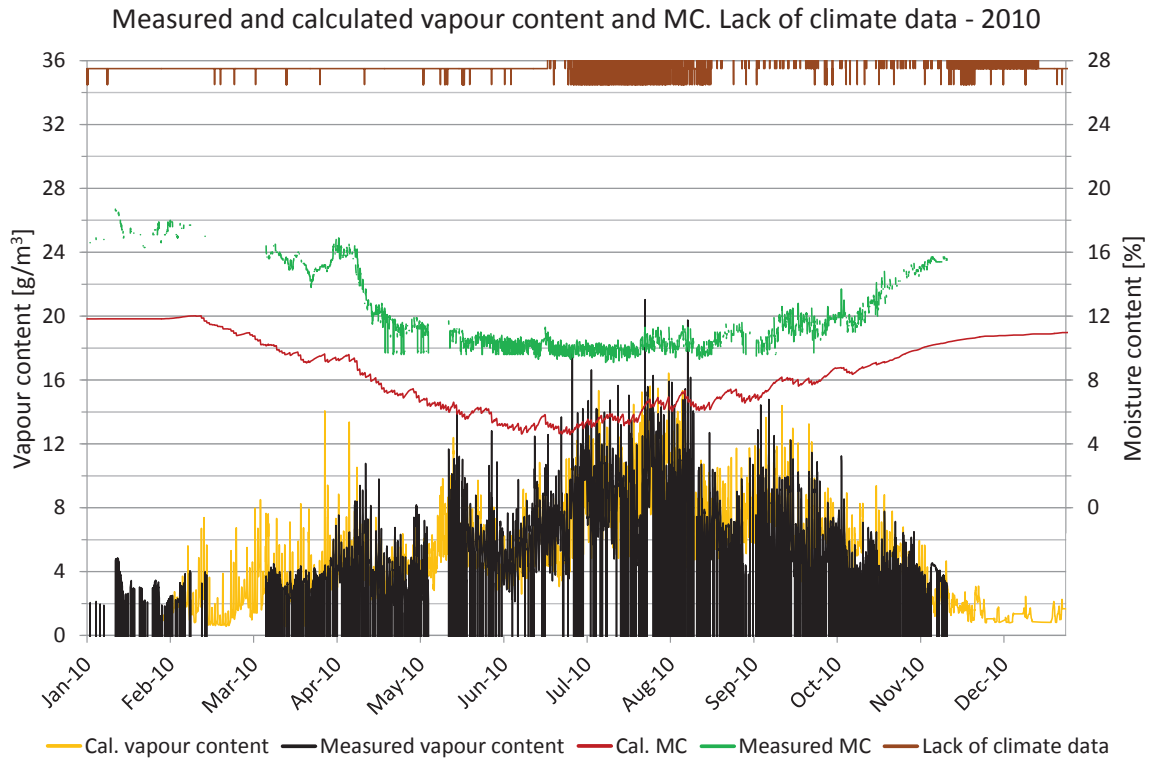


Figure 9.M.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

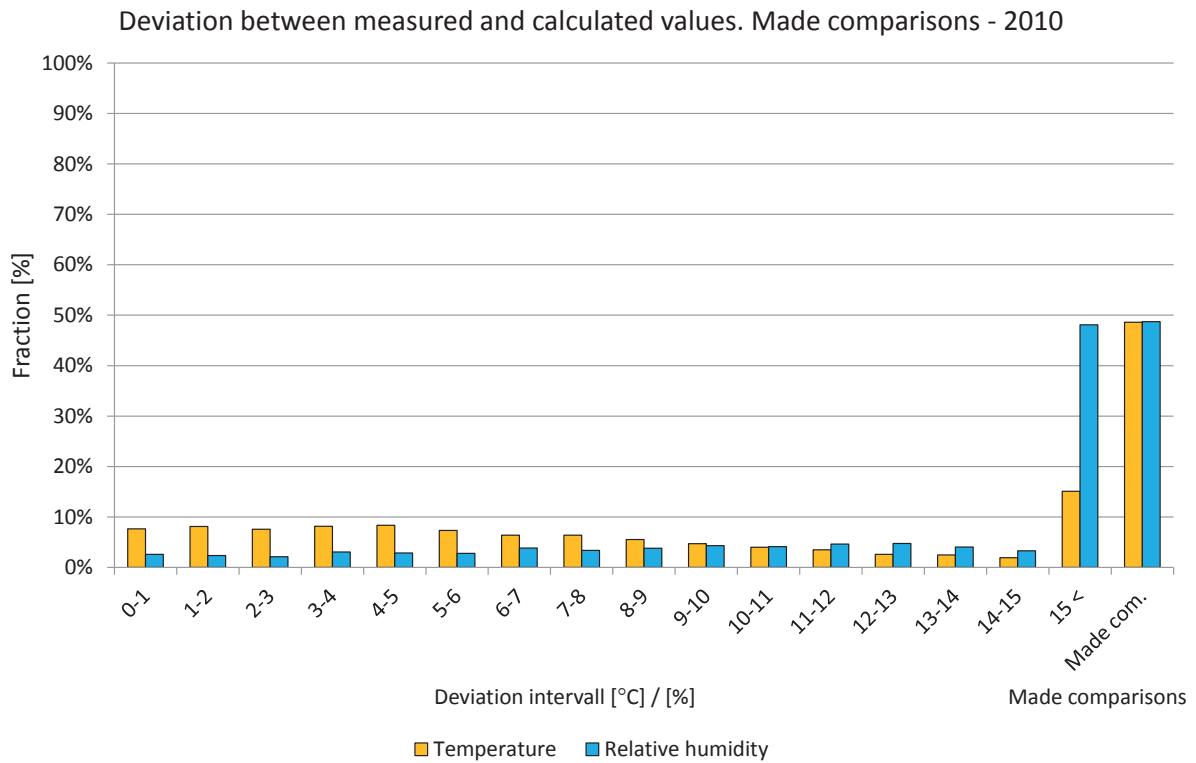


Figure 9.M.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

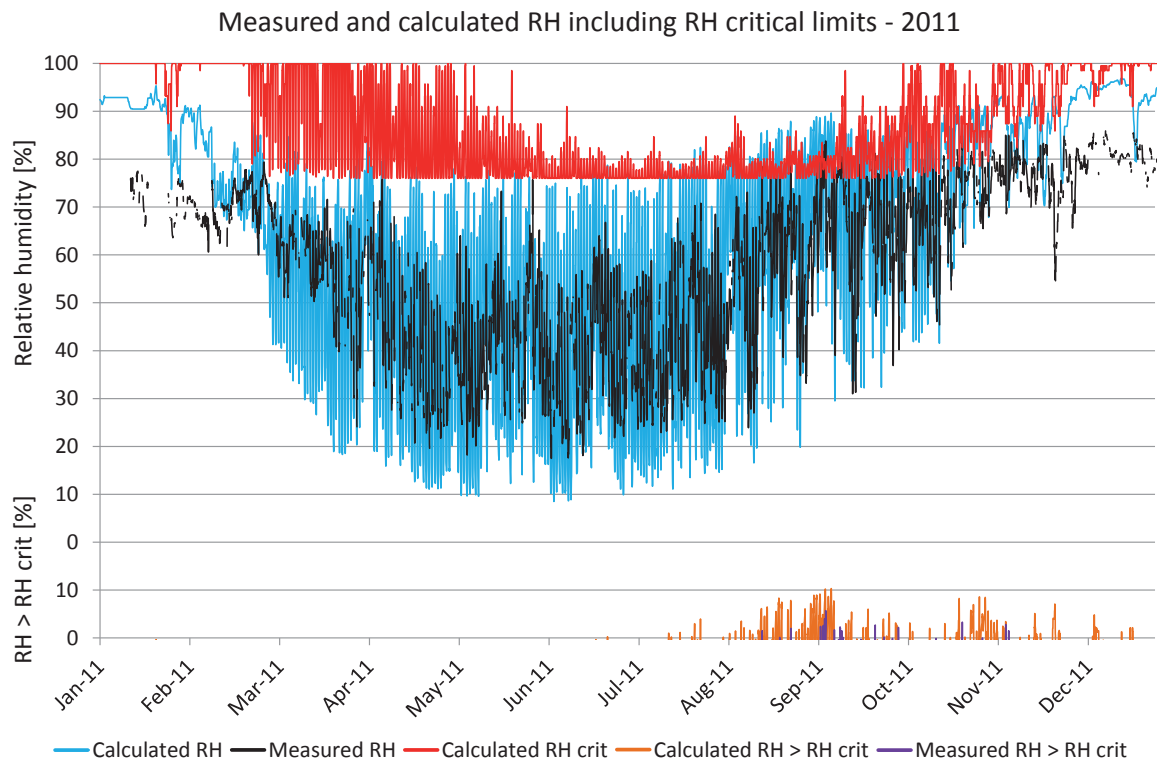


Figure 9.M.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

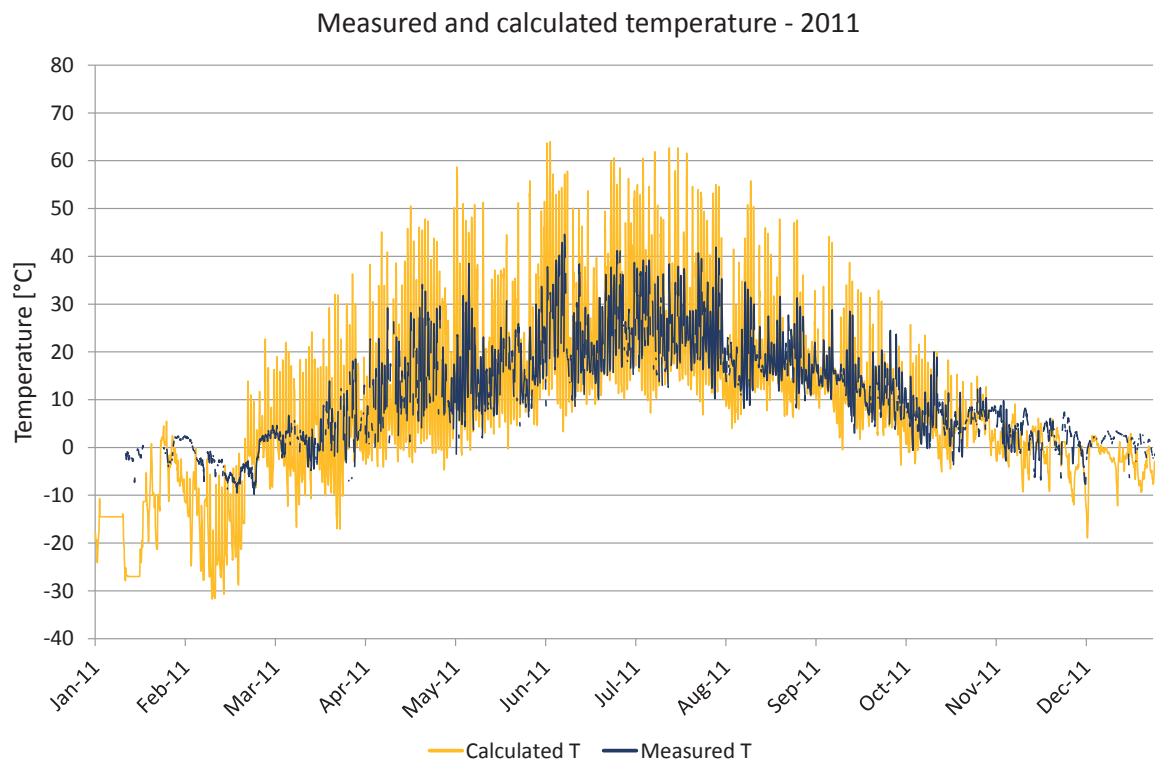


Figure 9.M.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

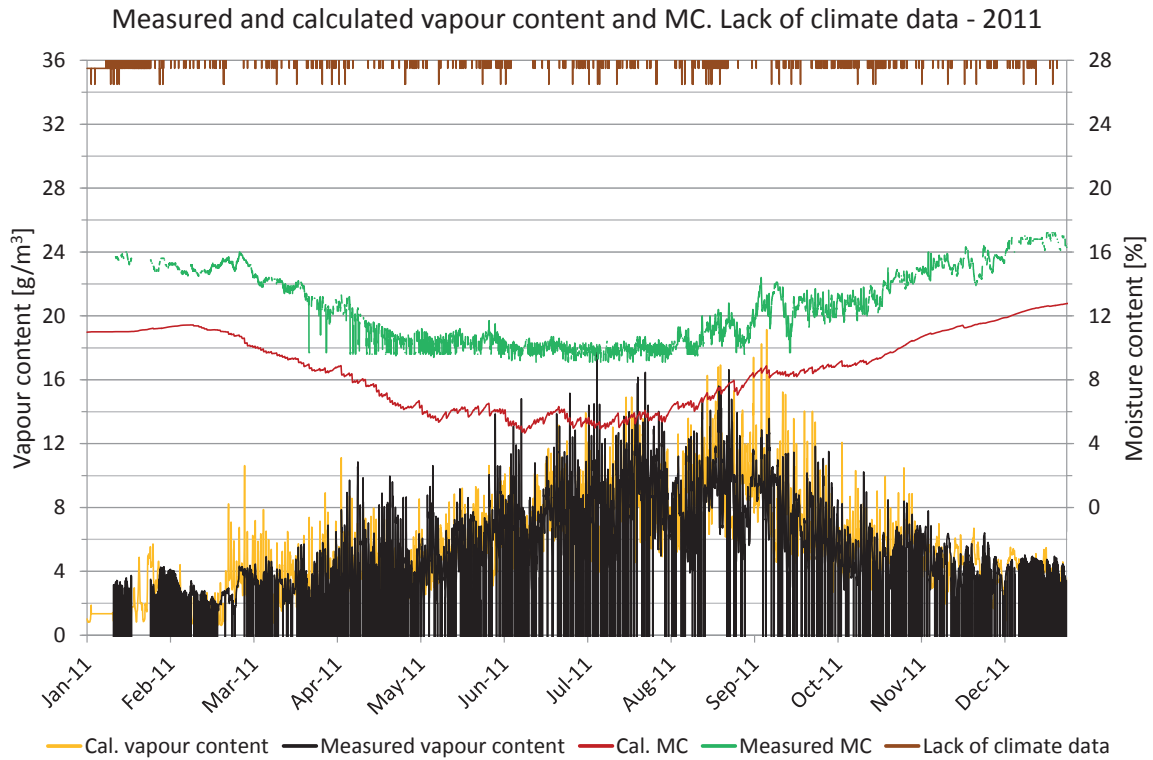


Figure 9.M.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content for calculated values (red) and measured values (green), periods with lack of climate data (brown).

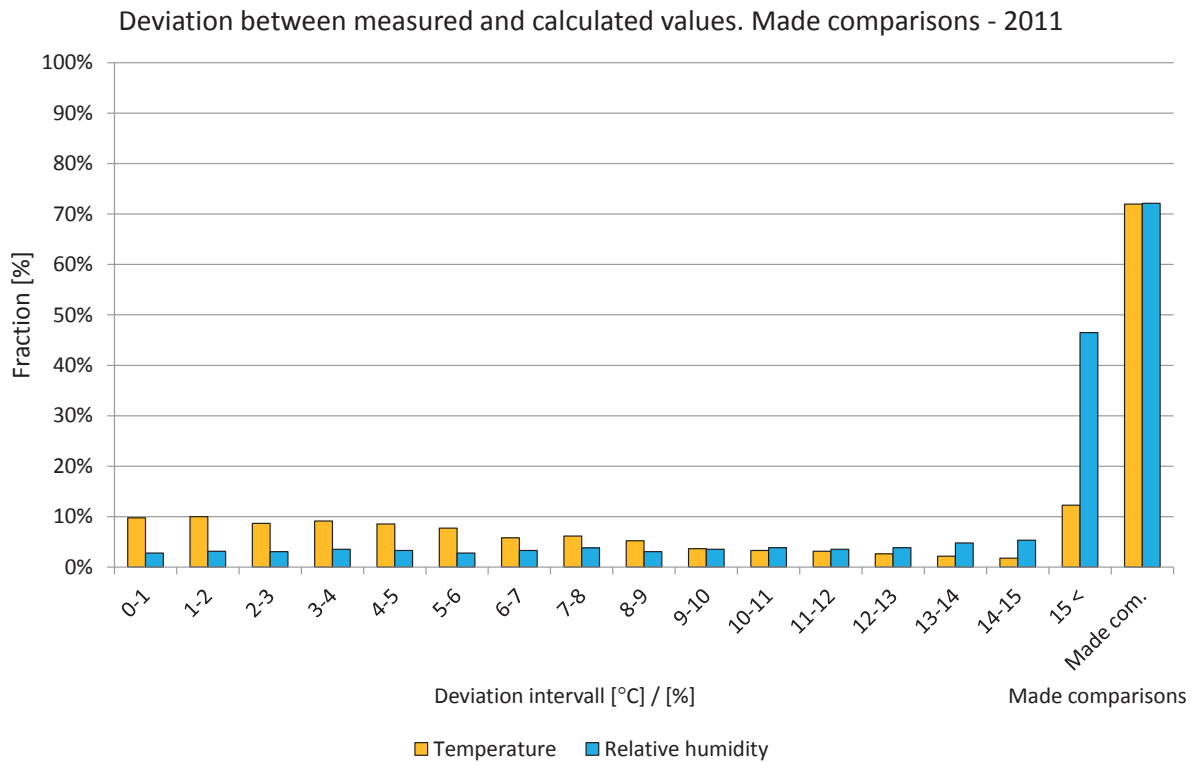


Figure 9.M.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

10.N Position N

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the parallel roof with 14 degrees roof angle facing north above the seventh floor.

