



Câmara Municipal de Lisboa

Departamento de Protecção Civil
Departamento de Informação
Geográfica e Cadastro



Lisbon Urban Heat Island Urban Planning and Risks



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Present Situation:

Since beginning of 2008 the CML Department of Civil Protection receives 4x daily meteorological forecasts for the next 7 days of temperature, wind speed, precipitation and tide.

If specified threshold values are exceeded, a warning email is send

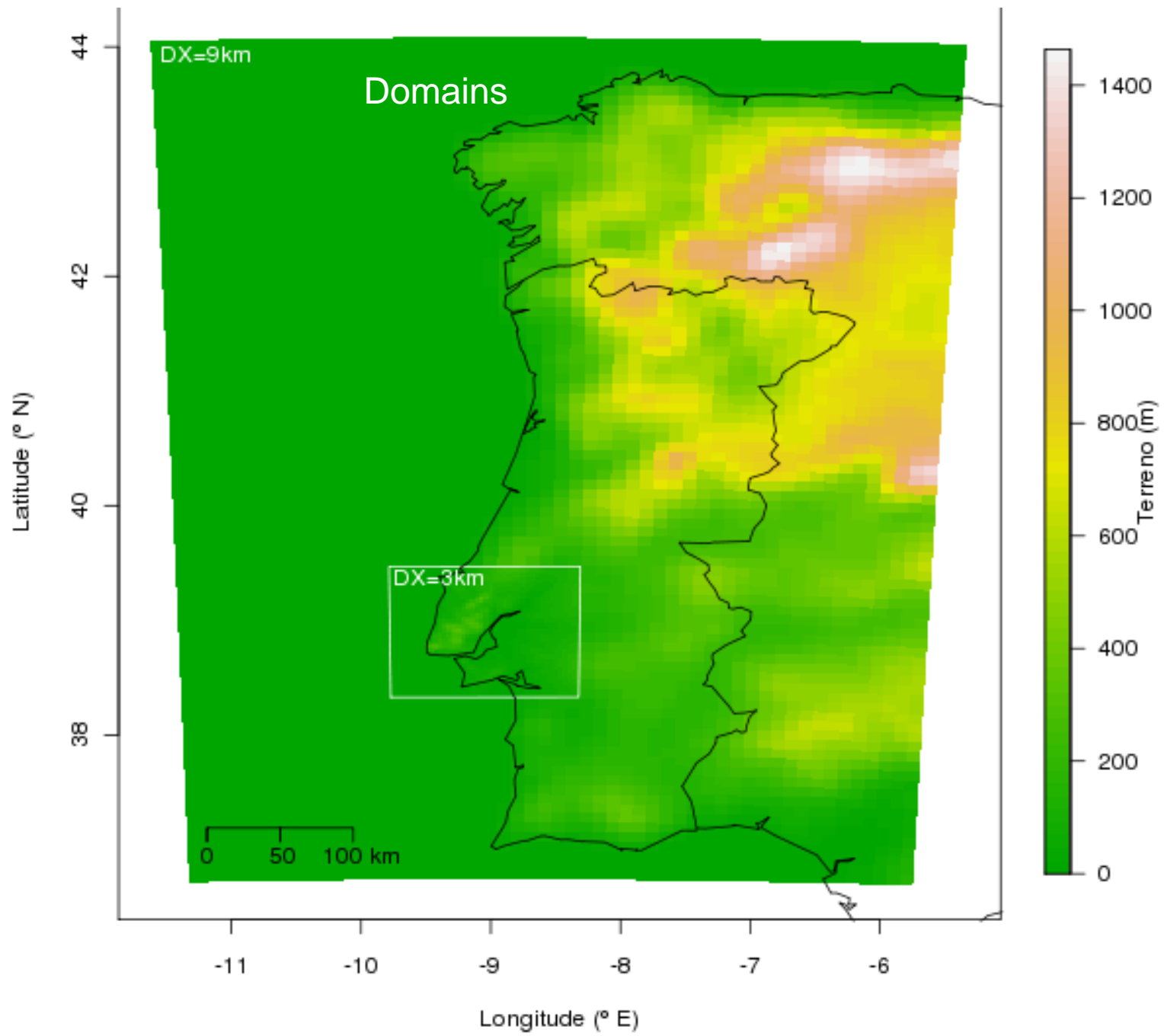
The Department accesses this information with warnings from the National Service Protection

Operational Forecast Models:

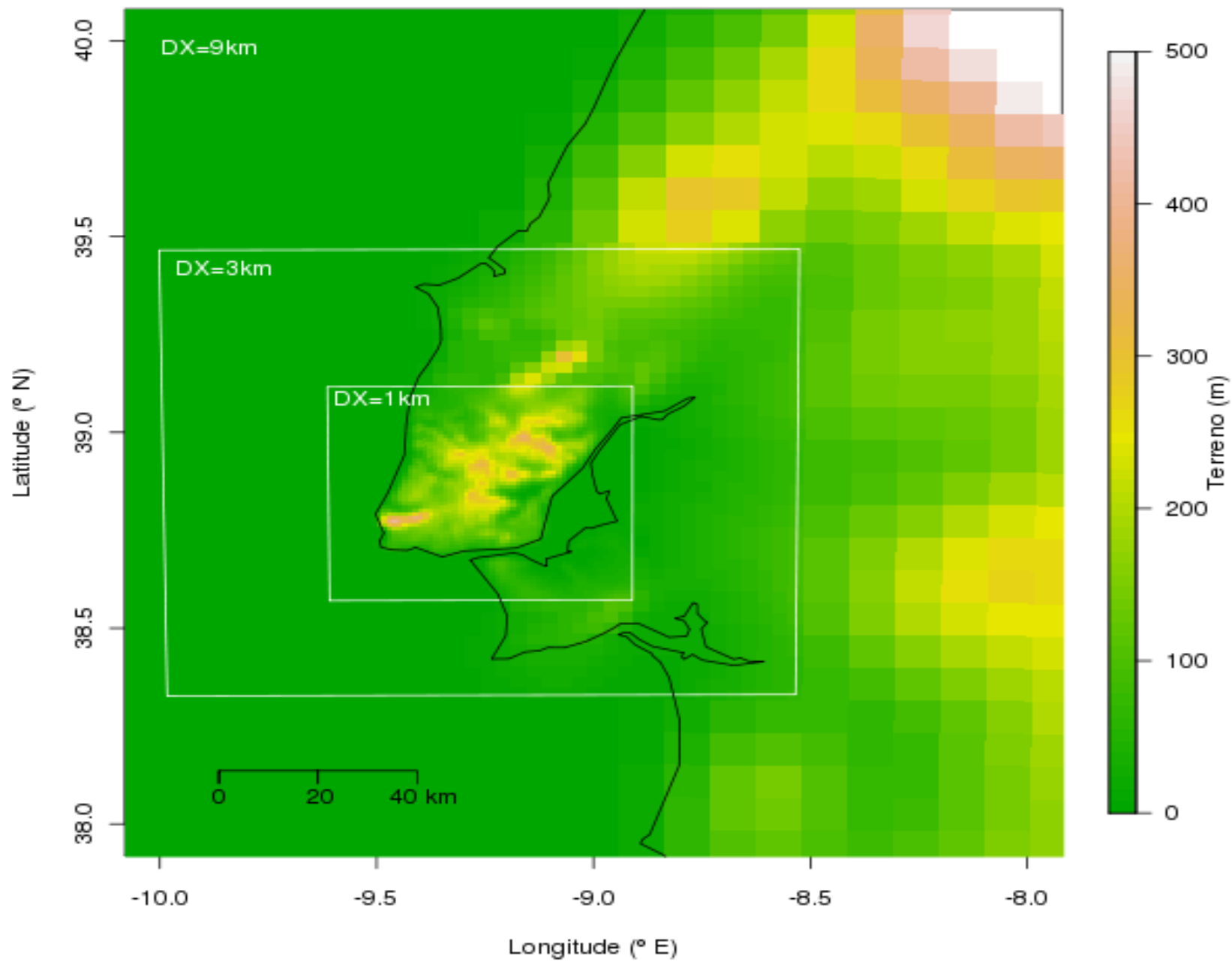
MM5-V3.7 initialized with GFS (Global Forecast System) from NCEP, runs in two way mode for nested 27 km and 9km domains.

Results are generally good for temperature and wind, reasonable for timing of precipitation. Not so good for heat waves and quantitative precipitation.

Since 2009 AWRP-V3.011 (Advanced Weather and Research Forecast) become operational in two way mode for nested 9km and 3km after extensive tests of 9km, 3km and 1km, besides parametrizations of land-soil and boundary layer schemes.

