Journal of Agricultural Engineering

Appendix

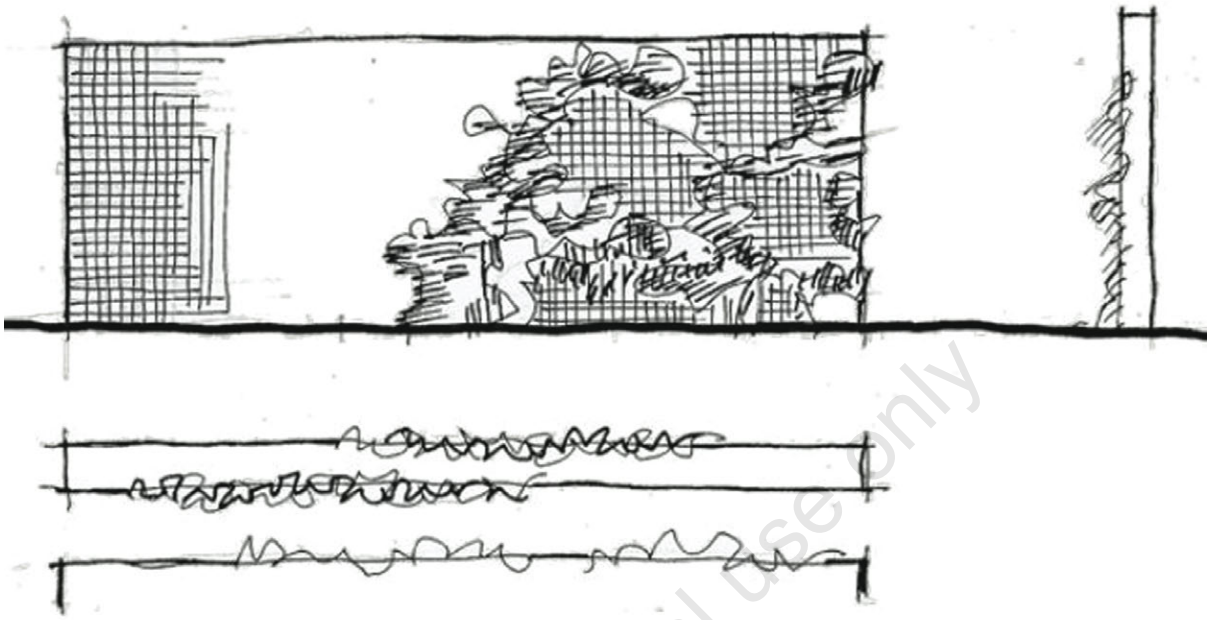
Effects of different architectural solutions on the thermal behaviour in an unconditioned rural building. The case of an Italian winery

Daniele Torreggiani, Alberto Barbaresi, Francesca Dallacasa, Patrizia Tassinari

Journal of Agricultural Engineering 2018; XLIX:52-63_Appendix
doi: 10.4081/jae.2018.779

Appendix Figures

A) Architectural sketch of the structure



B) *Parthenocissus tricuspidata*

Figure A1. Shading surface details.

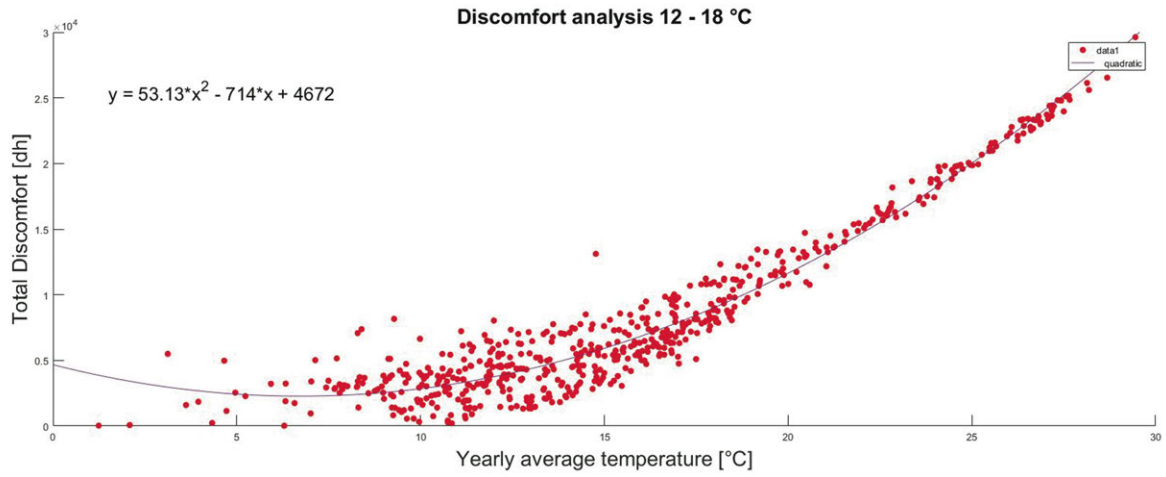
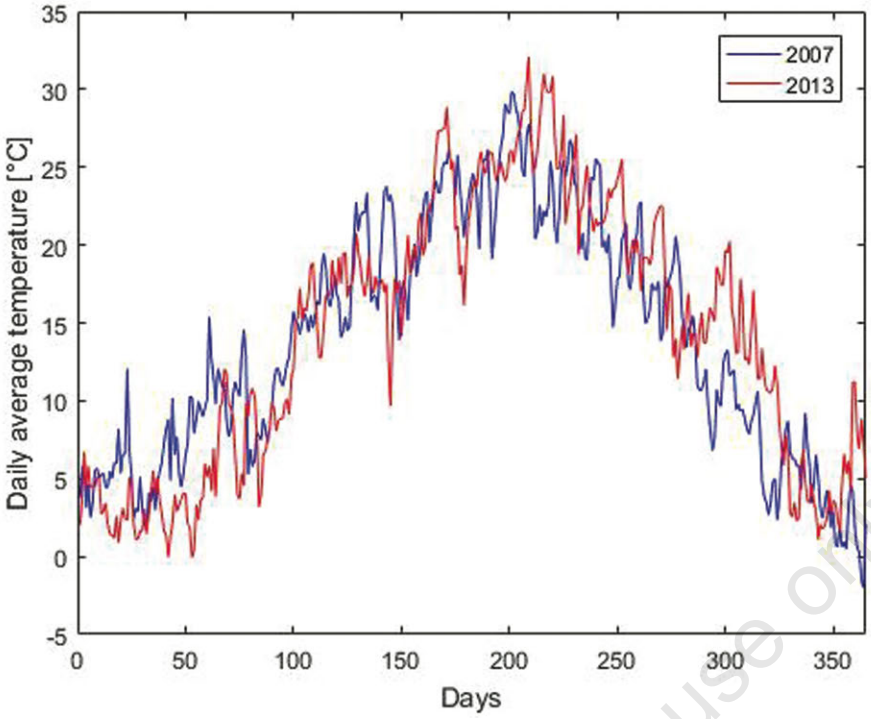


