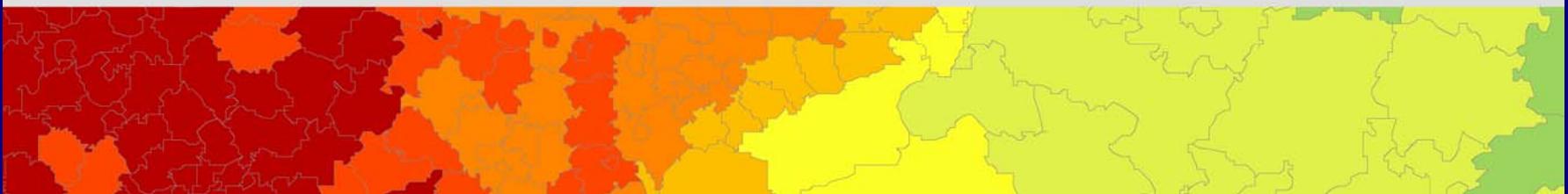




EUROPEAN SPATIAL PLANNING
OBSERVATION NETWORK



SOCIAL DATA AND THE MODIFIABLE AREAL UNIT PROBLEM (MAUP)

Claude GRASLAND

Professor of geography

University Paris 7 Denis Diderot

*CESSDA PPP Expert Workshop on Harmonisation Issues in
Comparative Social Surveys, Paris, April 3rd, 2008*

PLAN

- 1. An empirical view: “google wealth”**
- 2. A theoretical view: “spatial filters”**
- 3. A political view: ESPON 3.4.3**



1. “GOOGLE WEALTH”

Sources :

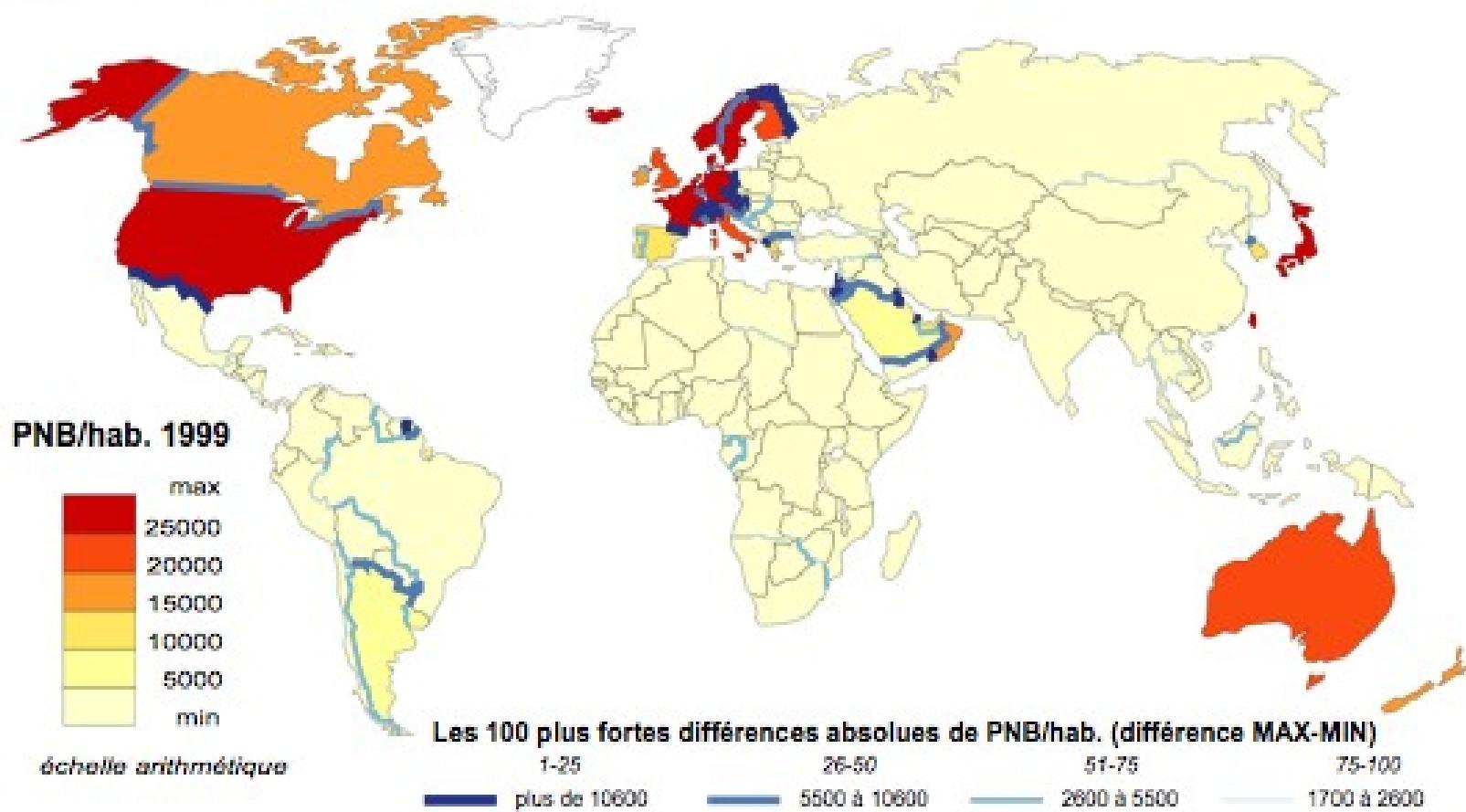
- C. Grasland, « borders » in Dictionnaire de la mondialisation (2007)
- ESPON 3.4.1 - Europe in the World (coord. RIATE, 2006)
- ESPON 3.4.3. - MAUP (coord. RIATE, 2006)
- EU Parliament Study (coord. Nordregio, 2007)
- Study on income in the Paris agglomeration (published in Le Goix & Saint-Julien, 2007)



1 : World Level

Where are the borders associated with highest ABSOLUTE differences of GNP/inh. ?

(a) Différences absolues

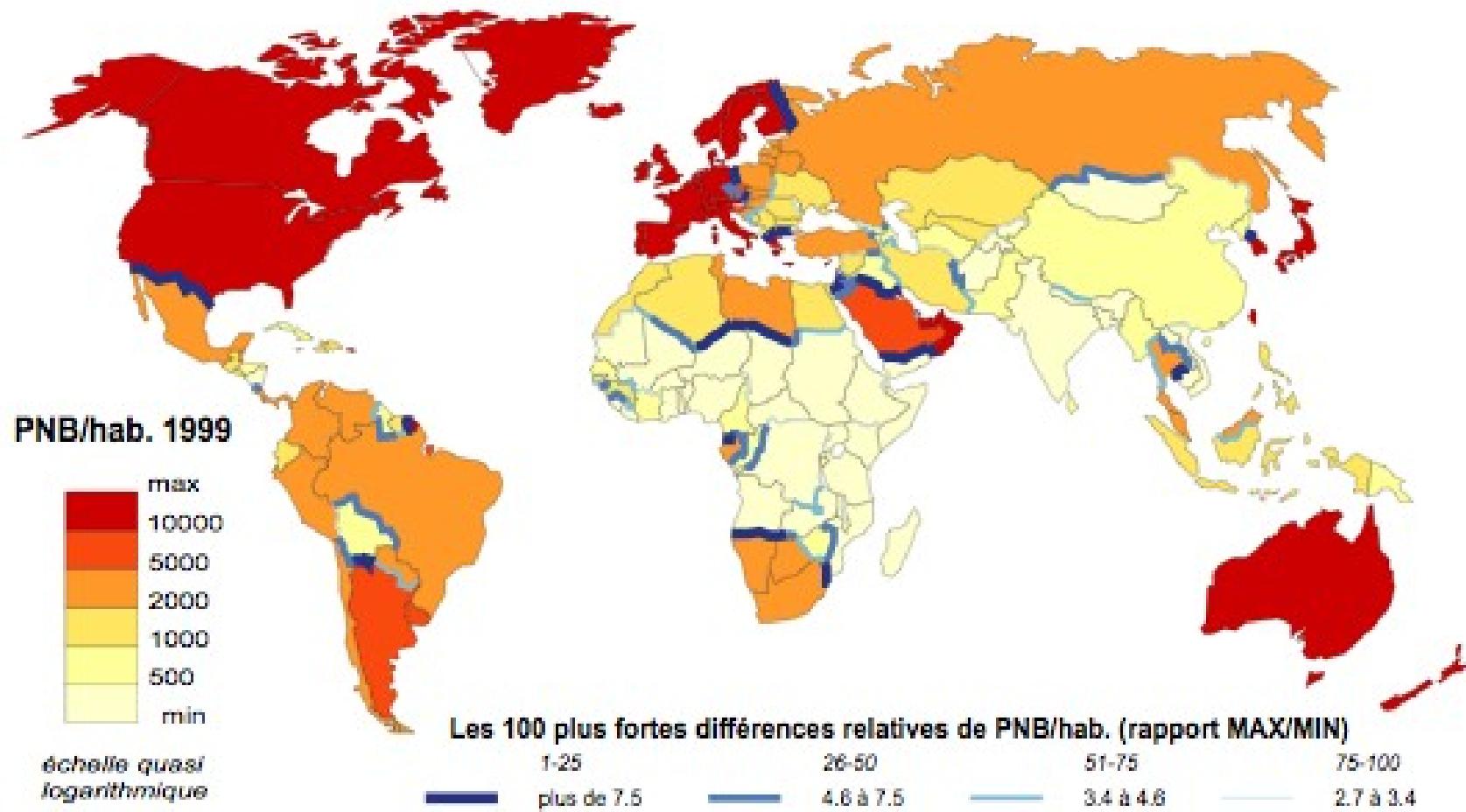


Where are the border associated with highest ABSOLUTE differences of GNP/inh. ?

rang des discontinuités	Pays le plus riche		Pays le plus pauvre		Différence absolue
	nom	PNB/hab.	nom	PNB/hab.	
1	Norvège	36000	Russie (Fed.)	2700	33300
2	United States	29100	Mexique	3700	25400
3	Allemagne	28300	Pologne	3600	24700
4	Autriche	27900	Slovaquie	3700	24200
5	Autriche	27900	Hongrie	4500	23400
6	Allemagne	28300	Rép. Tchétchène	5200	23100
7	Suisse	43100	Italie	20100	23000
8	Autriche	27900	Rép. Tchétchène	5200	22700
9	Finlande	24800	Russie (Fed.)	2700	22100
10	Koweit	20000	Irak	500	19500
11	Autriche	27900	Slovénie	9800	18100
12	Qatar	25000	Arabie Saoudite	7100	17900
13	Suisse	43100	France	26200	16900
14	Suisse	43100	Autriche	27900	15200
15	Israël	16200	Syrie	1100	15100
16	Israël	16200	Egypte	1200	15000
17	Suisse	43100	Allemagne	28300	14800
18	Oman	15000	Yemen, Rep.	300	14700
19	Israël	16200	Jordanie	1500	14700
20	Koweit	20000	Arabie Saoudite	7100	12900
21	Israël	16200	Liban	3400	12800
22	France	26200	Espagne	14500	11700
23	Norvège	36000	Finlande	24800	11200
24	Grece	11600	Albanie	800	10800
25	Guyane française	12000	Suriname	1300	10700

Where are the borders associated with highest RELATIVE differences of GNP/inh. ?

(b) Différences relatives



Where are the border associated with highest RELATIVE differences of GNP/inh. ?

rang des discontinuités	Pays le plus riche		Pays le plus pauvre		Diff' rence relative
	nom	PNB/hab.	nom	PNB/hab.	
1	Oman	15000	Yemen	270	55.6
2	Koweit	20000	Irak	500	40.0
3	Arabie Saoudite	7130	Yemen	270	26.4
4	Afrique du Sud	3220	Mozambique	140	23.0
5	Cor̄e du Sud	10550	Cor̄e du Nord	500	21.1
6	Gr̄ce	11620	Albanie	760	15.3
7	Israel	16180	Syrie	1120	14.4
8	Arabie Saoudite	7130	Irak	500	14.3
9	Israel	16180	Egypte	1200	13.5
10	Norv̄ge	36000	Russie (fed.)	2680	13.4
11	Argentine	8960	Guyana	800	11.2
12	Israel	16180	Jordanie	1520	10.6
13	Gr̄ce	11620	Mac̄doine (FYR)	1100	10.6
14	Libye	2000	Niger	200	10.0
15	Gr̄ce	11620	Bulgarie	1170	9.9
16	Finlande	24810	Russie (fed.)	2680	9.3
17	Argentine	8960	Bolivie	970	9.2
18	Thaïlande	2730	Cambodge	300	9.1
19	Guyenne Fr.	12000	Suriname	1320	9.1
20	Libye	2000	Tchad	230	8.7
21	Namibie	2110	Angola	260	8.1
22	Allemagne	28290	Pologne	3590	7.9
23	Etats-Unis	29060	Mexique	3700	7.9
24	Autriche	27900	Slovaquie	3680	7.6
25	Alḡrie	1500	Niger	200	7.5



2 : World region level

Maritim borders are important at this level (see. map of people died at the entry of Europe)



Source :

O. Clochard & P. Rekacewicz

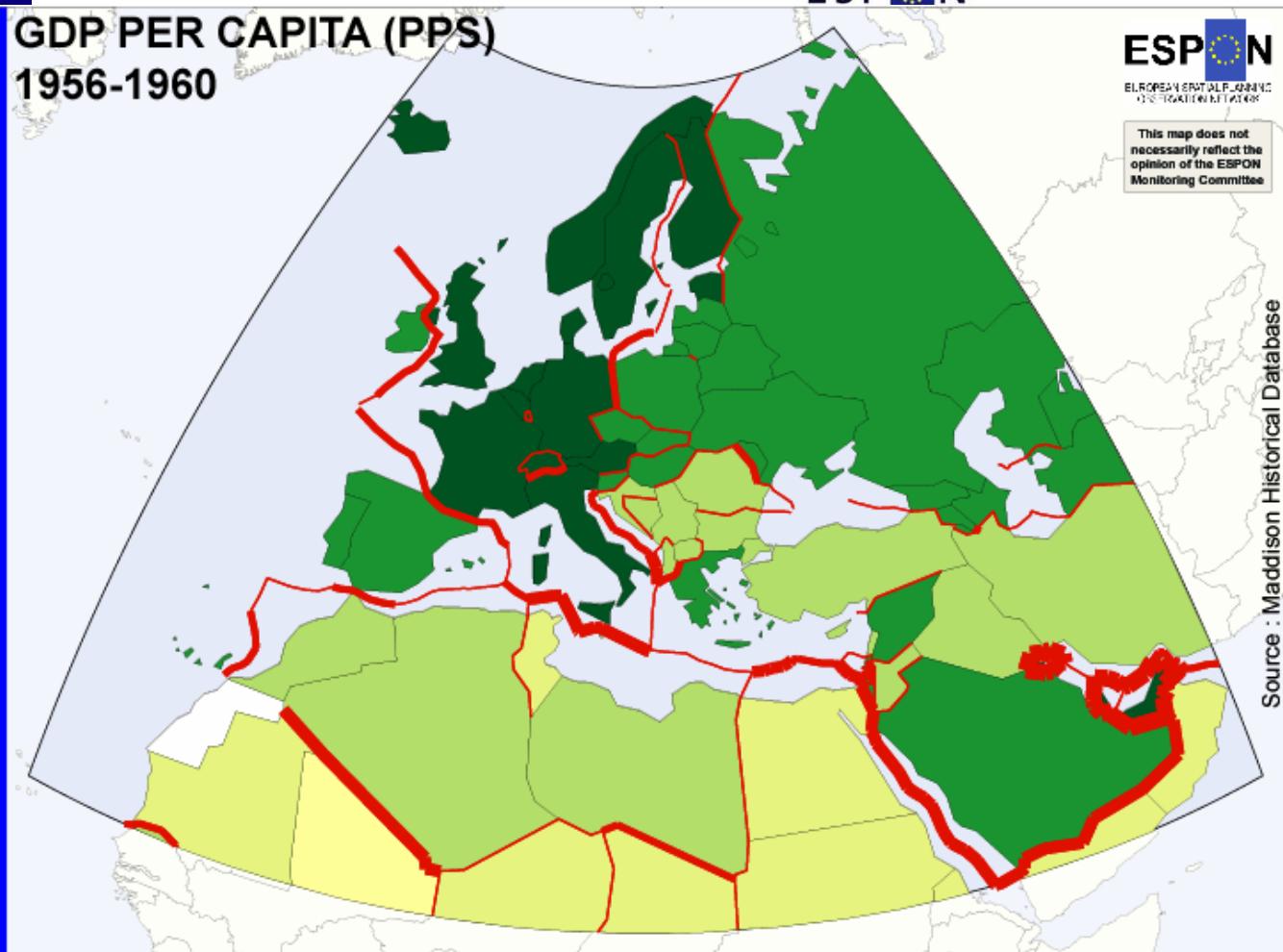
Le Monde Diplomatique

GDP PER CAPITA (PPS)

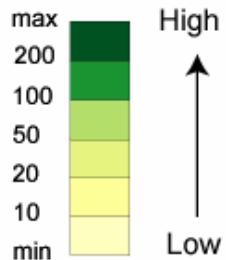
1956-1960

This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

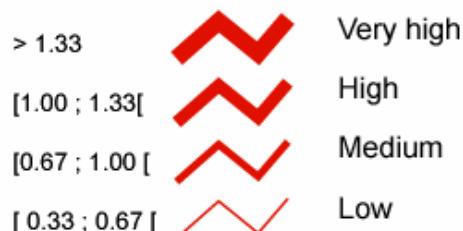
1958



Index 100 = World



DISCONTINUITIES (relative)

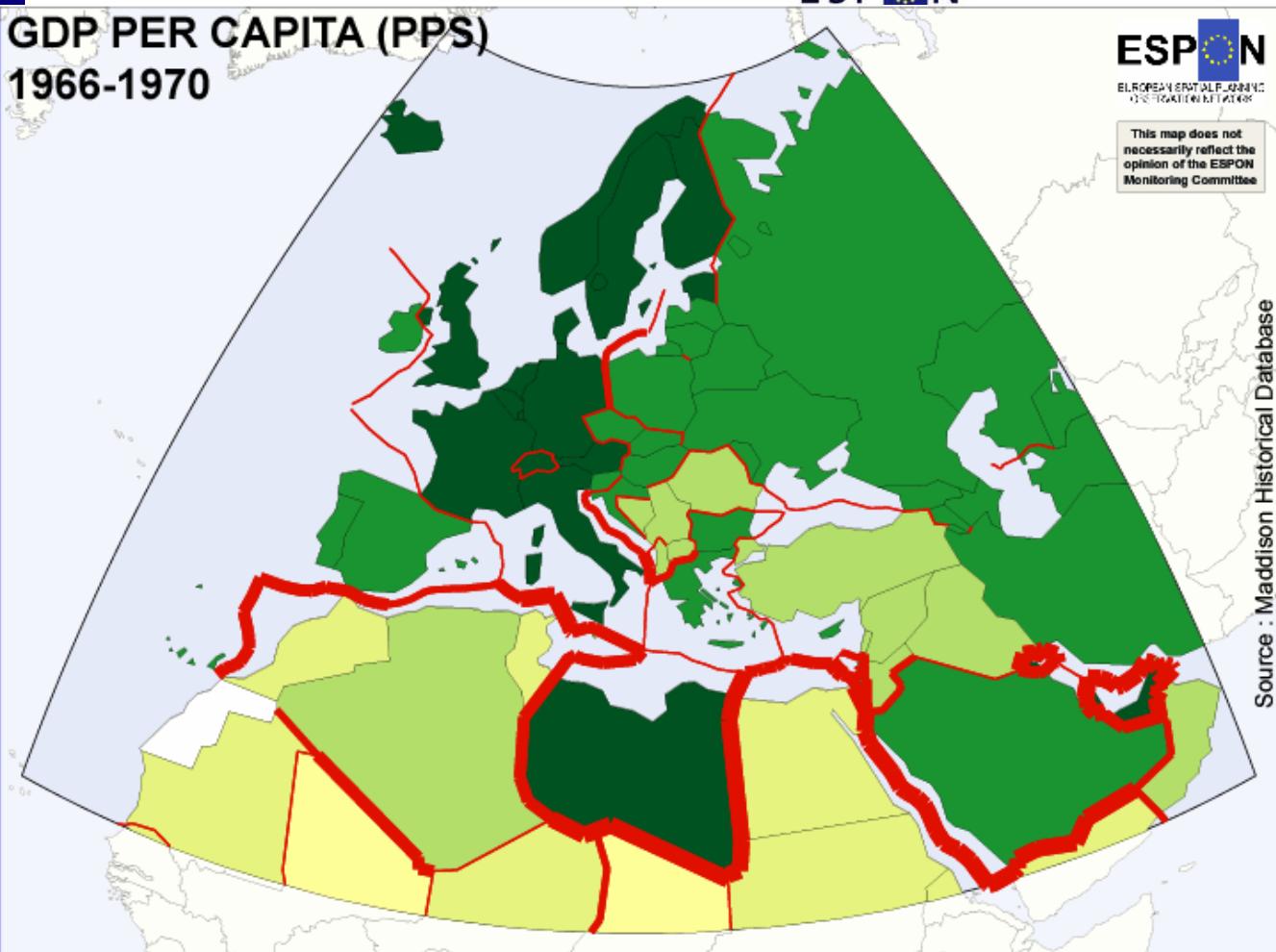


GDP PER CAPITA (PPS) 1966-1970

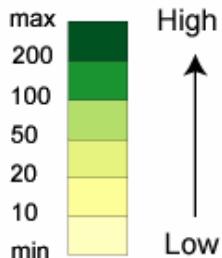
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

1968

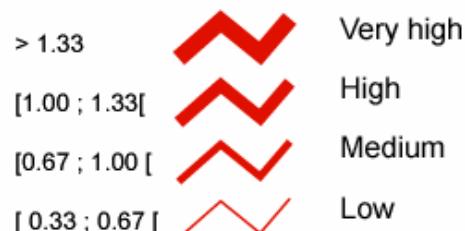
Source : Maddison Historical Database



Index 100 = World



DISCONTINUITIES (relative)



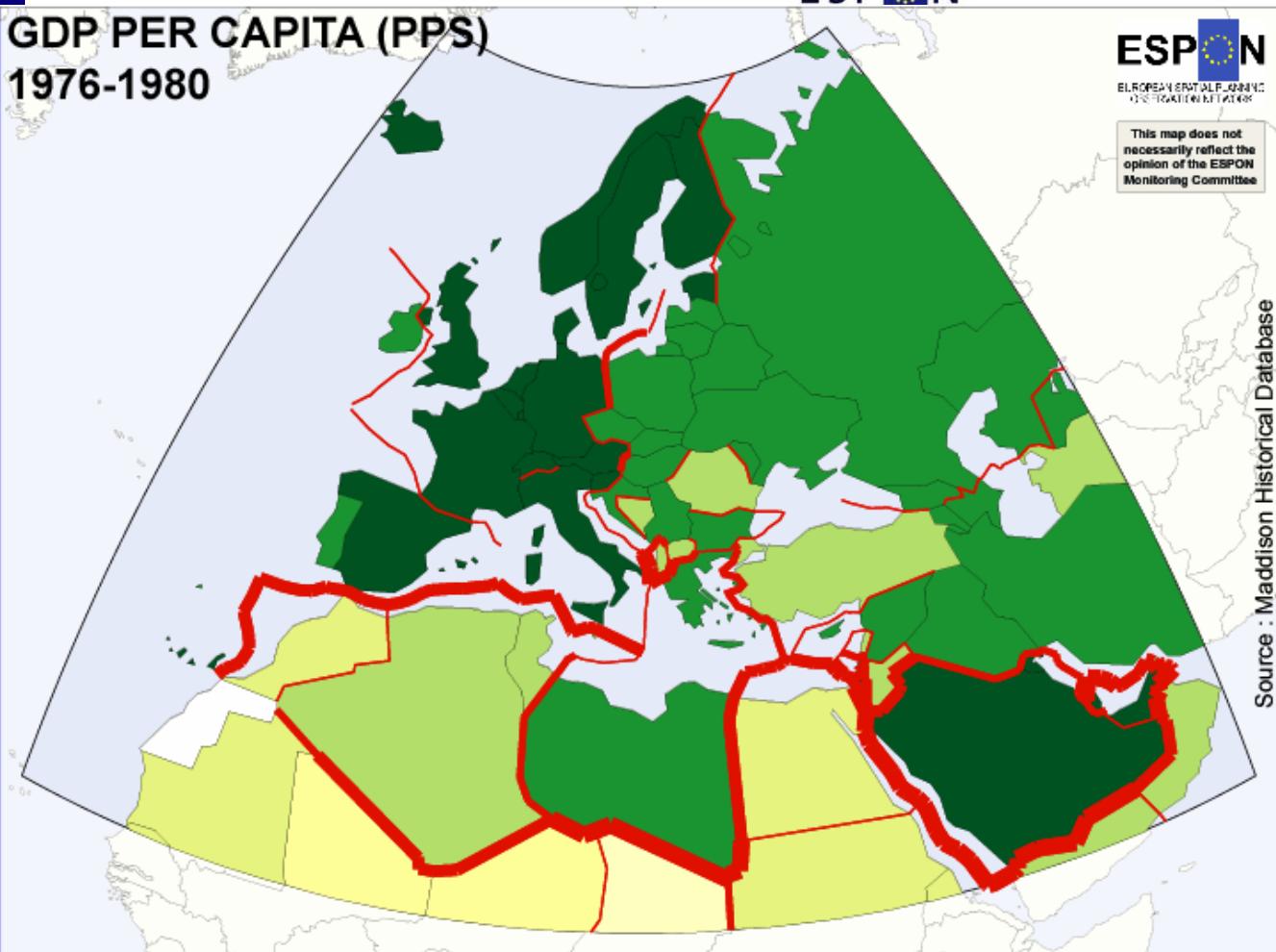
GDP PER CAPITA (PPS)