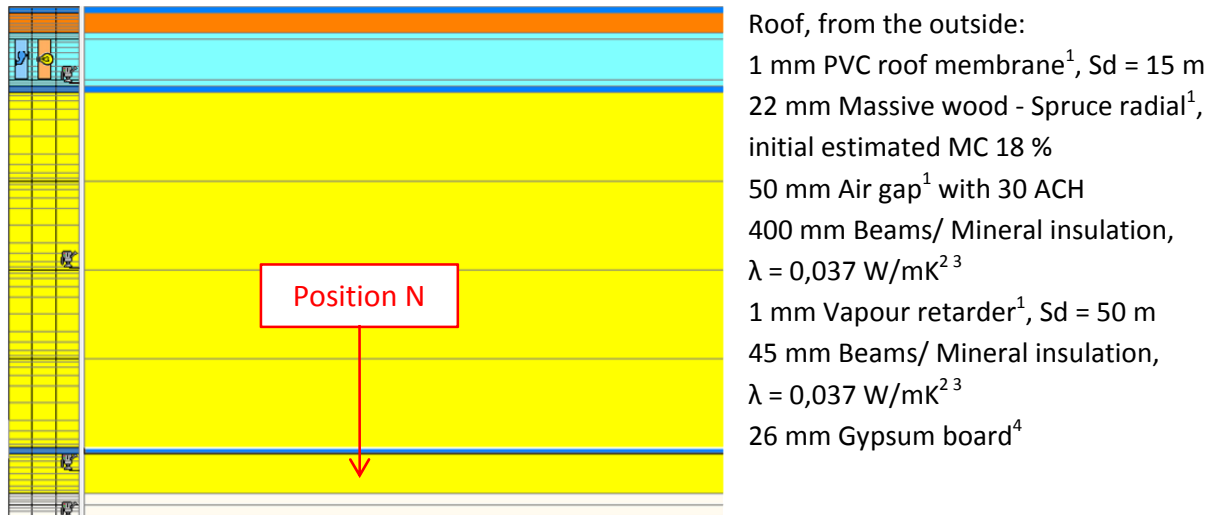


Figure 9.K.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996.

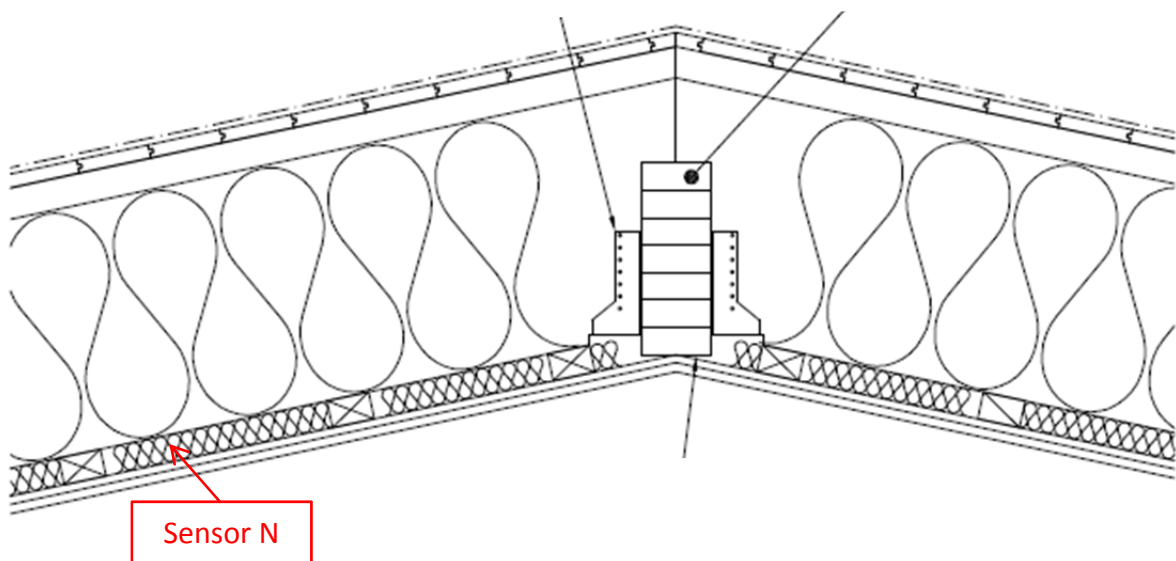


Figure 9.N.2. Location of the studied position.

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 2009

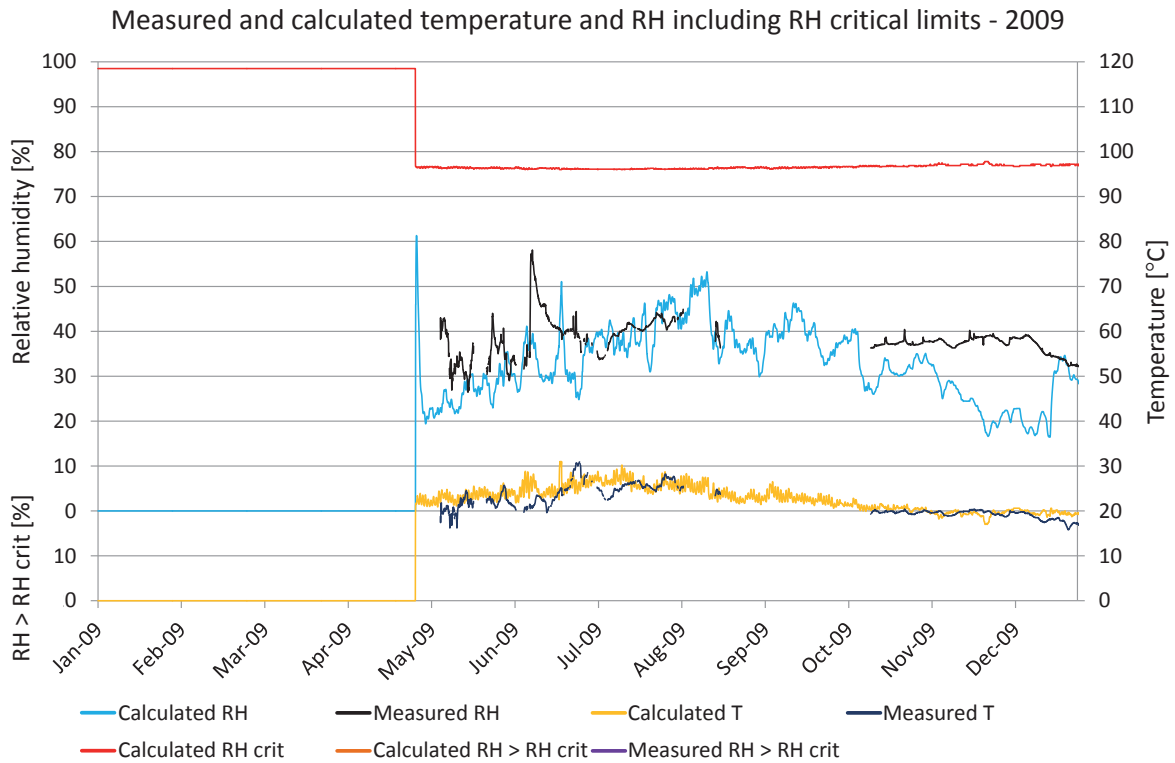


Figure 9.N.3. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

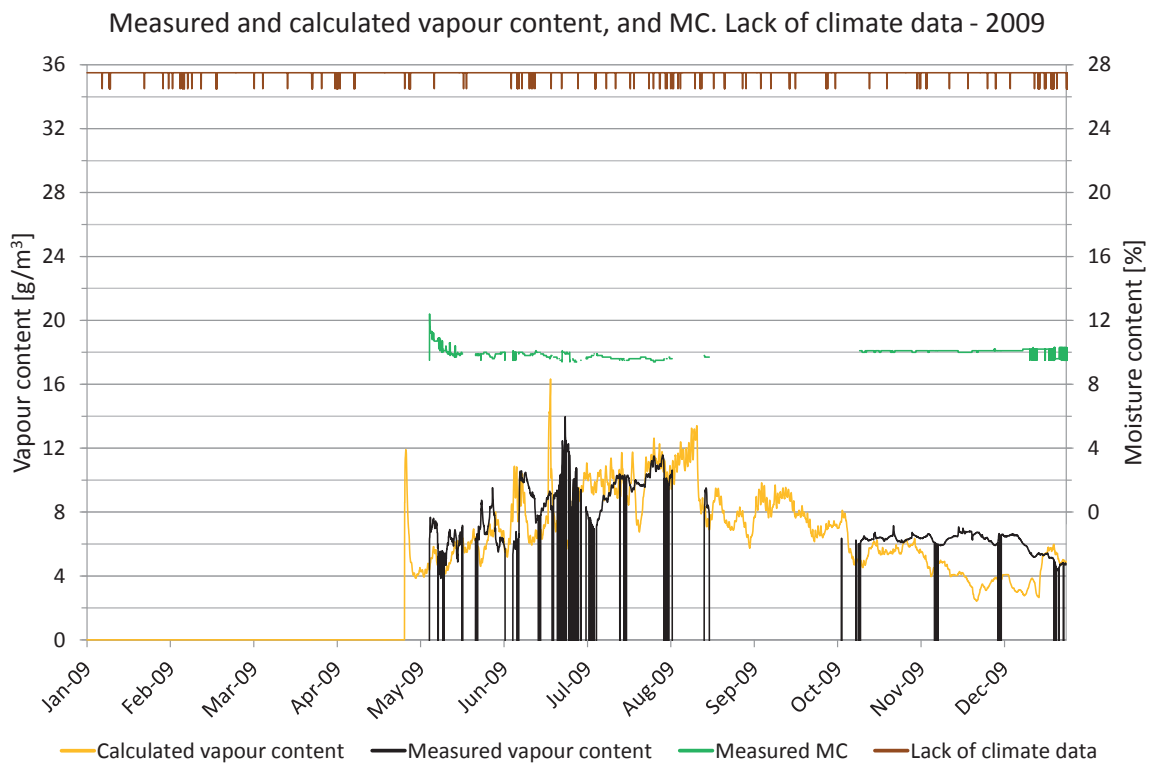


Figure 9.N.4. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

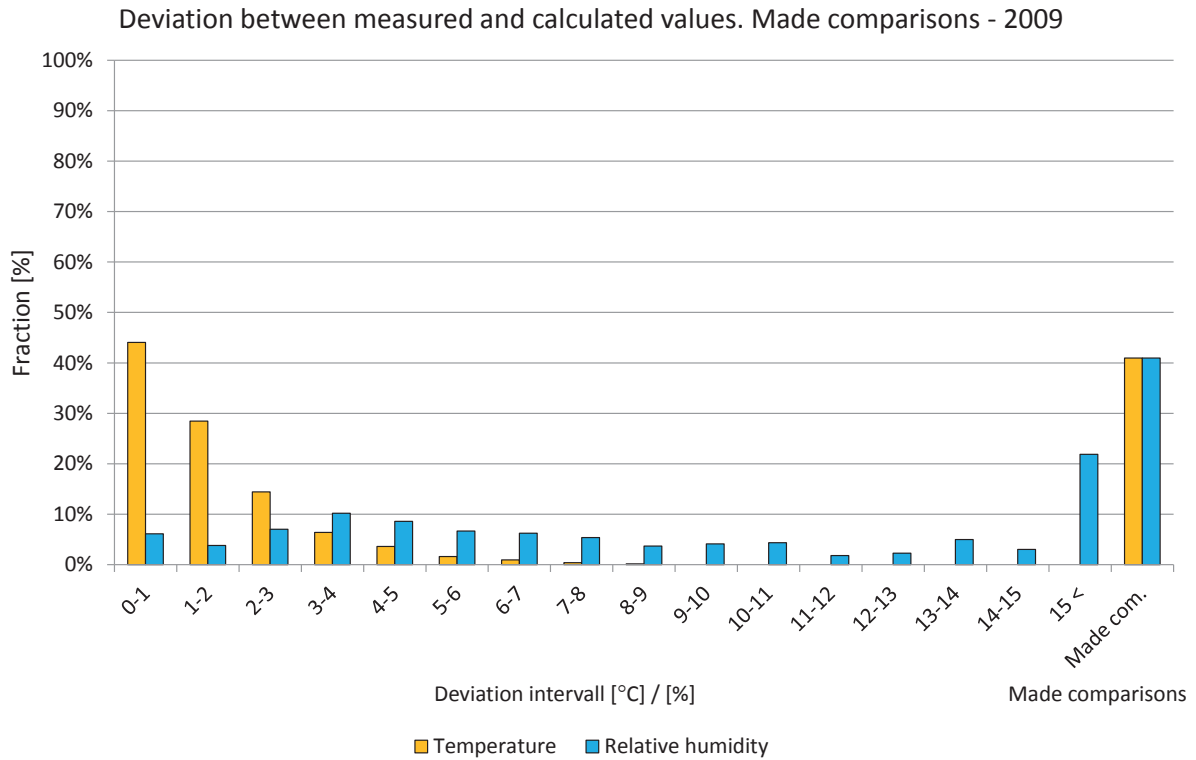


Figure 9.N.5. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

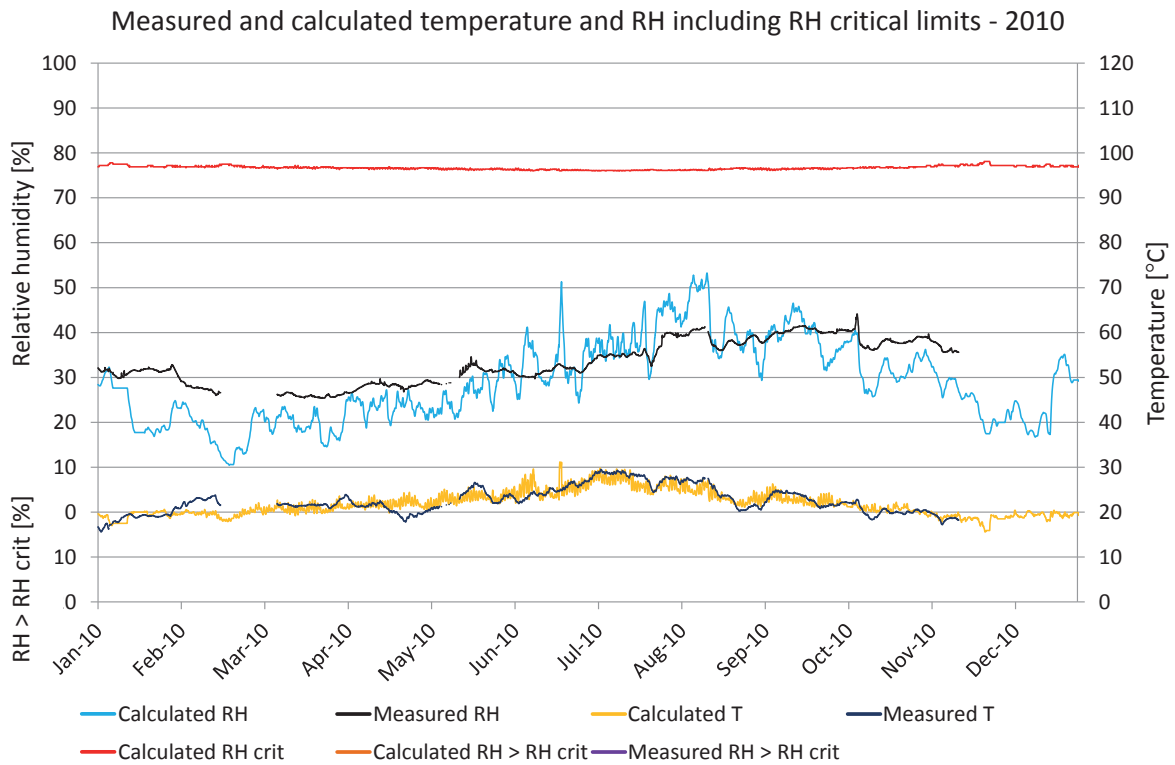


Figure 9.N.6. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated RH > RH_{crit} (light brown), measured RH > RH_{crit} (purple).