Figure A2. Total discomfort *vs* yearly average temperatures.

A) Daily average temperature trends



B) Monthly average temperature trends

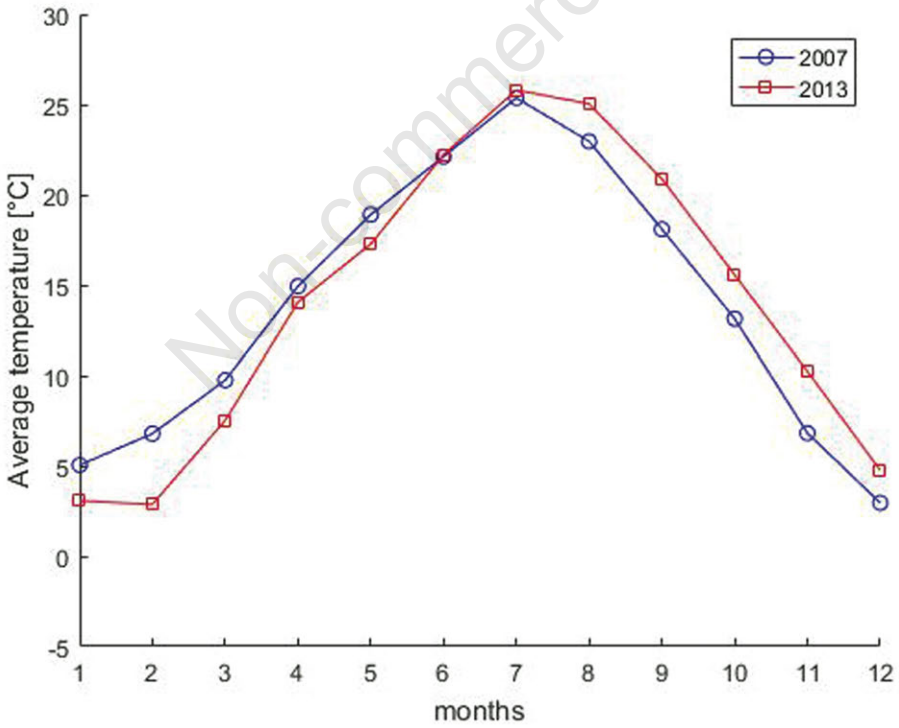
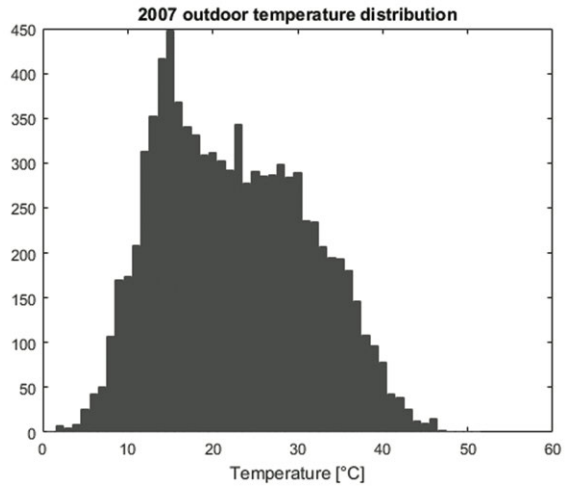
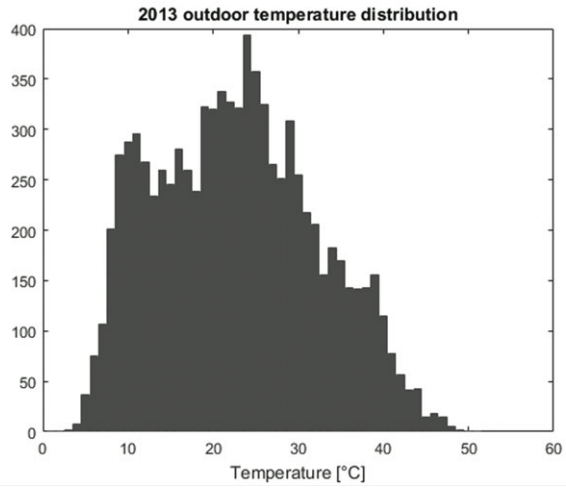