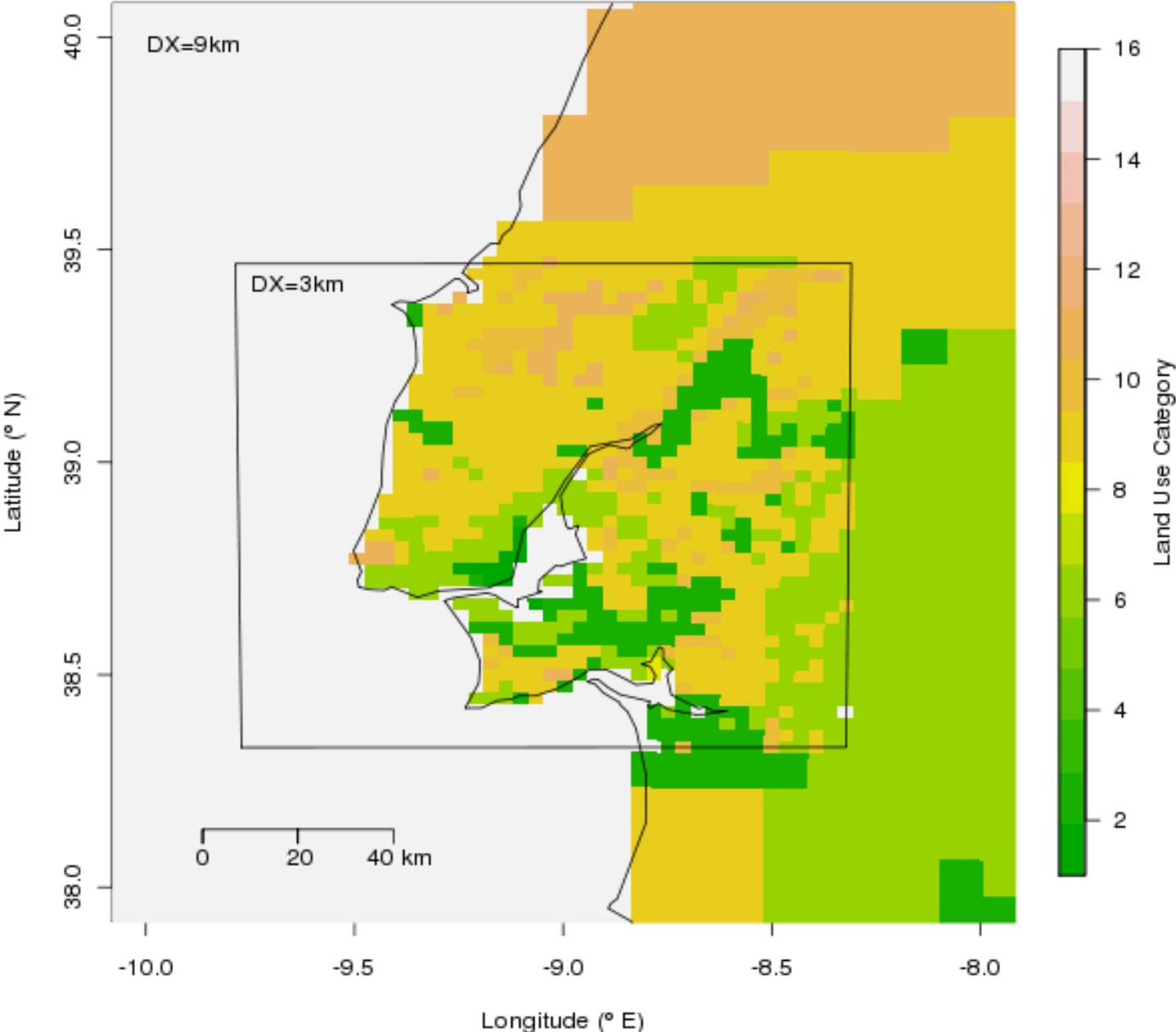


WRF - FNL



Land use categories

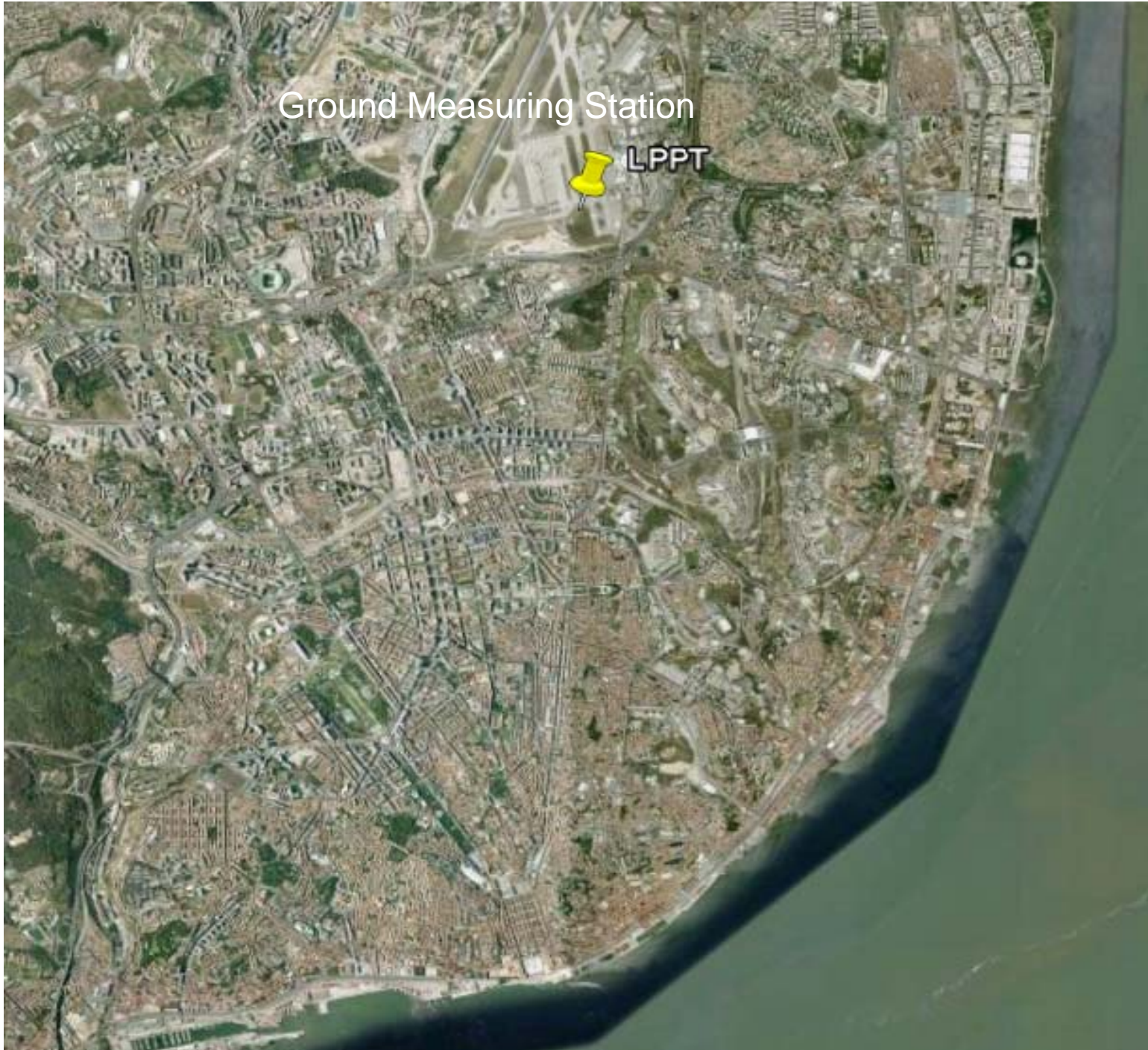
WRF - GRIB2



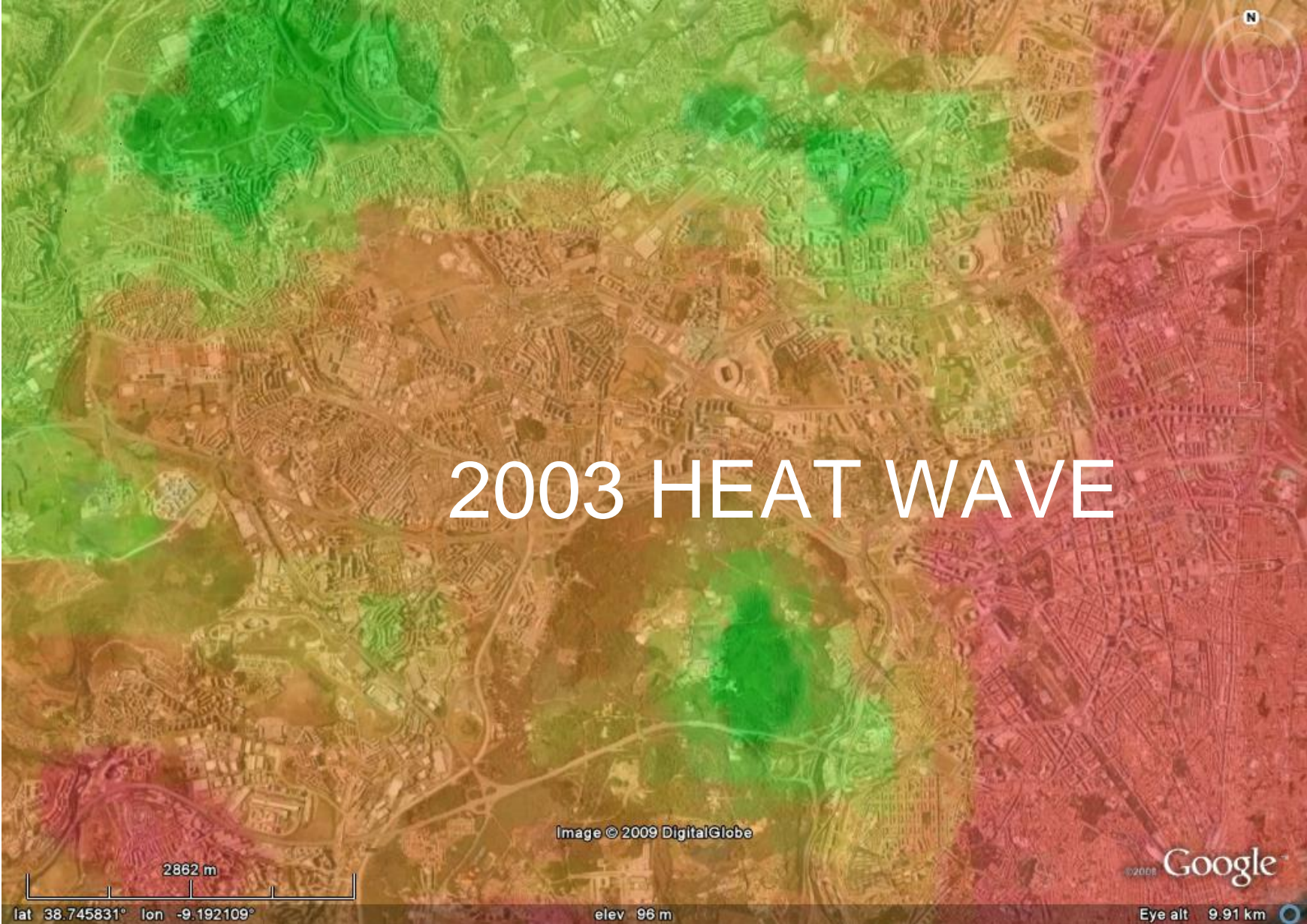
Ground Measuring Station



LPPT

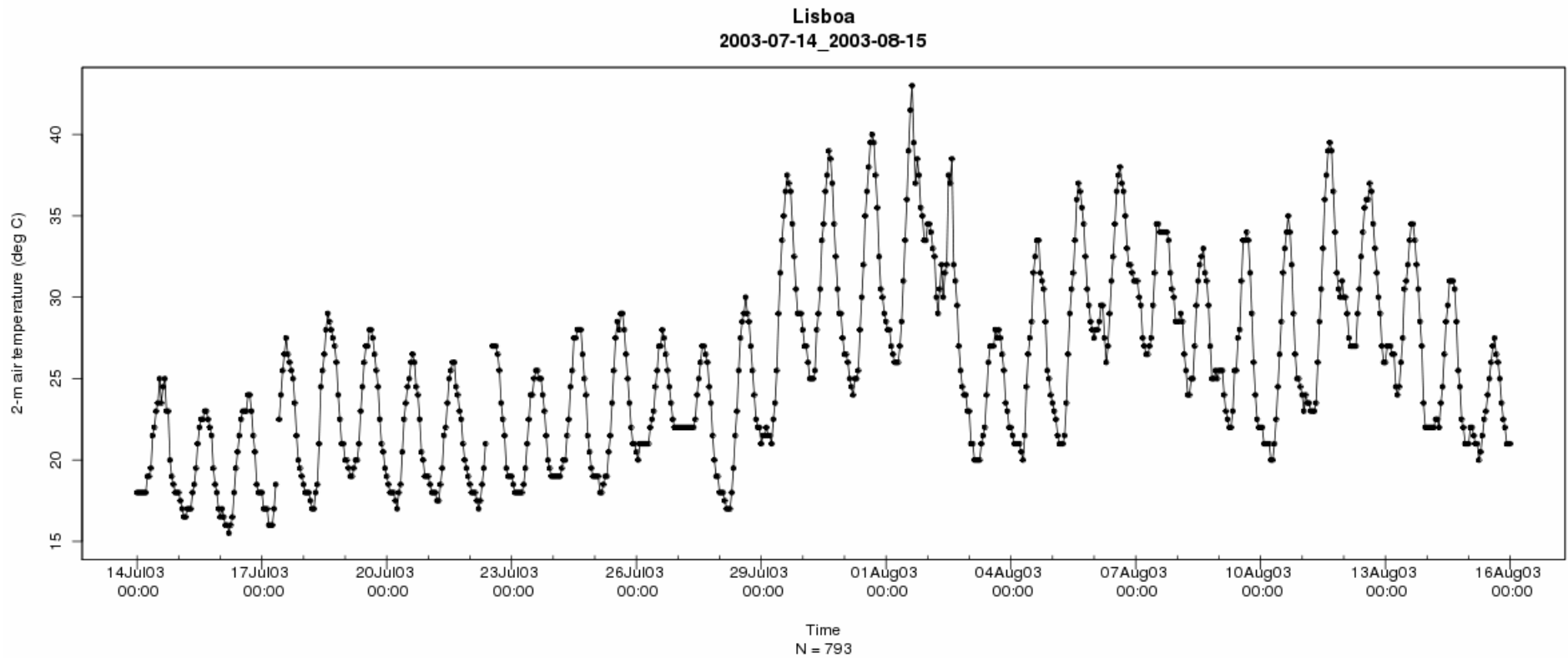


2003 HEAT WAVE



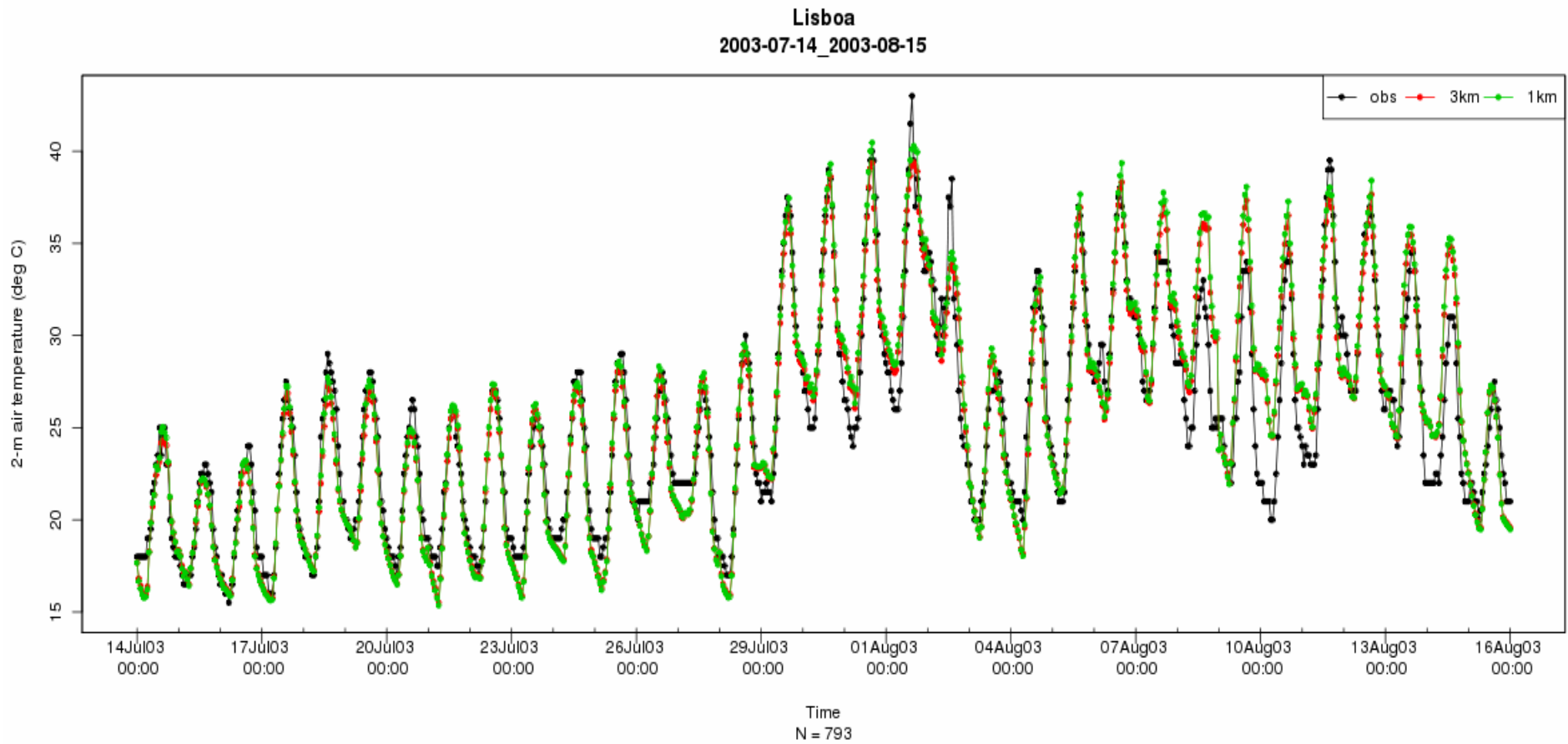
