INSTITUTO NACIONAL DE ESTATÍSTICA
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DERIVING TERRITORIAL INDICATORS BASED ON THE INTEGRATION OF GEOSPATIAL AND STATISTICAL DATA

CHALLENGES AND OPPORTUNITIES

INÊS FONTES AND CÁTIA NUNES

scorus
Standing Committee on Regional and Urban Statistics

Conference 2016

29 June – 1 July

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Overview

1 | Relevance of territorial information

2 | Production of new territorial indicators based on the integration of geospatial and statistical data

3 | Challenges and opportunities

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Relevance of Territorial Information

Territorial information

Key aspect to disentangle the conceptual and spatial complexity of cross-cutting issues that have been put forward in the European and global agenda

Smart , sustainable and inclusive growth

Sustainable Development Goals

Well-being and Quality of life

Growing demand

does not derive only from the need to provide greater spatial breakdown

but also

from the need to have indicators that are able to grasp territory-based dimensions associated to well-being and quality of life monitoring, namely accessibility to services to environmental sustainability, and to climate change and spatial planning

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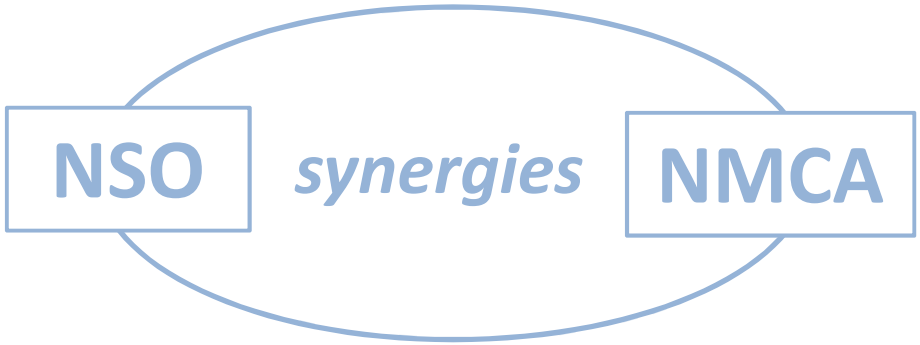
Relevance of Territorial Information

Challenges for NSO

Specific and increasing needs for statistical territorial based information

relevant for…

To assess, monitor, evaluate results of strategies, targets and public policies

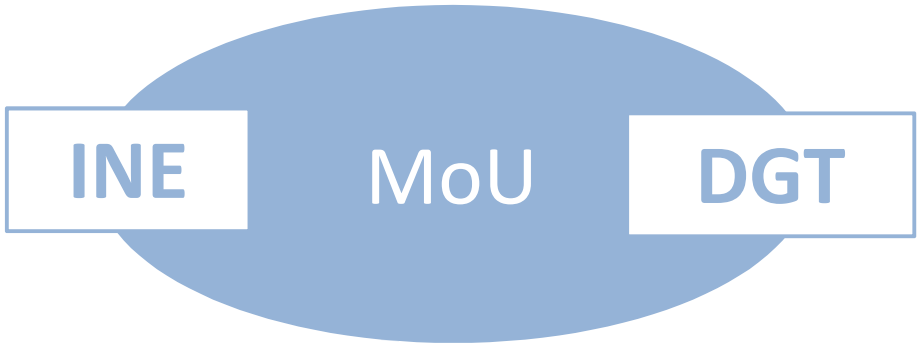


Relevance of Territorial Information

Statistics Portugal's (INE) medium-term strategy

the need to promote a greater interoperability between spatial and statistical data to support statistical production and to promote spatial and statistical integration to produce new indicators

An important step within the scope of this strategy was recently achieved through the signing of a Memorandum of Understanding (MoU) between Statistics Portugal and the Directorate-General for Territory (DGT)



