Bridging Science and Public Policies

encontro CIÊNCIA '22

ENCONTRO COM A CIÊNCIA E TECNOLOGIA EM PORTUGAL

16 a 18 MAIO 2022

#ciencia2022PT

A case of science contribution to public policies: planning the adaptation to climate change in cities

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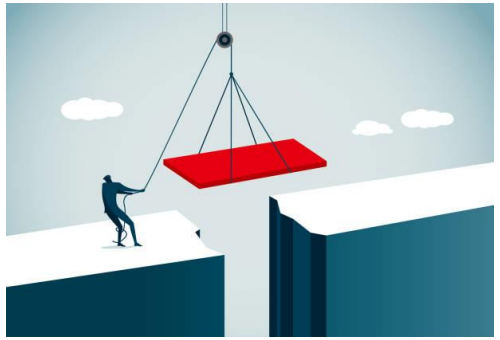
Centro de Estudos Geográficos IGOT - UNIVERSIDADE DE LISBOA

TERRA Laboratory for sustainable land use and ecosystem services

Bridging Science and Public Policies: a brief history

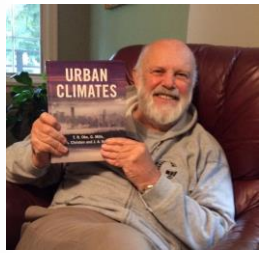


Energy and Buildings, 7 (1984) 1 - 10

Towards a Prescription for the Greater Use of Climatic Principles in Settlement Planning

T. R. OKE

The University of British Columbia, 1984 West Mall, Vancouver, B.C. (Canada)



1988 - The United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMO) establish the Intergovernmental Panel on Climate Change.
- The United Nations General Assembly endorses the action of UNEP and the WMO in setting up the IPCC.

- **climate has an important role to play** in settlement design and must be included as an integral part of the education of every urban planner.

- **very little use** is being made of the available urban climate knowledge and expertise in the planning process.

why are the fruits of their research largely being ignored by the planning and construction professions?

Energy and Buildings, 7 (1984) 1 - 10

Towards a Prescription for the Greater Use of Climatic Principles in Settlement Planning

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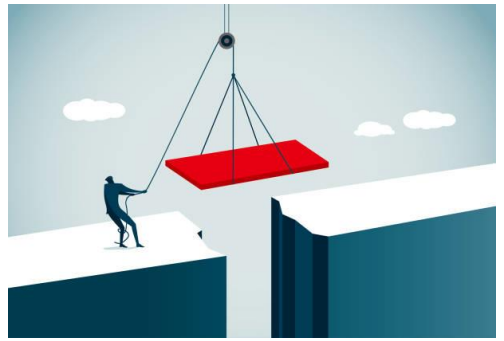


….the planner may consider the work of the urban climatologist to be:

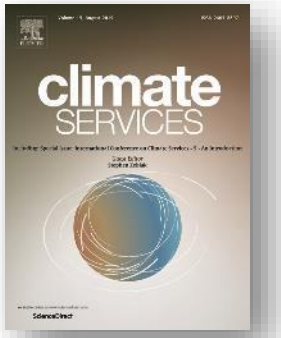
- irrelevant if the latter has not realized the nature of the planner's problem and has failed to relate his work to it. This implies **the climatologist to be ignorant of the planning process**.

- If the climate information is relevant but the planner considers it to be incomprehensible it implies **the user is ignorant of the science**.

- if the user and the supplier both see the relevance of the information to the problem, but the user finds it to be inapplicable**, this suggests a lack of communication between them**.

Climate services and climate applicability

"Climate services pioneers novel research areas that directly refer to ***how climate information can be applied in methodologies and tools for adaptation to climate change****."*

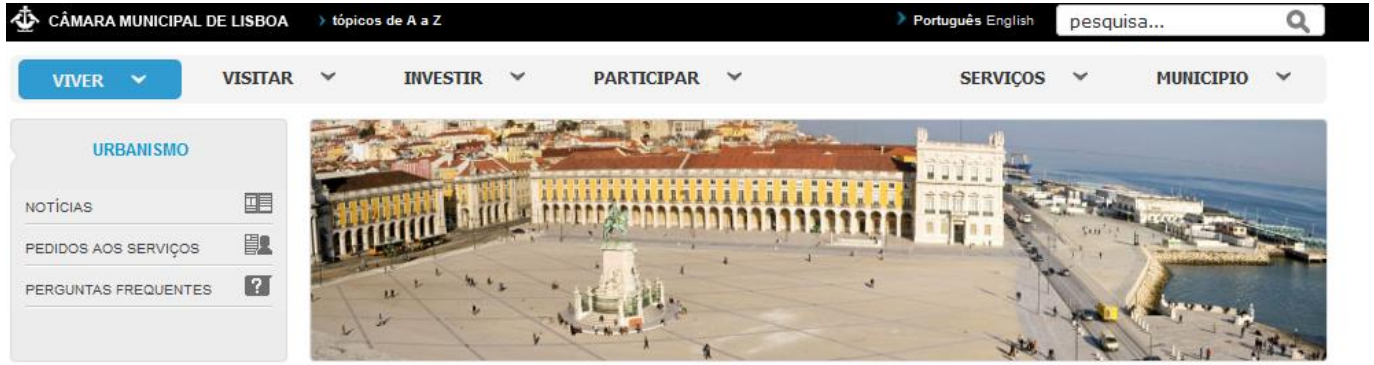


Vol.1 (2016)

- *Information must be:*
- *Accessible*
- *easily understandable by non specialists*
- *Directed for users*
- *Decision support tools*

…the intelligence behind the transition to a climate-resilient and low-carbon society"