Urban Heat Islands - Lisbon

The Heat wave of 2003 Measured temperatures at Lisbon Airport



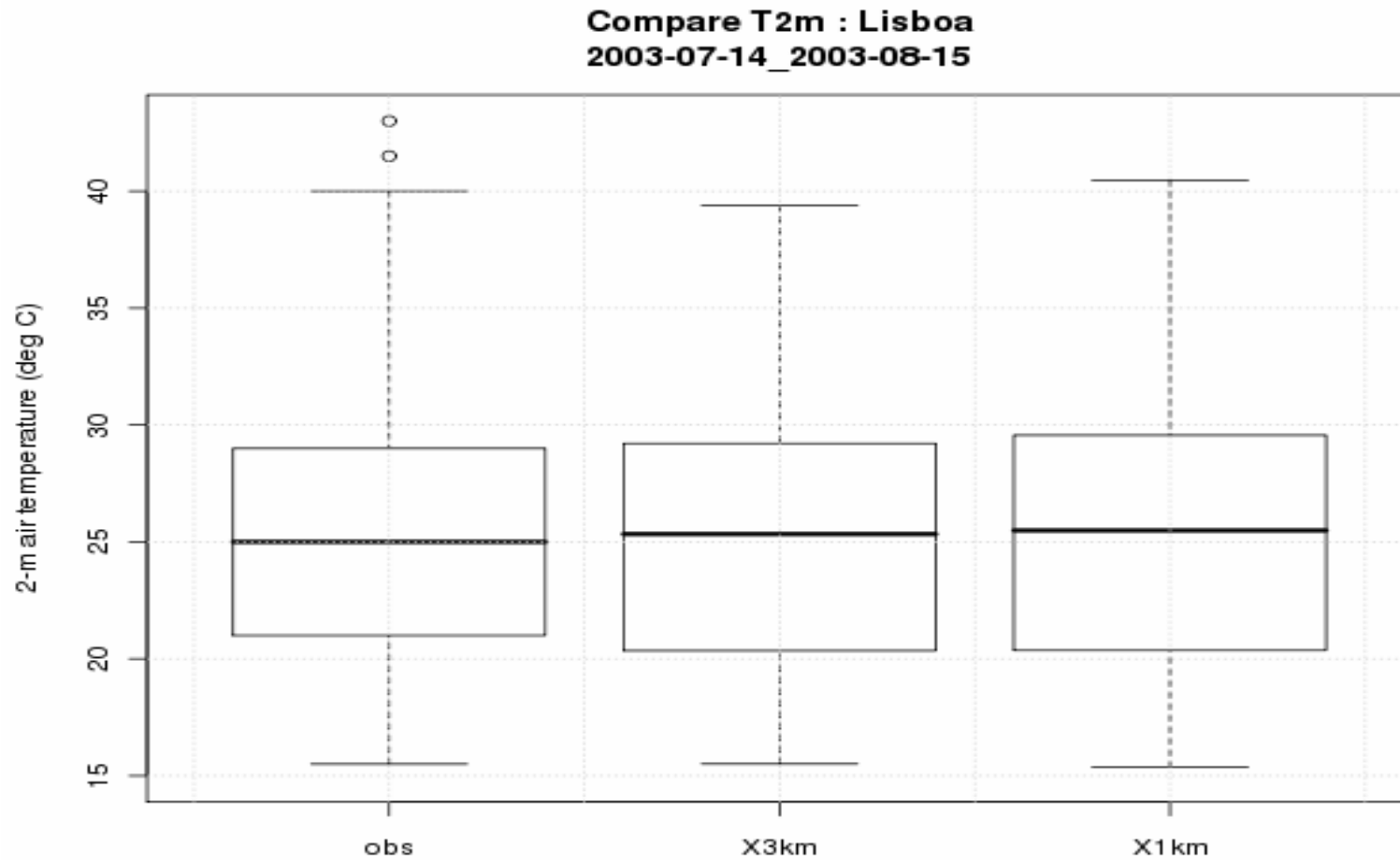
The Heat wave of 2003

Predicted and Measured temperatures at Lisbon Airport



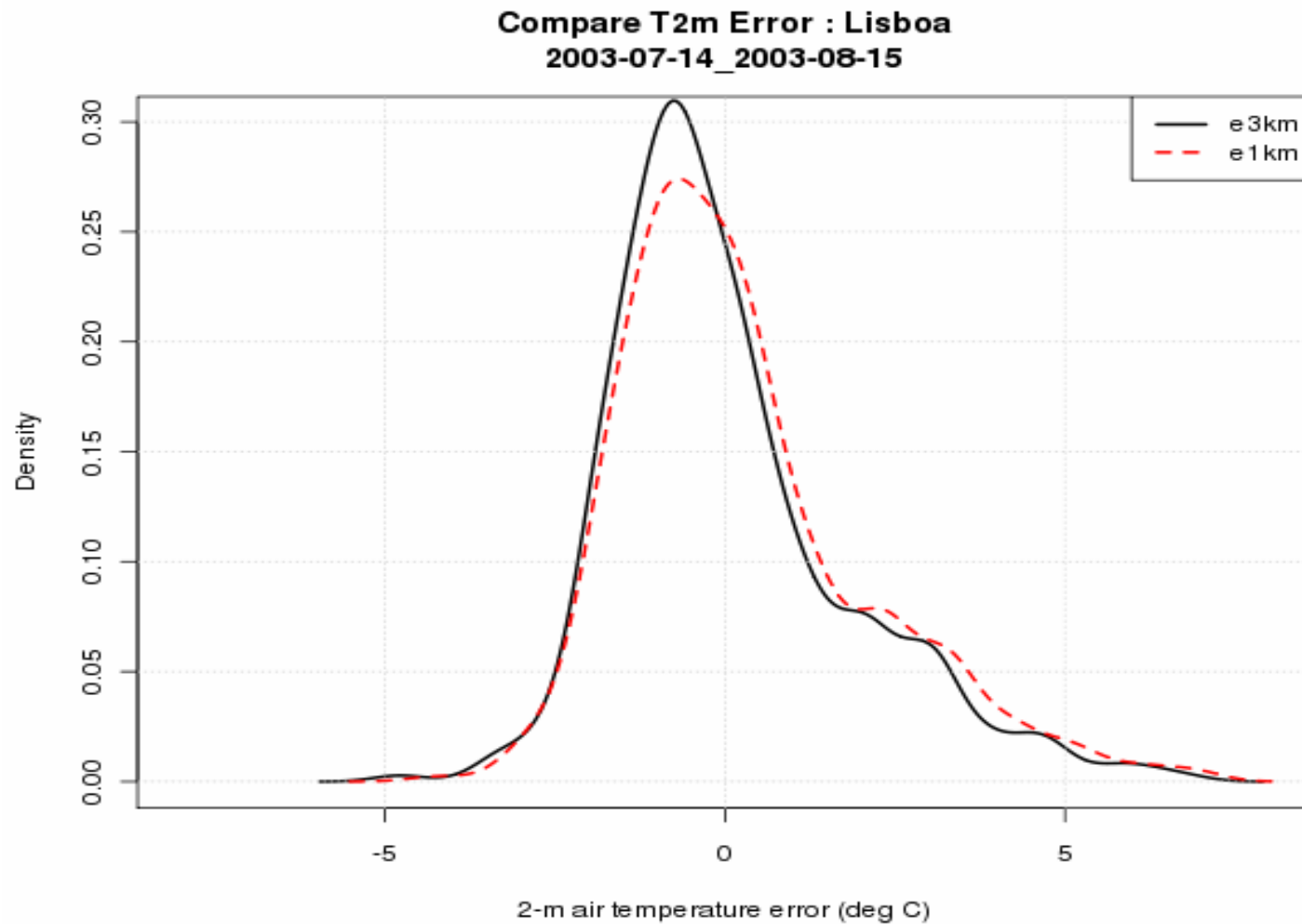
AWRF initialized with FNL (NCEP) 2 way nested (9km,3km, 1km)

