

Microsoft® Research

Faculty Summit 2010

Guarujá, Brasil | May 12 – 14 | In collaboration with FAPESP

The Atlantic forest geosensor network pilot study. Part 2: data analysis and prospects

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- 1. Experimental site in the Atlantic Forest**
- 2. Spatial and temporal patterns of measured temperature**
- 3. Prospects to investigate the Amazonian environment**

TEAM

- 1. Universidade de São Paulo (Laboratório de Clima e Biosfera)** Helber Freitas, Nilson Neres, Jonatan Tatsch
- 2. MSR** Juliana Salles, Rob Fatland
- 3. INPE** Carlos Nobre, Marcio Santana, Patricia Santana, Rogerio Carneiro, Celso von Randow
- 4. JHU** Doug Carlson and Andreas
- 5. Unicamp and Cena/Usp** Carlos Joly, Luiz Martinelli

Laboratório de Clima e Biosfera, IAG/Usp – technicians and students



Helber Freitas
Meteorologist, MSc



Emilia Brasilio
Meteorologist



Nilson Neres,
Engineer



Carlos Fagiolo
Meteorologist



Eduardo Gomes
Electronics
technician



Gabriel Costa
Meteorologist,
MSc



- 5 PhD students
- Jonatan Tatsch
- Jonathan Motta
- Monica Queiroz
- Helber Freitas
- Rogerio Carneiro

- 3 MSc students
- Bruno Paraluppi
- Giampiero Bini
- Cinthia Avellar

-
- 1 Post Doc
- Ana Elizabethe da Silva)

Laboratório de Clima e Biosfera, IAG/Usp

1. Observações de campo

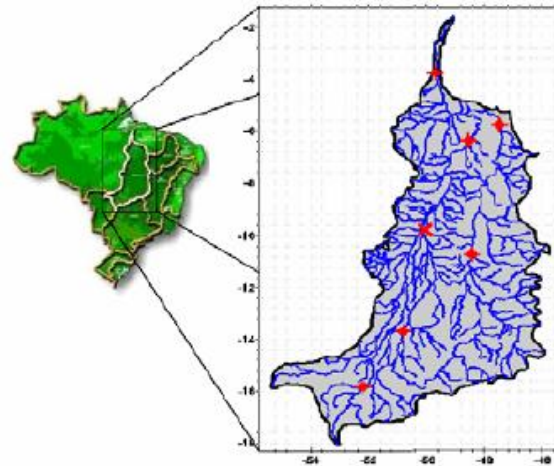
Sítios experimentais com torres de fluxo e vertedor hidrológico



2. Modelagem biosfera-atmosfera-hidrosfera

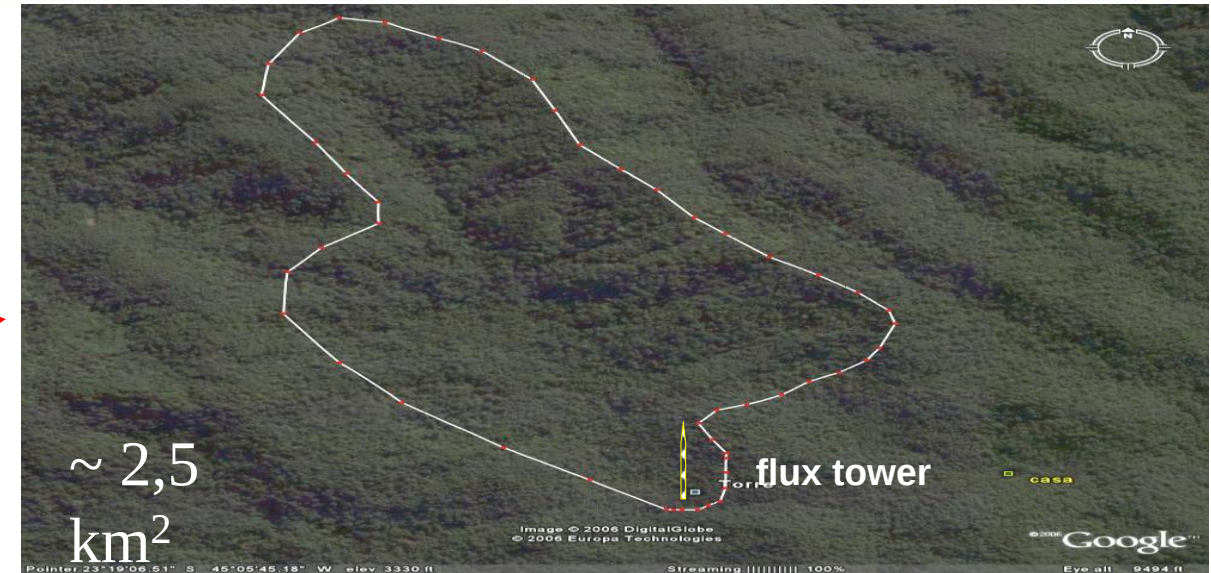
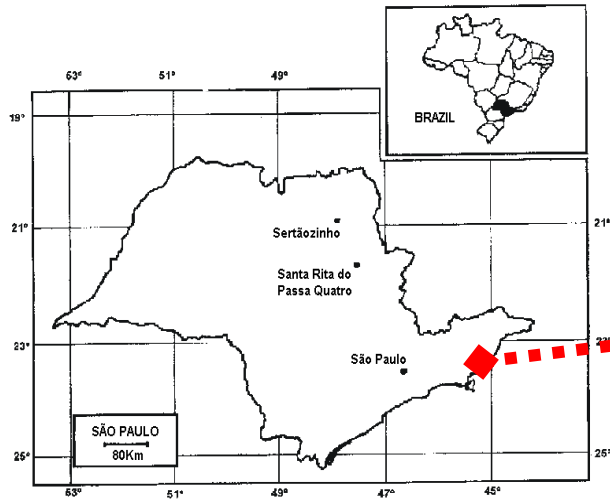
modelo atmosférico BRAMS

modelo hidrológico (modelo DHBM com SiB2; modelo SWAT)



Sítio Experimental: Ribeirão Casa de Pedra Watershed

Parque Estadual da Serra do Mar (23° 19' 42.5" S; 45° 05' 35.2 " W)

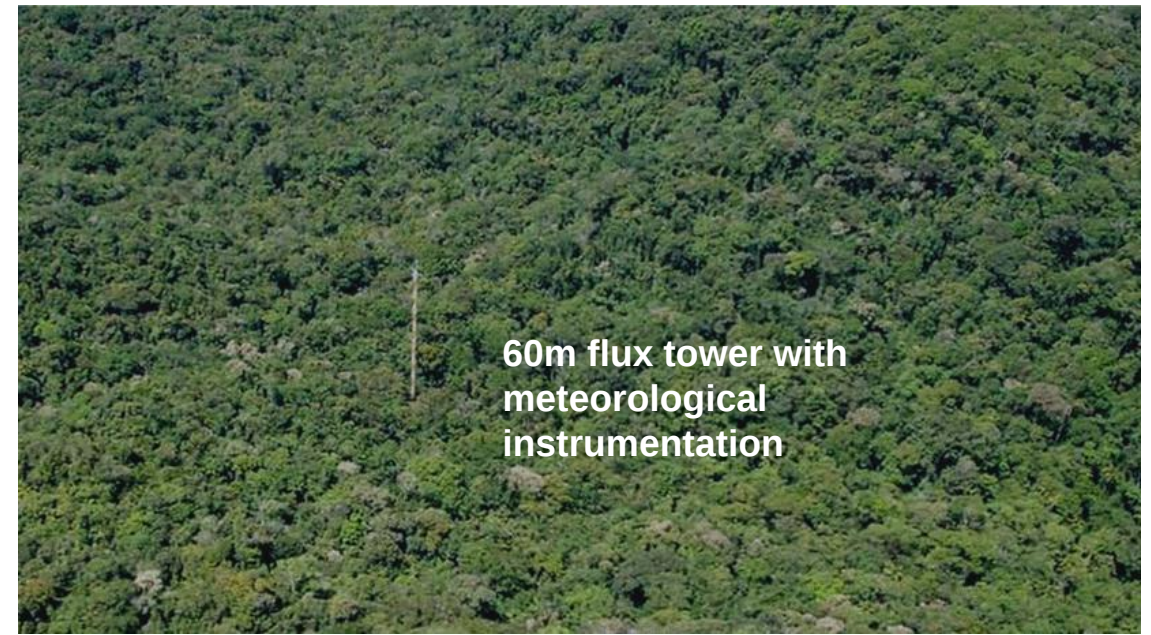


Temático FAPESP 03/09289-9.

Coordenação: Humberto Rocha
(Usp)

Temático FAPESP 2003/12595-7

Biota Gradiente Funcional:
Coordenador: Carlos Joly
(Unicamp).



Flux tower monitoring

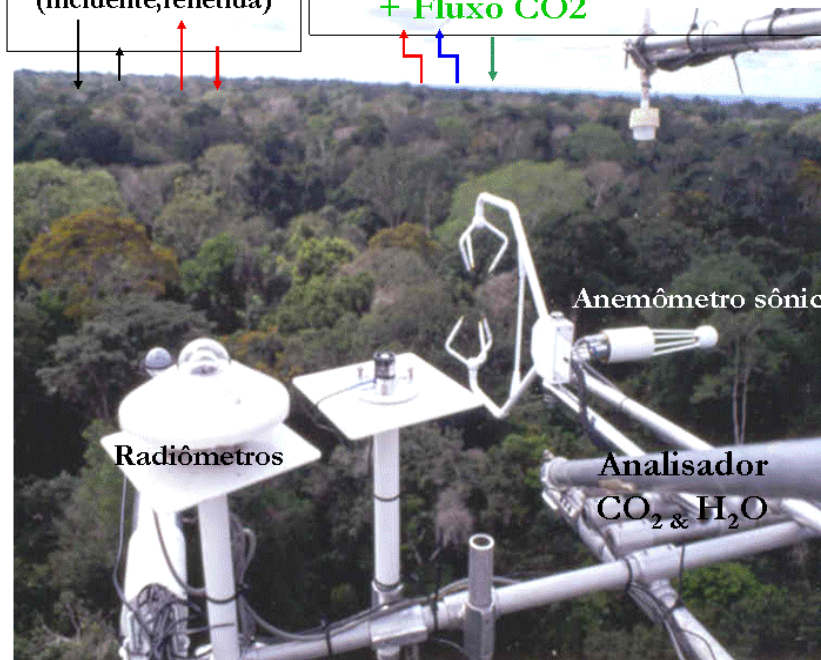


topo

Irradiância solar e
RFA
(incidente, refletida)

$$(R_n) \text{ Saldo de radiação} =$$

- + H (fluxo calor sensível)
- + LE (evapotranspiração)
- + Fluxo CO_2



Controle



base

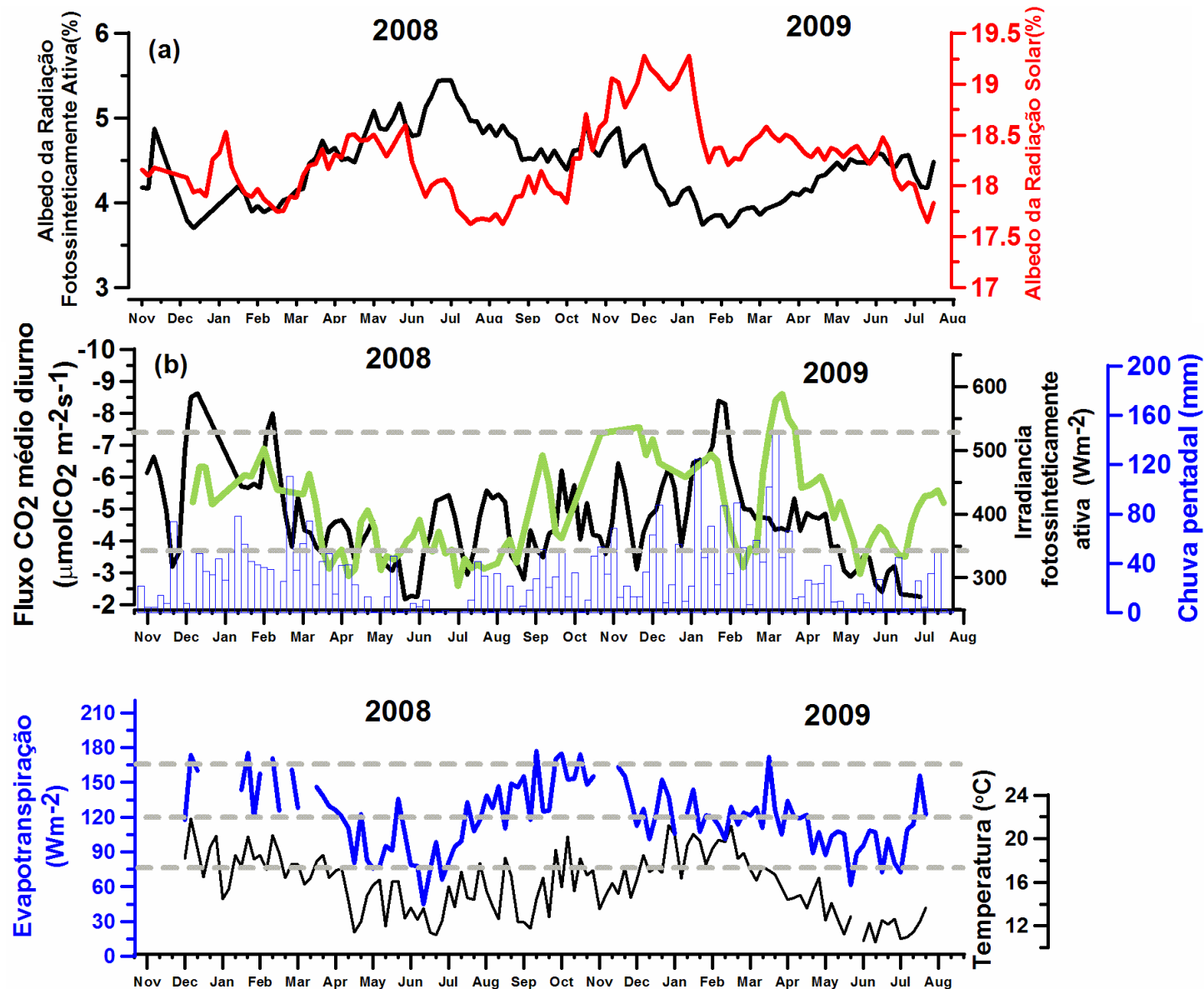


Umidade
do solo

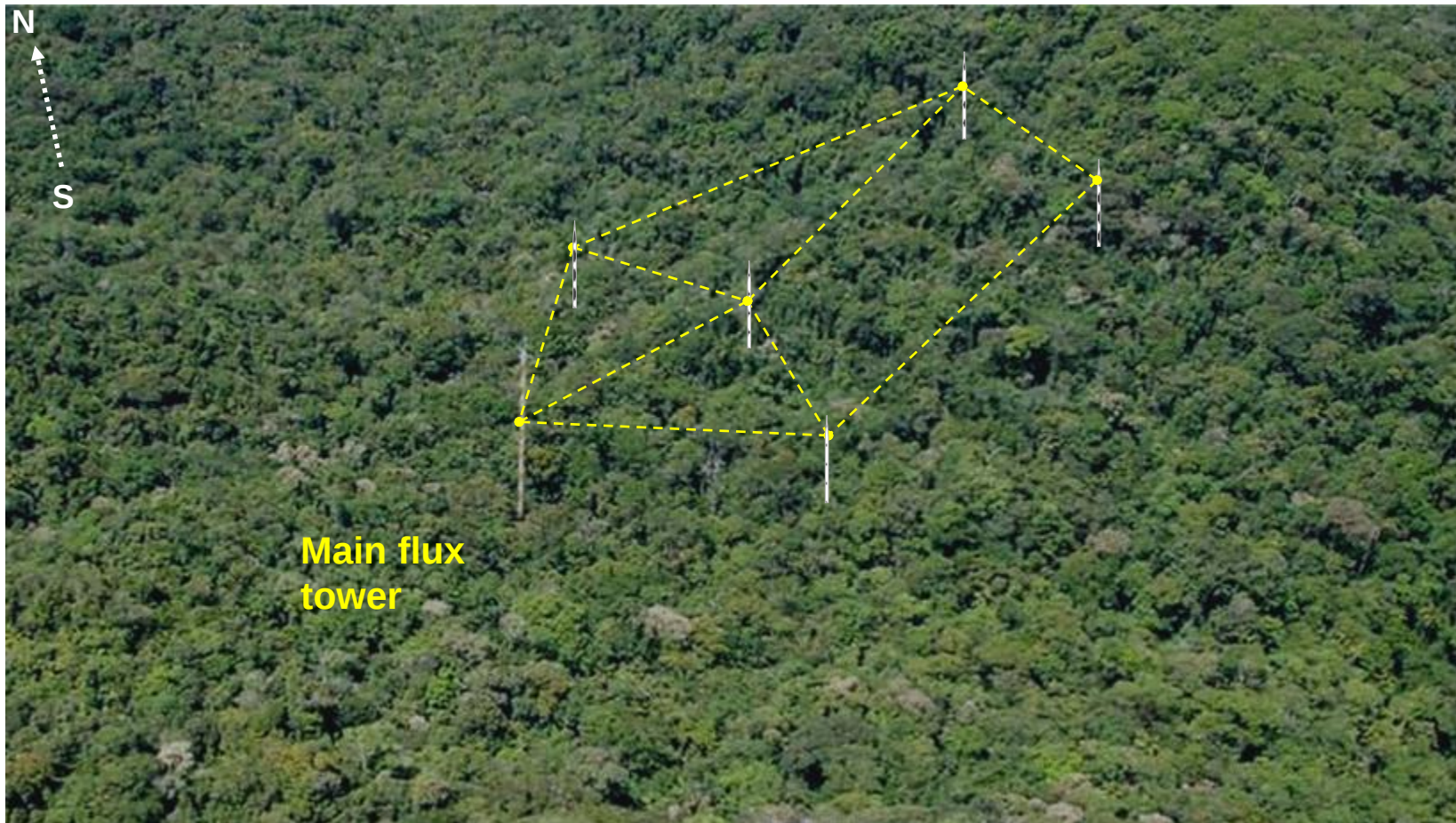


Efluxo
 CO_2 do
solo

Previous data of flux tower

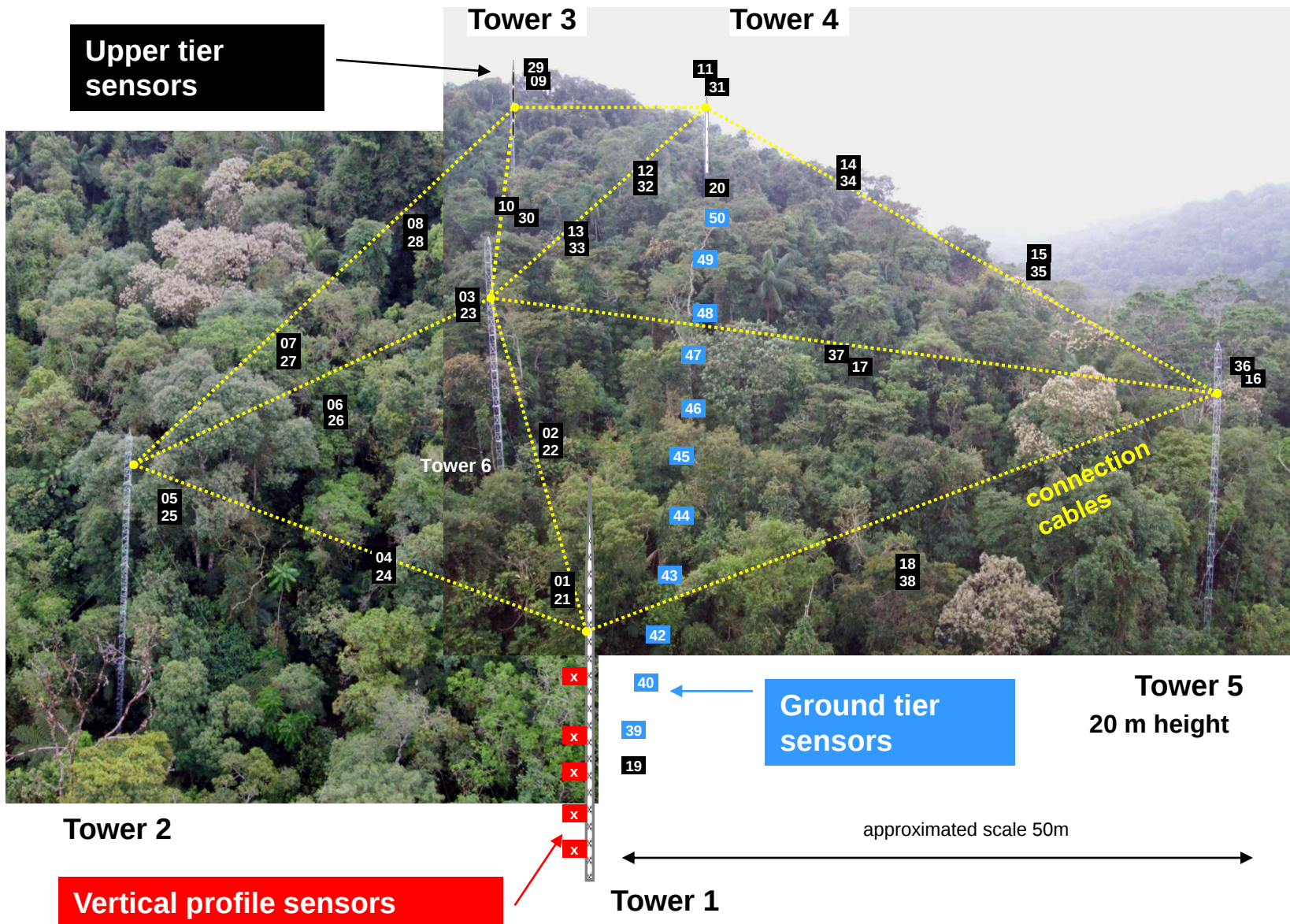


Geosensor network in the Atlantic forest



Network in the Atlantic Forest, which includes five 25m towers linked by Kevlar cables. The network was placed east of the main tower, along an altitudinal transect of ~60m height. (Pilot Experiment)

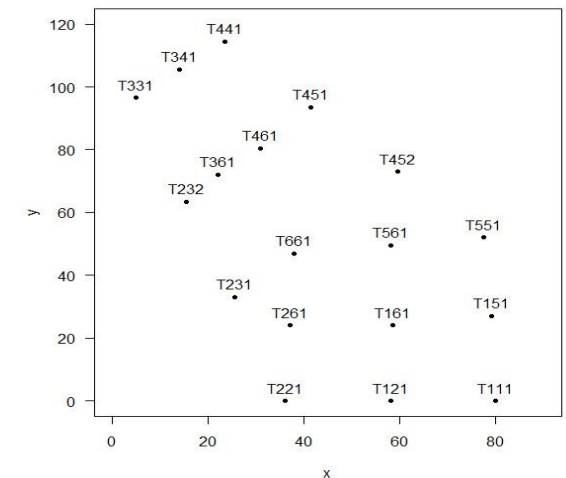
Geosensor network in the Atlantic forest : experimental design



Total 52 motes =

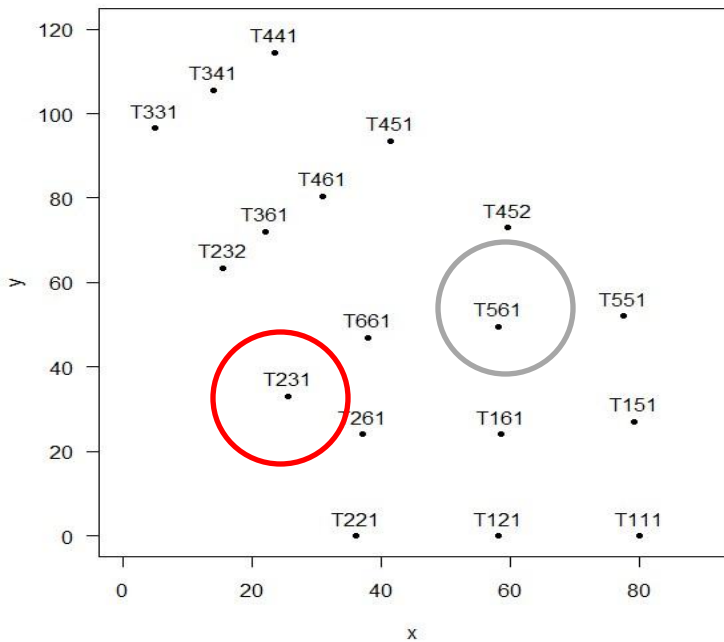
156 thermometers

52 hygrometers

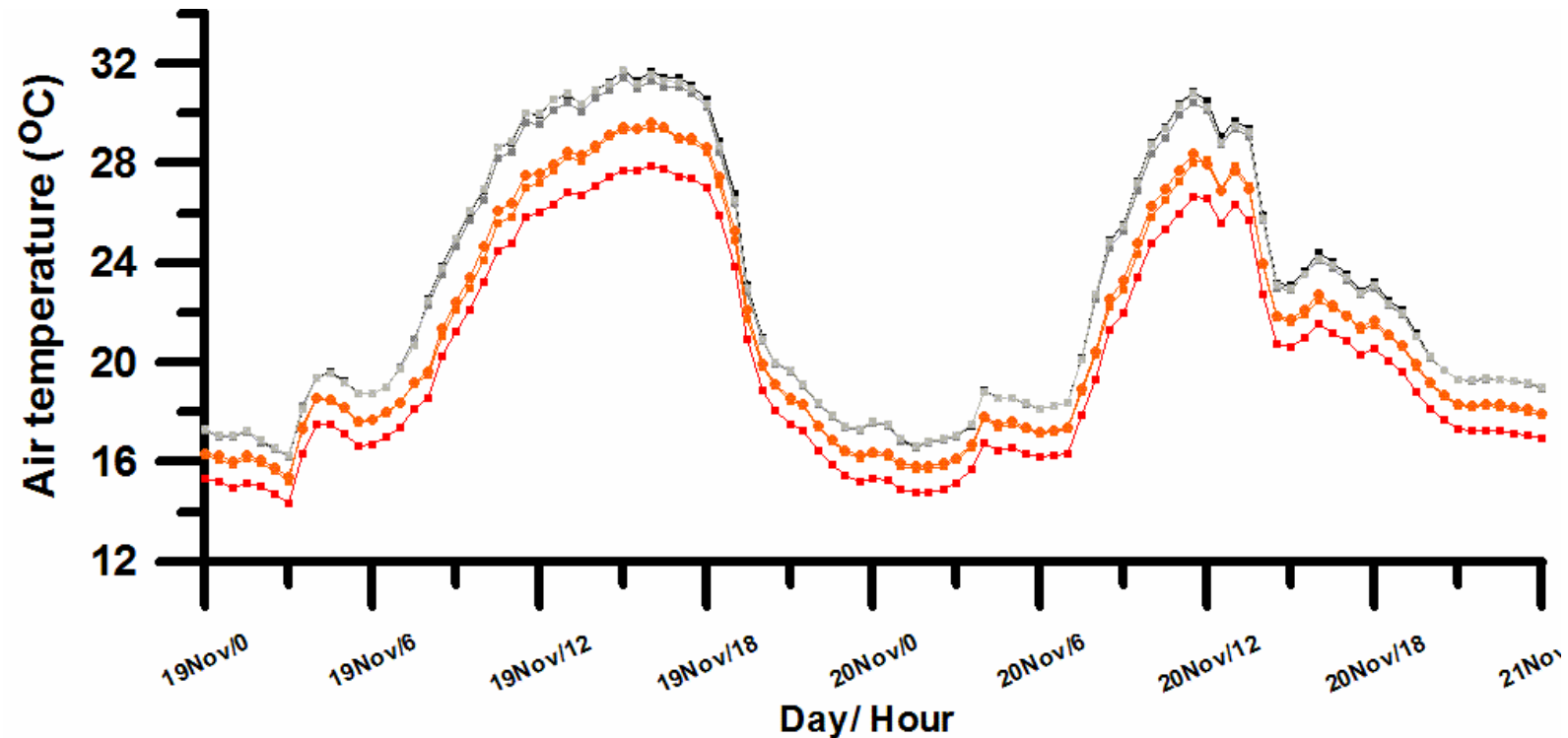
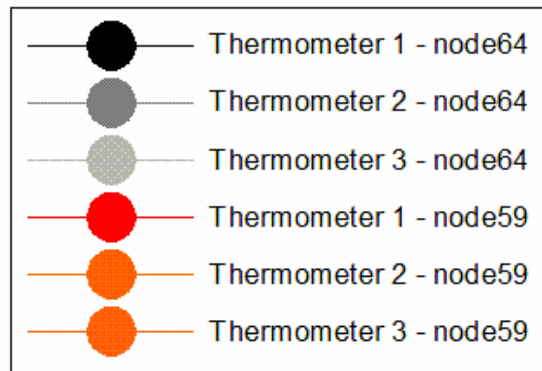


Upper tier design
with 18 nodes

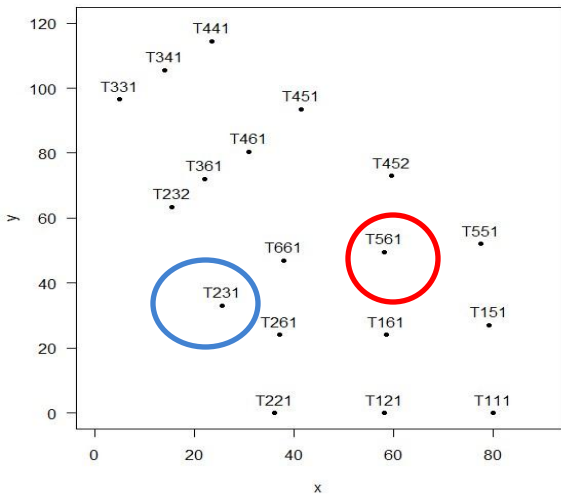
Spatial variability at 25 m height



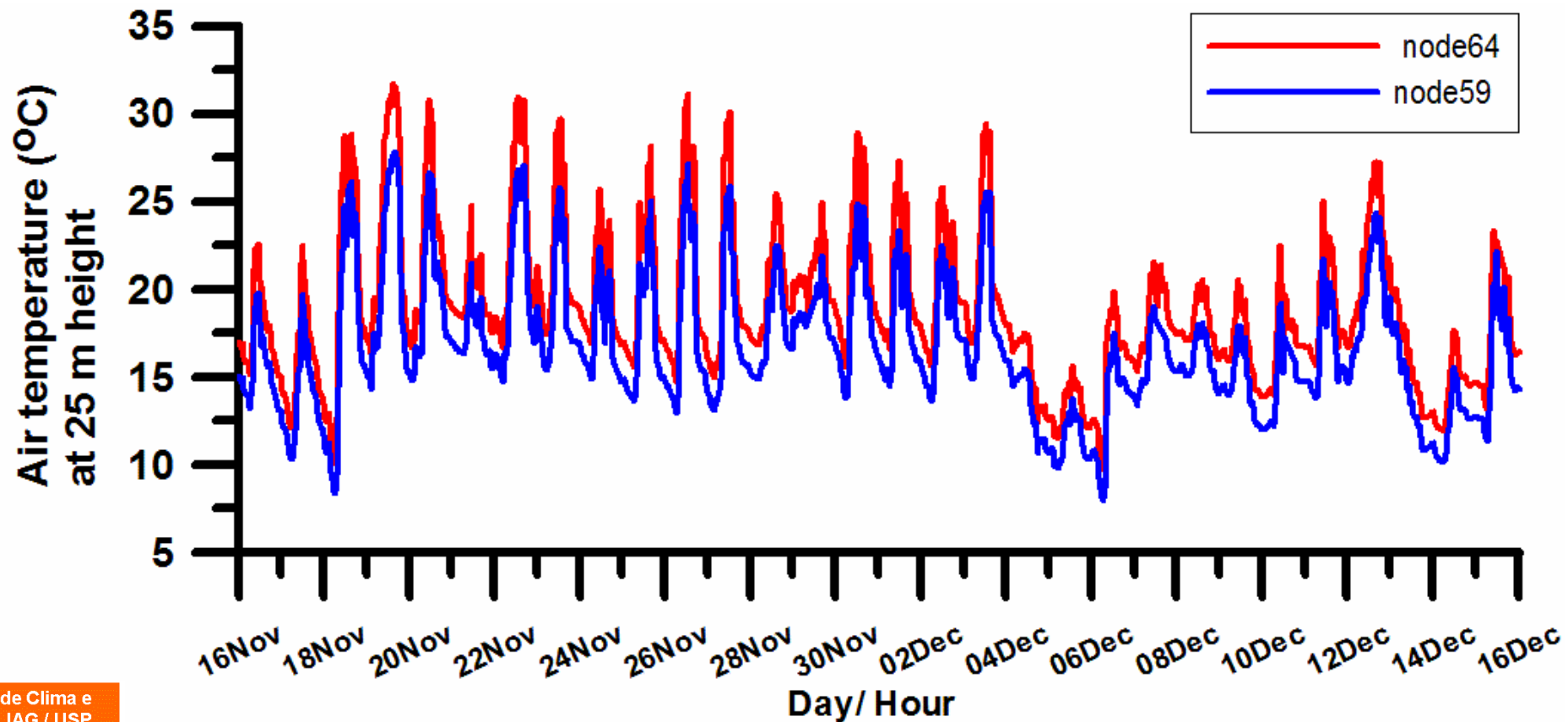
Sampling area : ~ 80 m x 120 m
18 nodes
Each node with 1 or 2 motes