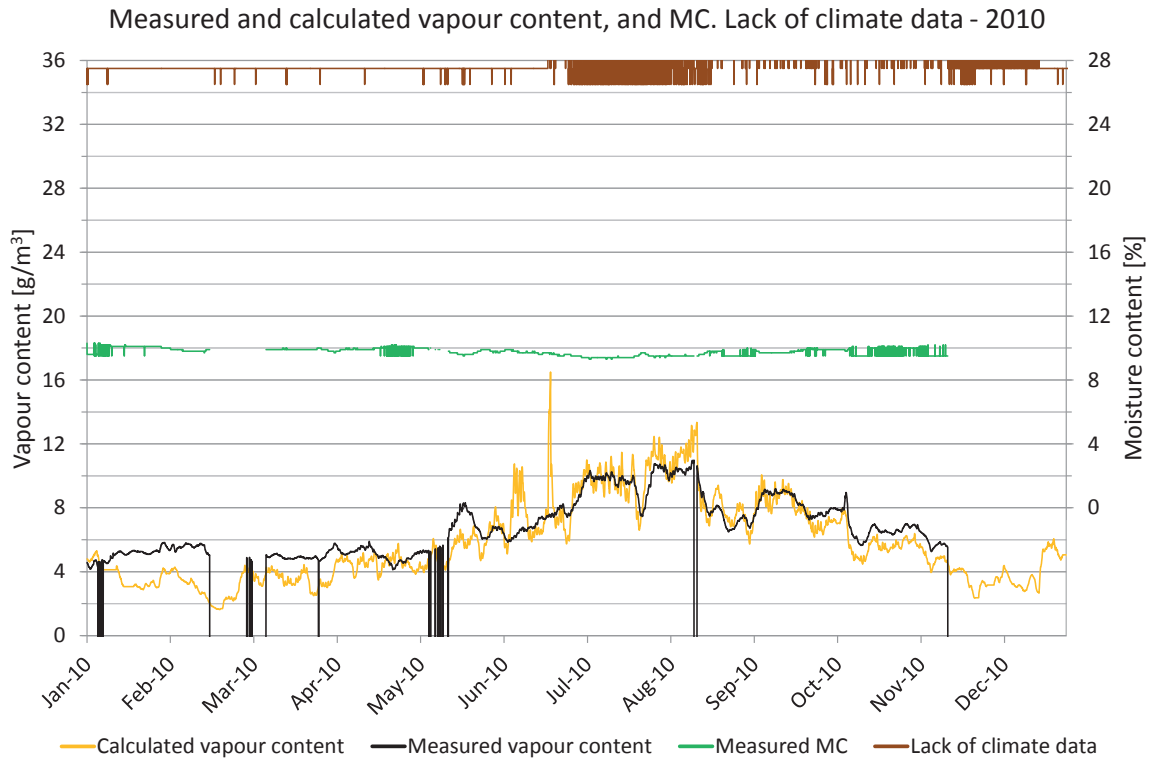


Figure 9.N.7. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

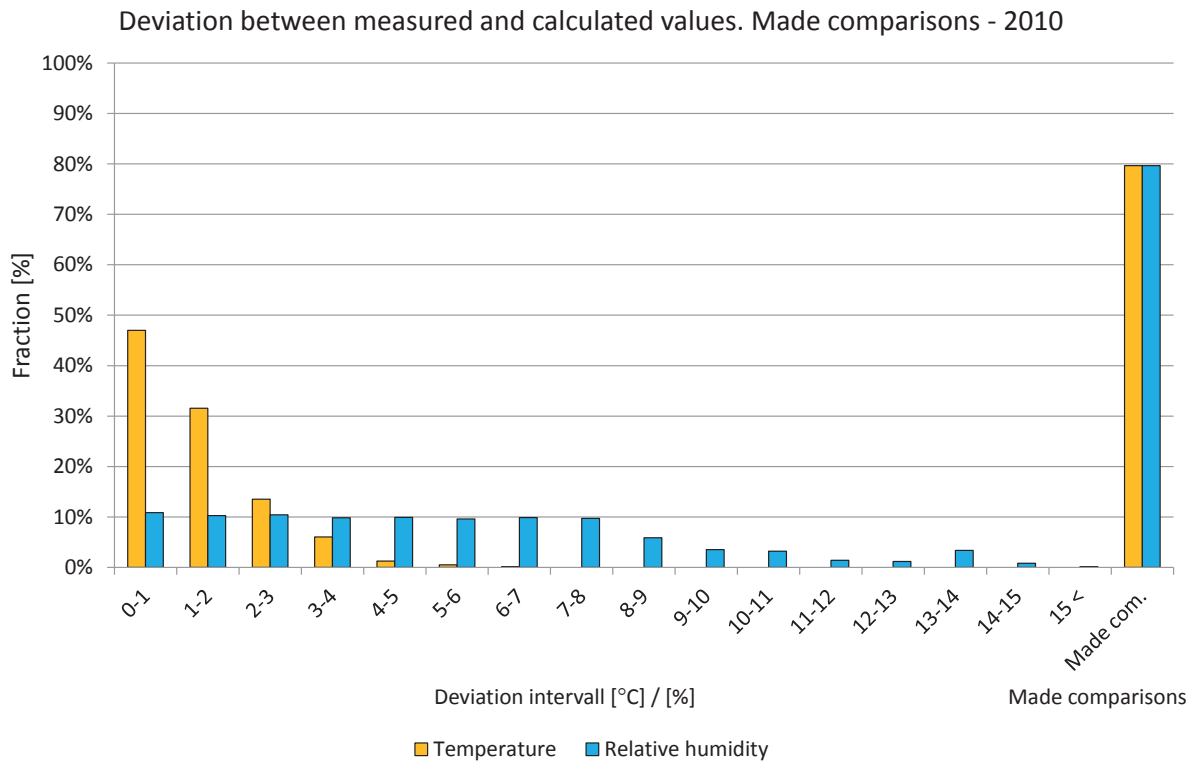


Figure 9.N.8. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

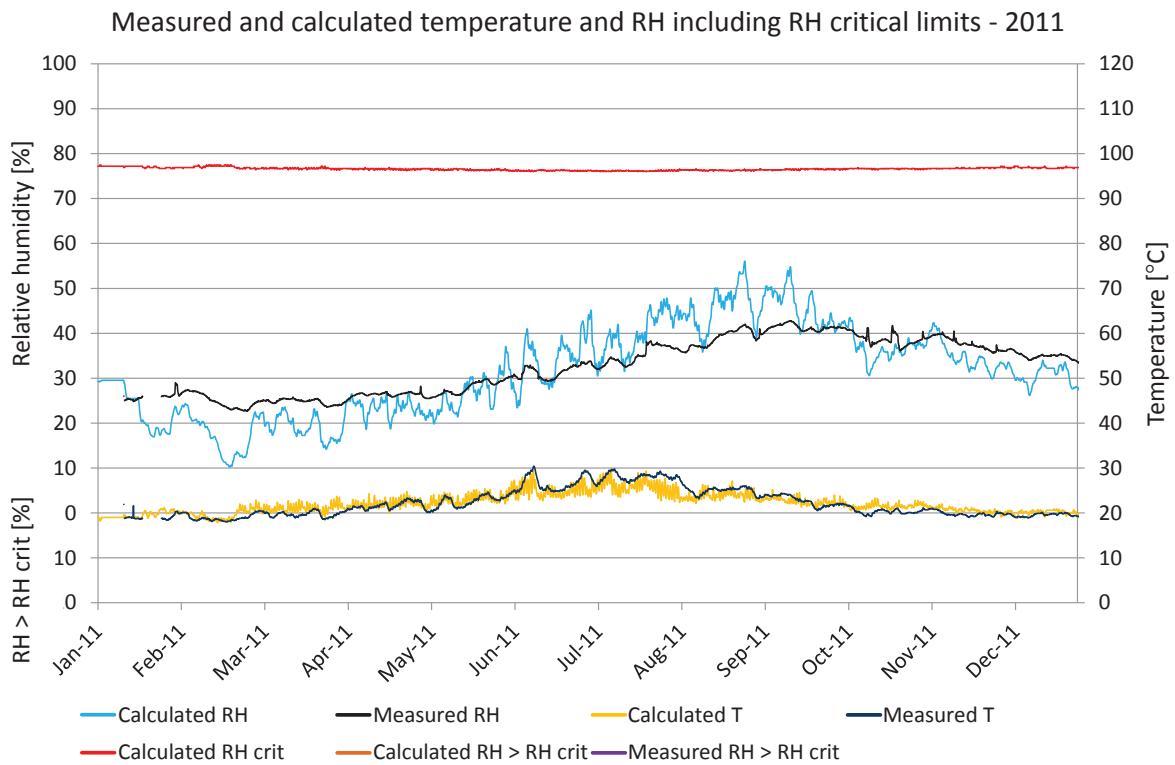


Figure 9.N.9. Comparisons between measured and calculated temperature and relative humidity. Calculated temperature (yellow), measured temperature (dark blue), calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

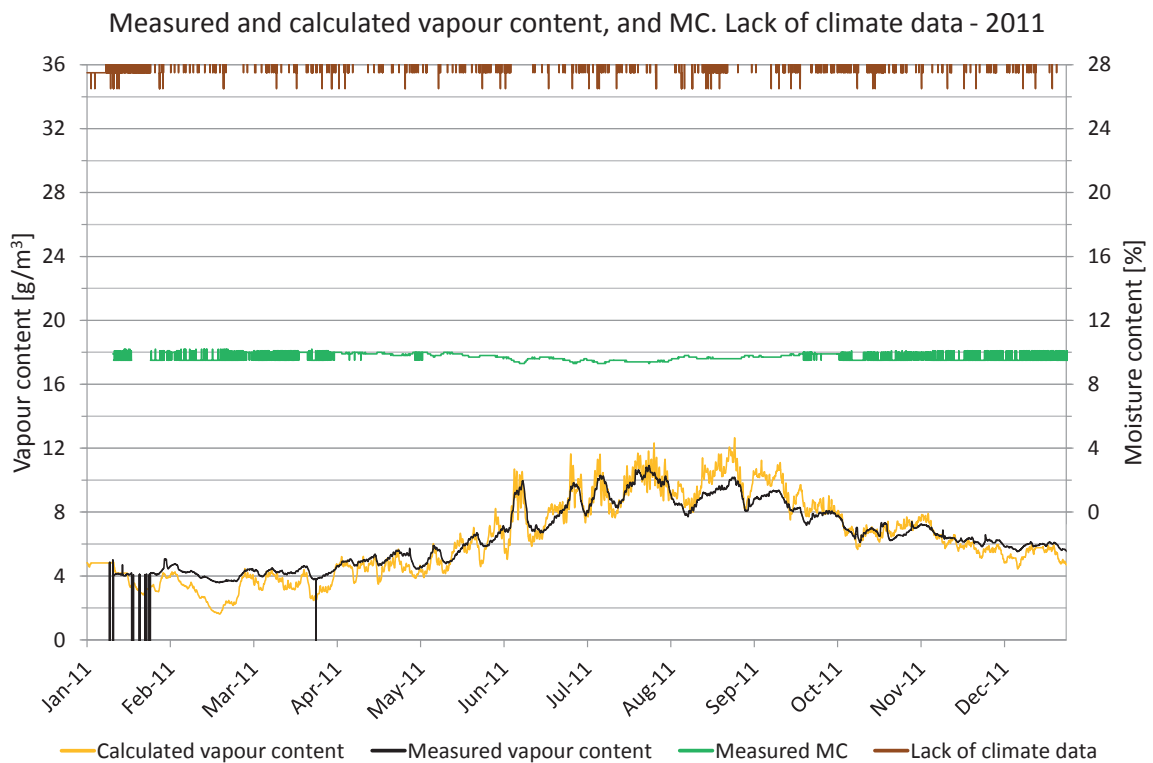


Figure 9.N.10. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

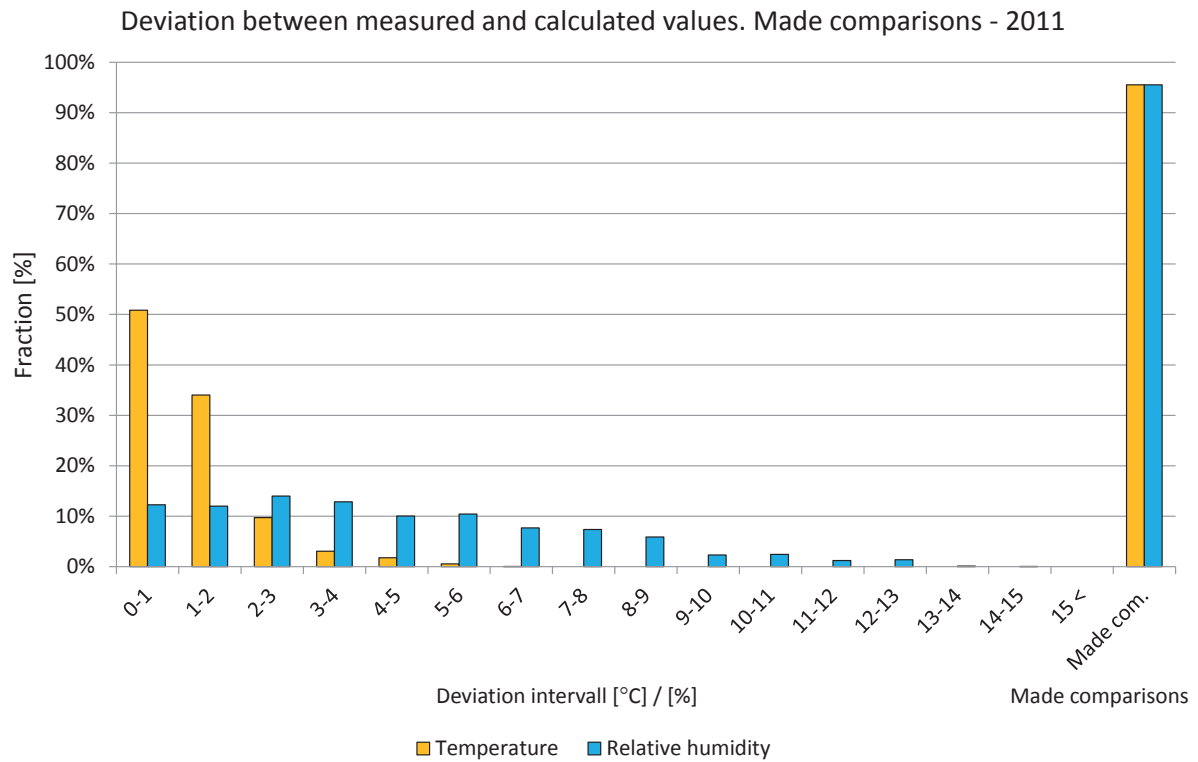


Figure 9.N.11. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

10.0 Position O

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the parallel roof with 14 degrees roof angle facing north above the seventh floor.