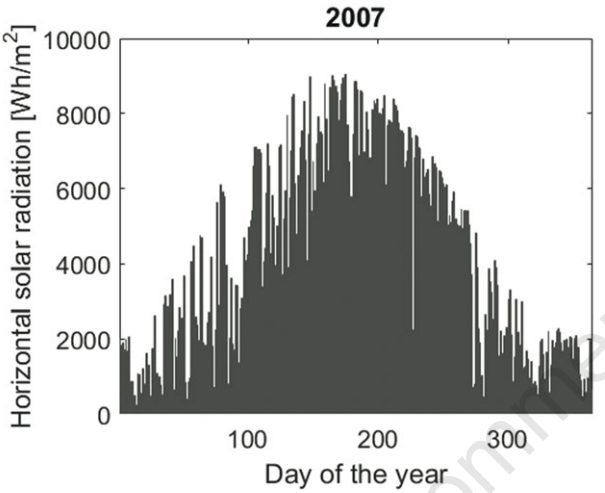
Figure A3. 2007 and 2013 temperature trends.



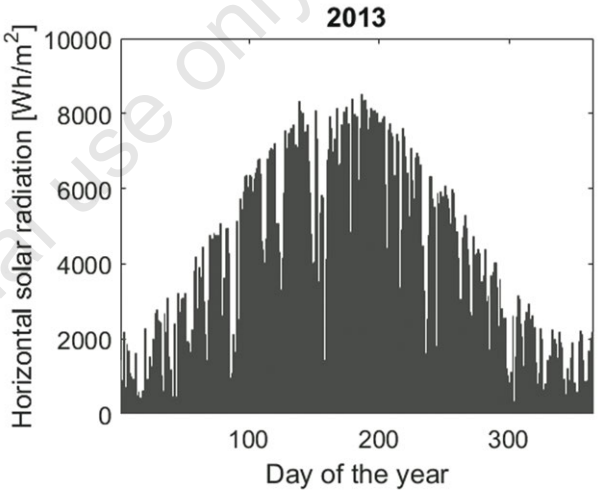
A) Temperature distribution in 2007



B) Temperature distribution in 2013



C) Daily total horizontal solar radiation 2007



D) Daily total horizontal solar radiation 2013

Figure A4. Outdoor temperature distributions.