1976-1980

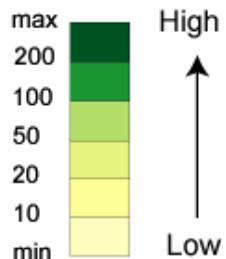
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

1978

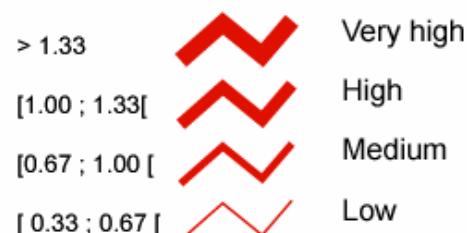
Source : Maddison Historical Database



Index 100 = World



DISCONTINUITIES (relative)



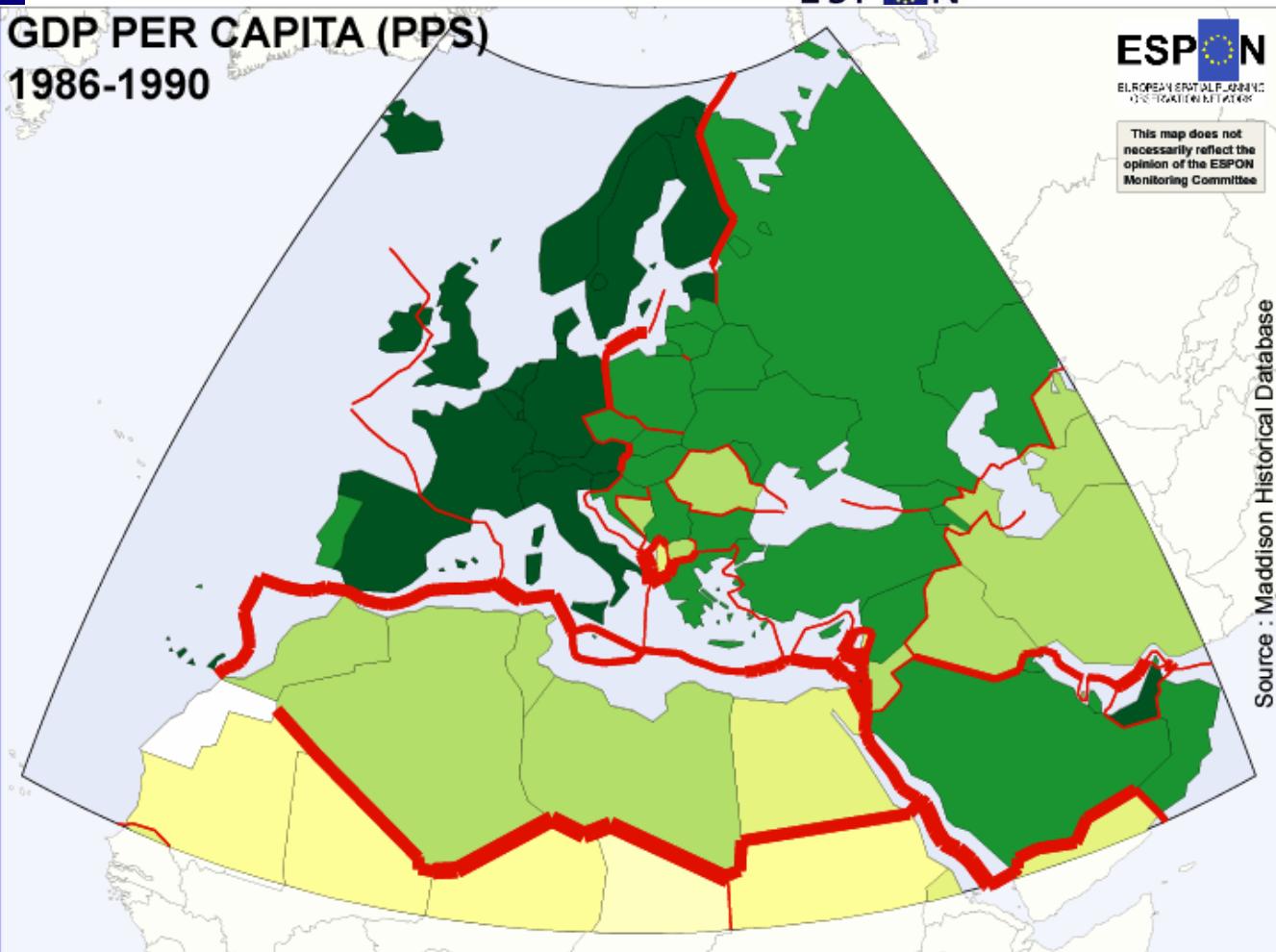
GDP PER CAPITA (PPS)

1986-1990

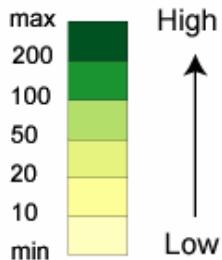
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

1988

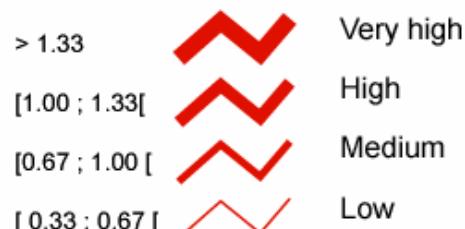
Source : Maddison Historical Database



Index 100 = World



DISCONTINUITIES (relative)

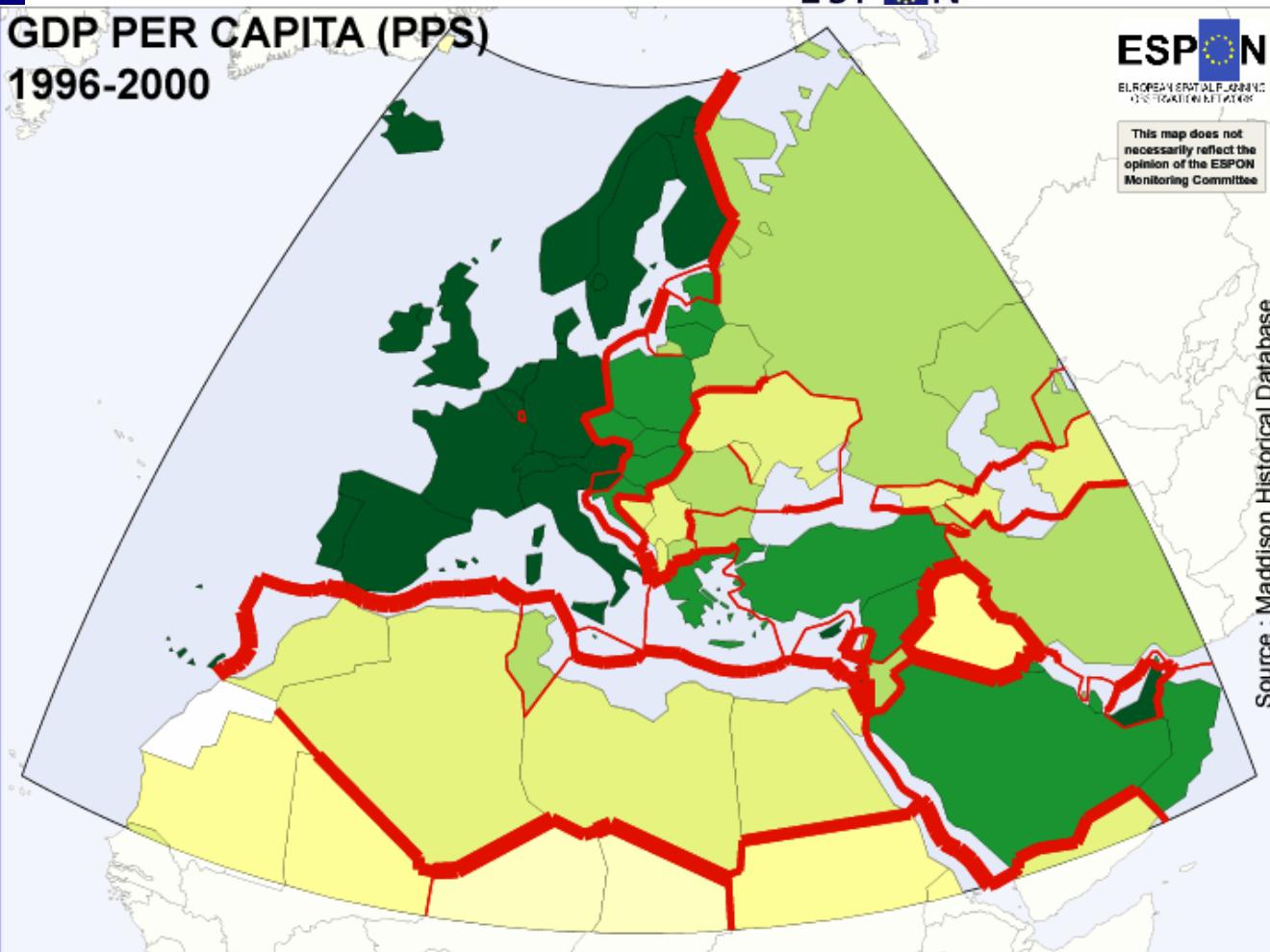


GDP PER CAPITA (PPS) 1996-2000

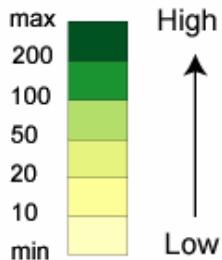
This map does not necessarily reflect the opinion of the ESPON Monitoring Committee

1998

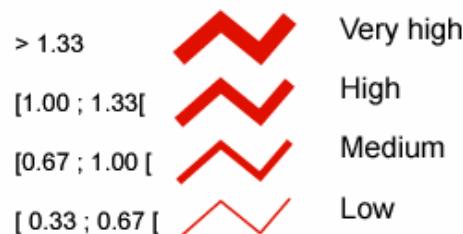
Source : Maddison Historical Database



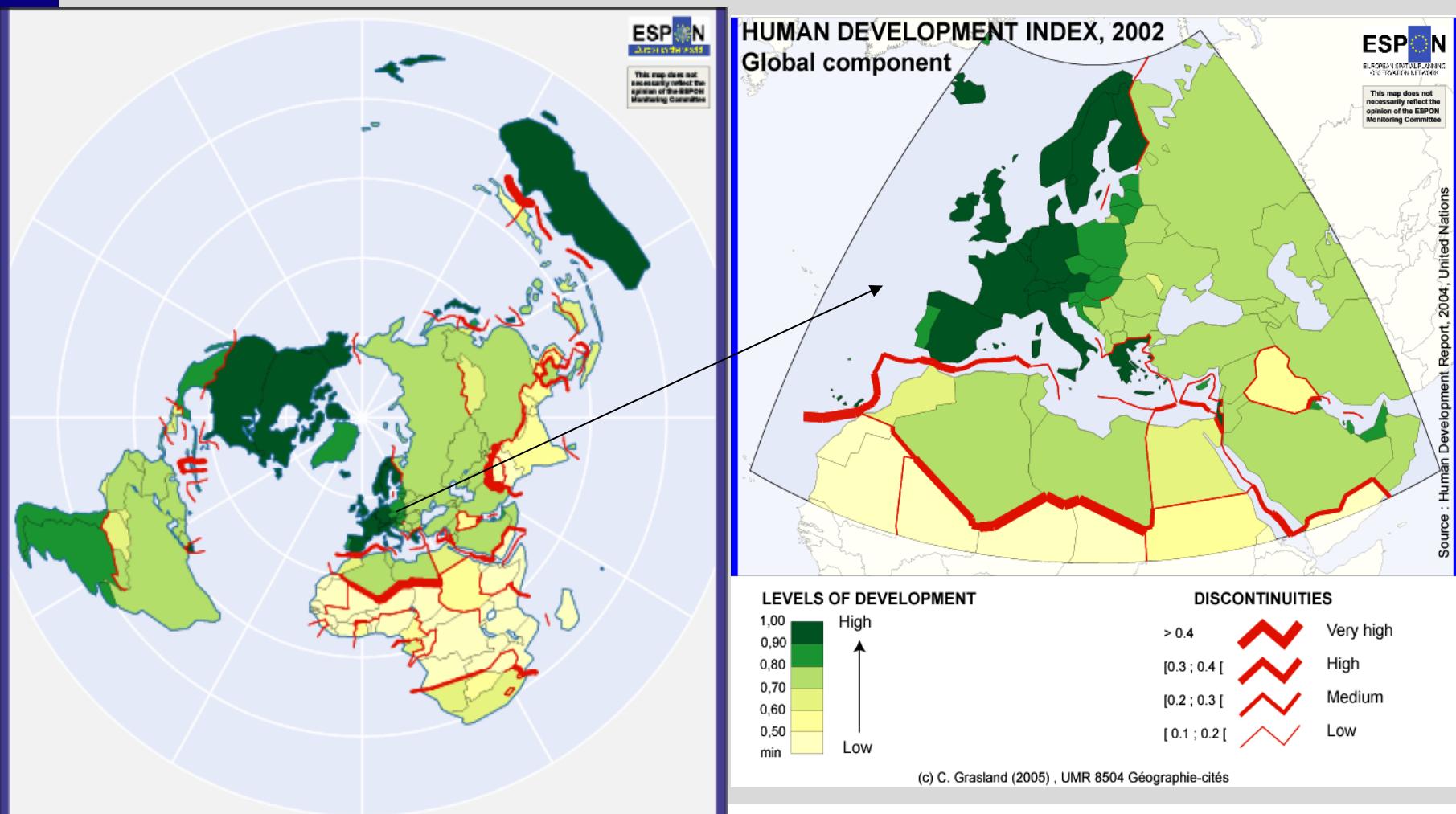
Index 100 = World



DISCONTINUITIES (relative)



But beware ... GDP is not a good indicator of welfare ! Alternative results could be obtained with HDI



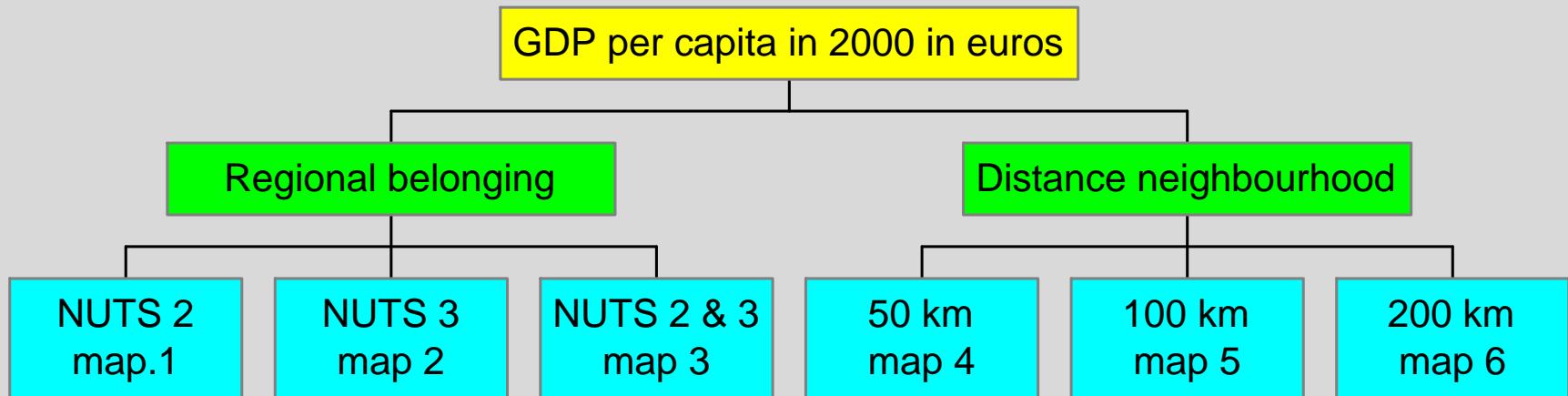
Top discontinuities of Human development are not located on Mediterranea but on Sahara.

State	HDI	State	HDI	Difference	Rank
Libya	0.79	Niger	0.29	0.50	1
Libya	0.79	Chad	0.38	0.42	2
Algeria	0.70	Niger	0.29	0.41	3
Australia	0.95	Papua New Guinea	0.54	0.40	4
Algeria	0.70	Mali	0.33	0.38	5
Cuba	0.81	Haiti	0.46	0.35	6
Colombia	0.77	Haiti	0.46	0.31	7
Spain	0.92	Morocco	0.62	0.30	8
Libya	0.79	Sudan	0.51	0.29	9
Oman	0.77	Yemen	0.48	0.29	10
Saudi Arabia	0.77	Yemen	0.48	0.29	11
Dominican Republic	0.74	Haiti	0.46	0.28	12
Oman	0.77	Pakistan	0.50	0.27	13
Algeria	0.70	West Sahara*	0.44	0.27	14
Saudi Arabia	0.77	Sudan	0.51	0.26	15
Japan	0.94	North Korea*	0.68	0.26	16
Australia	0.95	Indonesia	0.69	0.25	17
China	0.75	Pakistan	0.50	0.25	18
China	0.75	Nepal	0.50	0.24	19
Algeria	0.70	Mauritania	0.47	0.24	20

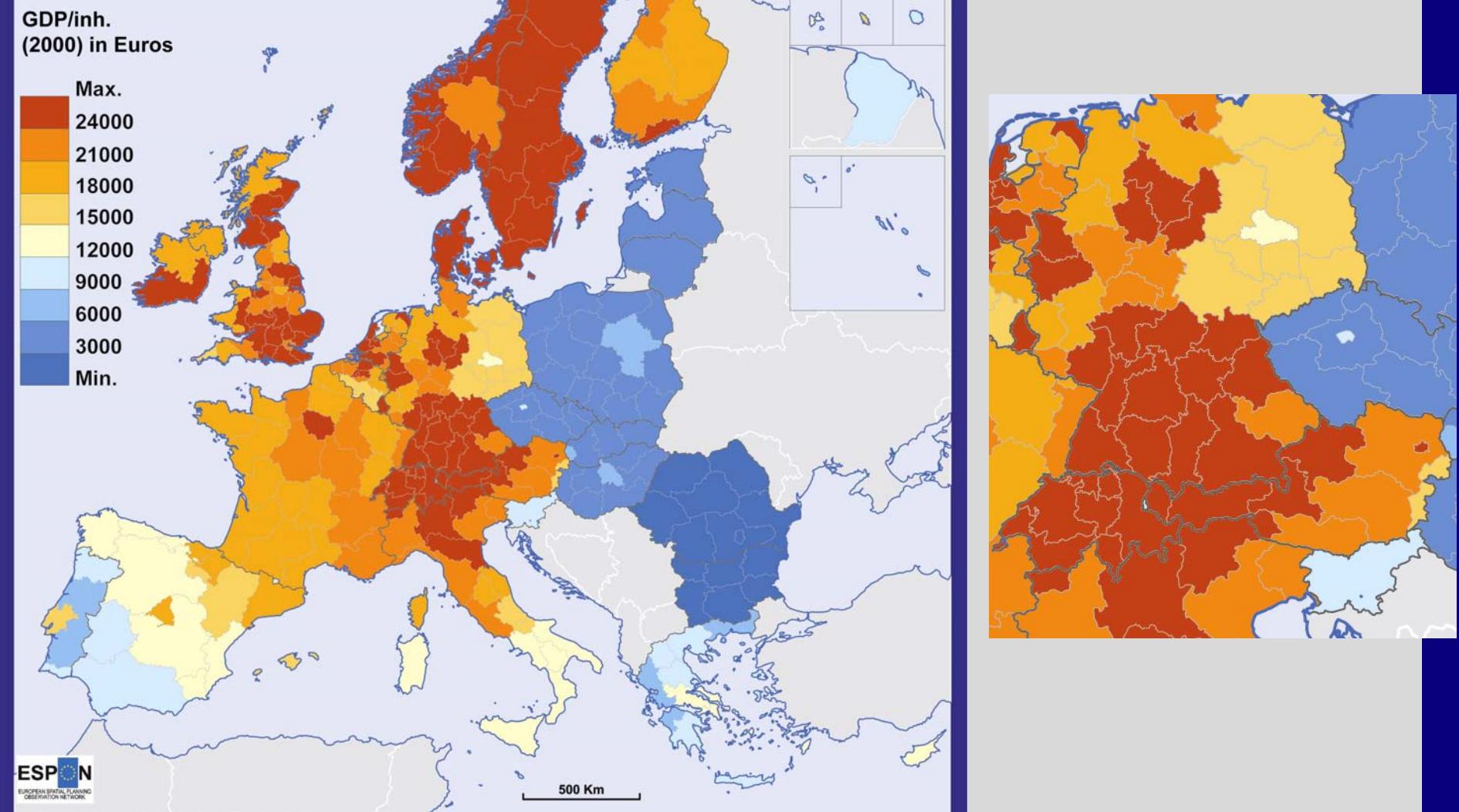


3. European Union level

Six variations on the map of GDP/capita in 2000



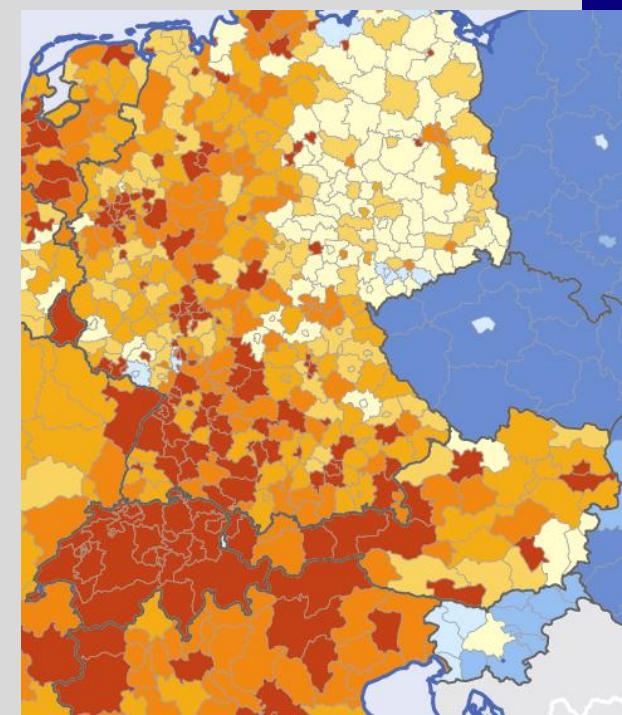
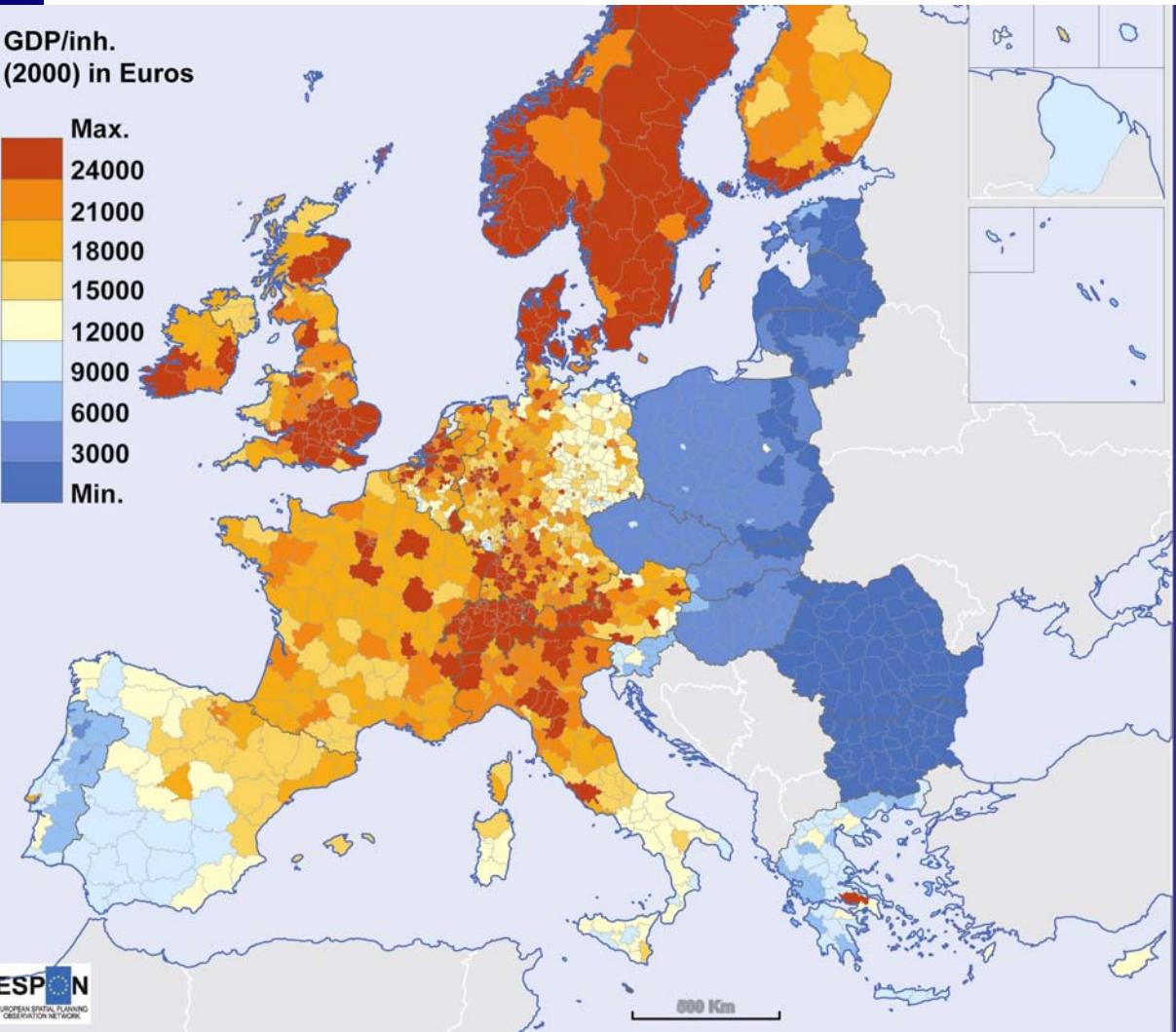
Map 1 : Official european divisions level NUTS 2



Map 2 : Official european divisions level NUTS 3

GDP/inh.
(2000) in Euros

Max.
24000
21000
18000
15000
12000
9000
6000
3000
Min.