RELEVANCE OF TERRITORIAL INFORMATION

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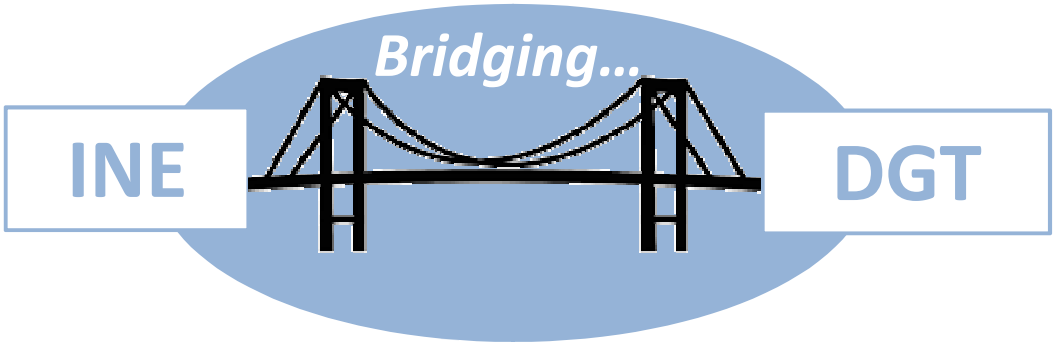
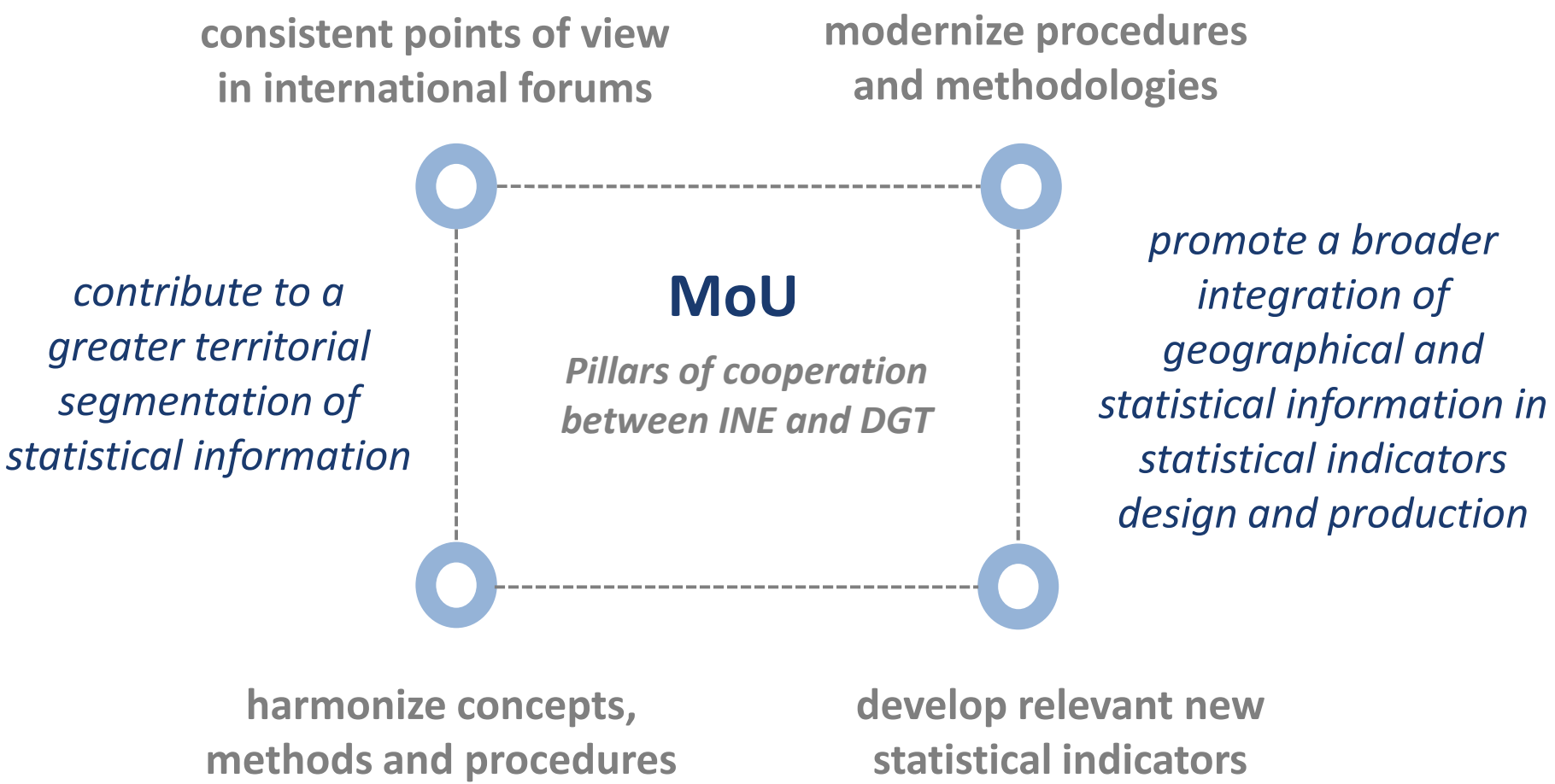


RELEVANCE OF TERRITORIAL INFORMATION



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Territorial indicators based on the integration of geospatial and statistical data