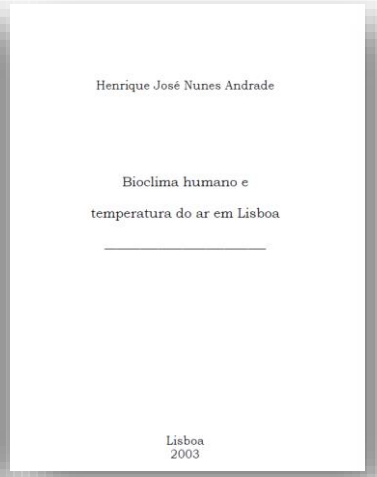
1st application - the Lisbon Municipal Plan (2003-2005)



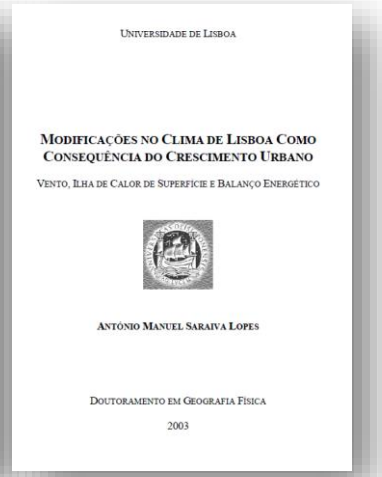
Orientações climáticas - estudo ↓

Urban climate studies in Lisbon applications (2003-2005)

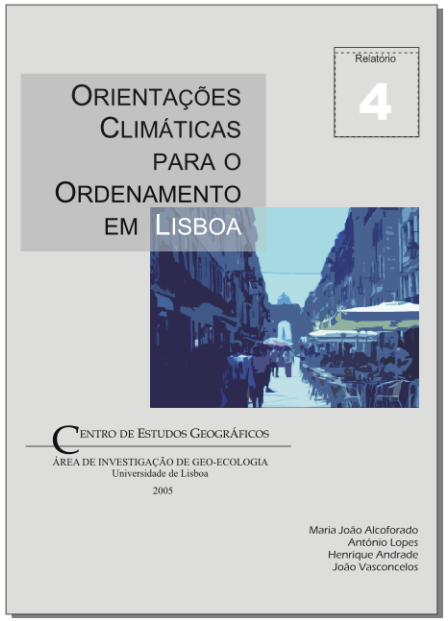
1989 (1992 ed)

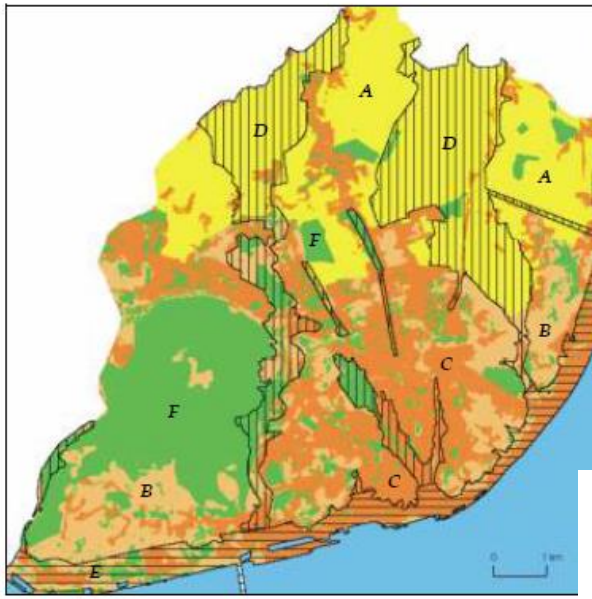


2003



2003





A Área de fraca densidade de construção do Norte
B Áreas construídas de média densidade
C Áreas construídas de alta densidade
D Corredores de ventilação
E Frente ribeirinha
F Espaços verdes

Fig. 18 - Delimitação das áreas para as quais são definidas orientações climáticas para o ordenamento urbano

Fig. 18 -Areas for which climate guidelines for planning were prepared

Quadro III – Quadro-resumo das orientações climáticas espacializadas para o ordenamento em Lisboa

Table III – Summary of spatialized guidelines for planning in Lisbon

Grupos de climatopos	Orientações
A Área de baixa densidade de construção do Norte de Lisboa (4+5+6 na fig.16)	1. Manter corredores de ventilação com orientação N-S (NW-SE a NE-SW) 2. Manter uma razão H/W ≤ 1 nas construções urbanas 3. Criar espaços verdes extensos no interior e entre as áreas edificadas
B Áreas construídas de média densidade a Sul do limite aerodinâmico (2, fig.16)	1. Preservar os fundos dos vales de novas construções e da ocupação com vegetação densa 2. Manter uma razão H/W ≤ 1 nas construções urbanas 3. Criar espaços verdes de média dimensão e preencher os espaços intersticiais com vegetação
C Áreas construídas de alta densidade (1+4, fig.16)	1. Preservar os fundos dos vales de novas construções e da ocupação com vegetação densa 2. Manter nas construções urbanas uma razão H/W o mais elevada possível (se possível ≤ 1); evitar o aumento do número de pisos dos edifícios e a construção nos espaços intersticiais 3. Ocupar os espaços intersticiais com vegetação, de preferência caducifólia 4. Utilizar materiais de construção e cobertura de baixa conductividade e albedo elevado