The Heat wave of 2003 Statistics of Observations and Predictions



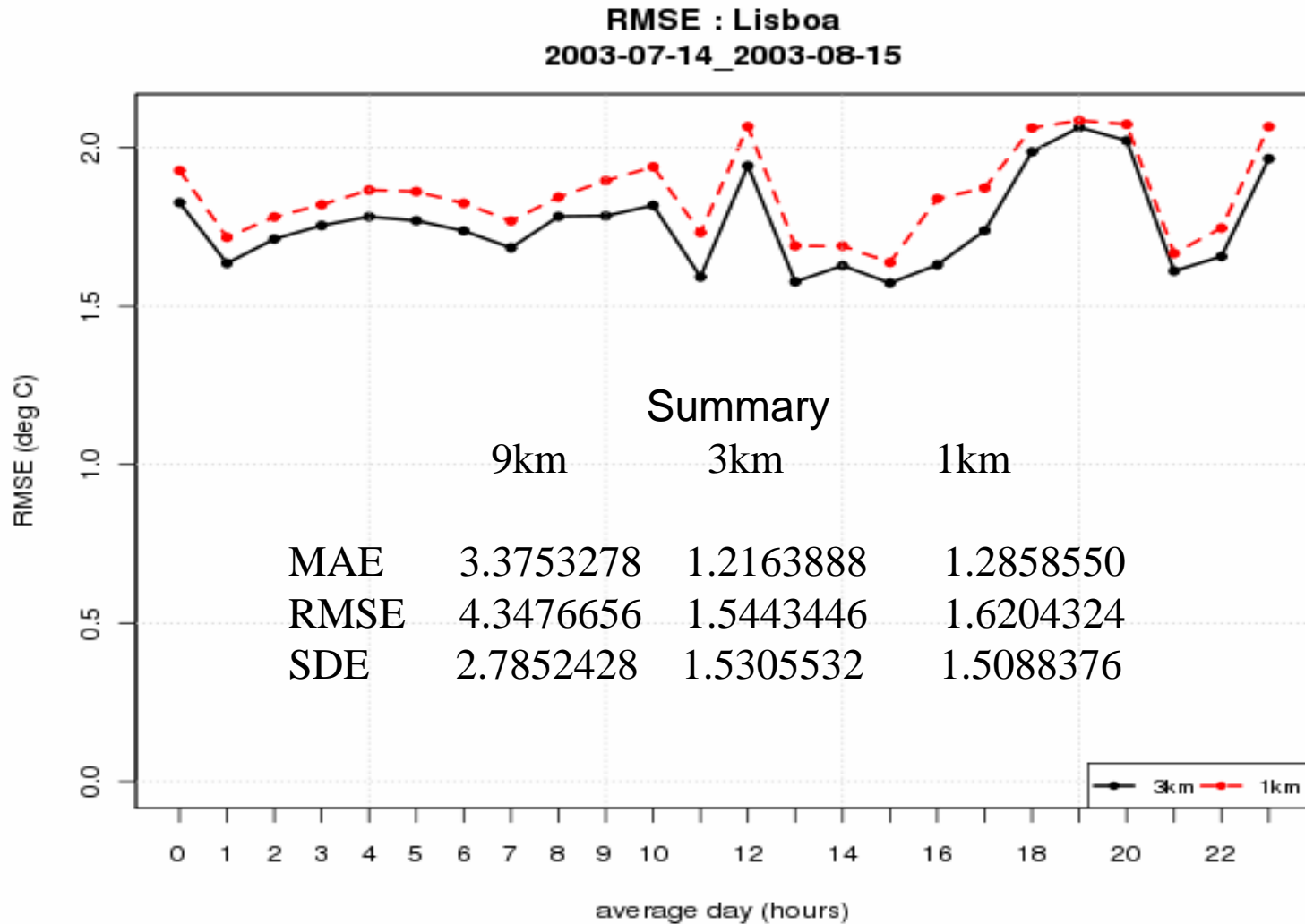
The Heat wave of 2003

Error's probability distribution at Lisbon Airport



The Heat wave of 2003

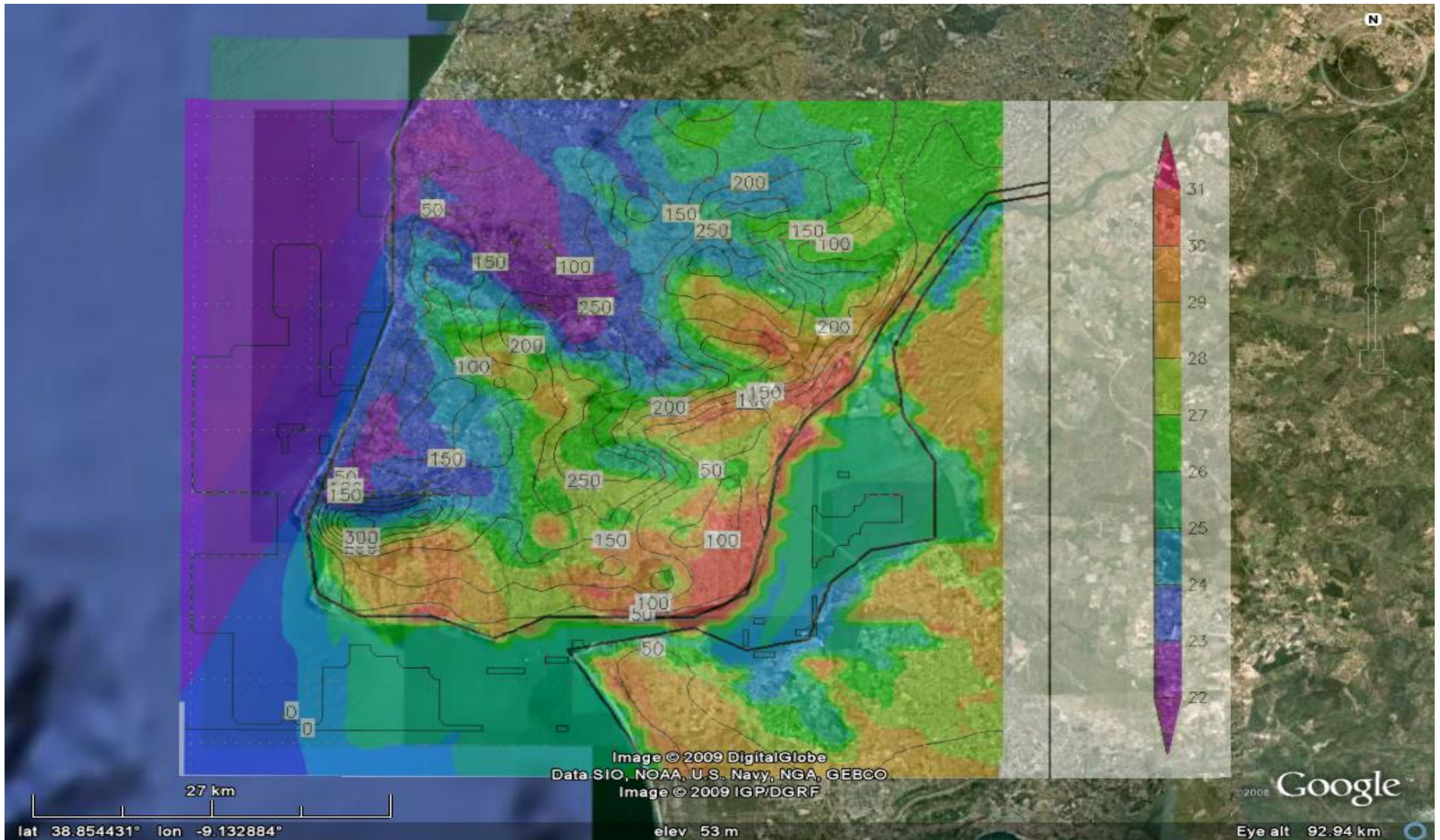
Root Mean Square Error at Lisbon Airport