Map 3 : « Non official » mixture of NUTS2 & NUTS 3

GDP/inh.
(2000) in Euros

Max.

24000

21000

18000

15000

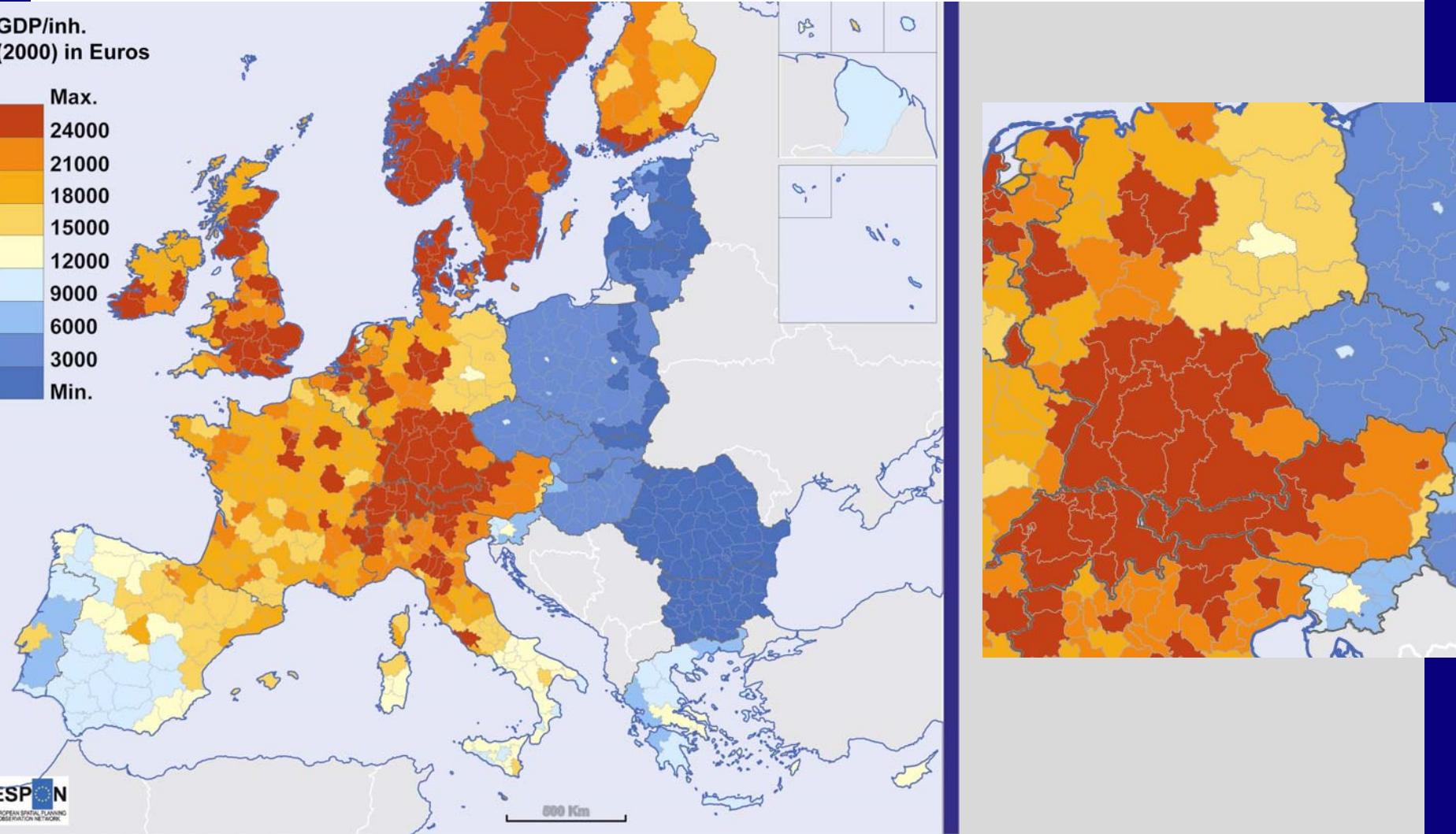
12000

9000

6000

3000

Min.



Map 4 : Smoothing in a neighbourhood of 50 km

GDP/inh.
(2000) in Euros

Max.

24000

21000

18000

15000

12000

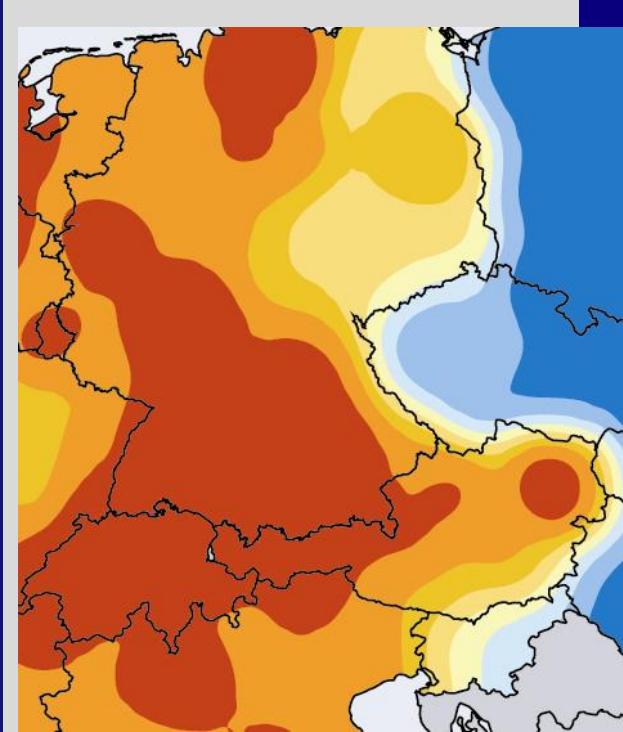
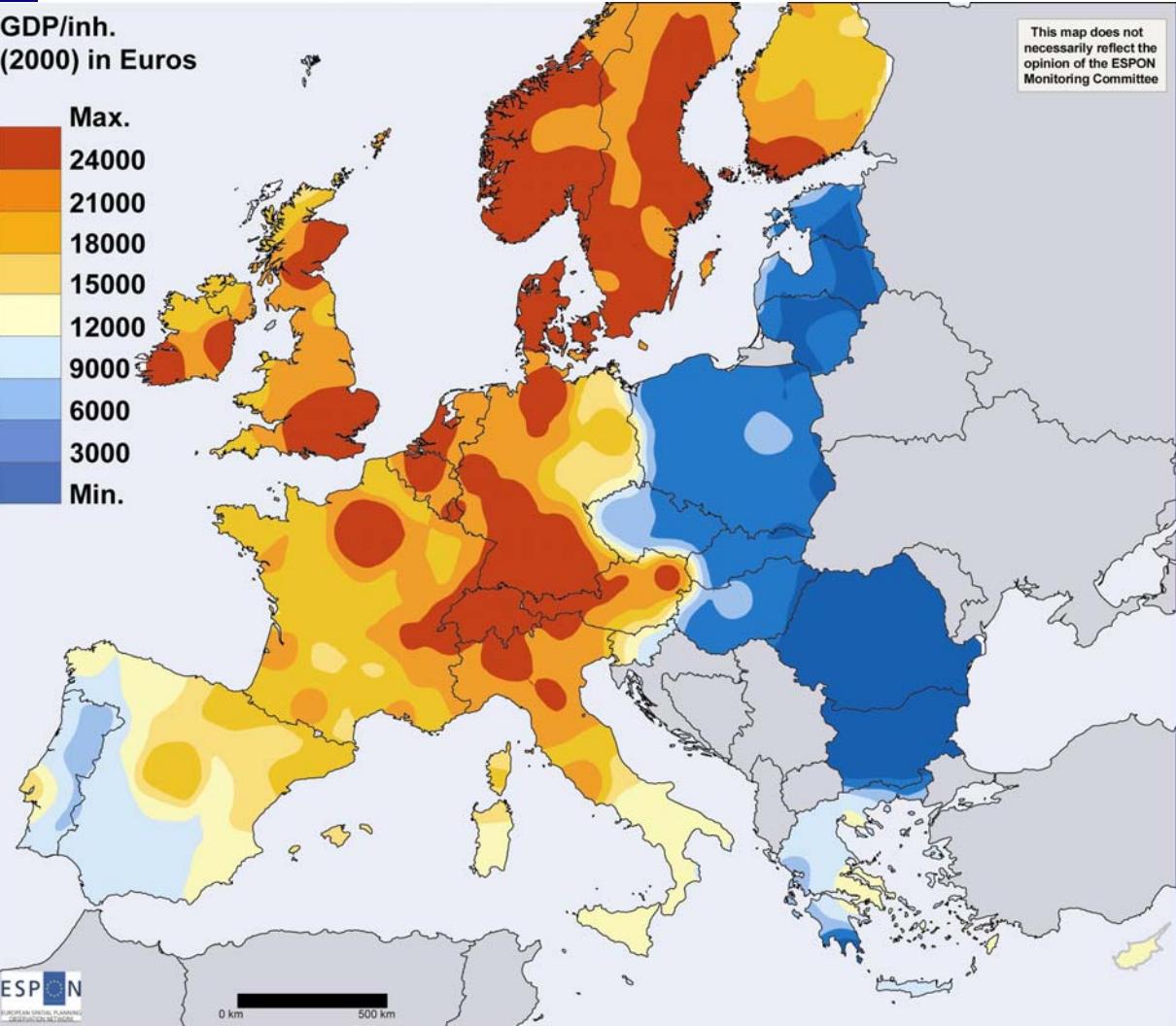
9000

6000

3000

Min.

This map does not
necessarily reflect the
opinion of the ESPON
Monitoring Committee



Map 5 : Smoothing in a neighbourhood of 100 km

GDP/inh.
(2000) in Euros

Max.

24000

21000

18000

15000

12000

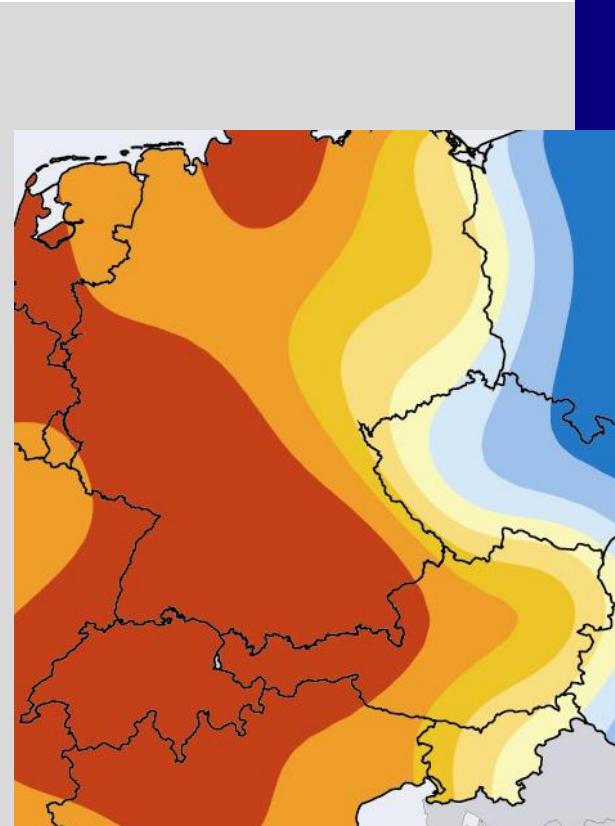
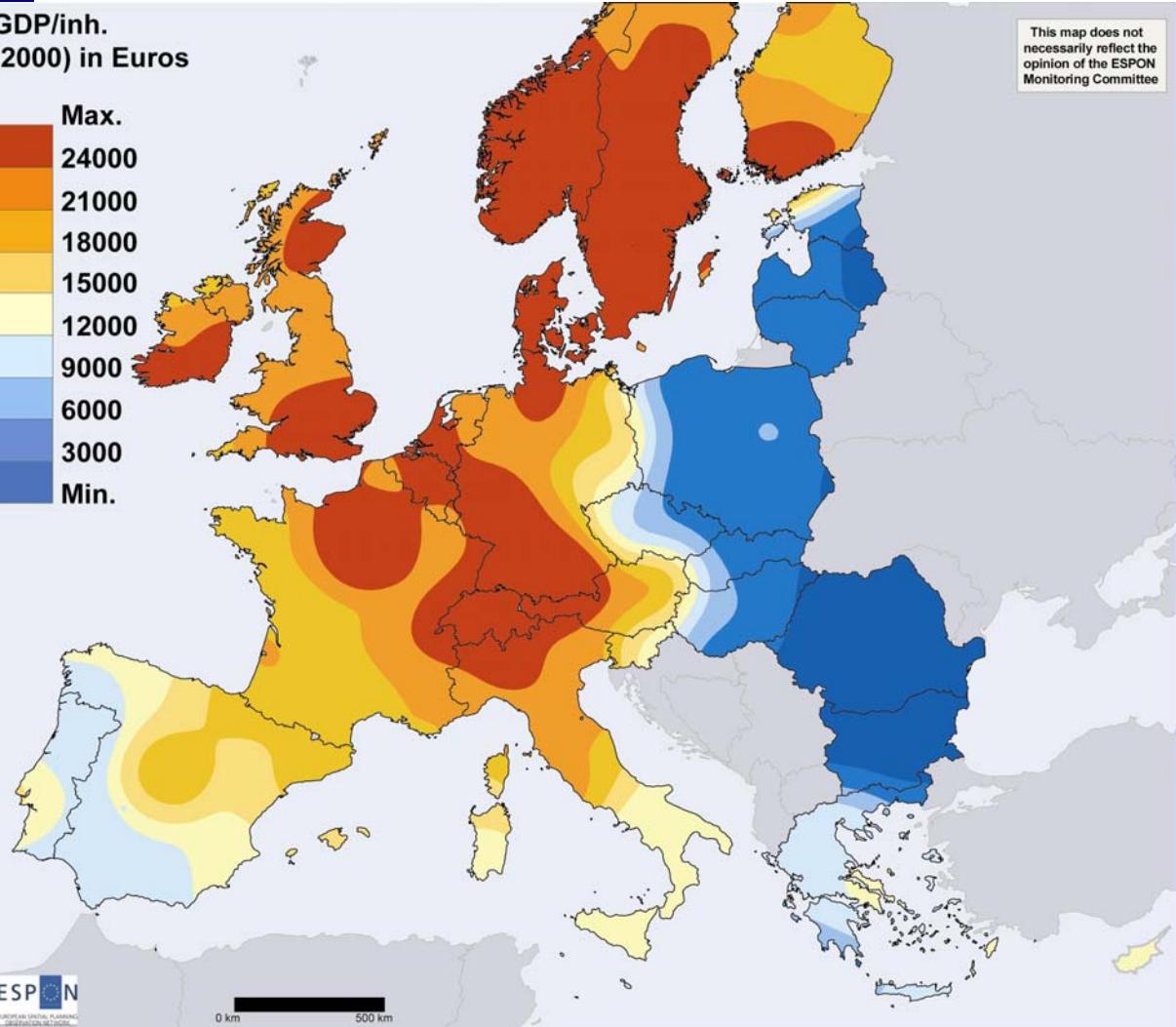
9000

6000

3000

Min.

This map does not
necessarily reflect the
opinion of the ESPON
Monitoring Committee



Map 6 : Smoothing in a neighbourhood of 200 km

GDP/inh.
(2000) in Euros

Max.

24000

21000

18000

15000

12000

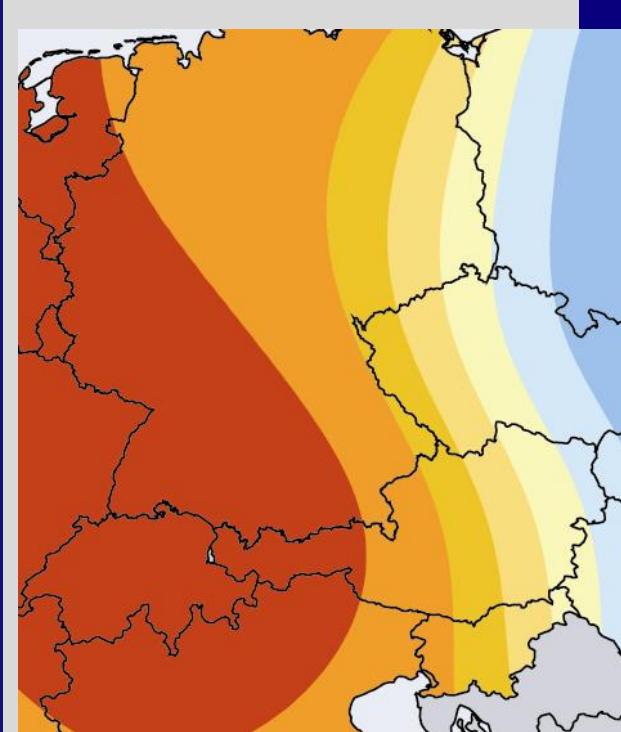
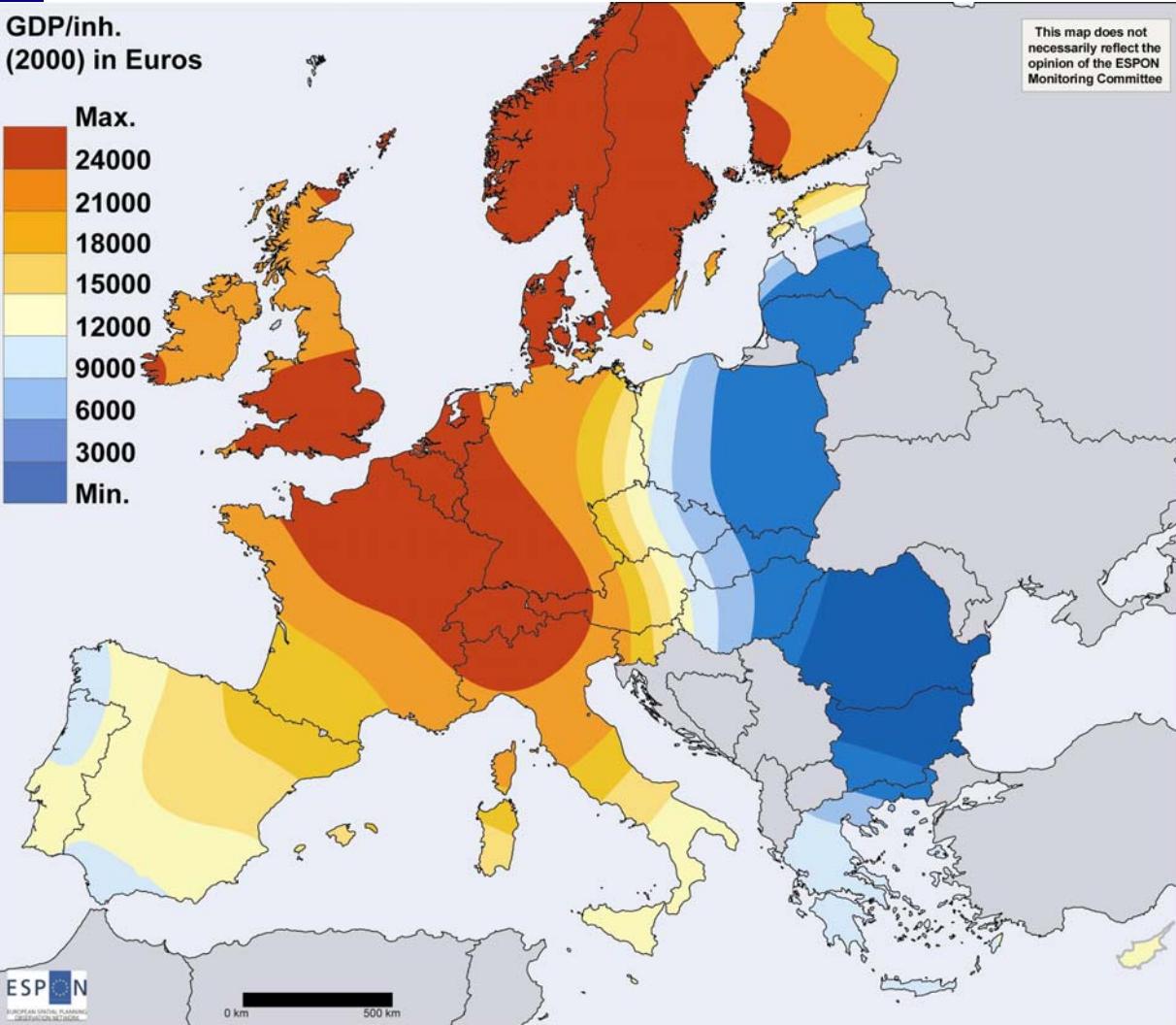
9000

6000

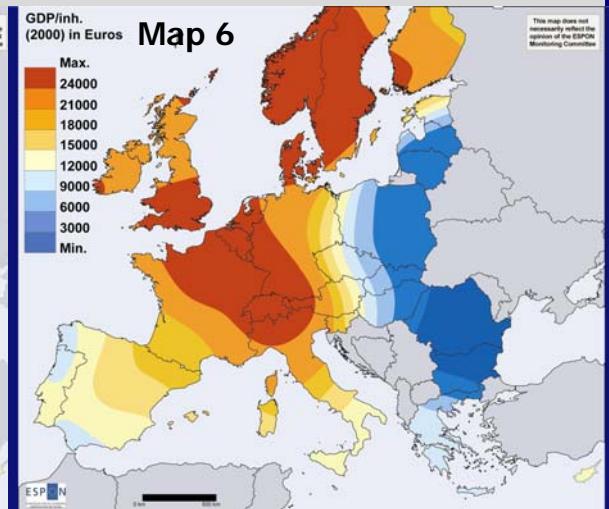
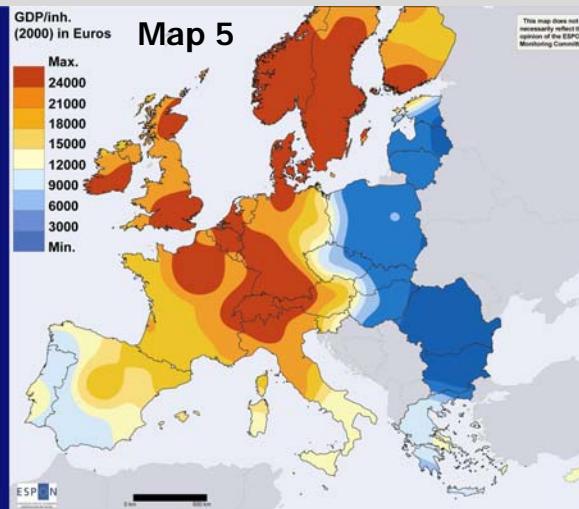
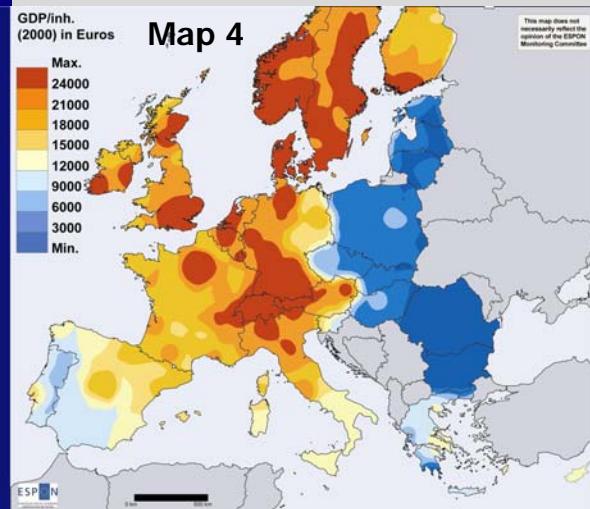
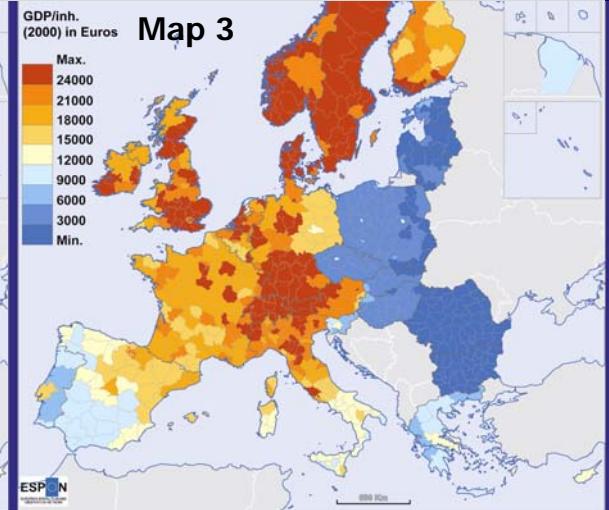
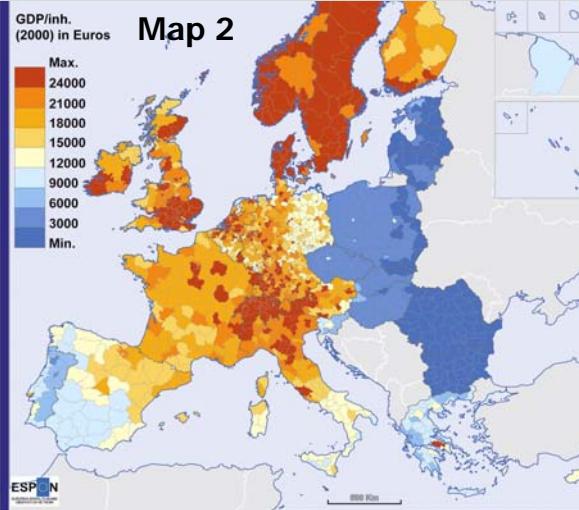
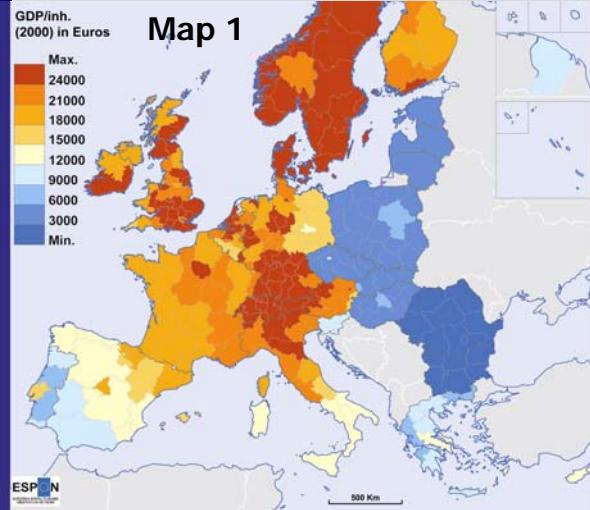
3000