Landscape and Urban Planning 90 (2009) 56–65

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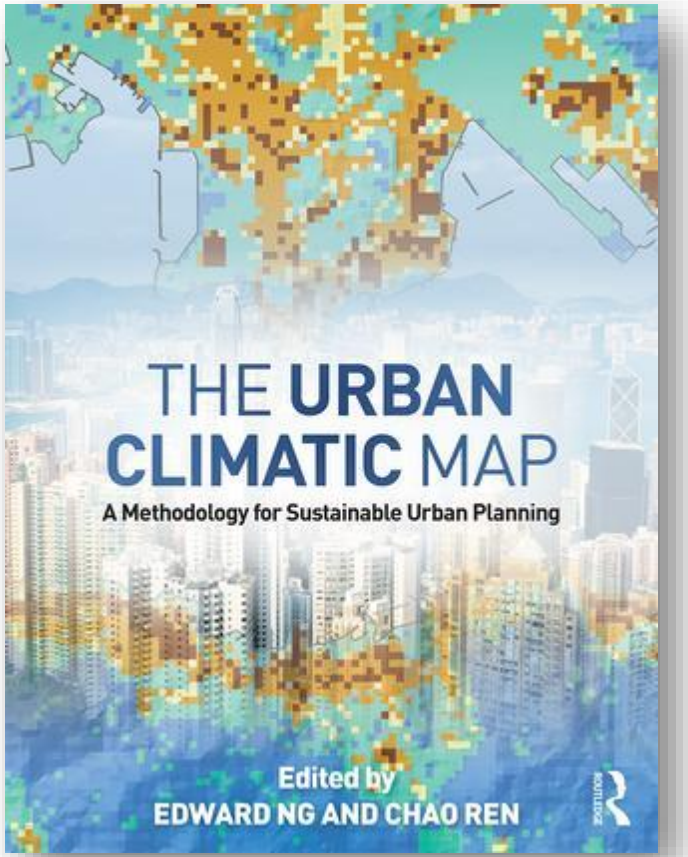
Landscape and Urban Planning

journal homepage: www.elsevier.com/locate/landurbplan

Application of climatic guidelines to urban planning
The example of Lisbon (Portugal)

Maria-João Alcoforado*, Henrique Andrade, António Lopes, João Vasconcelos

Centro de Estudos Geográficos, Universidade de Lisboa, Fac. Letras, Alameda da Universidade, 1600-214 Lisboa, Portugal



Chapter 16

Urban climatic map studies in Portugal

Lisbon

Maria João Alcoforado, António Saraiva Lopes and Henrique Andrade[1]

Introduction

Urbanised areas have grown significantly throughout Europe. The European Environment Agency reports that between 1950 and 1990 urban area grew between 26 per cent (Sunderland, UK) and 270 per cent (Algarve, Portugal) (Gill *et al.*, 2004). Urbanisation processes strongly impact the environment, mostly in negative ways. Climate is one component of the urban physical environment that may play a role in improving the quality of urban life and the sustainability of cities (Andrade, 2005). However, climate is not often taken into account in urban planning (Oke, 1984; Brazel and Martin, 1997; Eliasson, 2000; Mills, 2006; Oke, 2006) and there is hardly any legislation on climate quality in cities, compared to legislation on air quality and noise.

Climate change is a current and urgent topic as urban areas are particularly vulnerable due to

https://www.lisboa.pt/cidade/urbanismo/planeamento-urbano/teste-outros-estudos-e-planos/ondas-de-calor

Ondas de calor em Lisboa

HEAT WAVES IN LISBON

Identificação das Ilhas de Calor e Mapas Climático Urbanos

António Lopes e Ezequiel Correia

Instituto de Geografia e Ordenamento do Território da Universidade de Lisboa

23 de setembro de 2020

IGOT - team
António Lopes (coord.)
Ezequiel Correia
João Vasconcelos
Ana Oliveira
Cláudia Reis
Márcia Matias

www.lisboa.pt webinar

Organizado por:

Co-financiado por:

From Urban Geometry to Urban Climate-relevant Indices

Buildings Height

+

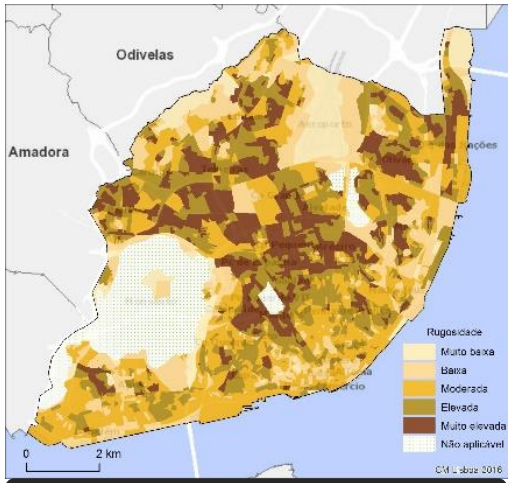
Building Footprints

+

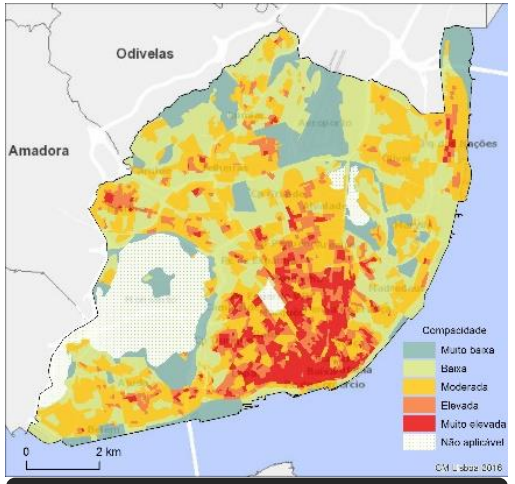
Wind Direction

urban climate algorithms

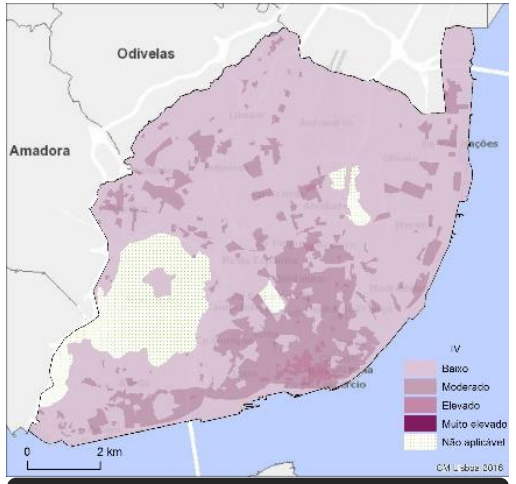
GIS



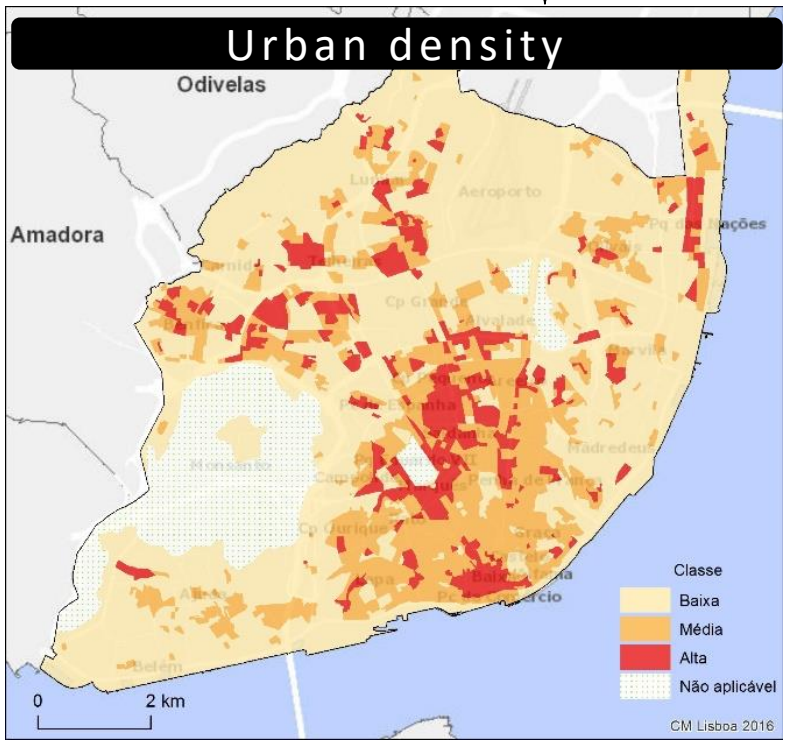
Roughness length



Compacity



Volumetry



Two main applications:

- In urban planning
- Urban Heat Island predictors

Co-financiado por:

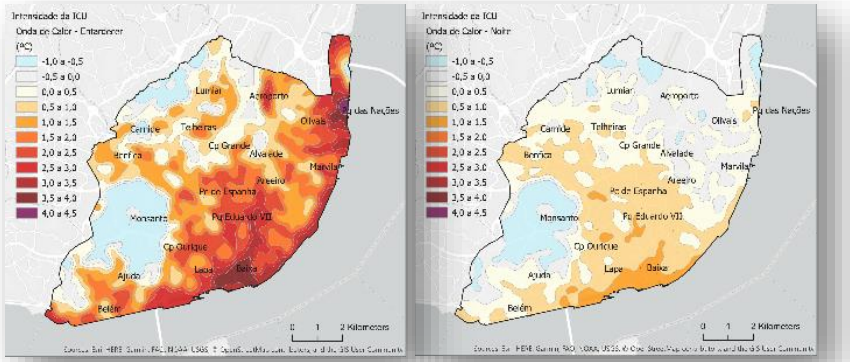
POSEUR PORTUGAL 2020 UNIÃO EUROPEIA Fundo de Coesão

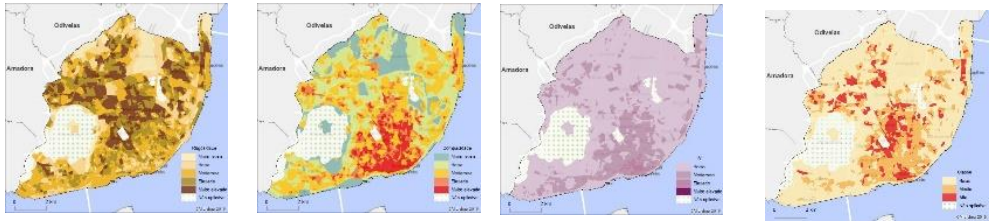
Organização:

LISBOA CÂMARA MUNICIPAL RESCCUE LISBOA CAPITAL VERDE EUROPEIA

Urban Heat Island mesoscale assessment maps: Predicting UHI spatial patterns during Heat Waves

Urban Heat island Intensity (ΔT_{u-r}) – present (weather types)



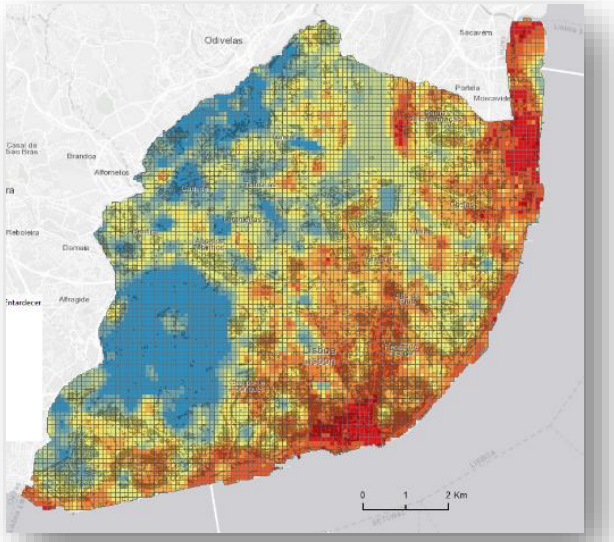


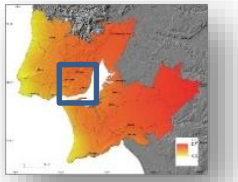
Map of Urban Density, as a predictor for the **Urban Heat Island** spatial pattern