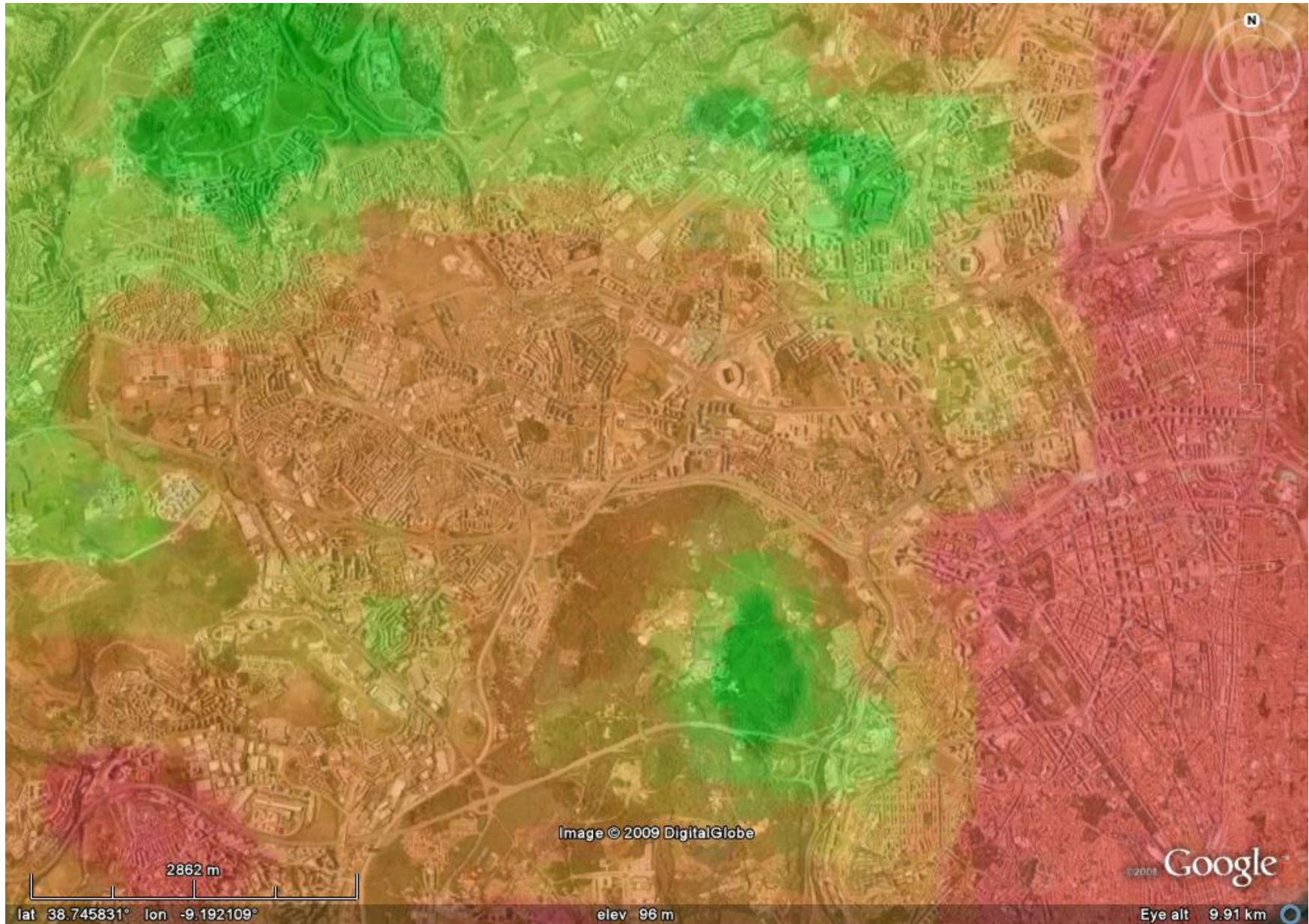
Urban Heat Islands - Lisbon

Heat wave of 2003

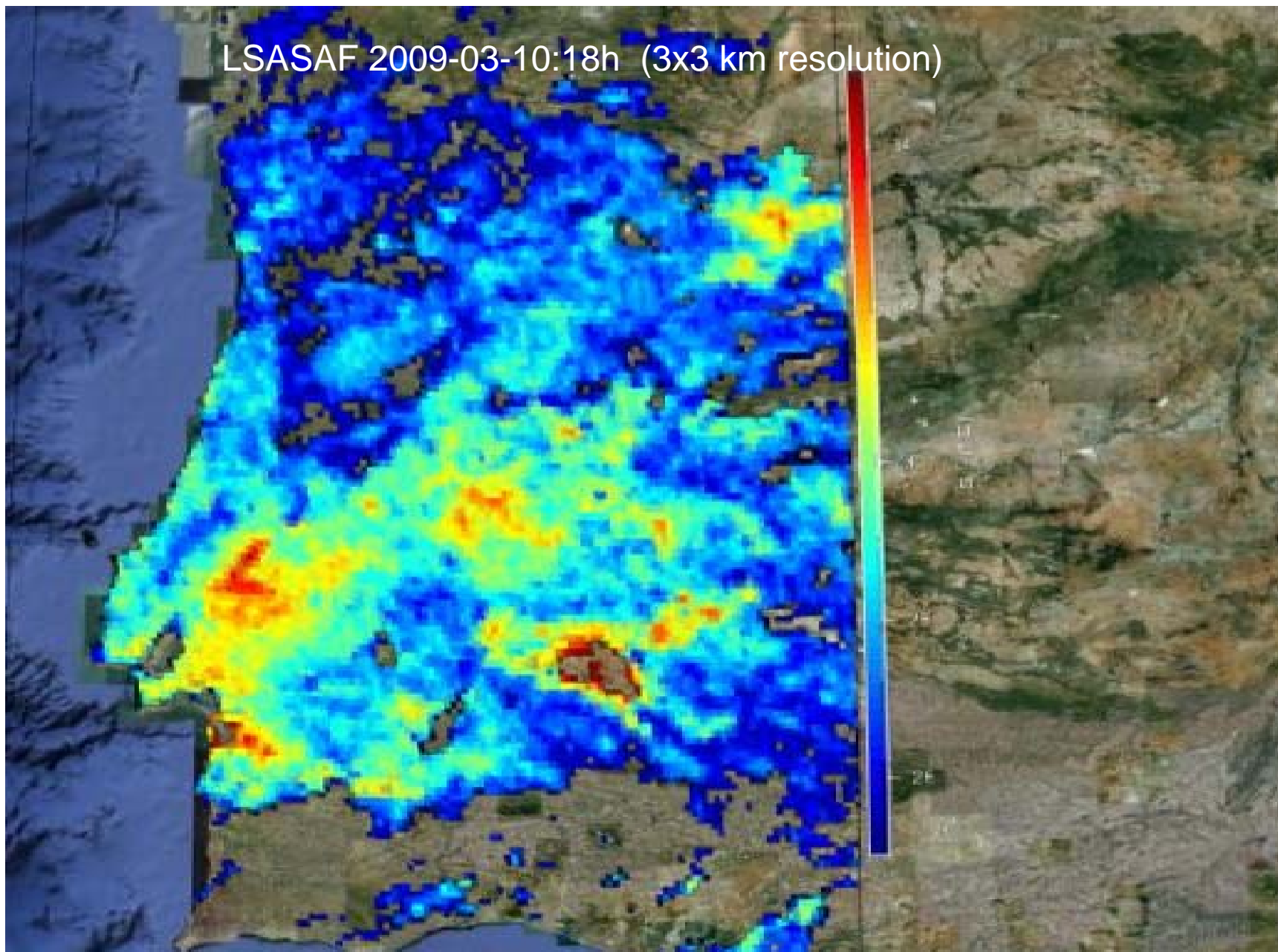
00 hours August 1



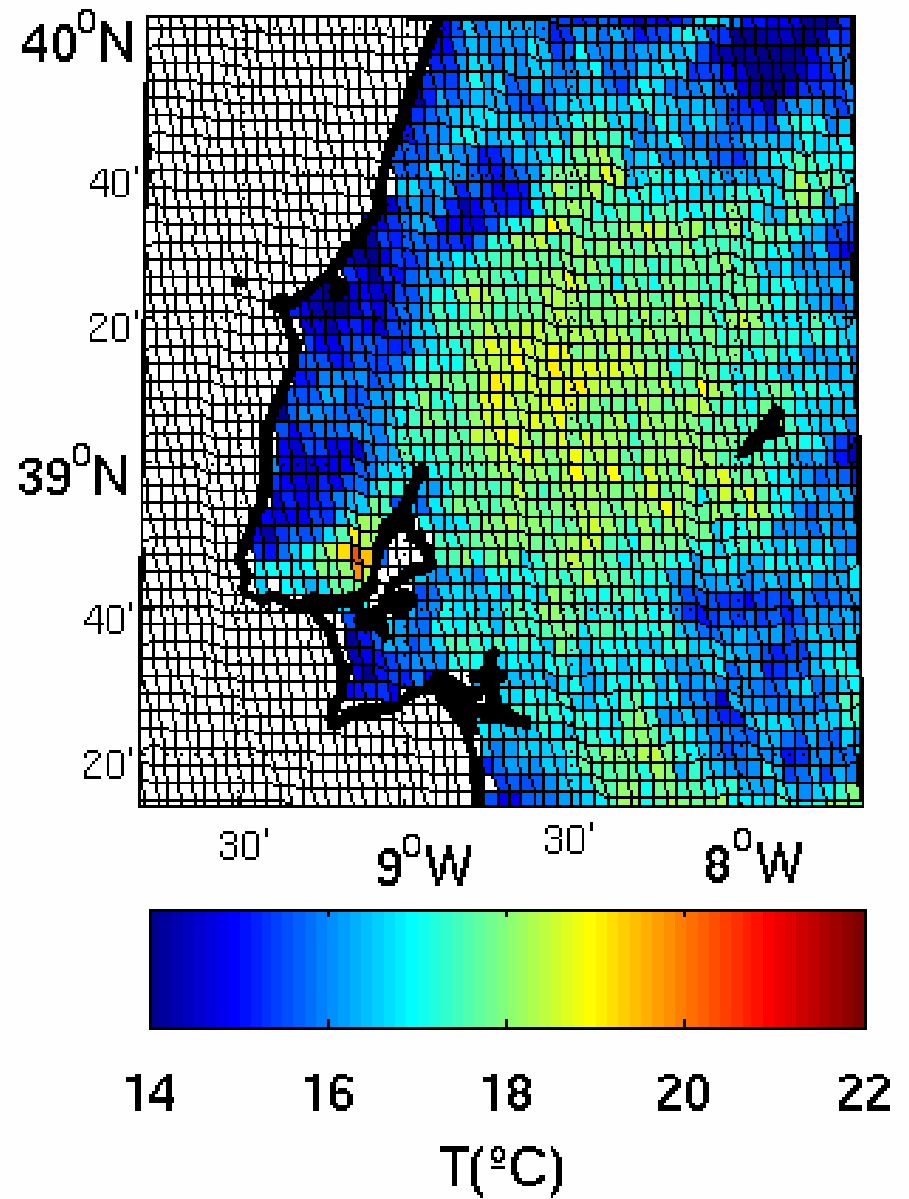
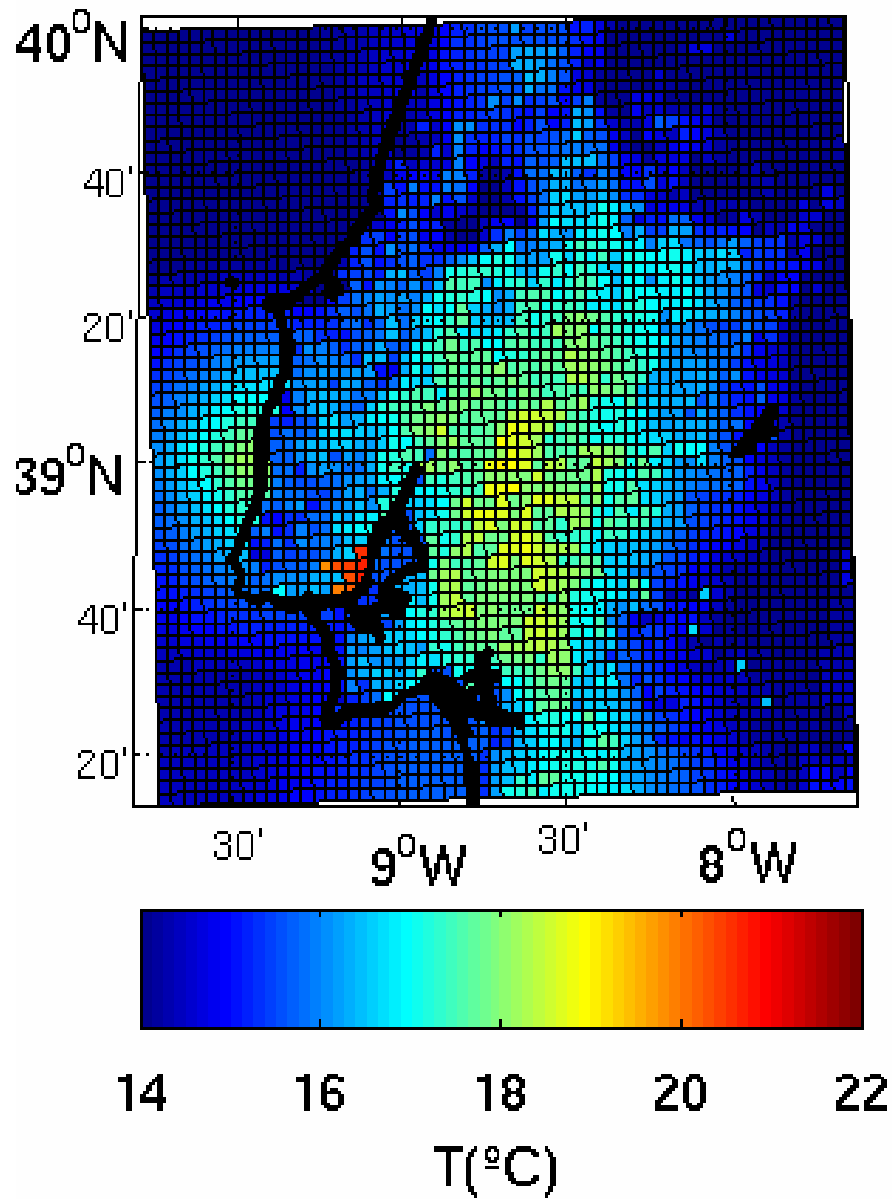