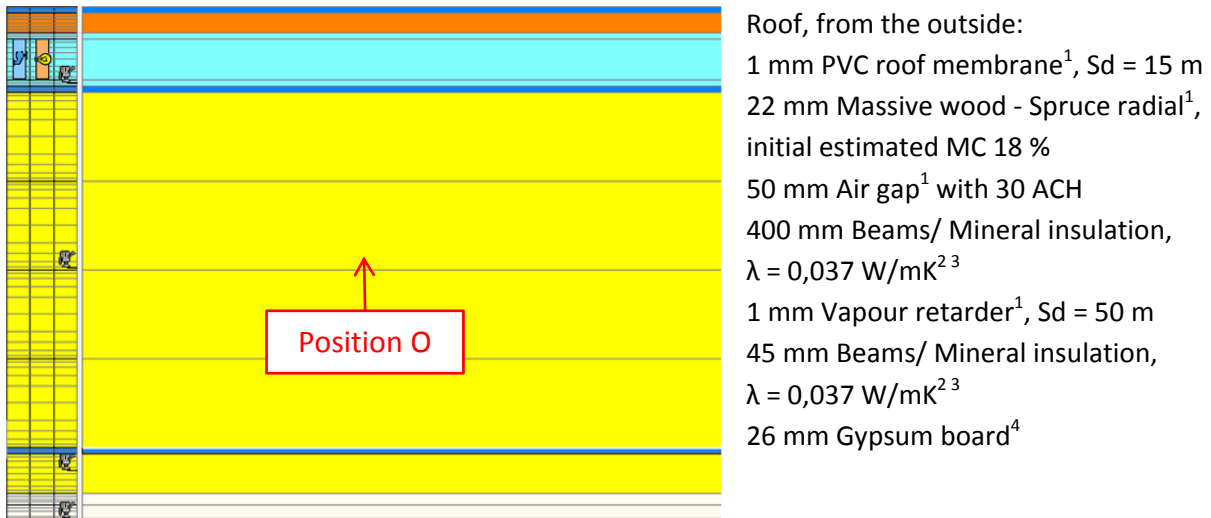


Figure 9.K.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996.

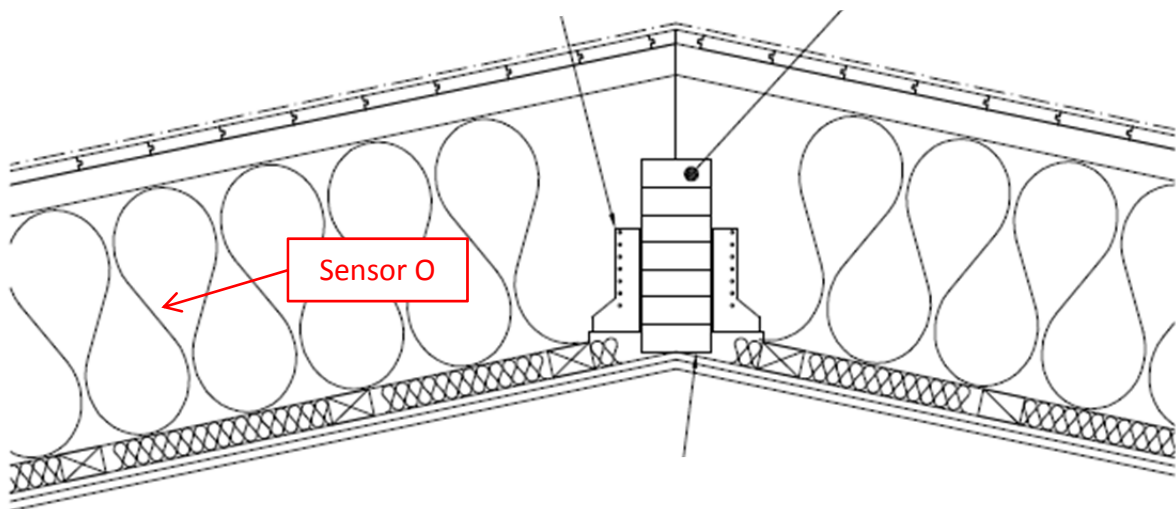


Figure 9.O.2. Location of the studied position.