Main Methodological Approaches

1

Extract Areas

Proportion of protected areas

2

Spatial Analysis

Territorial coverage of broadband internet access

3

Spatial Modelling

Climate statistics

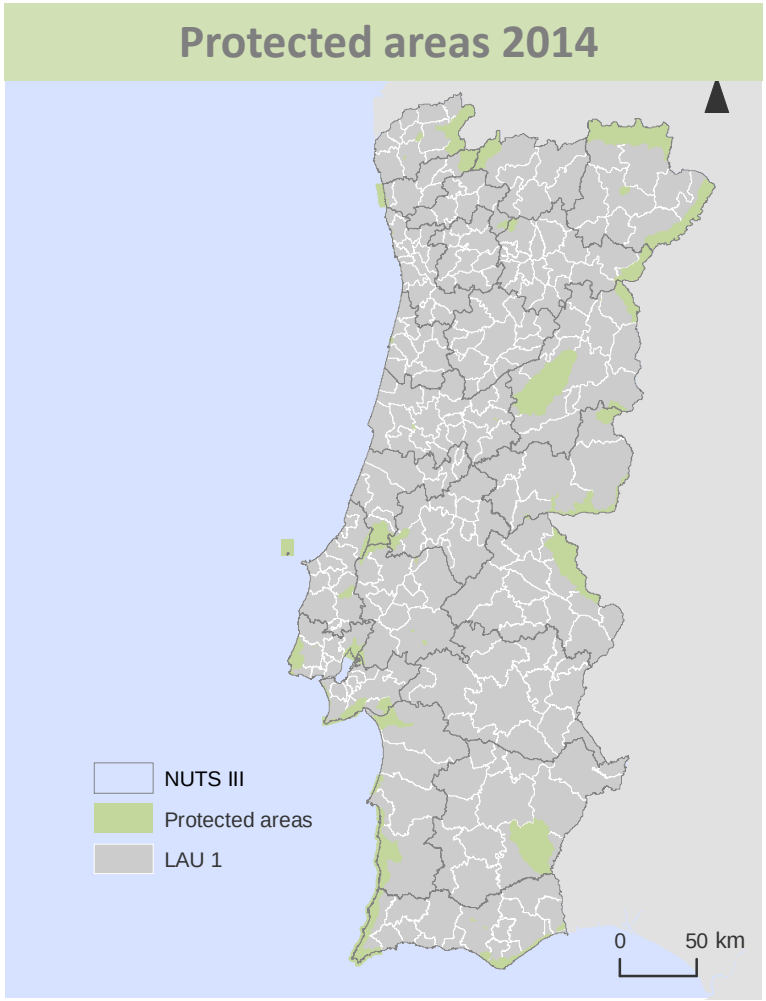
4

Network Analysis

Potential accessibility indicators to schools

EXTRACT AREAS

Proportion of protected areas at LAU 1 and NUTS III



Resulted from the need to disseminate annual protected areas:

LAU 1 → Regional Statistical Yearbooks

NUTS III → Input indicator for the environmental quality index - Regional Development Composite Index

Protected Areas (ICNF)

Institute for Nature Conservation and Forests

Union

ArcGIS tool

Administrative units (DGT)

Union tool allows the extraction of areas at different territorial units

EXTRACT AREAS

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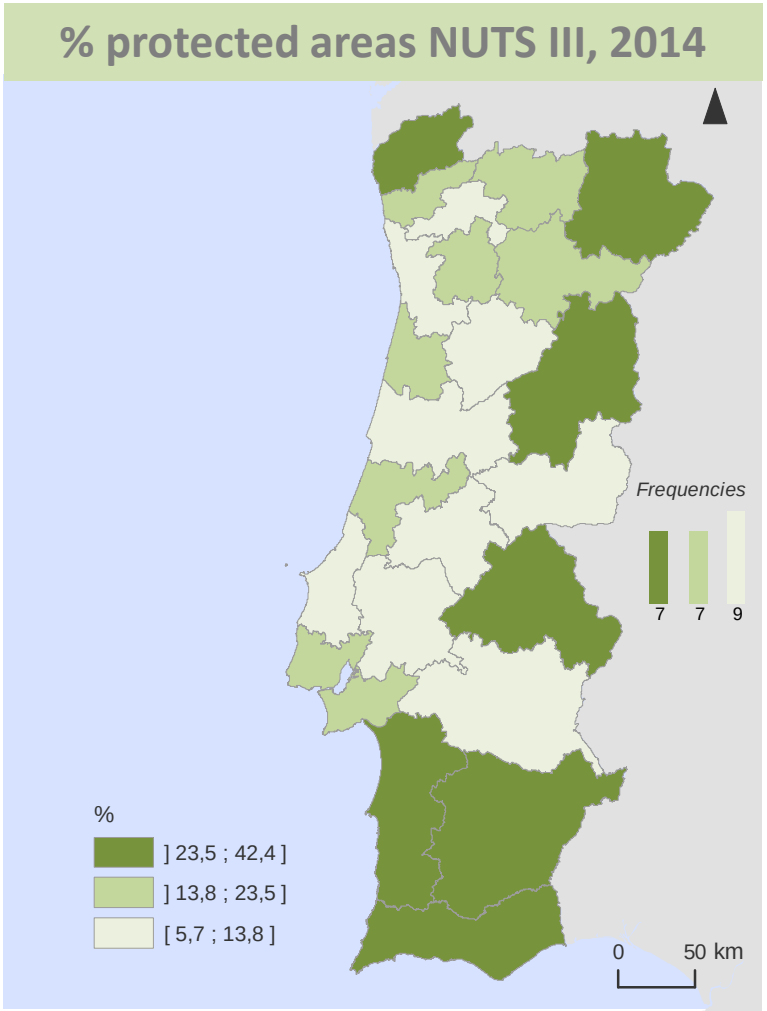