IPCC worst case scenario (RCP 8.5) + UHII (ΔT_{u-r}) + Heat Wave (Temp ºC) | 2070 - 2100

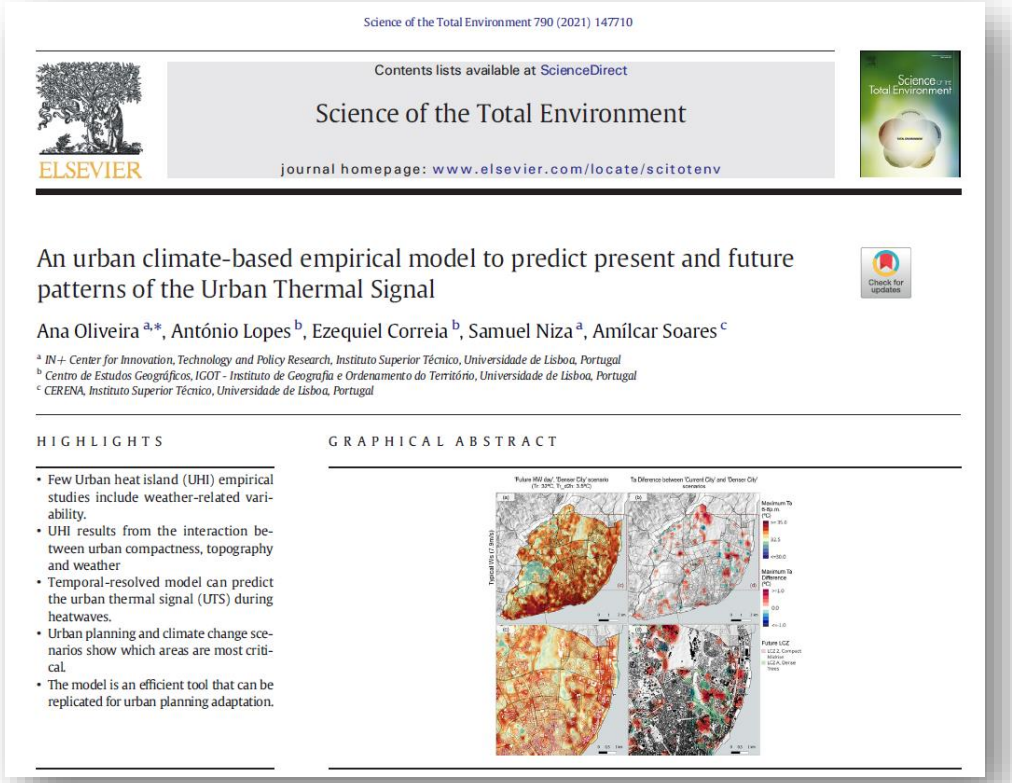
Temp ºC

- 32.8 - 33.5
- 33.6 - 34.0
- 34.1 - 34.5
- 34.6 - 35.0
- 35.1 - 35.5
- 35.6 - 36.0
- 36.1 - 36.6
- 36.7 - 37.2
- 37.3 - 37.9
- 38.0 - 39.5





IPCC - RCP 8.5 – Regional projections



Science of the Total Environment 790 (2021) 147710

Contents lists available at ScienceDirect

Science of the Total Environment

journal homepage: www.elsevier.com/locate/scitotenv

ELSEVIER

An urban climate-based empirical model to predict present and future patterns of the Urban Thermal Signal

Ana Oliveira [a,*], António Lopes [b], Ezequiel Correia [b], Samuel Niza [a], Amílcar Soares [c]

[a] IN+ Center for Innovation, Technology and Policy Research, Instituto Superior Técnico, Universidade de Lisboa, Portugal
[b] Centro de Estudos Geográficos, IGOT - Instituto de Geografia e Ordenamento do Território, Universidade de Lisboa, Portugal
[c] CERENA, Instituto Superior Técnico, Universidade de Lisboa, Portugal