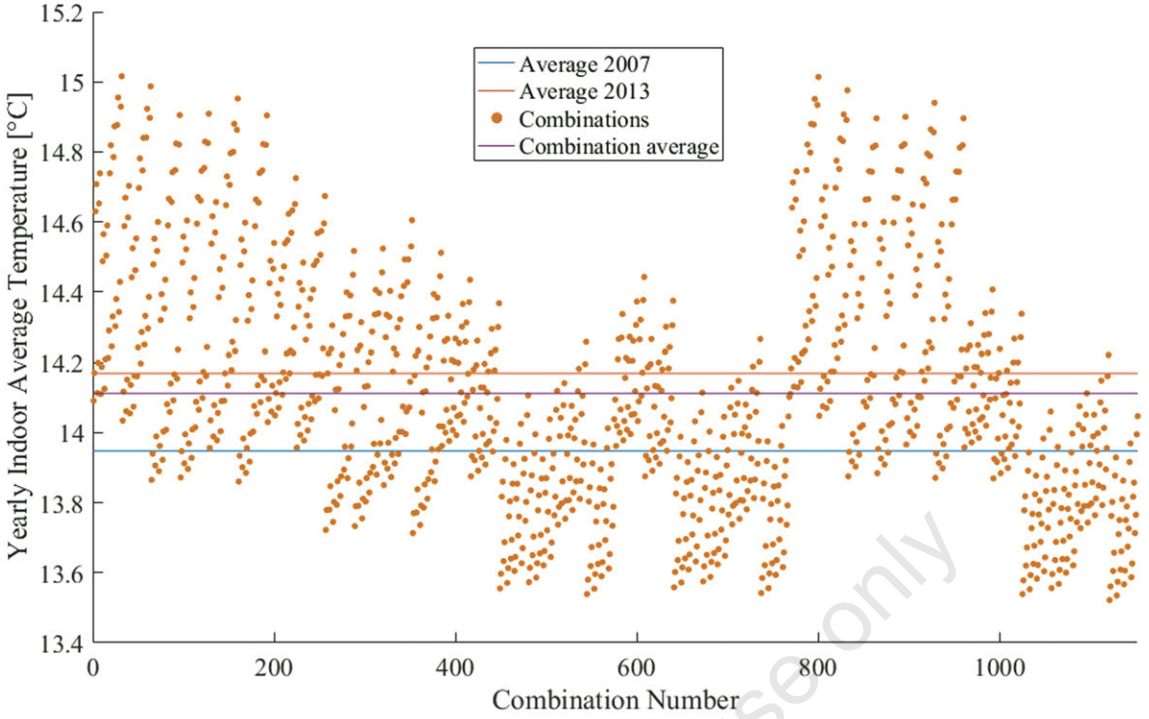
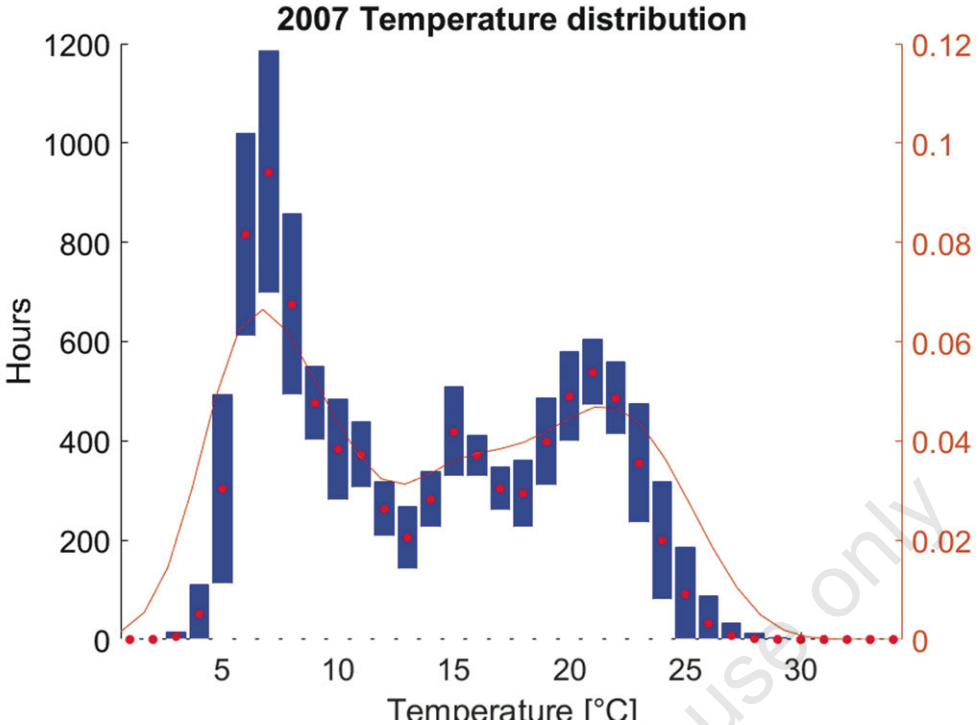


Figure A5. Yearly temperature averages for each combination.