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Protected Areas (ICNF) ⟷ **Administrative units (DGT)**

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ArcGIS tool

Union tool allows the extraction of areas at different territorial units

Derived territorial indicator
$\frac{\text{Protected areas}}{\text{Total area of administrative unit}} \times 100$

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Spatial Analysis

Territorial coverage of broadband internet access

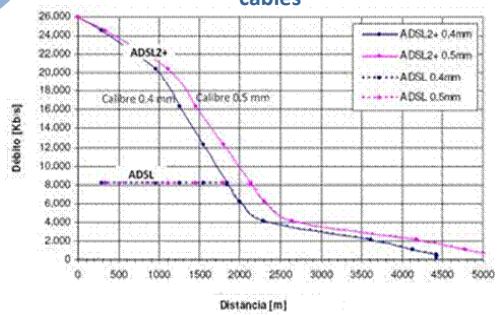
Relevant input indicator for the Regional Development Composite Index
Account for a technological service that is essential to assess regional competitiveness index

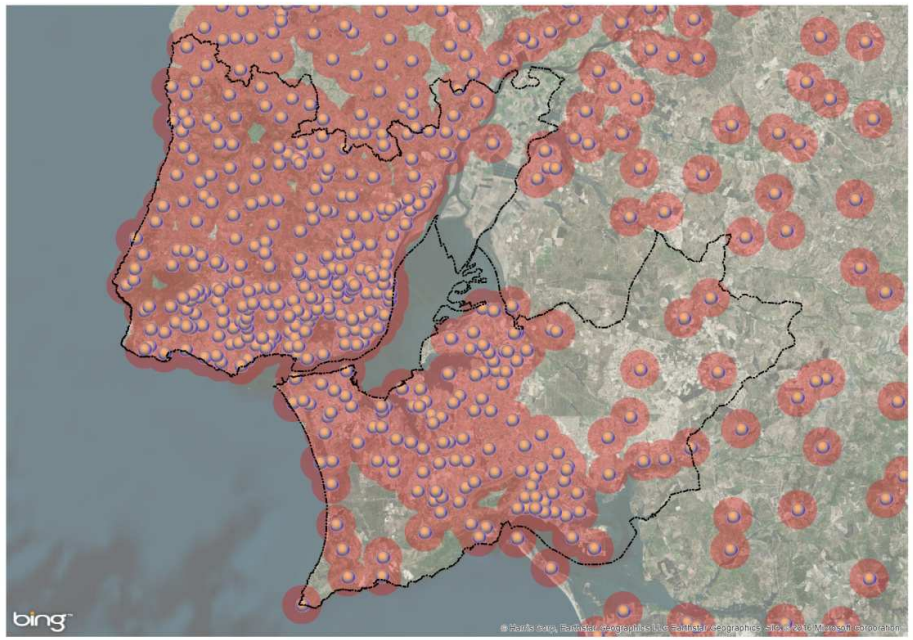
Distribution points of broadband internet (x, y)

areas of influence
2 500 m
buffer

Aggregate areas of influence

Theoretical curves that relate the speed (kb/s) according to the distance fr copper cables





NUTS III *shapefile*

Areas of influence at NUTS III (m^2)