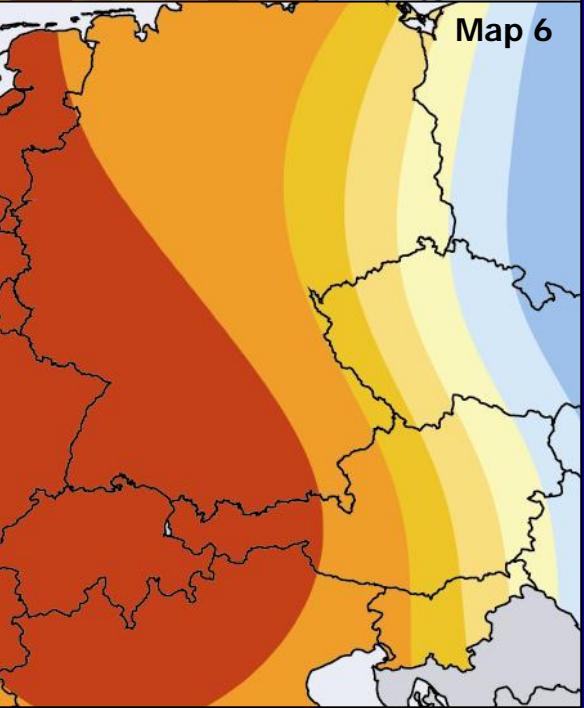
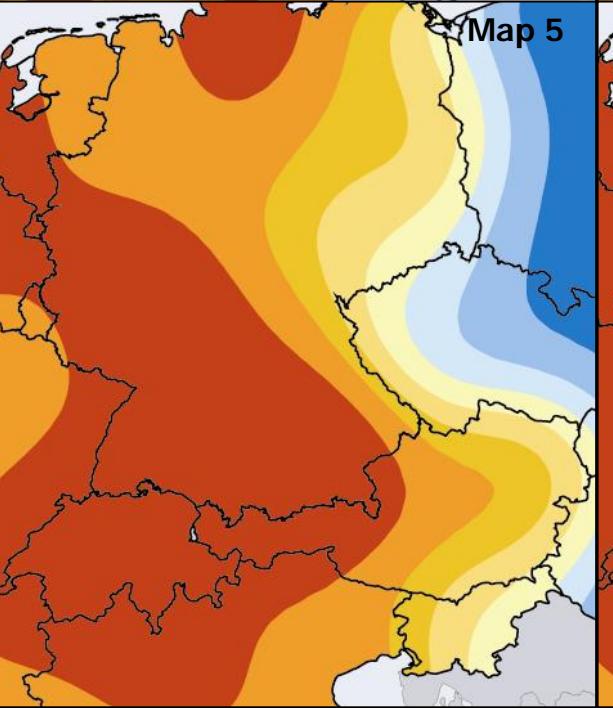
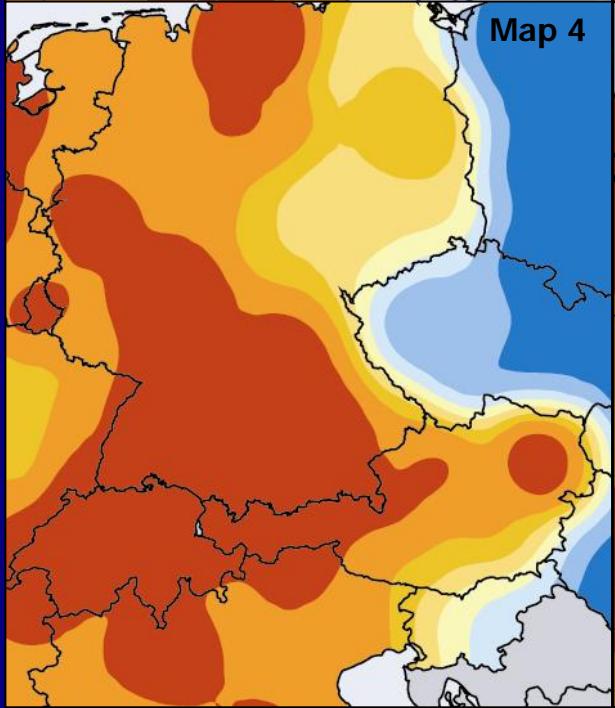
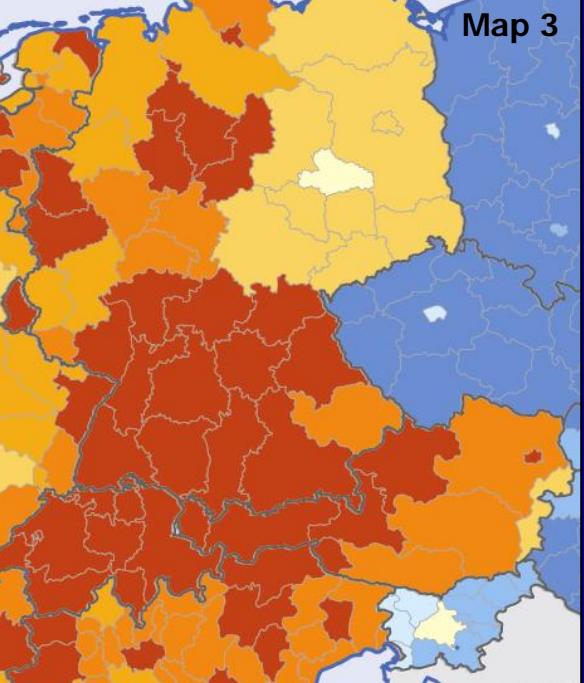
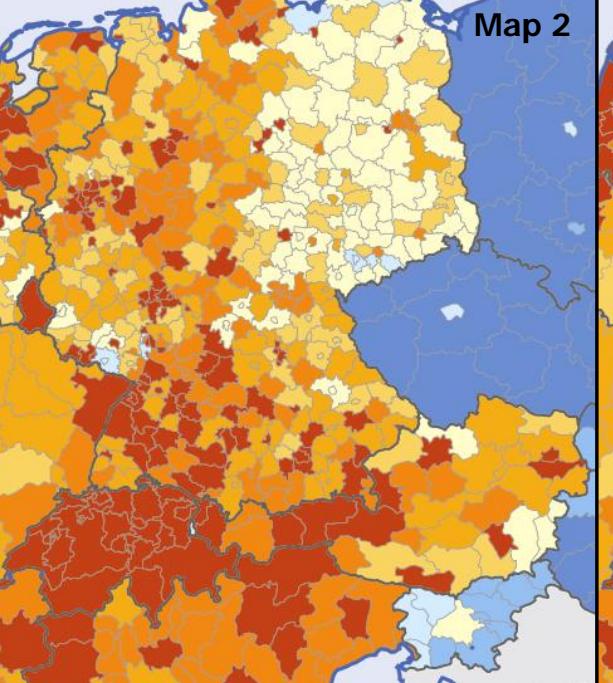
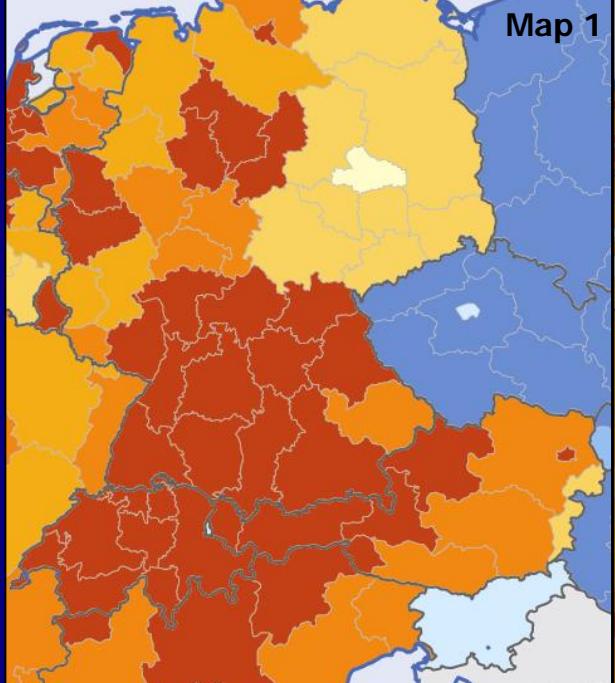
Min.

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necessarily reflect the
opinion of the ESPON
Monitoring Committee

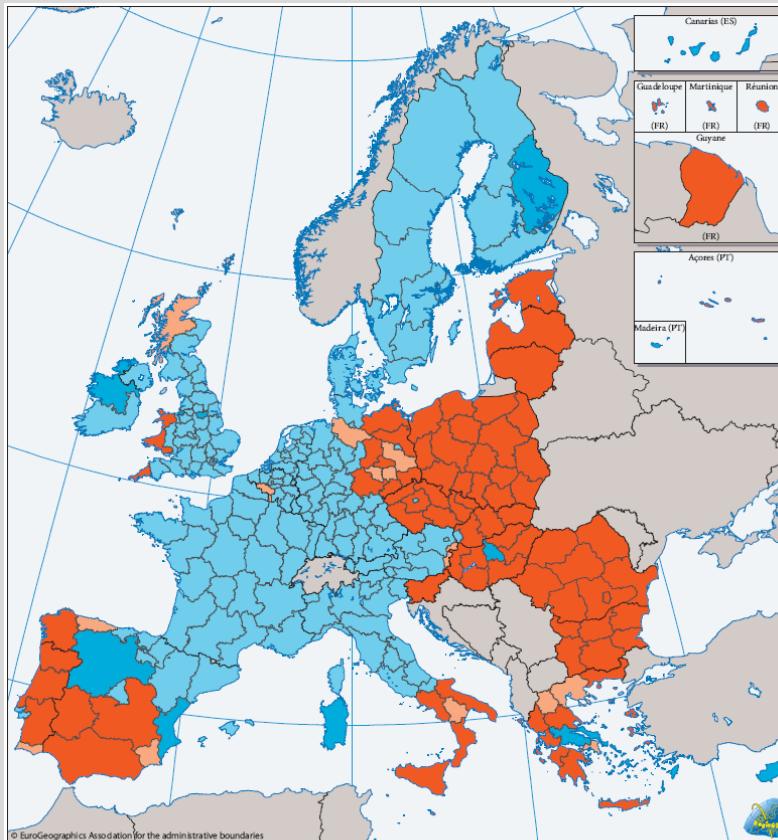


Comparison





Many solutions from scientific point of view ...
... but only one (NUTS2) from political point of view



**Structural Funds 2007- 2013:
Convergence and Regional Competitiveness Objectives**

- Convergence Regions
- Phasing-out Regions
- Phasing-in Regions
- Competitiveness and Employment Regions

Position as of October 2006.
Regional boundaries in Bulgaria and Romania are indicative only

0 1,000 Km

But what if NUTS1 or NUTS3 was used in place of NUTS2 ?

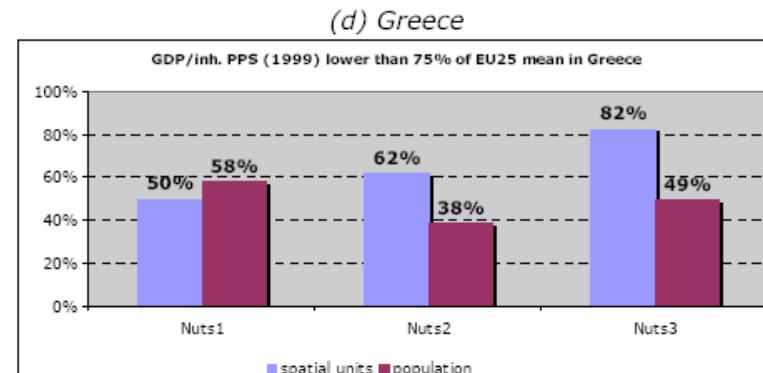
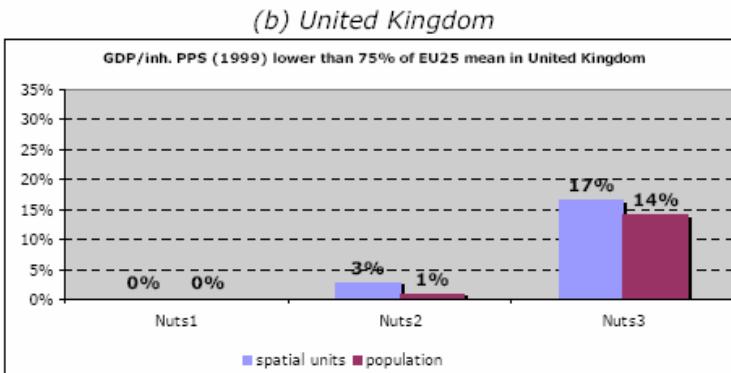
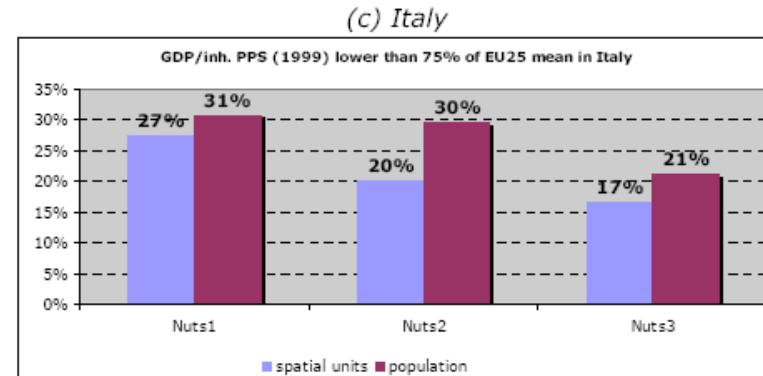
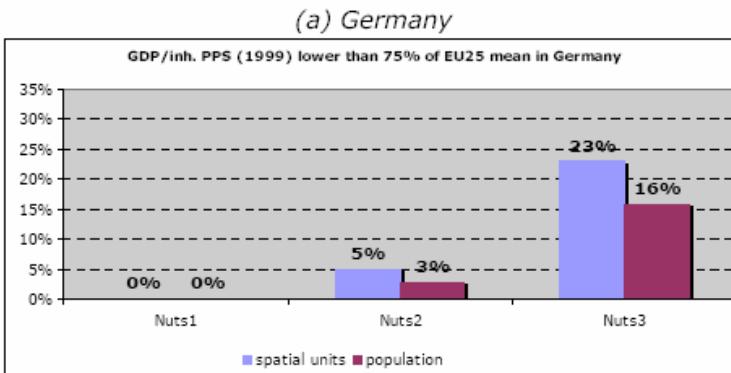


Figure 12 Simulation of the percentage of regions and population eligible to structural funds in different states according to the choice of NUTS division in 1999

Which vision of territorial disparities is obtained with official NUTS2 and NUTS 3 levels ?

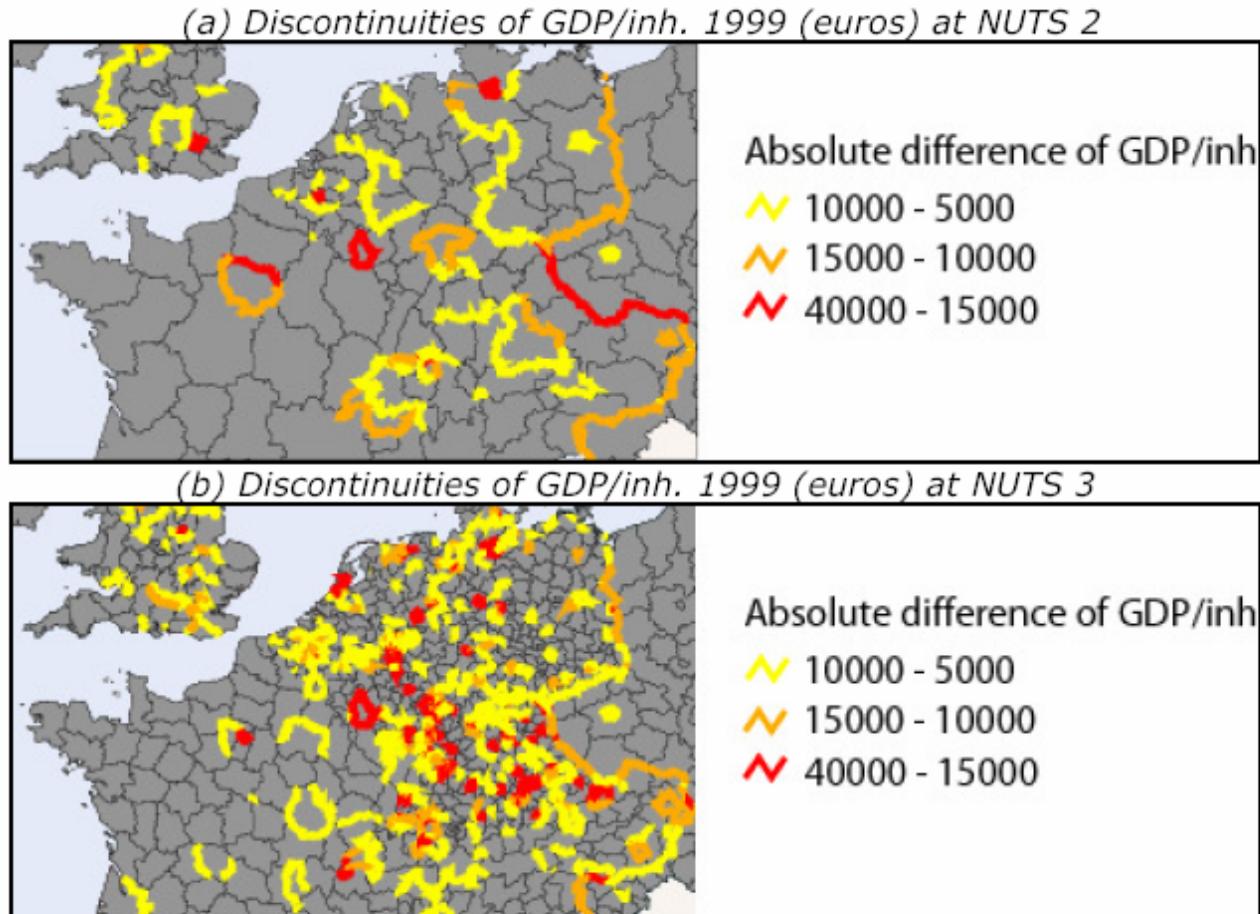
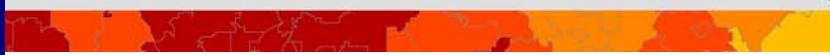


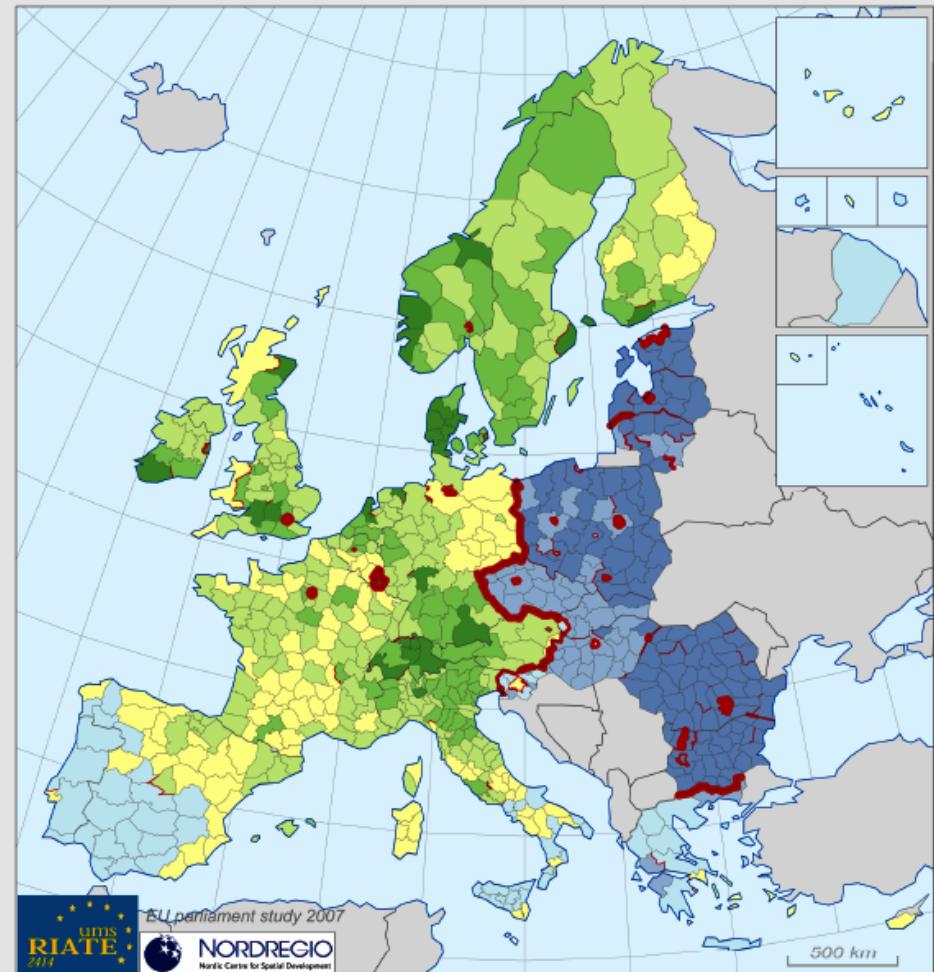
Figure 19 Impact of the choice of spatial units on the cartography of territorial discontinuities



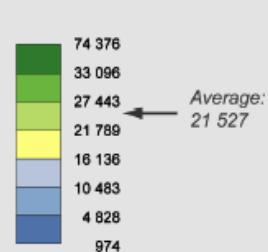
E
UROPE

A more correct map is obtained with a « non-official » mixture of NUTS2 and NUTS3 units.