A) Temperature distribution in 2007



B) Temperature distribution in 2013

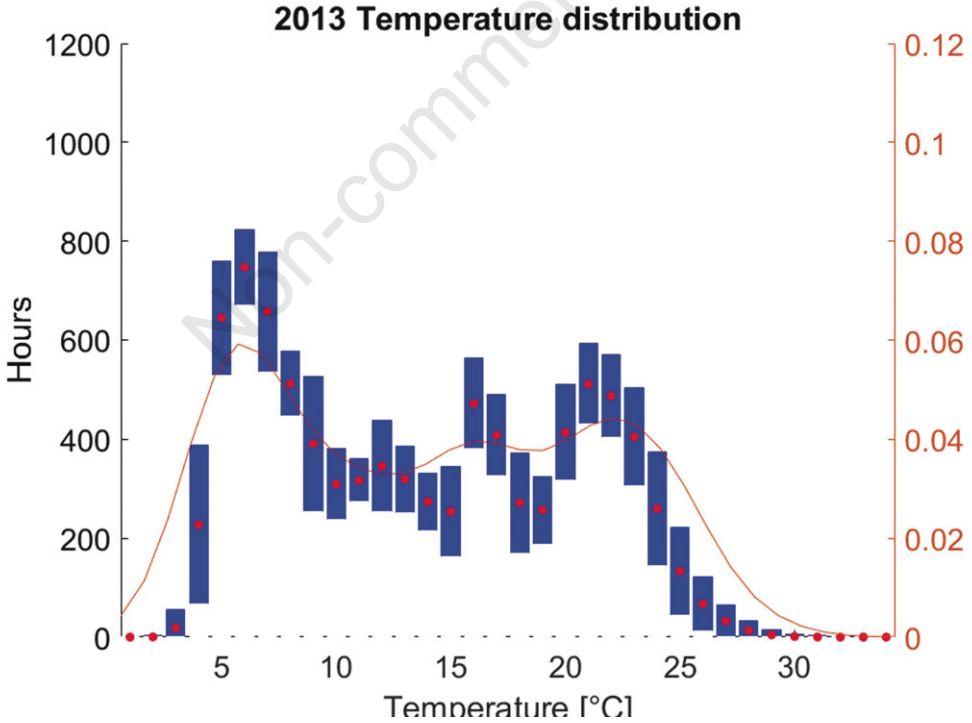
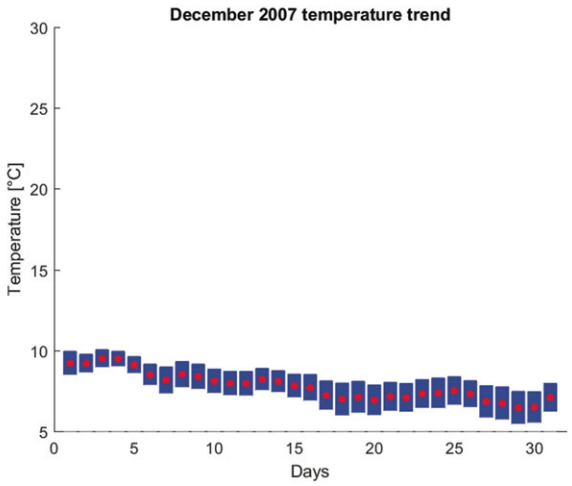
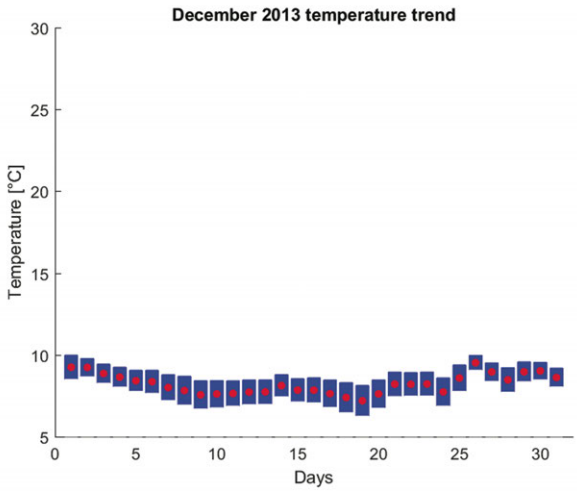


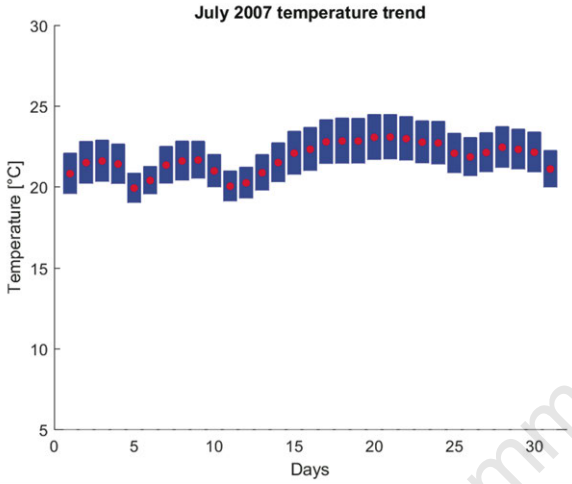
Figure A6. Indoor temperature distributions. The red circles represent the average temperatures, the blue box the standard deviations calculated in the 576 models for 2007 (A) and 2013 (B). The orange line is the kernel density estimation for the outdoor temperature distribution.