Intersect
ArcGIS tool

Intersect tool allows layers combination

SPATIAL ANALYSIS

Territorial coverage of broadband internet access

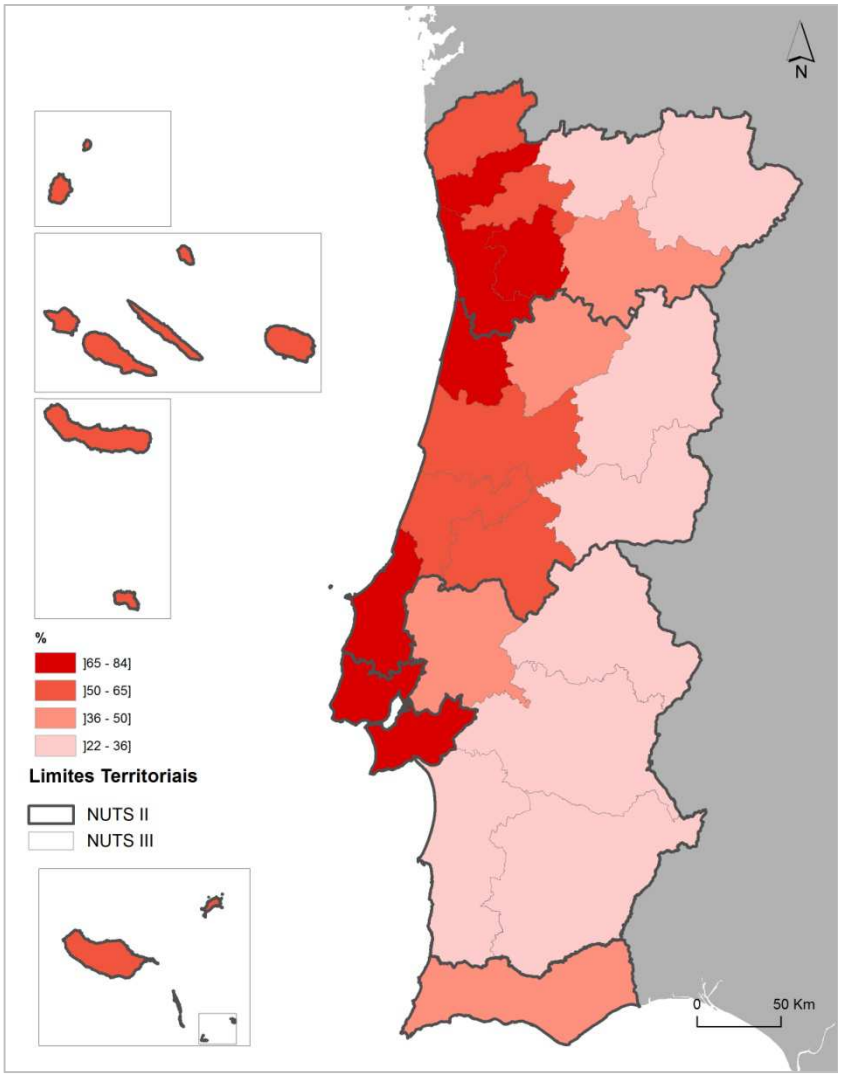
The combination of buffer zones with the Administrative Map of Portugal and the use of spatial analysis techniques

made it possible to obtain the potential broadband internet access associated to each NUTS III region

then derive a % of area covered with broadband internet access in the total area of each NUTS III region