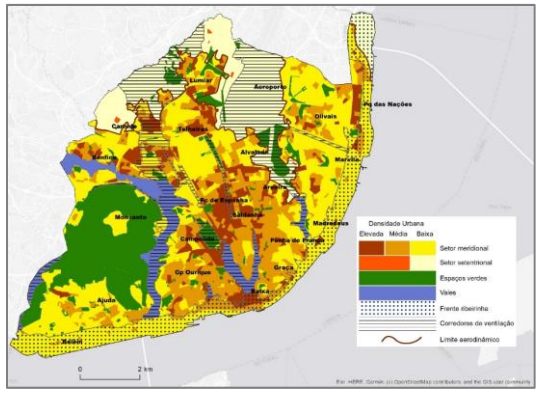
HIGHLIGHTS

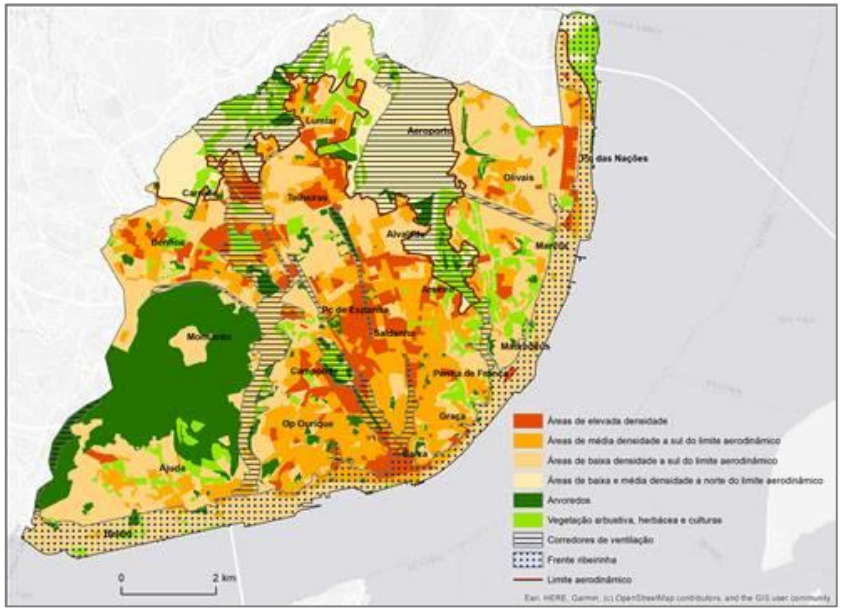
- Few Urban heat island (UHI) empirical studies include weather-related variability.
- UHI results from the interaction between urban compactness, topography and weather
- Temporal-resolved model can predict the urban thermal signal (UTS) during heatwaves.
- Urban planning and climate change scenarios show which areas are most critical.
- The model is an efficient tool that can be replicated for urban planning adaptation.

GRAPHICAL ABSTRACT

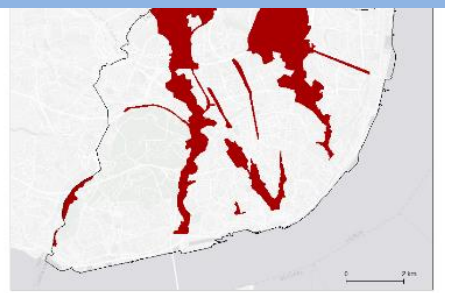
New Guidelines for Urban Planning 2020 proposal |considering urban climate

9 Climatopes | **9 areas** with climatic guidelines not necessarily the same | about **34 measures**
3 examples



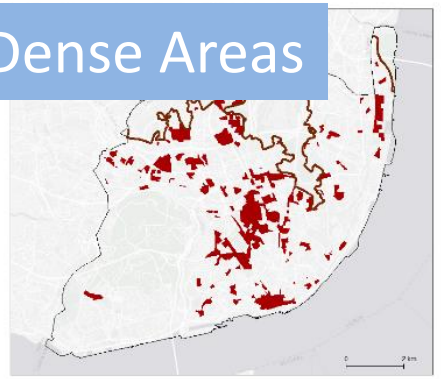


Ventilation Paths



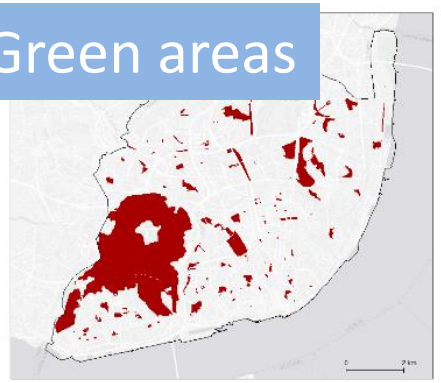
- To maintain N/S Ventilation Paths (VP)
- To maintain small VP interconnections
- To reduce Z_0 (roughness length) < 0.7 m

Dense Areas



- To prevent high density (H/W <1) in dense built areas.
- To prevent long alignments of buildings perpendicular to the predominant wind (N), in new neibourghoods.
- New materials with appropriate thermal conductivity and high albedo.
- Green and white roofs, white previous surfaces , etc.

Green areas



- To increase spaces that contributes to human bioclimatic conditions
- Cooling urban spaces (shading and evapotranspiration
- To promote biodiversity
- To promote connections between green spaces and ventilation paths.

Recent advances in urban climate and applications

Urban Climate 43 (2022) 101168

Contents lists available at ScienceDirect

Urban Climate

journal homepage: www.elsevier.com/locate/uclim

Assessing urban heat island effects through local weather types in Lisbon's Metropolitan Area using big data from the Copernicus service

Cláudia Reis [a,*], António Lopes [a,b], A. Santos Nouri [c]

[a] Universidade de Lisboa, Institute of Geography and Spatial Planning (IGOT), Centre of Geographical Studies, Rua Branca Edmée Marques, Cidade Universitária, 1600-276 Lisboa, Portugal
[b] Associated Laboratory Terra, Lisboa, Portugal
[c] Department of Interior Architecture and Environmental Design, Faculty of Art, Design and Architecture, Bilkent University, Bilkent, Turkey

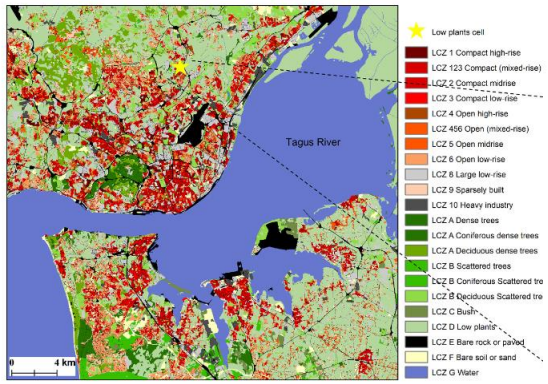
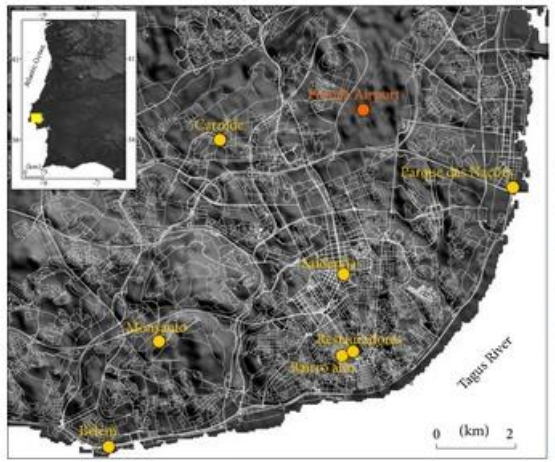