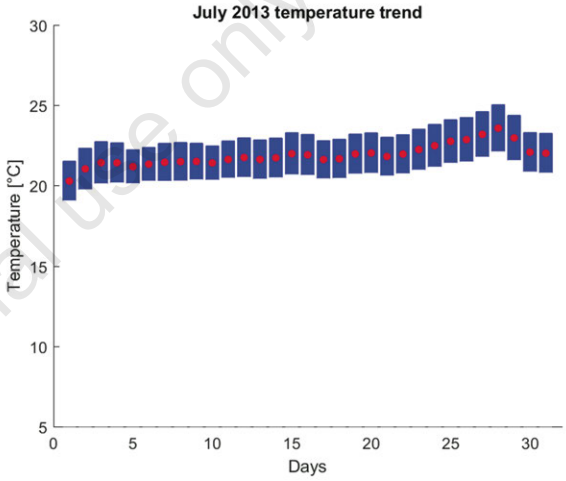
A) Temperature trends in December 2007



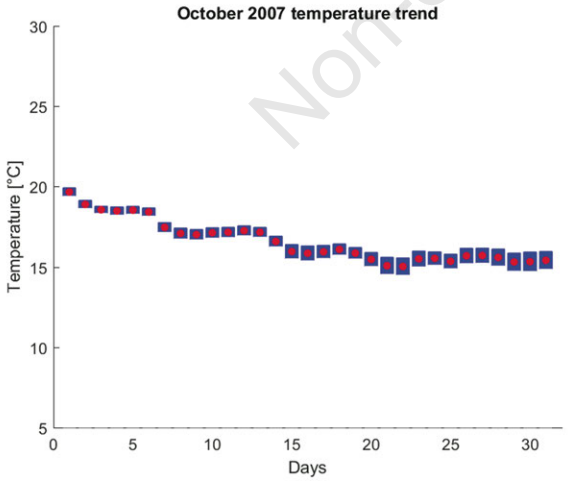
B) Temperature trends in December 2013



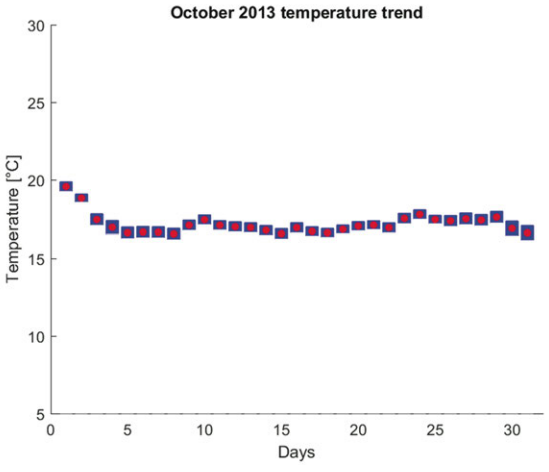
C) Temperature trends in July 2007



D) Temperature trends in July 2013



E) Temperature trends in October 2007



F) Temperature trends in October 2013

Figure A7. Seasonal temperature trends. Average temperatures (red circles) and standard deviations (blu boxes) are shown.

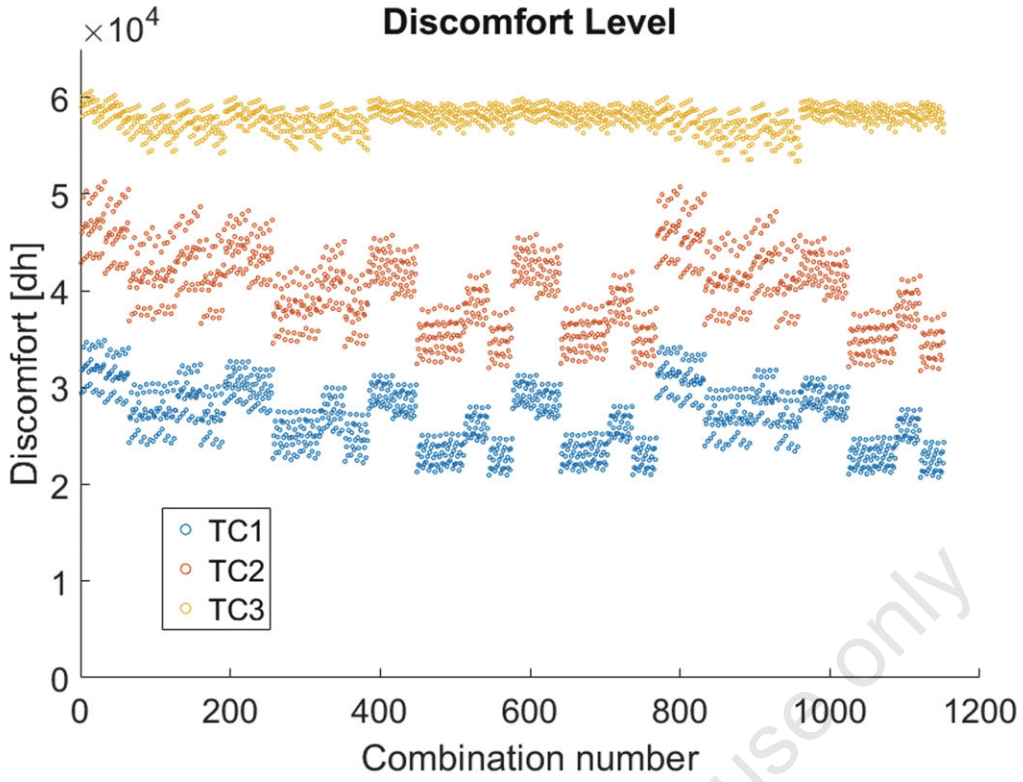


Figure A8. Discomfort levels calculated on each combination for the 3 thermal comfort ranges.