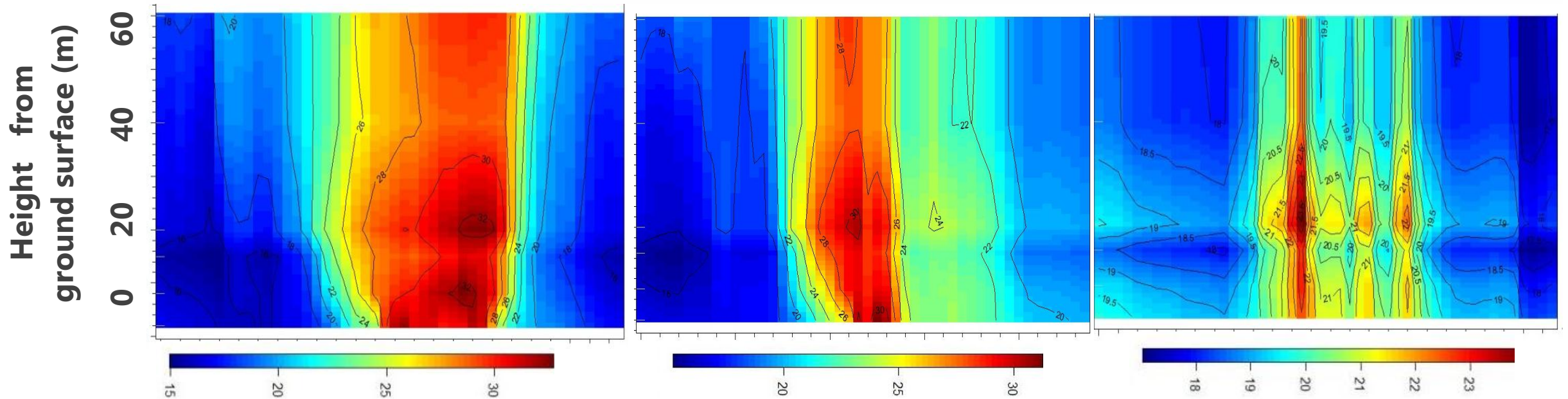
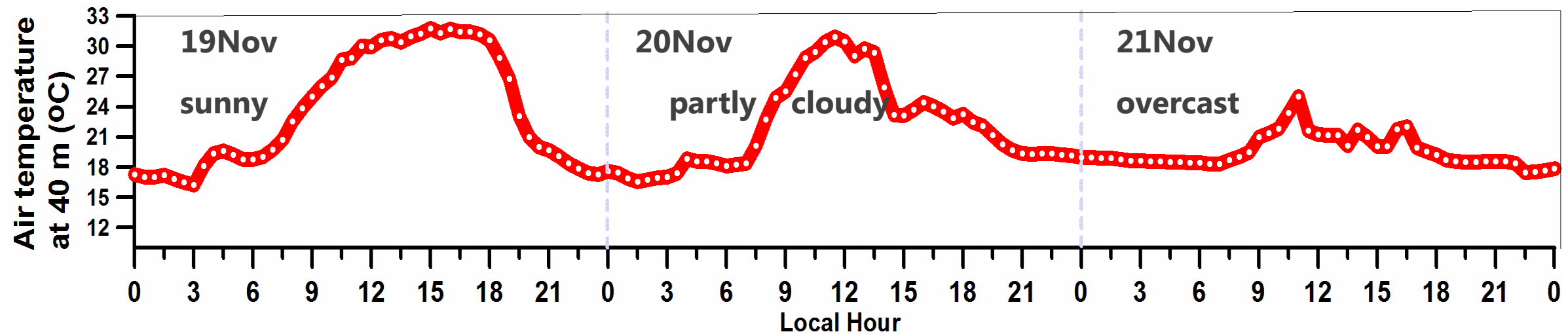
Spatial variability at 25 m height



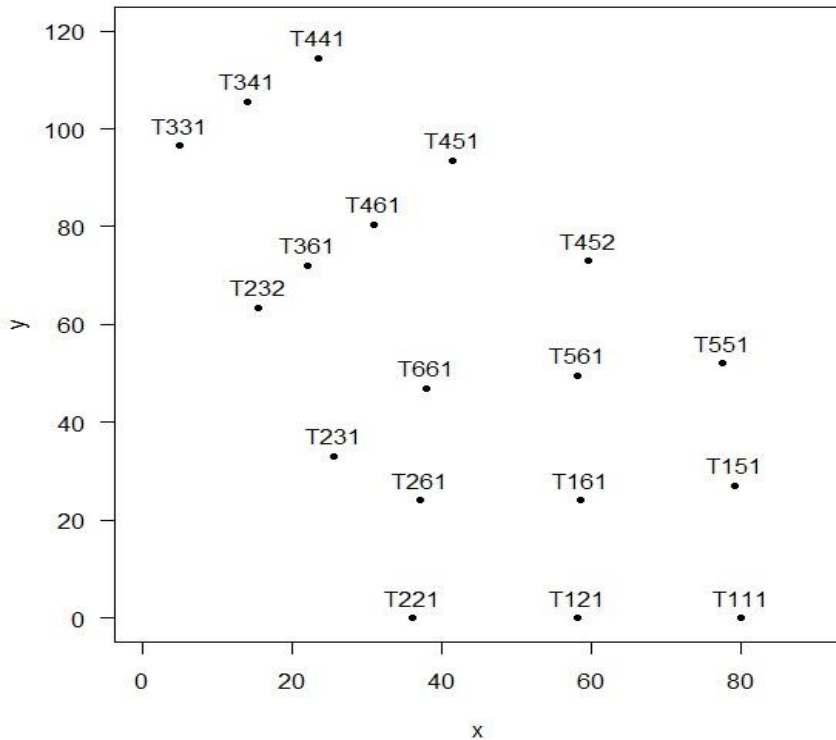
Period of measurements: 16Nov-18Dec 2009



Vertical variation of the temperature



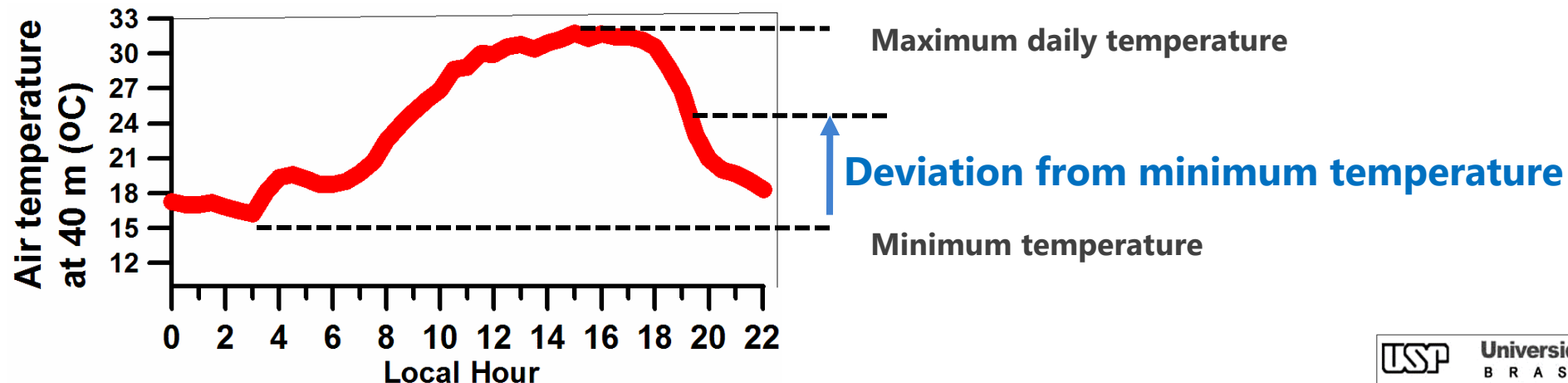
Visualization of spatial variability at 25 m height

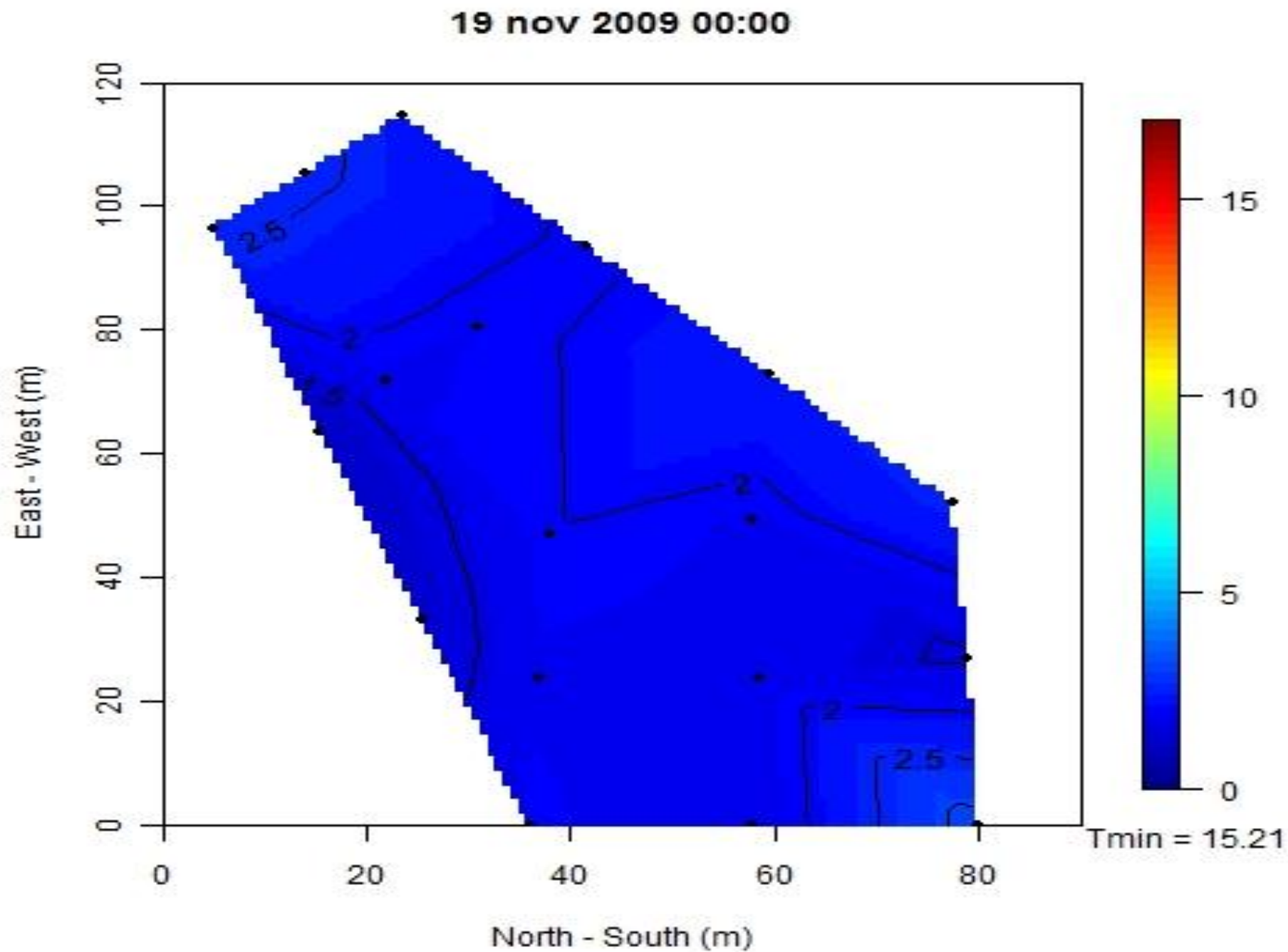
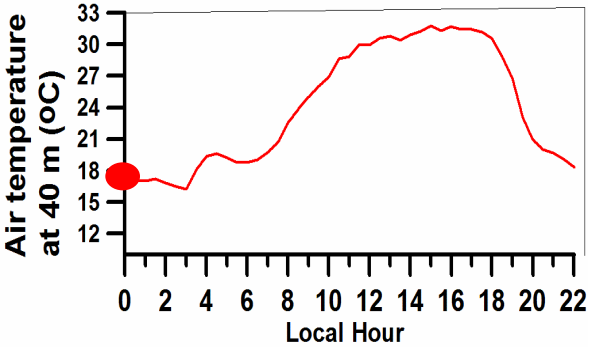


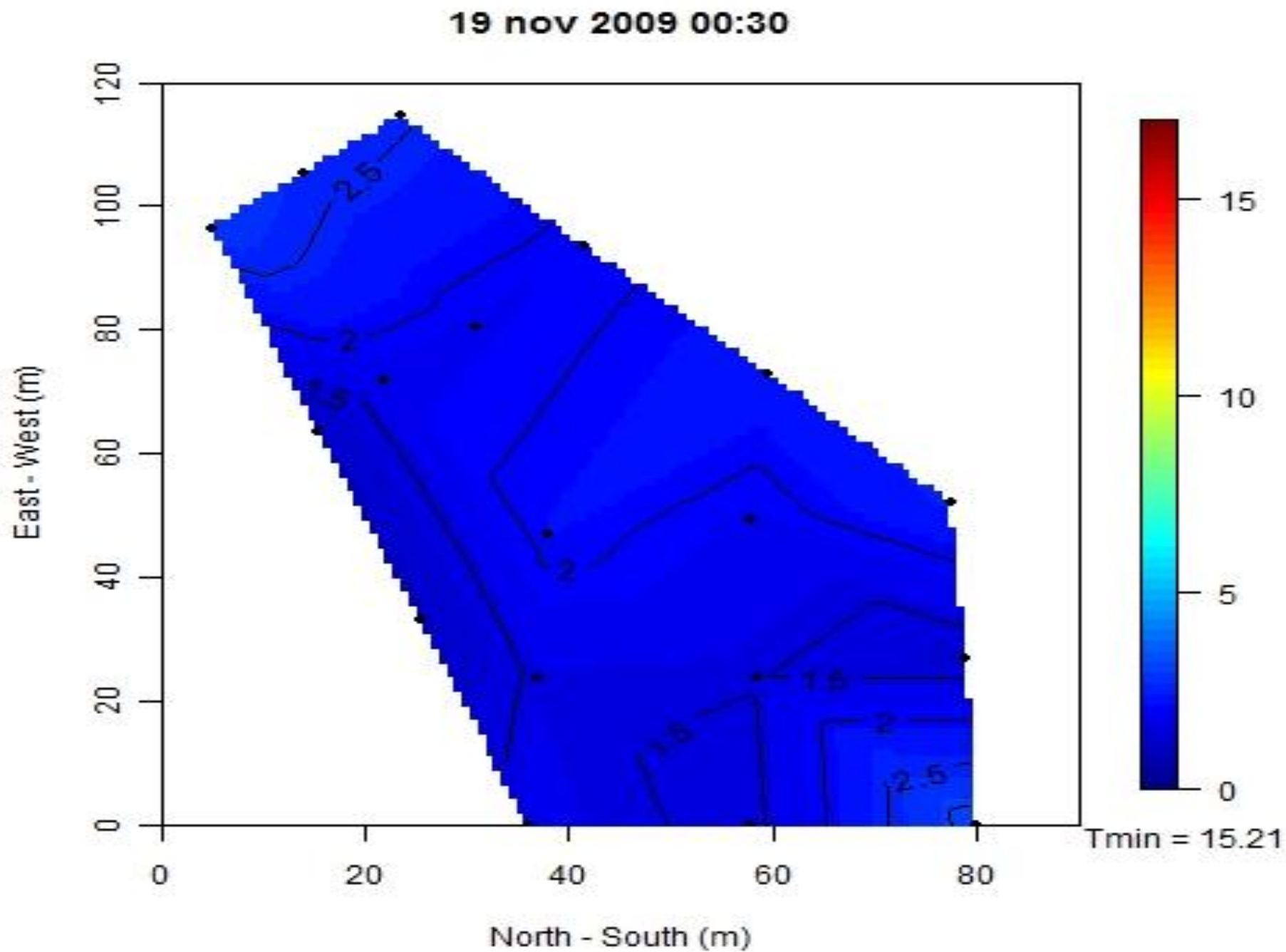
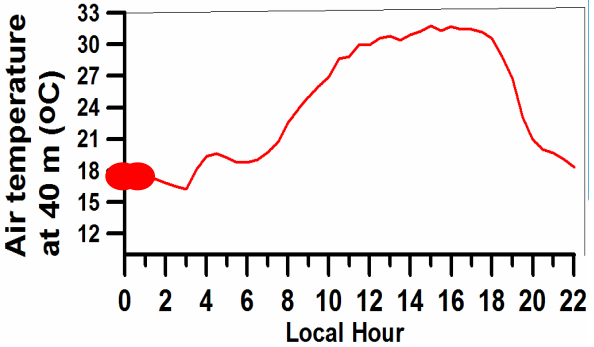
Node	Location	Nome	X (m)	Y (m)
6	Tower 3-4	T341	14	105,5
7/60	Tower 2-3	T232	15,5	63,5
8	Tower 1-5	T151	79	27
9	Tower 3-6	T361	22	72
13	Tower 1-2	T121	58	0
27/30	Tower 4	T441	23,5	114,5
29/50	Tower 2	T221	36	0
40/41	Tower 3	T331	5	96,5
42/69	Tower 5	T551	77,5	52
44/47	Tower 1	T111	80	0
46	Tower 6	T661	38	47
51/52	Tower 1-6	T161	58,5	24
56/58	Tower 4-5	T451	41,5	93,5
57/63	Tower 4-5	T452	59,5	73
59/61	Tower 2-3	T231	25,5	33
62/66	Tower 4-6	T461	31	80,5
64	Tower 5-6	T561	58	49,5
65	Tower 2-6	T261	37	24

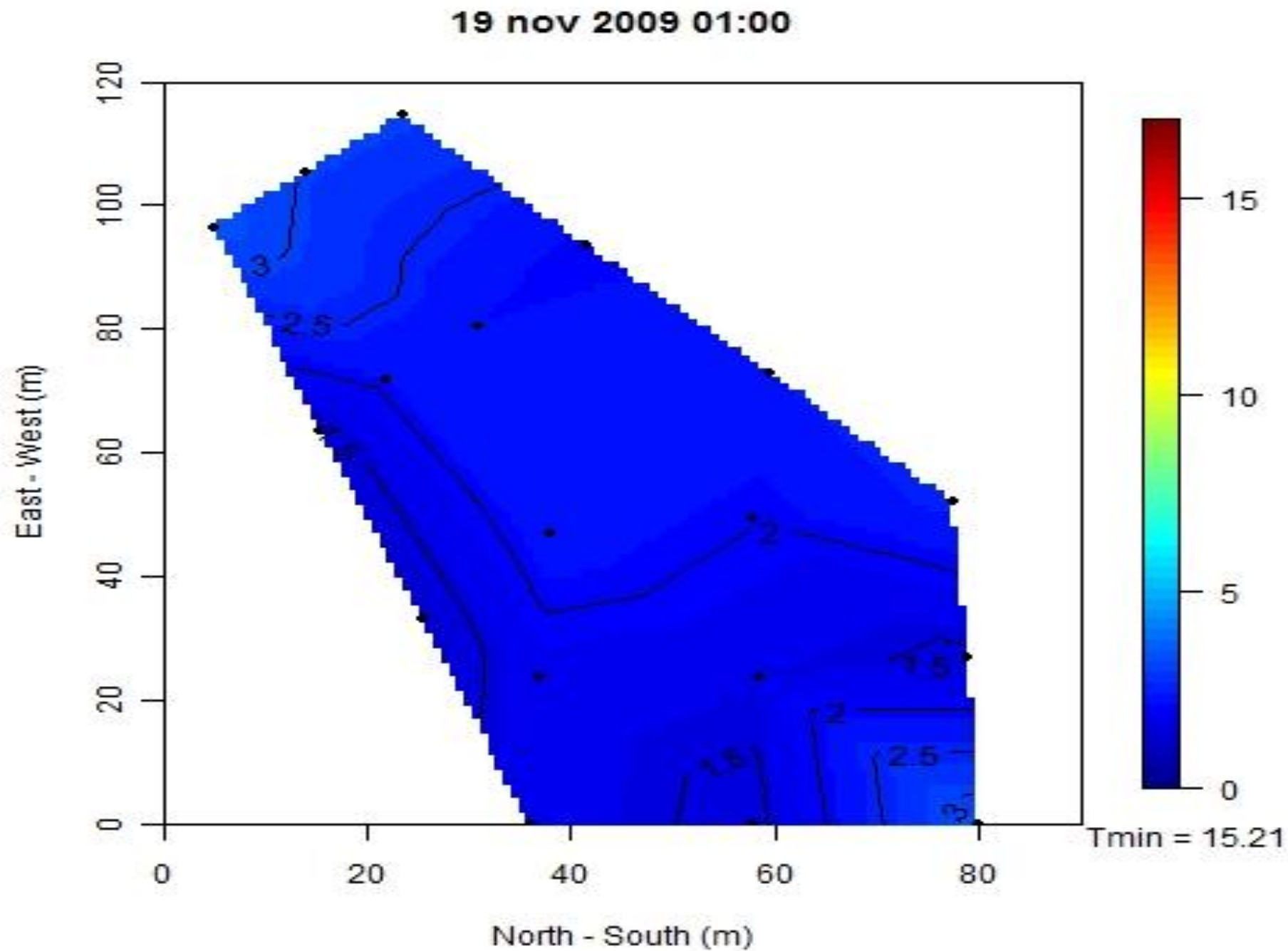
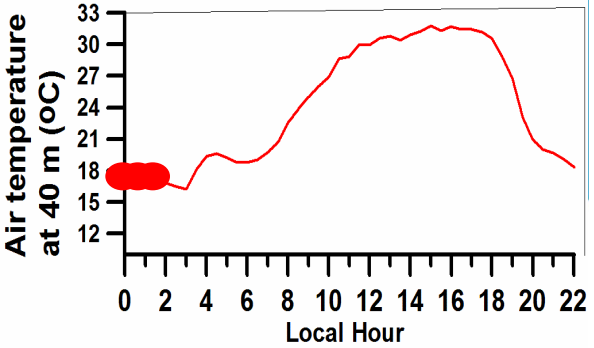
**Node temperature value assigned:
median of all thermometers
each node**

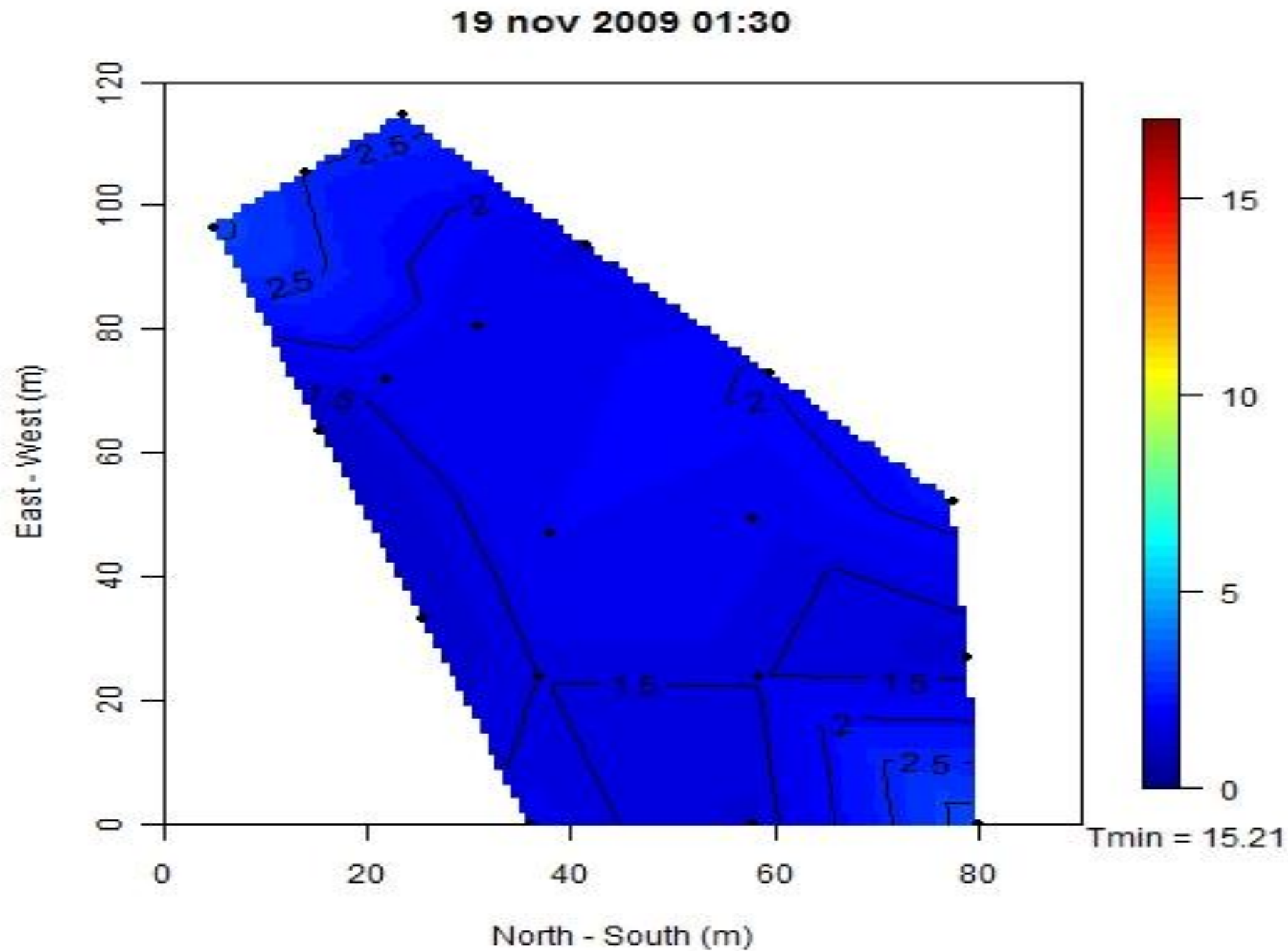
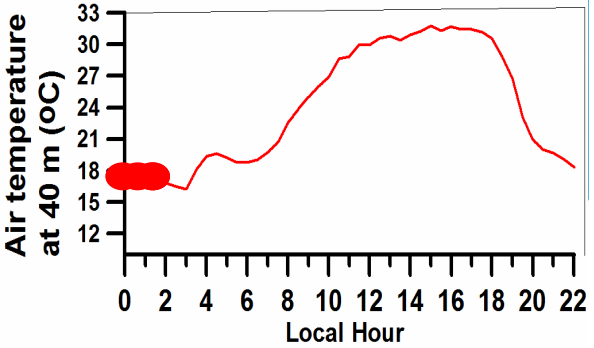
**Visualization: deviation from
minimum temperature**

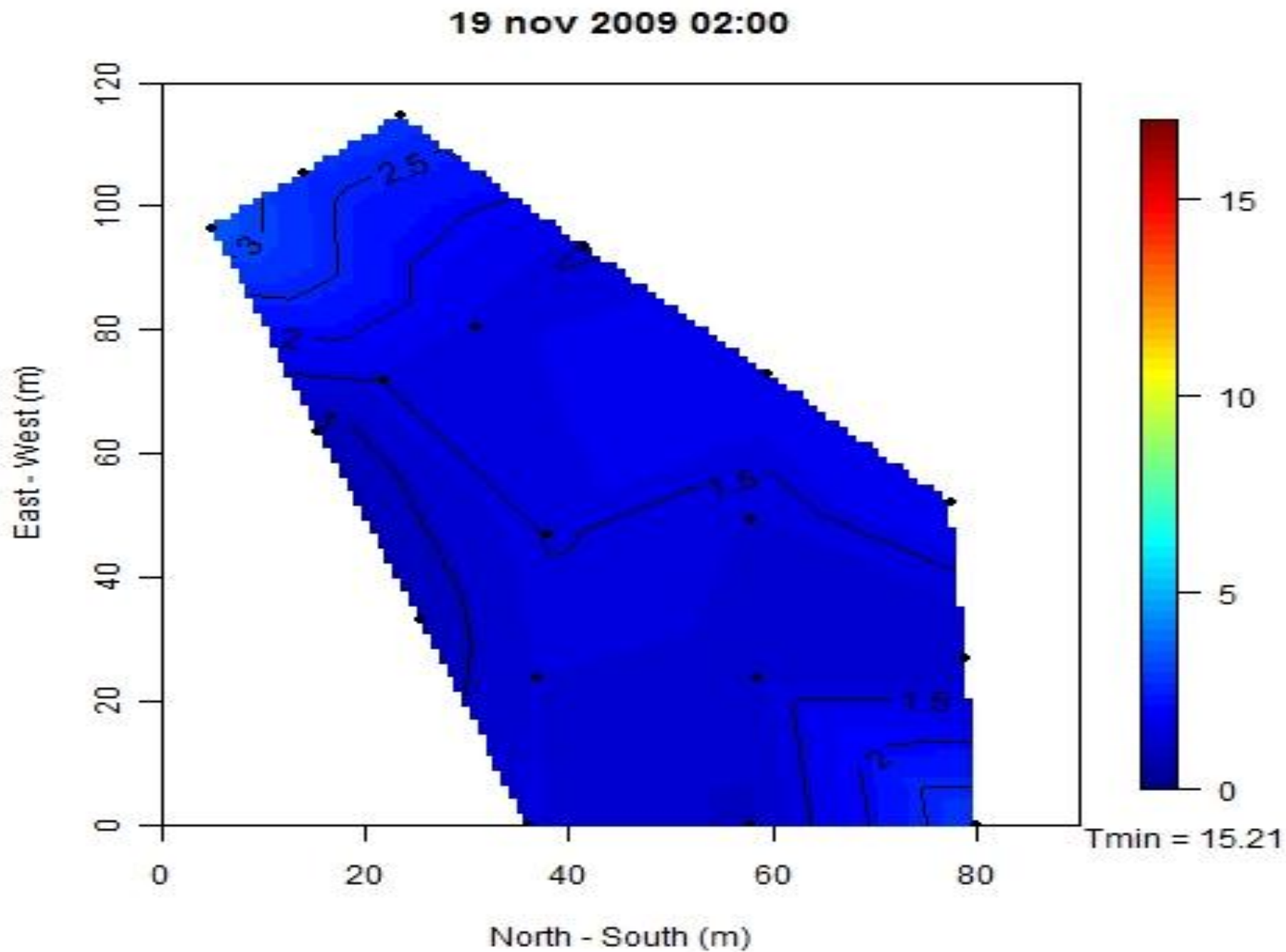
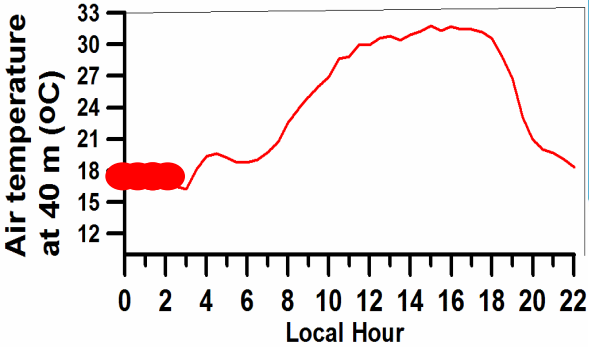


