

Holistic Dynamic thermal calculations

Wood construction

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Insulation for a better tomorrow



OBJECTIVE:

Compare dynamic thermal performance in buildings made in wood construction using Wood Fibre (WF) or Glasswool (GW) insulation

PRECEDENTS

In previous presentation we have concluded no significant difference at constructive element level (wall) exists

METHOD:

Dynamic calculation at building level (using ENERGY plus software)

Consider one building as example (single family house)

Identical profile of use of the building (residential)

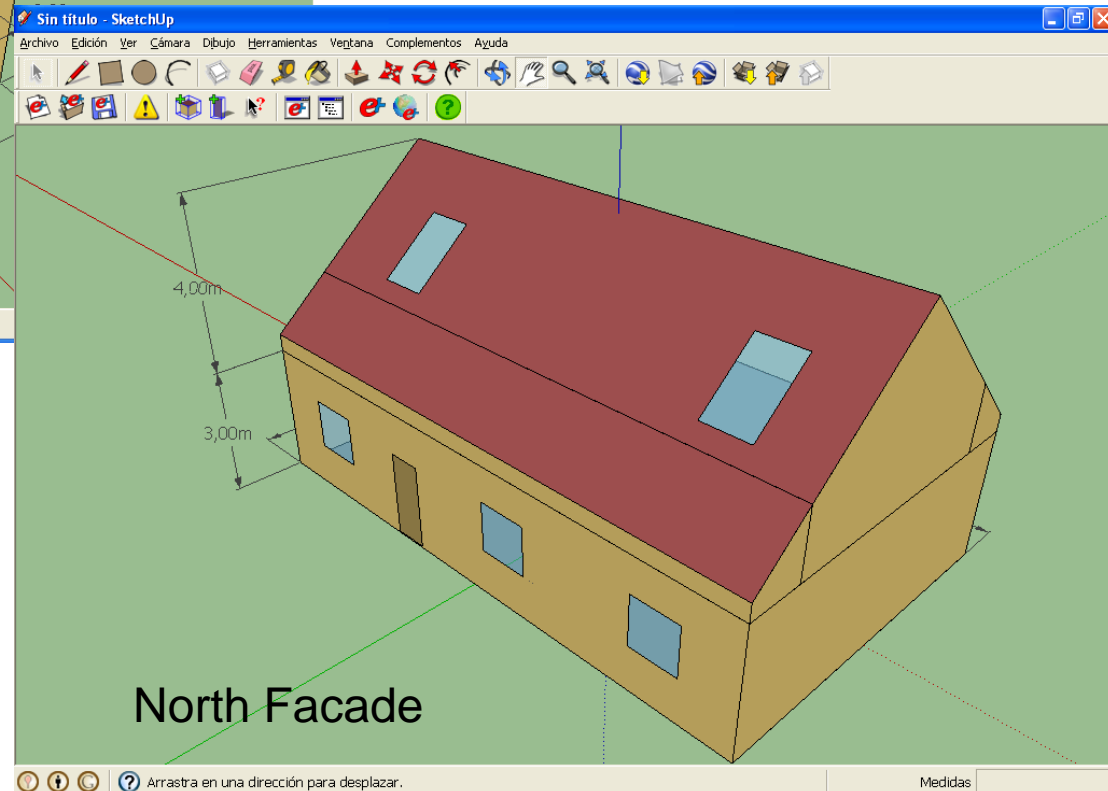
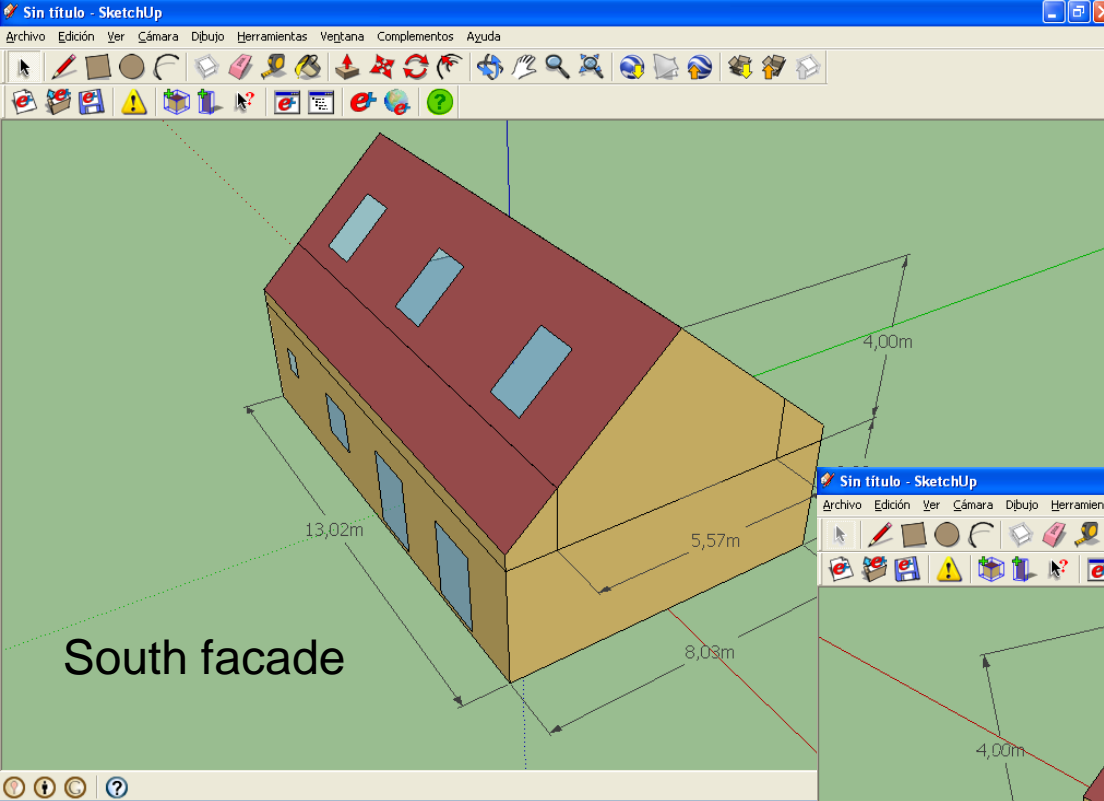
Different European situations

a) fully conditioned building (energy demand)

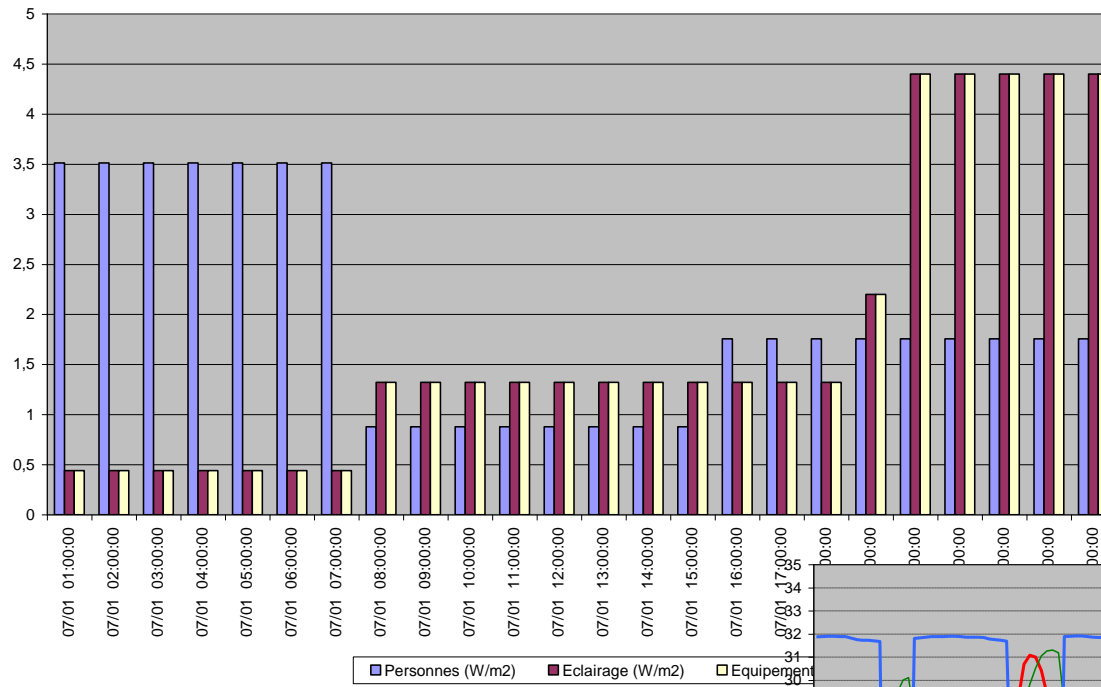
b) non cooled buildings (free floating peak temperatures, number hours above comfort temperature)

CONCLUSION:

Single Family house MI2



Internal gains / Air infiltration / air ventilation



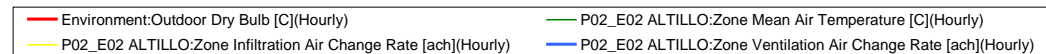
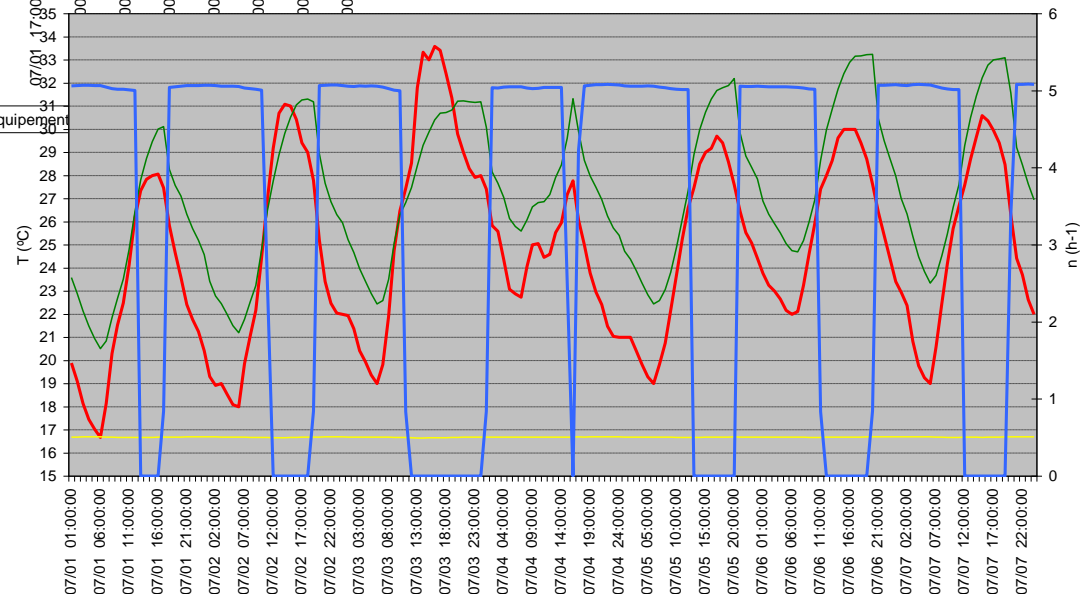
Internal gains