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 2009

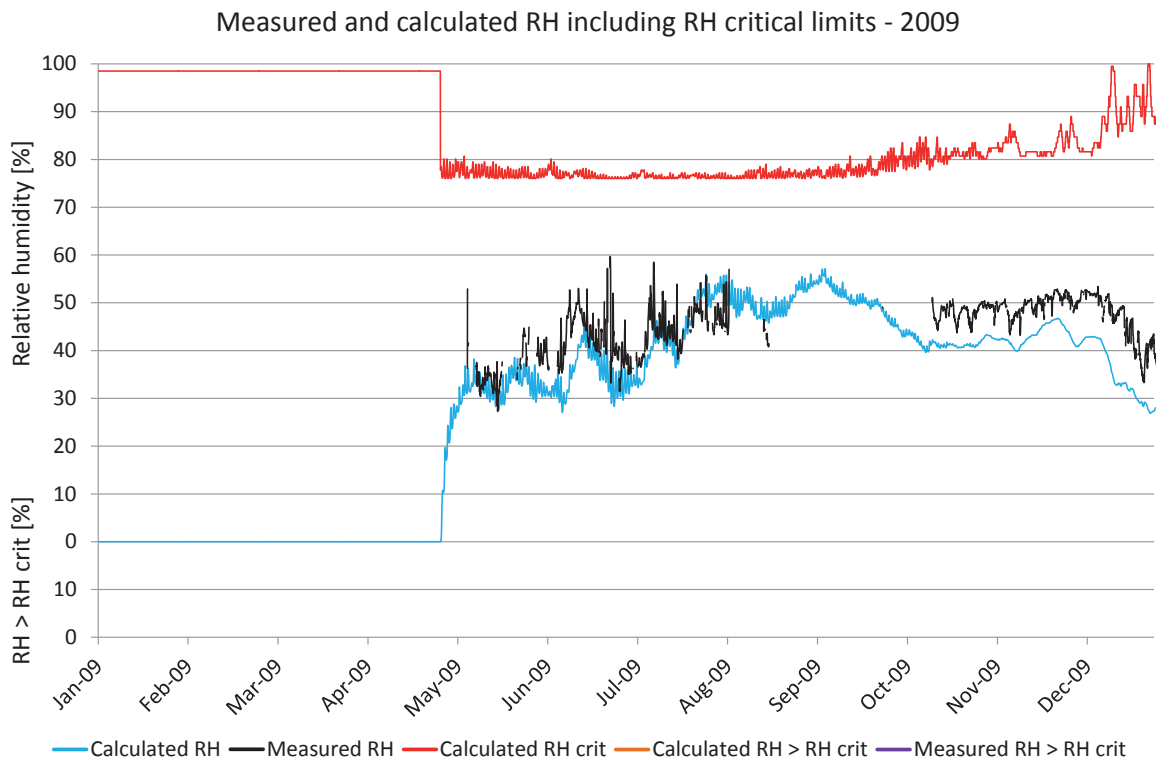


Figure 9.O.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

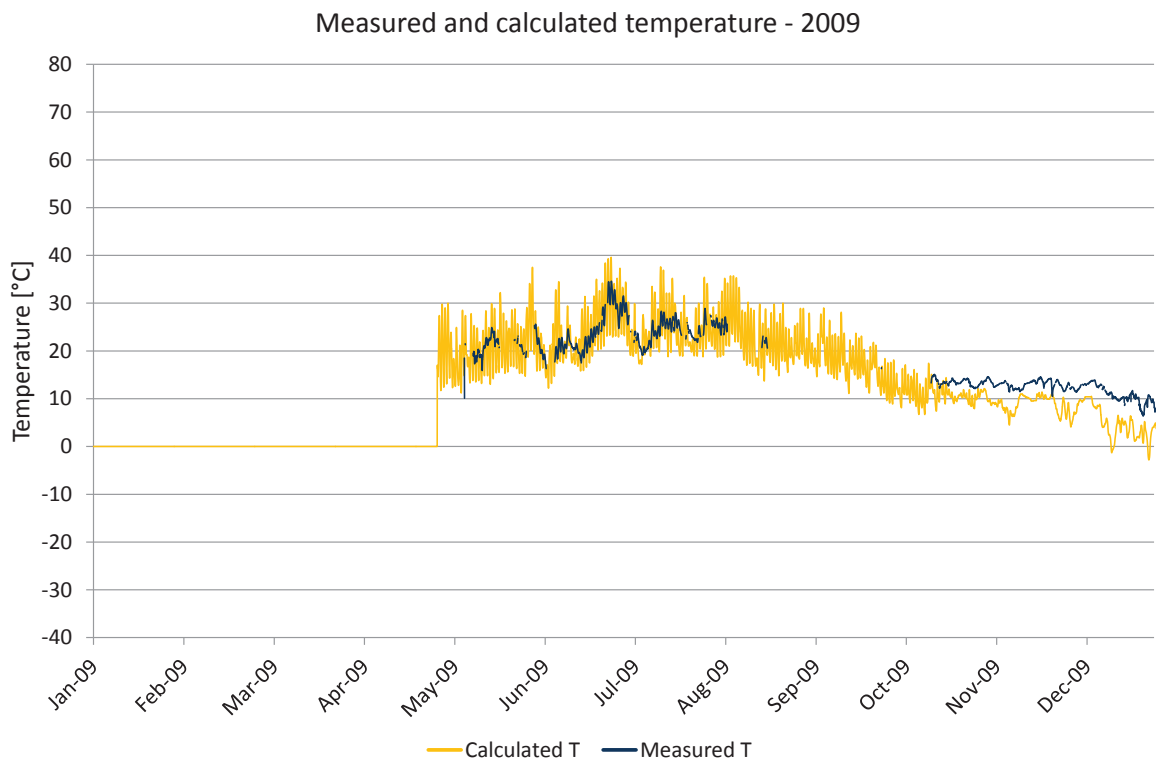


Figure 9.O.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

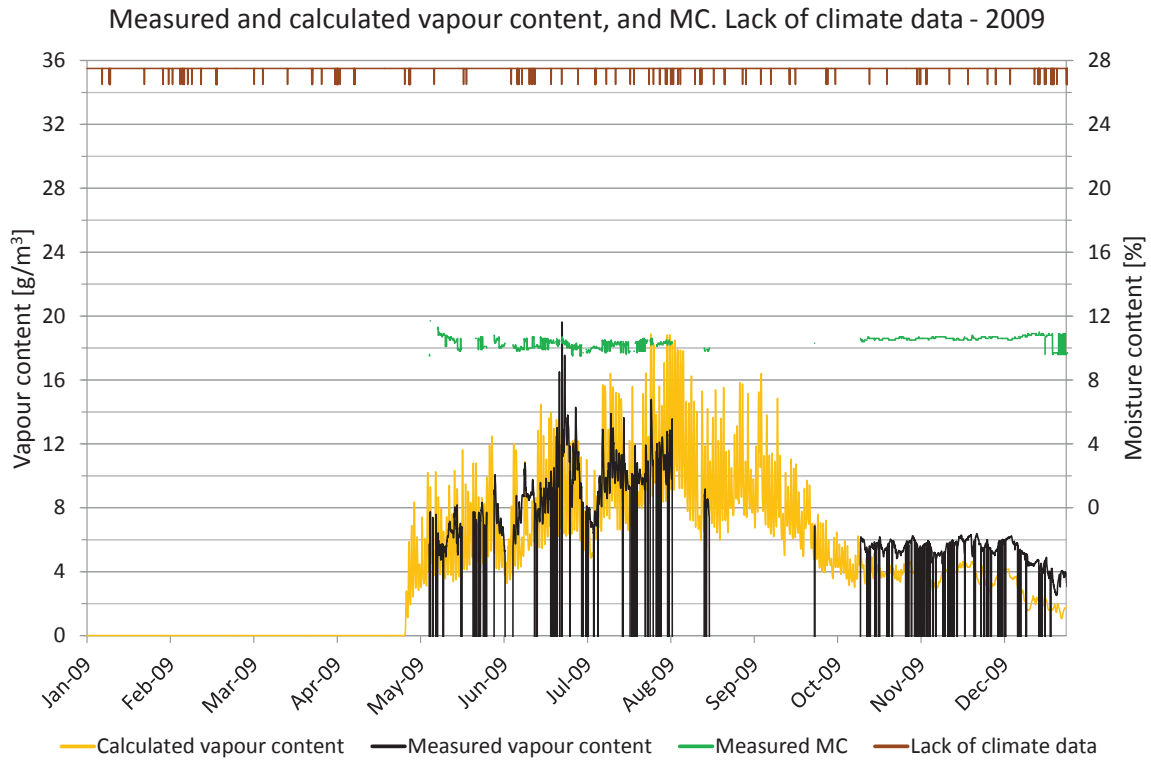


Figure 9.O.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

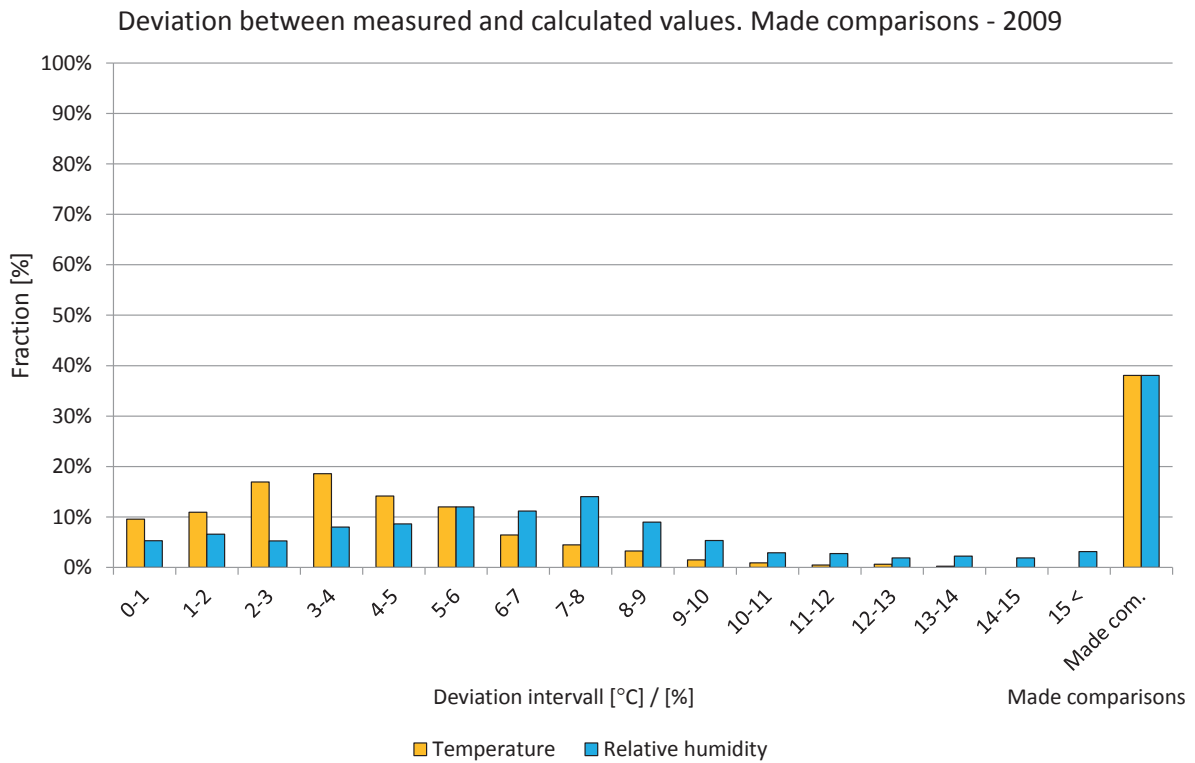


Figure 9.O.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

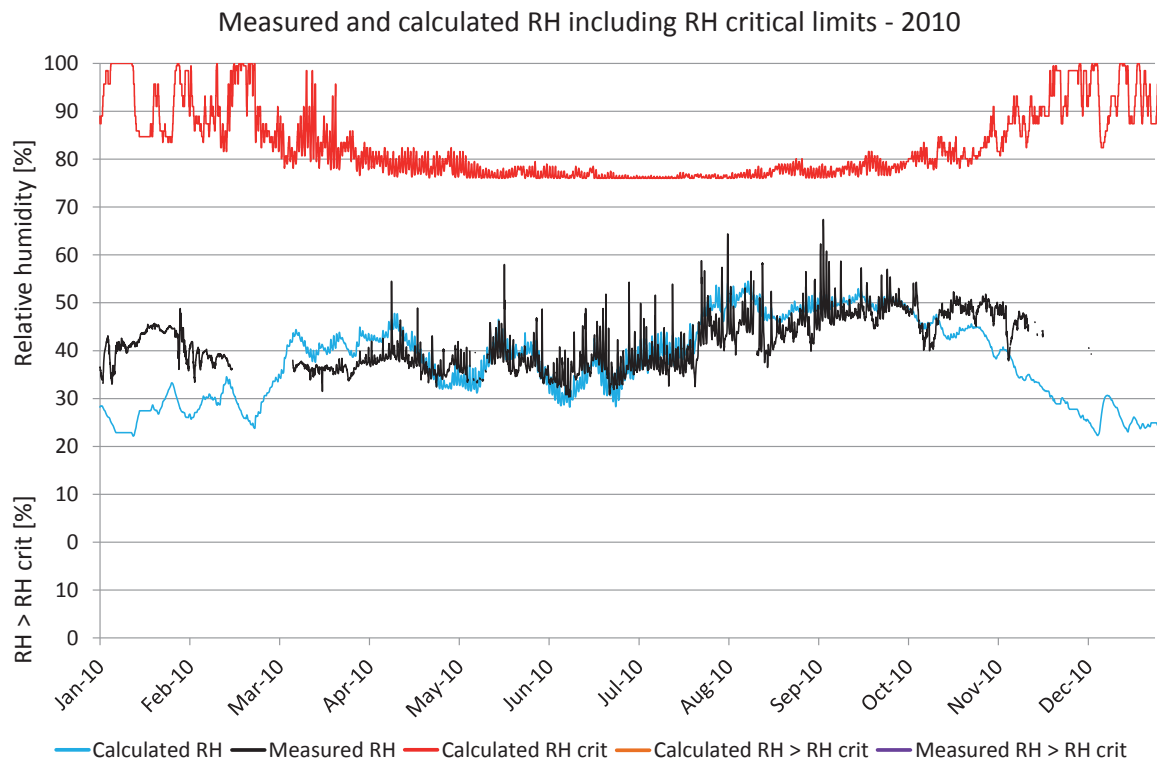


Figure 9.O.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

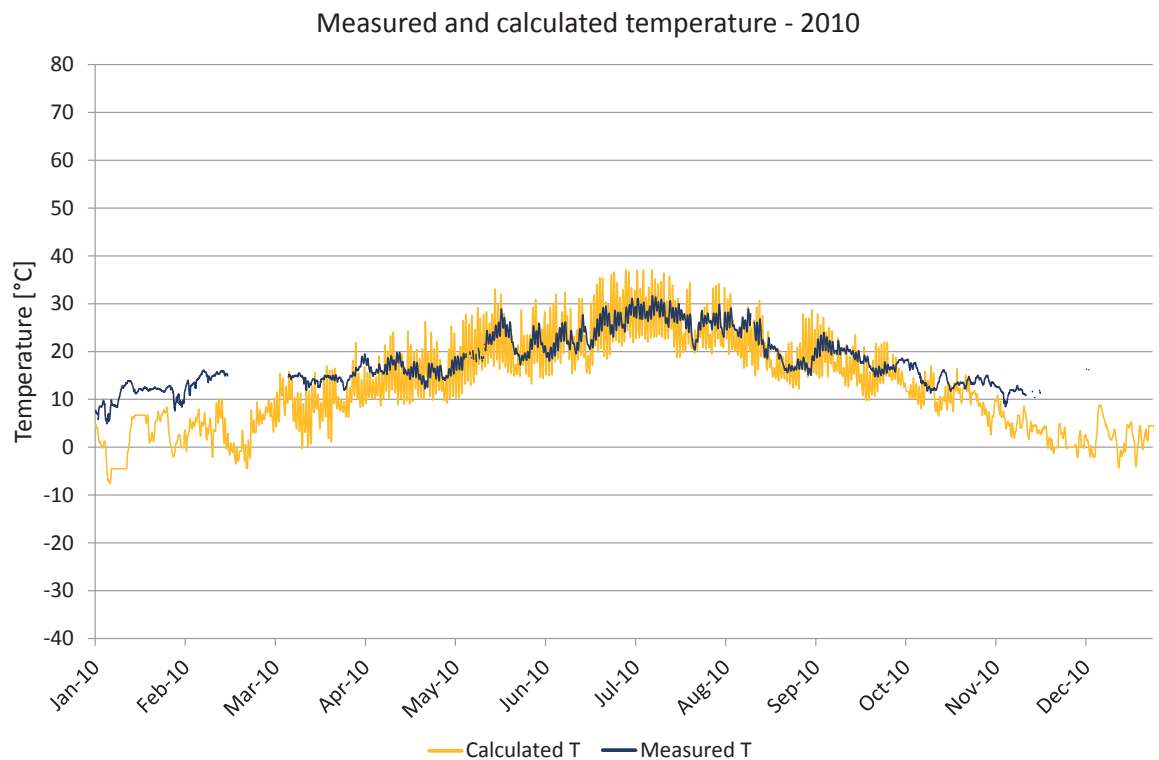


Figure 9.O.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

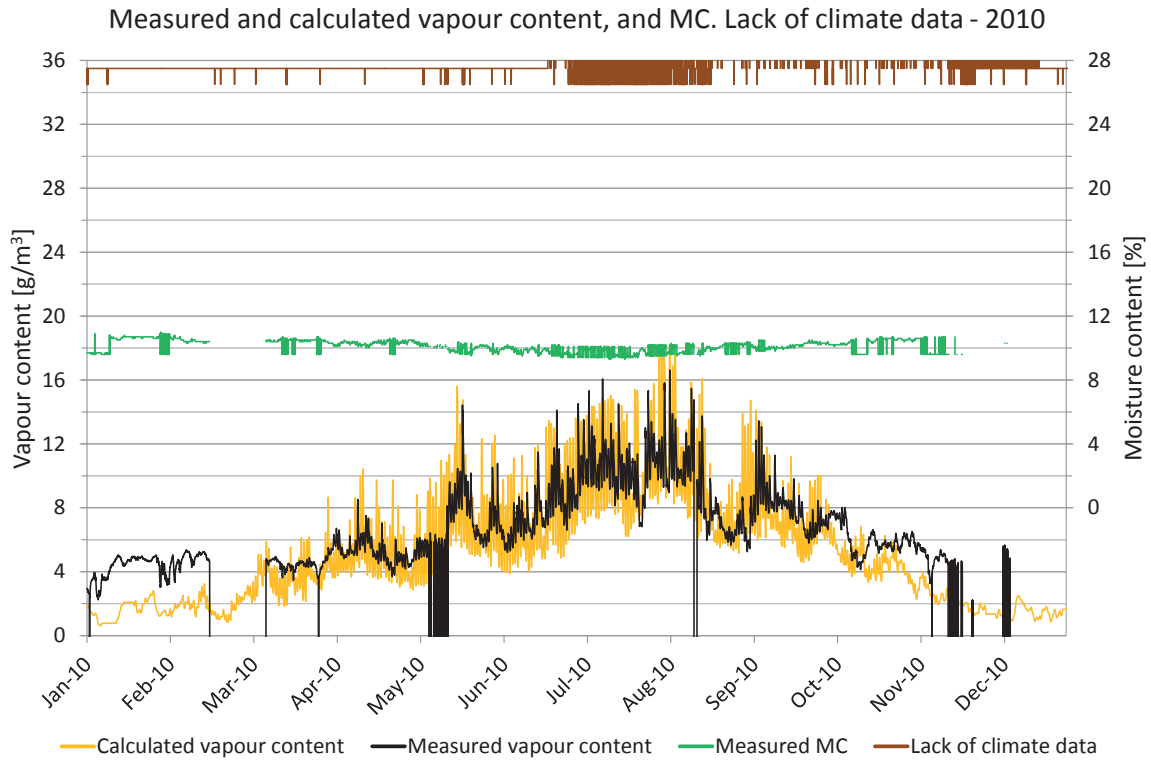


Figure 9.O.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

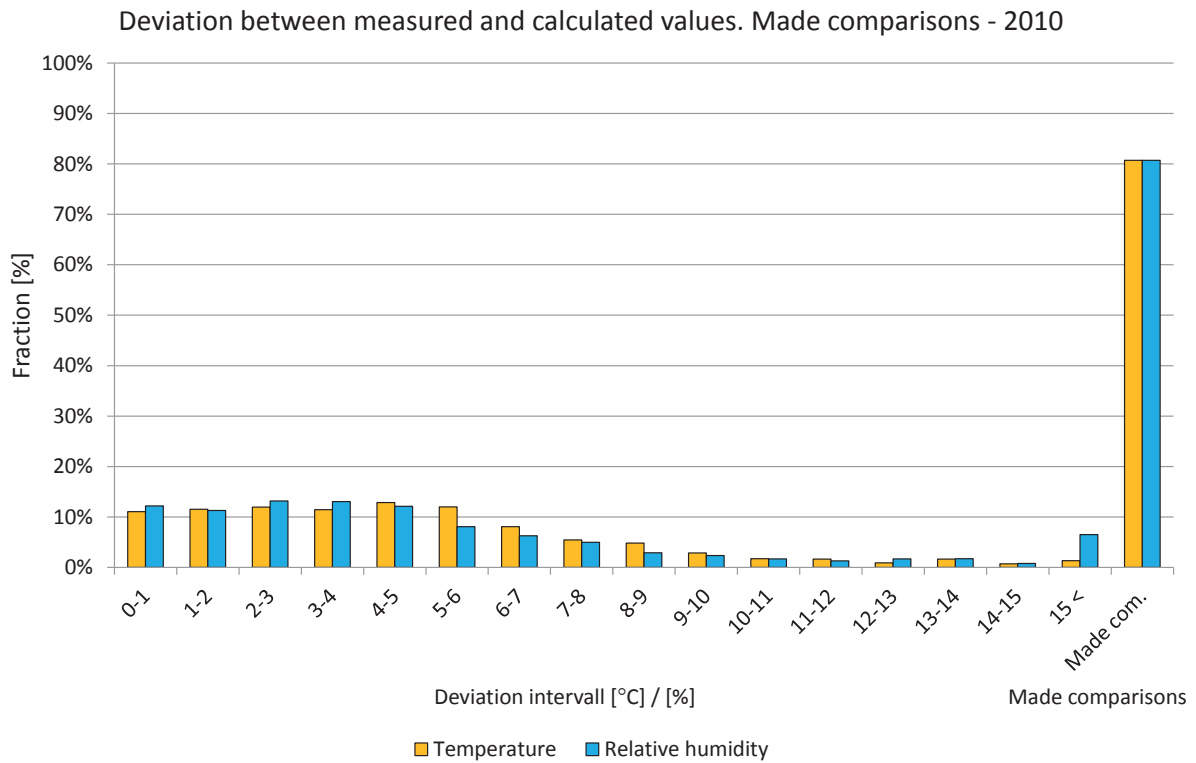


Figure 9.O.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

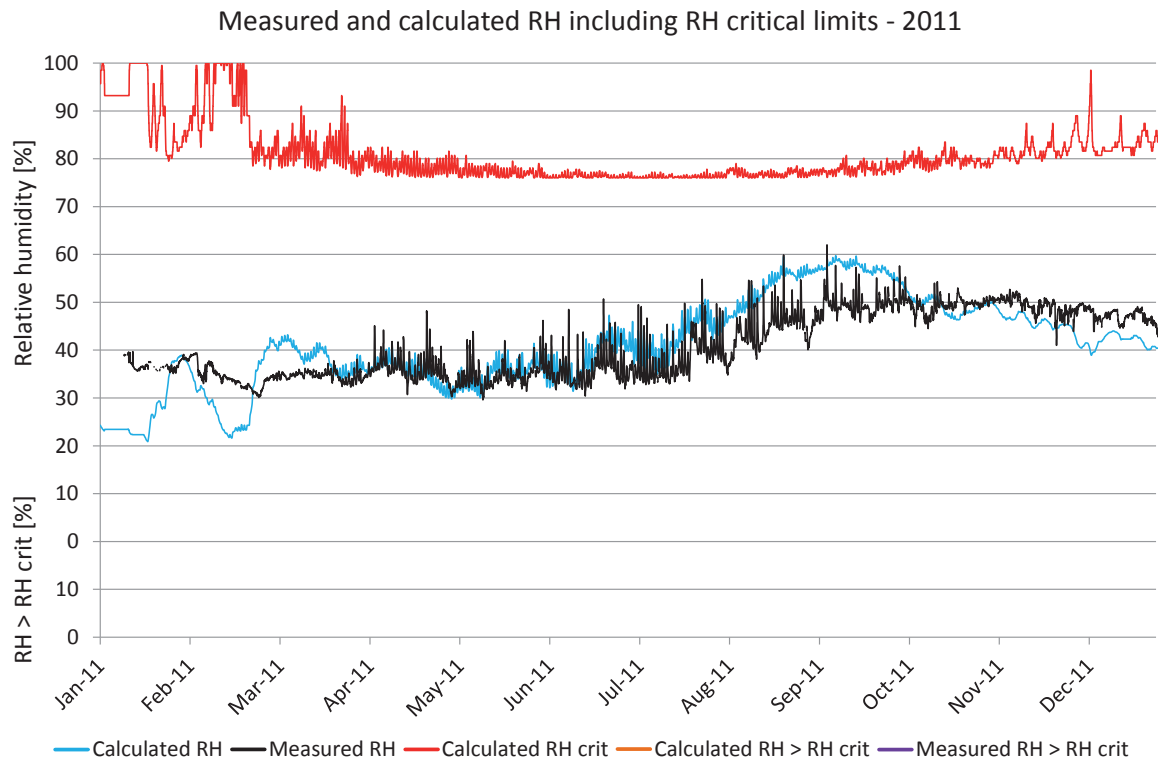