Temperatures 2003-08-01:00



LSASAF 2009-03-10:18h (3x3 km resolution)



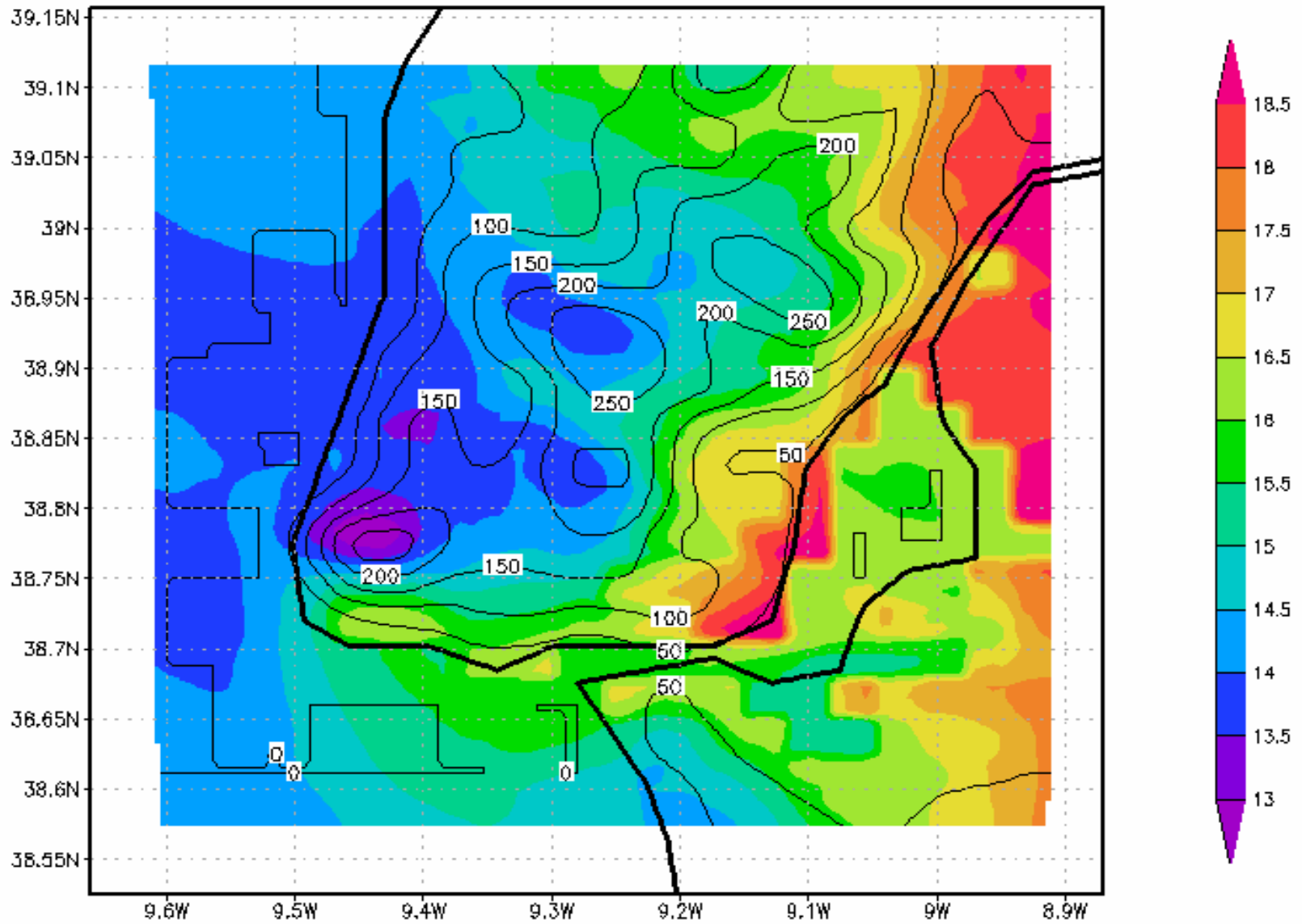
Prediction and LSASAF 2009-03-10:18h (3x3 km resolution)



Temperatura a 2m (C) e relevo(m)