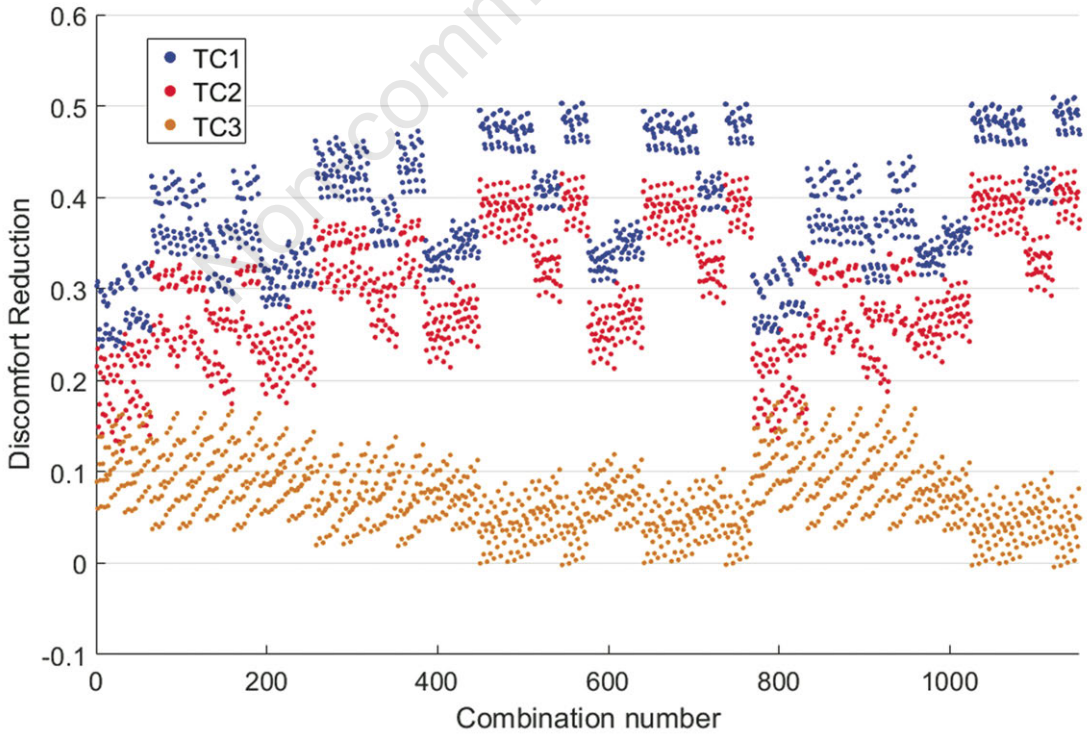


Figure A9. Discomfort reduction for each combination calculated on the 3 thermal comfort ranges.

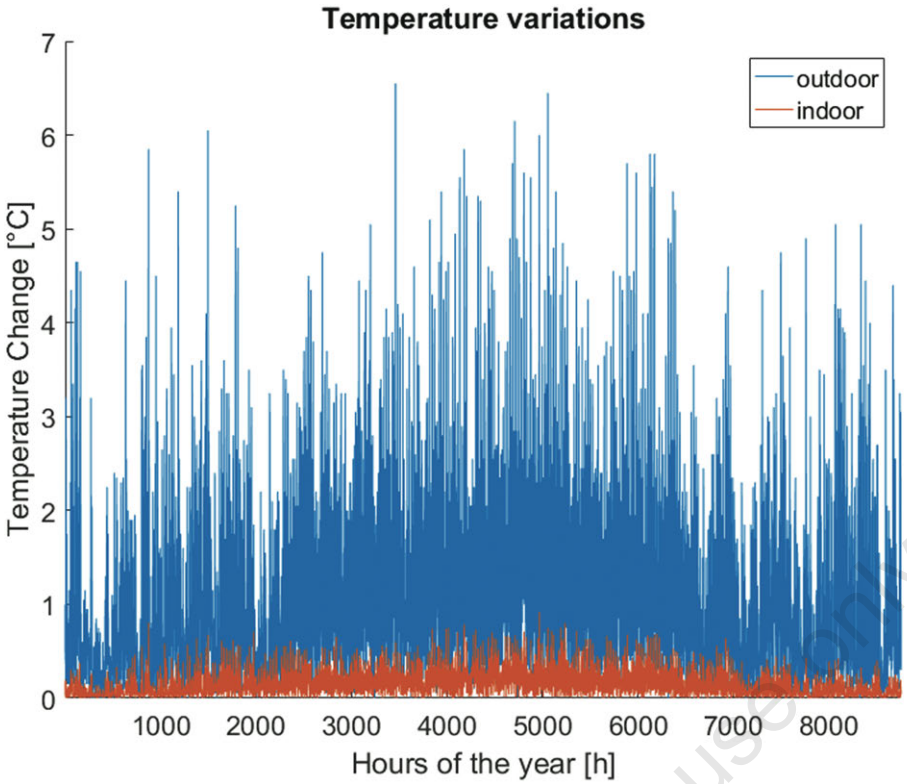


Figure A10. Temperature change trends.