People
Lighting
Equipments

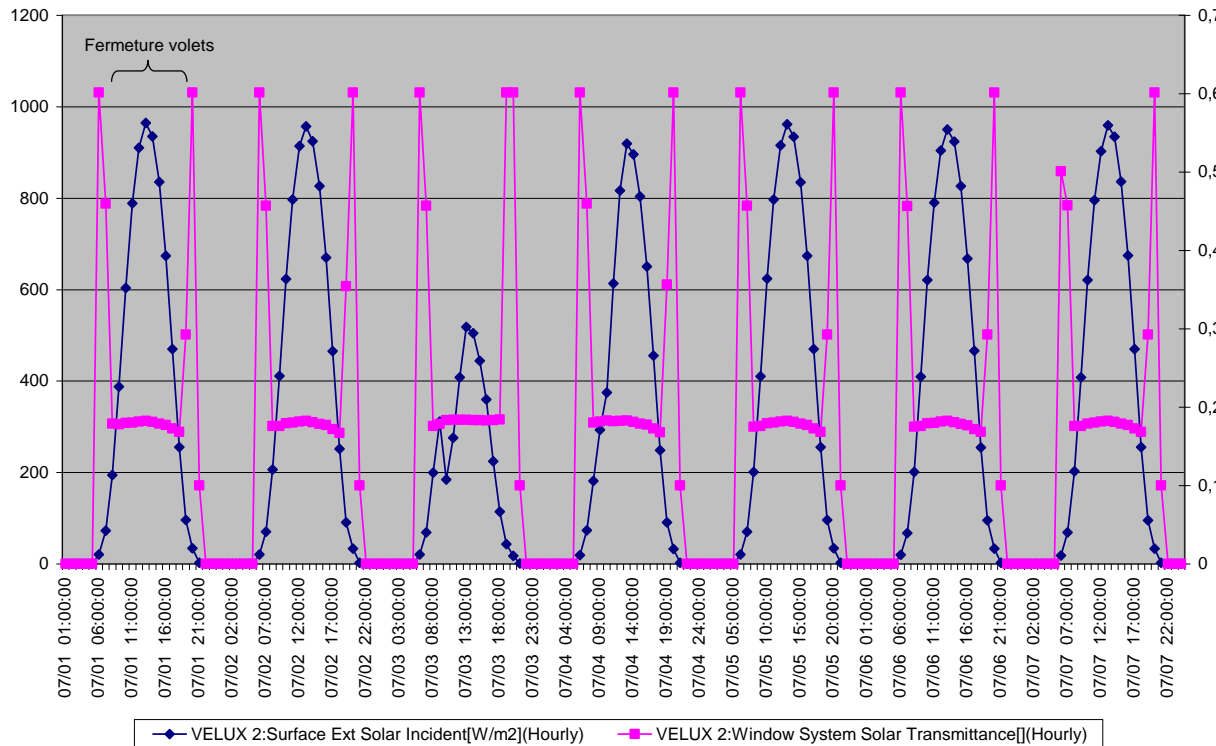
Air Infiltration / Ventilation

Infiltration 0,5 n⁻¹

Ventilation 5 n⁻¹ (if Tex < 27°C and Tint > Text)



Solar protection



**Solar protection
if incident radiation > 75W/m2**

Internal thermal inertia 20 kJ/m2·K

Wall		Thickness cm	Lambda W/m·K	Density Kg/m ³	Specific heat J/kg·K
Render		1,5	1.-	1700	1000
Concrete brick		20	0,87	1000	1000
Insulation	GW	20	0,035	20	1030
	WF	20	0,040	50	2000
Vapour barrier		--	--	--	--
Plasterboard		1,5	0,25	800	1000

Floor		Thickness cm	Lambda W/m·K	Density Kg/m ³	Specific heat J/kg·K
Concrete		12	2.-	2400	1000
Insulation		5	0,034	35	1400
Mortar		4	0,7	1700	1000
Ceramic		2	1,9	2300	1000

Roof		Thickness cm	Lambda W/m·K	Density Kg/m ³	Specific heat J/kg·K
Tile		1,5	1,9	2300	1000
Air gap		3	0,19	1,2	1008
Wind barrier		--	--	--	--
Insulation R=5	GW	17,5	0,035	20	1030
	WF	20	0,040	50	2000
Vapour Barrier		--	--	--	--
Plasterboard		1.2	0,25	800	1000

Intermediate floor		Thickness cm	Lambda W/m·K	Density Kg/m ³	Specific heat J/kg·K
Ceramic		2	1,9	2300	1000
Wood panel		3	0,15	600	1700
Insulation		10	0,04	12	1030
Plasterboard		1,5	0,25	800	1000

Fully conditioned building

Comfort is maintained by systems, the issue is yearly energy demand (not possible to change insulation from winter to summer)

	Heating		Cooling		Total		
	GW Insulation (Heat)	WF Insulation (Heat)	GW Insulation (Cool)	WF Insulation (Cool)	GW Insulation (Tot)	WF Insulation (Tot)	WF vs GW
Napoli	2.783,85	2.803,26	2.520,16	2.432,99	5.304,01	5.236,25	-1,3%
Roma	2.895,16	2.910,65	1.903,15	1.796,16	4.798,31	4.706,81	-1,9%
Barcelona	2.689,27	2.697,36	1.634,86	1.554,78	4.324,13	4.252,14	-1,7%
Sevilla	1.280,27	1.254,23	3.228,25	3.116,53	4.508,52	4.370,76	-3,2%
Madrid	4.223,51	4.241,93	1.729,85	1.634,84	5.953,36	5.876,77	-1,3%
Marseille	3.846,08	3.881,43	1.581,94	1.497,07	5.428,02	5.378,50	-0,9%
Paris	7.574,44	7.670,16	139,89	113,62	7.714,33	7.783,78	0,9%
Strasbourg	8.772,77	8.885,20	179,32	142,14	8.952,09	9.027,34	0,8%
Berlin	9.944,57	10.074,76	268,86	245,83	10.213,43	10.320,59	1,0%
Munich	11.014,11	11.156,06	95,43	76,72	11.109,54	11.232,78	1,1%
Frankfurt	9.347,93	9.466,23	146,34	122,20	9.494,27	9.588,43	1,0%
Krakow	11.528,15	11.678,55	118,07	94,08	11.646,22	11.772,63	1,1%
Warsaw	11.499,03	11.645,61	82,55	64,70	11.581,58	11.710,31	1,1%
Belgrade	8.546,74	8.645,60	786,16	706,04	9.332,90	9.351,64	0,2%
Ljubljana	10.394,67	10.519,31	209,43	165,71	10.604,10	10.685,02	0,8%
Moscow	15.665,91	15.862,78	154,91	132,87	15.820,82	15.995,65	1,1%
Sain Petersburg	15.878,99	16.082,15	48,97	40,13	15.927,96	16.122,28	1,2%
Istanbul	5.145,19	5.209,94	1.549,69	1.462,40	6.694,88	6.672,34	-0,3%
Athens	1.950,67	1.954,52	4.104,97	4.041,57	6.055,64	5.996,09	-1,0%

Difference is positive (more energy demand) for WF in central and northern sites and only very small negative (less energy demand) for southern sites. In any case difference is very low 1% approx (lower than uncertainty)

During summer for non conditioned buildings the issue is comfort

Indicators:

- a) Number of hours exceeding 26 °C during one period of time (from 30th of July to 2nd August)
- b) Hourly temperature profile (difference on peak temperatures)

Noon cooled buildings Hours exceeding 26 °C

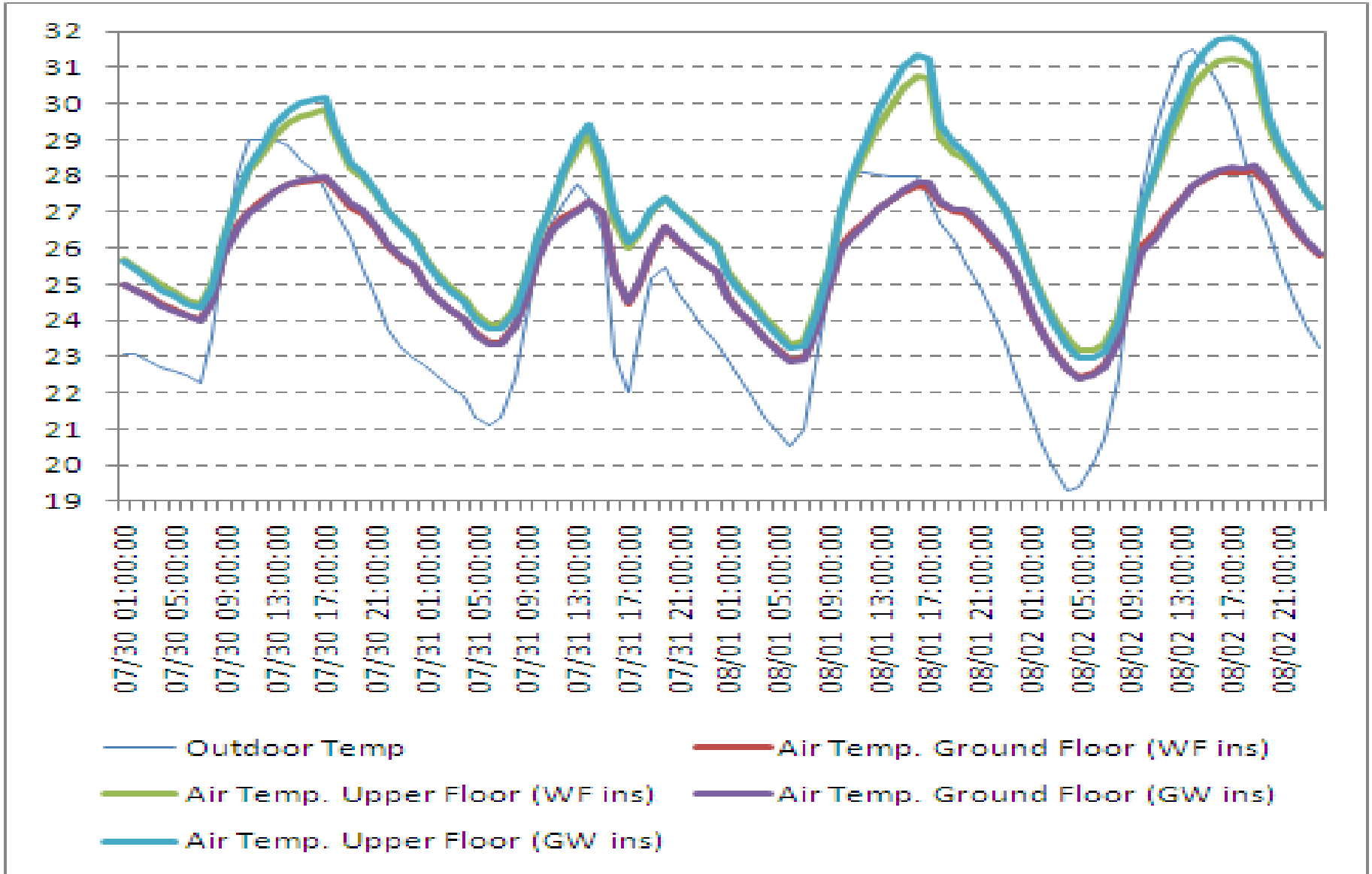
Period: 07/30 to 02/08, total 96 h

	Ground Floor		Upper floor	
	WF Insulation	GW Insulation	WF Insulation	GW Insulation
Napoli	51	51	74	70
Roma	47	45	61	61
Barcelona	52	52	67	67
Sevilla	77	77	87	86
Madrid	26	27	38	38
Marseille	28	28	37	37
Paris	1	2	6	8
Strasbourg	0	0	5	8
Berlin	0	0	0	0
Munich	0	0	5	6
Frankfurt	0	0	0	0
Krakow	0	0	0	0
Warsaw	0	0	2	4
Belgrade	38	38	55	54
Ljubljana	11	11	33	35
Moscou	0	0	0	0
Sain Petersbourg	0	0	4	6
Istambul	39	41	56	54
Athenes	75	75	91	90

No significant differences between building using WF or GW
Sometimes using GW less non comfort hours exist.