Figure 9.O.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

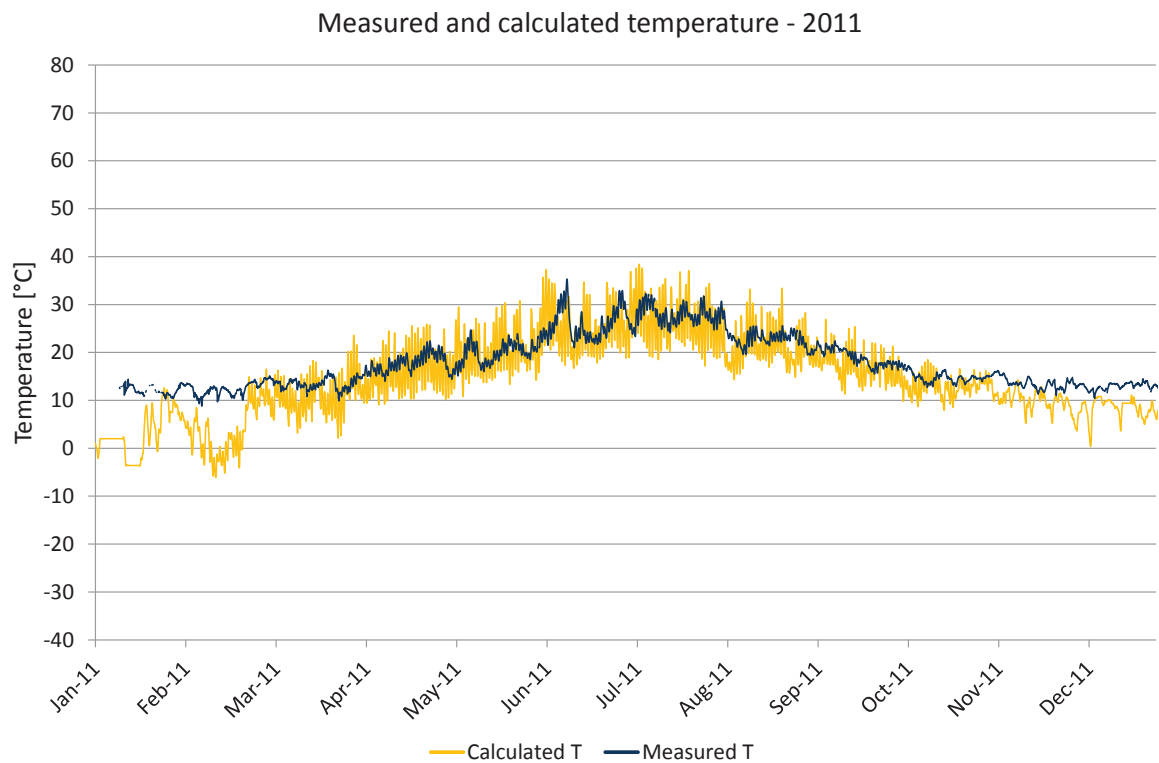


Figure 9.O.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

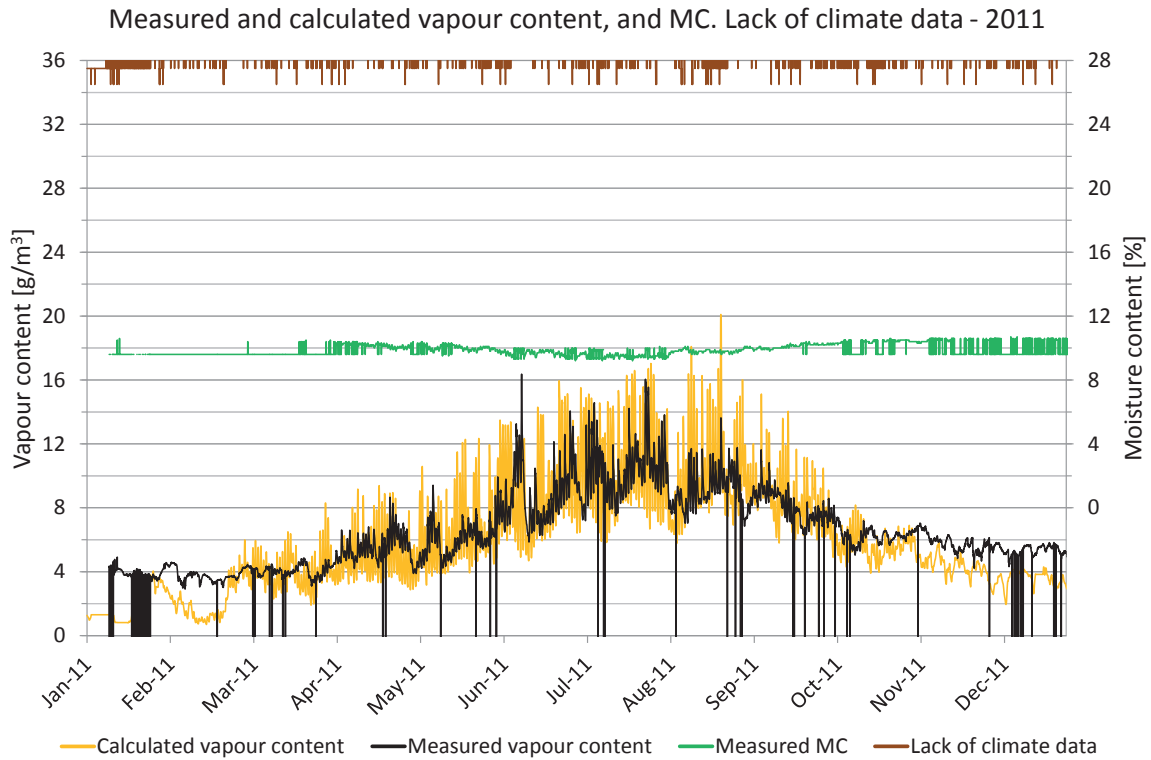


Figure 9.O.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

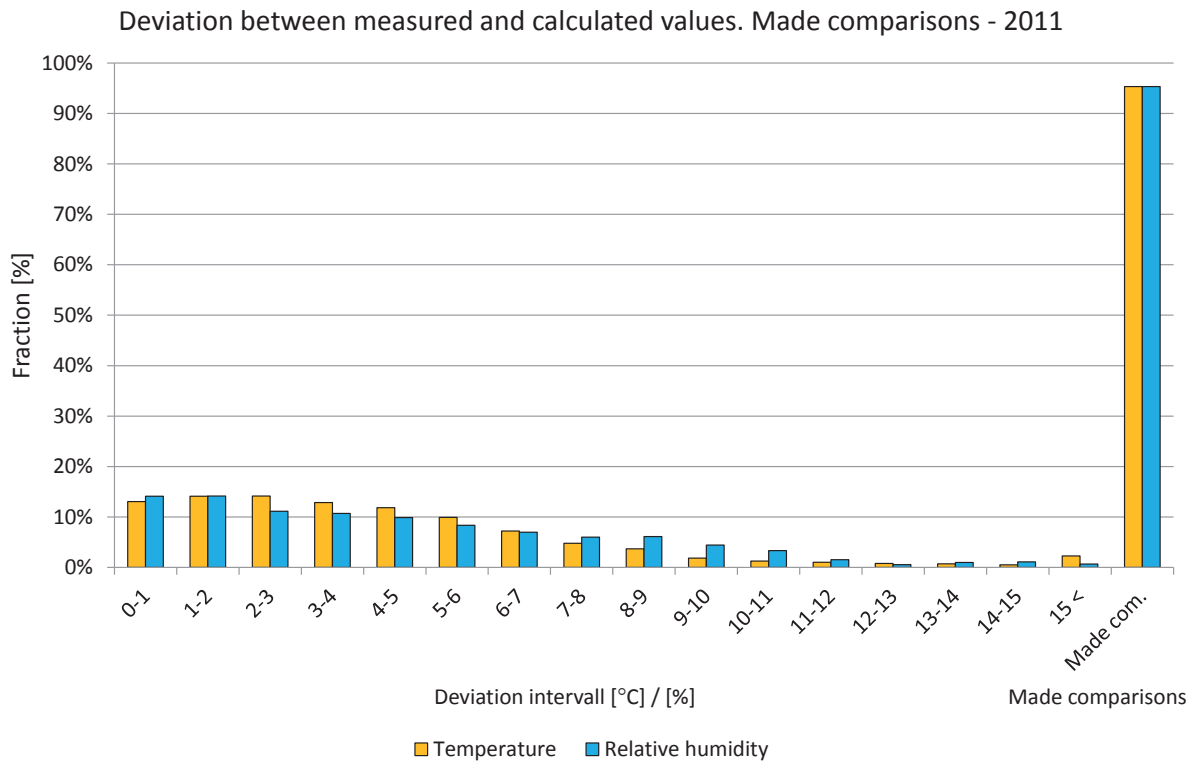


Figure 9.O.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

10.S Position S

The locations of the measured and calculated position are shown in the drawings and figures below. The studied position is located in the parallel roof with 14 degrees roof angle facing north above the seventh floor. Moisture content measurements were out of order during the entire period and presented results of MC are therefore not reliable.

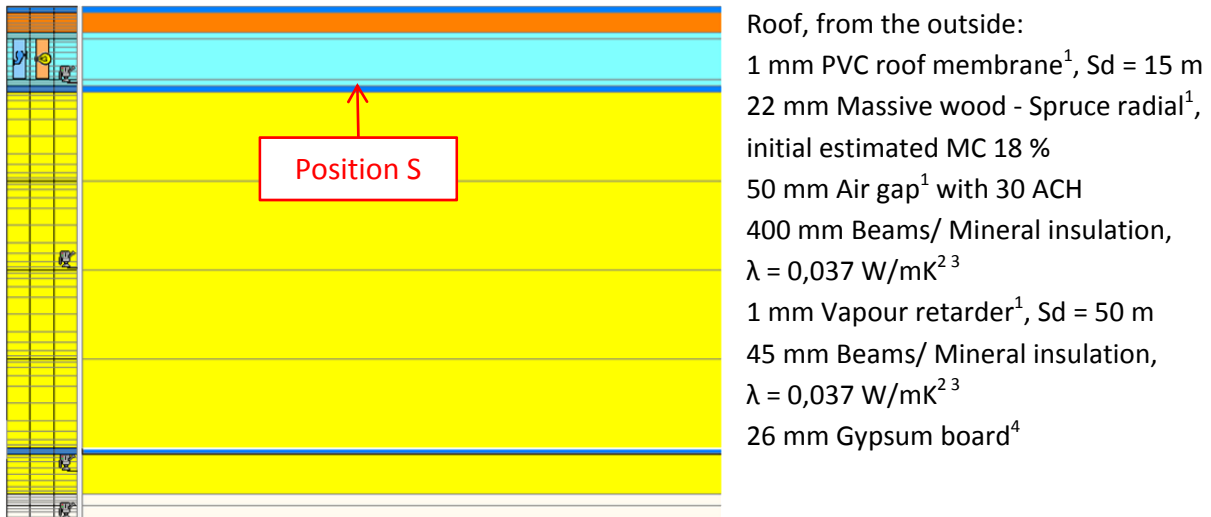


Figure 9.K.1. WUFI calculation model showing the studied position. 1. IBP, 2012, 2. IEA Annex 24, 1996, 3. Paroc, 2002, 4. Krus, M., 1996.

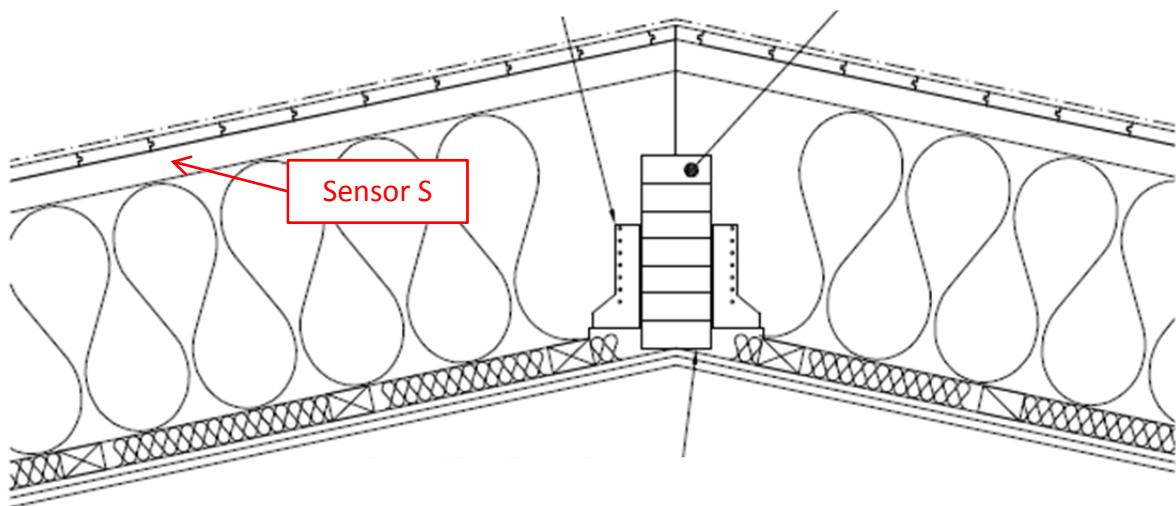


Figure 9.S.2. Location of the studied position.