RELATIVE DIFFERENCES OF GDP AT THE BORDERS



GDP per capita (in Euros)
in 2004



Relative differences
between neighbouring
regions (Max/Min)

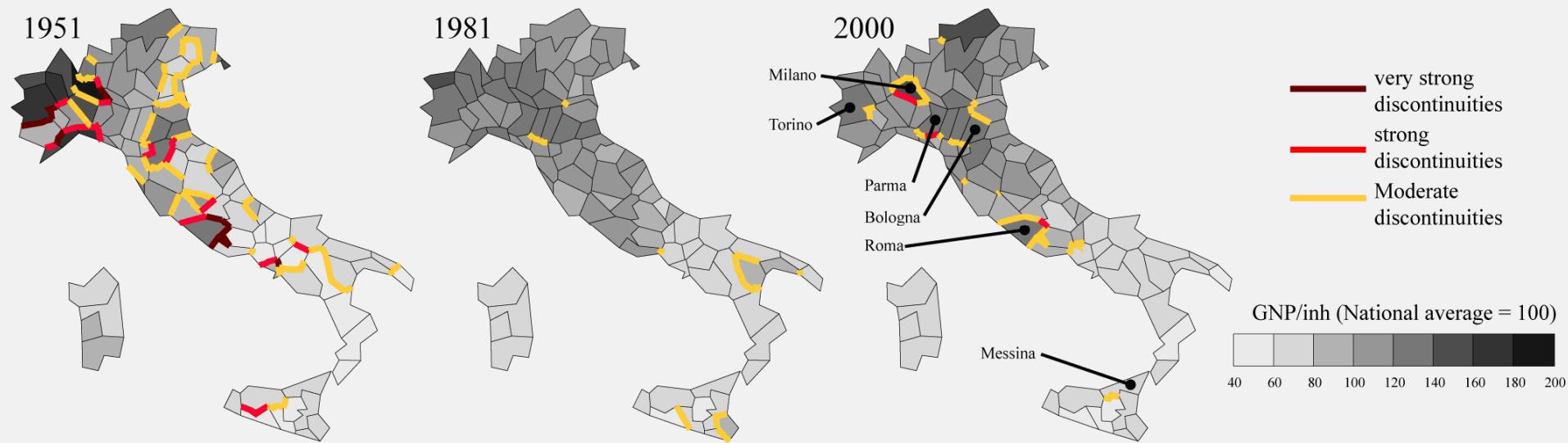
- more than 2.29
- 2.04 to 2.29
- 1.79 to 2.04
- 1.53 to 1.79

Source : EU Parliament study
June 2007



4. National level

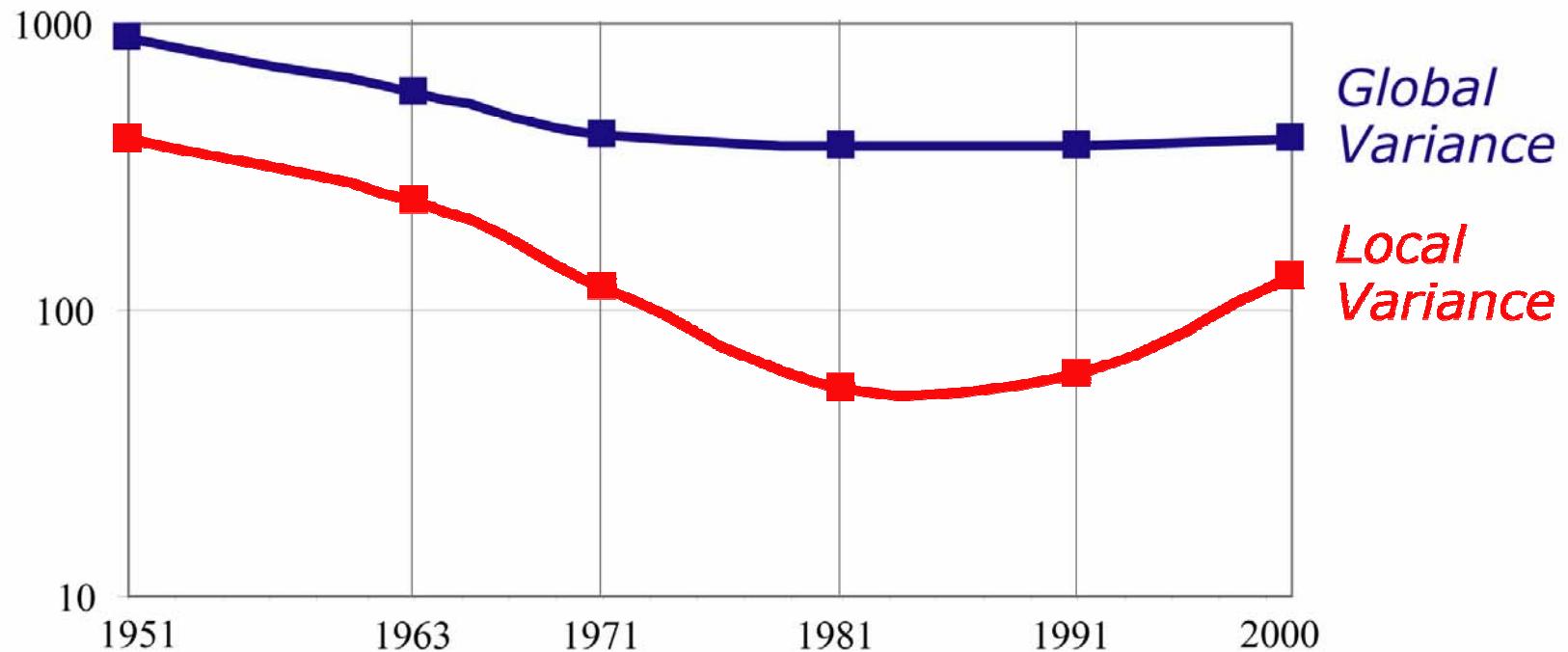
The example of Italia reveals the interest of long term time series ...



Source : Etude pour le Parlement Européen, Juin 2007

... and the problem of *scales* of convergence.

Gross Regional product variance in Italy



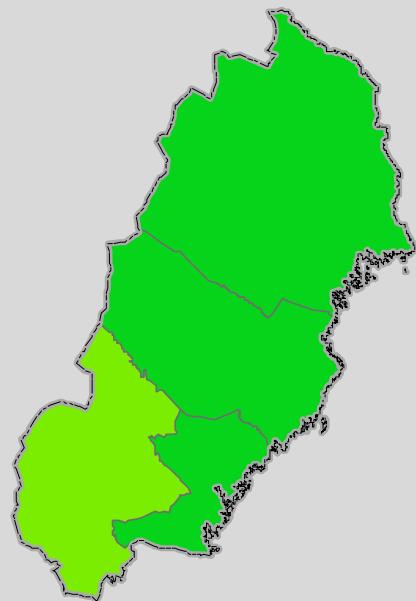
Source : Etude pour le Parlement Européen, Juin 2007



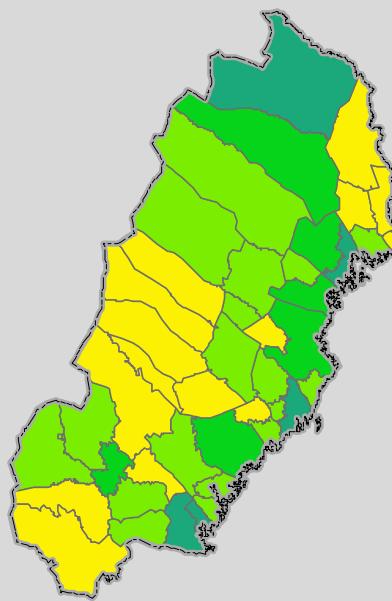
5. Local level

The example of northern Sweden

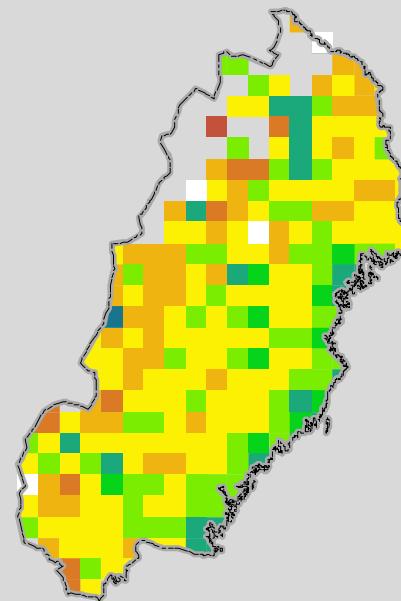
Counties (NUTS 3)



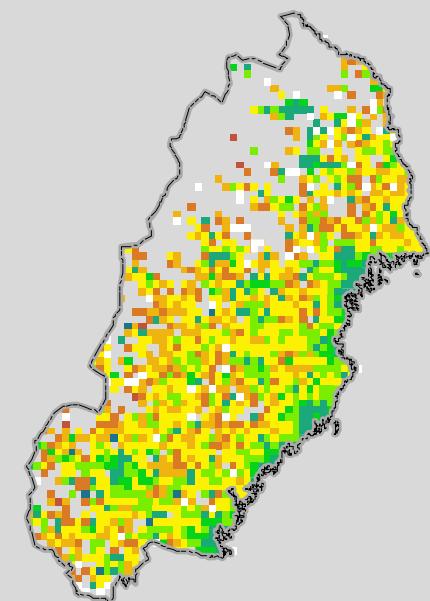
Municipalities (NUTS 5)



30 km squares



10 km squares



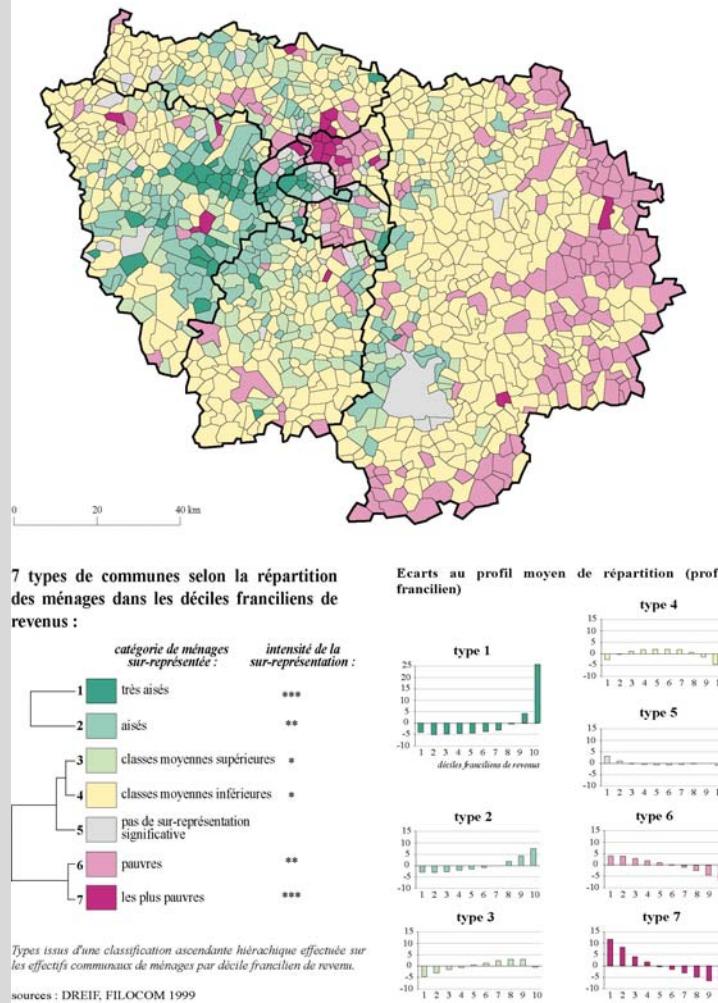
Disposable income (SEK)
inhabitant (>15 years)
2002

400 - 50,000	115,100 - 130,000	145,100 - 200,000
50,100 - 100,000	130,100 - 140,000	200,100 - 340,000
100,100 - 115,000	140,100 - 145,000	

0 100 200 400
km

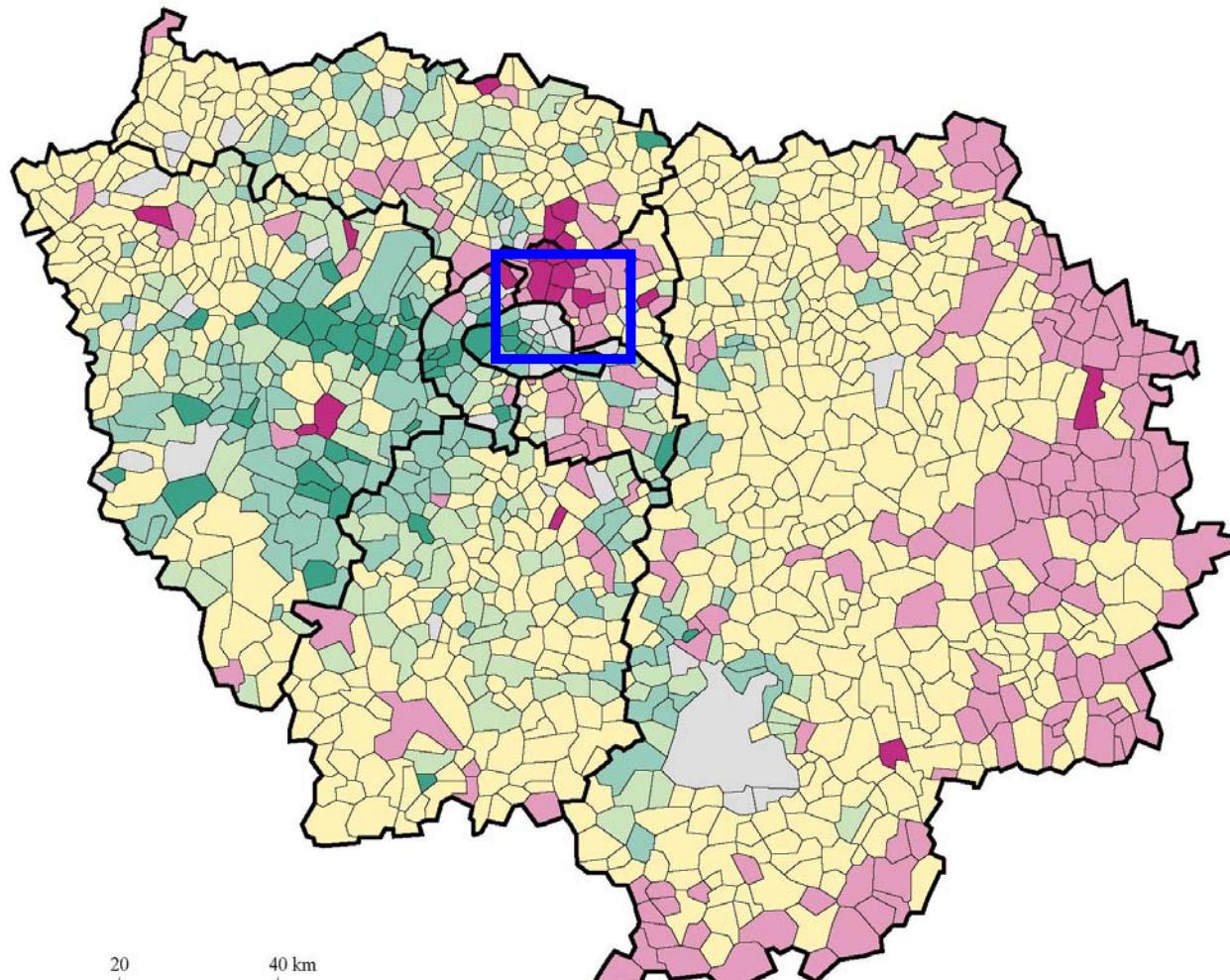
The example of Ile de France (Paris region)

Figure 2. Inégalités des revenus des ménages dans les communes franciliennes

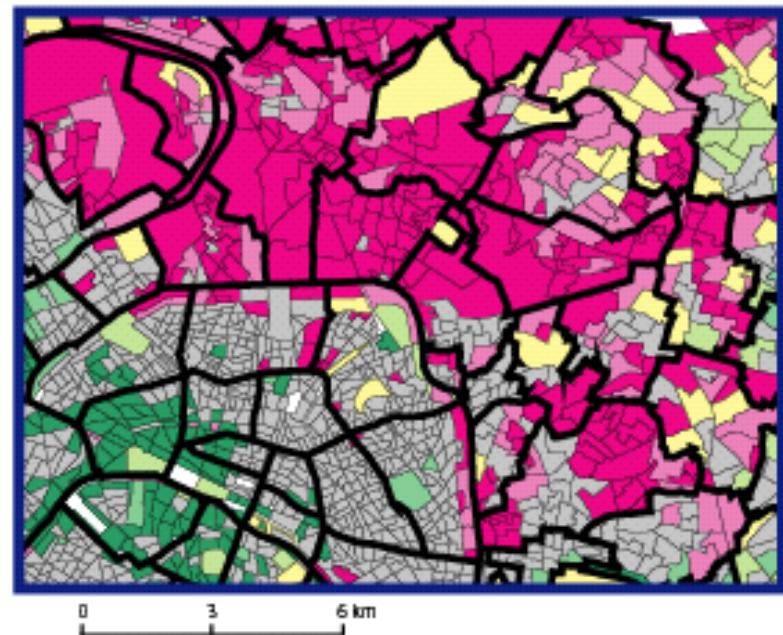
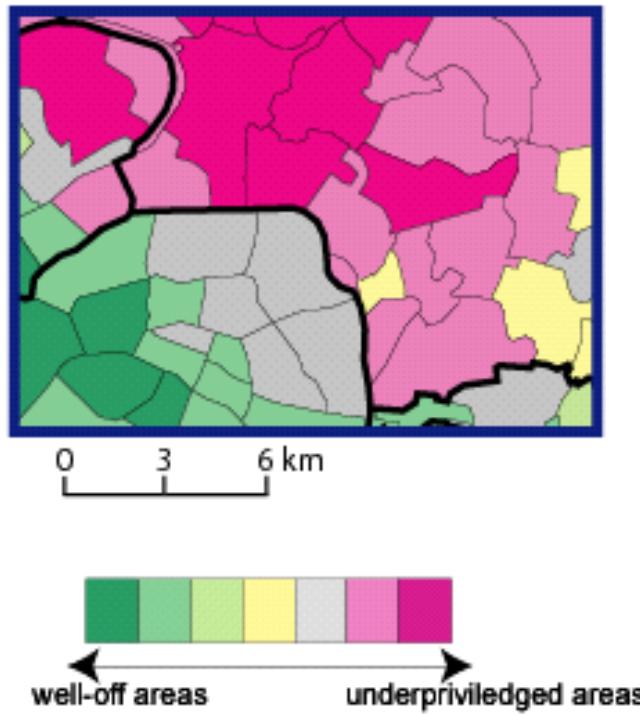


Global disparities at local authority levels (communes)

Figure 2. Inégalités des revenus des ménages dans les communes franciliennes



Further differentiations at the infra-communal level.



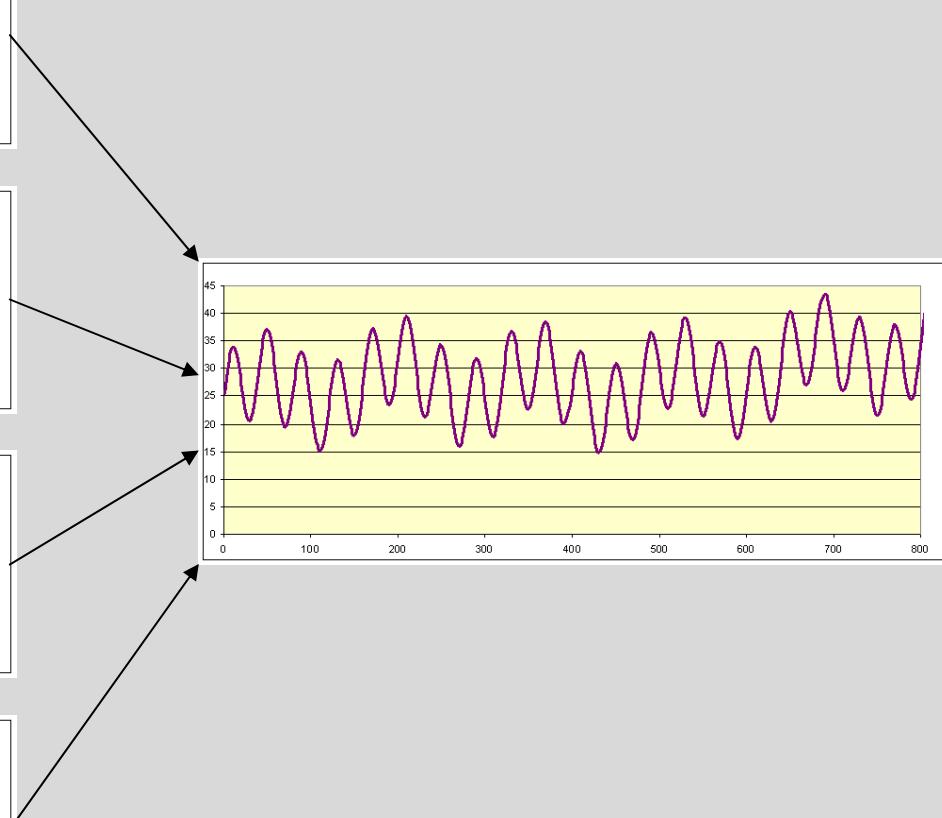
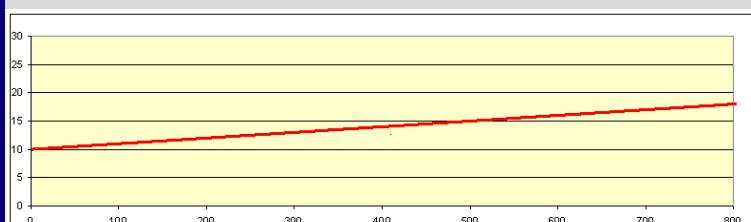
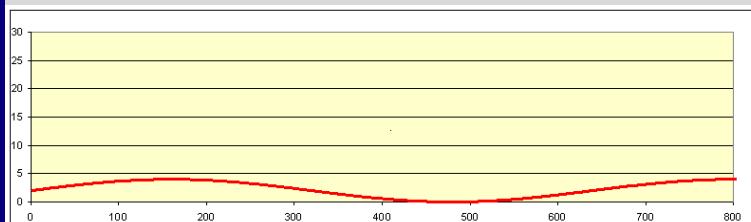
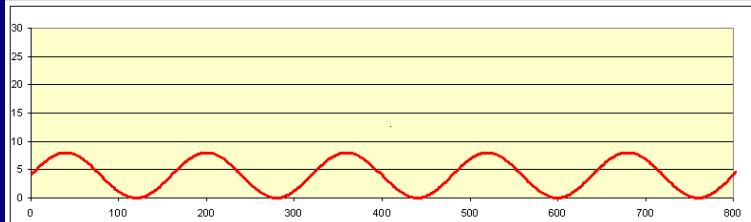
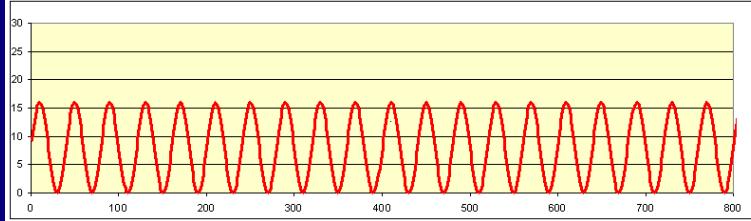


EUROPEAN SPATIAL PLANNING
OBSERVATION NETWORK



2. Territorial units as “spatial filters” (Tobler)

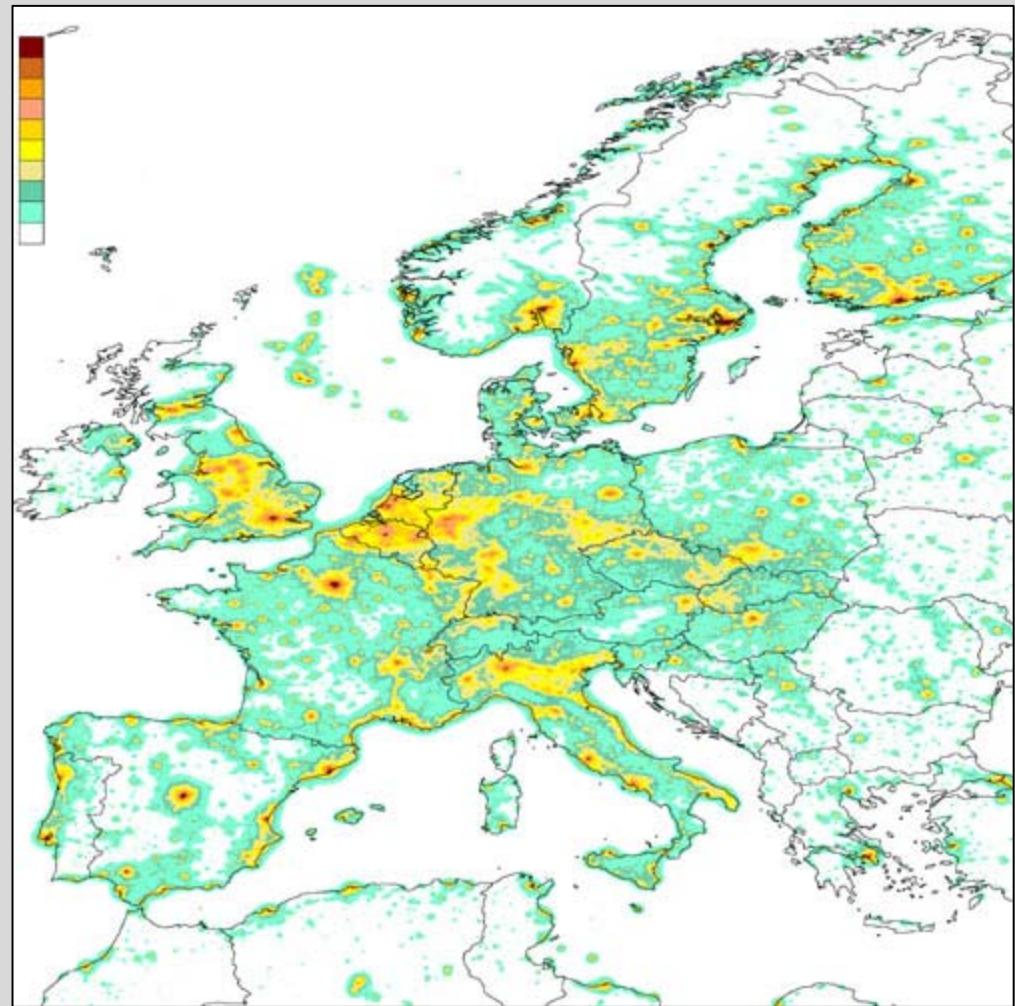
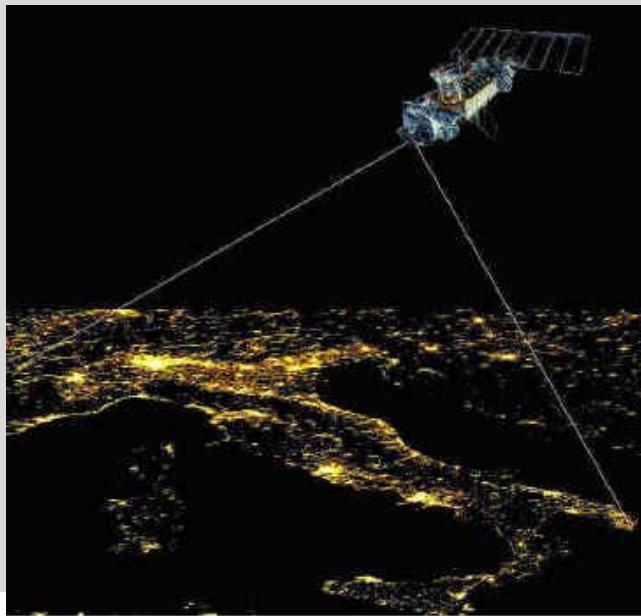
Spatial differences appears at different scales and can be considered as waves of different lengths