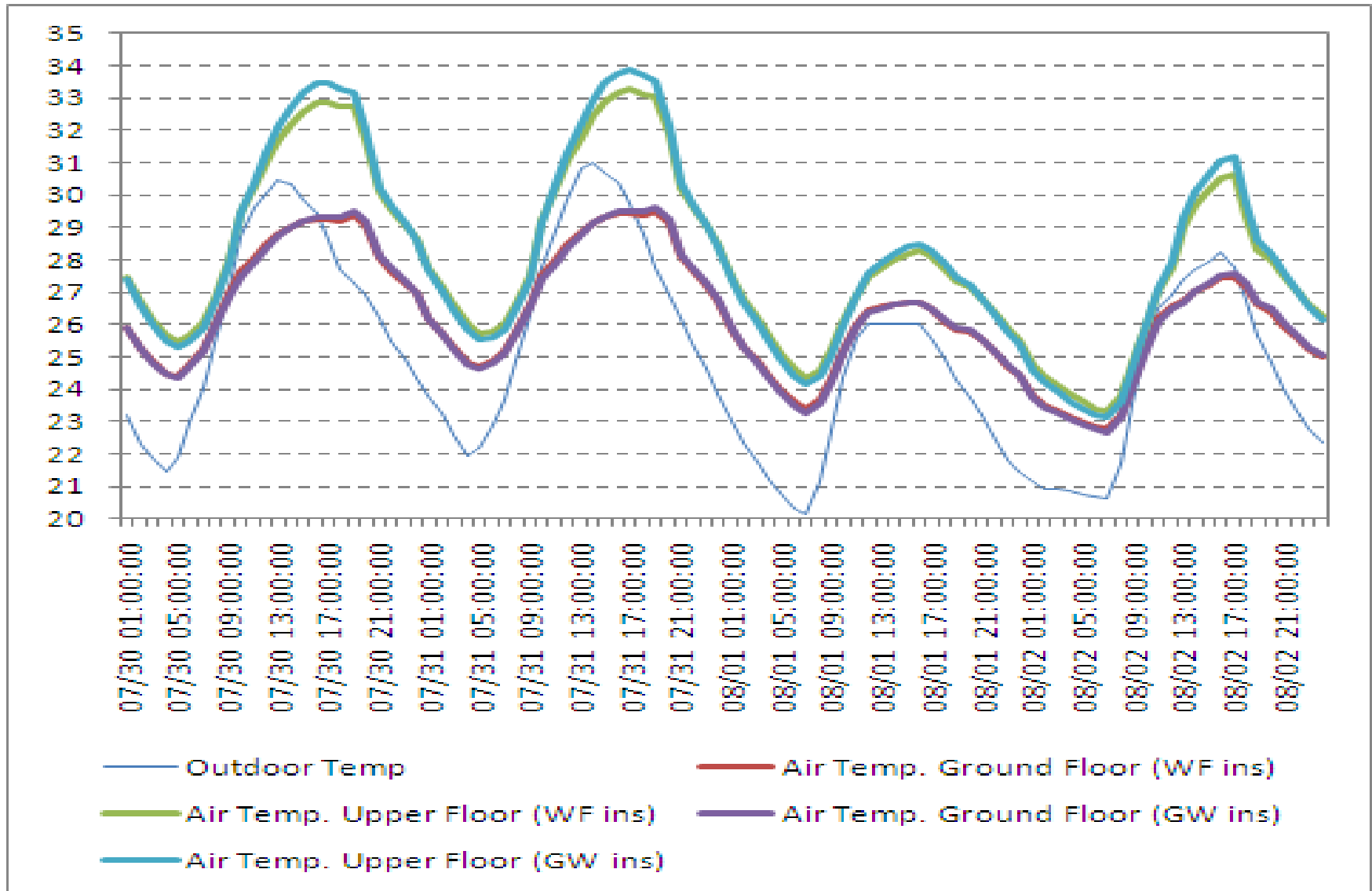
Noon cooled buildings Temperature profile

ROMA



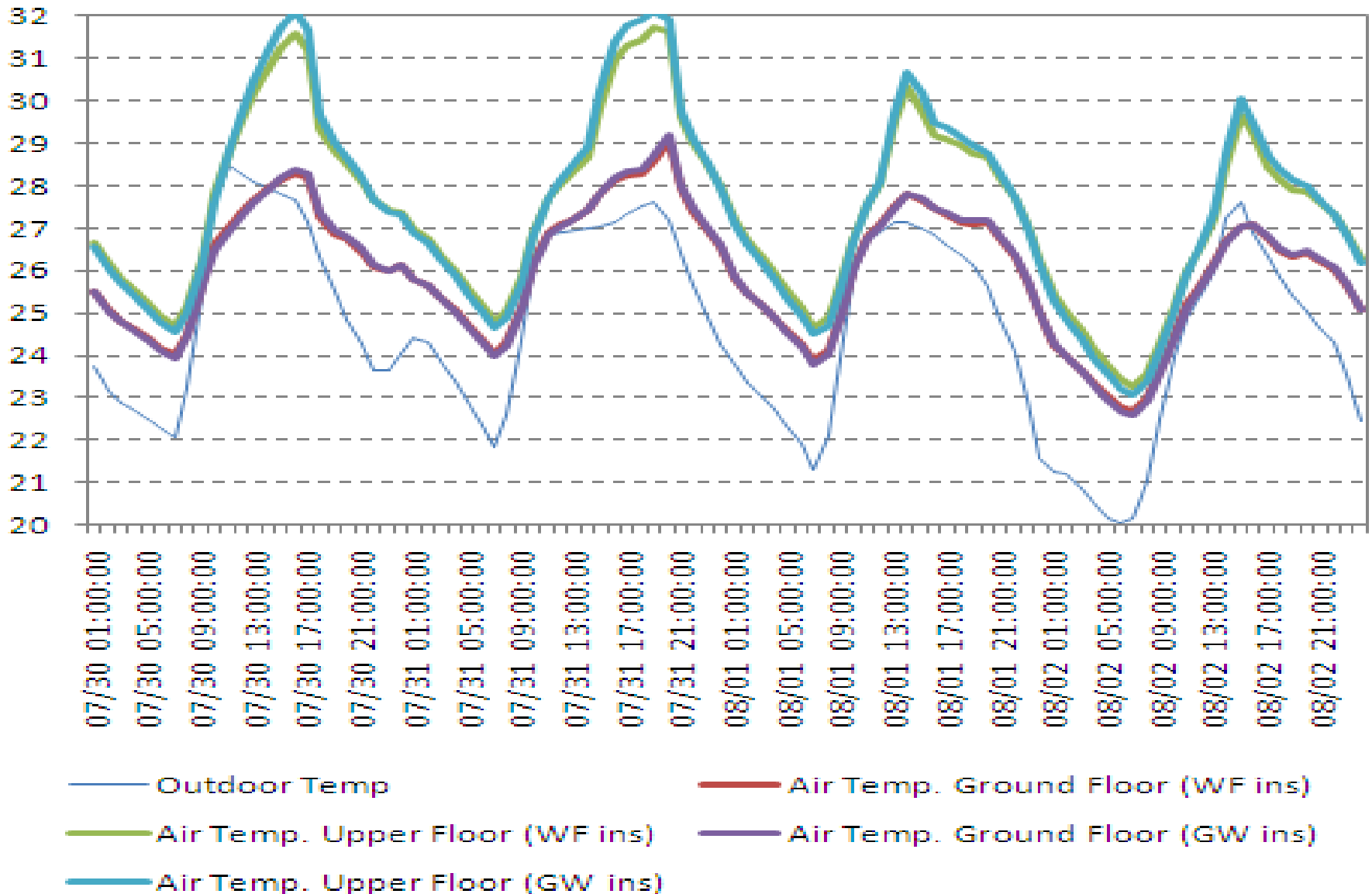
Noon cooled buildings Temperature profile

NAPOLI



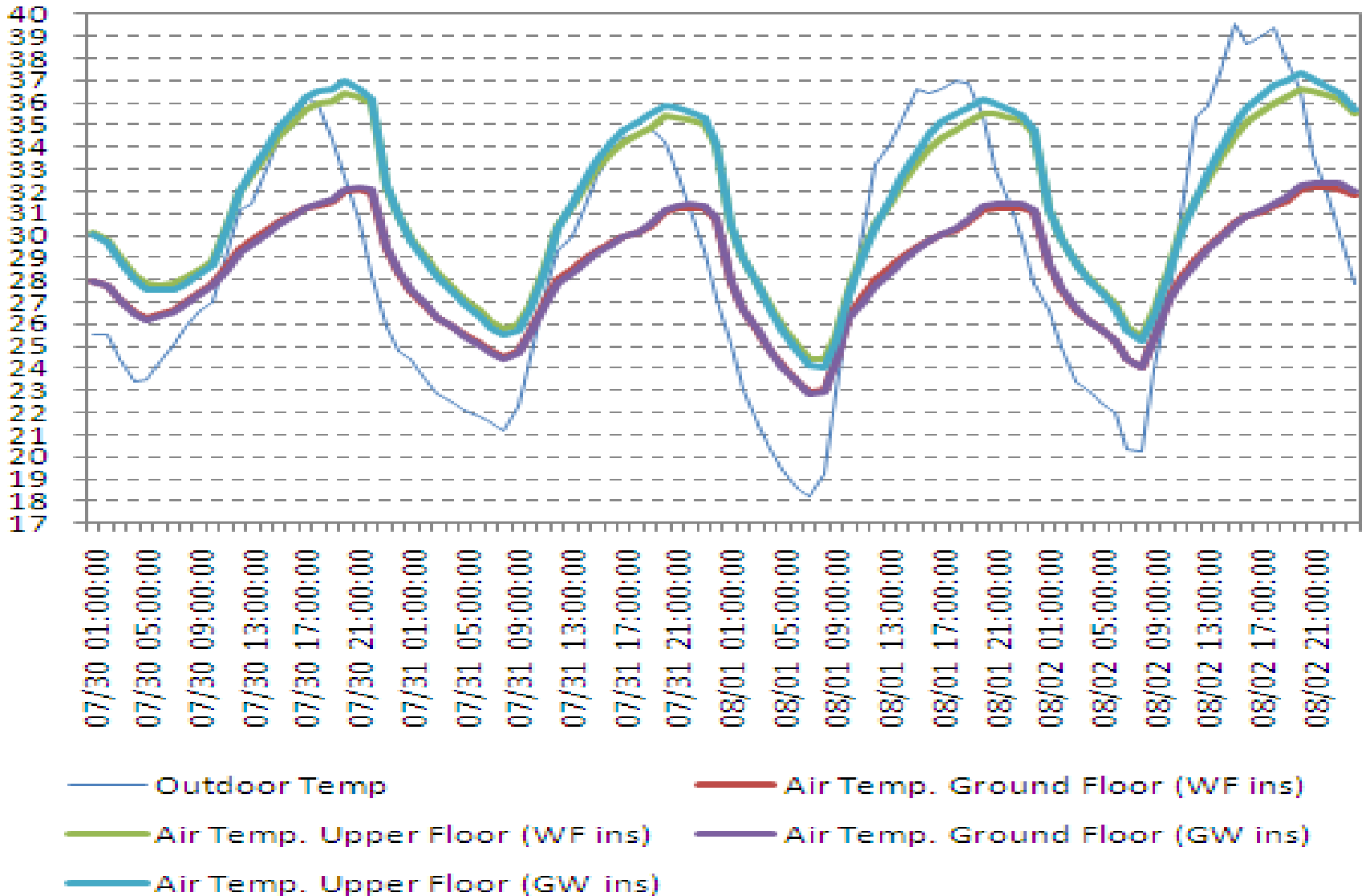
Noon cooled buildings Temperature profile