18h 10-MAR-2009

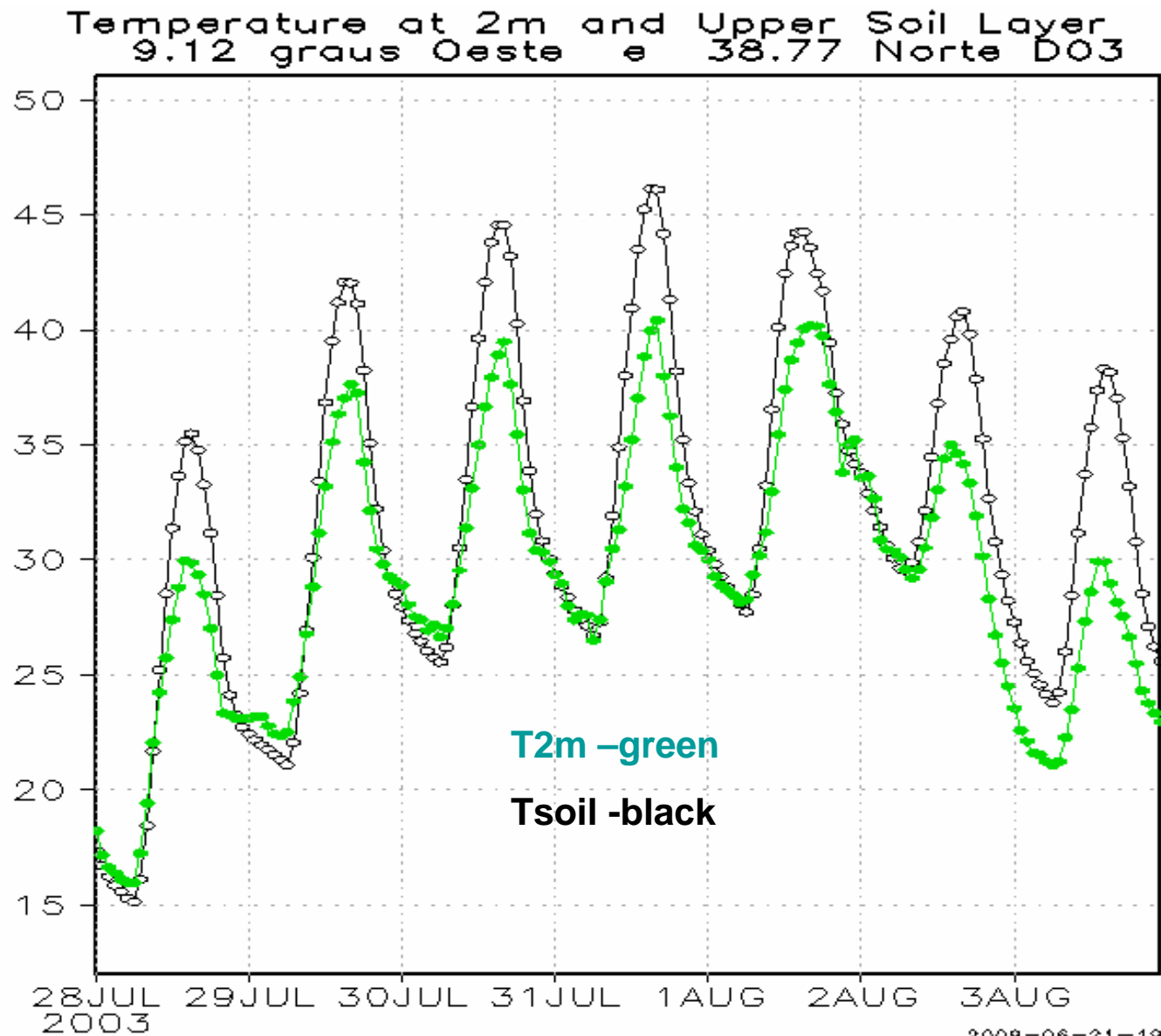
D03



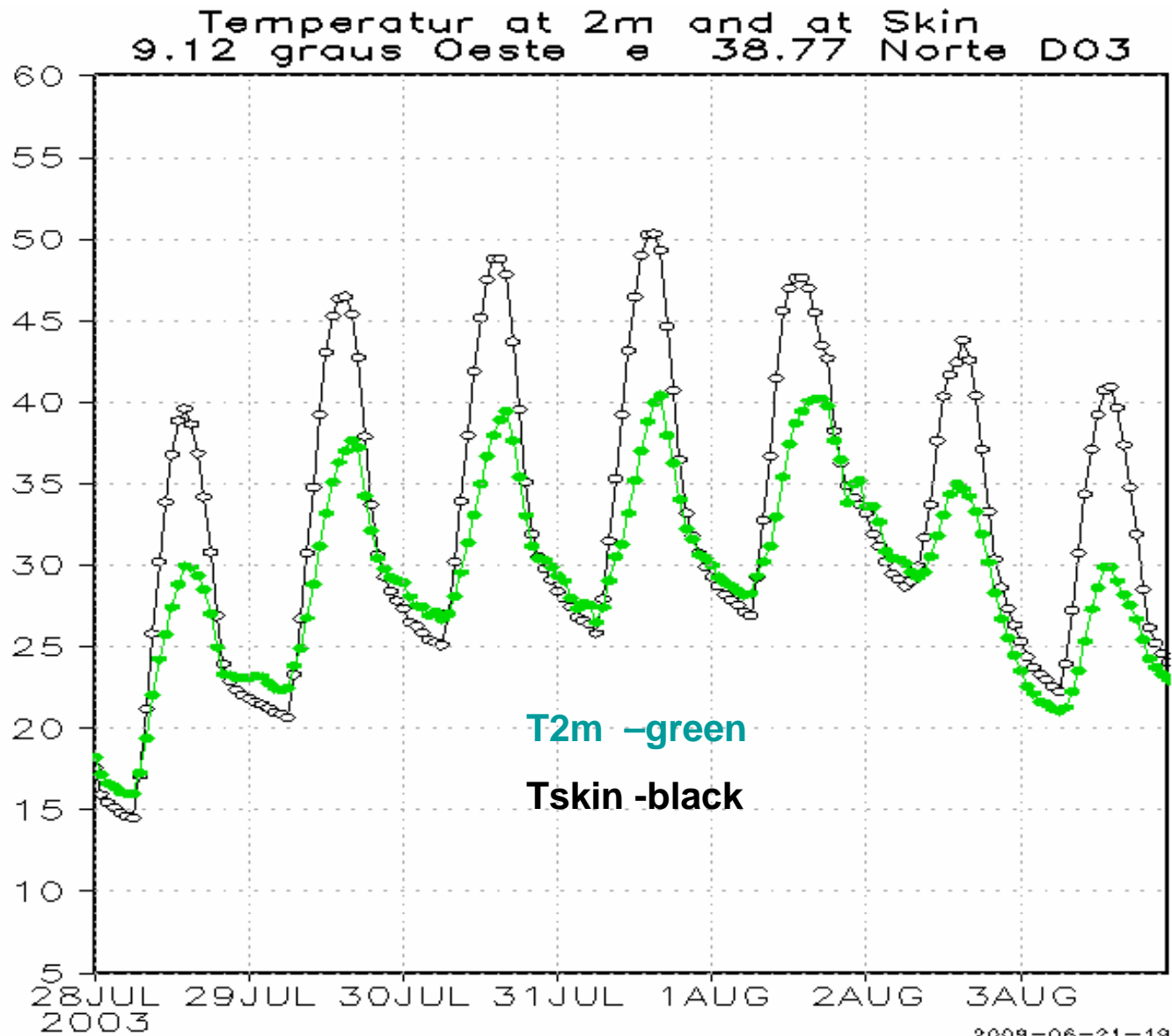
Prediction 2009-03-10:18h (3x3 km resolution)