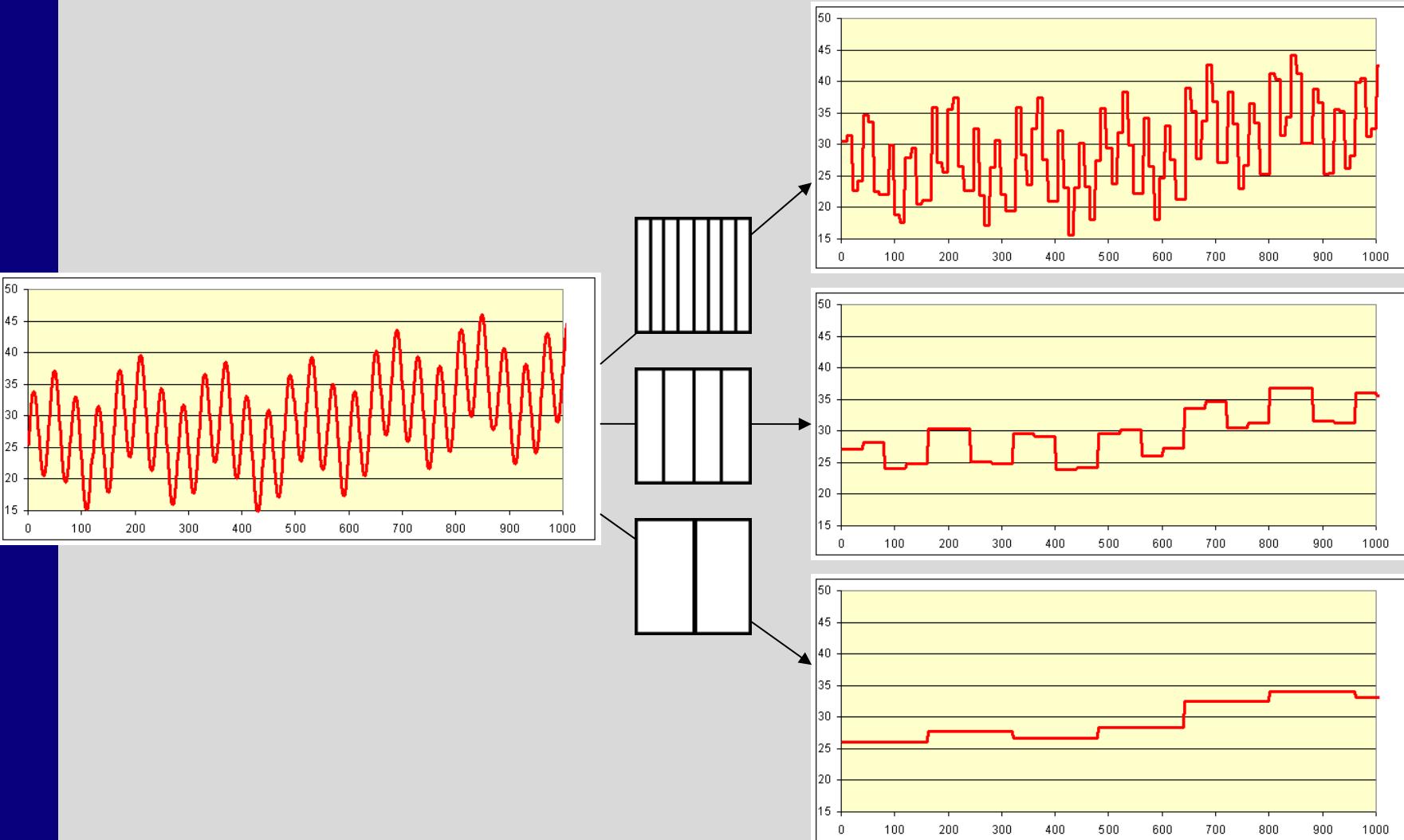
A CONCRETE ILLUSTRATION

<http://www.lightpollution.it/dmsp/>

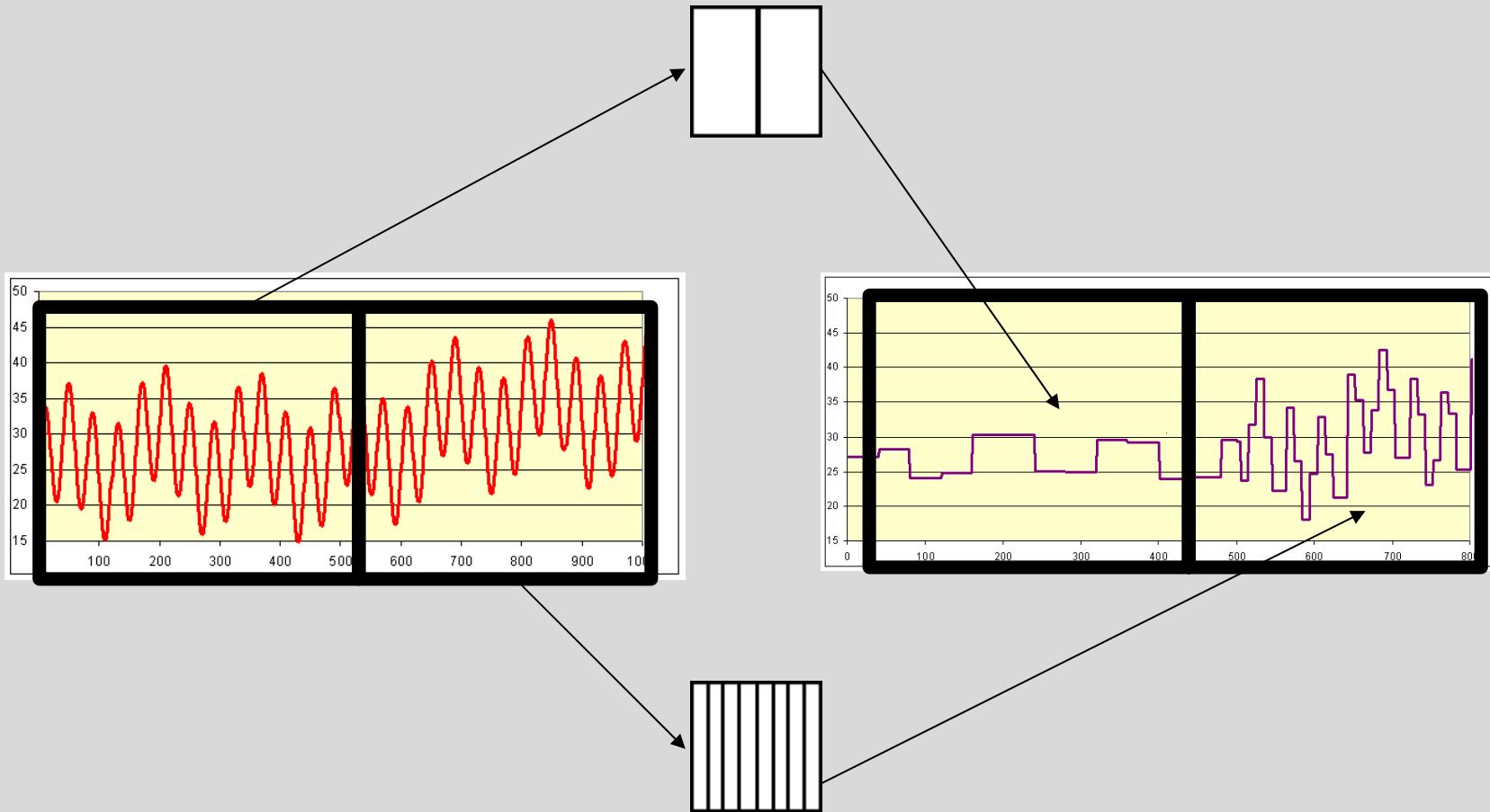
Light pollution is a good example of information that can be measured with very high spatial resolution (less than 1 km)

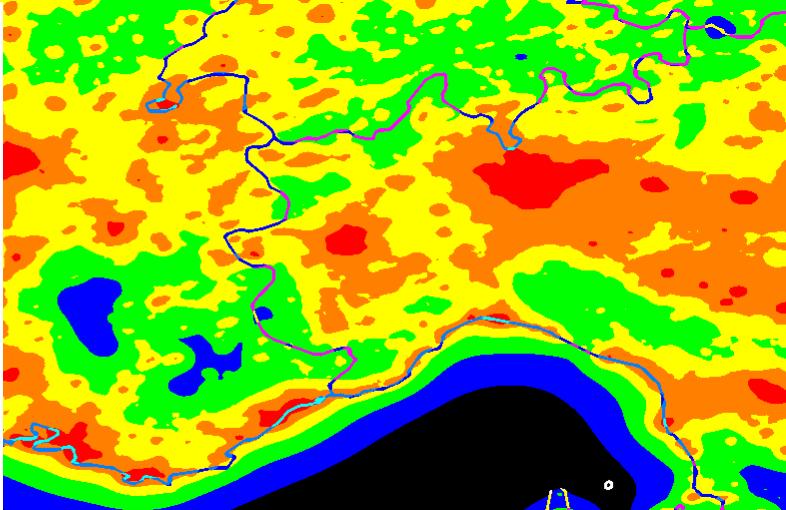
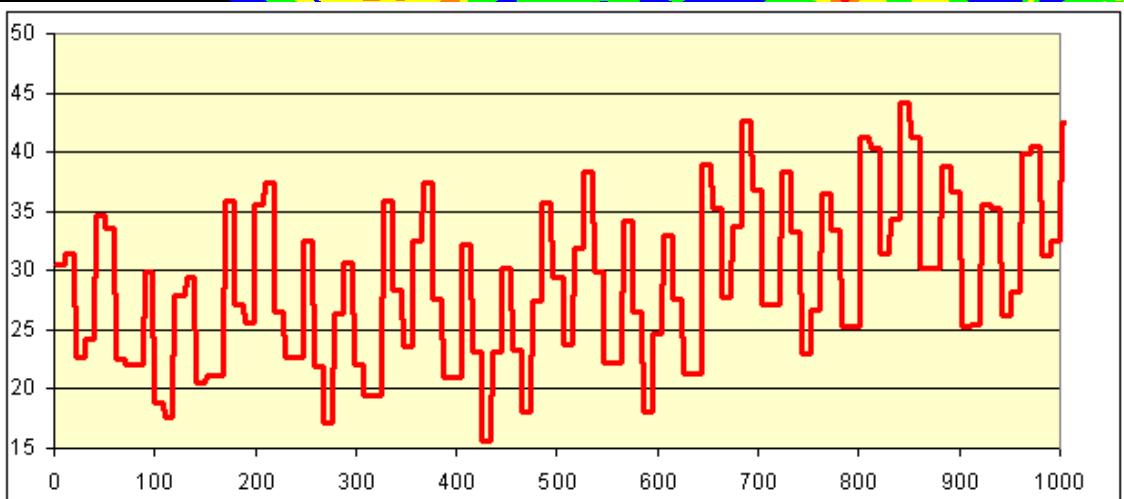
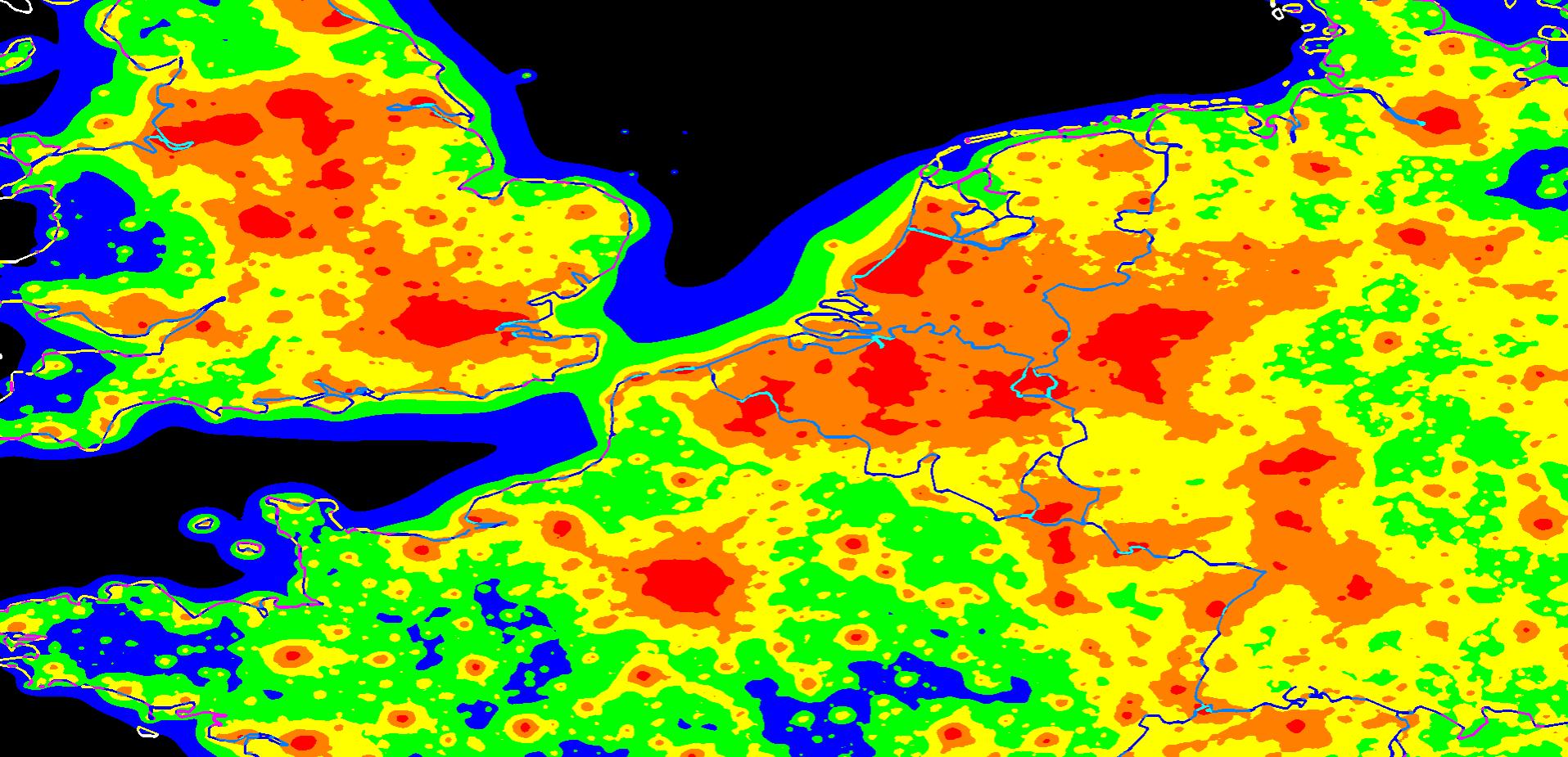


Territorial units are filters (high-, low-, bandpass)

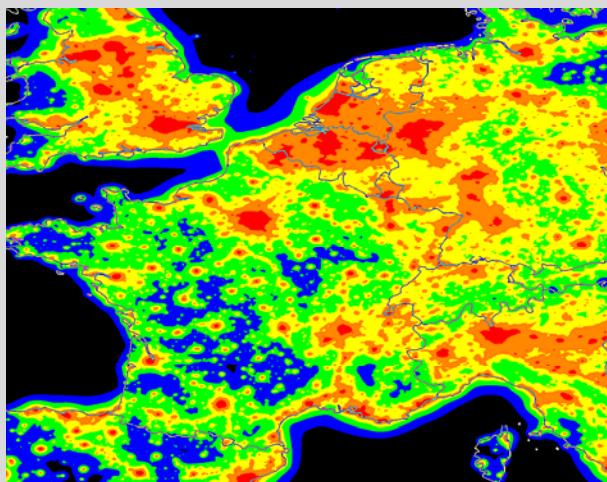


A good filter should not be heterogeneous !

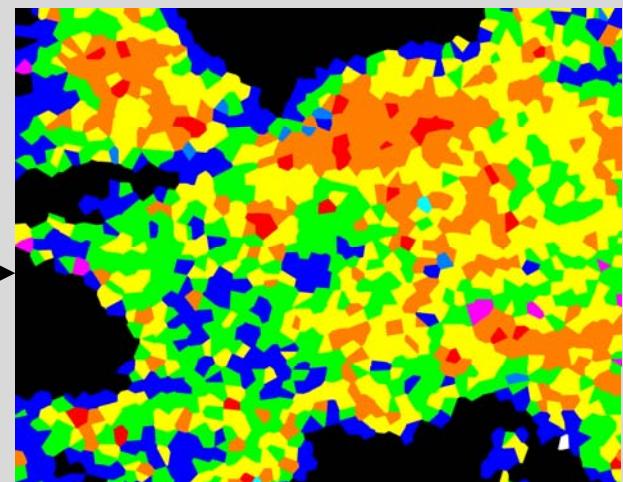
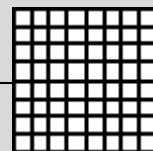




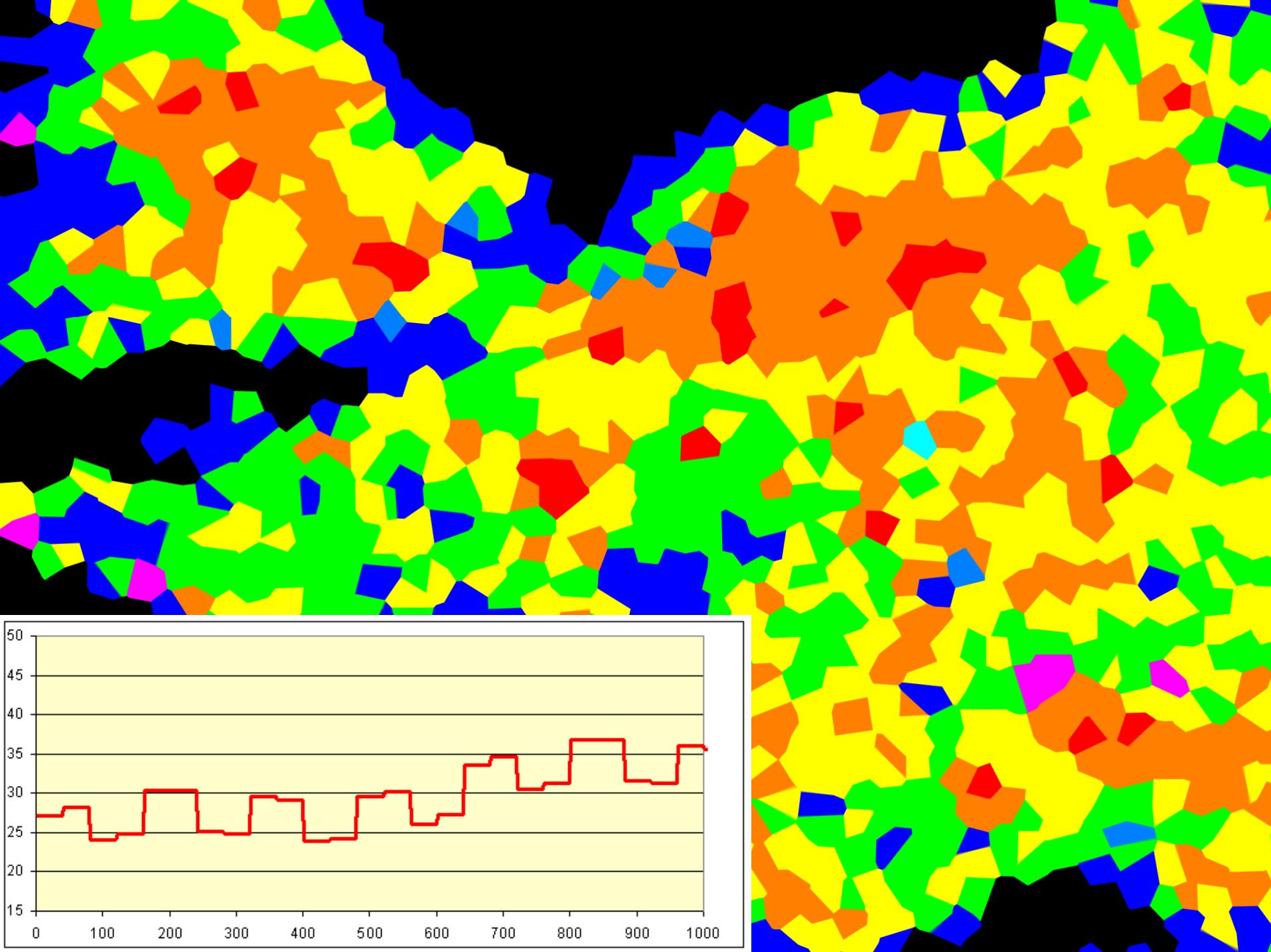
Local territorial filter



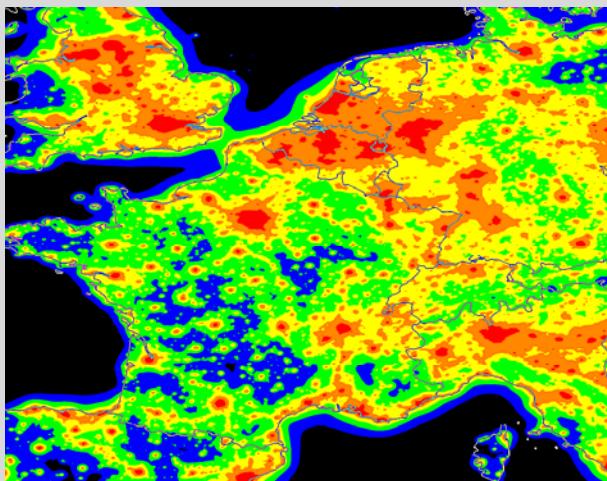
Initial information



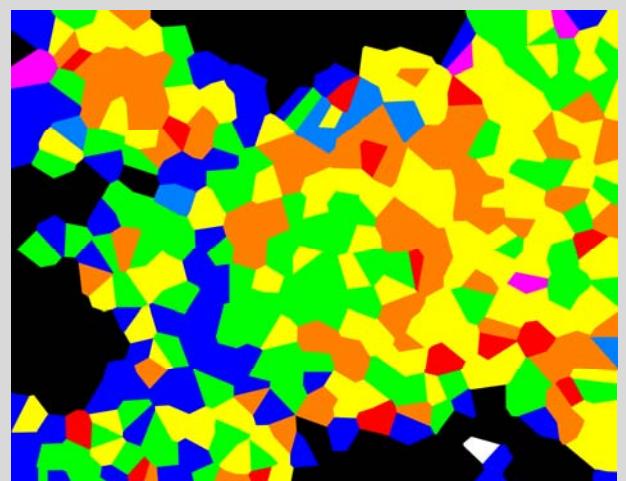
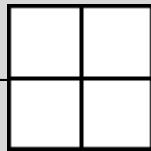
Territorial information



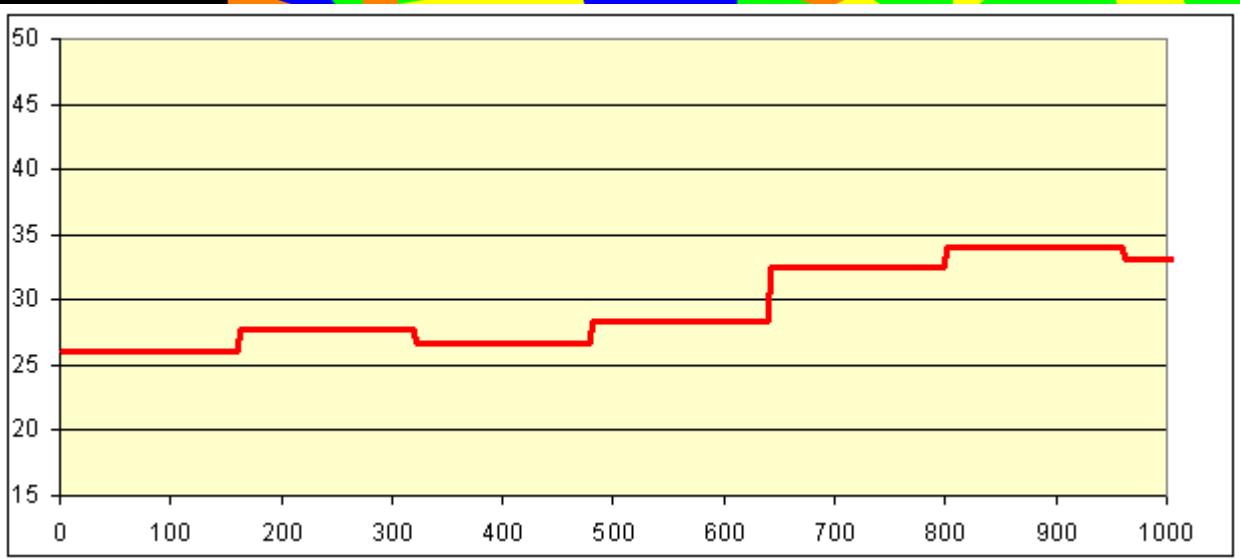
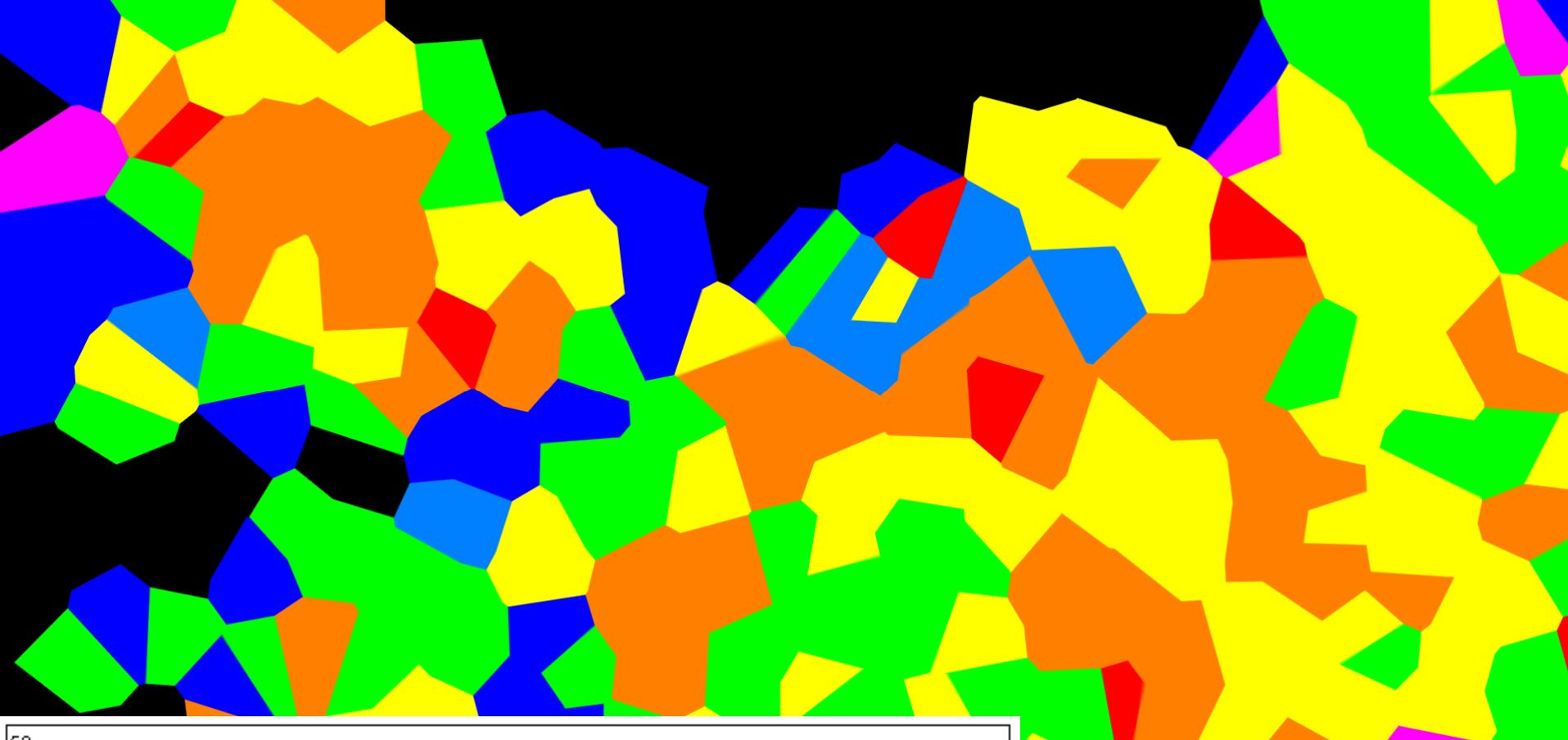
Medium territorial filter