BARCELONA



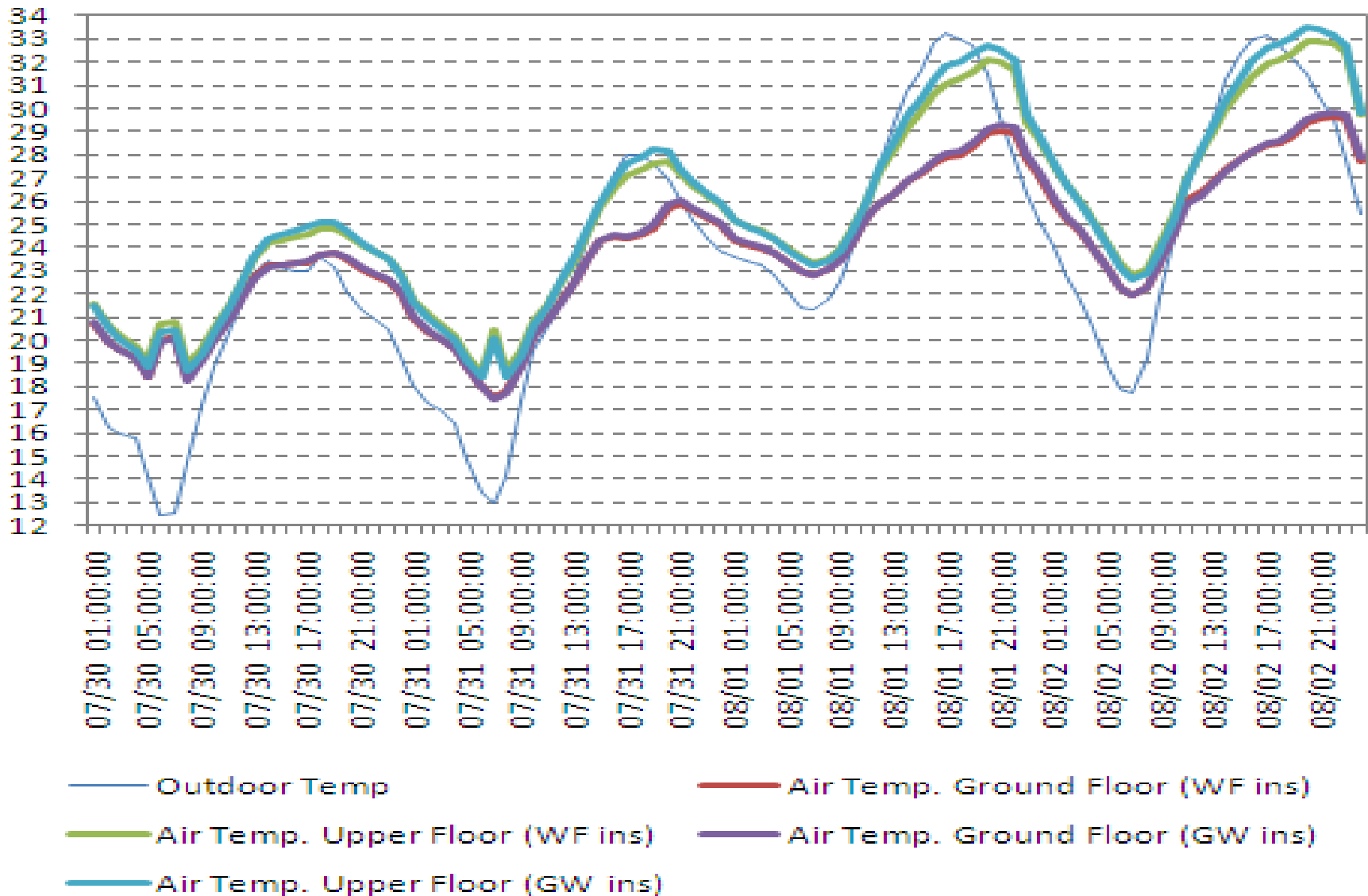
Noon cooled buildings Temperature profile

SEVILLA



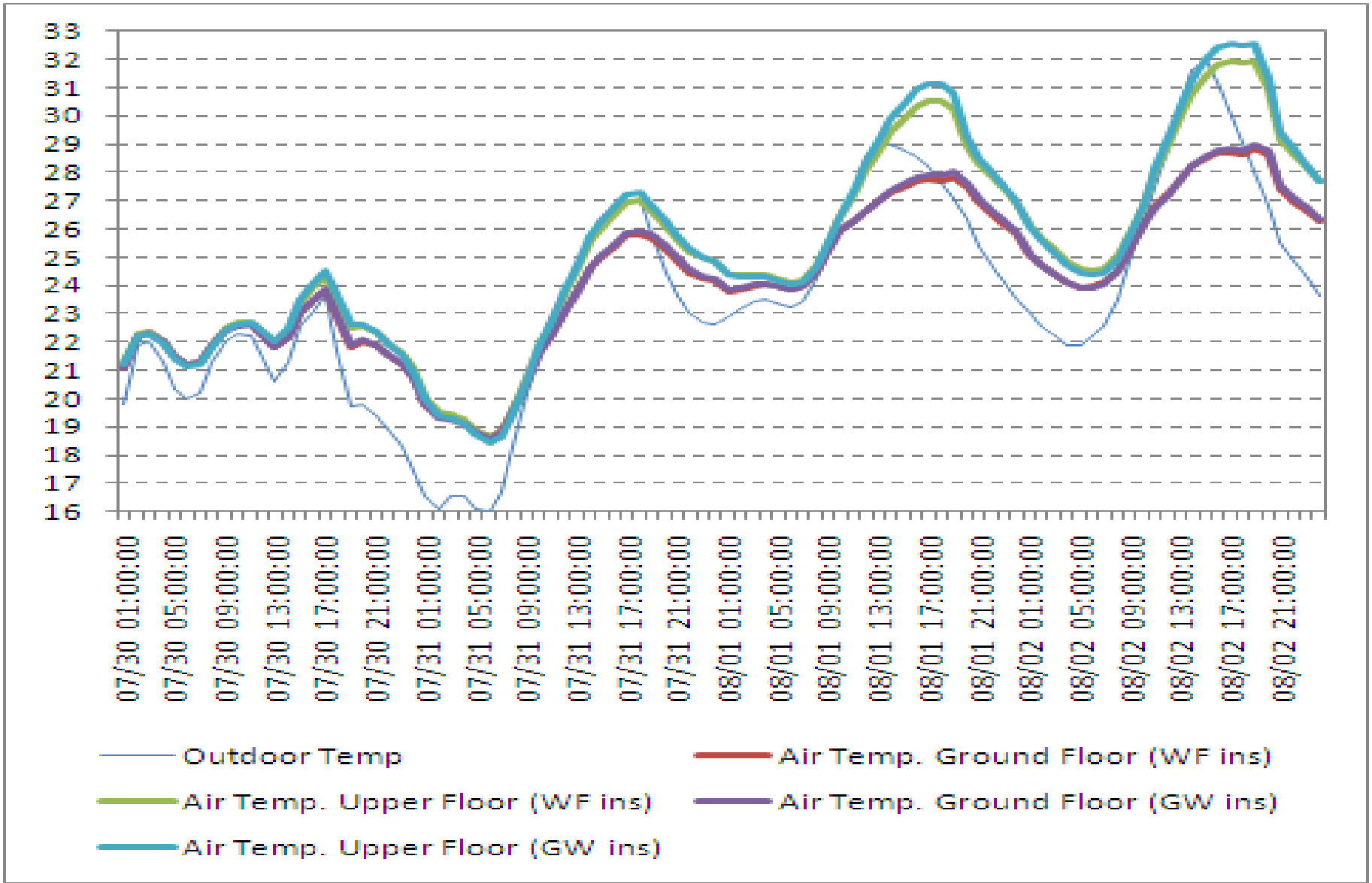
Noon cooled buildings Temperature profile

MADRID



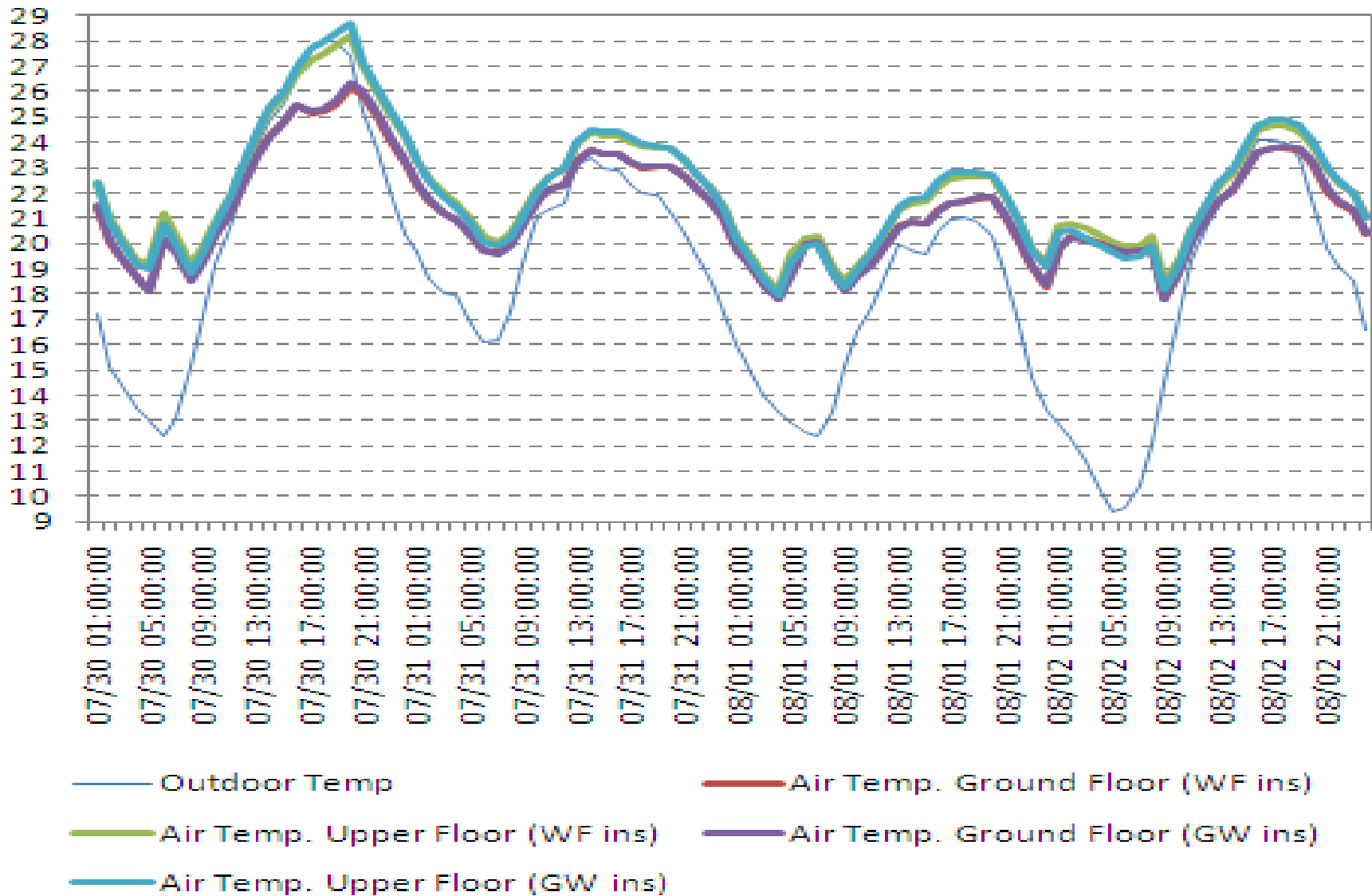
Noon cooled buildings Temperature profile