Urban Heat Islands - Lisbon

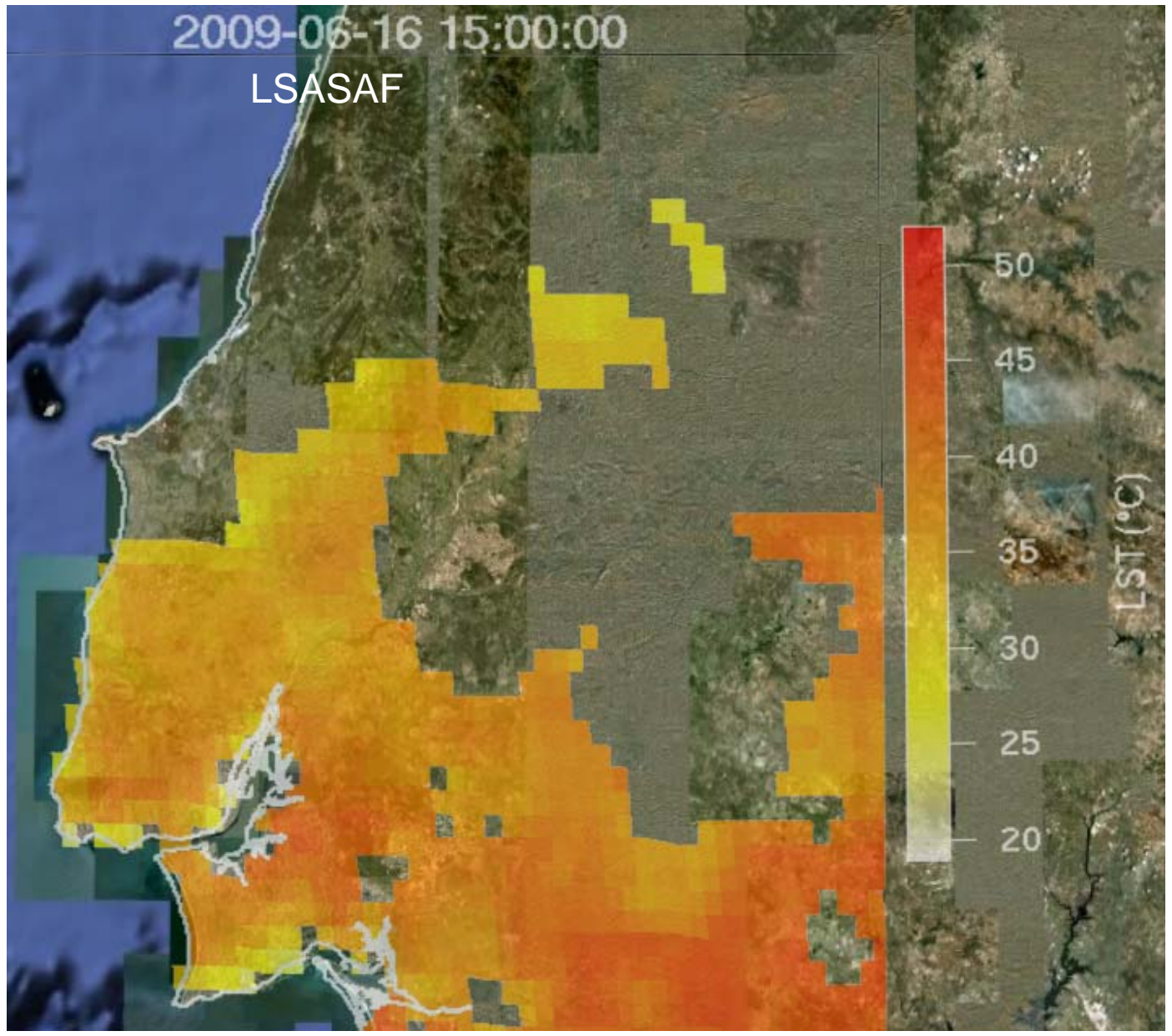


Urban Heat Islands - Lisbon



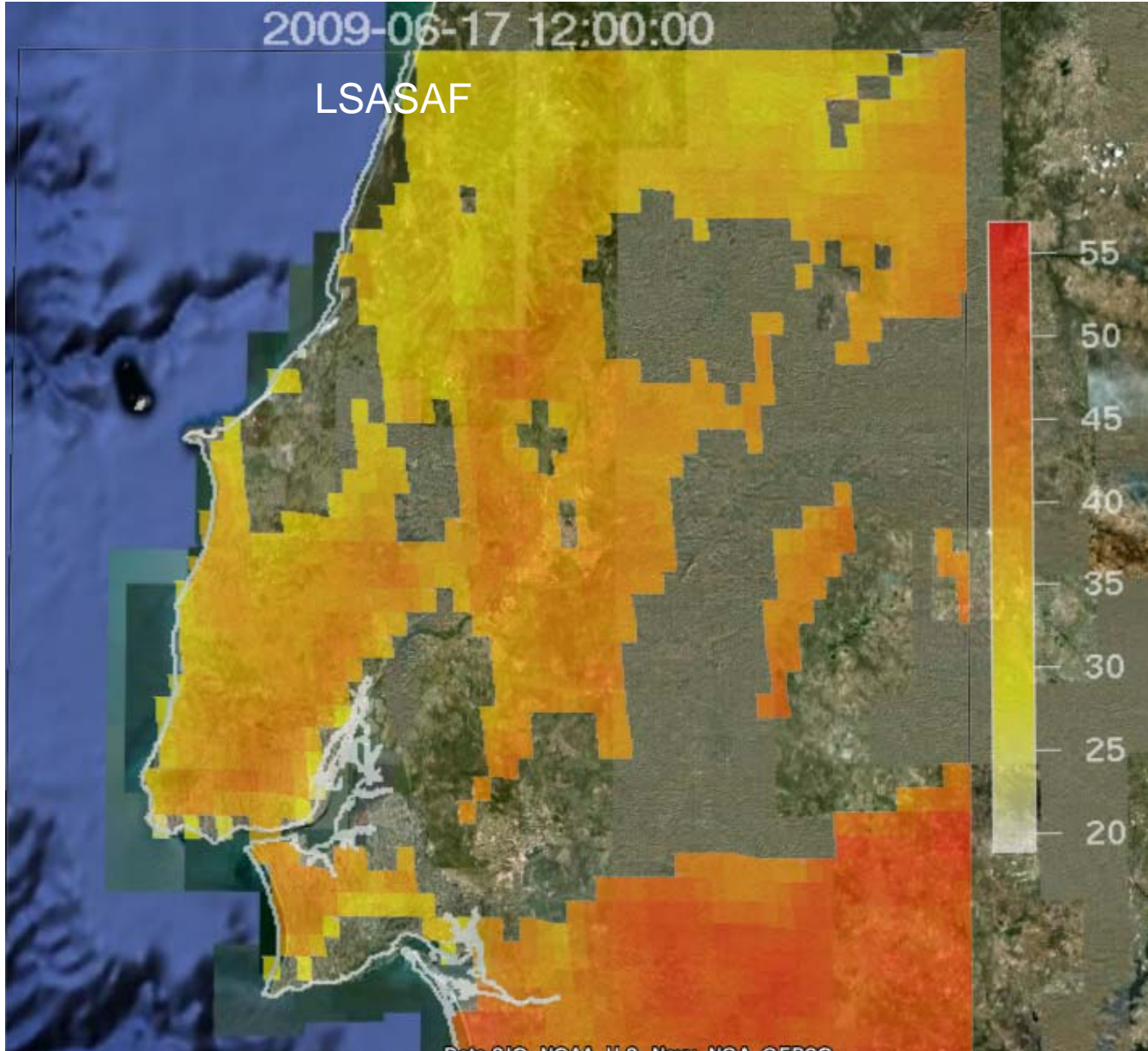
2009-06-16 15:00:00

LSASAF



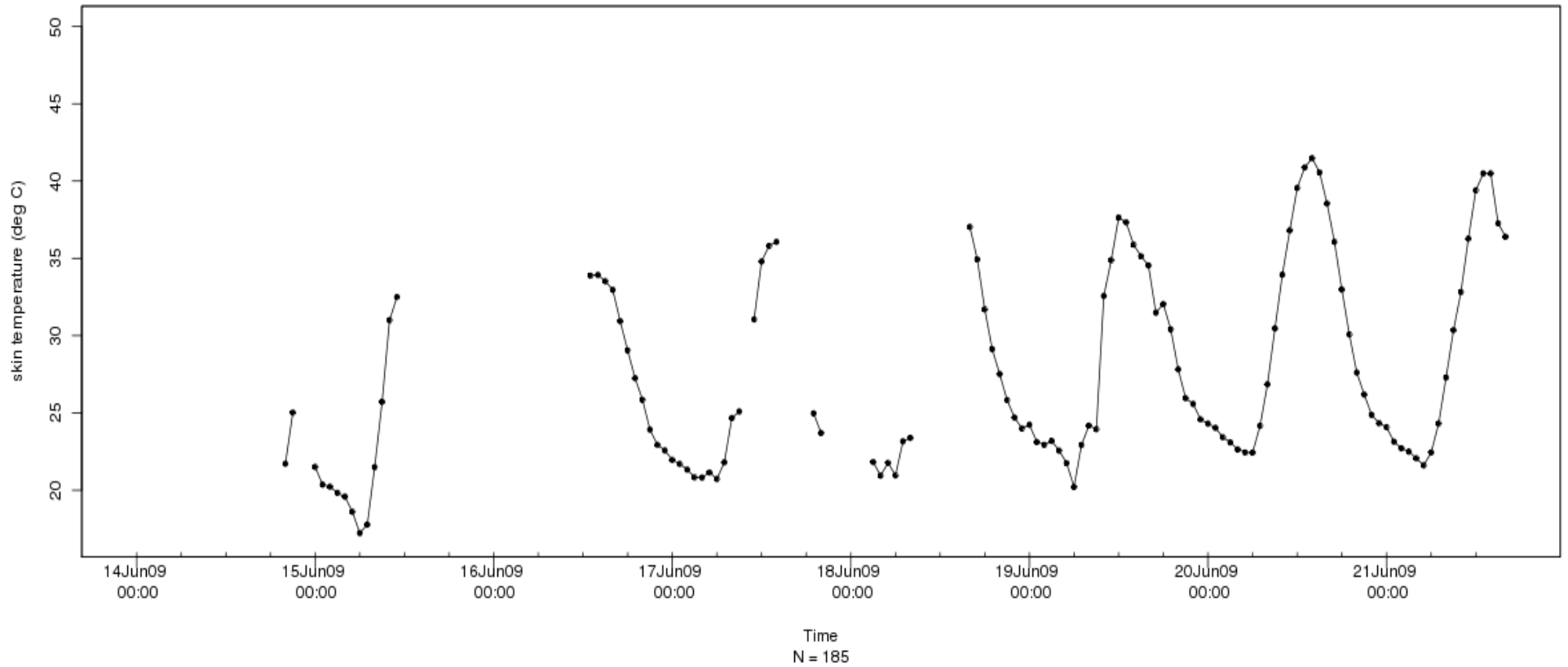
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LSASAF



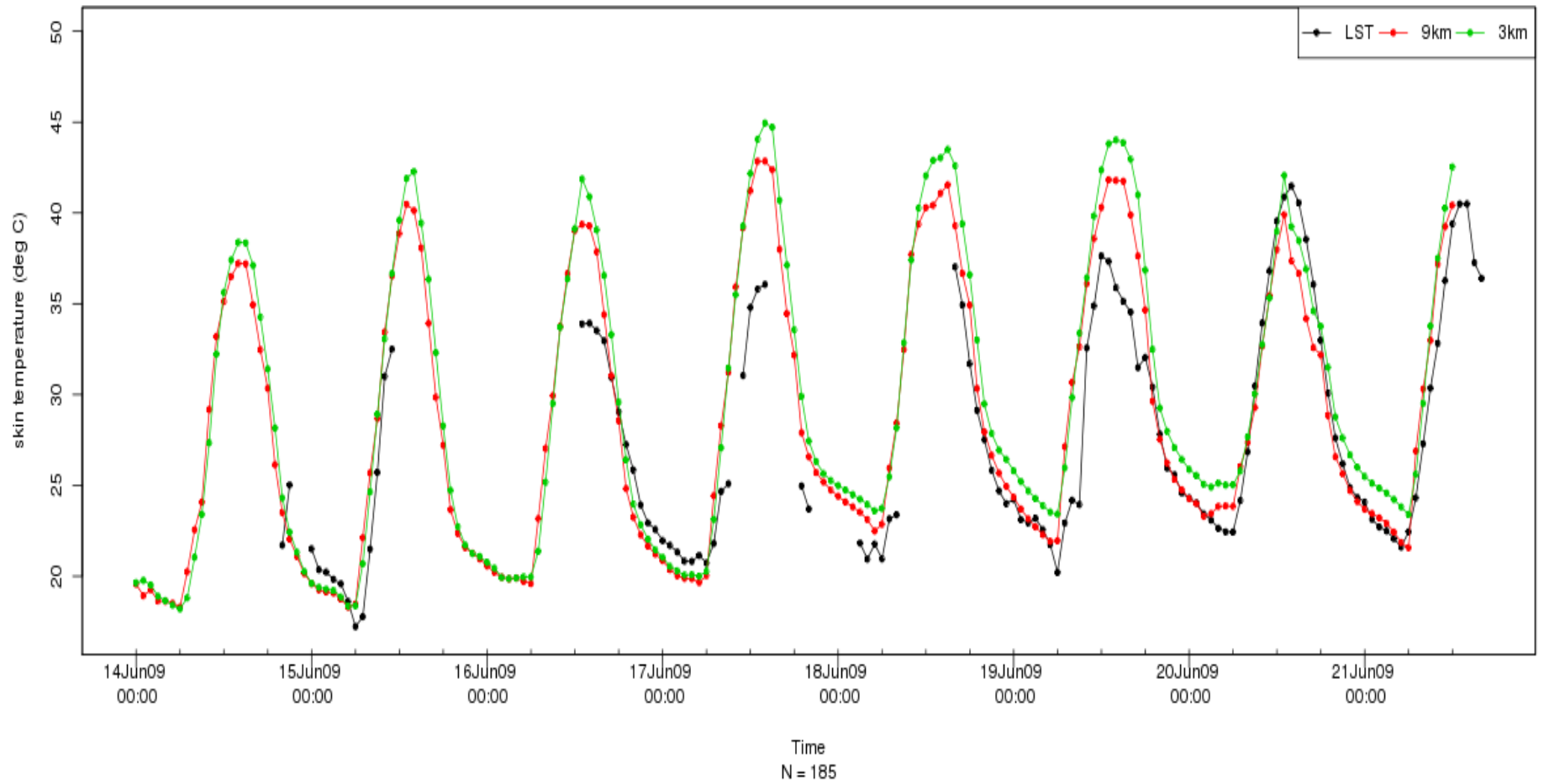
Skin Temperature from Satellite

Lisboa
2009-06-14_2009-06-21



Satellite & forecast

Lisboa
2009-06-14_2009-06-21



SOME PRELIMINARY CONCLUSIONS

1. Risk management:

State of the art operational models in use provide early warning of (extreme) climate events at useful urban scales with RMSE of predictions comparable with presently available satellite pictures.

Results are dependent of global forecast and results would improve with assimilation of satellite information at the mesoscale level

There is a real need of well controlled temperature measurements to verify prediction errors and to thoroughly test Satellite conversion algorithms of IR radiation to temperatures.

2. Urban Planning

Climatic studies presently available (based on statistical treatment of historical records) are not detailed enough for present day needs of urban planning and unable to quantitatively predict and address consequences of climate variability and change, energy use and air pollution.

Past Climate reconstruction at urban scales, based on analysis and reanalysis is invaluable for planning. Basic tools and data is already available and would be improved with more detailed (~100 m) surface characterization regarding thermal and fluid dynamic properties.

Satellite thermography at 100m resolution would be very useful

THANK YOU

... for your attention