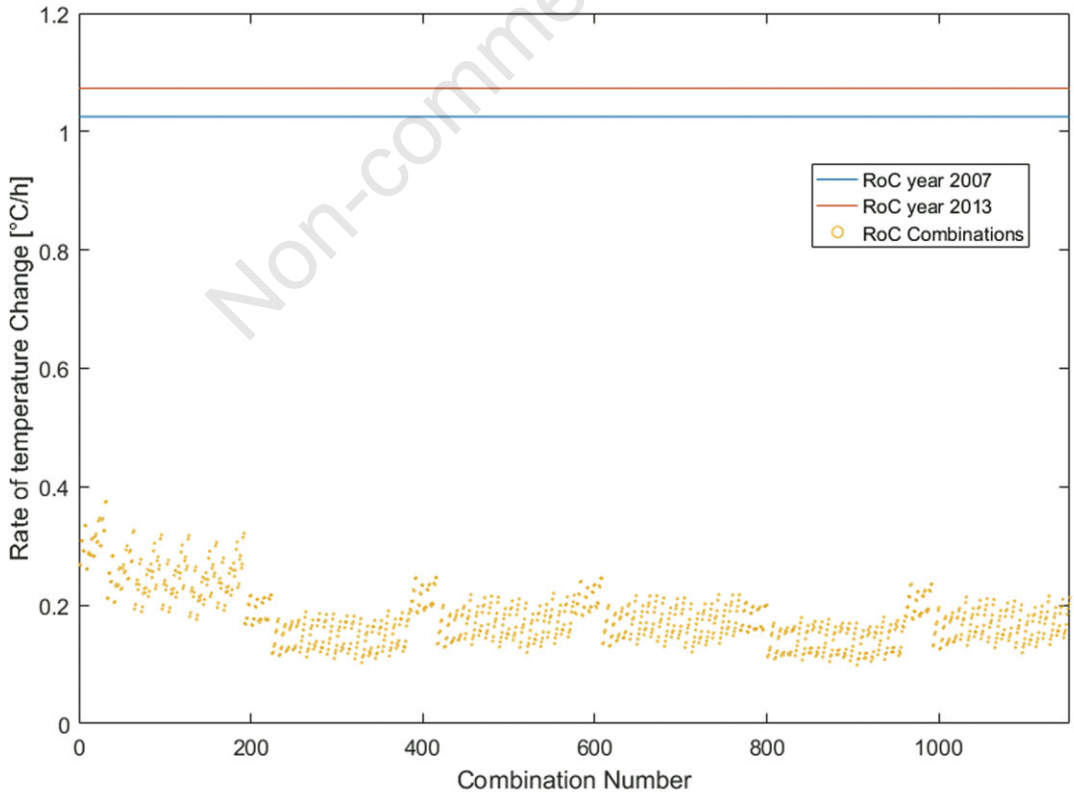


Figure A11. Rate of temperature change for each combination.

Appendix Tables

Table A1. Wall layers and thermal characteristics. Materials are listed from outdoor to indoor.

Wall	Material	Thickness [m]	Conductivity $[Wm^{-1}K_{-1}]$	Density $[kgm^{-3}]$	Specific heat $[Jkg^{-1}K_{-1}]$
w01	Plaster	0.015	0.700	1400	900
	Bricks	0.012	0.700	1600	830
	Plaster	0.015	0.700	1400	900
w02	Plaster	0.015	0.700	1400	900
	Light-weight concrete	0.260	0.450	1100	1100
	Plaster	0.015	0.700	1400	900
w03	Plaster	0.015	0.700	1400	900
	Heavy polystyrene	0.080	0.035	120	1350
	CLT panel	0.220	0.220	500	1650
w04	Plaster	0.015	0.700	1400	900
	Light polystyrene	0.080	0.360	1200	830
	Hollow bricks	0.220	0.220	500	1650
	Plaster	0.015	0.700	1400	900
w05	Plaster	0.015	0.700	1400	900
	Concrete	0.360	1.800	2400	1000
	Plaster	0.015	0.700	1400	900
w06	Strawbales	0.500	0.110	1000	1500
	Plaster	0.015	0.700	1400	900
	Light-weight concrete	0.260	0.450	1100	1100
	Plaster	0.015	0.700	1400	900

Table A2. Roof layers and thermal characteristics.

Roof	Material	Thickness [m]	Conductivity [$Wm^{-1}K-^{1}$]	Density [kgm^{-3}]	Specific heat [$Jkg^{-1}K-^{1}$]
r01	Roof tiles	0.030	2.000	2700	1260
	Hollow slab	0.200	0.800	1000	600
	Plaster	0.015	0.700	1400	900
r02	Roof tiles	0.040	0.700	1800	830
	Hollow slab	0.250	0.800	1000	600
	Plaster	0.015	0.700	1400	900
r03	Roof tiles	0.040	0.700	1800	830
	Fiber wood panels	0.130	0.039	160	2100
	Hollow slab	0.250	0.800	1000	600
	Plaster	0.015	0.700	1400	900
r04	Roof tiles	0.040	0.700	1800	830
	Light polystyrene	0.120	0.040	20	1350
	Hollow slab	0.200	0.800	1000	600
	Plaster	0.015	0.700	1400	900
r05	Roof tiles	0.040	0.700	1800	830
	Fiber wood panels	0.120	0.150	1000	2500
	Plaster	0.015	0.700	1400	900
r06	Roof tiles	0.040	0.700	1800	830
	Fiber wood panels	0.180	0.039	160	2100
	Hollow slab	0.250	0.800	1000	600
	Plaster	0.015	0.700	1400	900