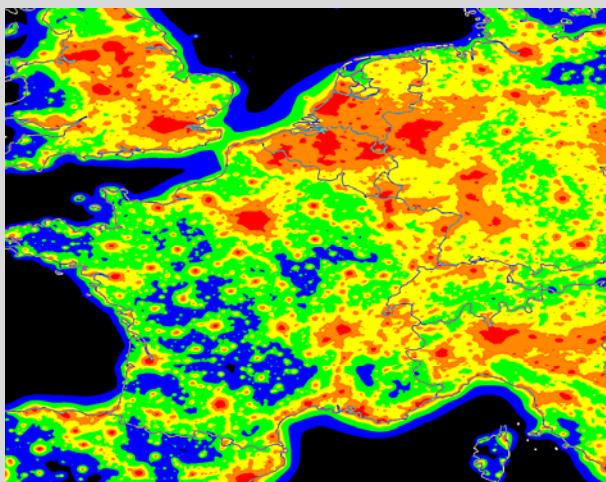
Initial information



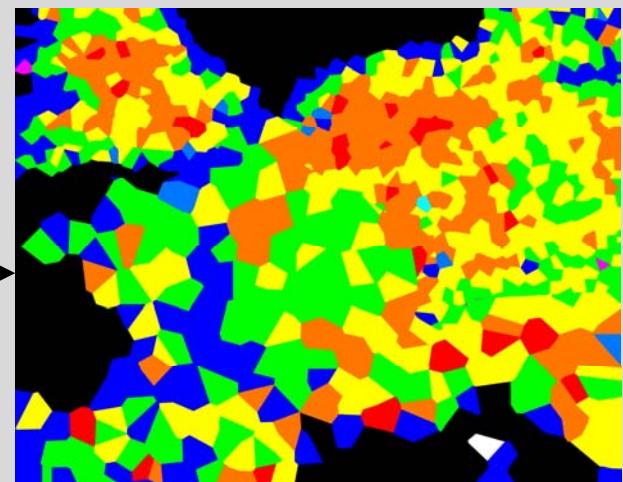
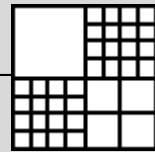
Territorial information



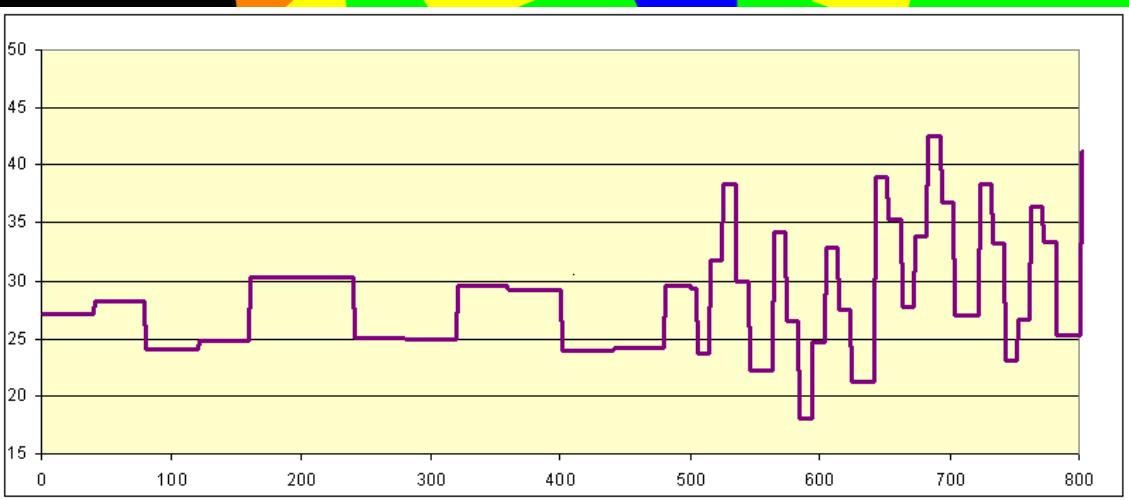
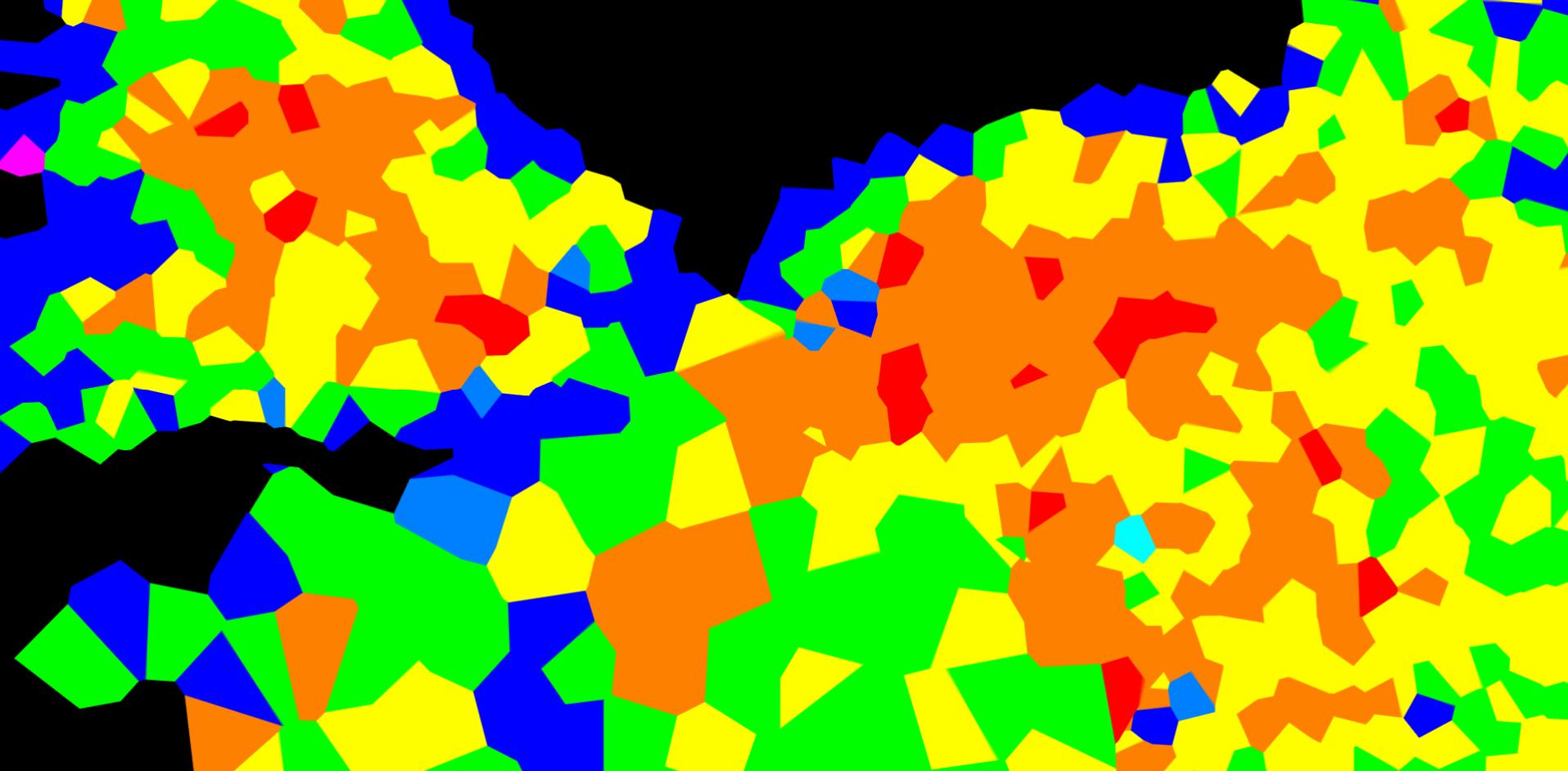
Heterogeneous territorial filter

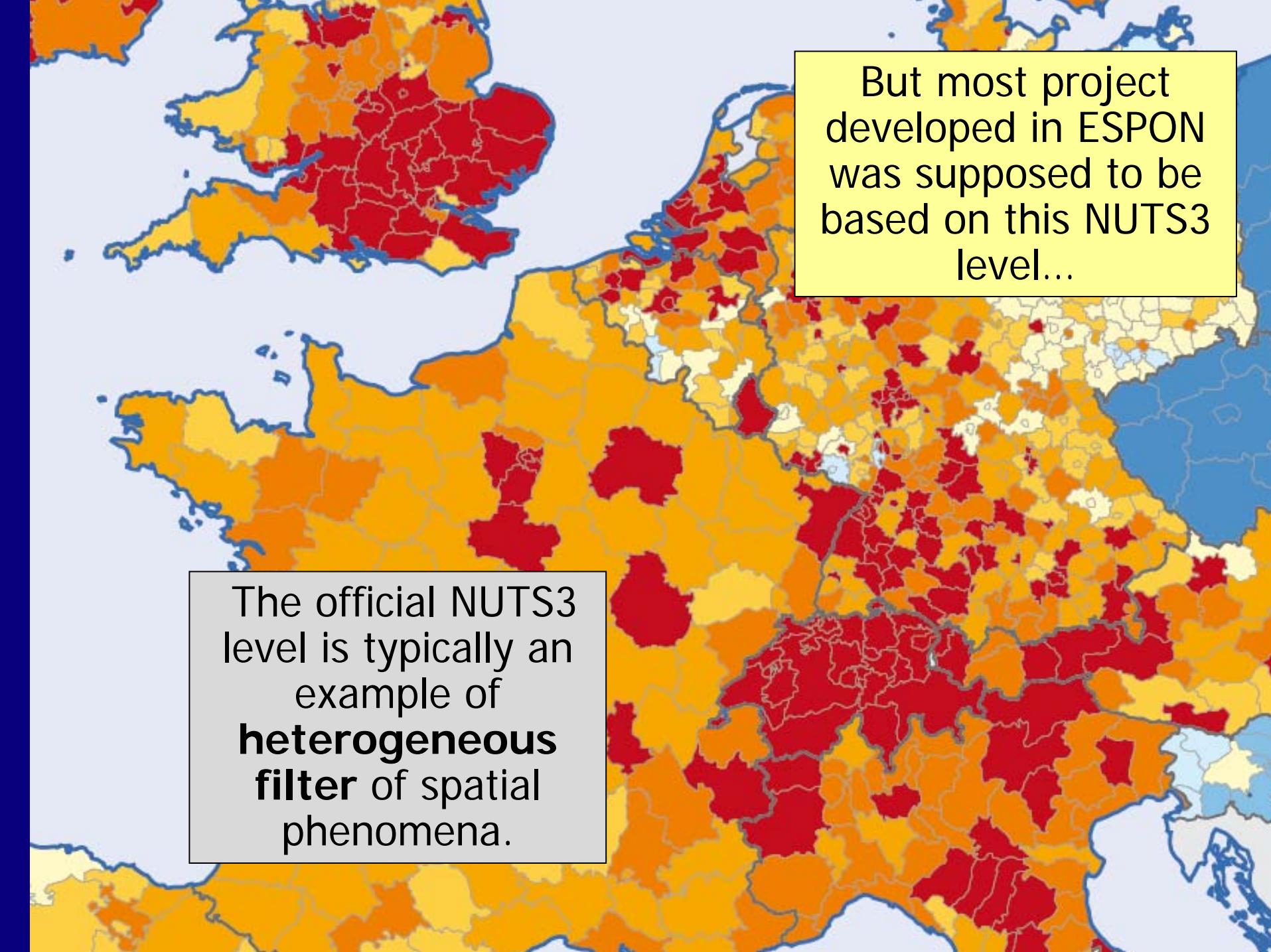


Initial information

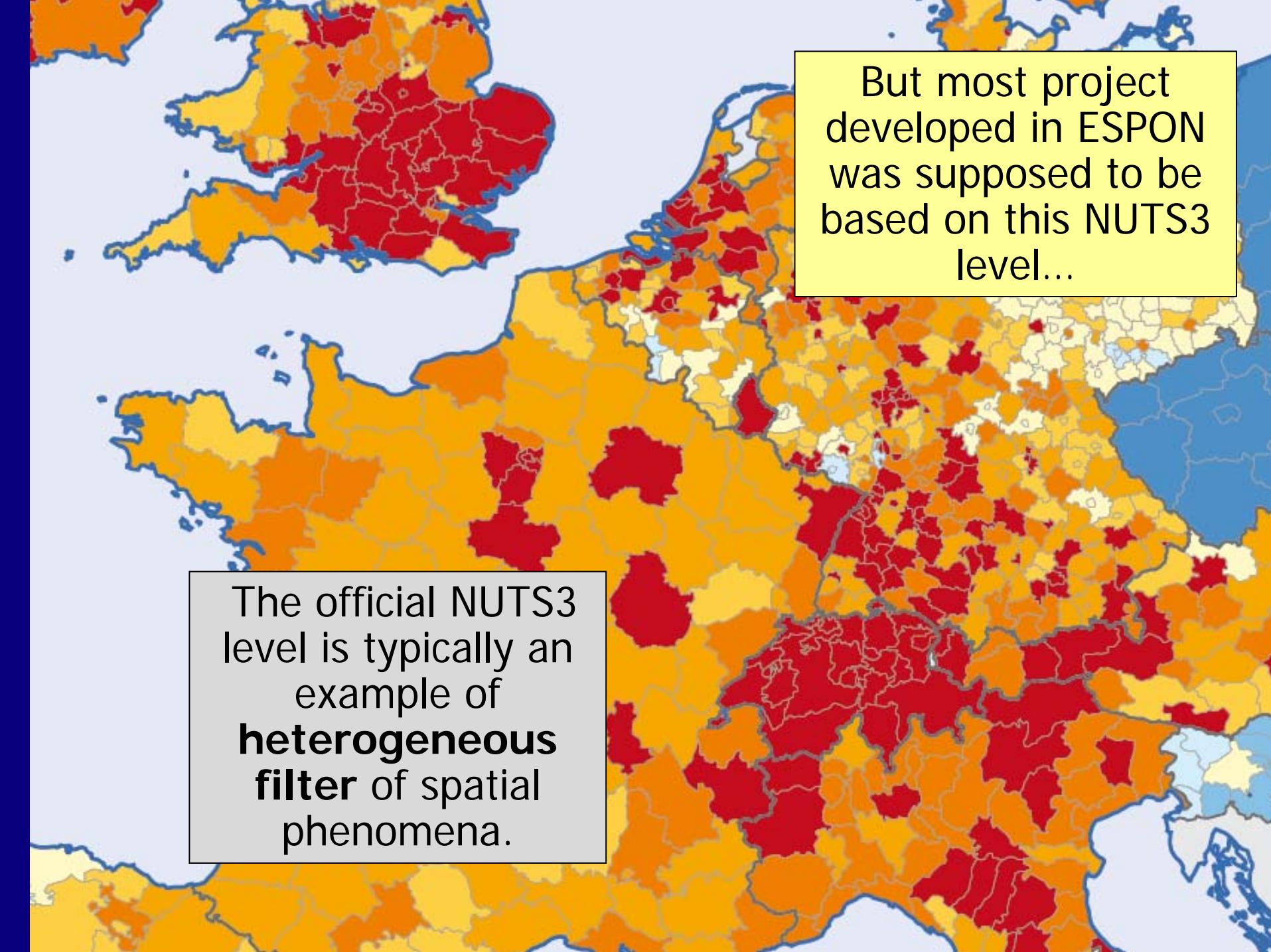


Territorial information





But most project developed in ESPON was supposed to be based on this NUTS3 level...



The official NUTS3 level is typically an example of **heterogeneous filter** of spatial phenomena.

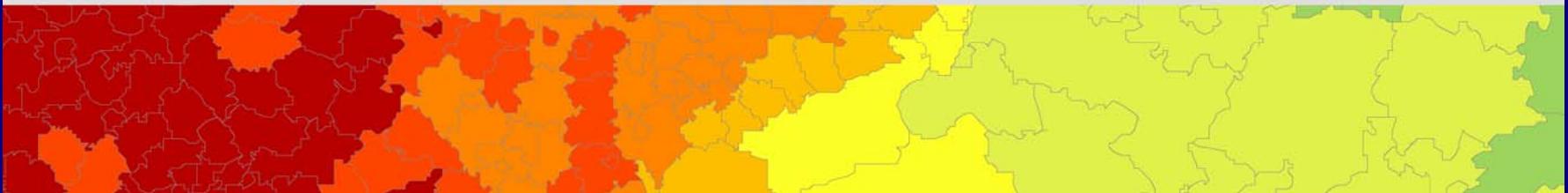


PROBLEM FOR ESPON II : THE USE OF NUTS3 UNITS

Key message :

From scientific point of view, the NUTS 3 level is definitively not relevant for cartographic and statistical analysis. It should be used only for initial data collection.

From political point of view, the choice of NUTS 3 is a symbol of the lack of progress in political integration of European Union.



3. The ESPON Project 3.4.3 MAUP

GEOGRAPHIE-CITES (FR) : M. Ben Rebah, C. Grasland, H. Mathian, L. Sanders
RIATE (FR) : N. Lambert, M. Madelin, I. Salmon

IGEAT (BE) : P. Medina, C. Vandermotten

UMEA (SE) : K. Holme, M. Strömberg

NCG (IE) : S. Fotheringham, M. Charlton, J. Cheng

BBR (DE): W.D. Rase

ID-IMAG (FR) : J.M. Vincent

CESA (FR): K. Serrhini, P. Mathis

CONTENT OF THE FINAL REPORT

available at <http://www.espon.eu>

Part 1 : Scientific approach of the MAUP

- What is the MAUP ?
- State of the art
- Case study on Sweden
- Case study on Ireland
- Case study on Germany

Part 2 : ESPON and the MAUP

- Examples of MAUP in ESPON
- Survey on cartography

Part 3 : Progress for ESPON II

- New statistical divisions
- Smoothing methods
- Cartograms
- Gridding methods
- Dynamic maps

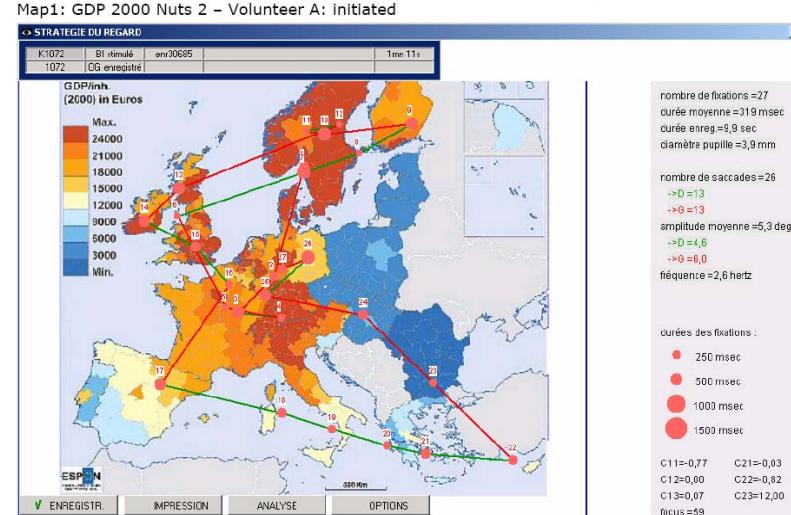
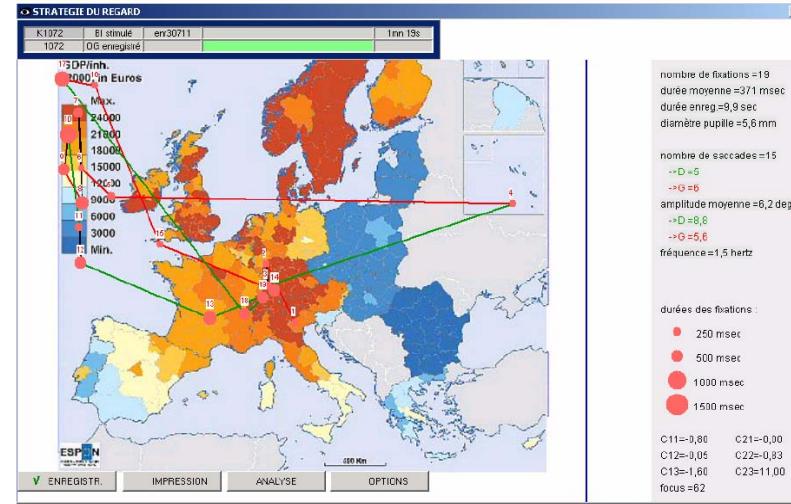


Figure 61 Different readings of the title and the caption

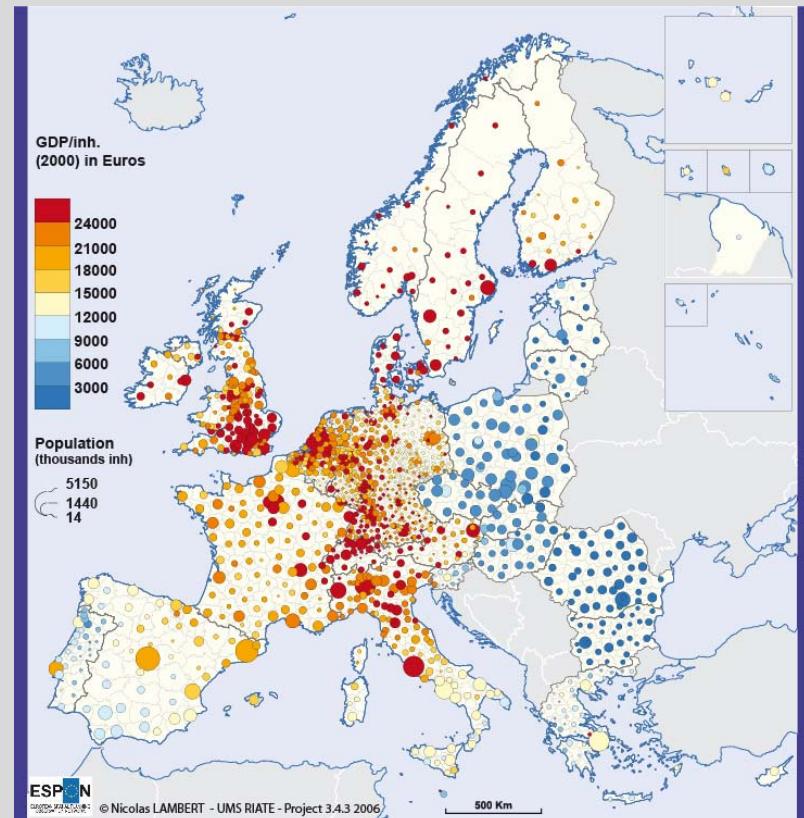
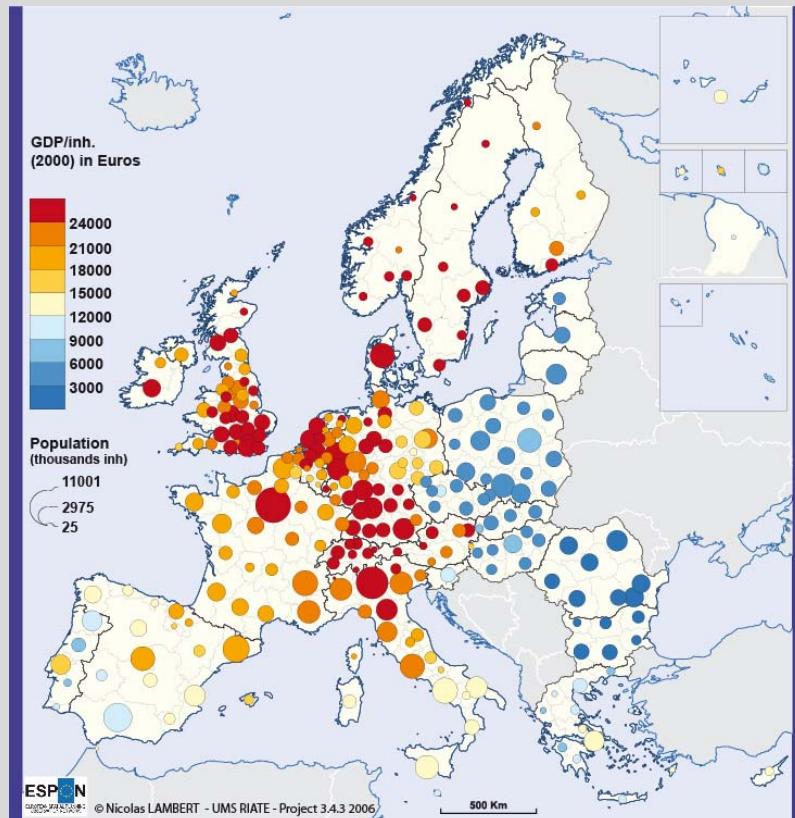