MARSEILLE



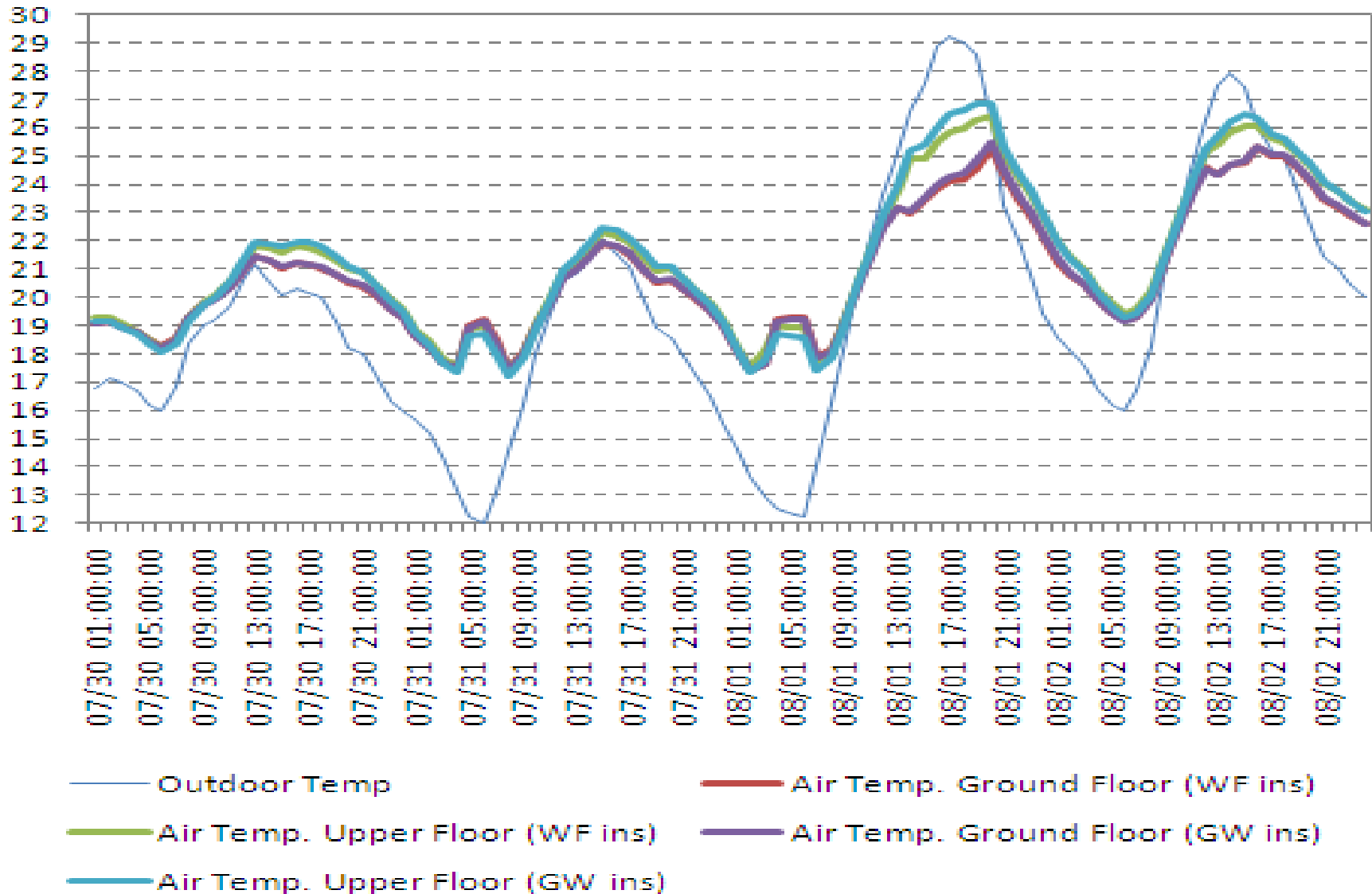
Noon cooled buildings Temperature profile

PARIS



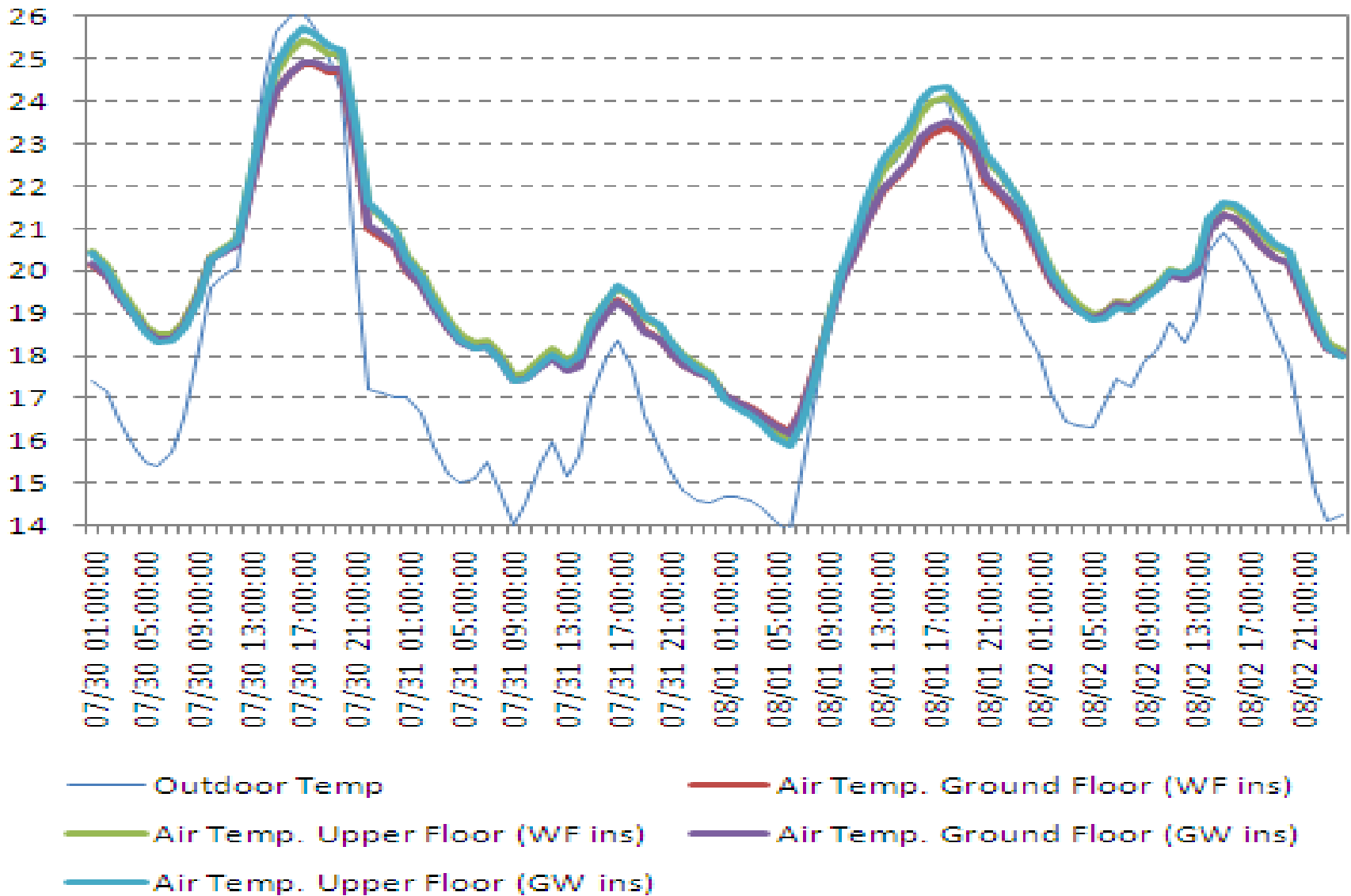
Noon cooled buildings Temperature profile

STRASBOURG



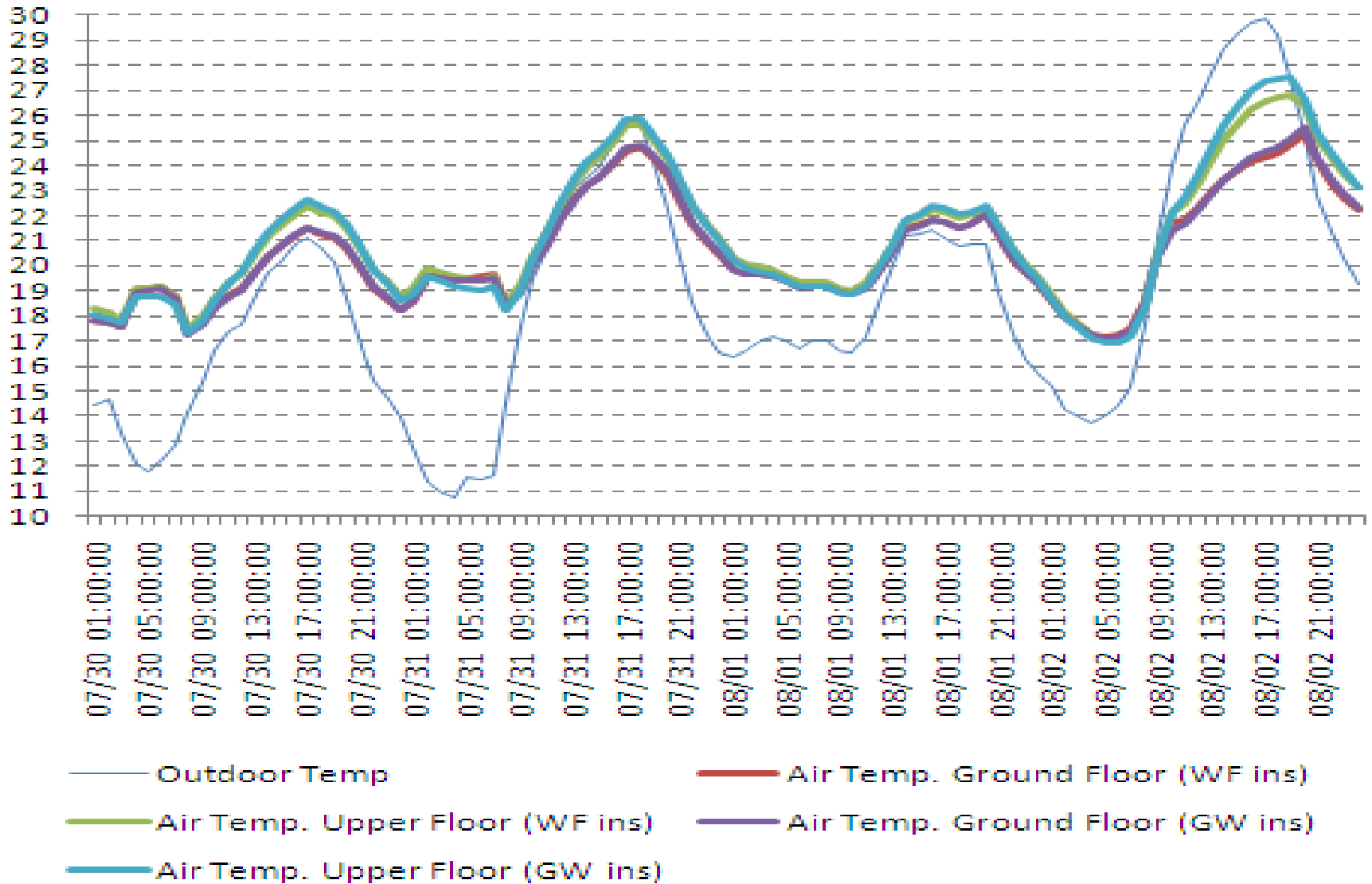
Noon cooled buildings Temperature profile