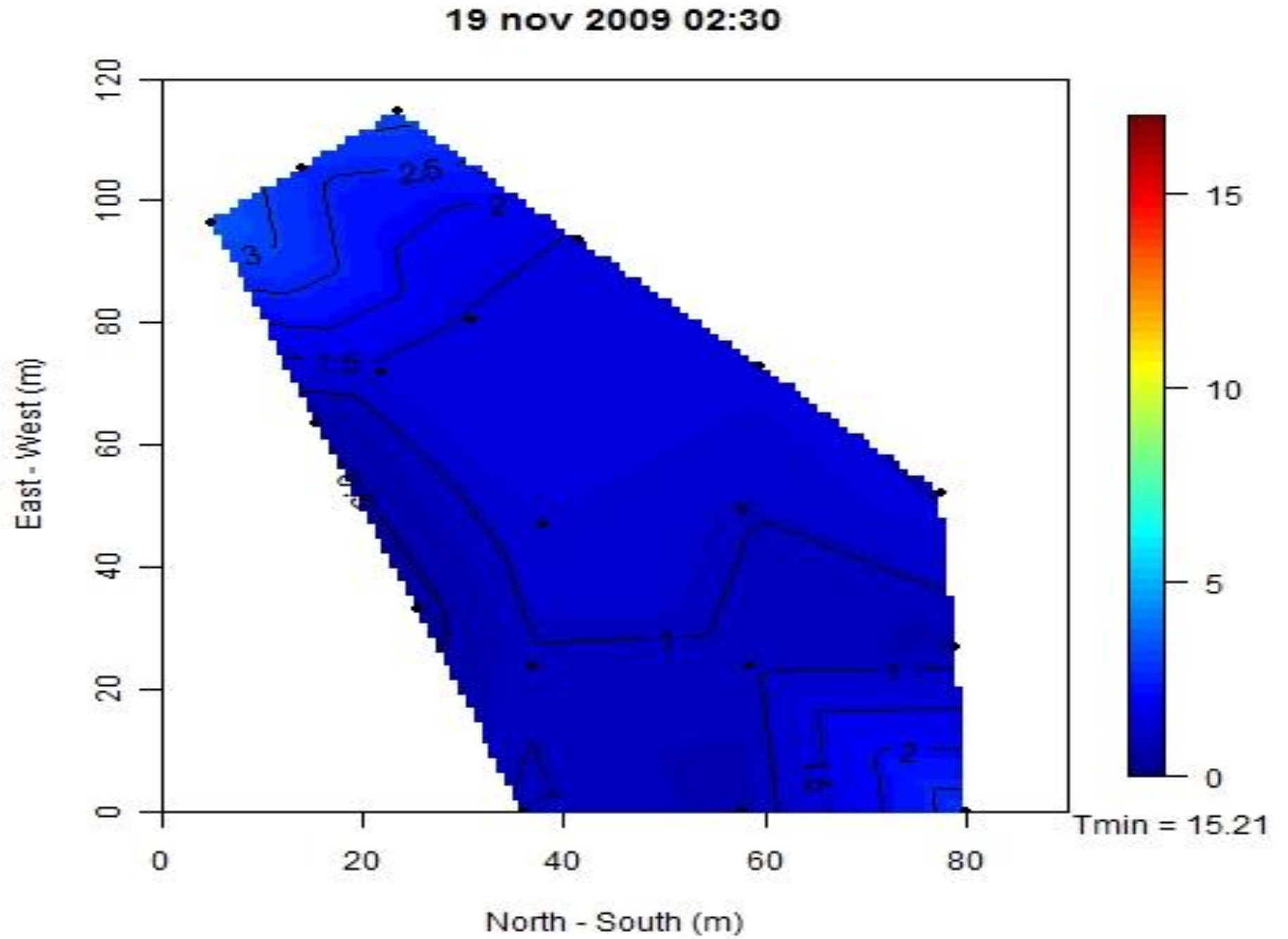
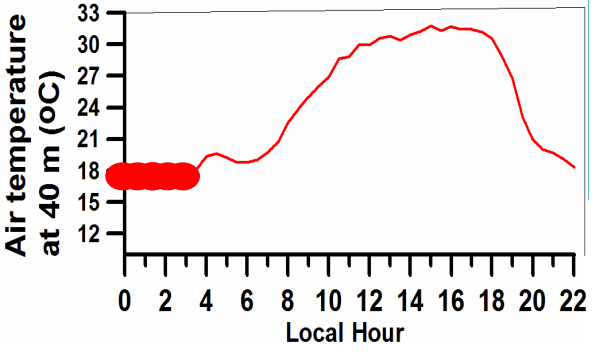


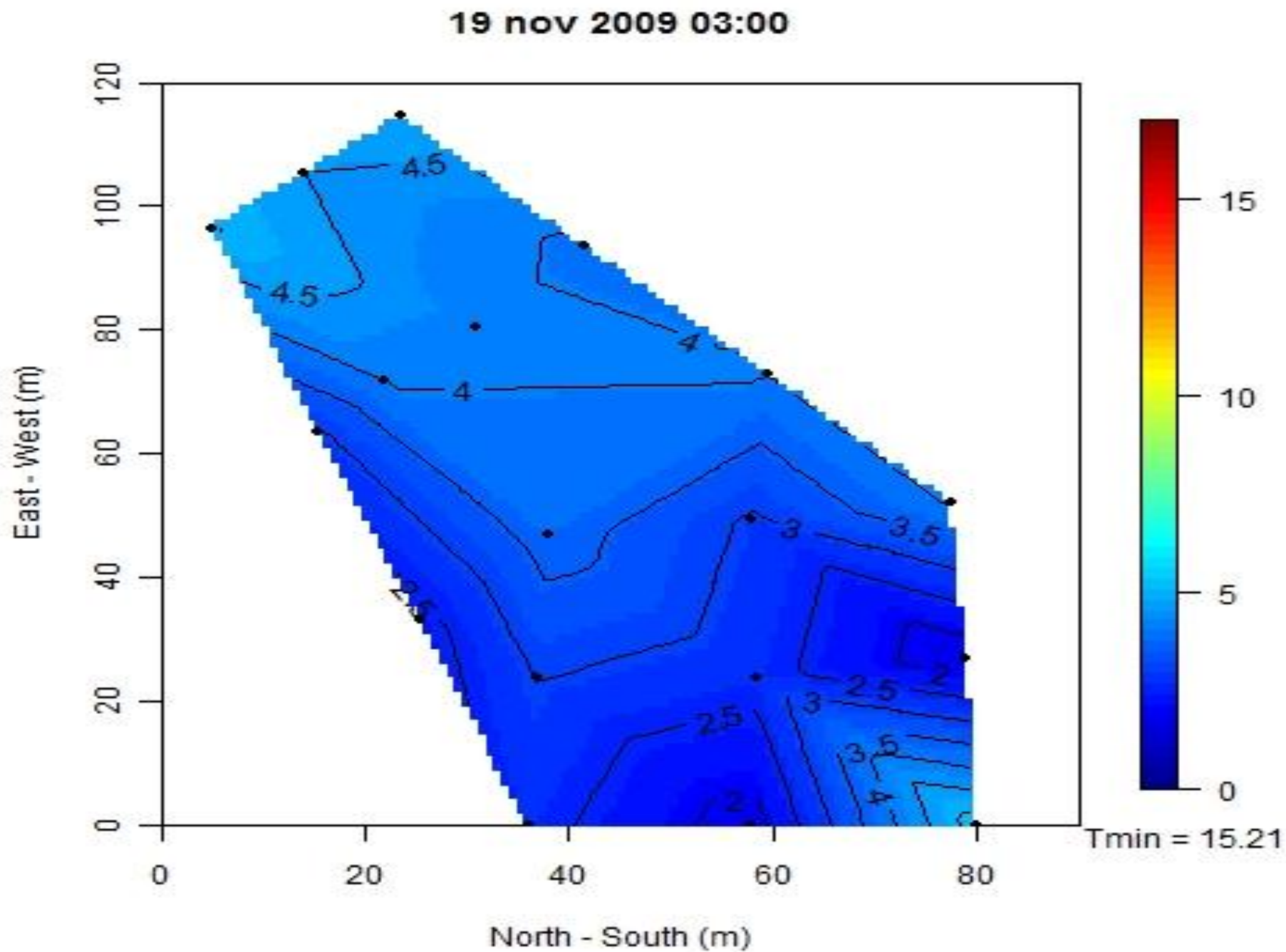
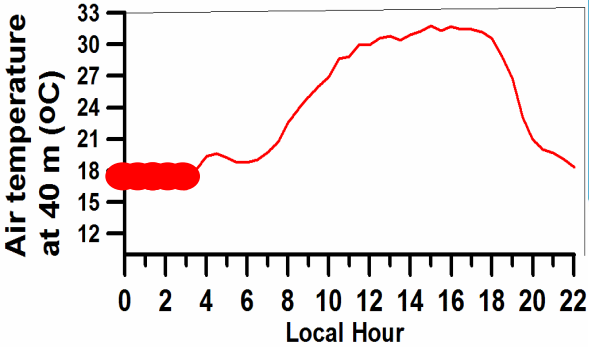


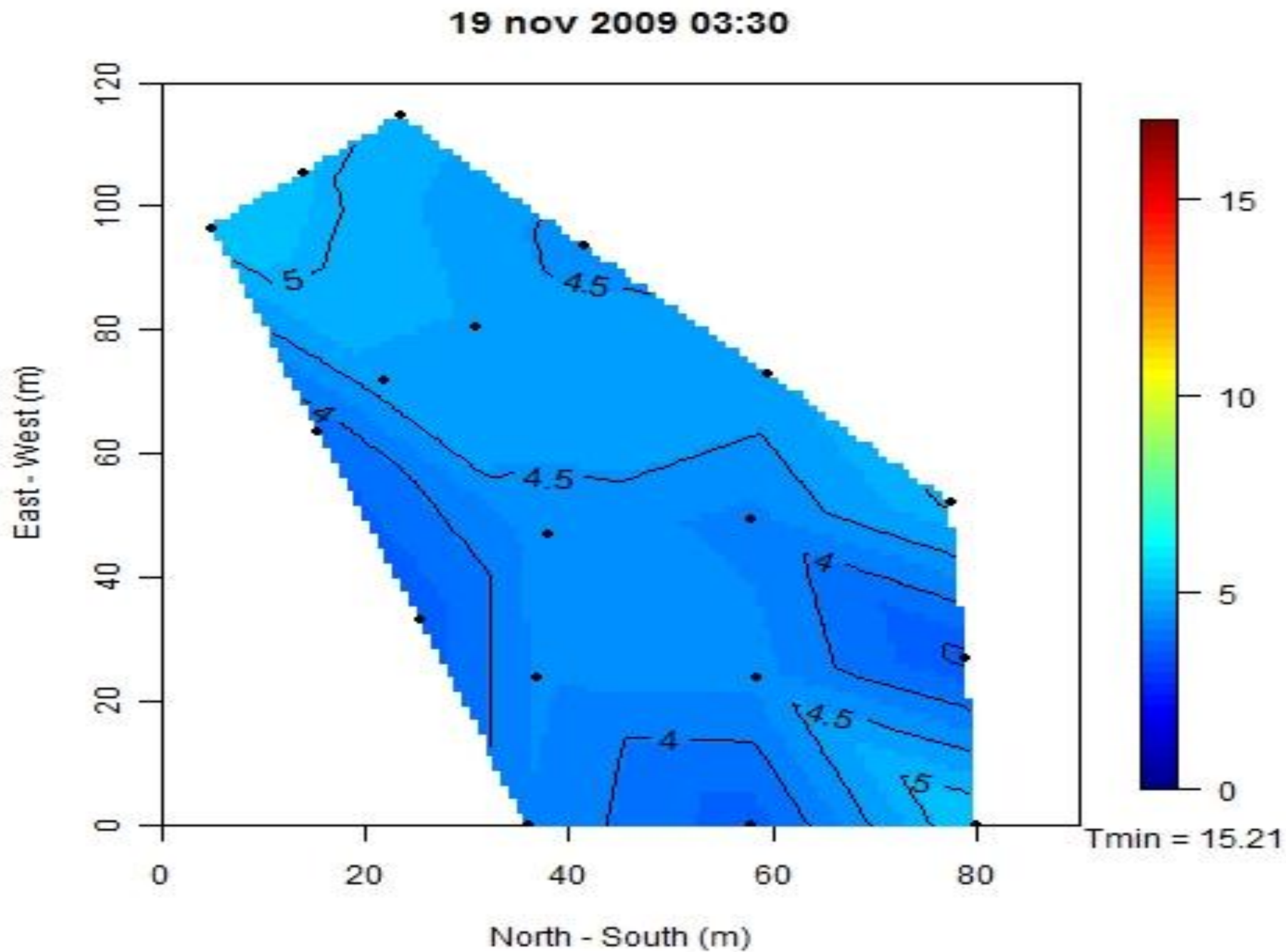
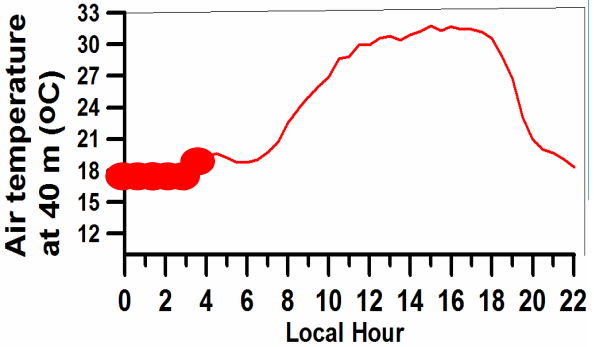


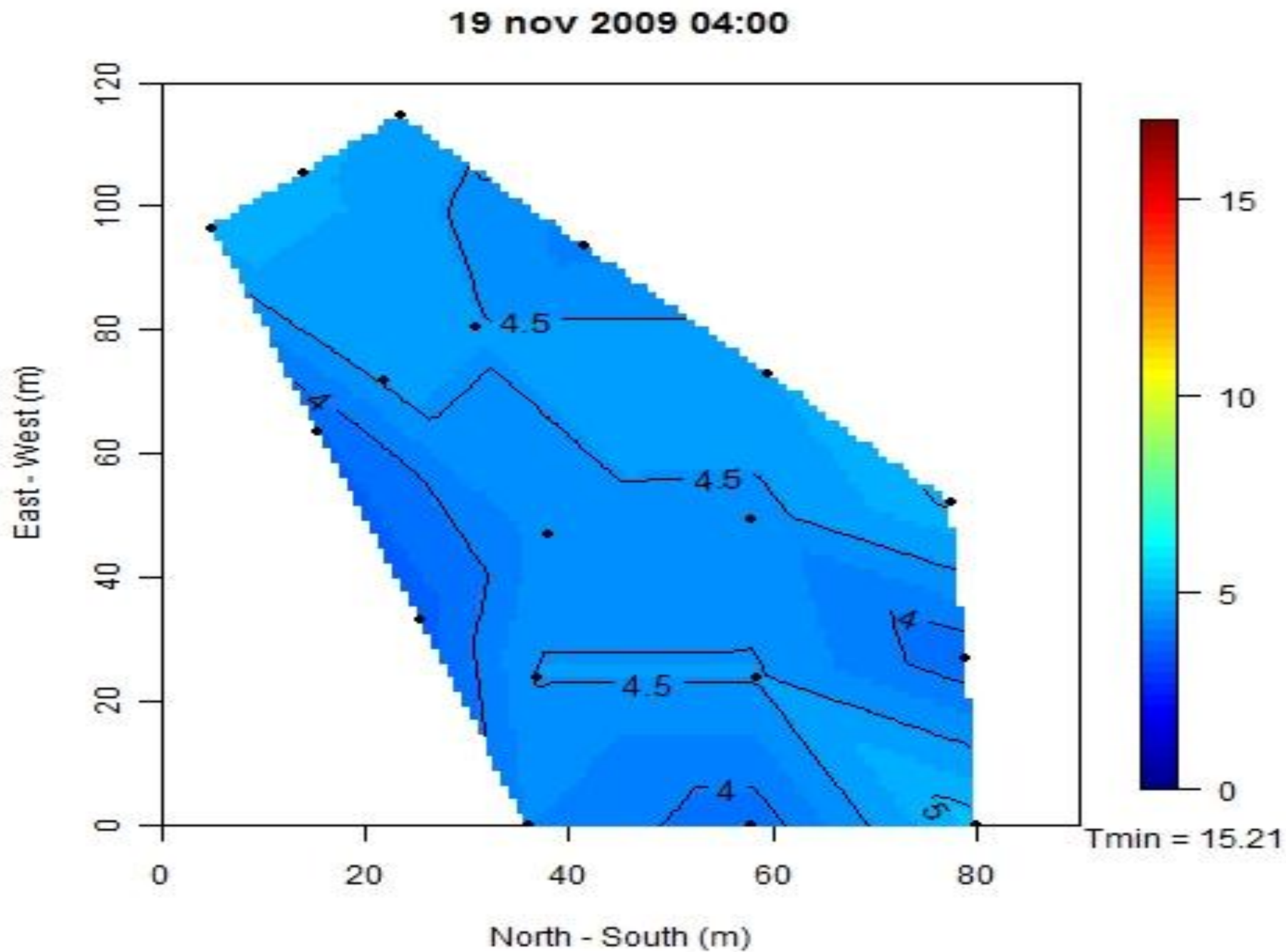
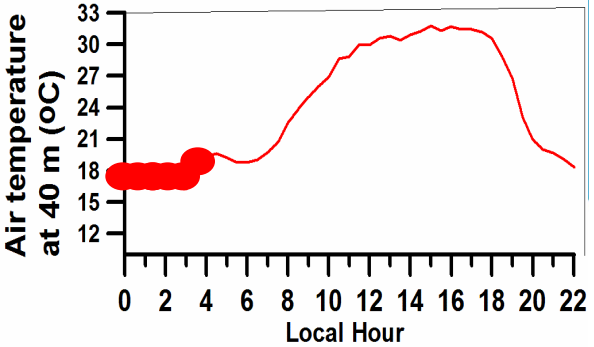


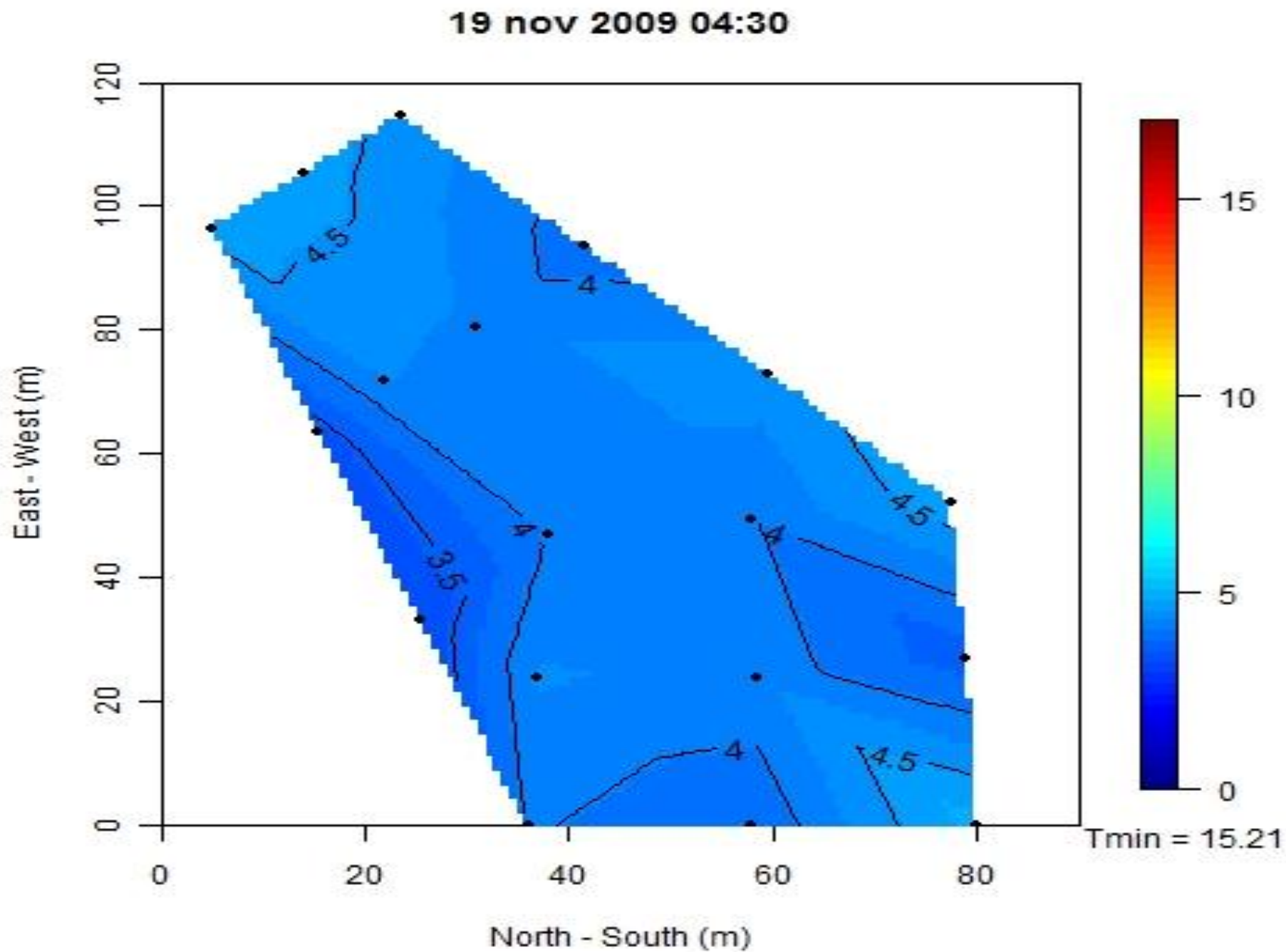
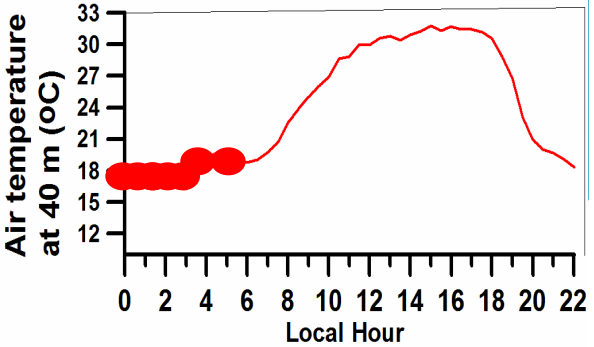


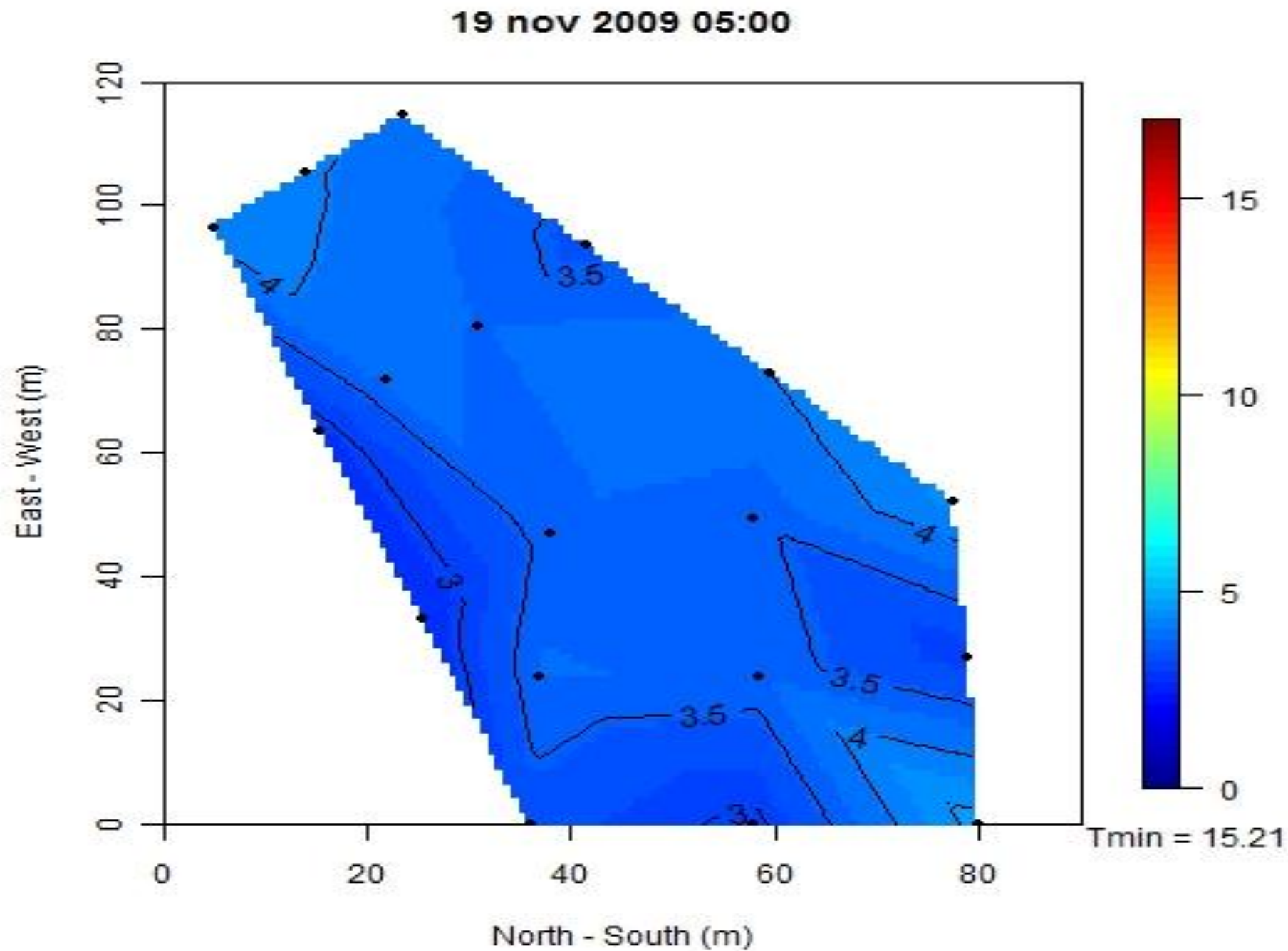
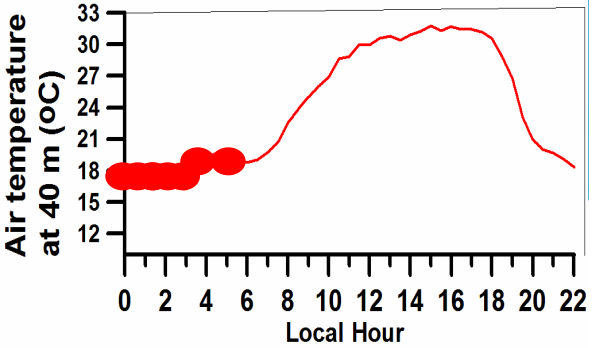


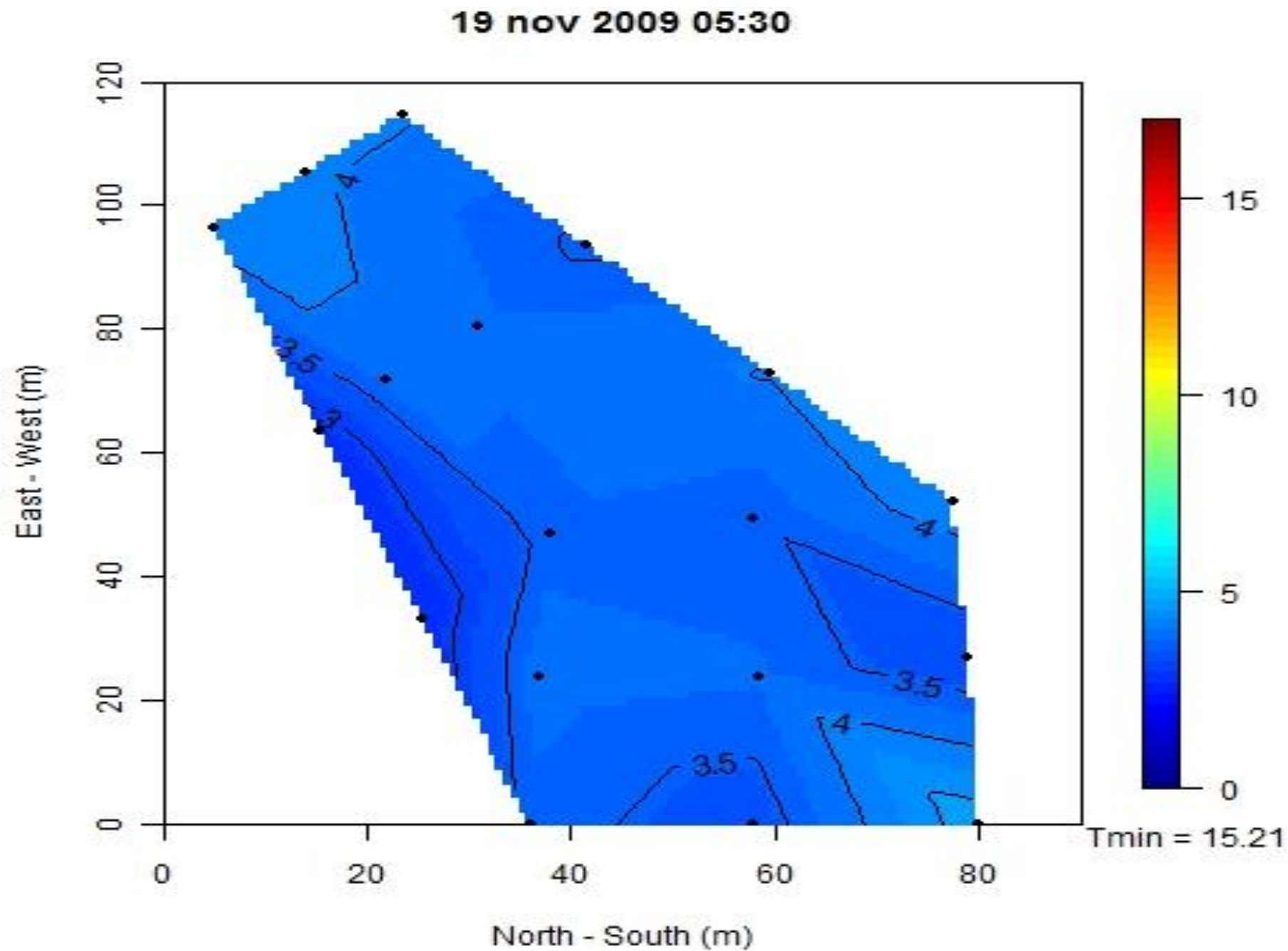
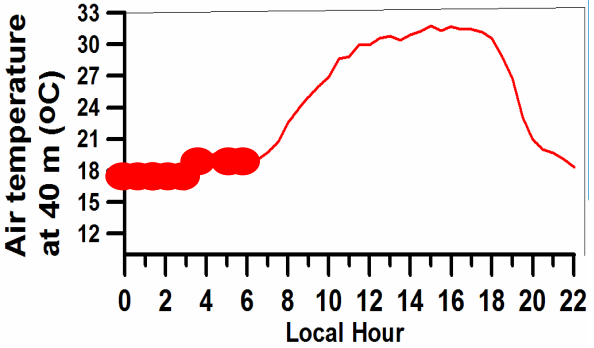