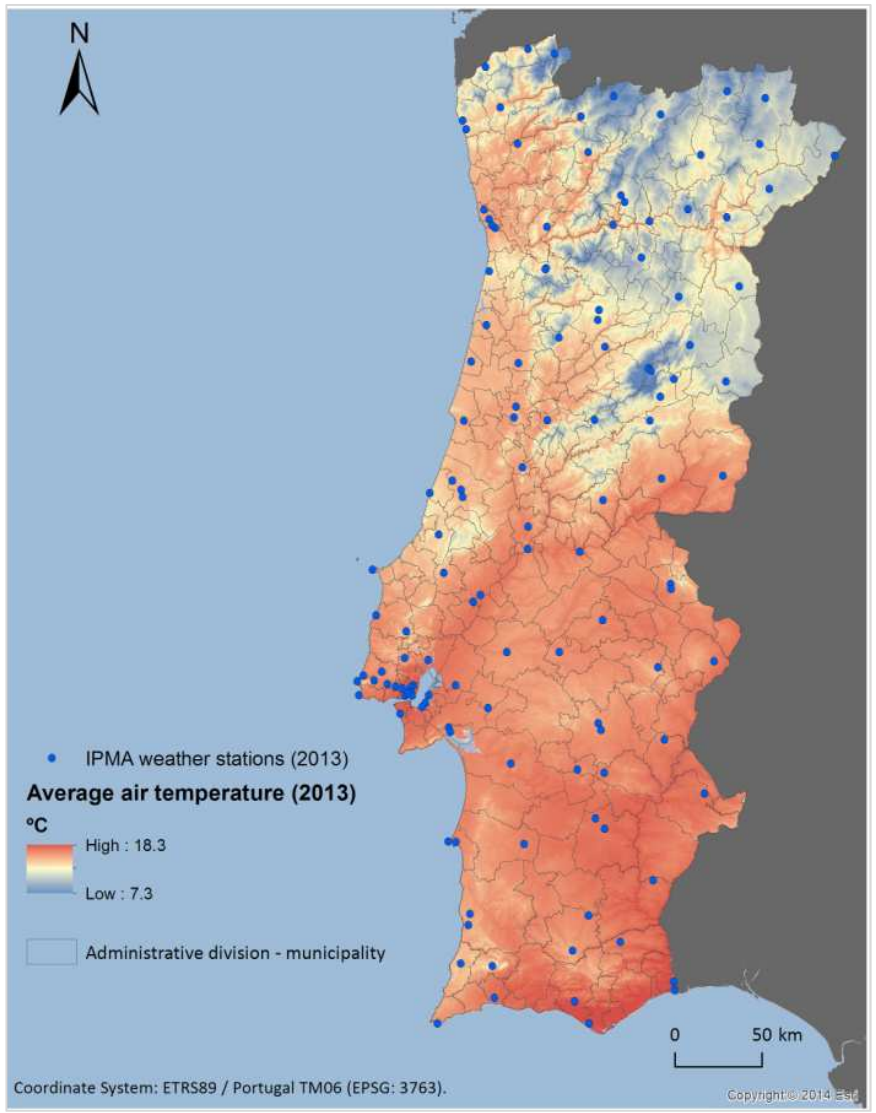
Derived territorial indicator

$$\frac{\text{Territorial coverage of broadband at NUTS III}}{\text{Total area of NUTS III}} \times 100$$



SPATIAL MODELLING

Climate statistics – annual air temperature

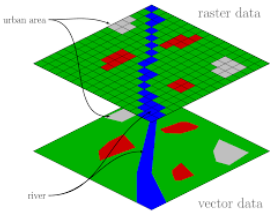


Resulted from the need to disseminate annually climate statistics at LAU 1 and NUTS III levels in the Regional Statistical Yearbooks

Climate variables are an important tool to monitor climate change at regional and local level.

weather stations (x, y)

Estimated surface (*raster*)



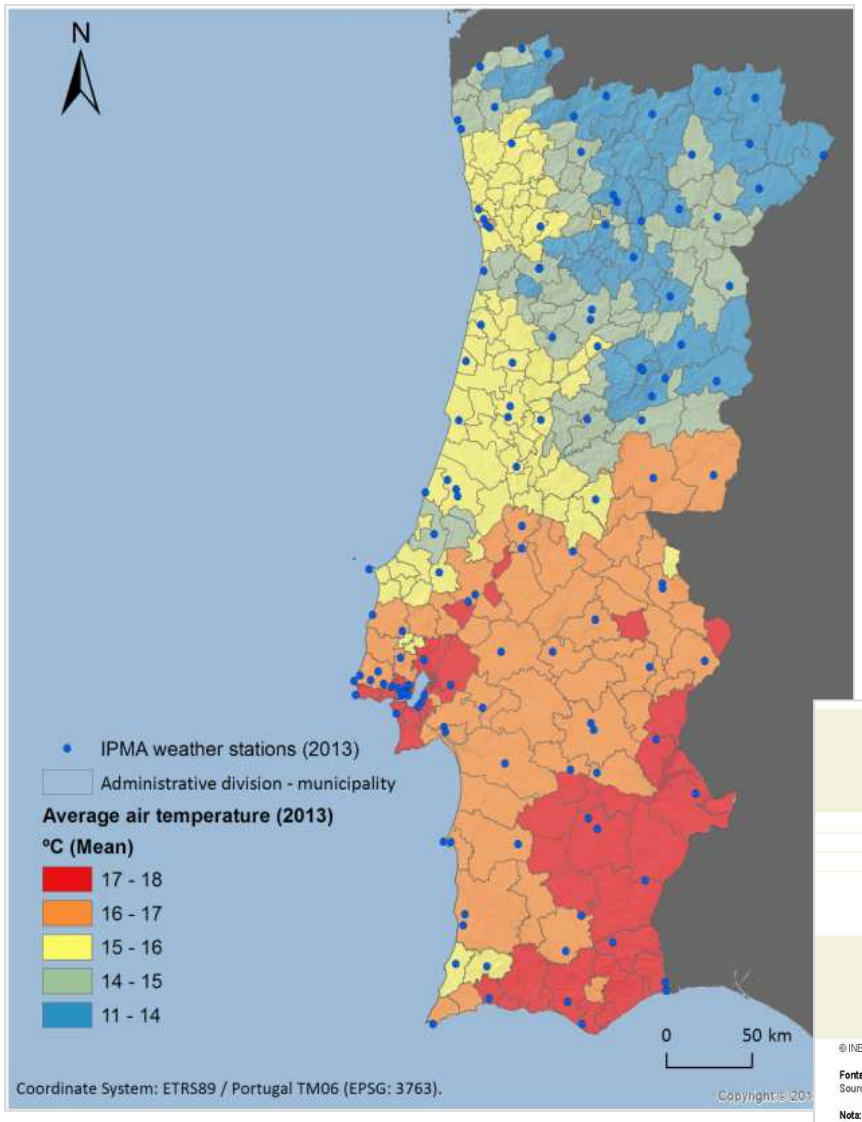
IPMA *Portuguese Sea and Atmosphere Institute*

Geostatistics interpolating *ordinary kriging*

Kriging assumes that the distance or direction between points reflects a spatial correlation that can be used to explain variation in the surface