Fig. 4. LMA's updated LCZ (Oliveira et al., 2020b) and location



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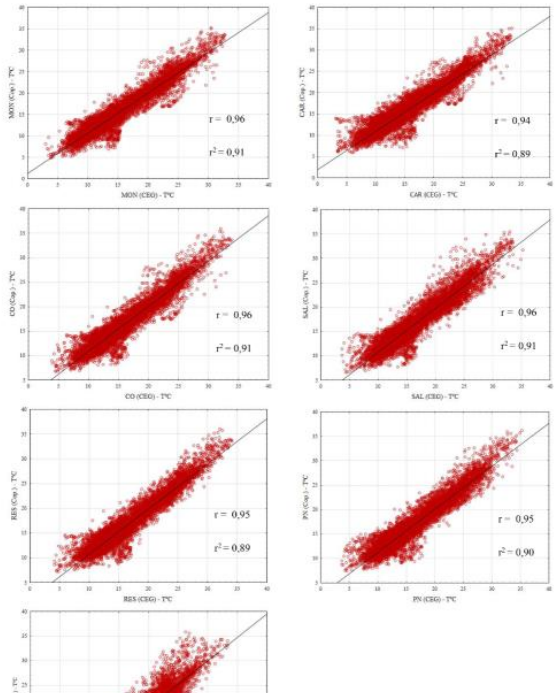

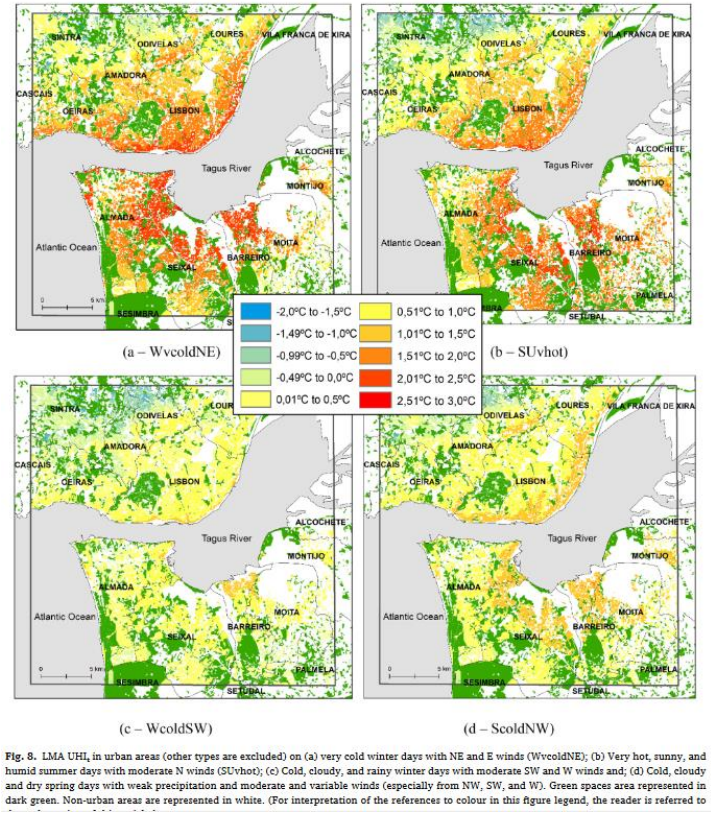

Fig. 8. LMA UHI, in urban areas (other types are excluded) on (a) very cold winter days with NE and E winds (WvcoldNE); (b) Very hot, sunny, and humid summer days with moderate N winds (SUvhot); (c) Cold, cloudy, and rainy winter days with moderate SW and W winds and; (d) Cold, cloudy and dry spring days with weak precipitation and moderate and variable winds (especially from NW, SW, and W). Green spaces area represented in dark green. Non-urban areas are represented in white. (For interpretation of the references to colour in this figure legend, the reader is referred to

Recent advances in urban climate and applications (and there is more to come)

Weather and Climate Extremes 36 (2022) 100455

Contents lists available at ScienceDirect

Weather and Climate Extremes

journal homepage: www.elsevier.com/locate/wace

Excess Heat Factor climatology, trends, and exposure across European Functional Urban Areas

Ana Oliveira [a,d], António Lopes [b,e,*], Amílcar Soares [c]

[a] IN+ Center for Innovation, Technology and Policy Research, Instituto Superior Técnico, Universidade de Lisboa, Portugal
[b] Centre of Geographical Studies, Institute of Geography and Spatial Planning, University of Lisbon, Portugal
[c] CERENA, Instituto Superior Técnico, Universidade de Lisboa, Portugal
[d] CoLAB +ATLANTIC, Portugal
[e] Associated Laboratory Terra, Portugal