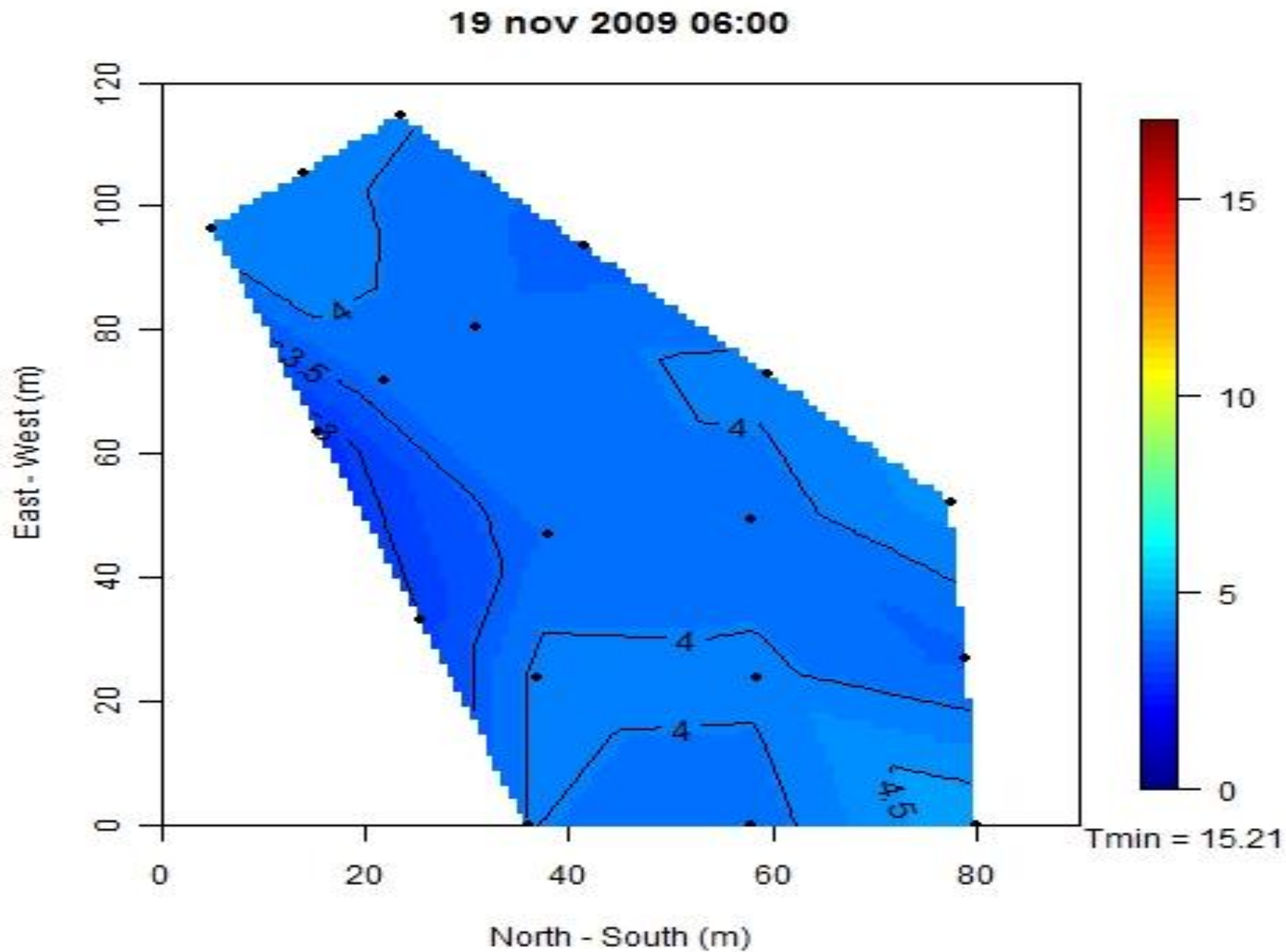
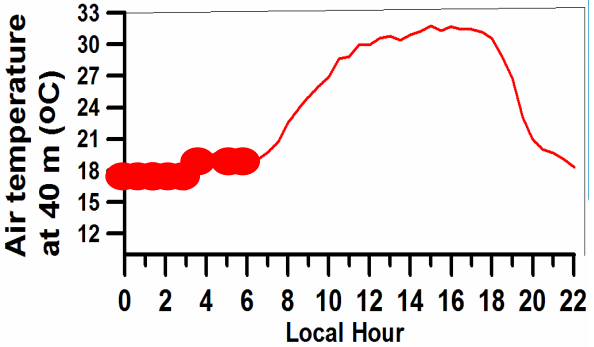


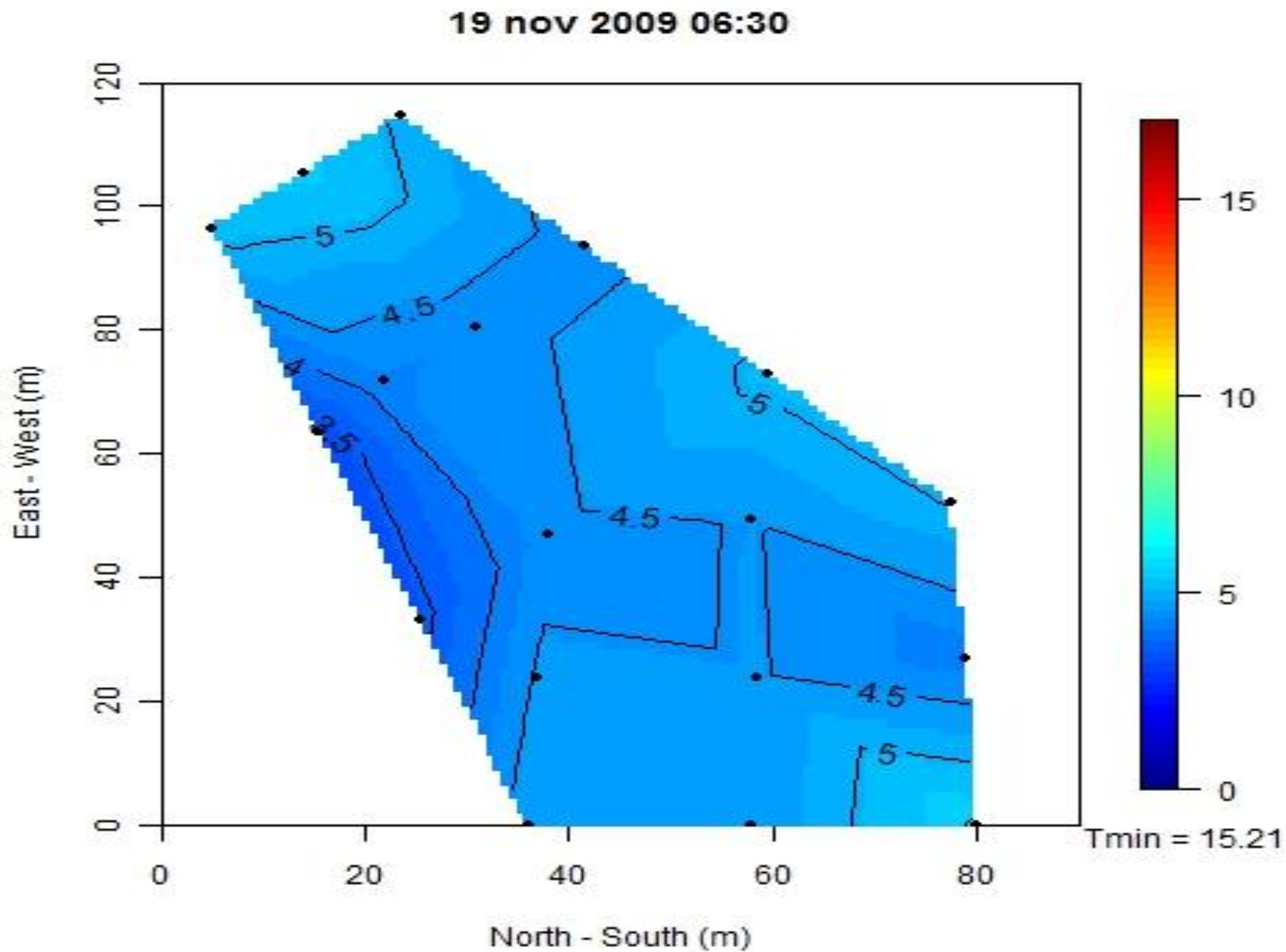
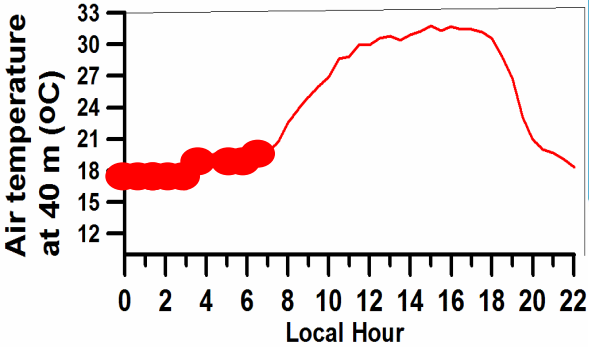


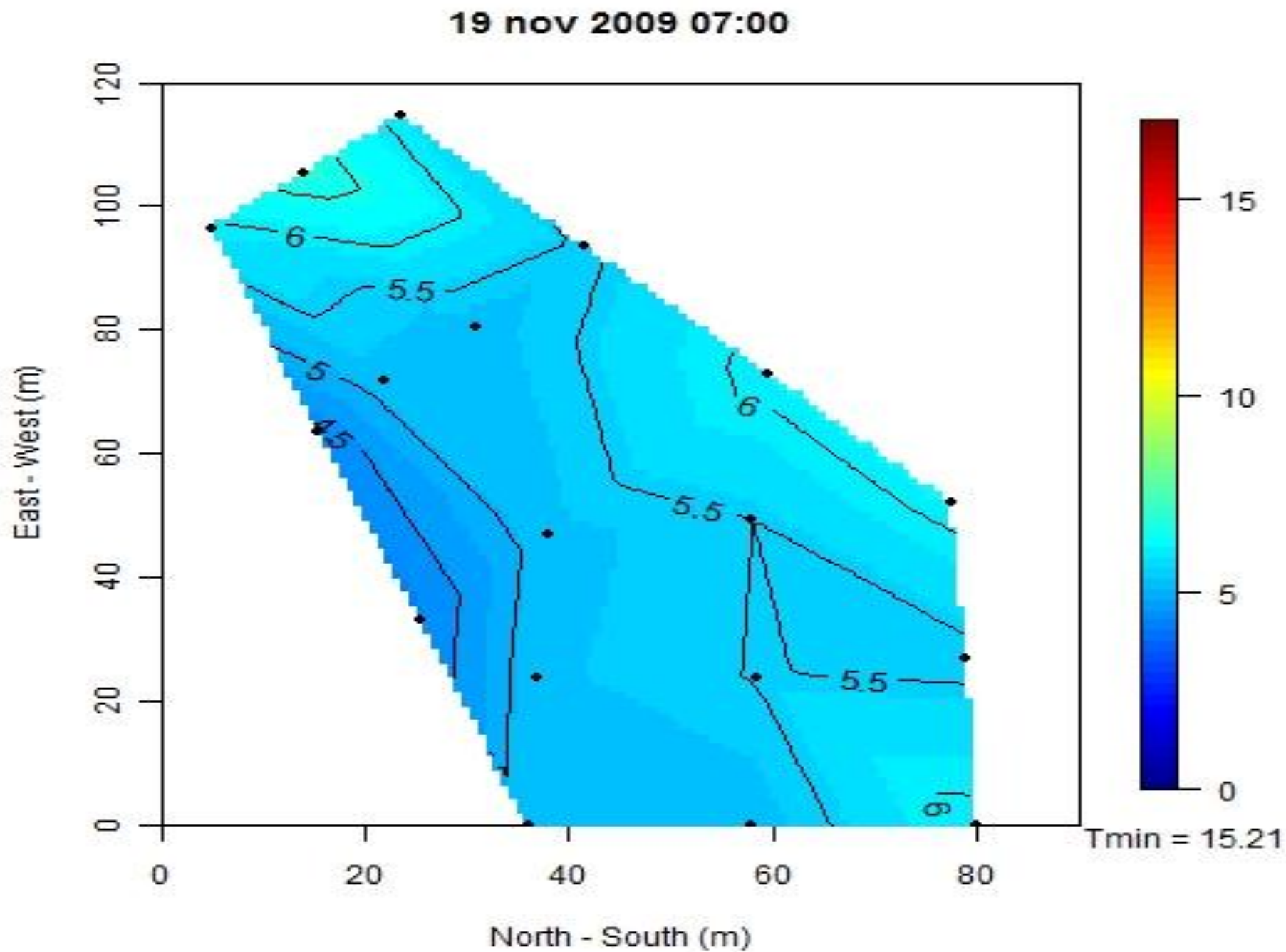
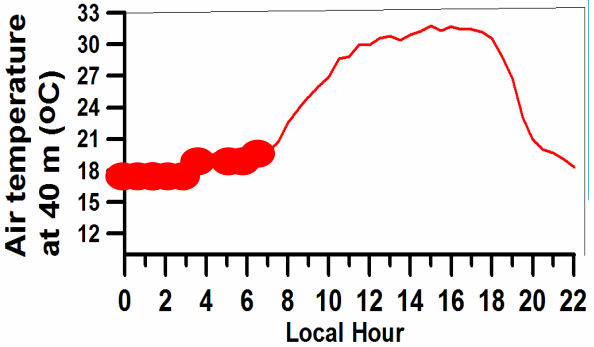


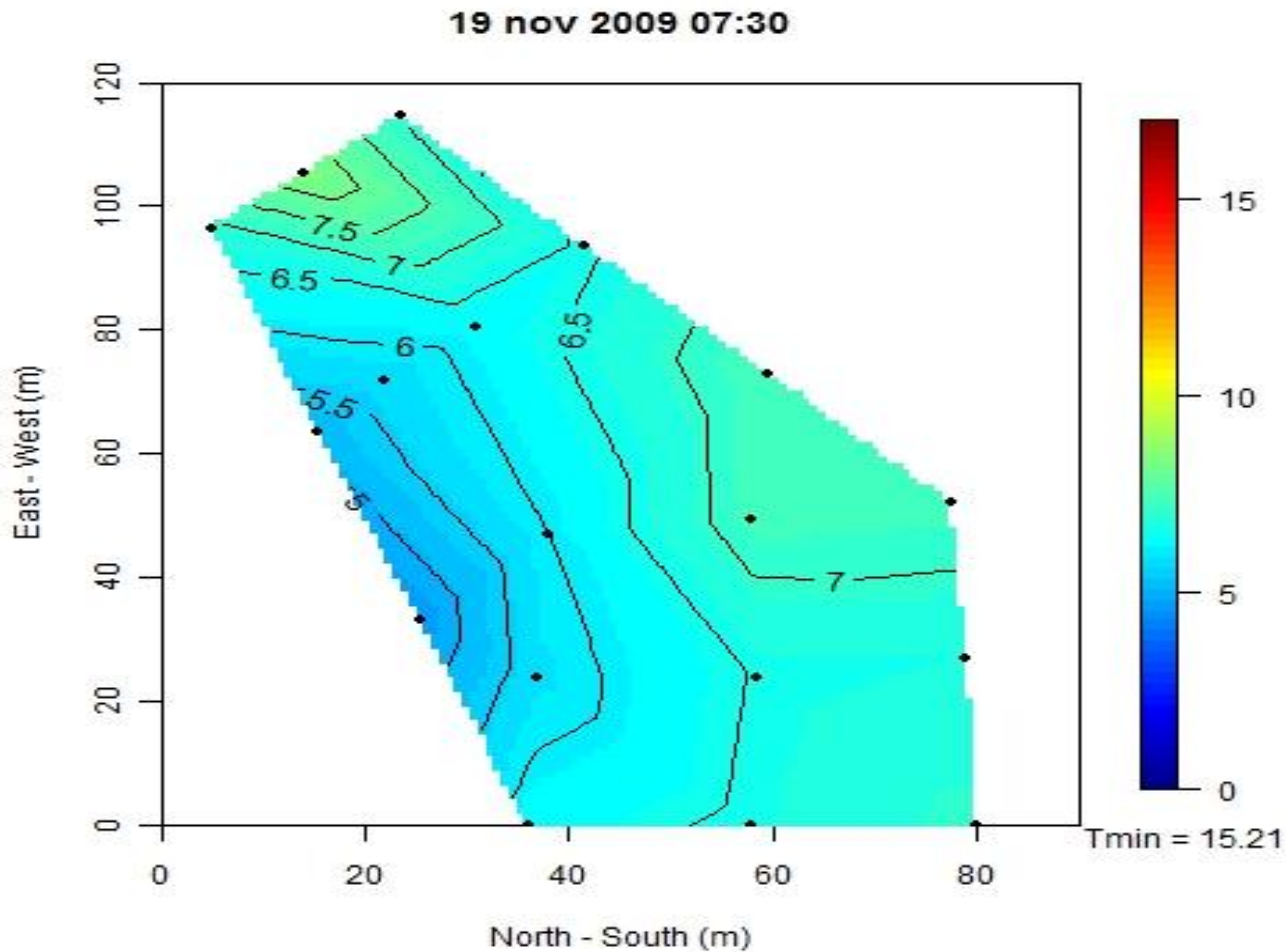
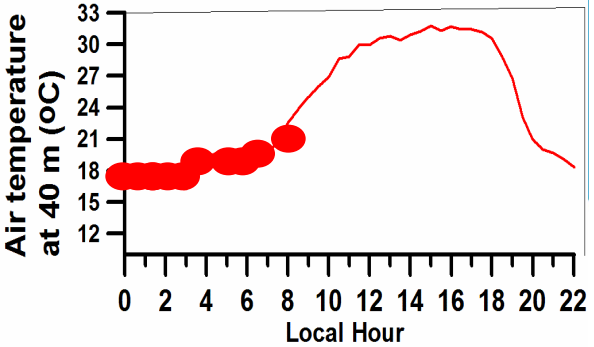


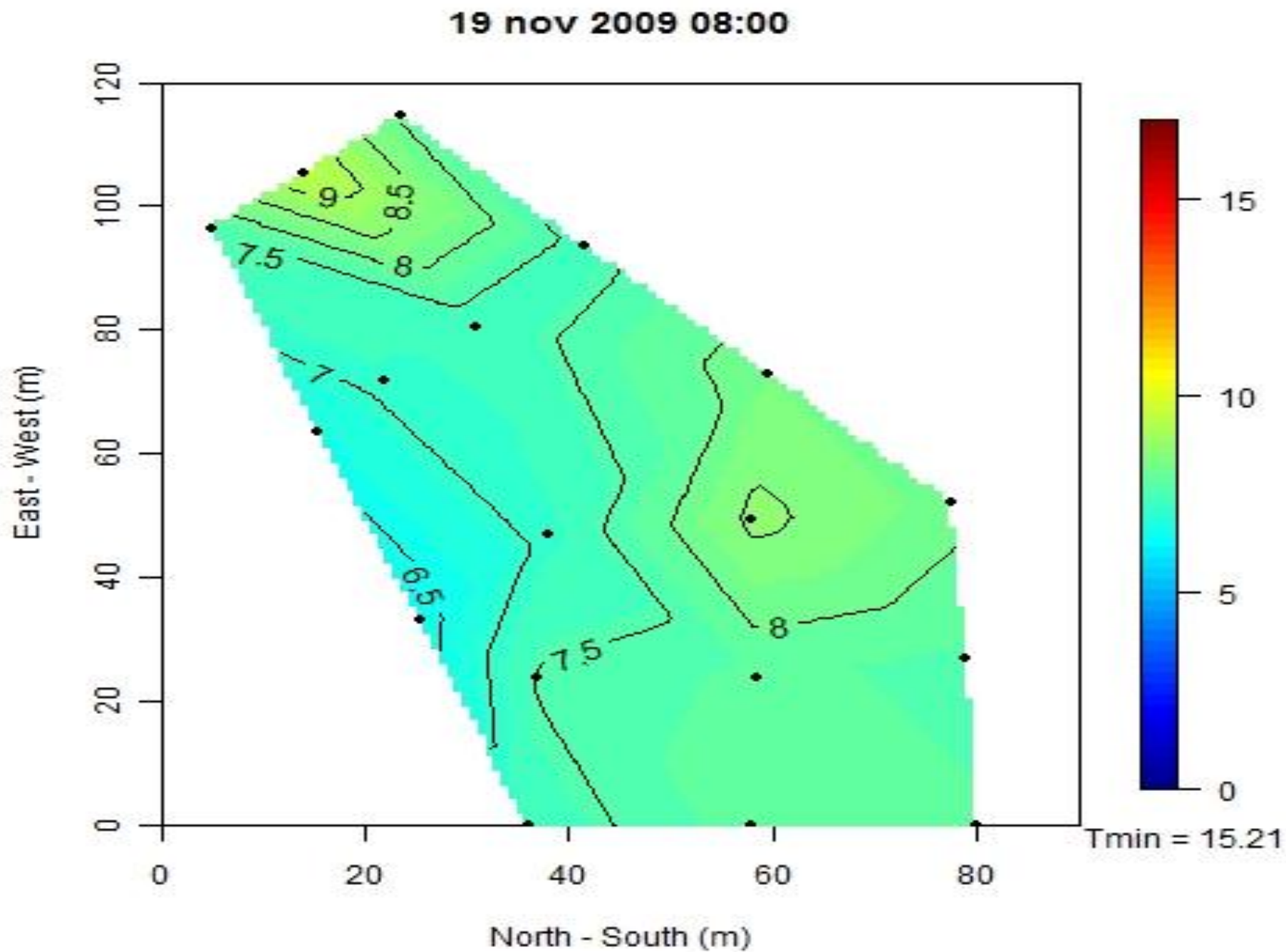
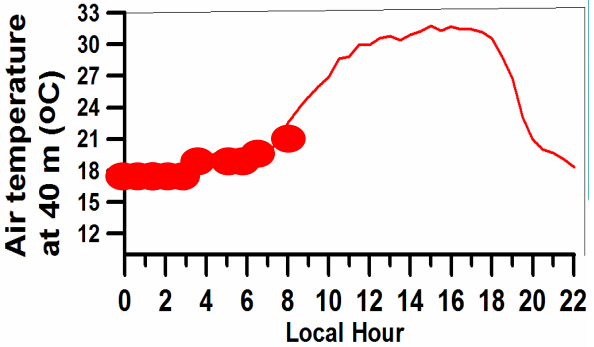


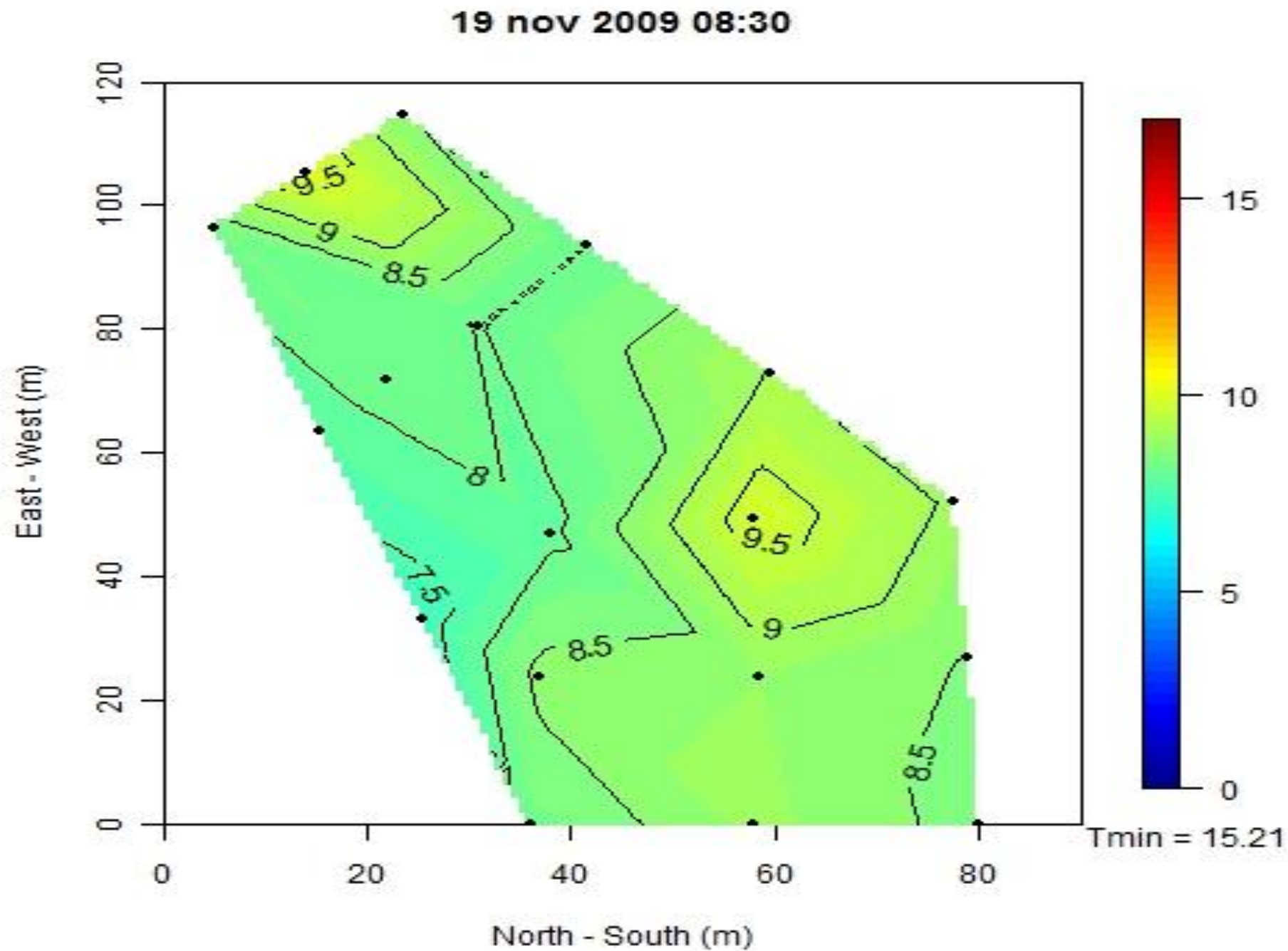
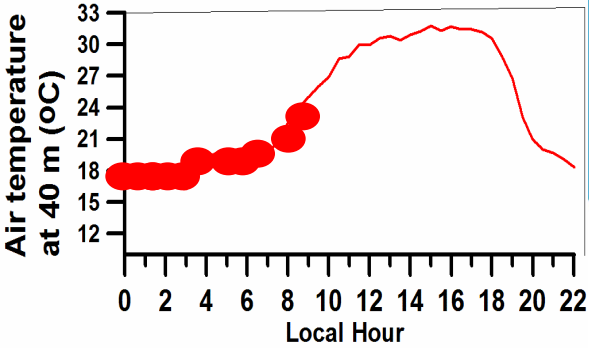


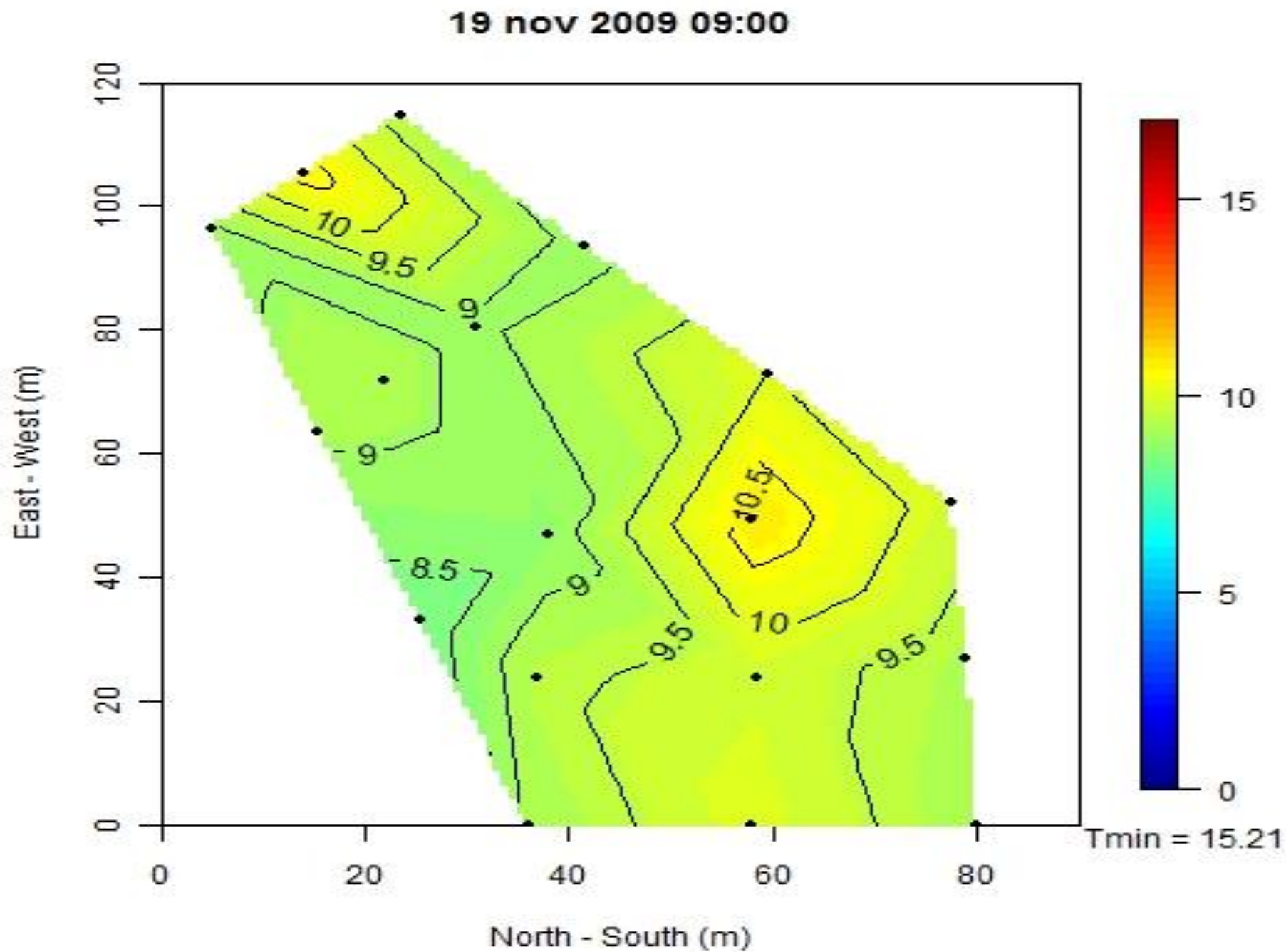
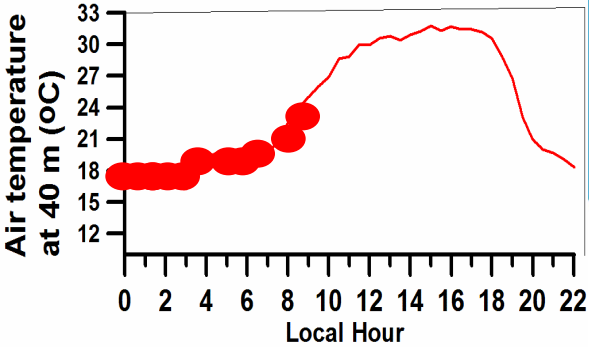


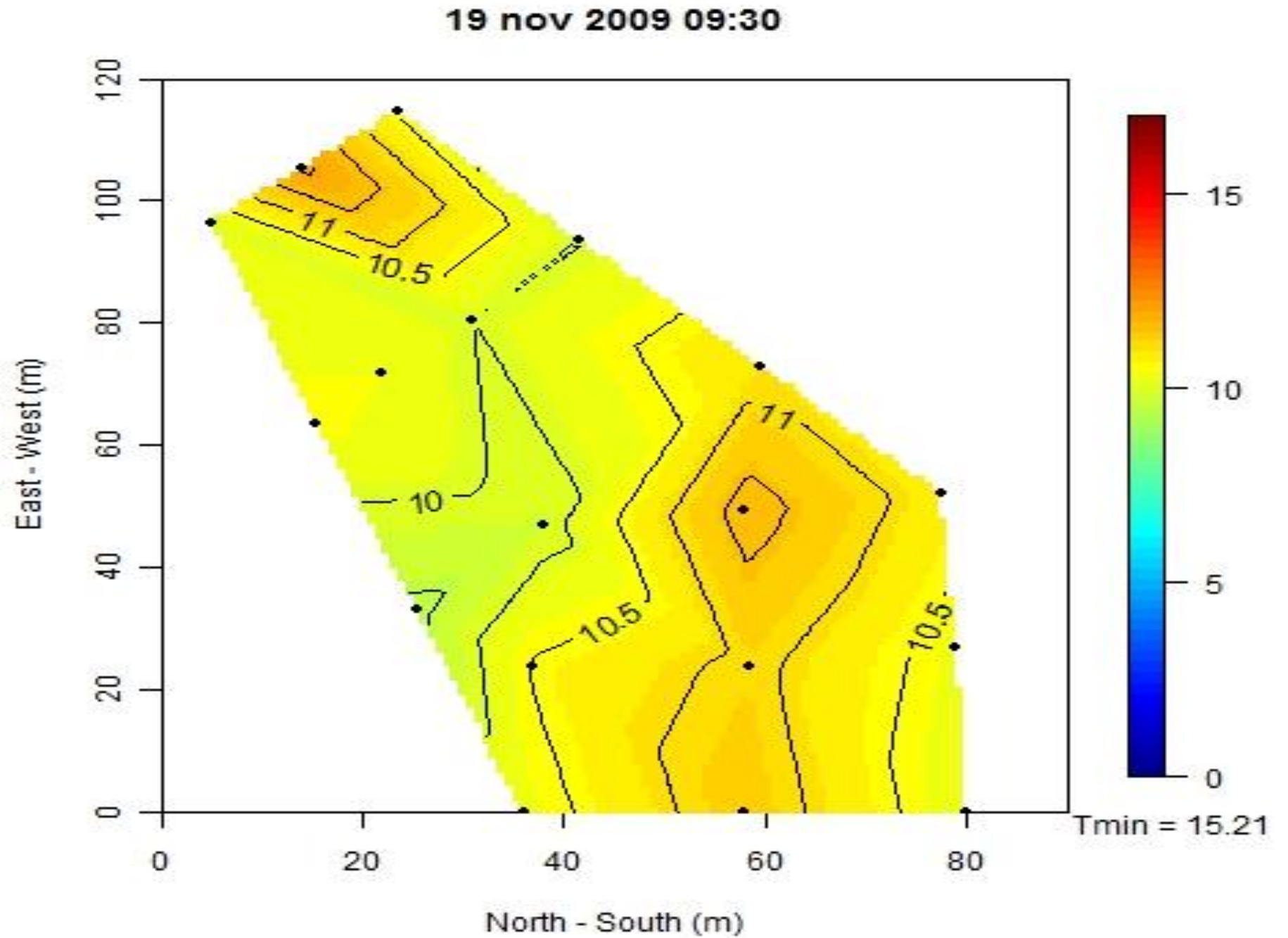
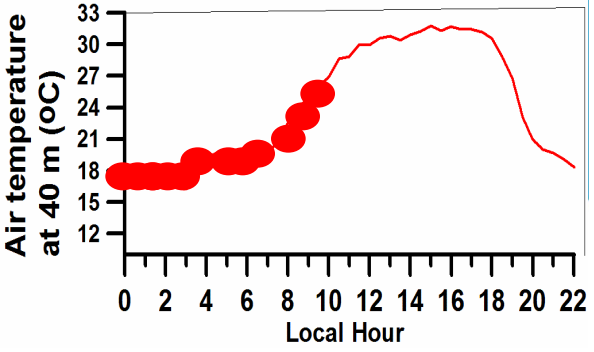