SPATIAL MODELLING

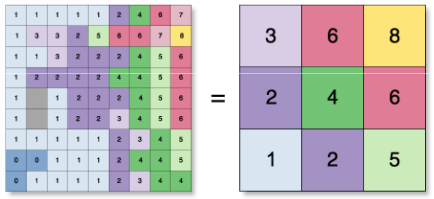
Climate statistics – annual air temperature



Estimated temperature (raster) ⟷ LAU 1 level (raster)

Aggregate

Mean



Regional Statistical Yearbooks

I.1.7

	Média da temperatura anual			Precipitação anual
	Média	Mínima	Máxima	
	ºC			mm
Continente	15,4	9,9	20,9	939,0
Norte	13,7	7,9	19,4	1 374,2
Minho-Lima	13,7	8,4	19,0	1 996,1
Arcos de Valdevez	13,3	8,0	18,5	x
Caminha	13,8	9,1	18,6	x
(...)				

	ºC			mm
	Mean	Minimum	Maximum	Annual precipitation
	Annual average temperature			

Fonte: Instituto Português do Mar e da Atmosfera, I.P.
Source: Portuguese Sea and Atmosphere Institute

Nota: Os valores da temperatura foram obtidos por interpolação dos valores médios observados na rede de estações operacionais do Instituto Português do Mar e da Atmosfera, por regressão multivariada com altitude e distância ao litoral, e krigagem residual. Os valores da precipitação foram obtidos por krigagem normal dos valores totais de precipitação observados na rede de estações operacionais do Instituto Português do Mar e da Atmosfera.
Note: The data on the temperature were obtained by interpolating the average values recorded by the operating meteorological stations of the Portuguese Sea and Atmosphere Institute network, through multivariate regression with altitude and distance to sea and residual kriging. The precipitation data were obtained by ordinary kriging of the total precipitation values observed at the operating meteorological stations of the Portuguese Sea and Atmosphere Institute network.

NETWORK ANALYSIS

Potential accessibility indicators to schools

AIM: to develop accessibility indicators to schools in order to assess the possibility of regular production within the National Statistical System

Experimental study based on a case-study approach

Four case study areas were selected based on the following principles: urban vs. rural areas, population density and distribution (intense vs. scattered)

- Urban and scattered
- Urban and densely populated
- Rural and intense/ structured
- Rural and scattered

- Pre-primary
- Basic – 1st cycle
- Secondary

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Network Analysis

Potential accessibility indicators to schools

Two types of potential time-distance accessibility indicators based on the weighted average of the minimum distances between each territorial unit and schools:

Territory – weighted by the area (m^2)

Population – weighted by the population from the specific age group

ArcGIS Network Analyst shortest path

Modes of transport	Type	Speed
On foot		3,5 km/h
By car	Highway	120 km/h
	Outside localities	90 km/h
	Inside localities	50 km/h
	Localities < 2 000 inhabitants	50 km/h
5 seconds off at intersections in urban areas		

Potential territorial accessibility

$$IATerrit_j^k = \sum_{i=1}^{n} \left[Min\,(Distance_{i \to j}) \times \left(\frac{Area_i}{Area_k} \right) \right]$$

Potential population accessibility

$$IAPop_j^k = \sum_{i=1}^{n} \left[Min\,(Distance_{i \to j}) \times \left(\frac{population_i}{population_k} \right) \right]$$

Where:

k – LAU 2

i – statistical subsection

j – level of education

j – school of level of education

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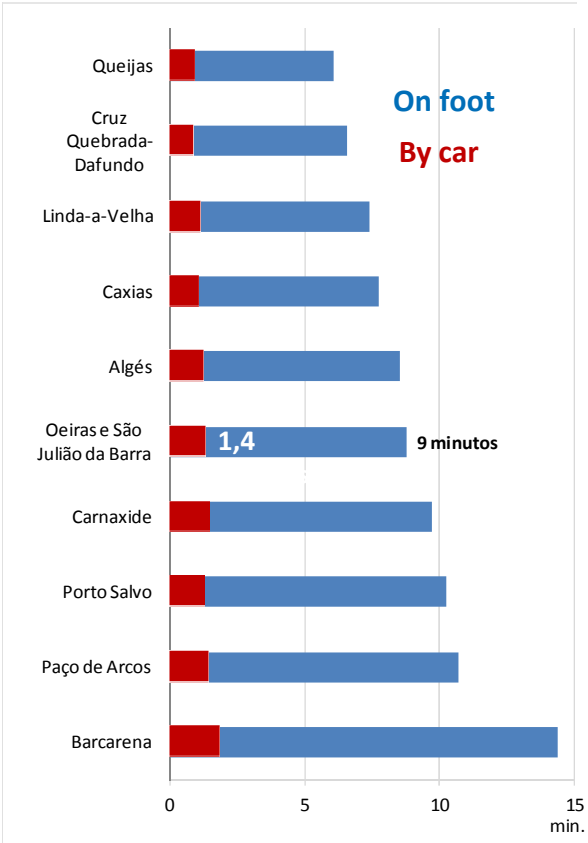