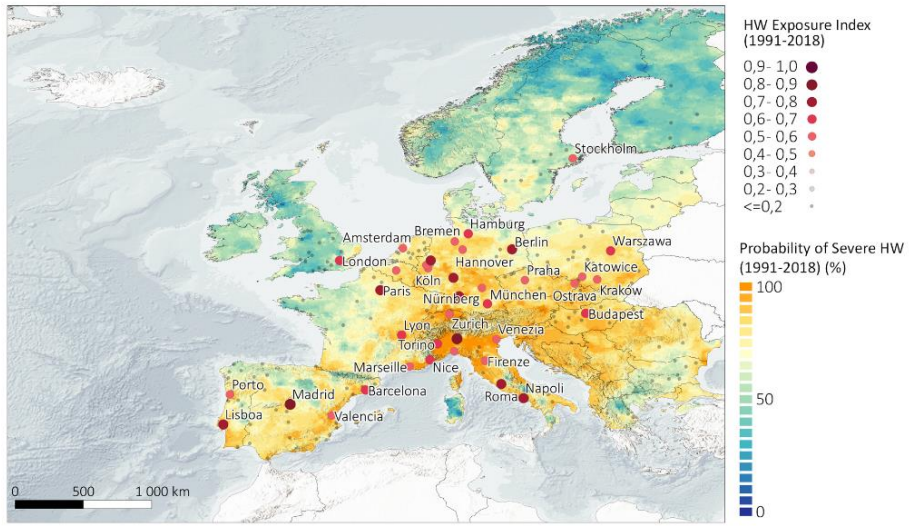

Fig. 6. Heatwave Exposure ($HW_{EXPOSURE}$) levels for the European Functional Urban Areas (FUAs) over Severe Heatwave Probability (HW_{PROB}) in the 1991–2018 period. Labelled FUAs have $HW_{EXPOSURE}$ levels equal or greater than 0.5 (0–1 normalized scale).

7th position - Lisbon

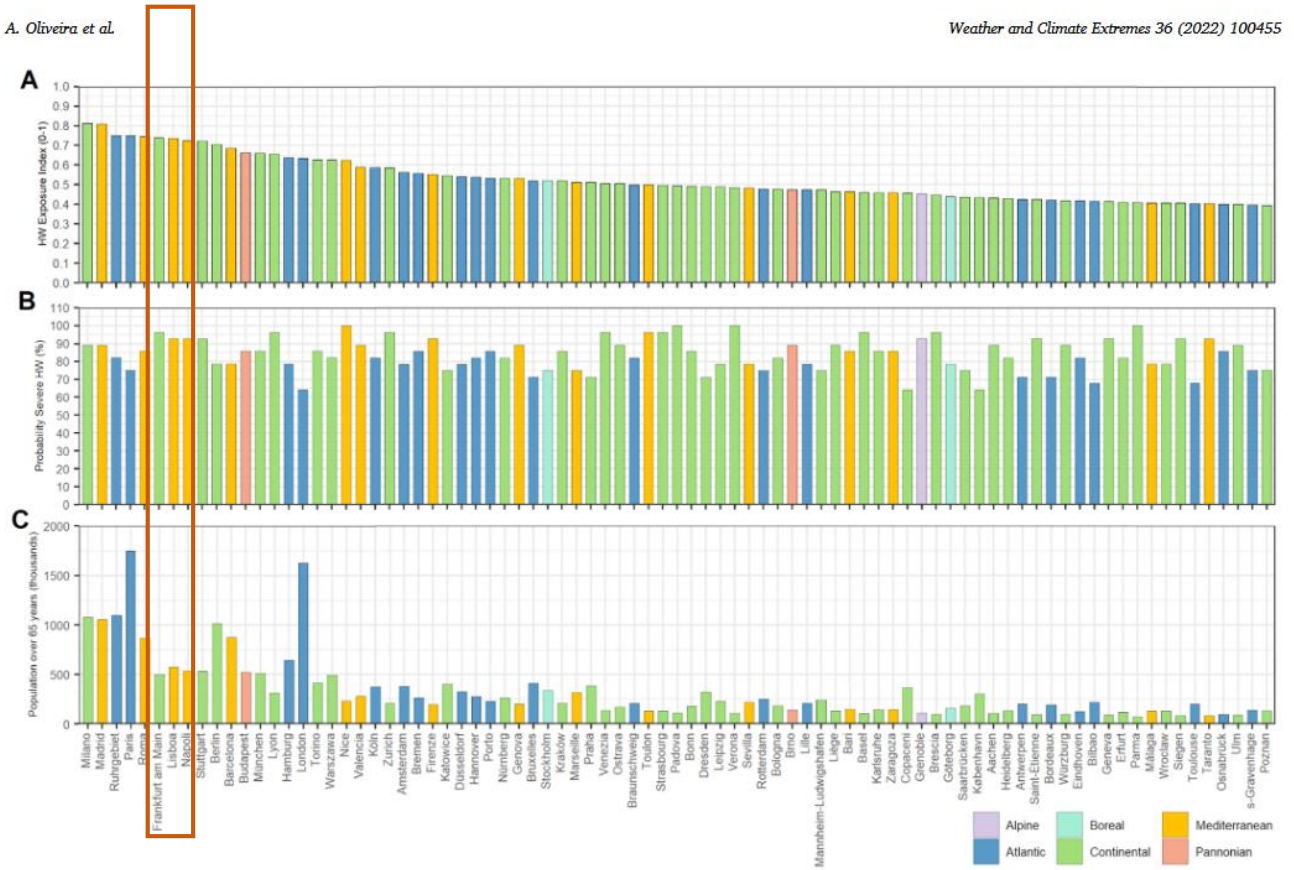

Fig. 7. Ranking results of the (a) Heatwave Exposure ($HW_{EXPOSURE}$) levels for the European Functional Urban Areas (FUAs), together with (b) probability of Severe HW and (c) Number of people aged 65 or over (2008–2018 period).

Thank you for your attention

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Bridging Science and Public Policies

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