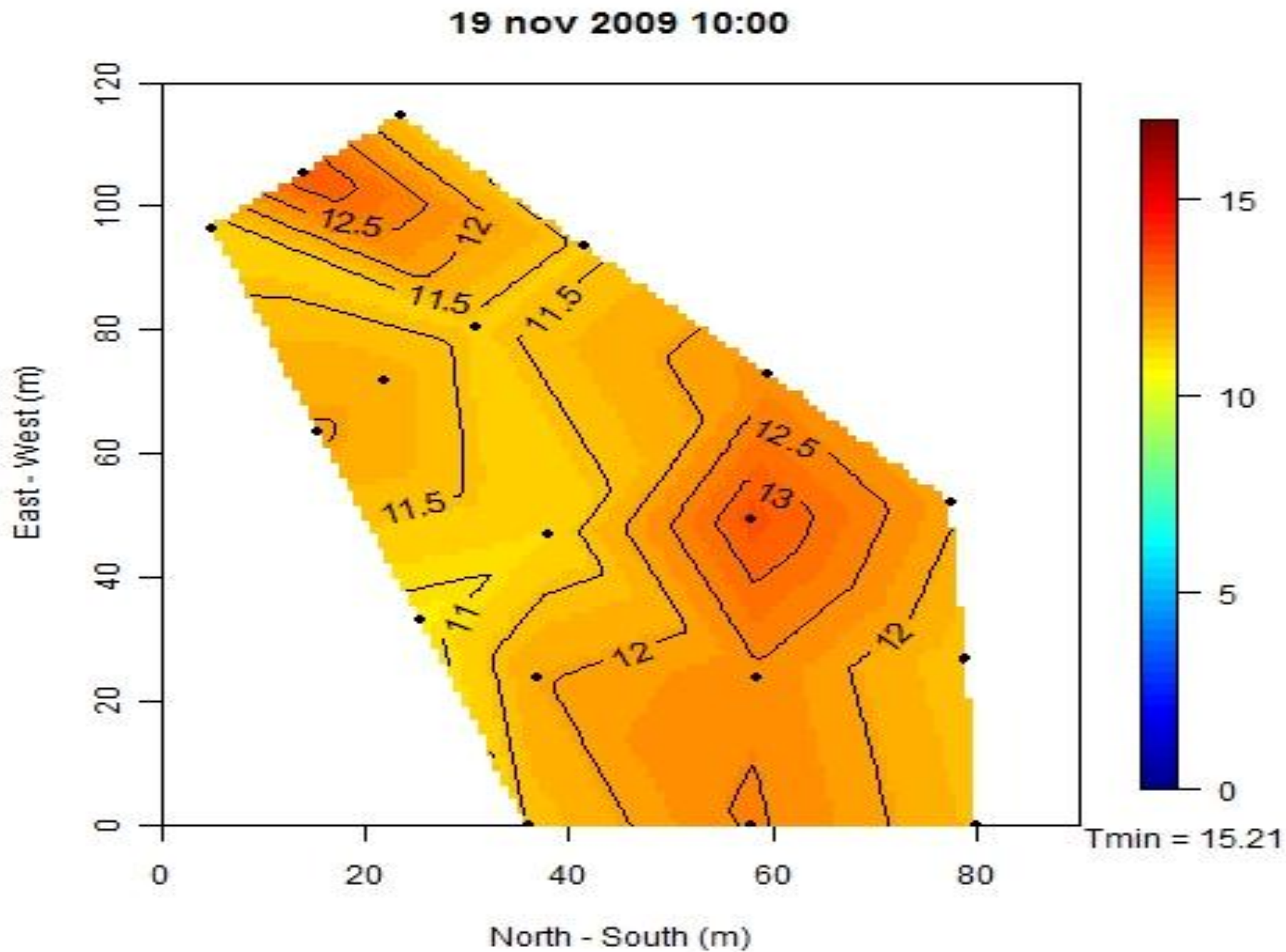
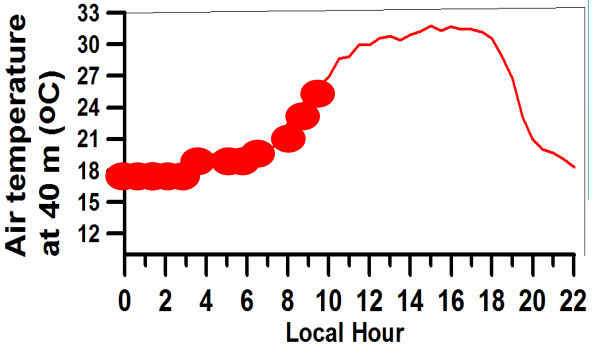


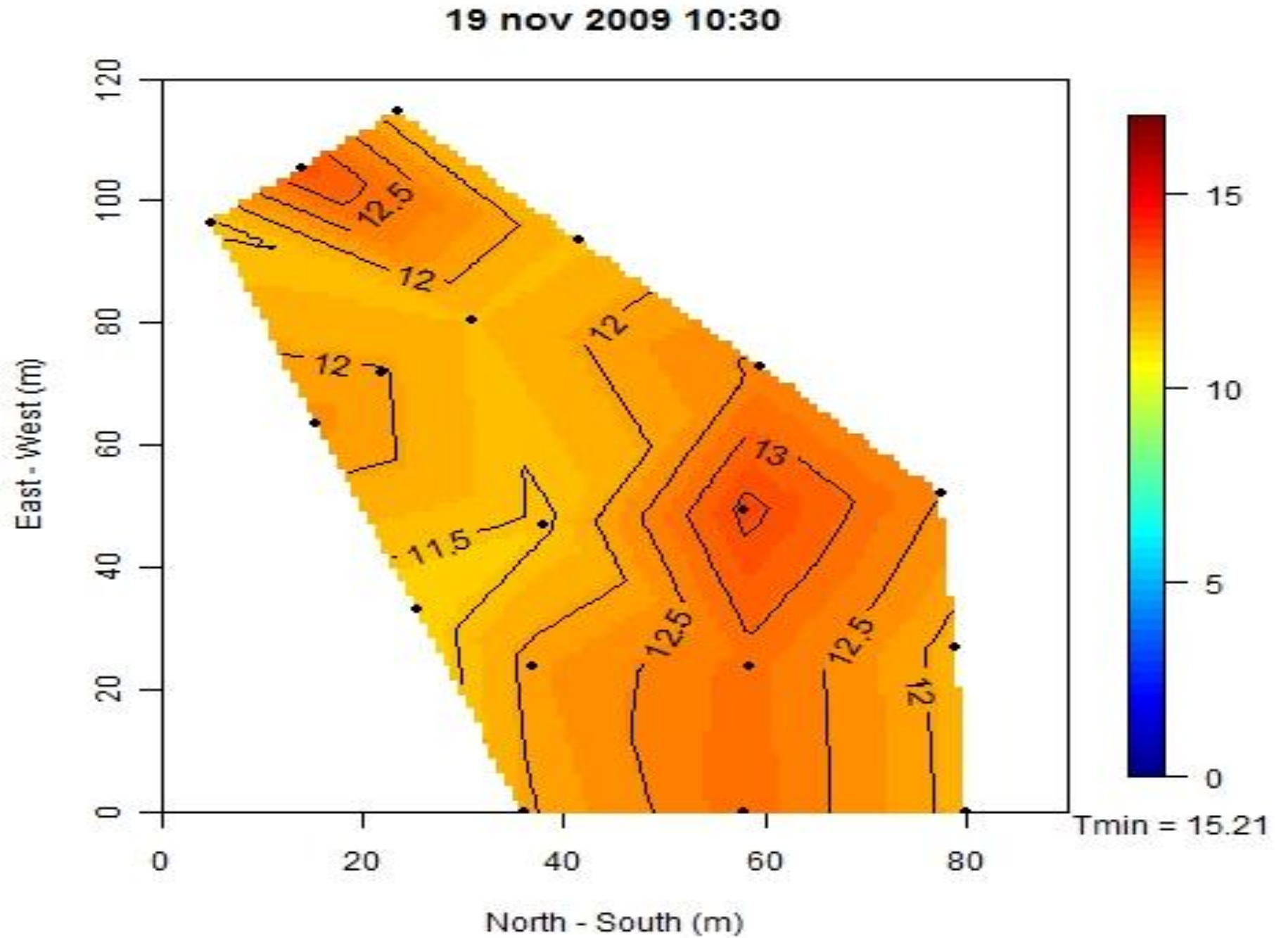
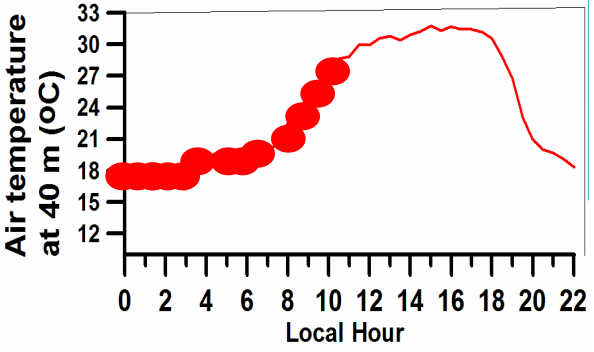


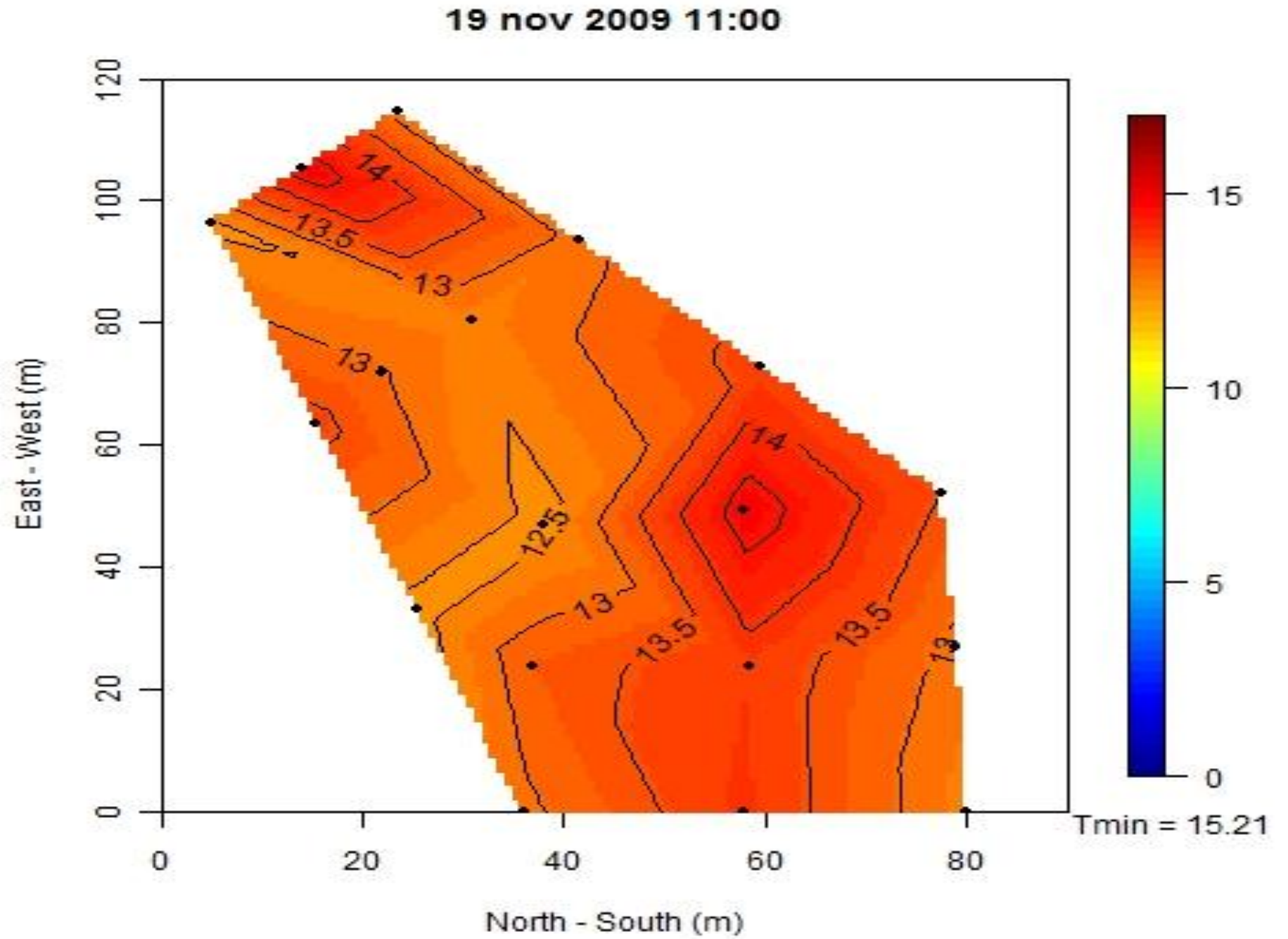
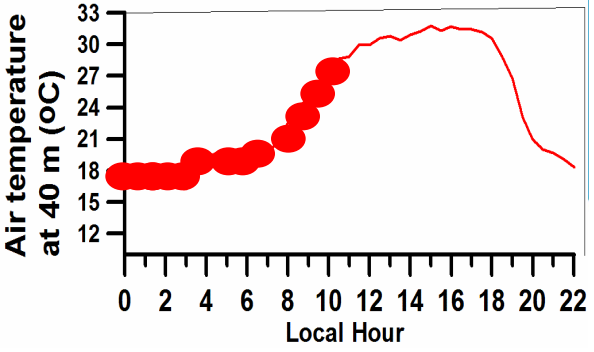


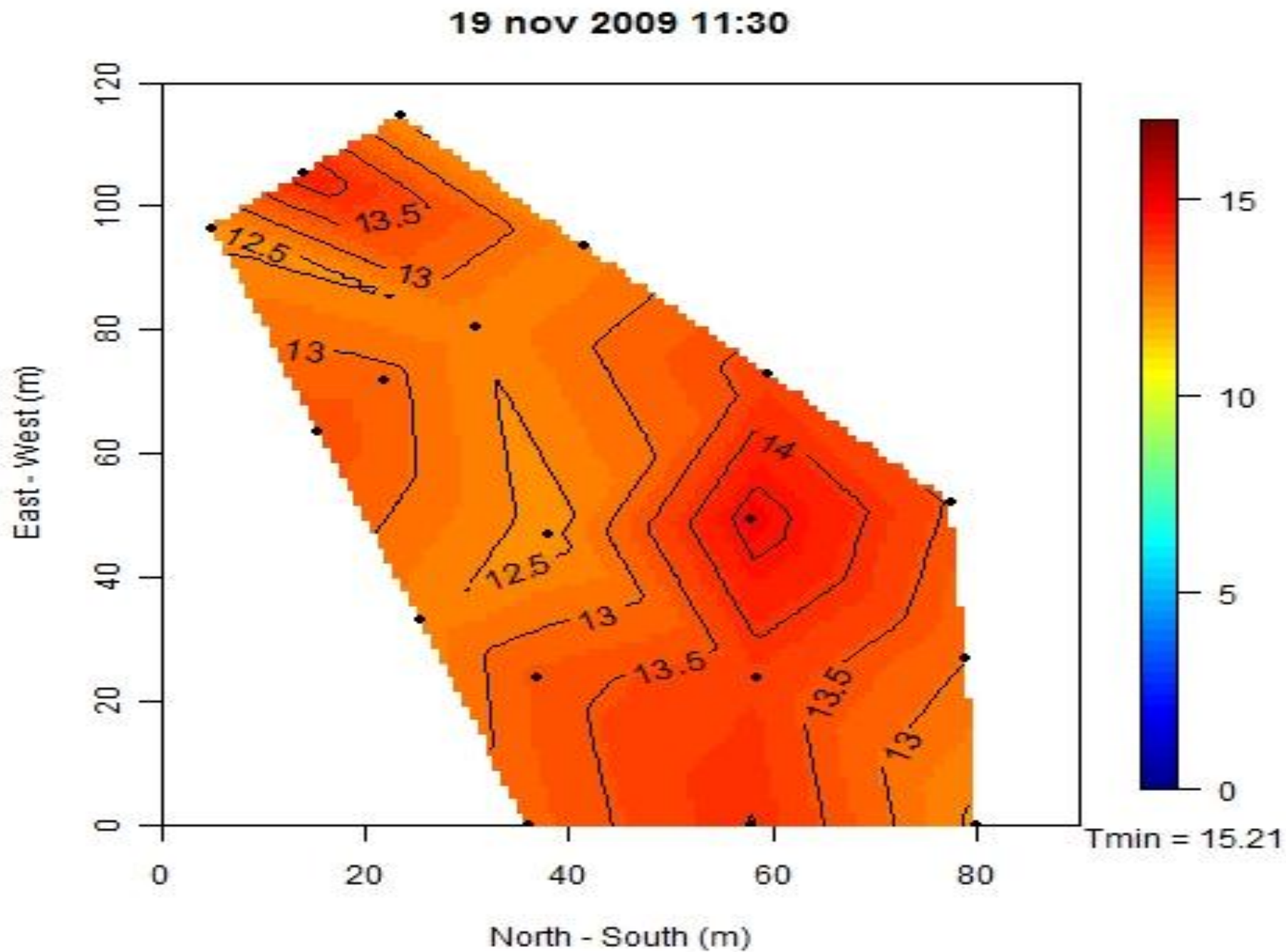
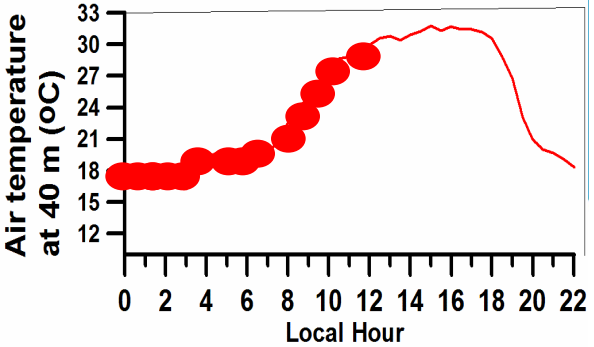


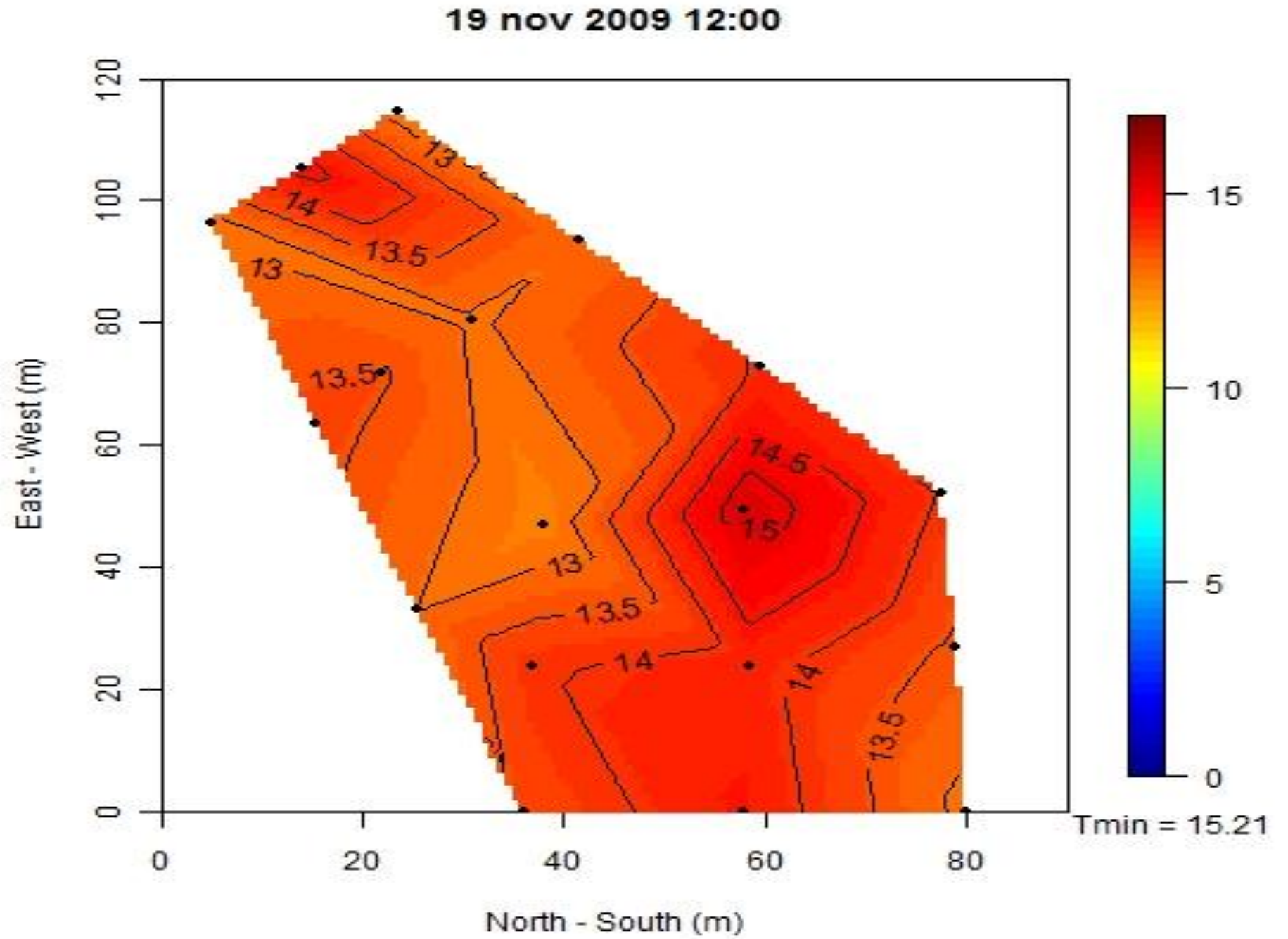
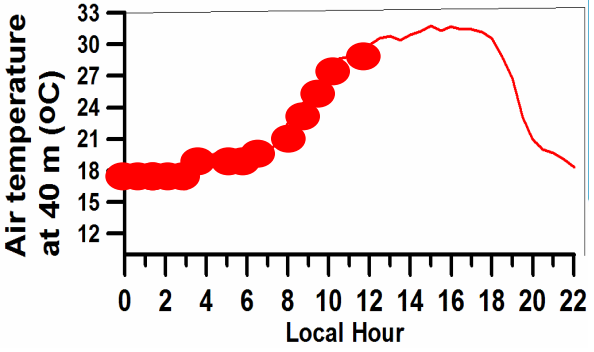


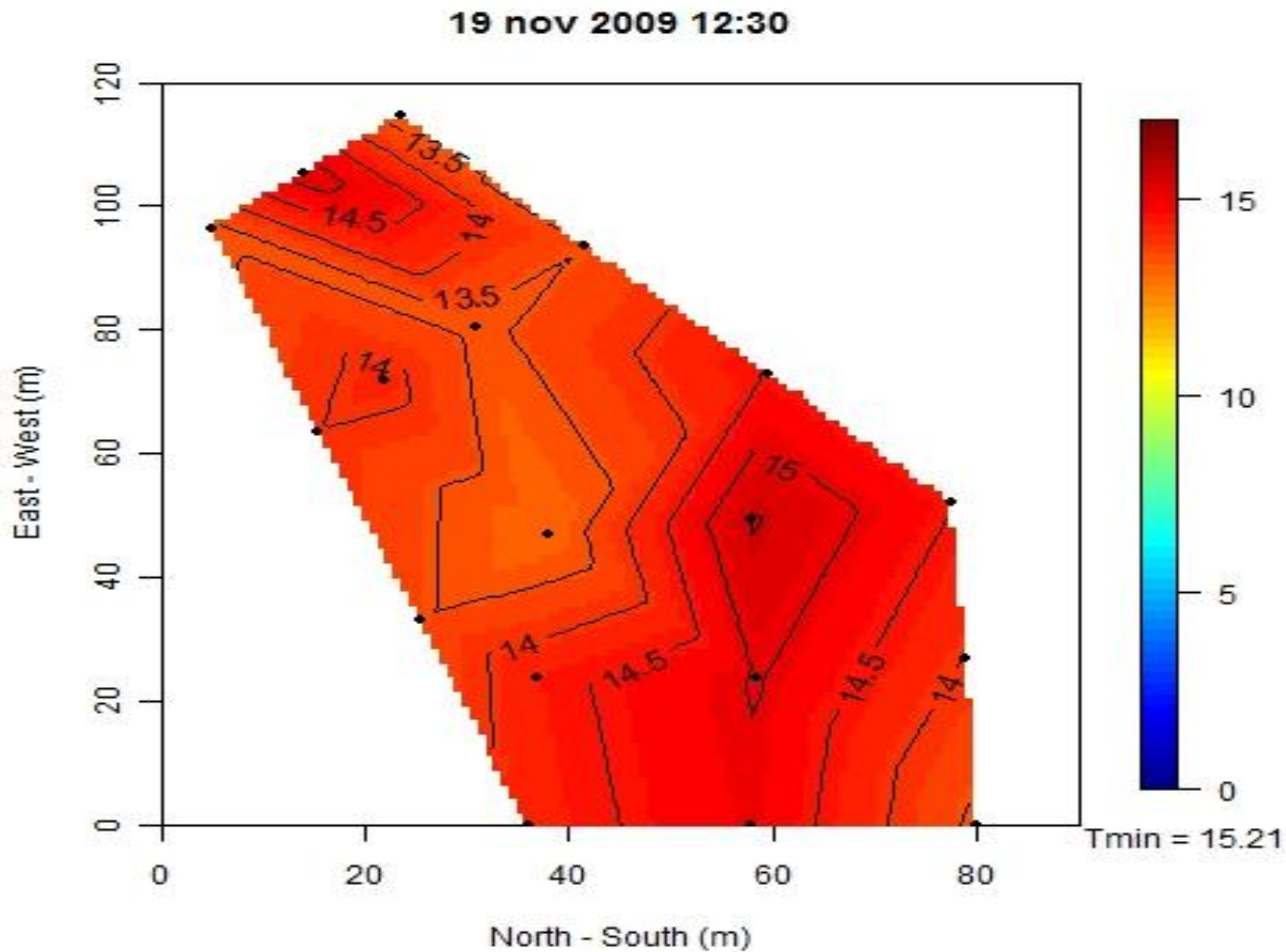
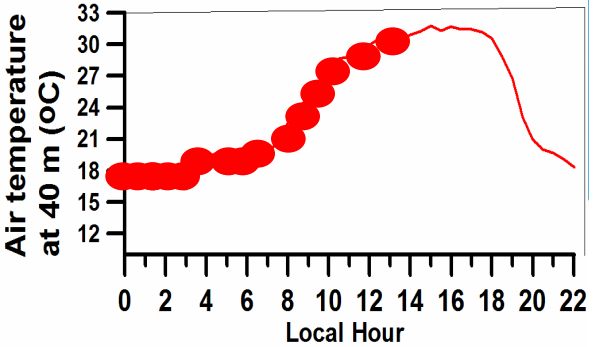


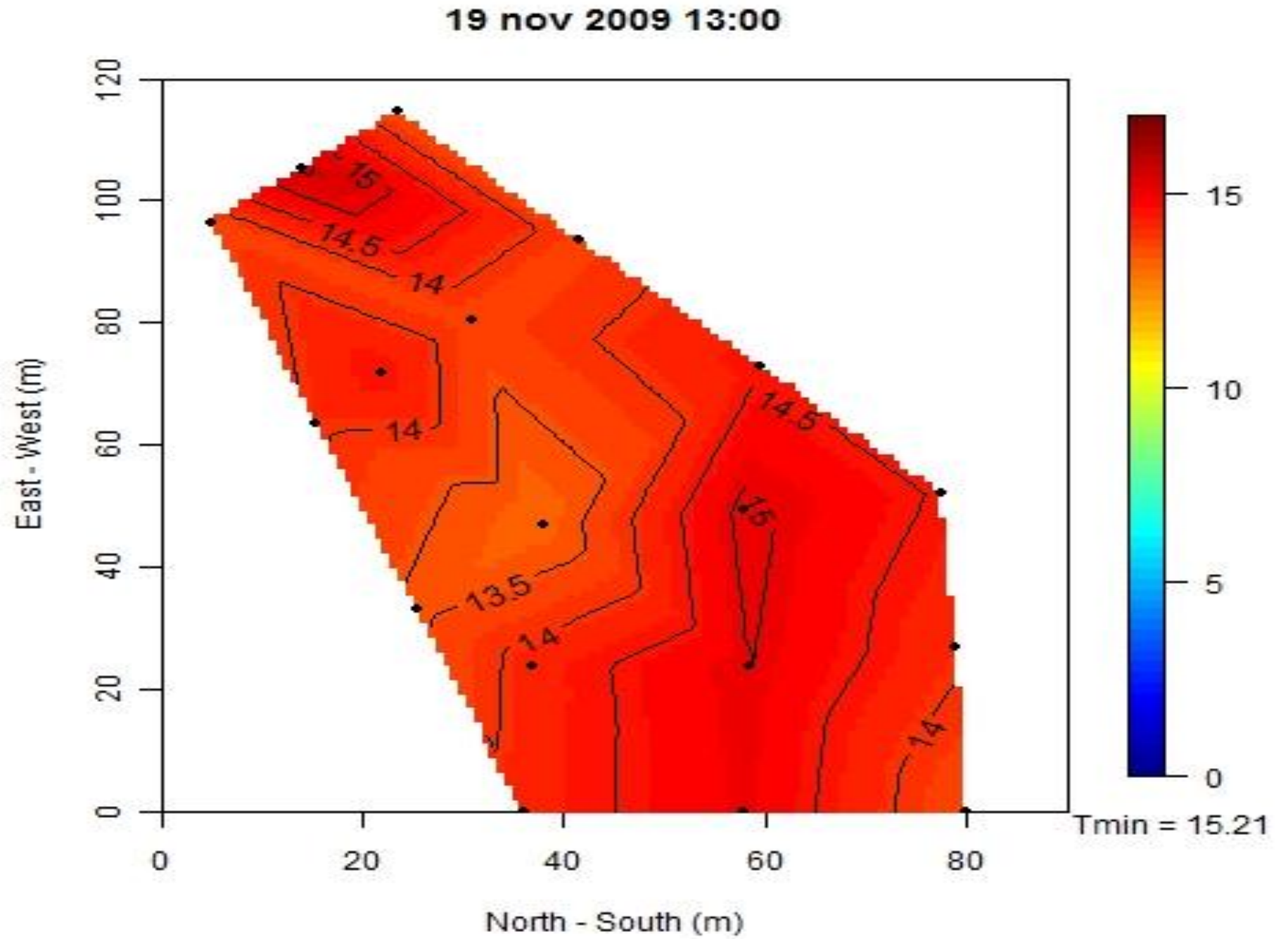
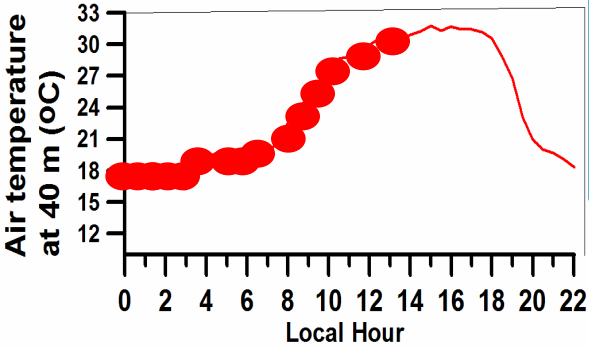