Oeiras municipality

Potential population accessibility to schools - basic

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Challenges and Opportunities

need to have coherent and integrated geospatial and statistical information, but also to comply with quality standards for statistical production

Four key aspects

1

metadata on input information

Earth observation data
Geographic data
Administrative data
Statistical data

2

metadata on operations and procedures

Accurate, consistent and validated methods on data analysis techniques – statistical and spatial

Euro SDMX Metadata Structure

GSBPM

ESS QAF

3

differentiated quality assurance

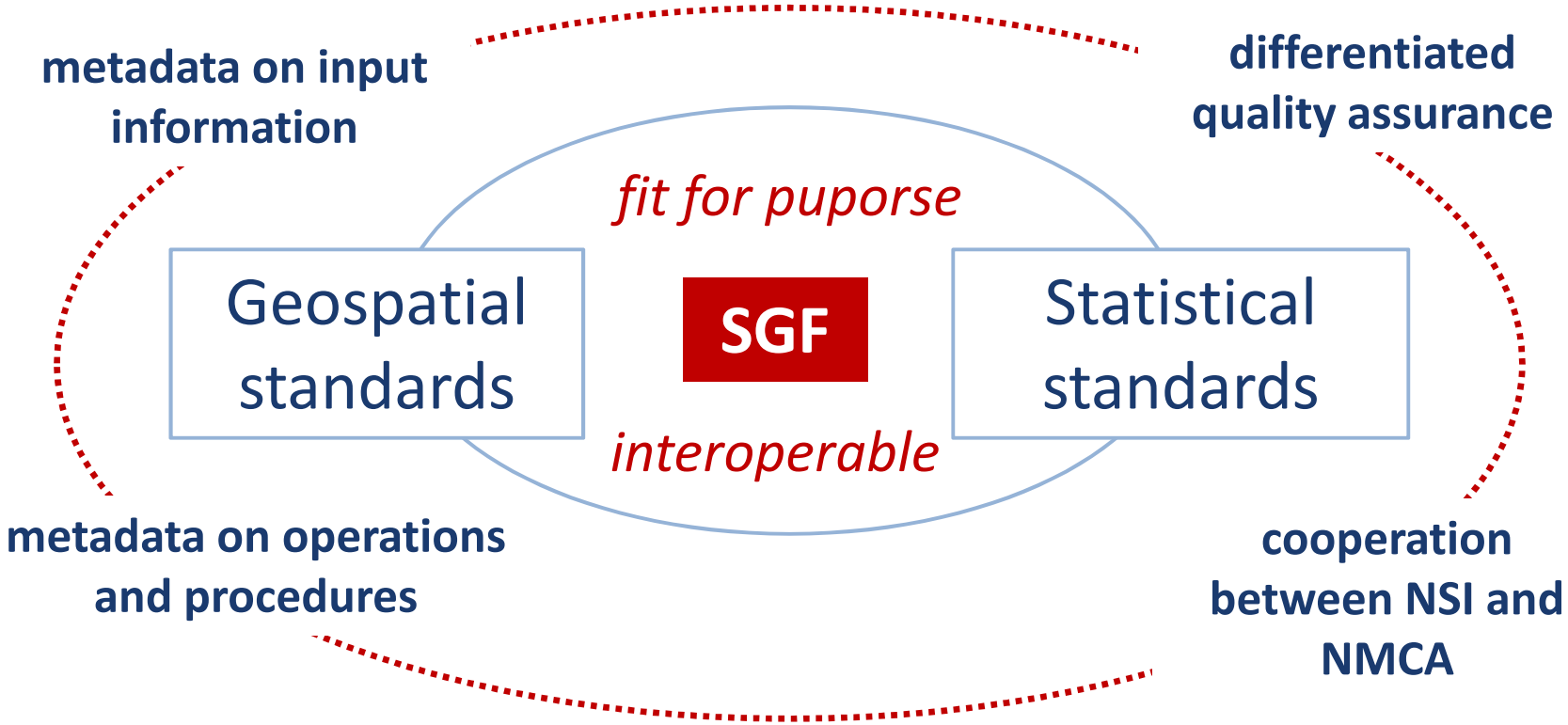
Comply with quality standards for statistical production
Multi-source statistics
Side-effects

4

cooperation between NSI and NMCA

CHALLENGES AND OPPORTUNITIES

need to have coherent and integrated geospatial and statistical information, but also to comply with quality standards for statistical production



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THANK YOU FOR YOUR ATTENTION

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