BERLIN



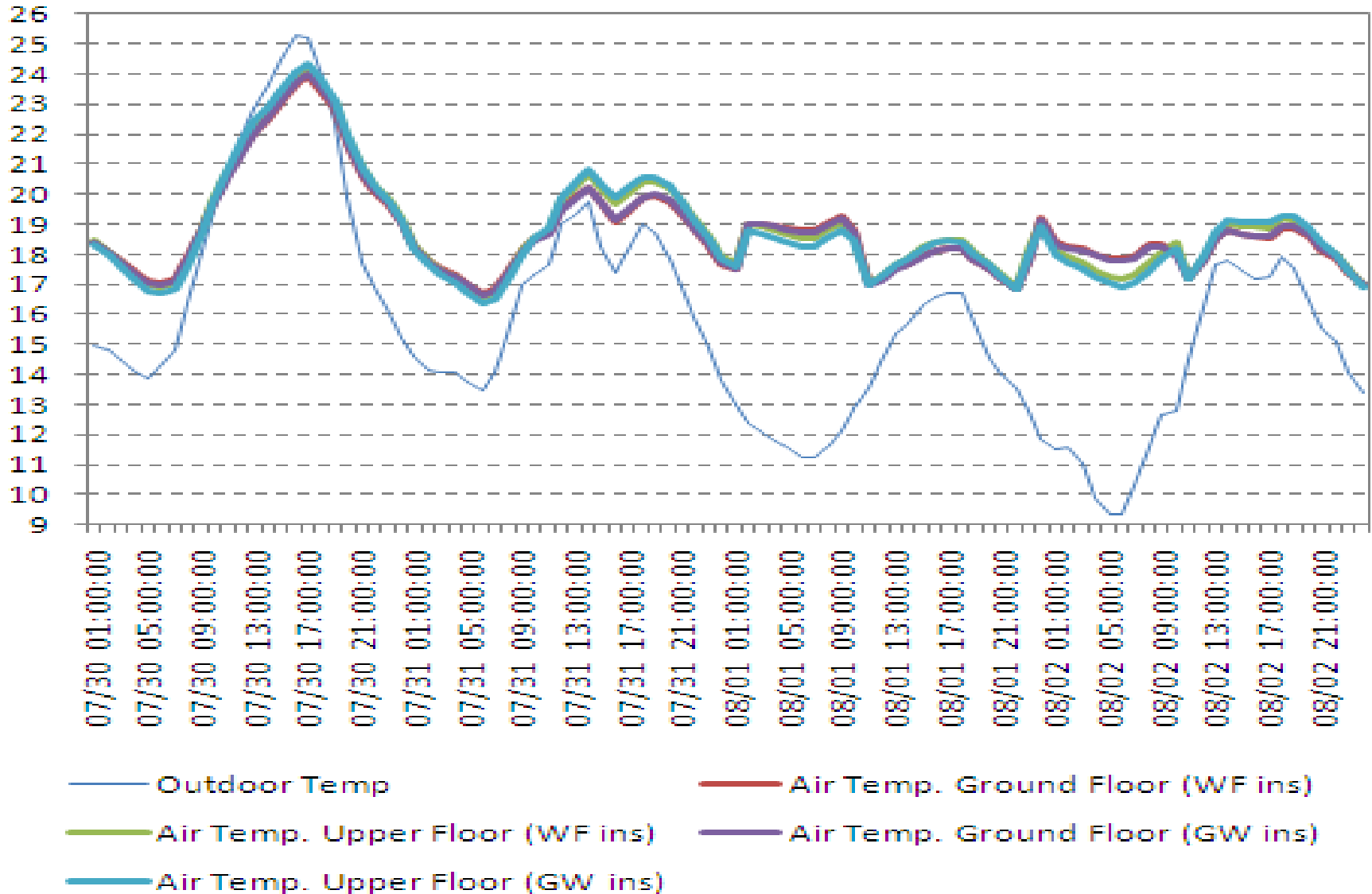
Noon cooled buildings Temperature profile

MUNICH



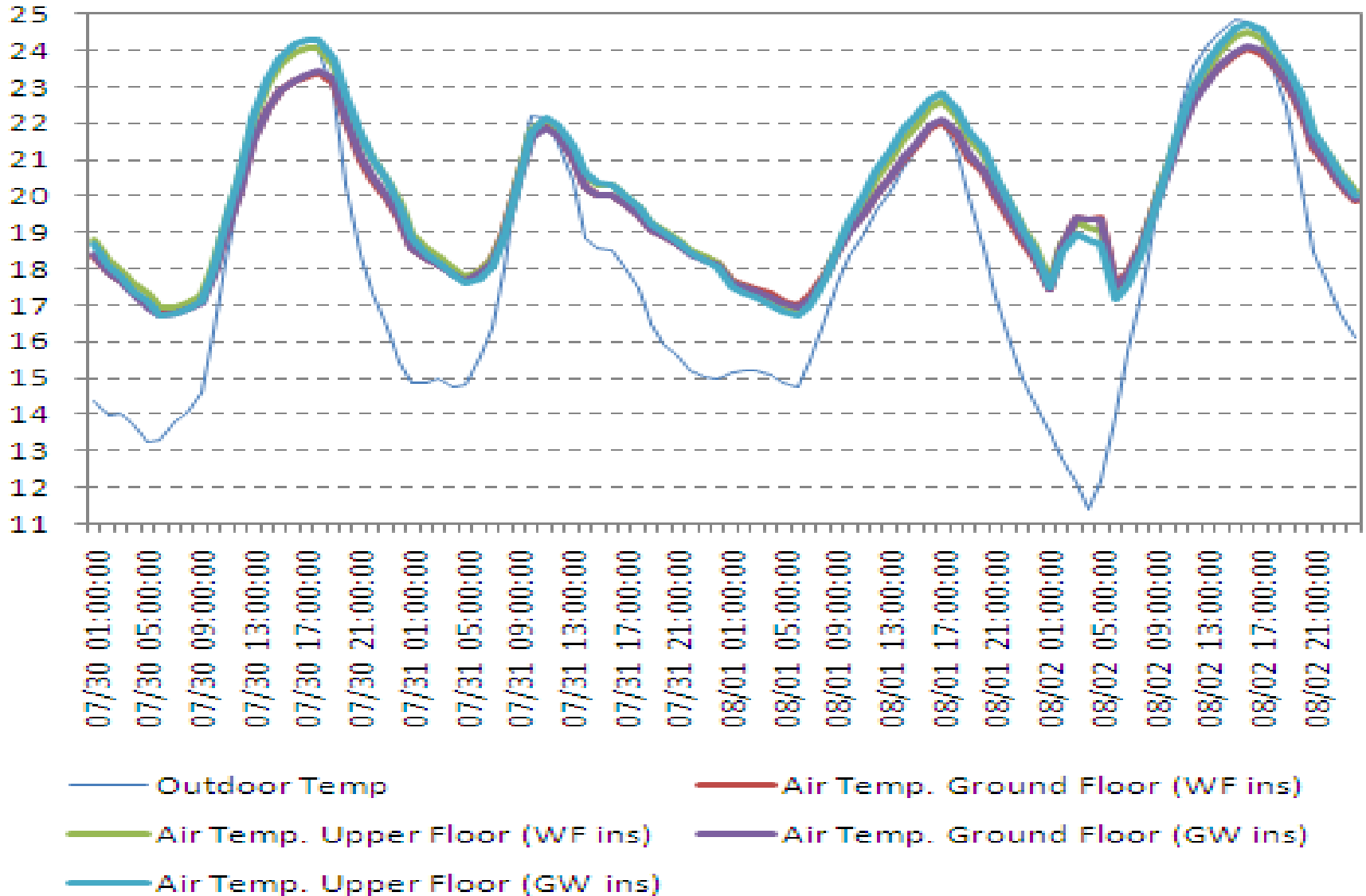
Noon cooled buildings Temperature profile

FRANKFURT



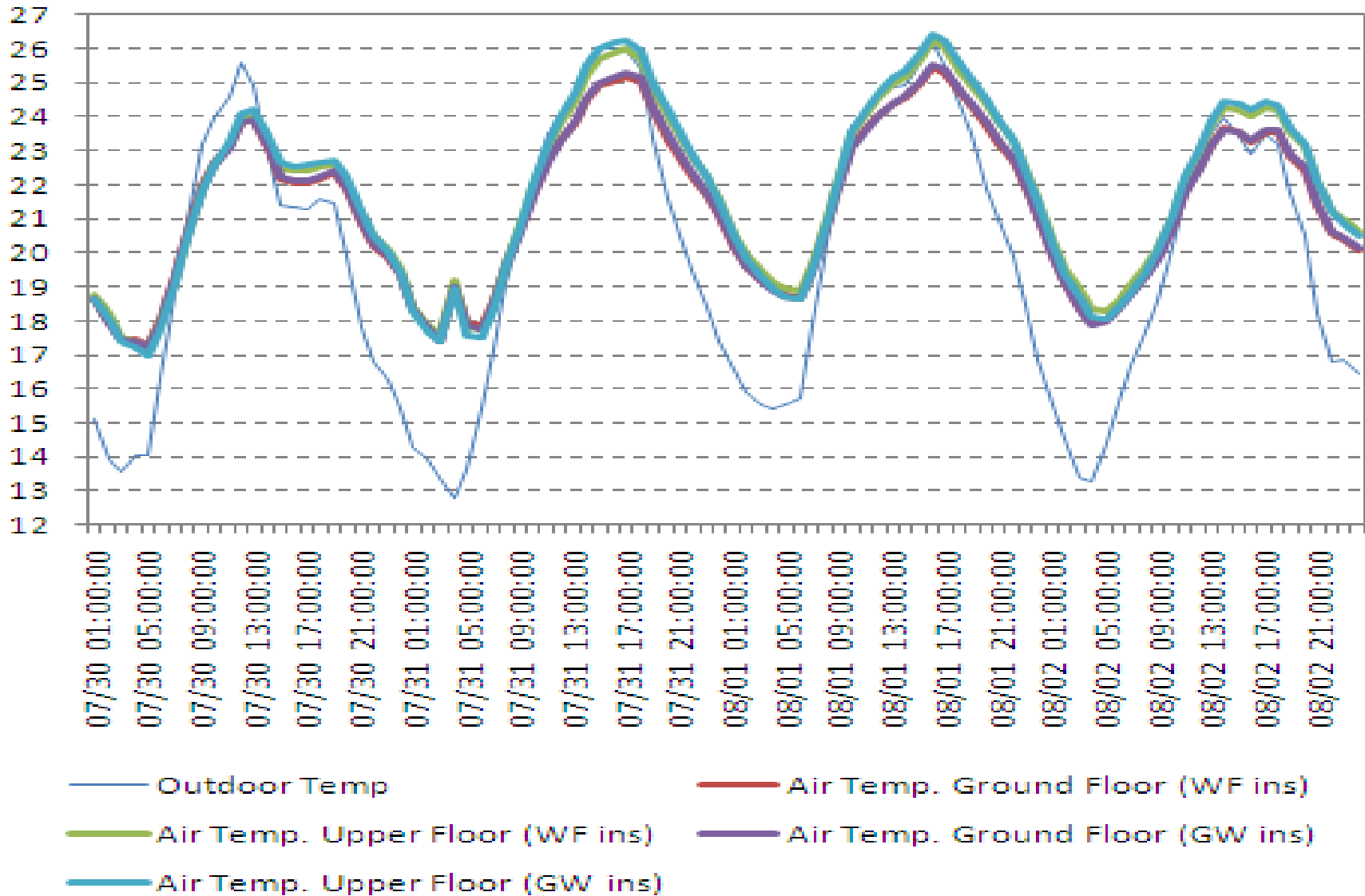
Noon cooled buildings Temperature profile