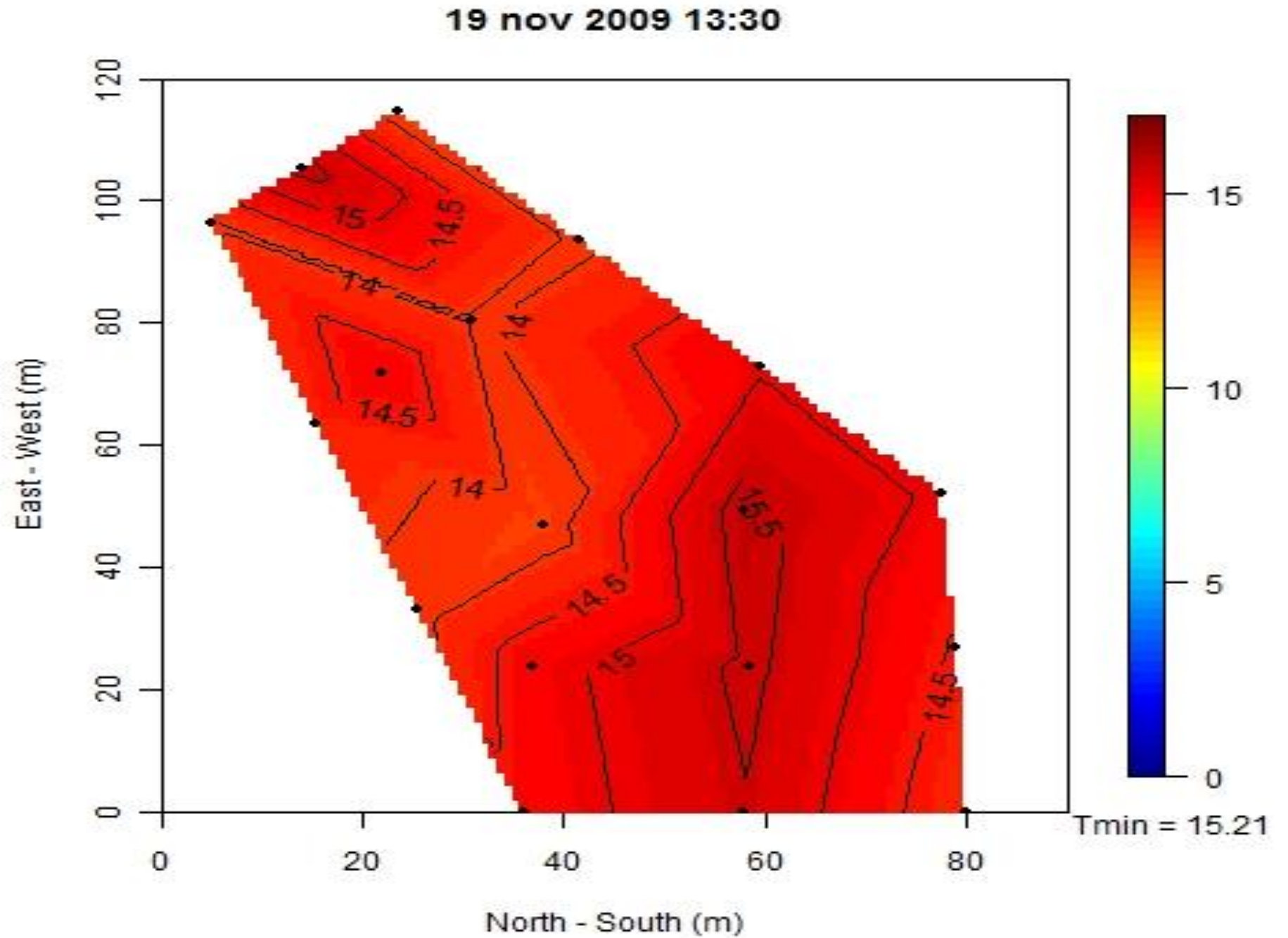
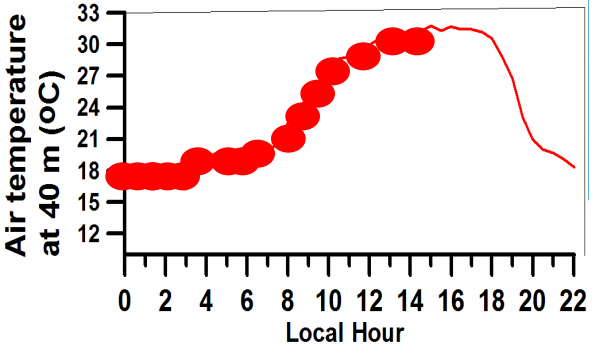


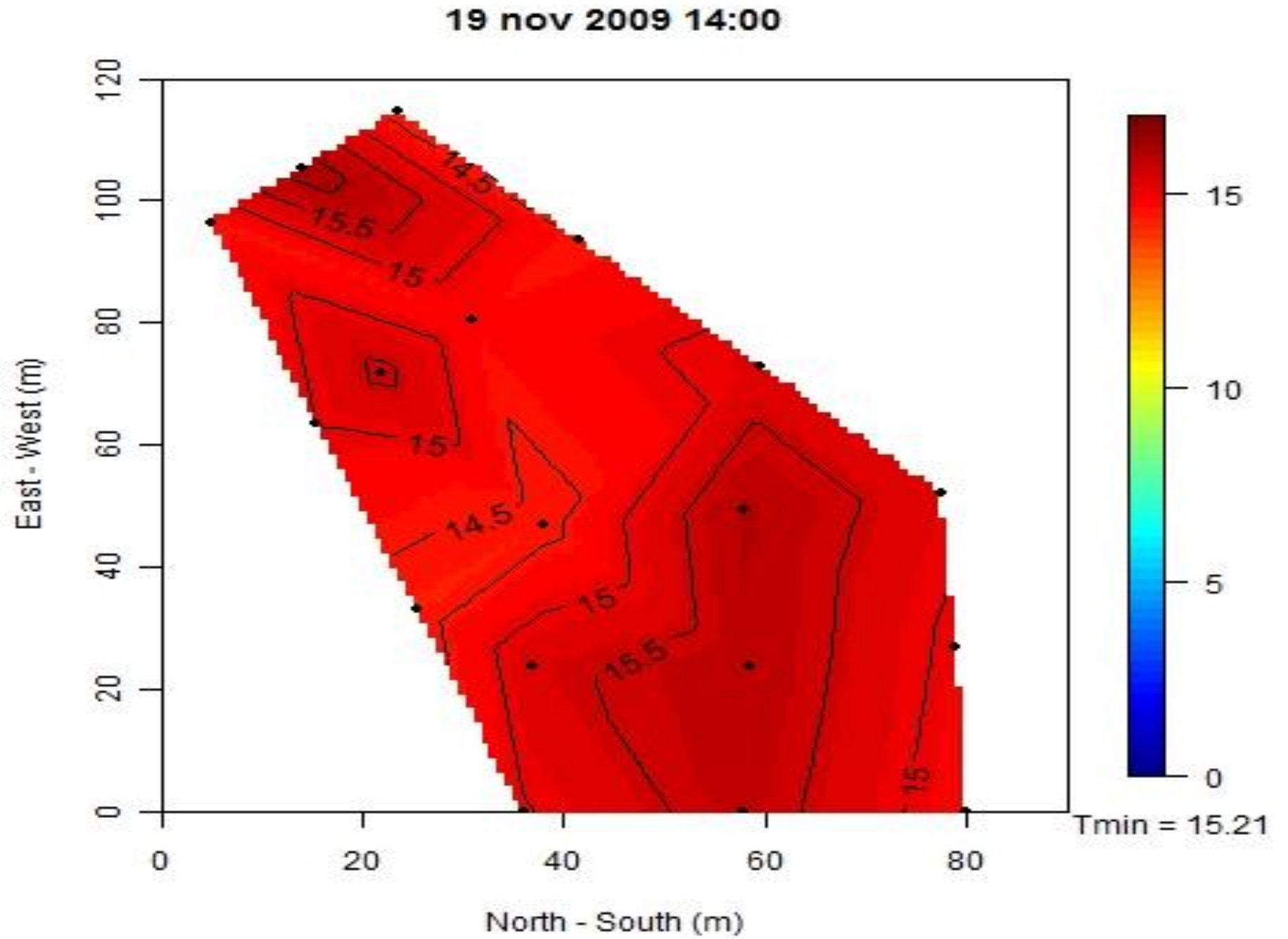
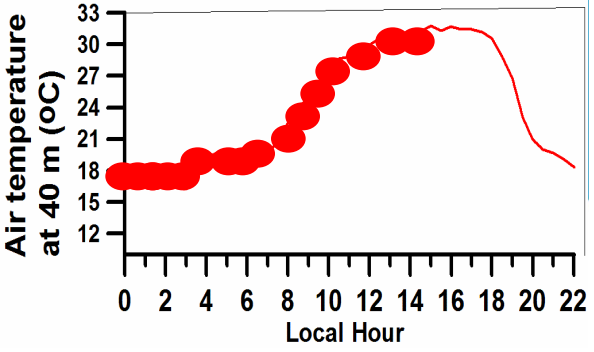


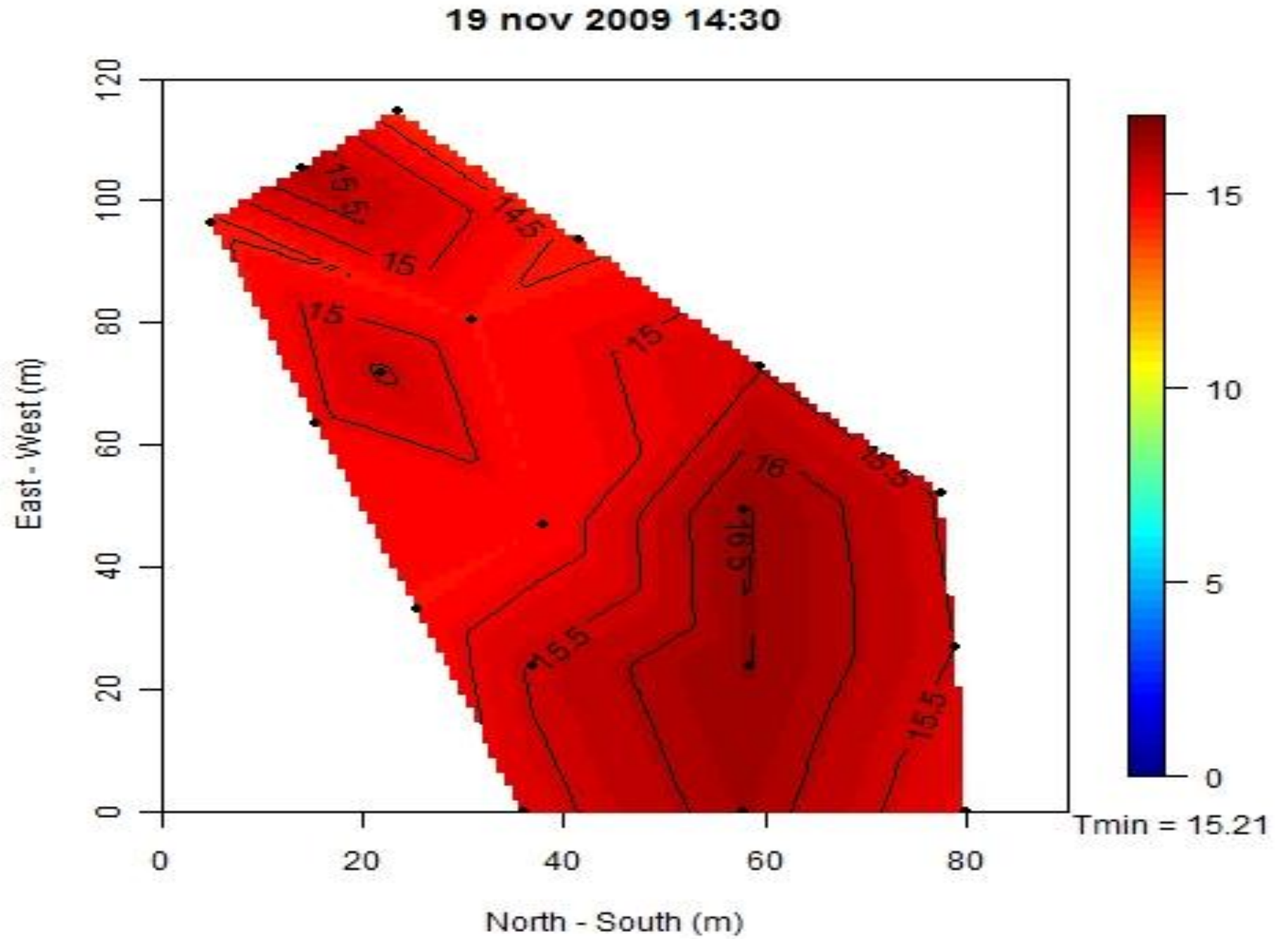
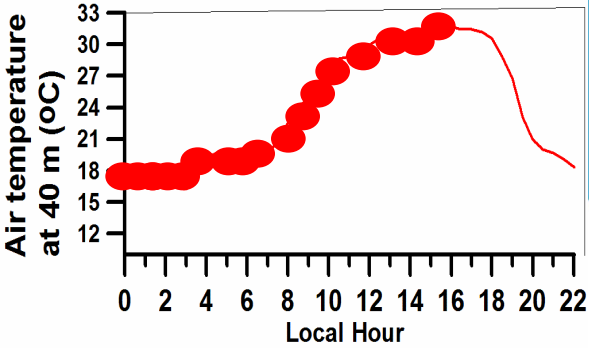


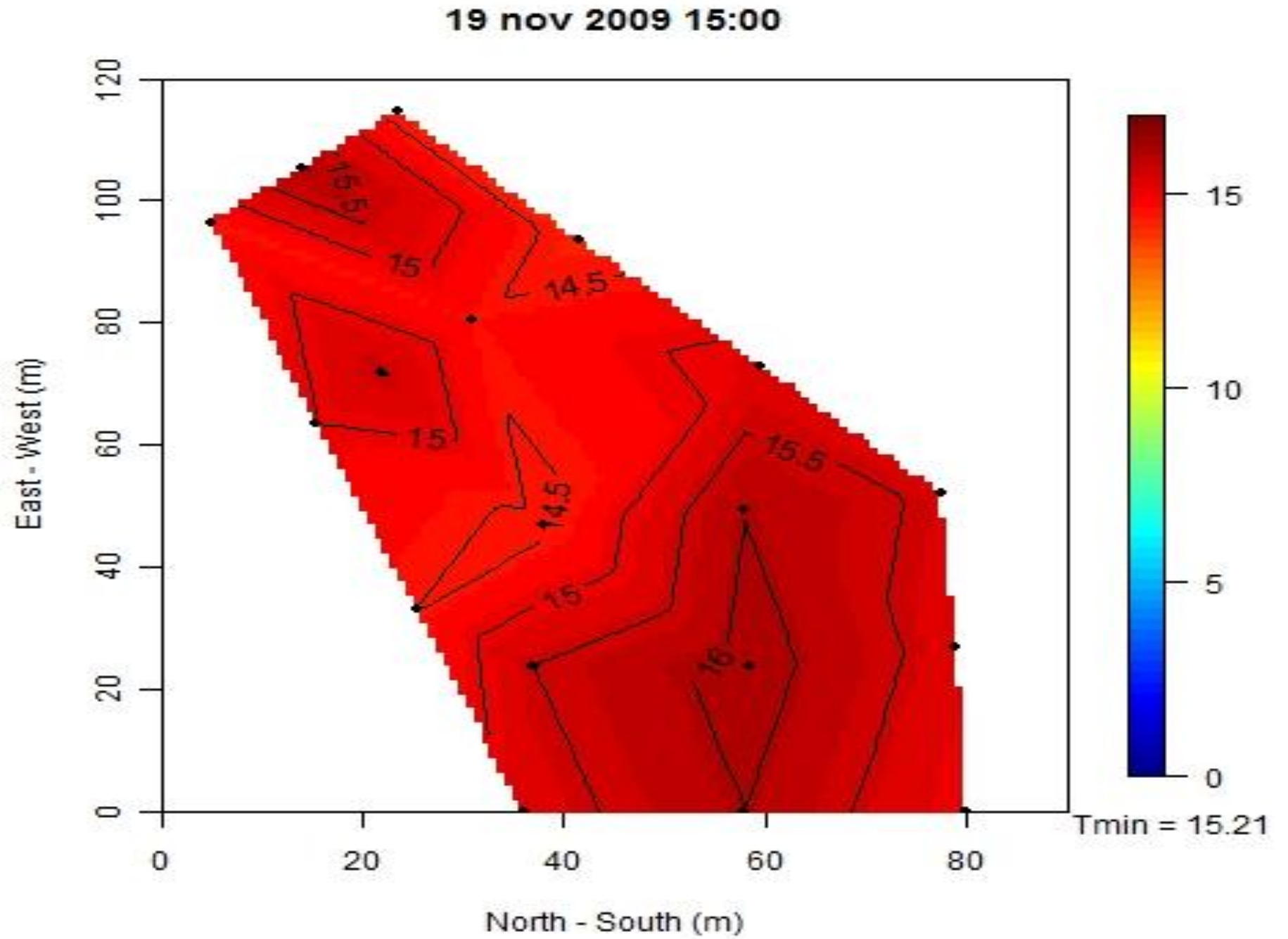
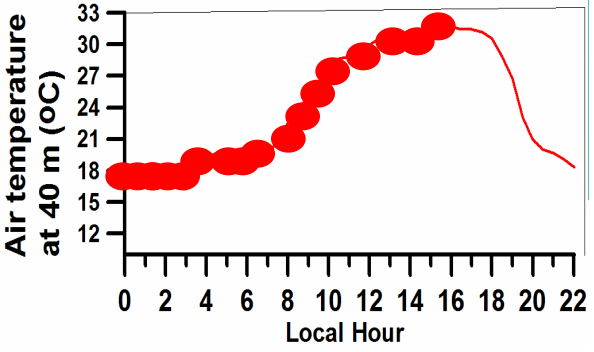


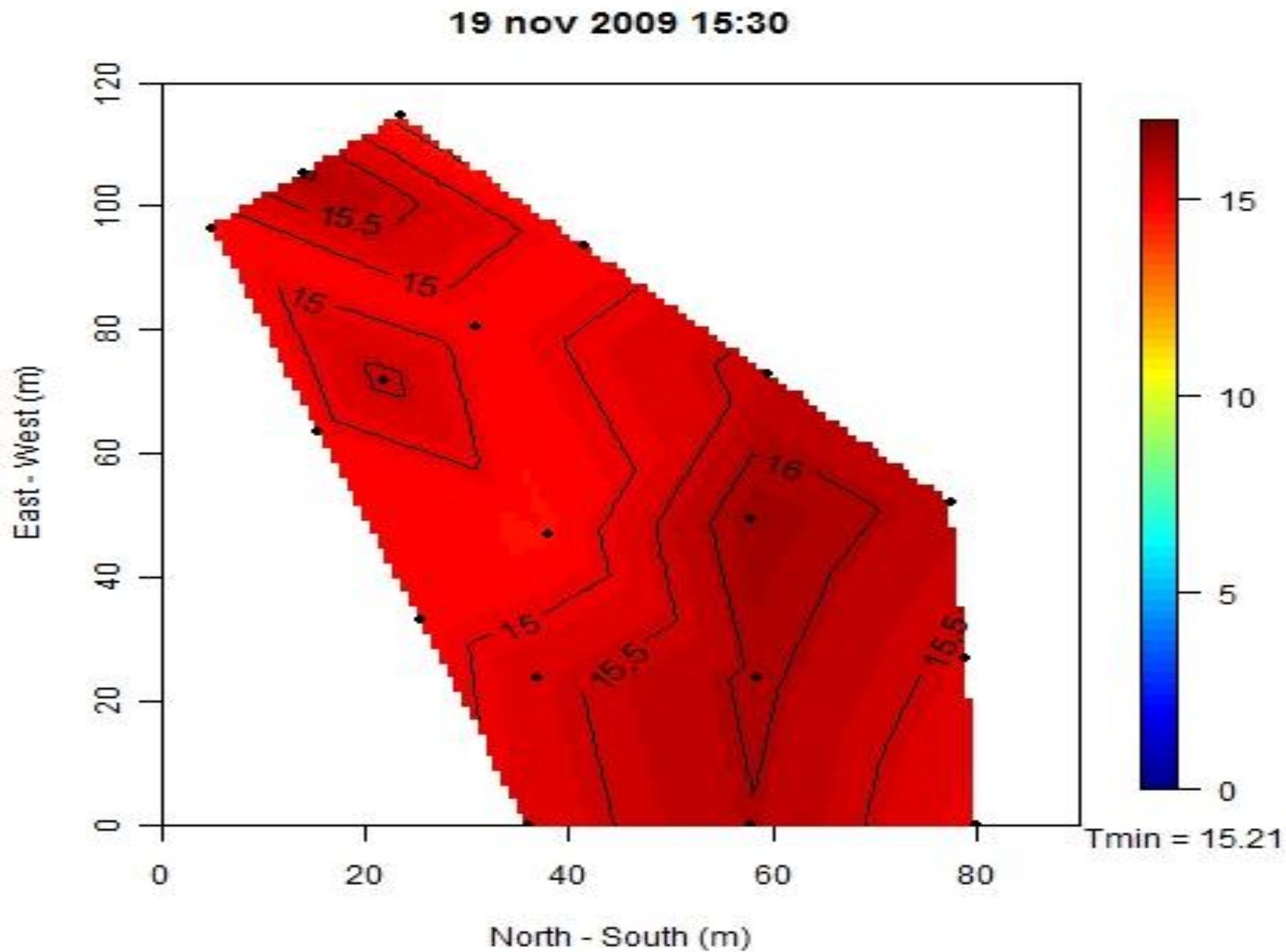
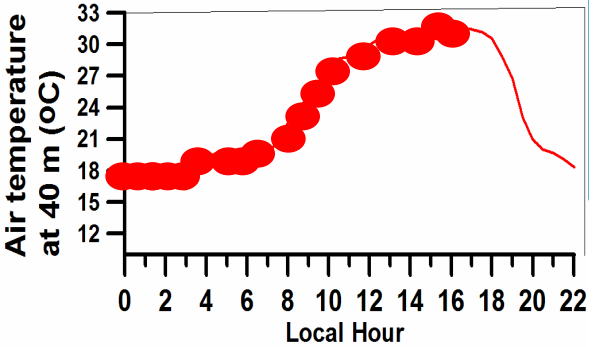


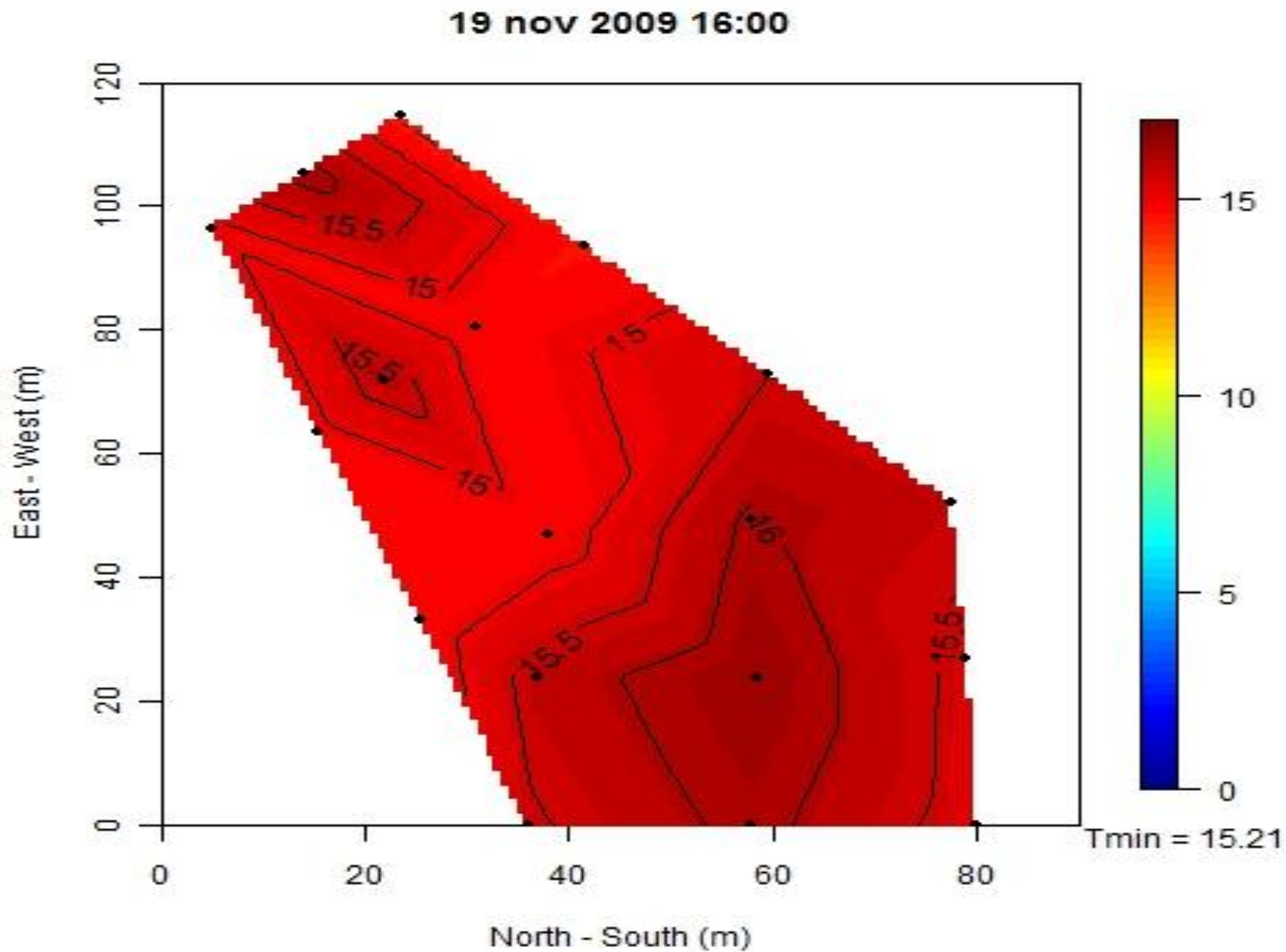
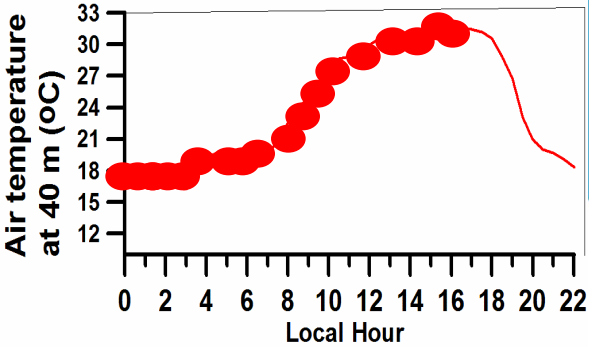


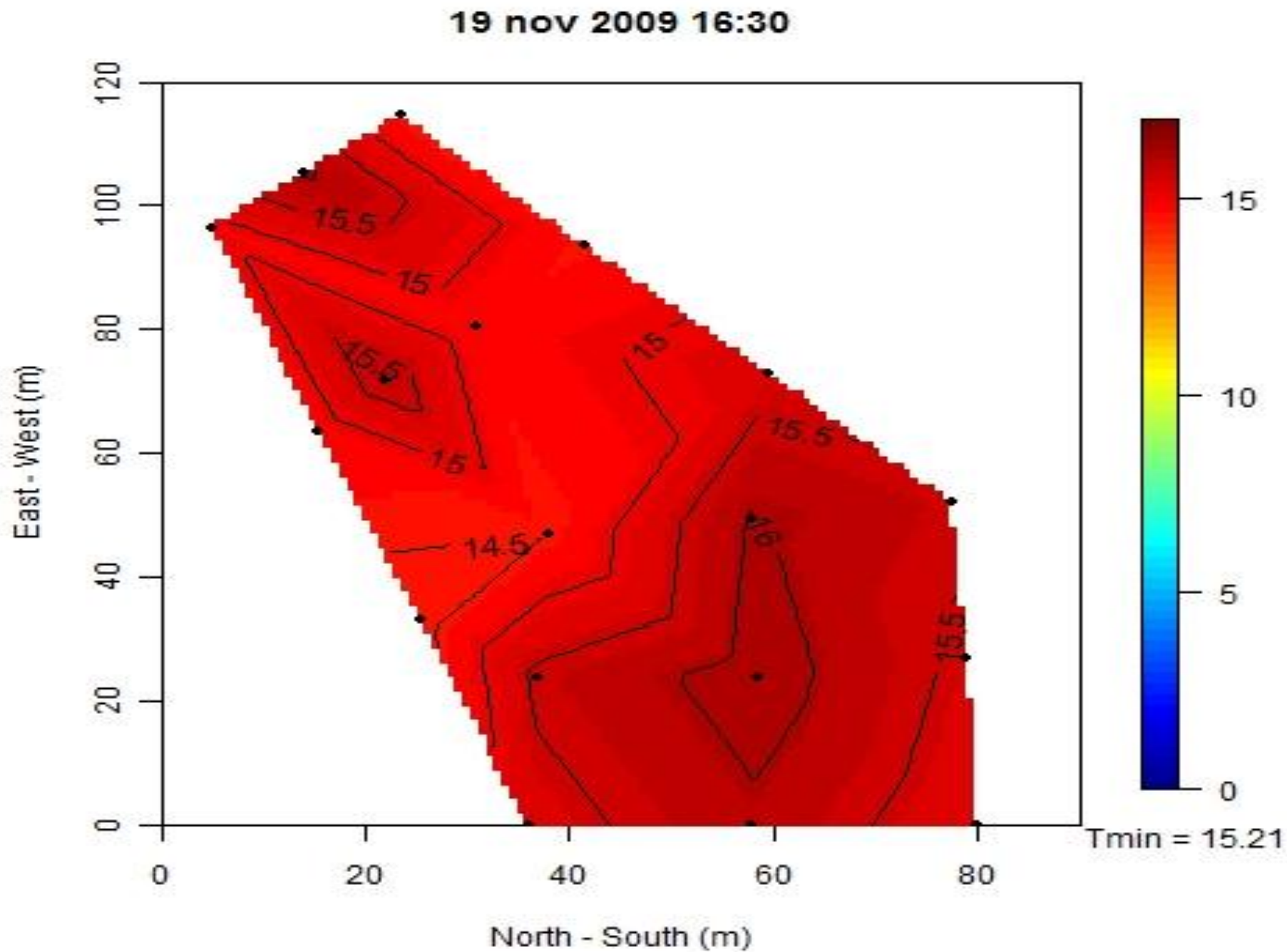
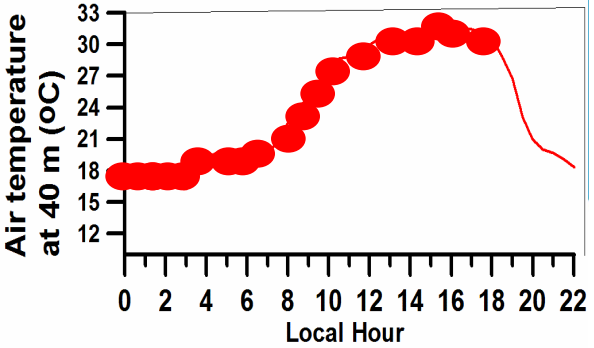