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 2009

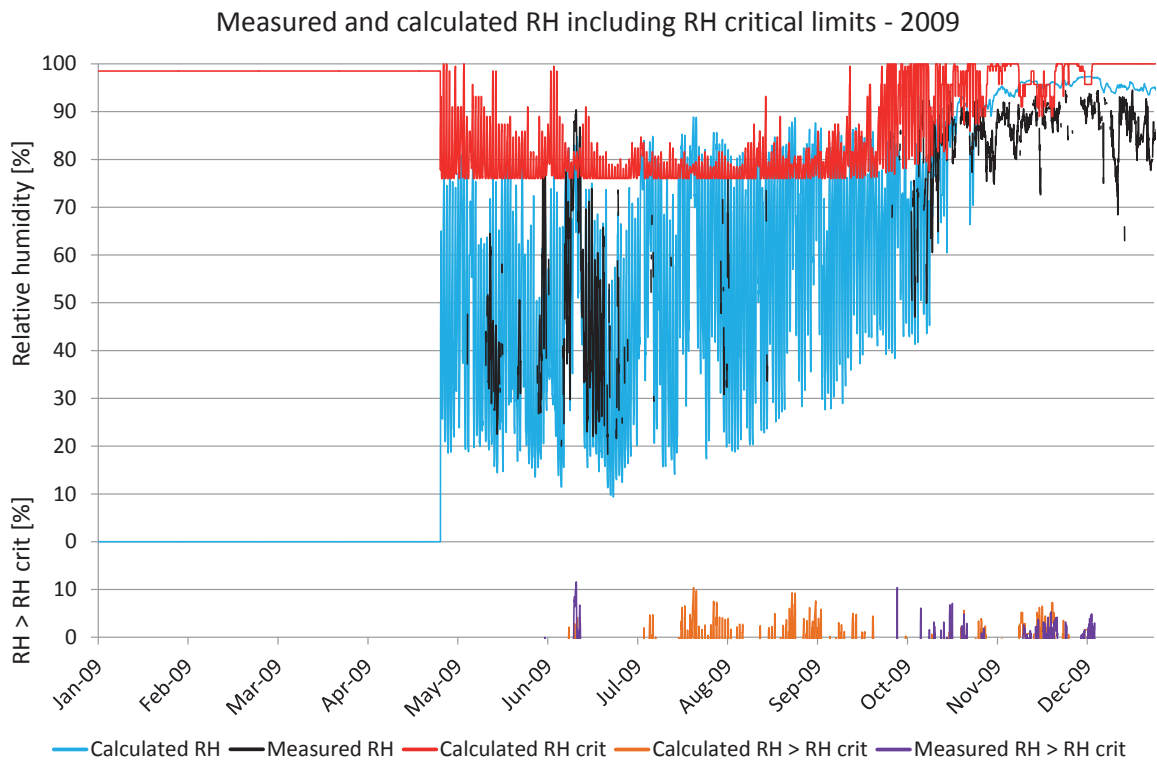


Figure 9.S.3. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

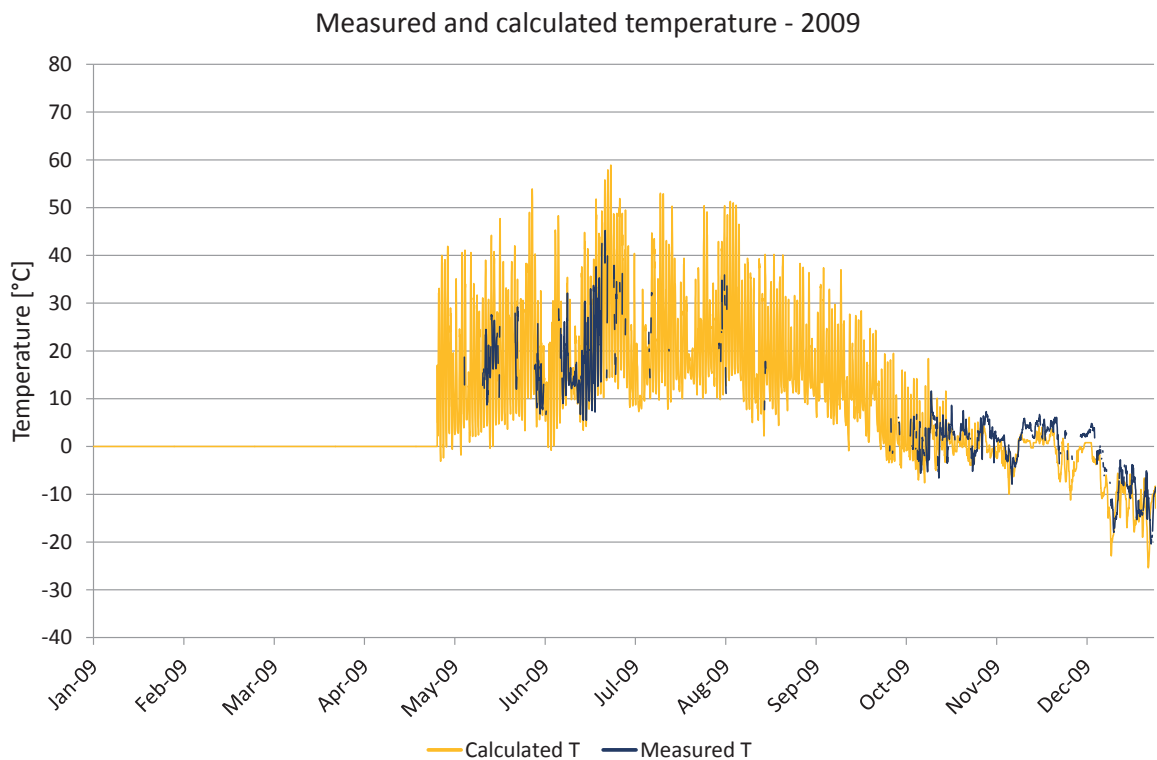


Figure 9.S.4. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

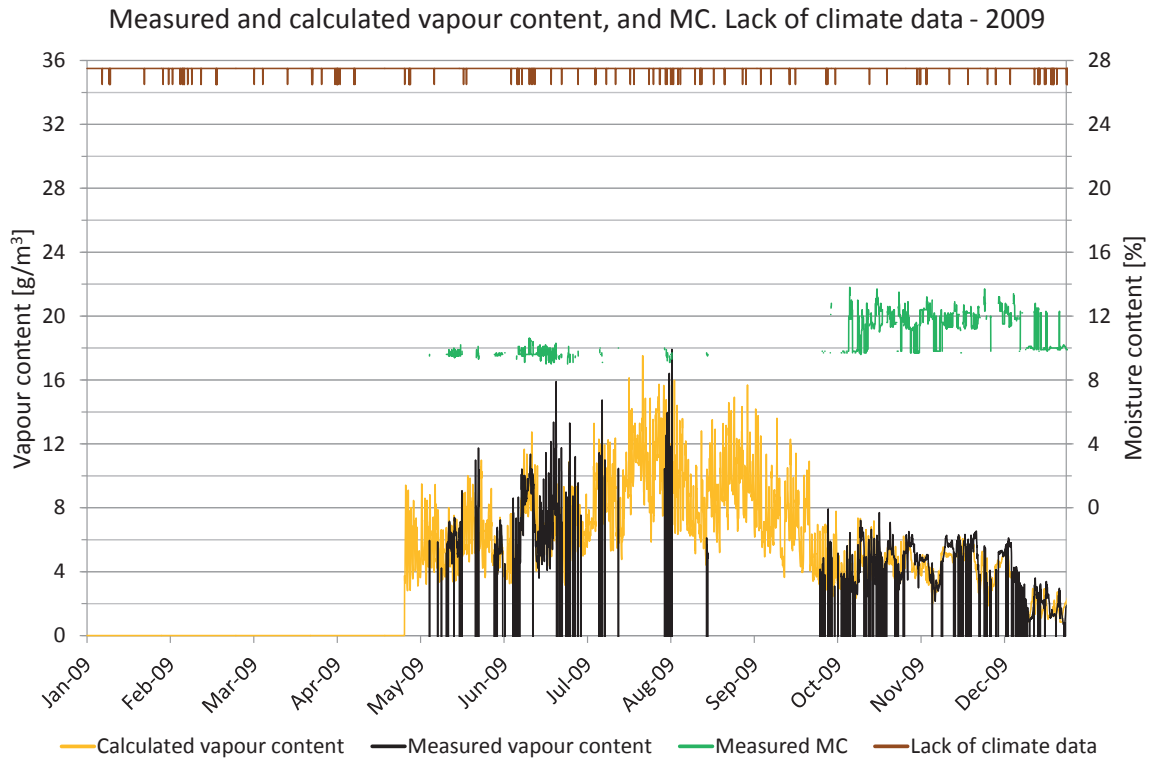


Figure 9.S.5. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

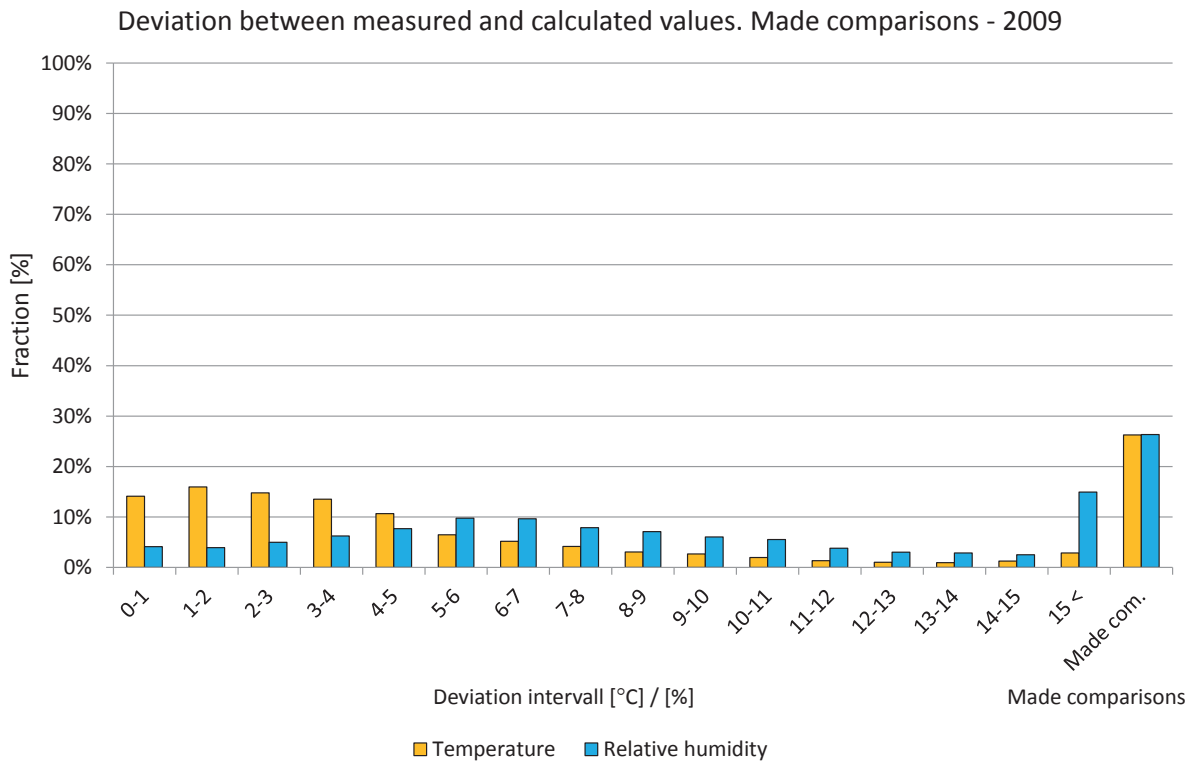


Figure 9.S.6. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2010

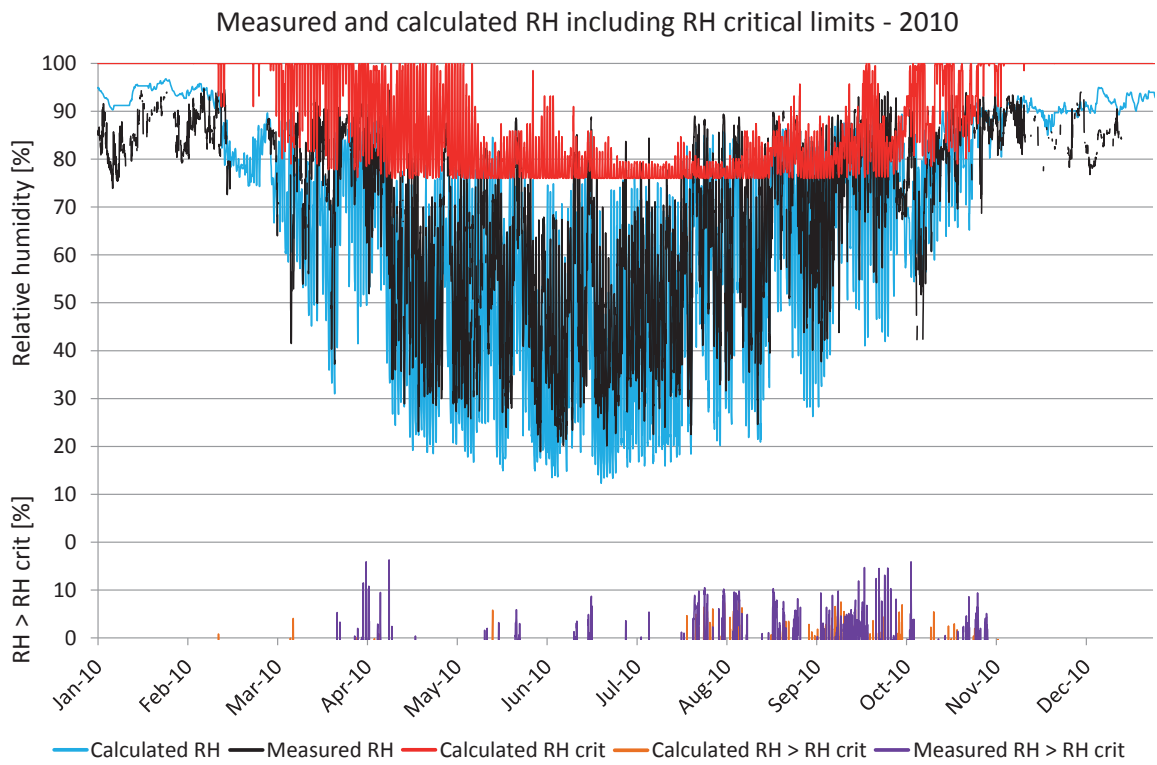


Figure 9.S.7. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

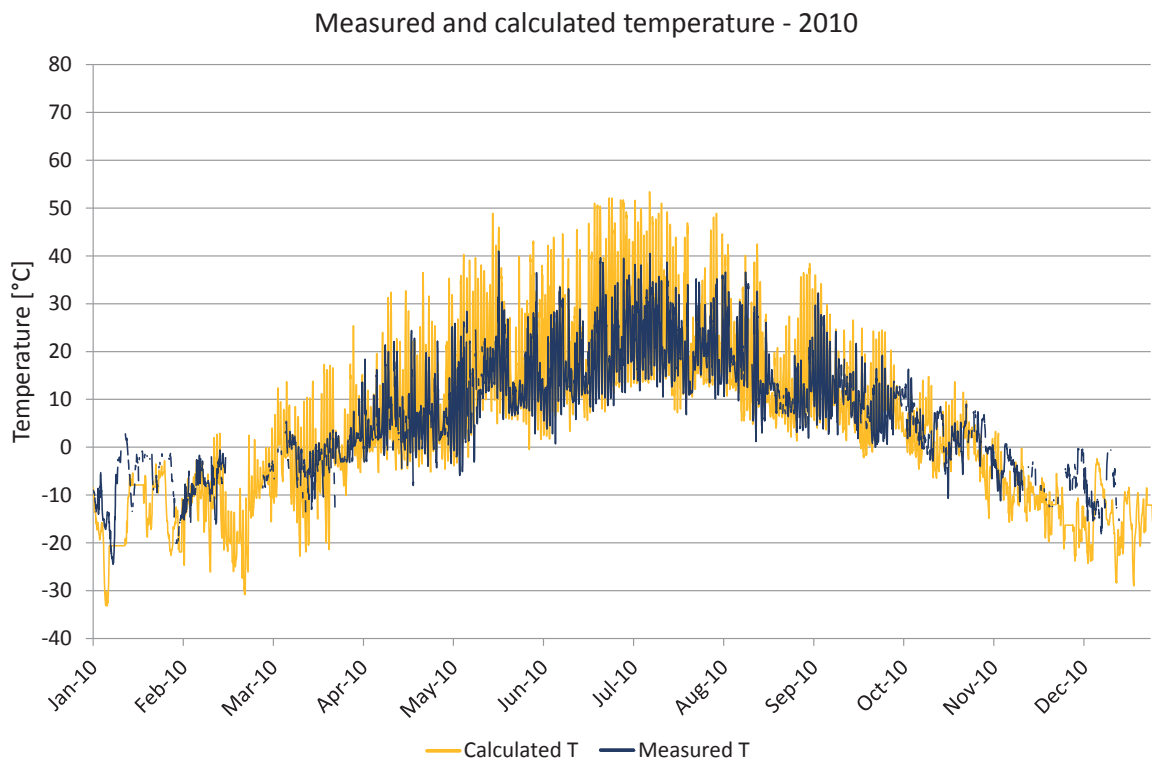


Figure 9.S.8. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

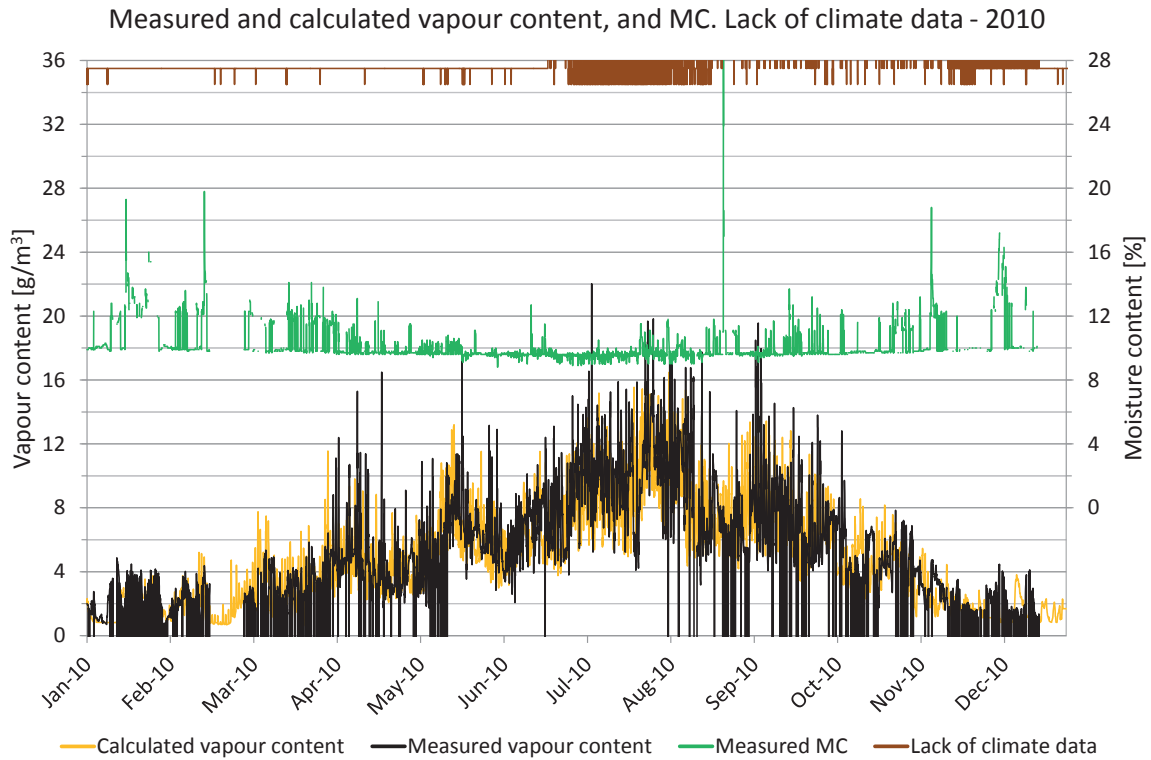


Figure 9.S.9. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

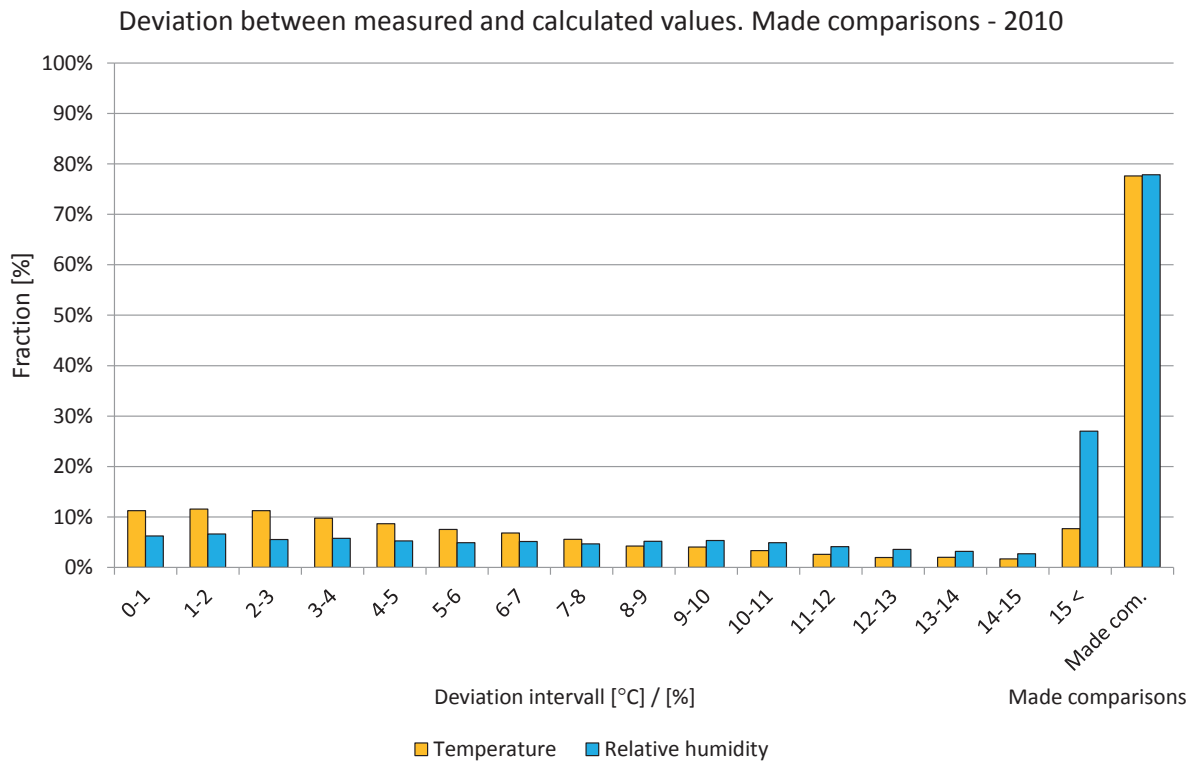


Figure 9.S.10. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

Year 2011

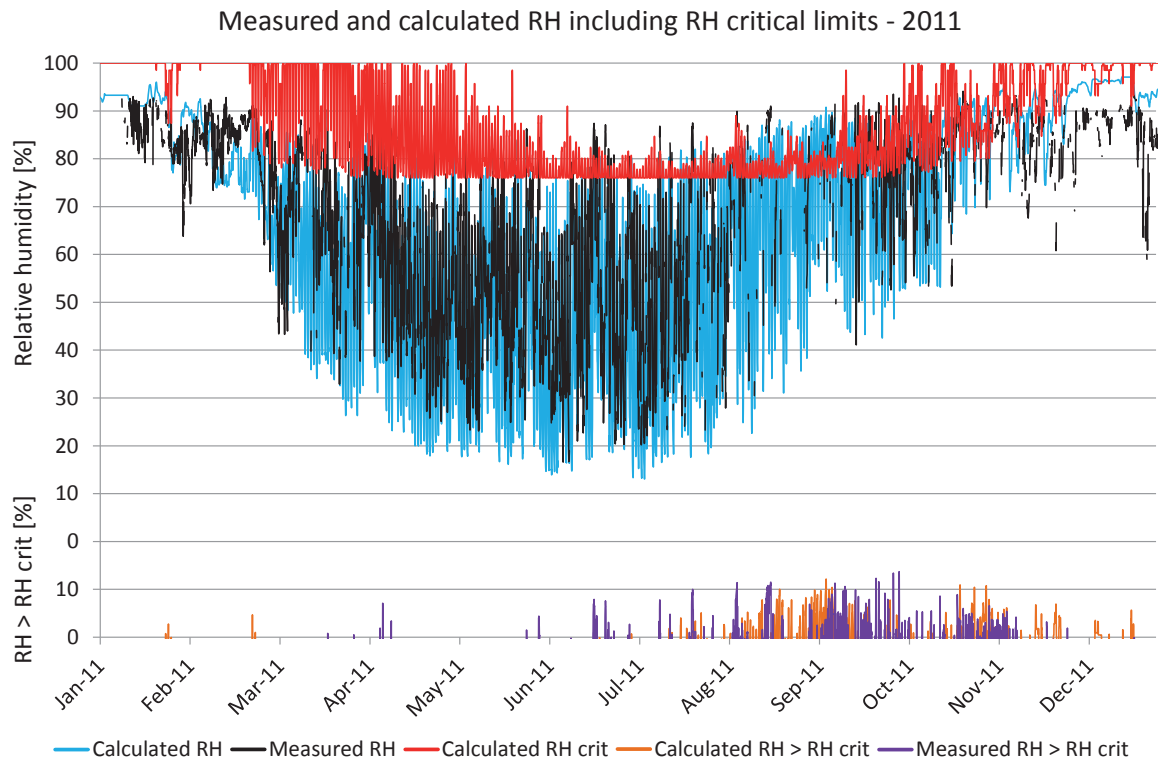


Figure 9.S.11. Comparisons between measured and calculated relative humidity. Calculated RH (turquoise), measured RH (black), RH_{crit} for calculated values (red), calculated $RH > RH_{crit}$ (light brown), measured $RH > RH_{crit}$ (purple).

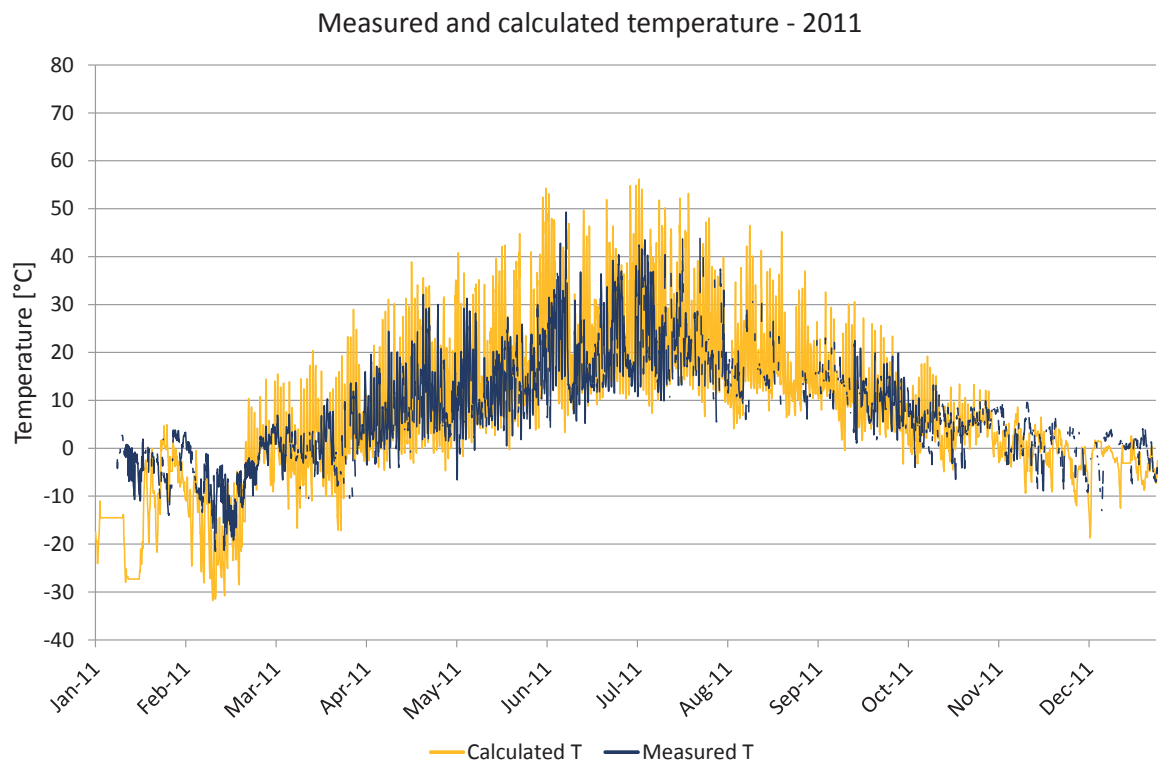


Figure 9.S.12. Comparisons between measured and calculated temperature. Calculated temperature (yellow), measured temperature (dark blue).

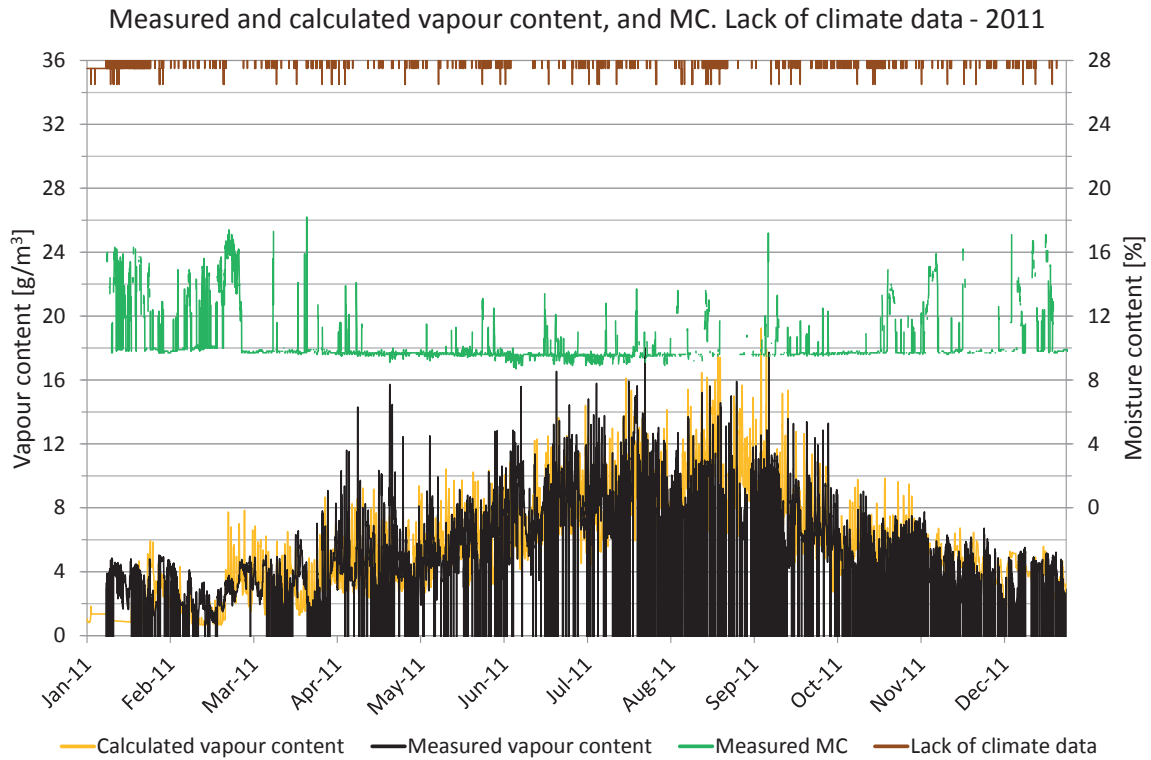


Figure 9.S.13. Measured moisture content, periods lacking climate data and comparisons of vapour content. Vapour content for calculated values (yellow) and measured values (black). Moisture content (green), periods with lack of climate data (brown).

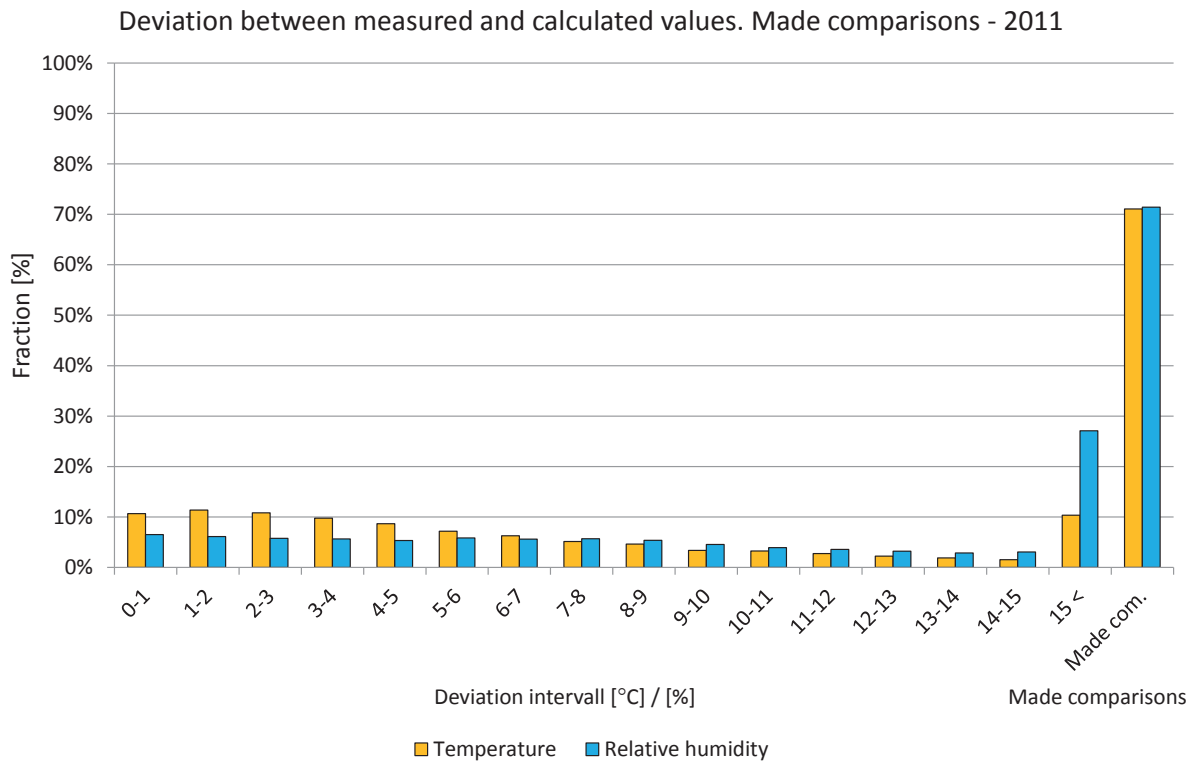


Figure 9.S.14. Deviations in comparisons shown in intervals from 0 to 15 °C or %. The two right-hand bars show the percentage of comparisons during the year. Temperature (yellow) and relative humidity (light blue).

11 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.

11.1 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 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. However, there were constant deviations of approximately 10 to 20 percent lower measured relative humidity. The differences, between the measured and blindly calculated relative humidity, tend to be greater during the winter and seem to depend on the differences between 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.