KRAKOW



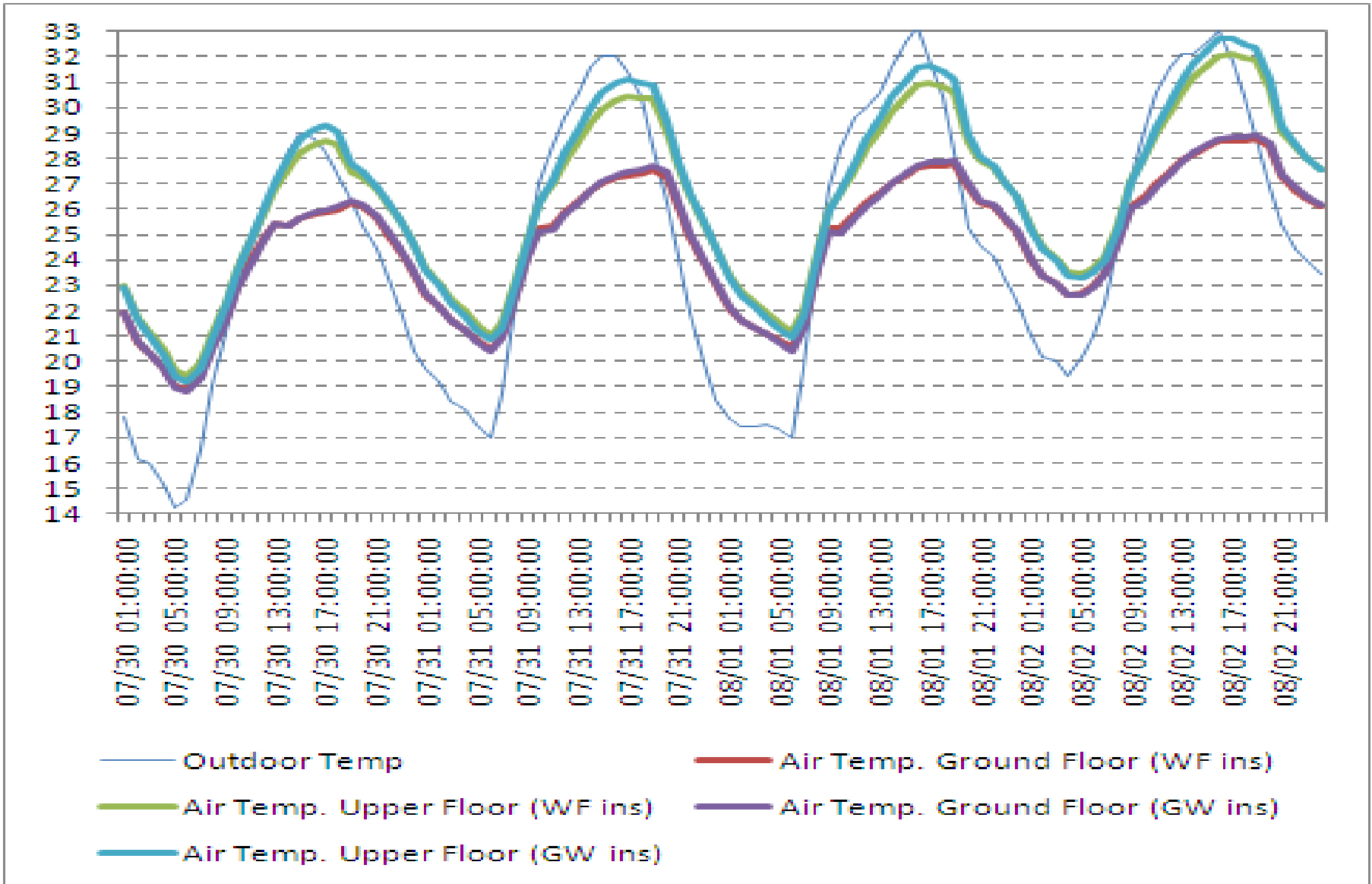
Noon cooled buildings Temperature profile

WARSAW



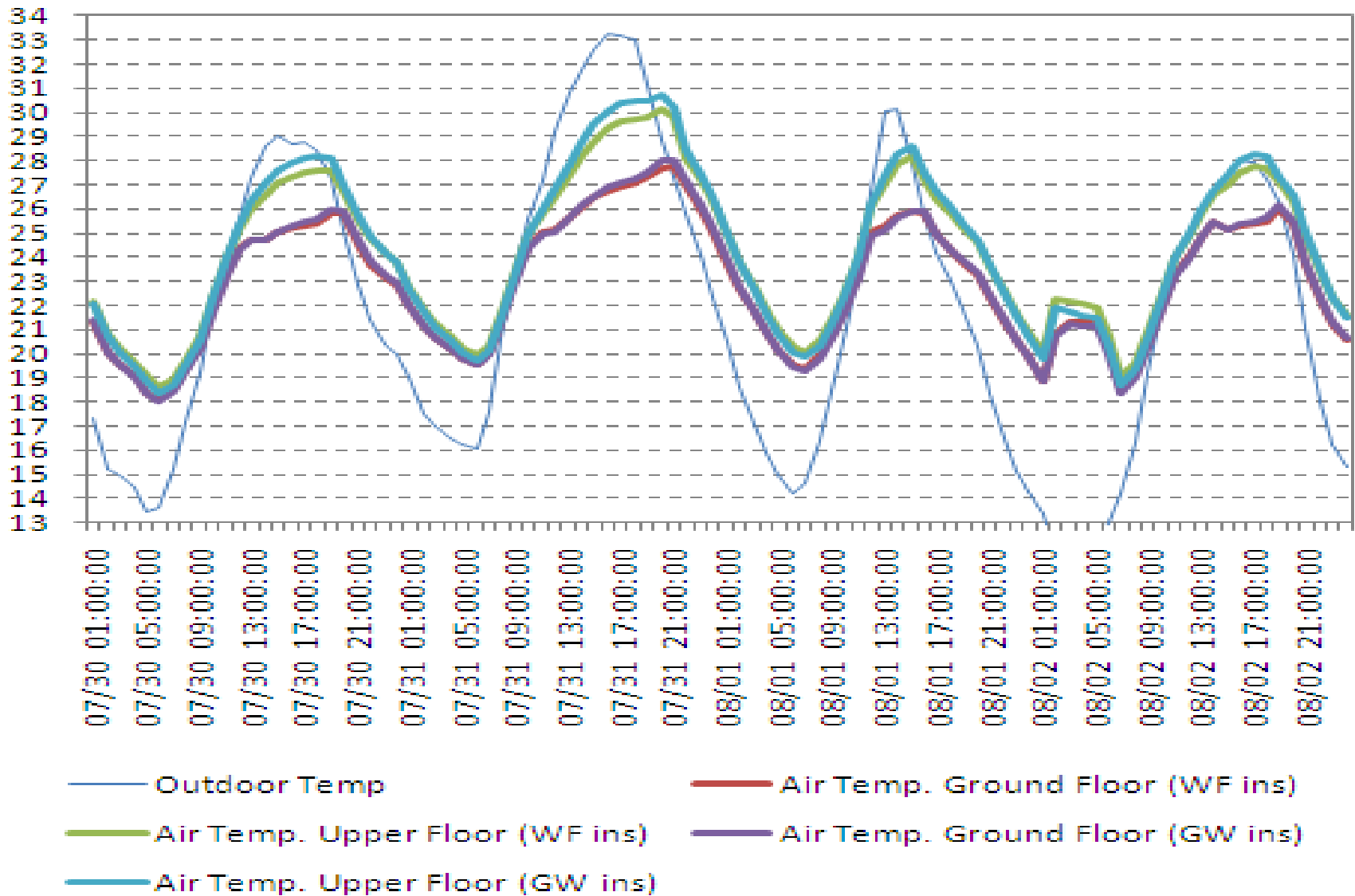
Noon cooled buildings Temperature profile

BELGRADE



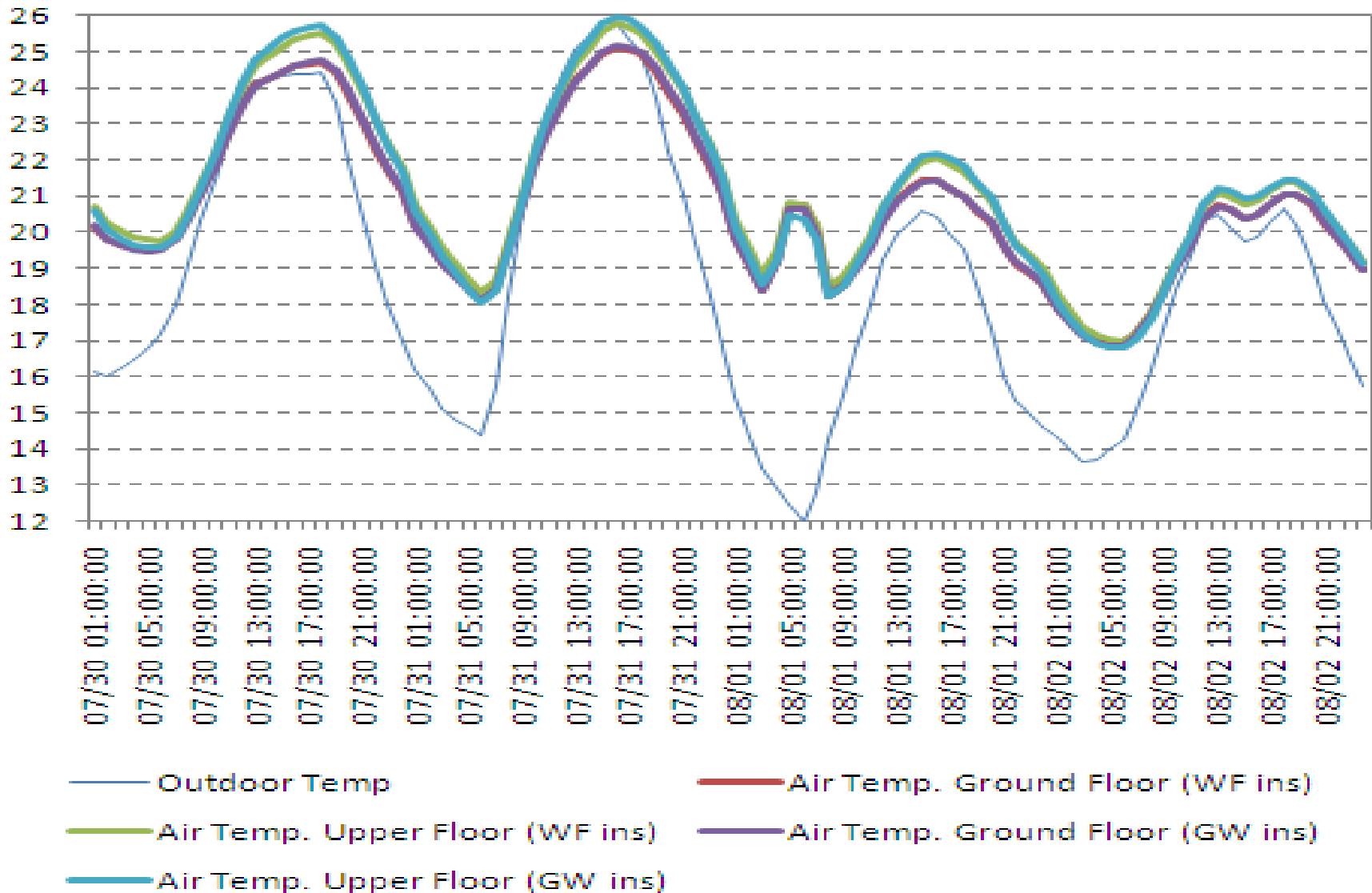
Noon cooled buildings Temperature profile