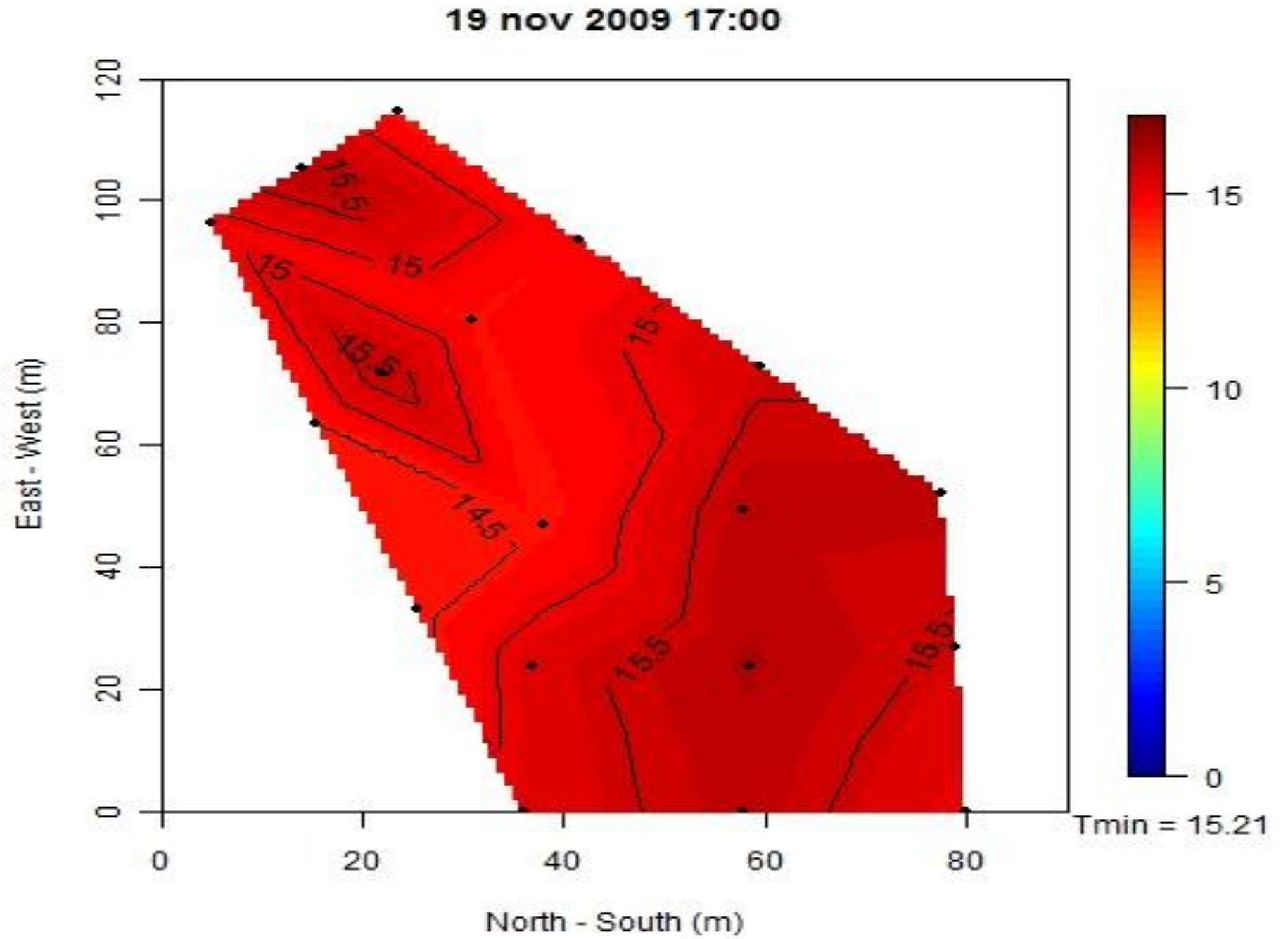
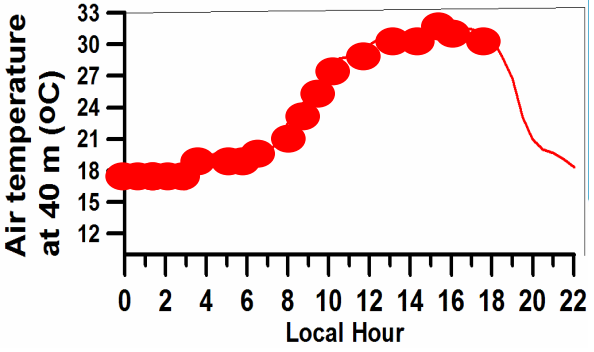


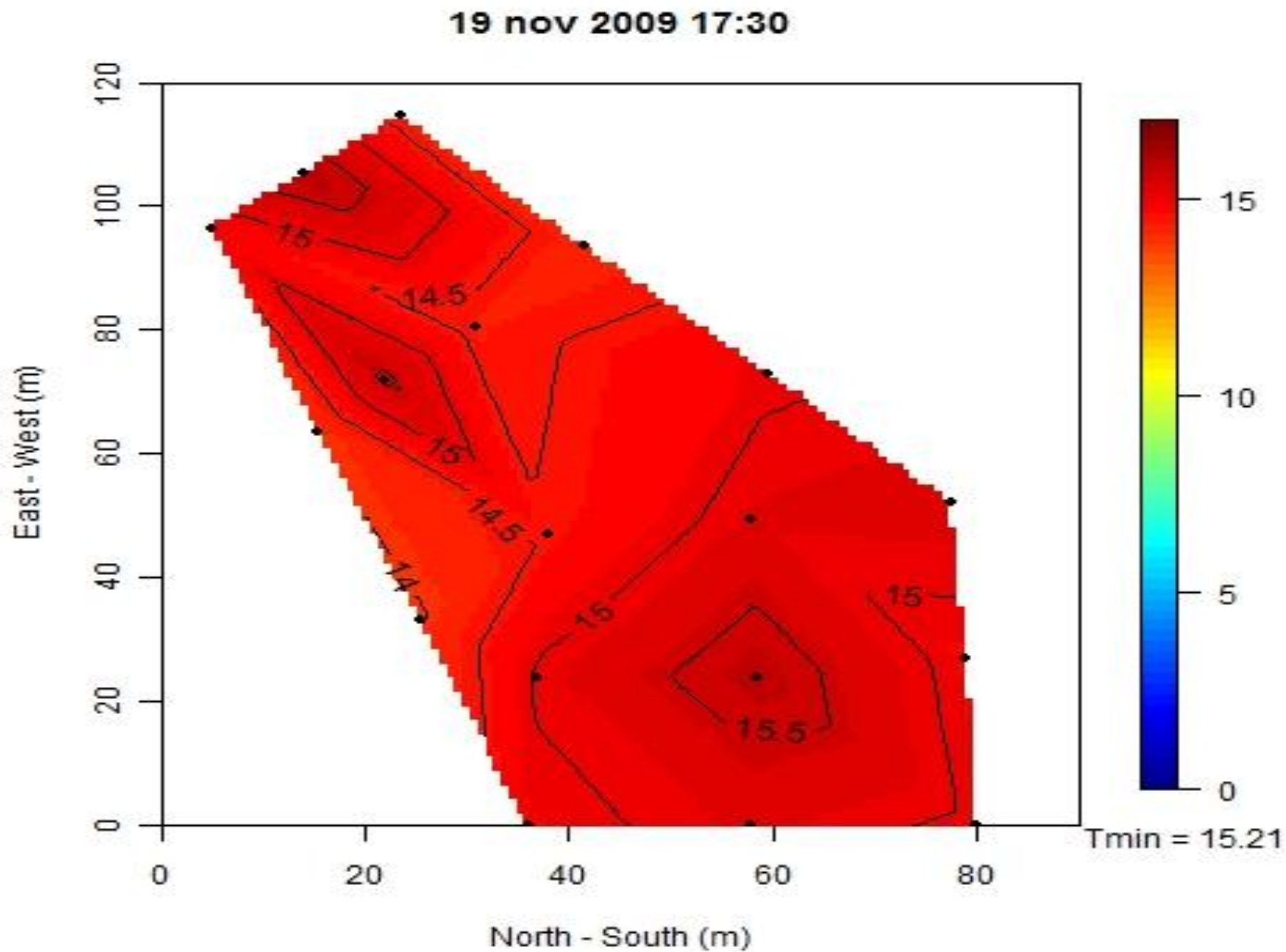
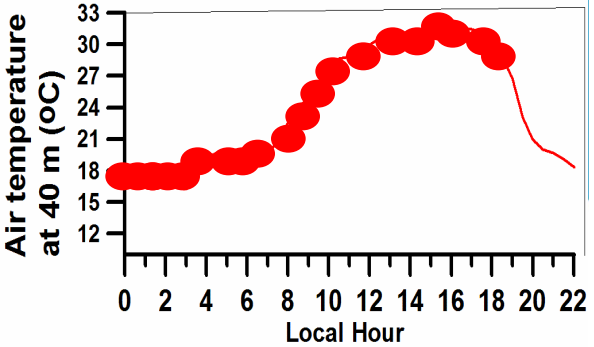


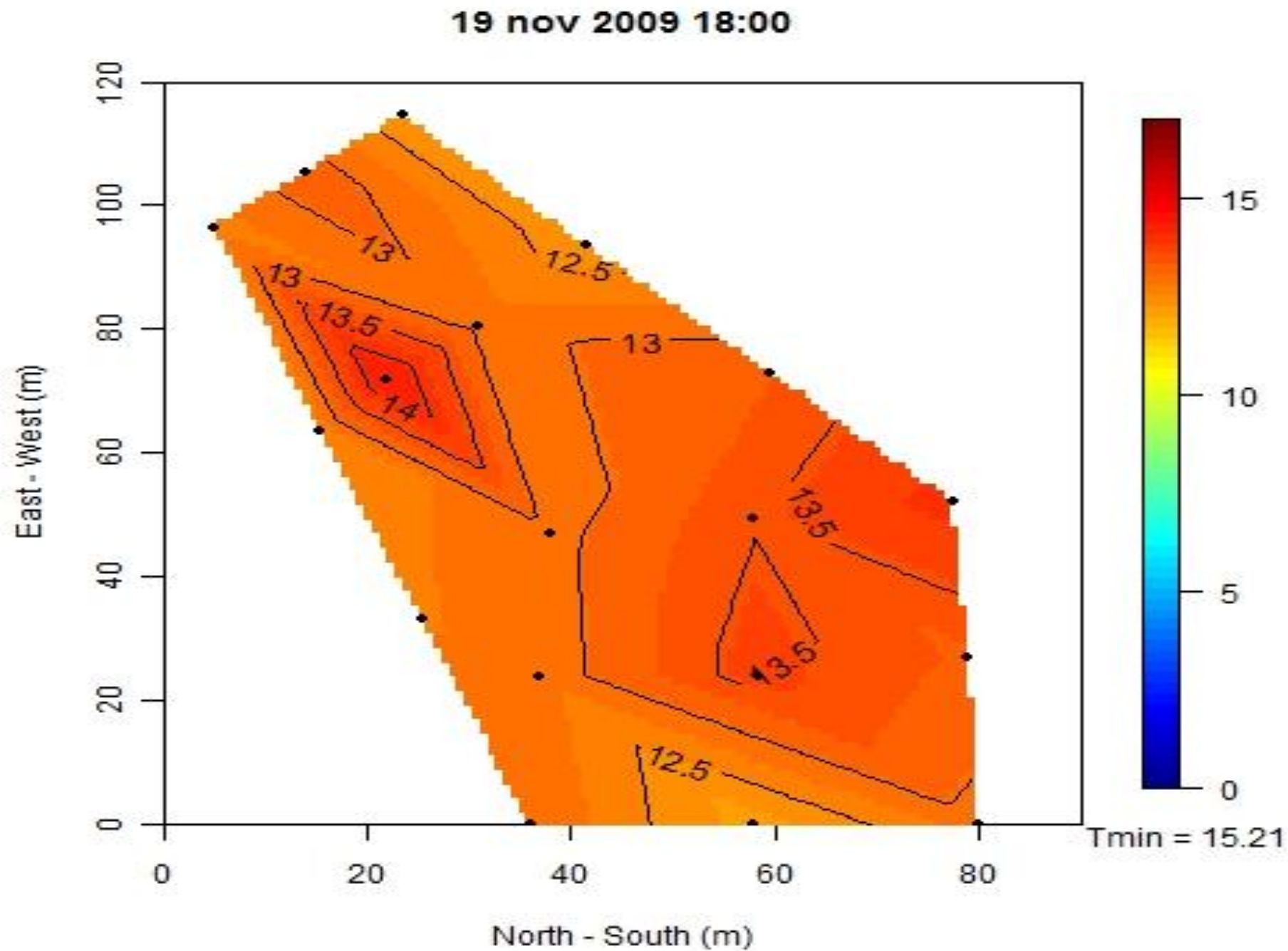
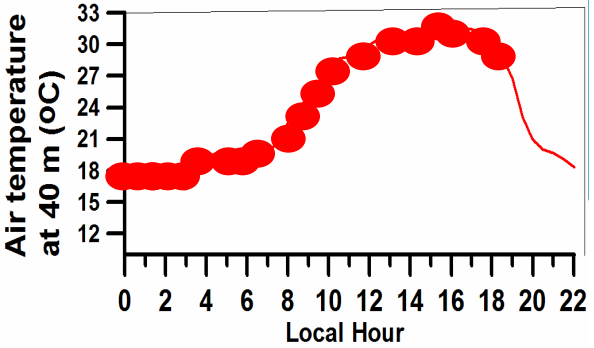


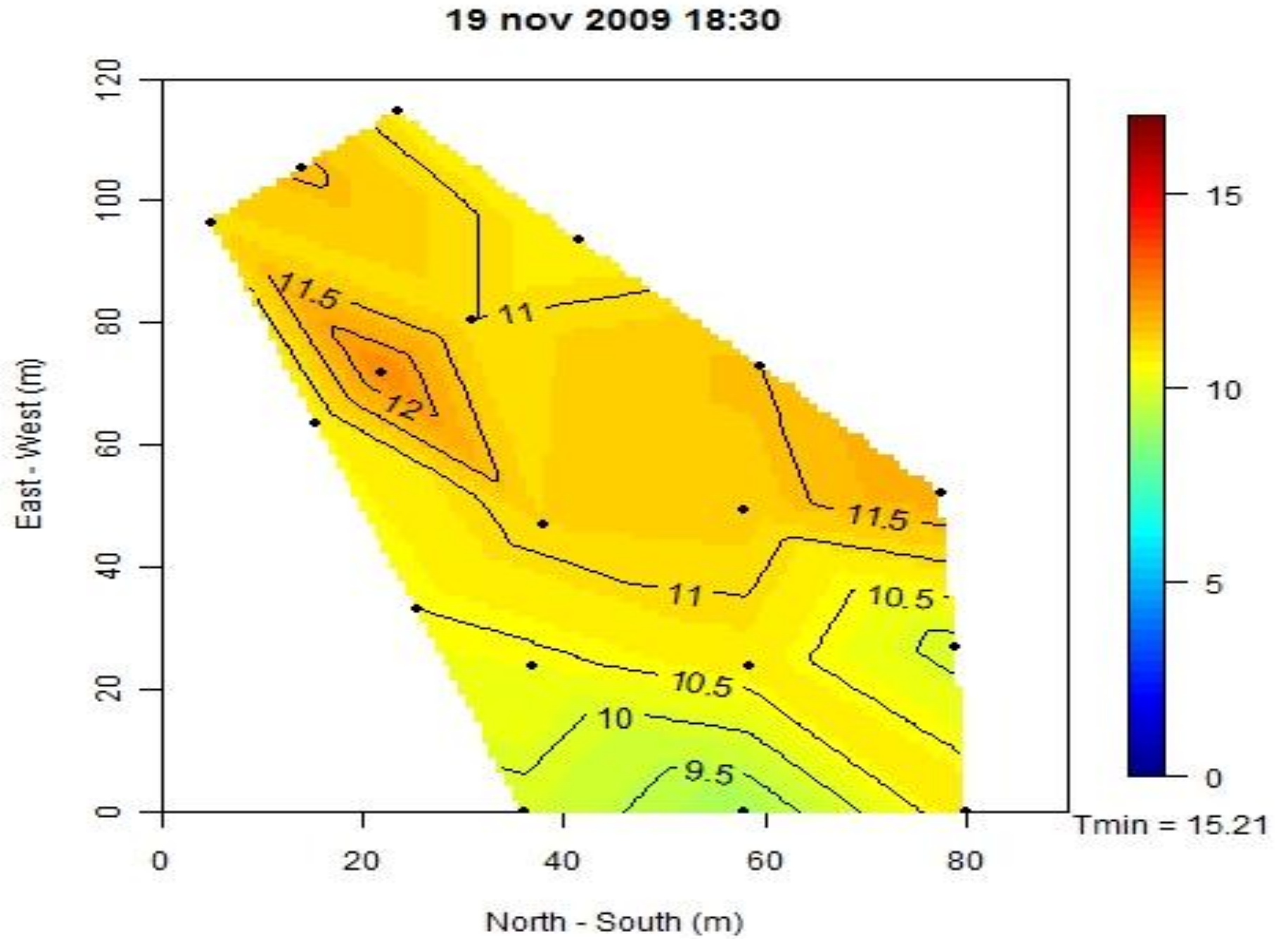
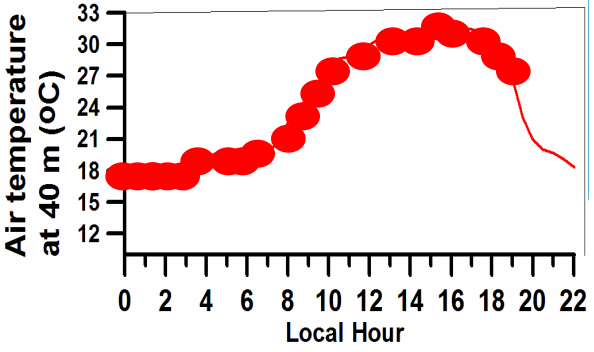


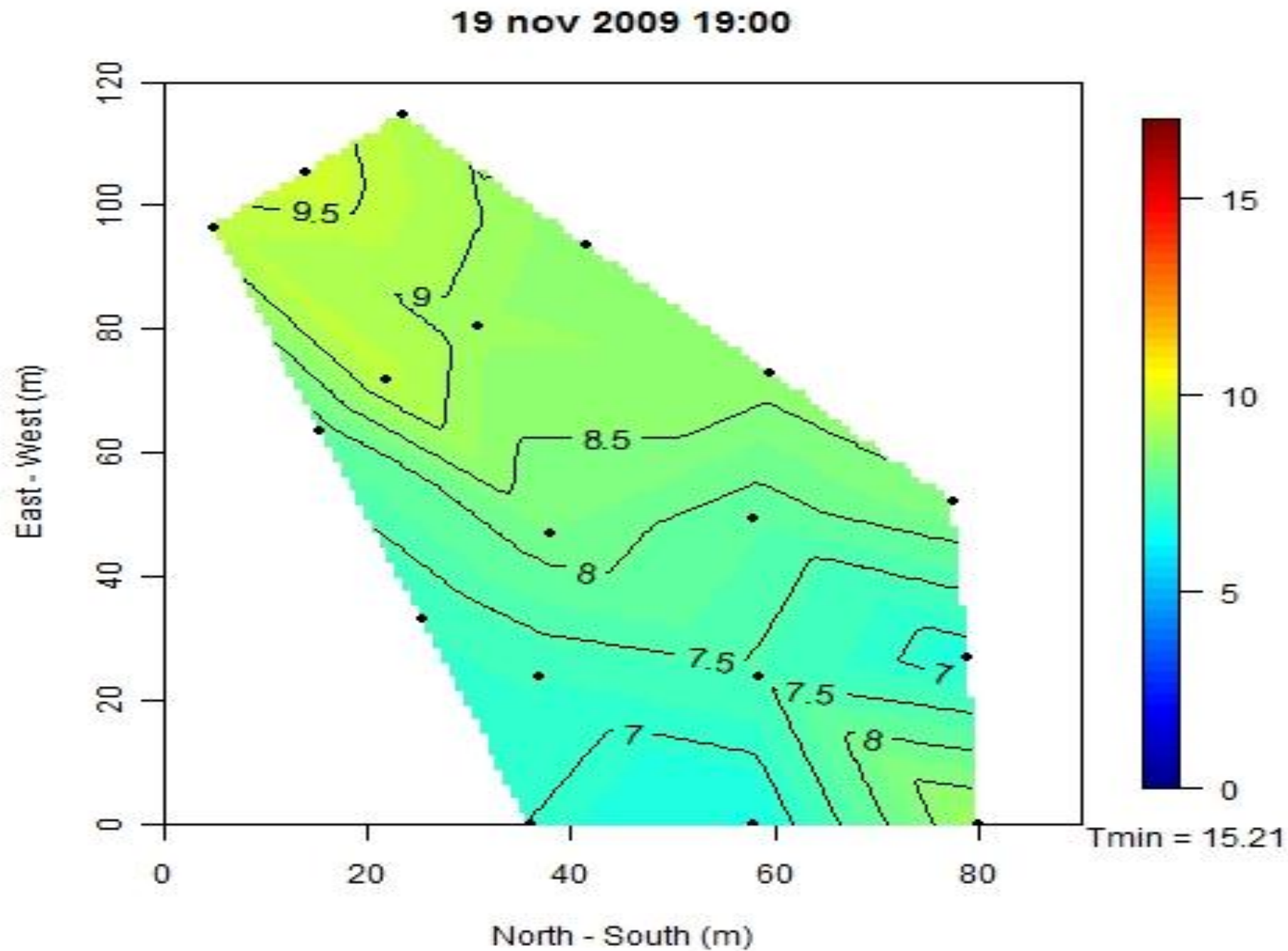
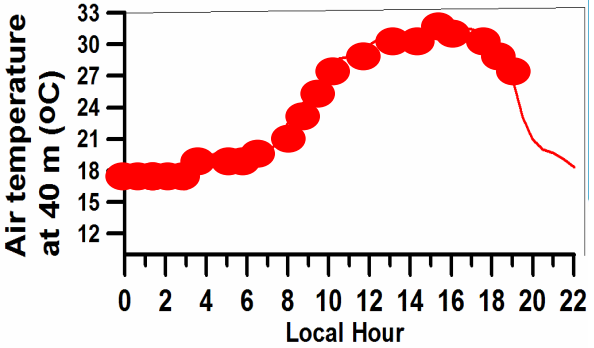


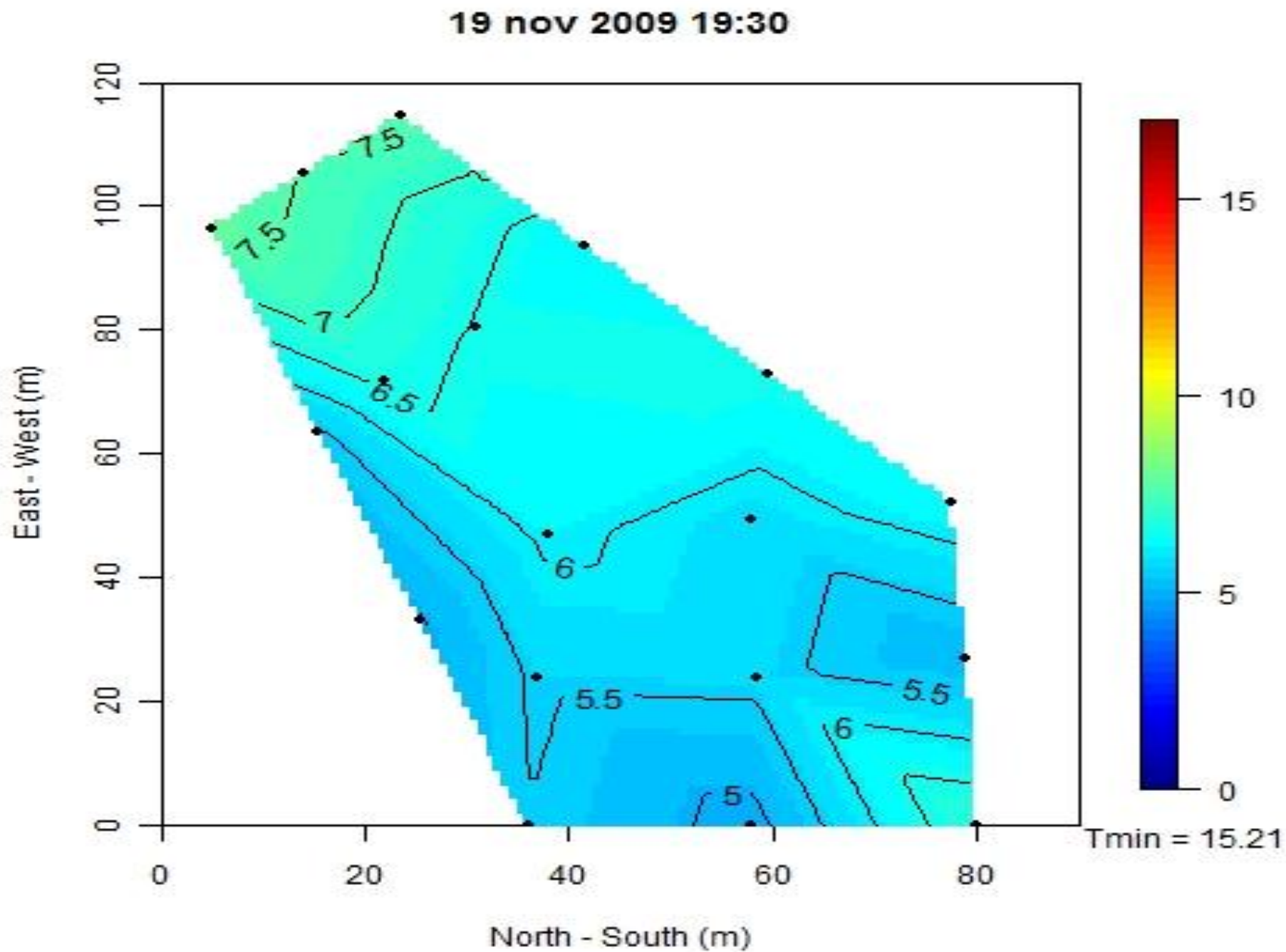
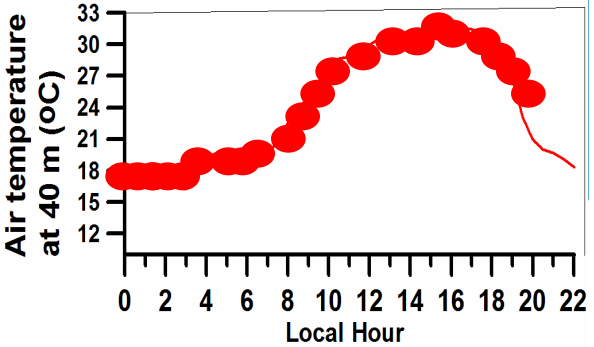


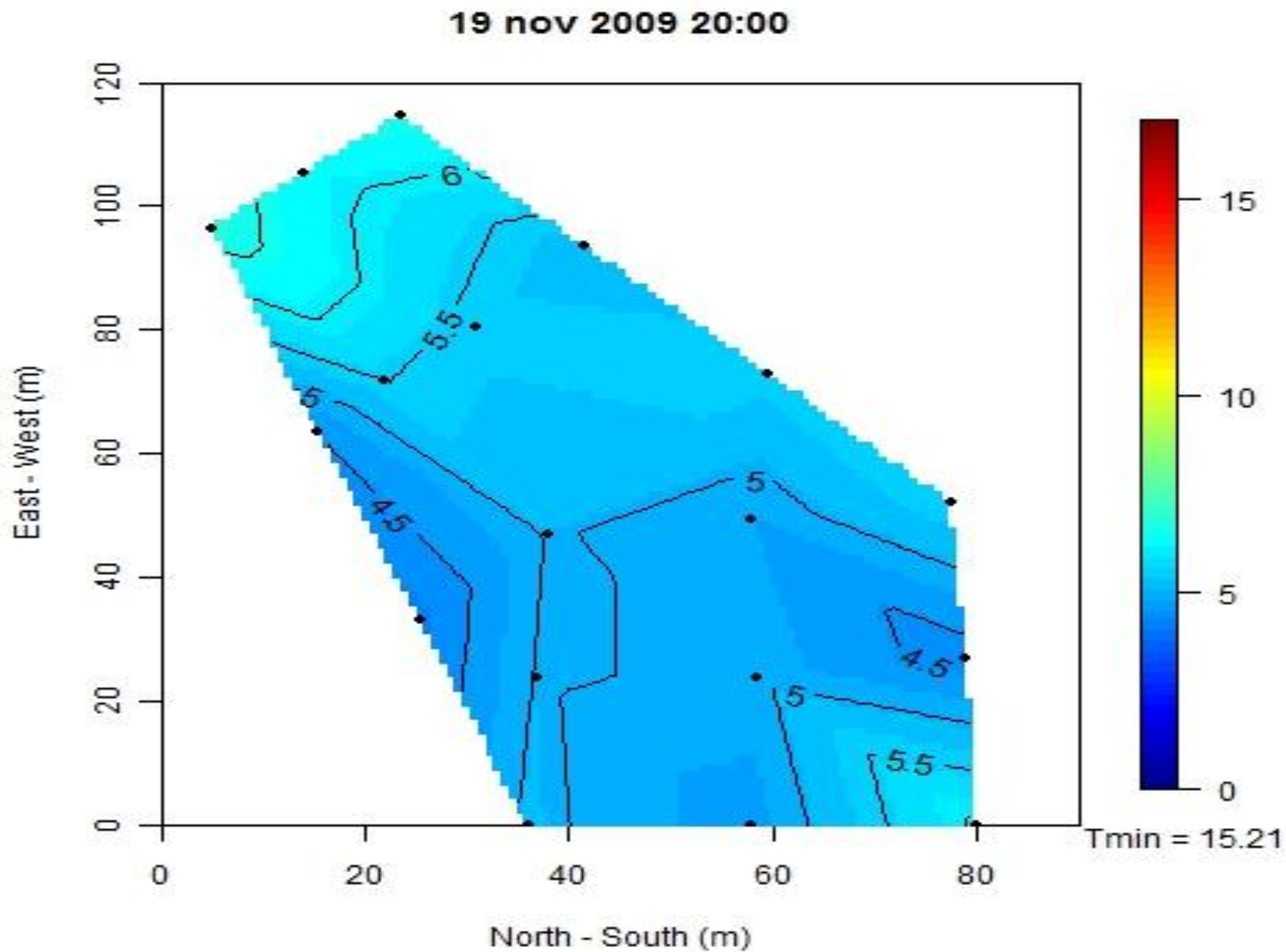
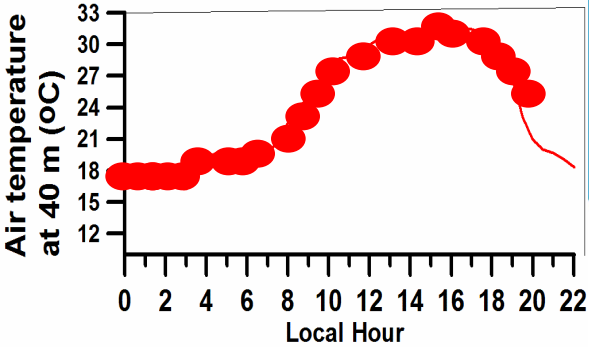