Measured values on the outside of the façade provided results that followed the calculated values. However, there were constant deviations of approximately 10 to 30 percent lower measured relative humidity. As mentioned above, these differences tend to depend on the variations between the measured and calculated temperature. These become especially obviously since the differences were greater in the façade directed towards south which were more exposed to solar radiation that increase the temperature. Comparisons between measured and blindly calculated moisture content, in the exterior part of the façade, were poor. This may depend on several of factors such as the façade panel structure, possible influence of paint or the exterior climate boundary conditions influence on the façade material.

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.

11.2 Attic

In general there was a clear correlation between the measured and blindly calculated values in most of the studied positions in the cold attic area. Possible differences between the measured and blindly calculated values are analyzed and discussed below.

Studied positions in the cold attic space and on the inside of the tongued and grooved wood shows a clear correlation between the measured and blindly calculated values. During the cold periods there were deviations dependent on the temperature. Calculated moisture content in the tongued and grooved wood provided results that followed the measured values but was up to 4 percent lower during some periods.

The daily variation in temperature and relative humidity in the cold attic space, and on the inside of the tongued and grooved wood show higher values in measured values compare to blind calculated values in the attic that was directed towards south dependent on the heat from the sun radiation.

11.3 Roof

There were also clear correlations between the measured and blindly calculated values in most of the studied positions in the roof. Possible differences between the measured and blindly calculated values are analyzed and discussed below.

Studied positions located close to the interior, on the outside of the vapour barrier, and in the middle of the insulation showed good correlation from the time when correct indoor boundary climate conditions were used.

Positions located in the middle of the insulation generally show clear correlations between the measured and blind calculated values from Mars to October. During the colder period, November to February, there were deviations where measured values mainly show a higher relative humidity of 10 to 15 percent that were caused by higher vapour content.

Positions located in the air gap on the inside of the tongued and grooved wood also show correlations between the measured and blind calculated values from Mars to October. However, during the colder period November to February there were deviations when measured relative humidity was 10 to 15 percent lower that were caused by higher temperatures.

12 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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