LUJBANA



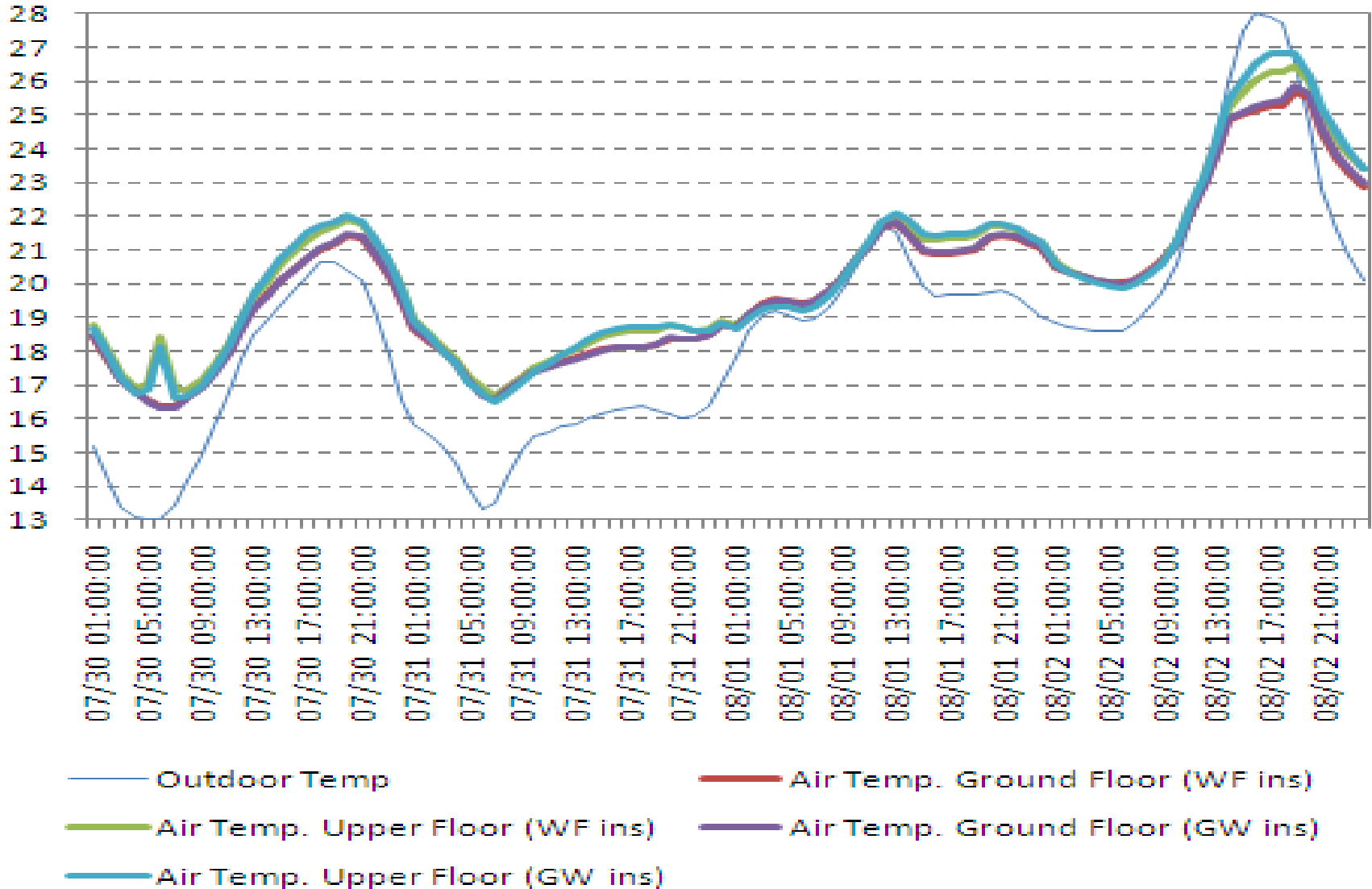
Noon cooled buildings Temperature profile

MOSCOU



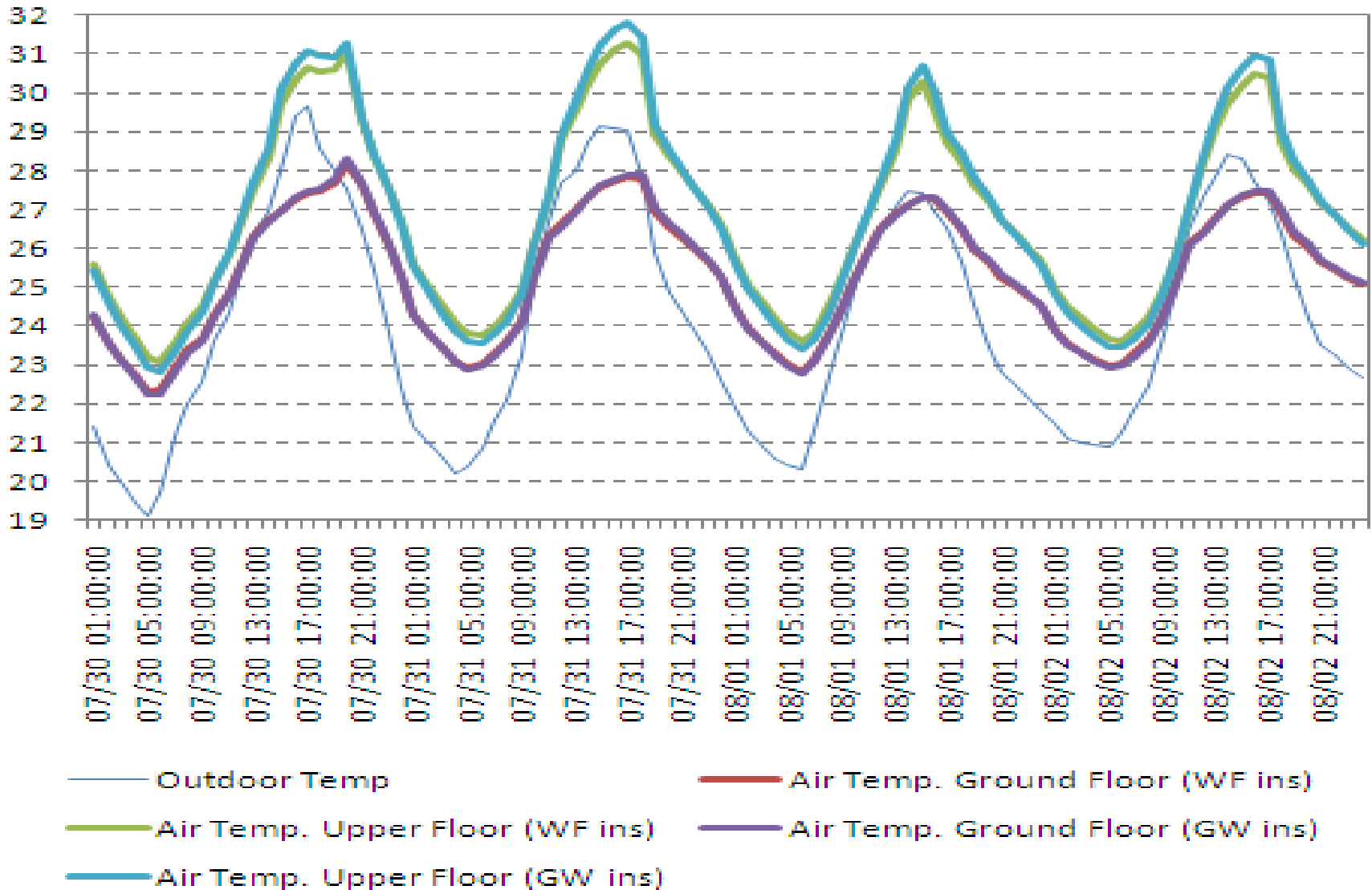
Noon cooled buildings Temperature profile

SAINT PETERSBOURG



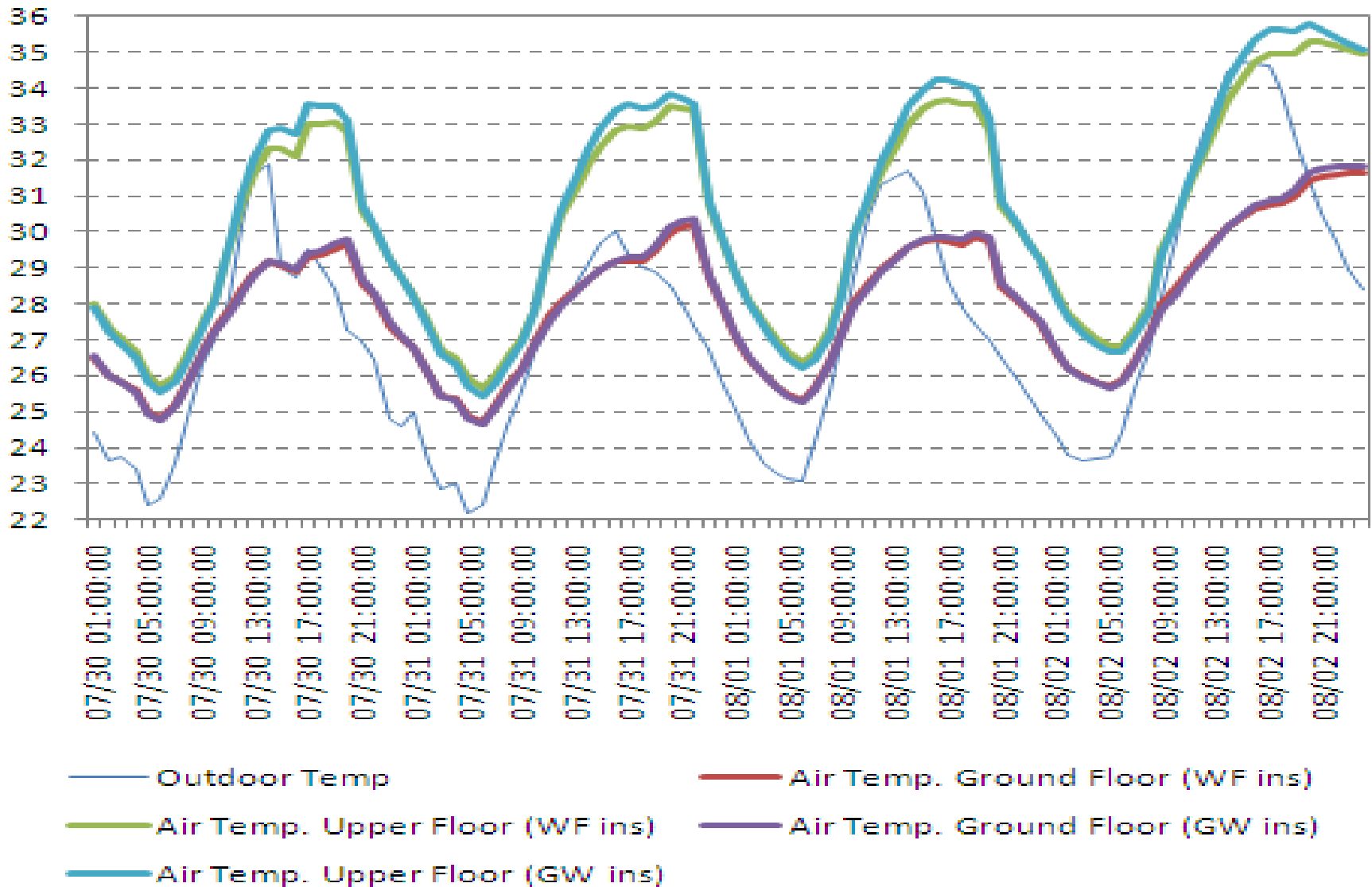
Noon cooled buildings Temperature profile

ISTAMBUL



Noon cooled buildings Temperature profile

ATHENES



In all sites:

No difference in the ground floor level

In upper floor level difference less than 1°C between WF and GW

- **Fully conditioned buildings**

No advantage to use WF instated GW in central and Nordic European sites

Small advantage in southern sites

Difference in any case is round 1%

- **Non Cooled buildings**

During summer time no significant difference between WF and GW insulated buildings (similar non comfort hours and peak temperatures)

During winter time energy demand is lower using GW (R= vs R=5 in walls)

- **Differences can easily be compensate adapting thermal resistance or shading profile or ventilation.**

There is no technical interest to use WF instated GW
There is no economical interest to use WF instated GW

Gracias por su atención
Thanks for your attention
Danke für Ihre Aufmerksamkeit
Спасибо за внимание

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