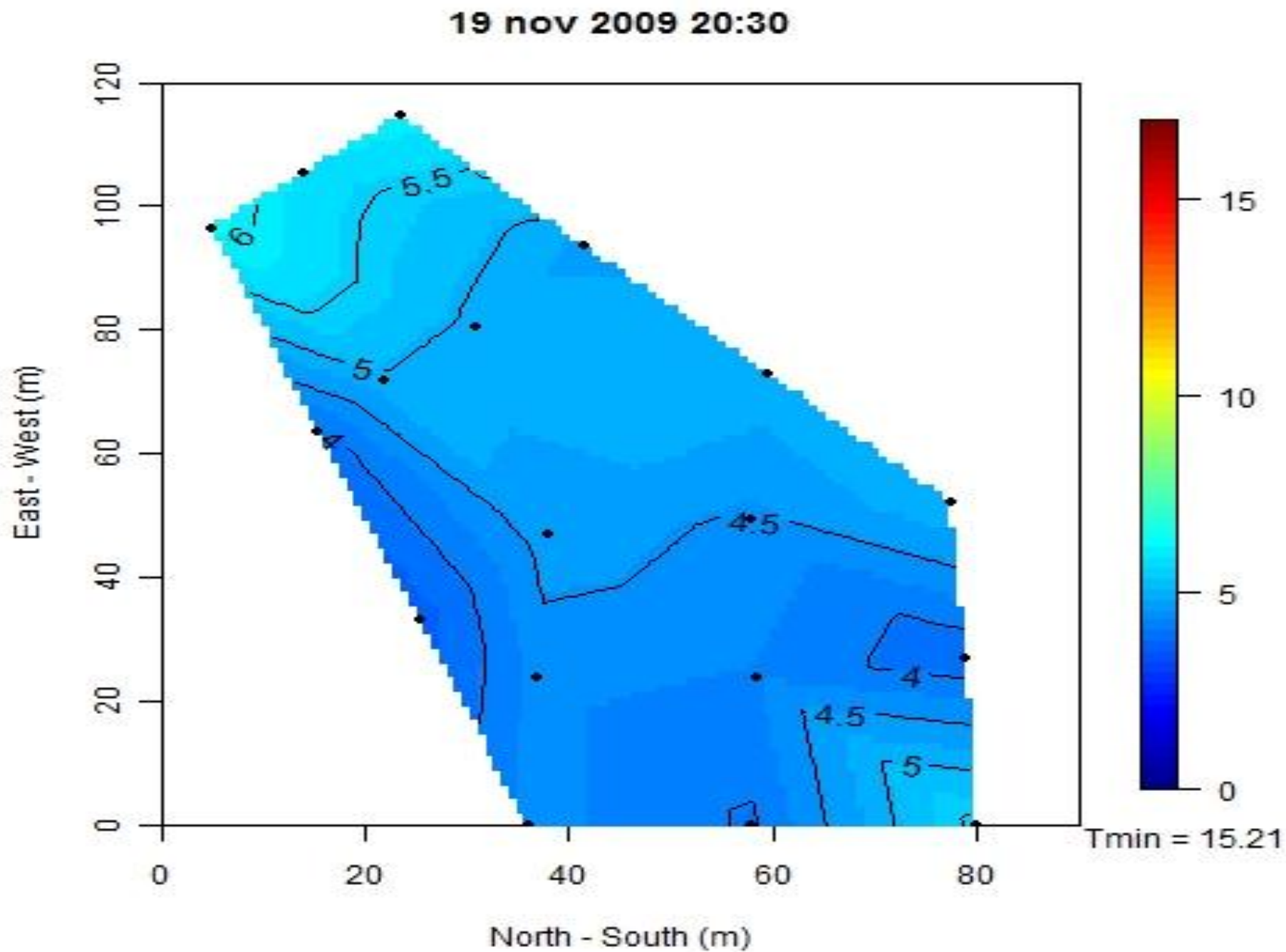
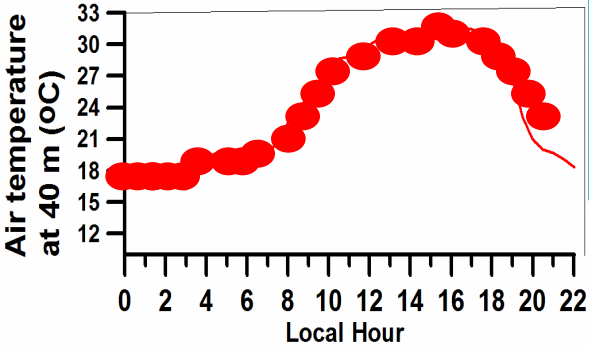


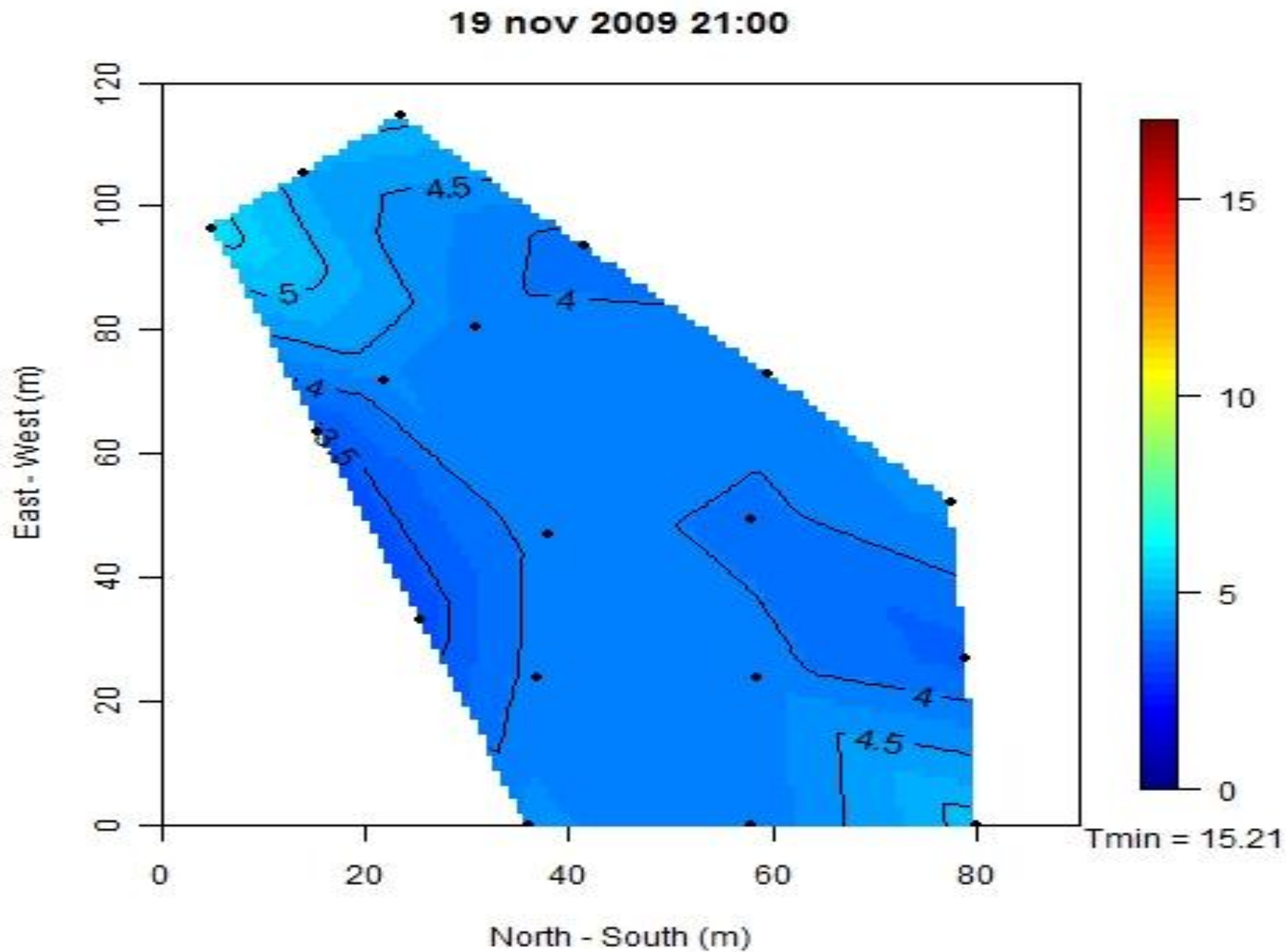
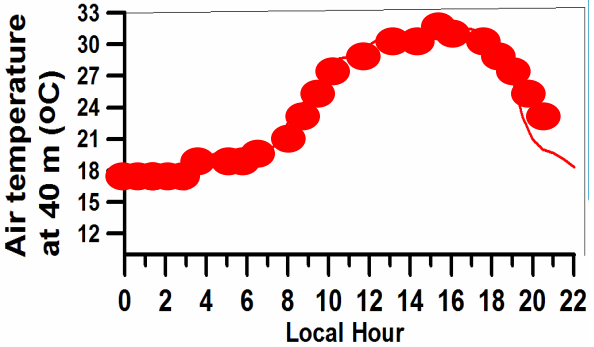


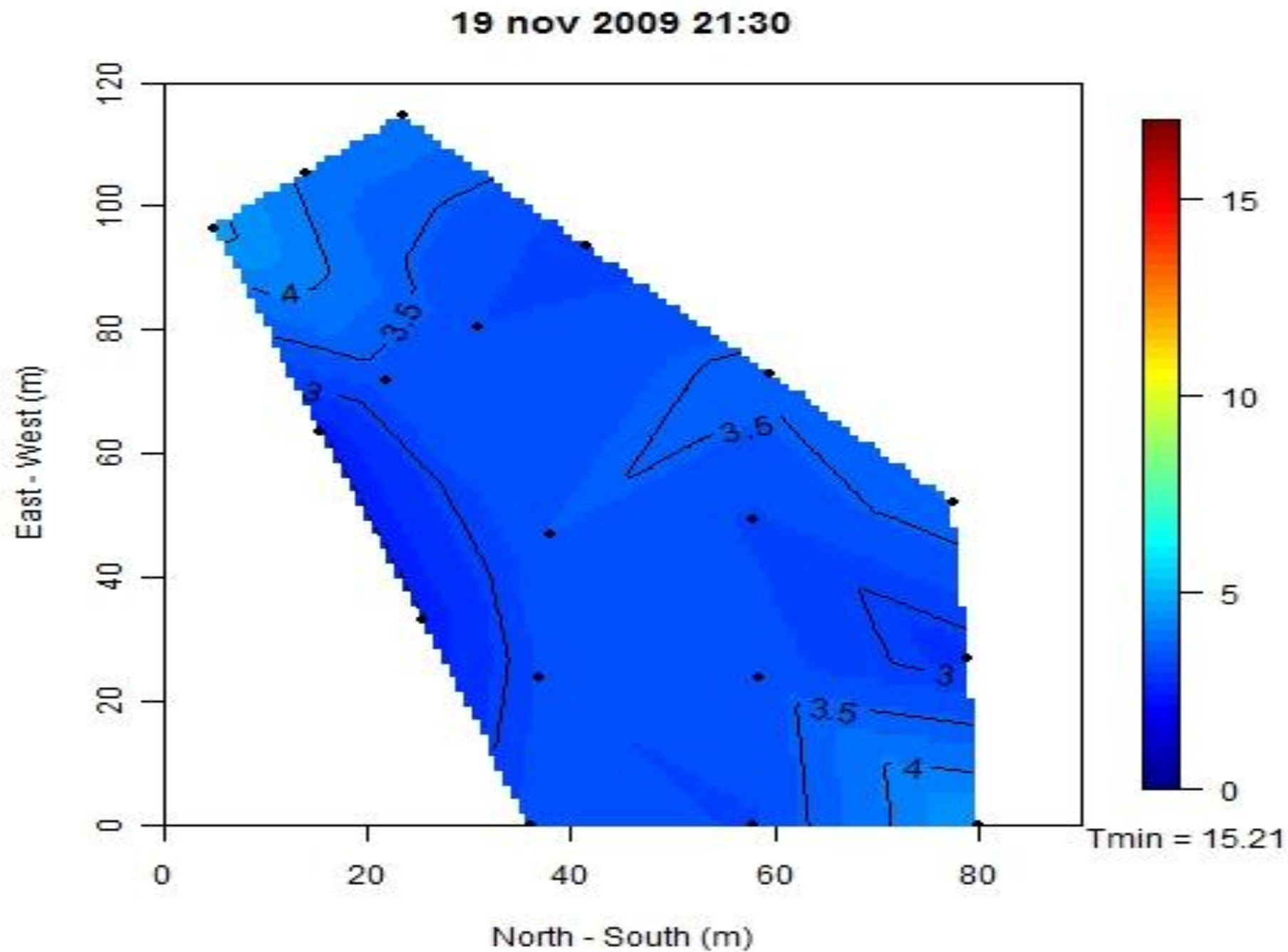
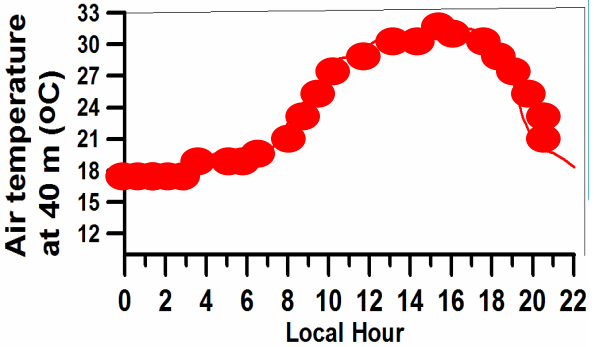


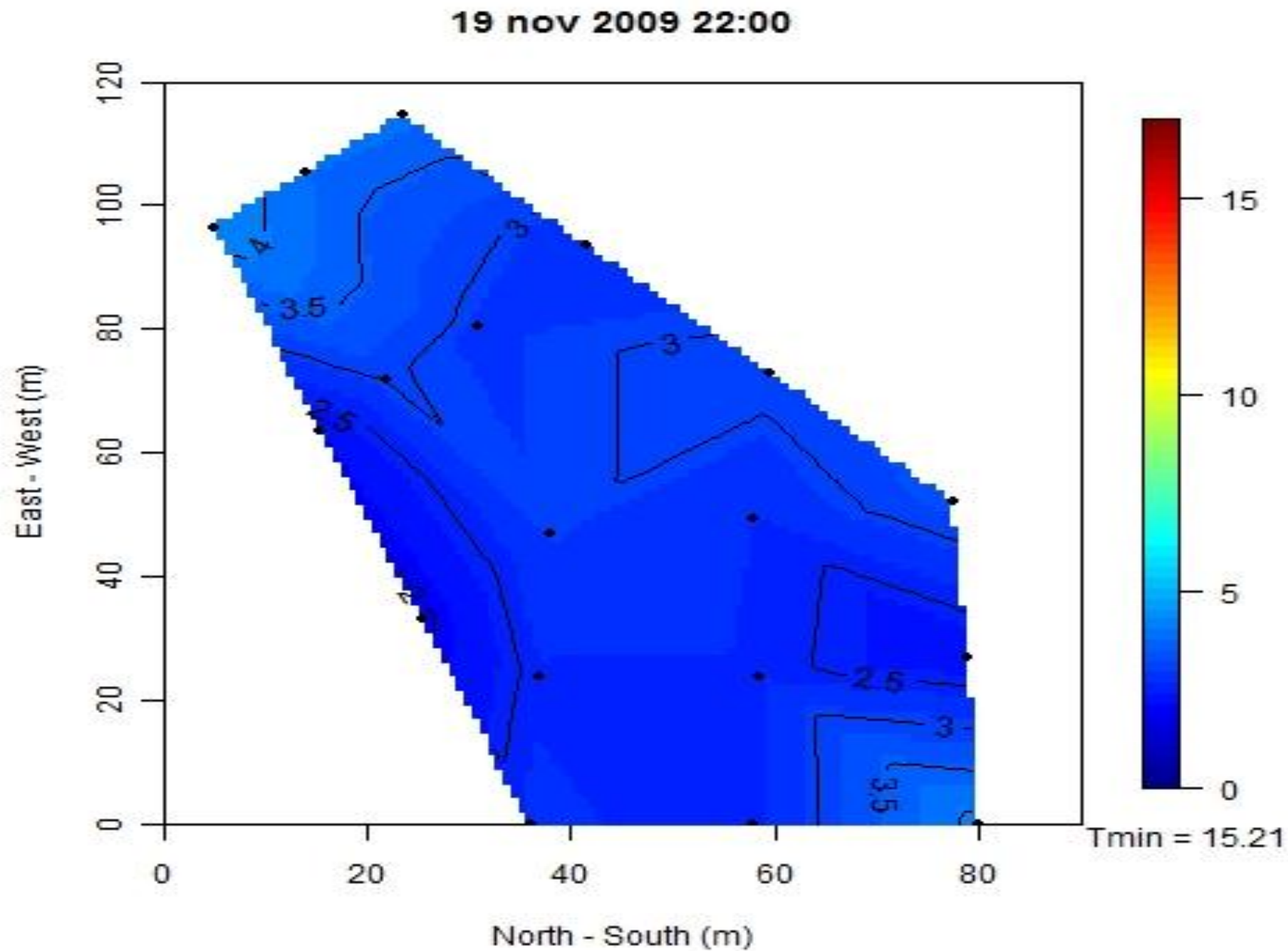
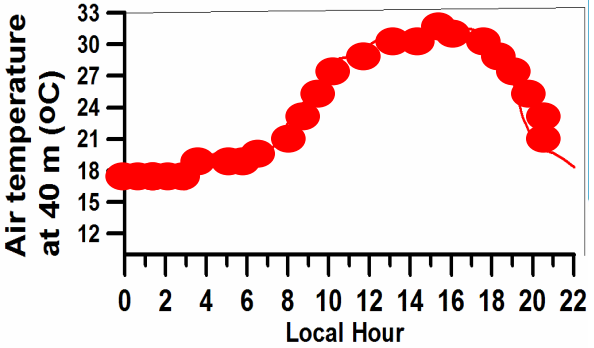


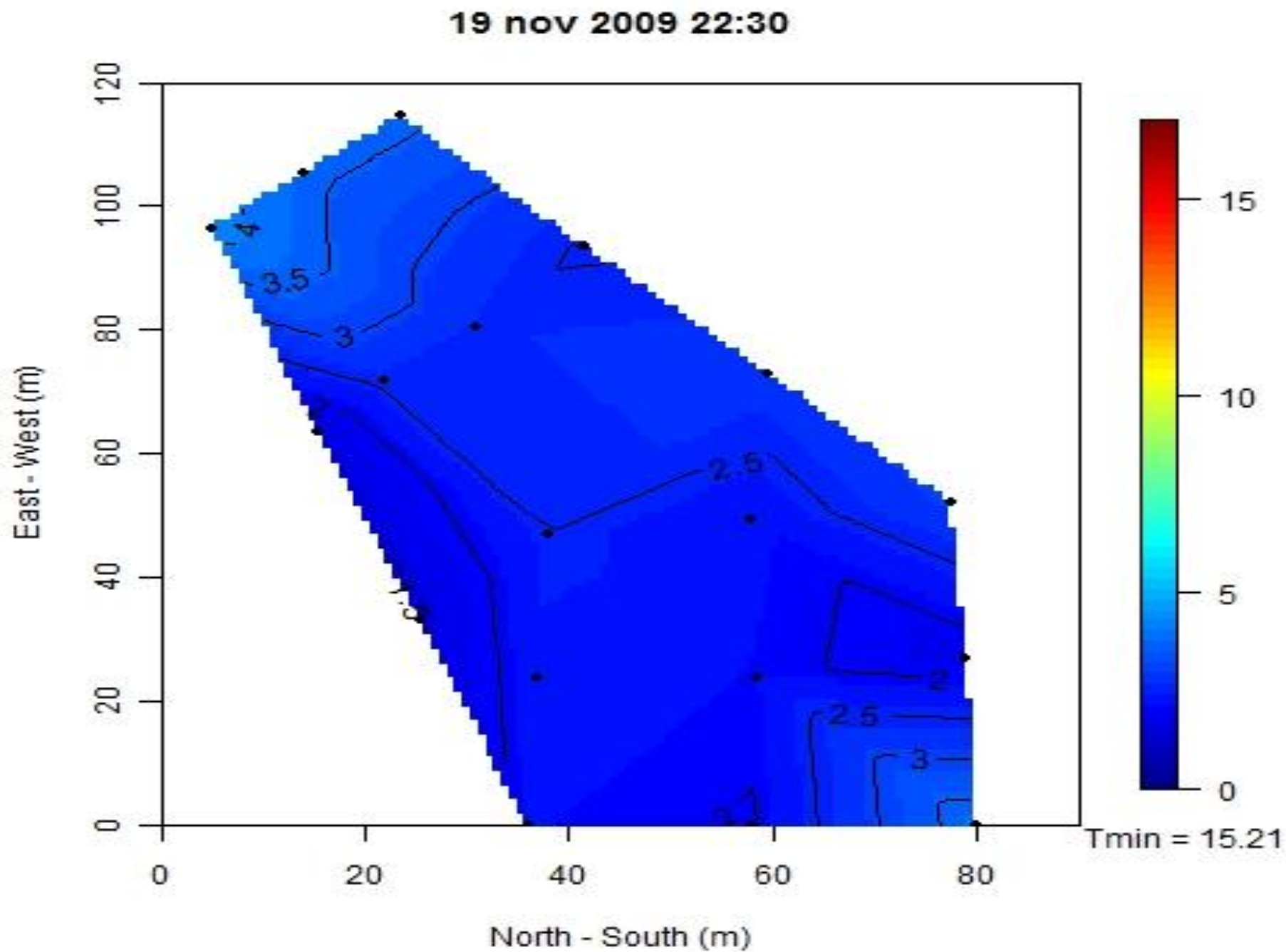
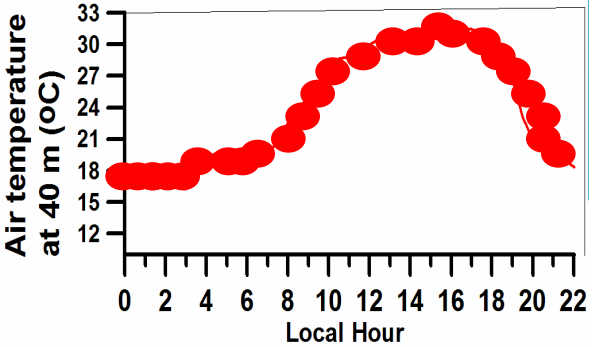


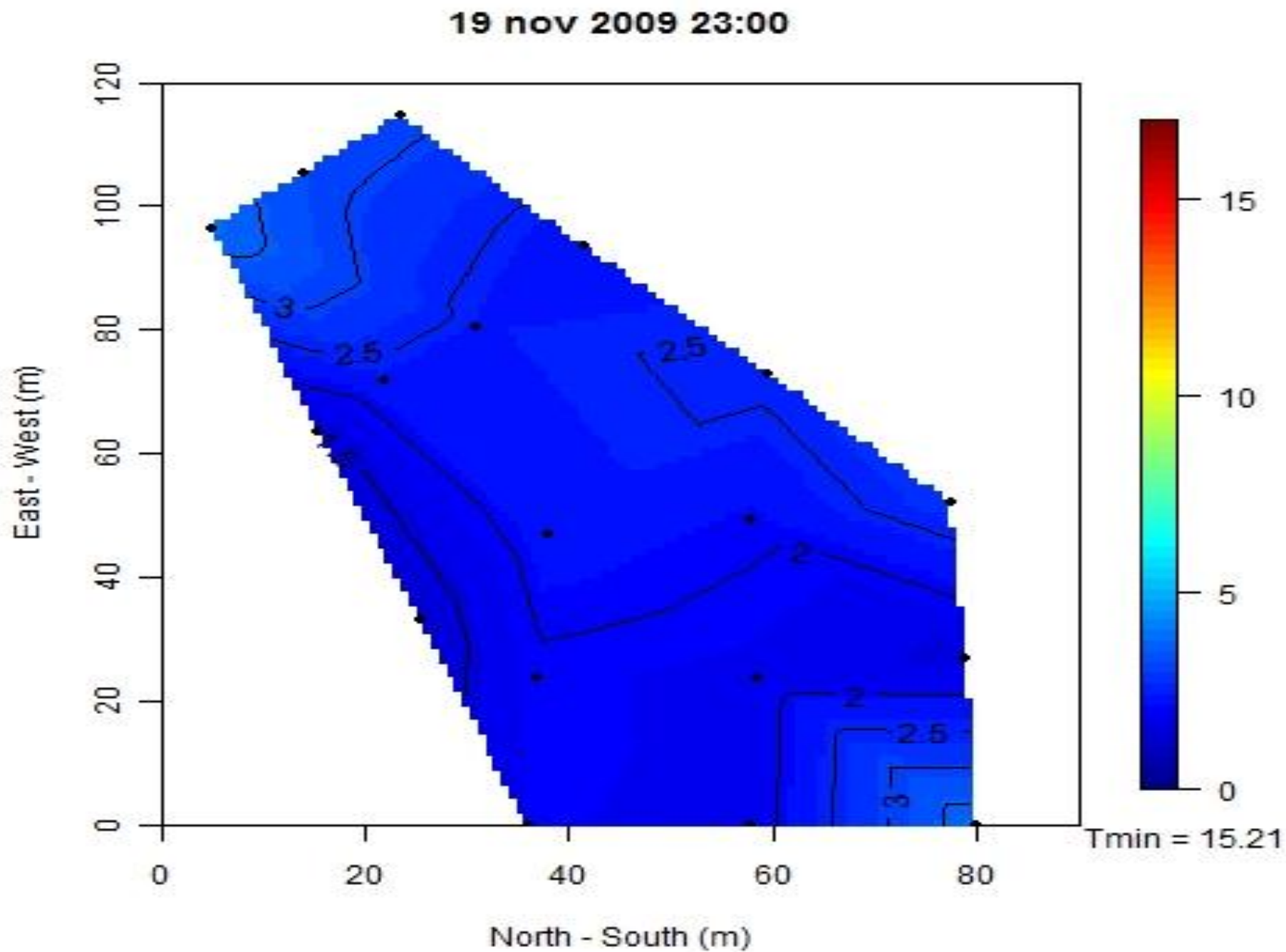
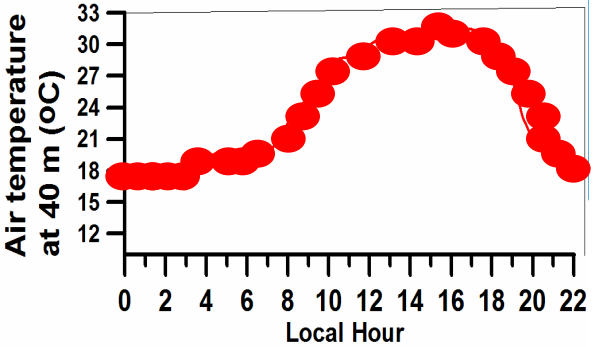












Microsoft® Research

Faculty Summit 2010

Guarujá, Brasil | May 12 – 14 | In collaboration with FAPESP

- 1. Experimental site in the Atlantic Forest**
- 2. Spatial and temporal patterns of measured temperature**
- 3. Prospects to investigate the Amazonian environment**



A consortium of



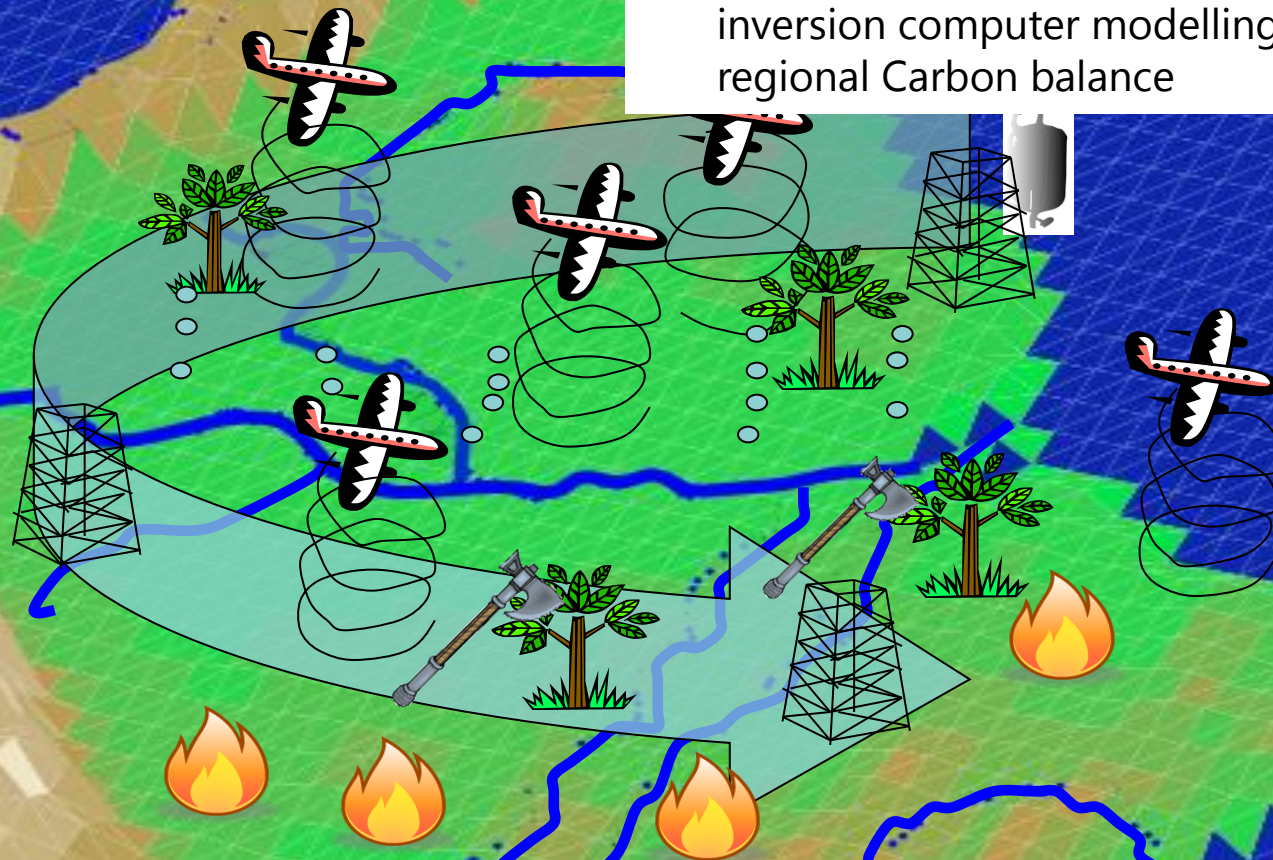
Large Scale Biosphere-
Atmosphere Experiment
in Amazonia



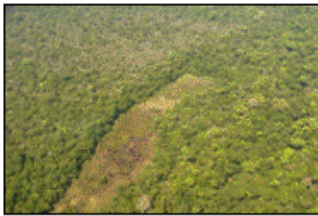
Programa FAPESP de
Pesquisa sobre
Mudanças Climáticas
Globais (PFPMCG)

Thematic Project FAPESP Carbon Tracker and
Water availability: controls of land use and
climate changes (2009-2014). Coordination
USP

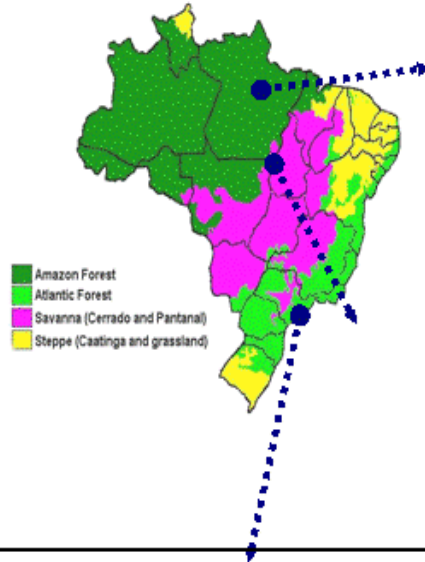
- Will survey Amazon basin with aircraft,
satellite, flux tower and use numerical
inversion computer modelling to estimate
regional Carbon balance



Laboratório de Clima e Biosfera – sítios experimentais em florestas tropicais

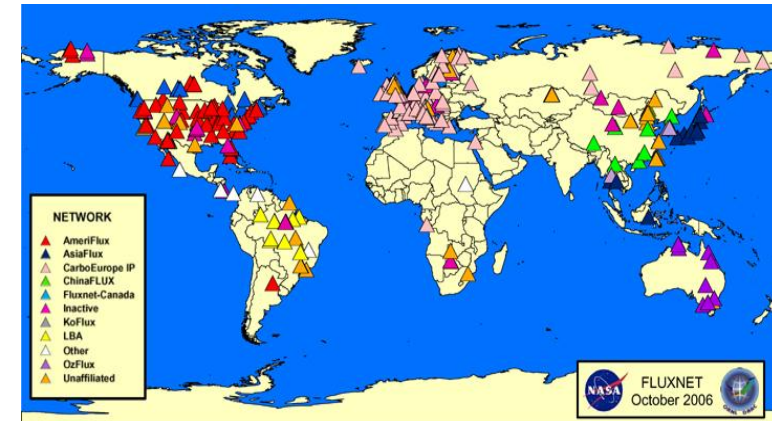


(b) Cerrado Flood plain
Ilha do Bananal (TO)



(a) Amazonian Tropical forest
Santarem (Flona Tapajós) k83

(c) Atlantic Forest (Ubatuba & São Luis Paraitinga, SP)



Fluxnet (global network)

Conclusions

1) Outstanding capacity of cooperation and expertise in only 1 year work (May 2009-April 2010) with five institutions

- **Preliminary analysis showed physically sounding data**
- **Detection of improvements (e.g. humidity measurement, sensor accuracy)**

2) Foreseeing to monitor Amazonia

Wild environment with largest worldwide tropical forest, 20% world freshwater and an enormous biodiversity

Supportive on going projects:

Fapesp-MSR 2009-2011 : sensor and software development (von Randow/Inpe + Usp)

LBA/Fapesp Carbon Tracker 2009 – 2014 : regional multi-disciplinary data

Next steps: to address which relevant questions to answer, partnerships, and how technology can help science and environment