PATH OF PROGRESS FOR ESPON II

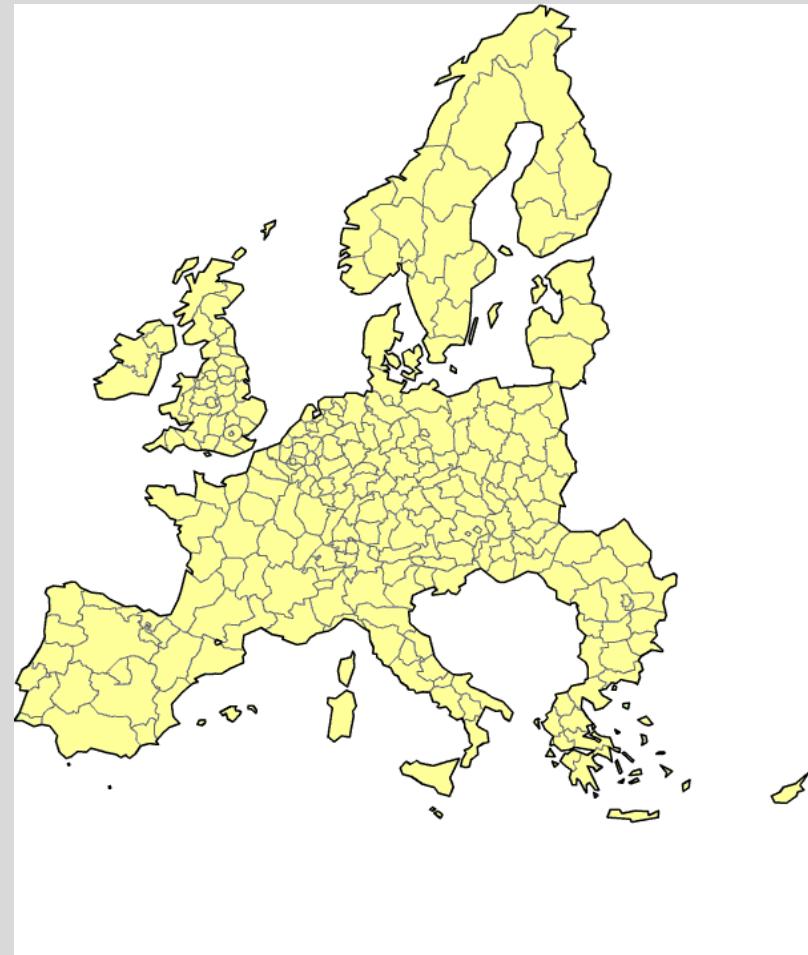
Key message : *The fact that cartographical and statistical results are changing with scale and territorial divisions is a factor of progress for research.*

ESPON II has interest to develop a wider set of solution for cartography and statistical analysis than ESPON I.

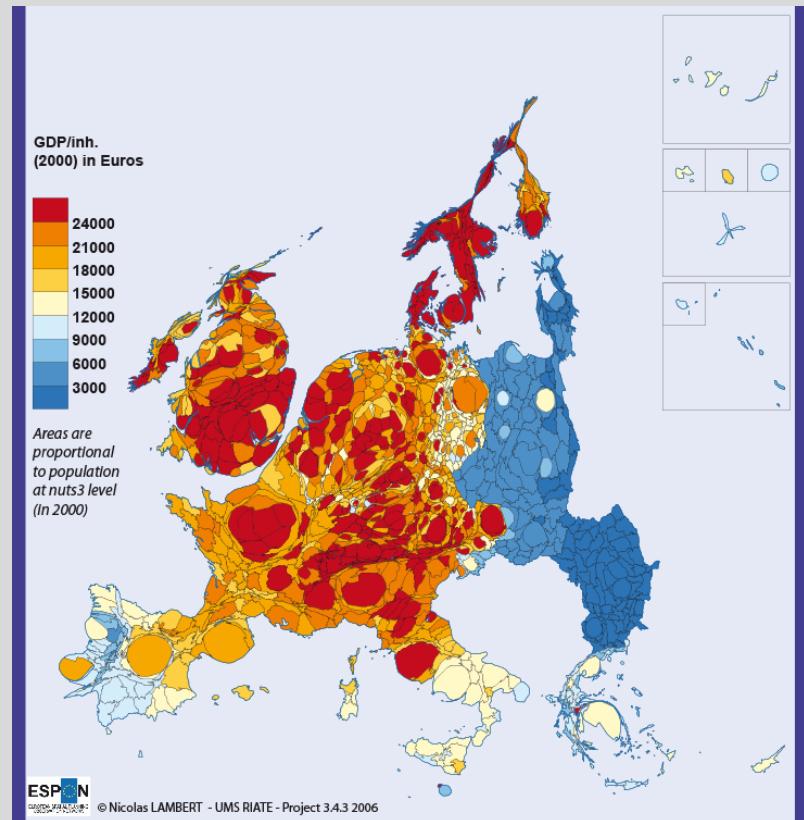
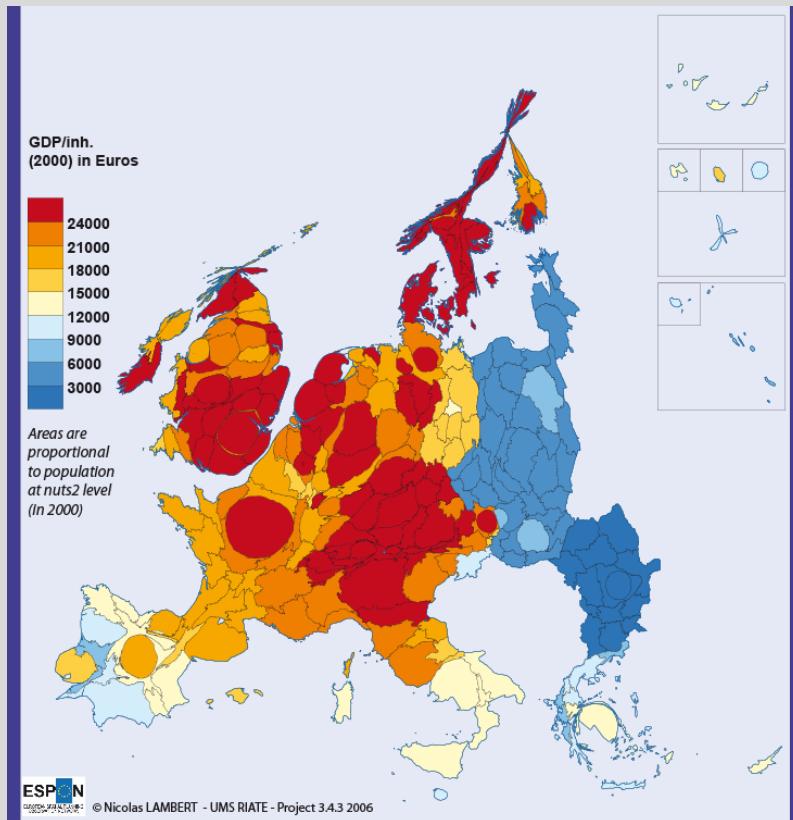
Progress 1 : combination of size and intensity



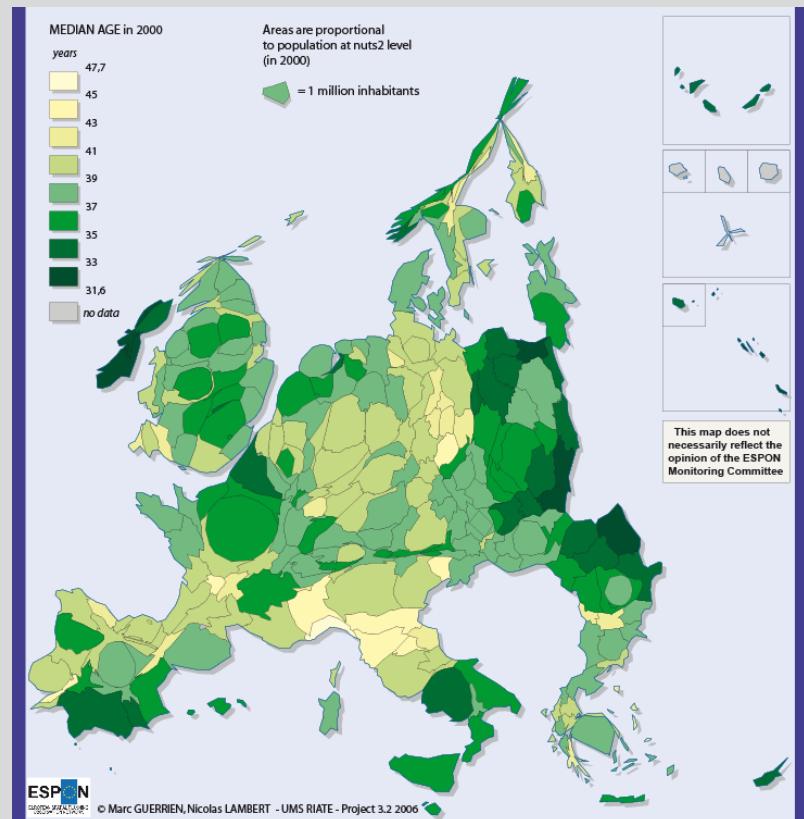
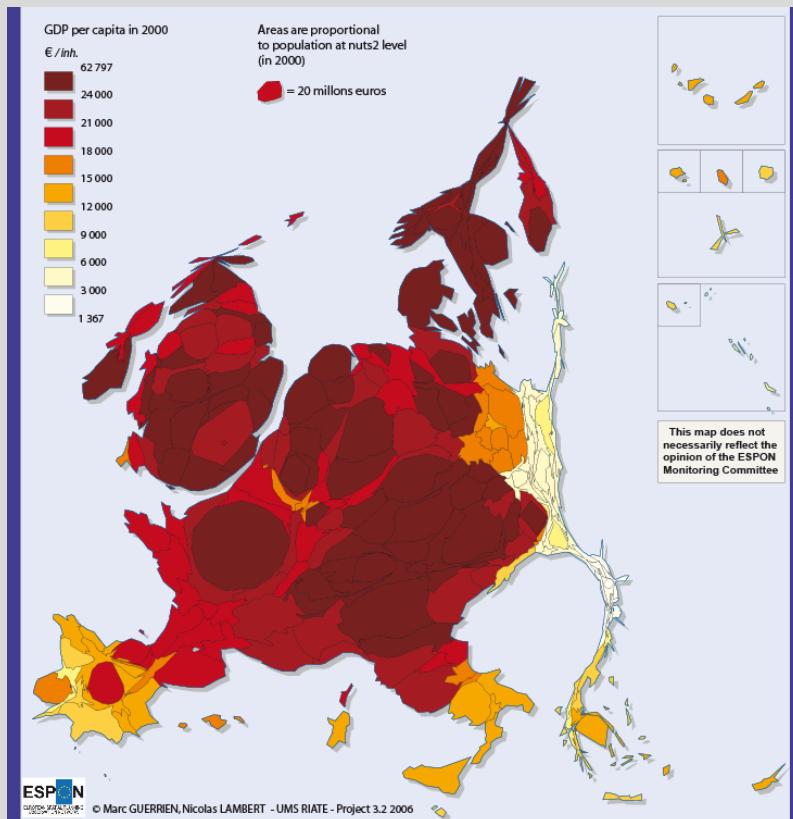
Progress 2 : use of cartograms



Progress 2 : use of cartograms



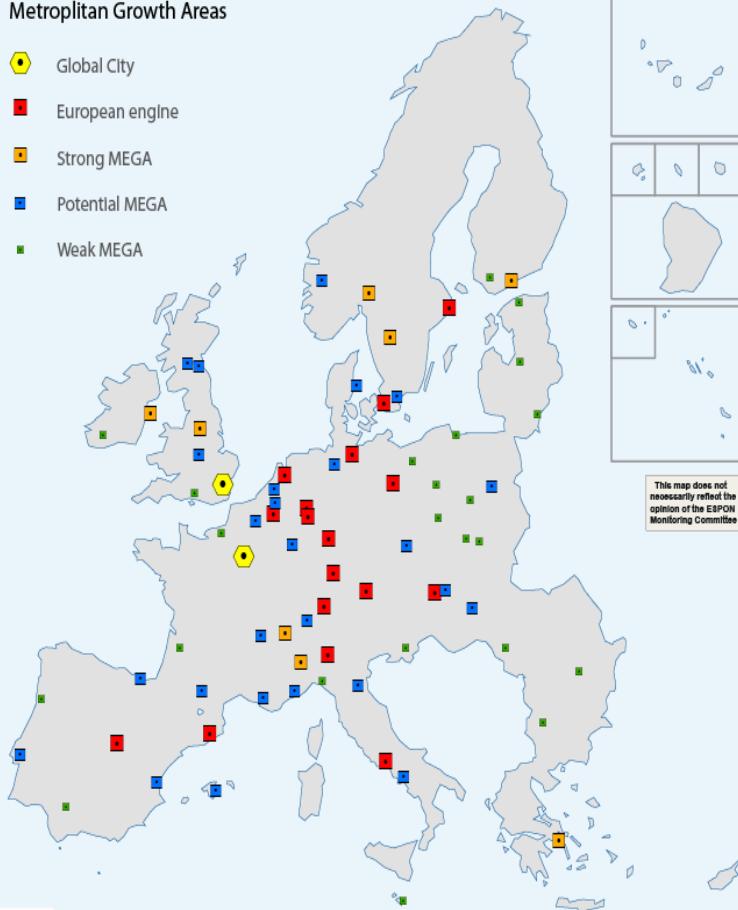
Progress 2 : use of cartograms



Progress 2 : use of cartograms

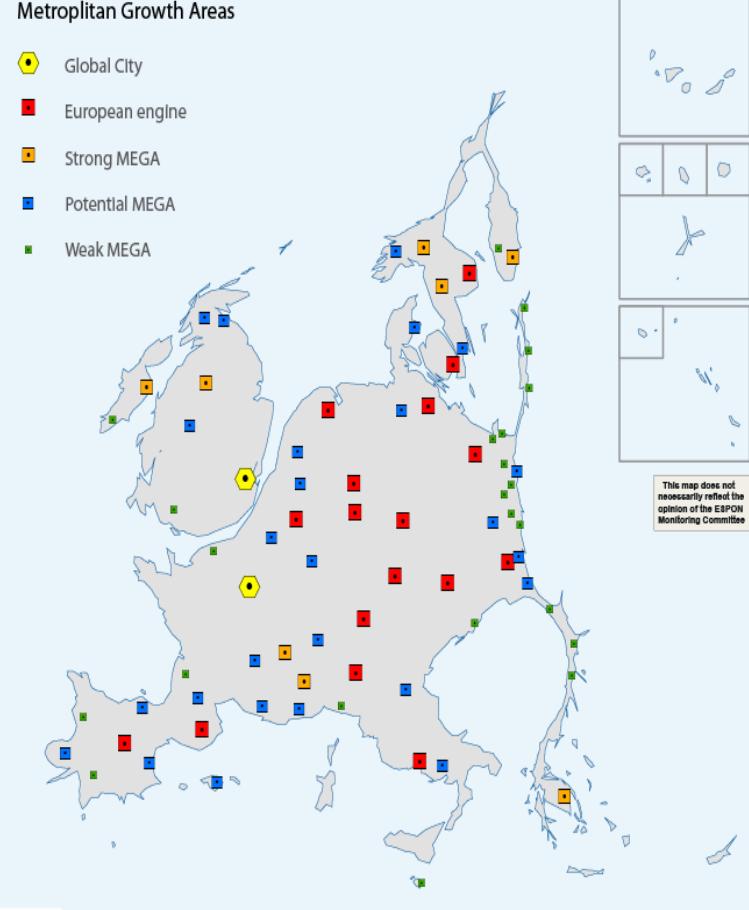
Metropolitan Growth Areas

- ◆ Global City
- ◆ European engine
- ◆ Strong MEGA
- ◆ Potential MEGA
- ◆ Weak MEGA

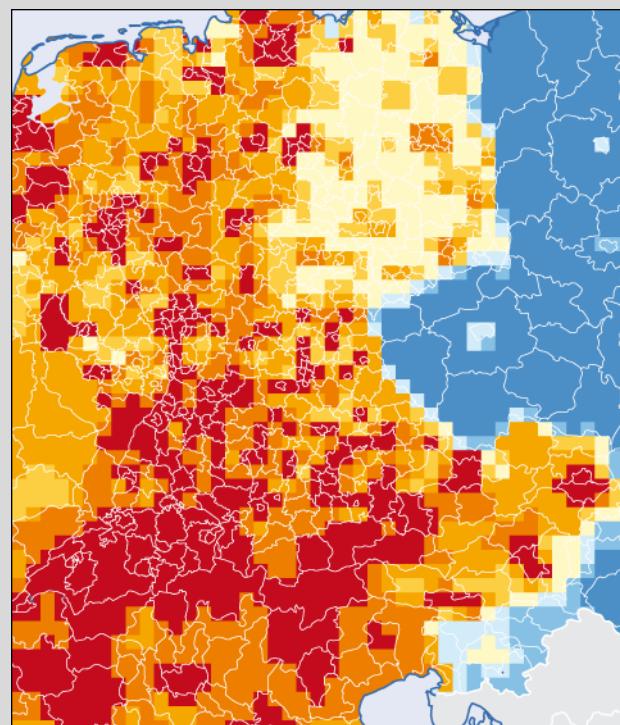
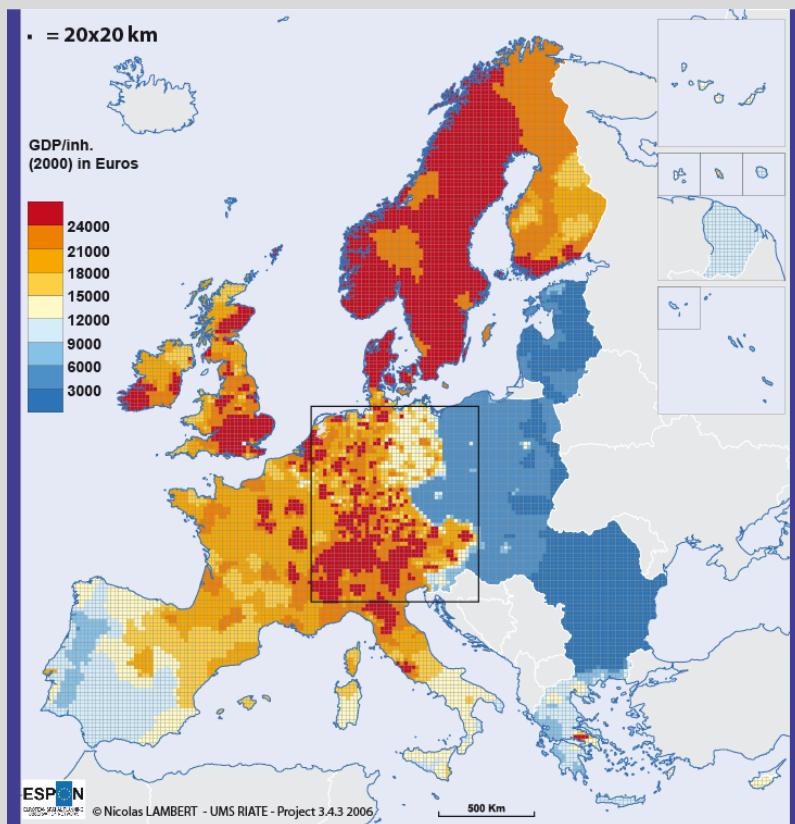


Metropolitan Growth Areas

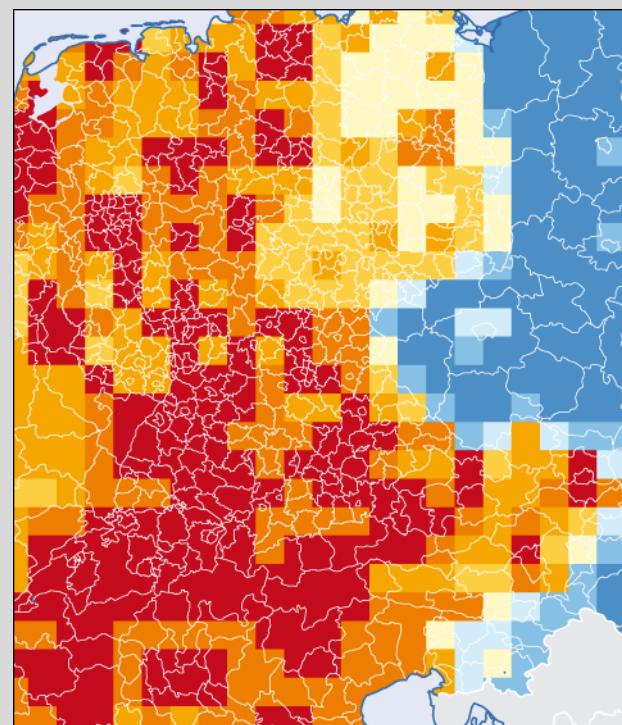
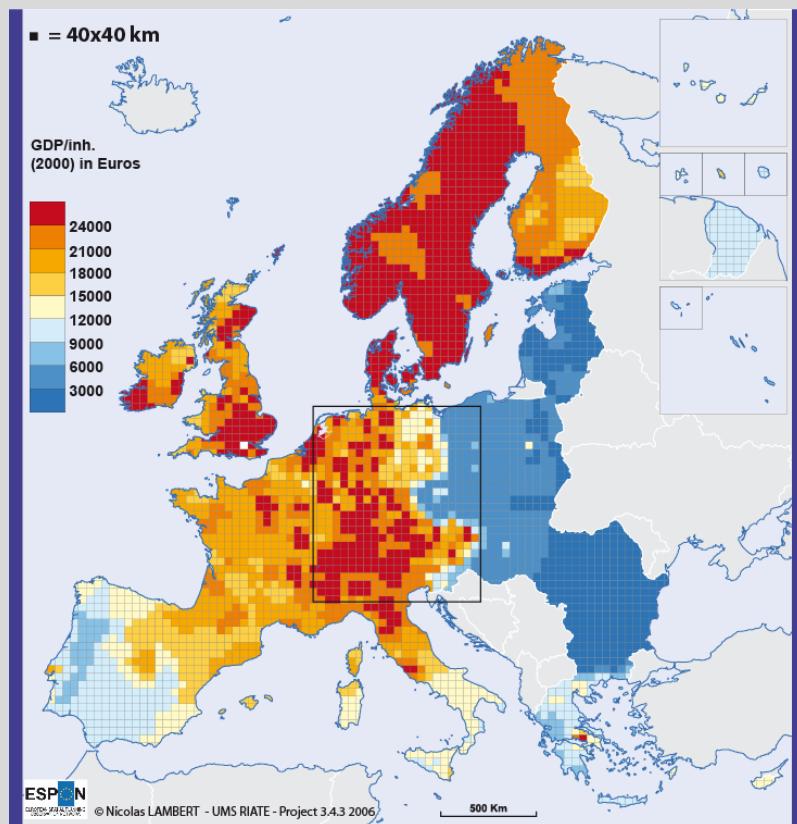
- ◆ Global City
- ◆ European engine
- ◆ Strong MEGA
- ◆ Potential MEGA
- ◆ Weak MEGA



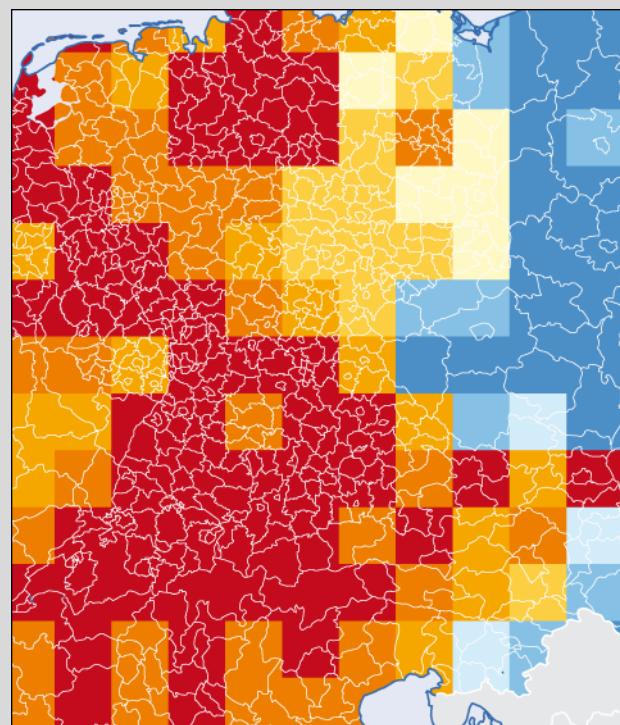
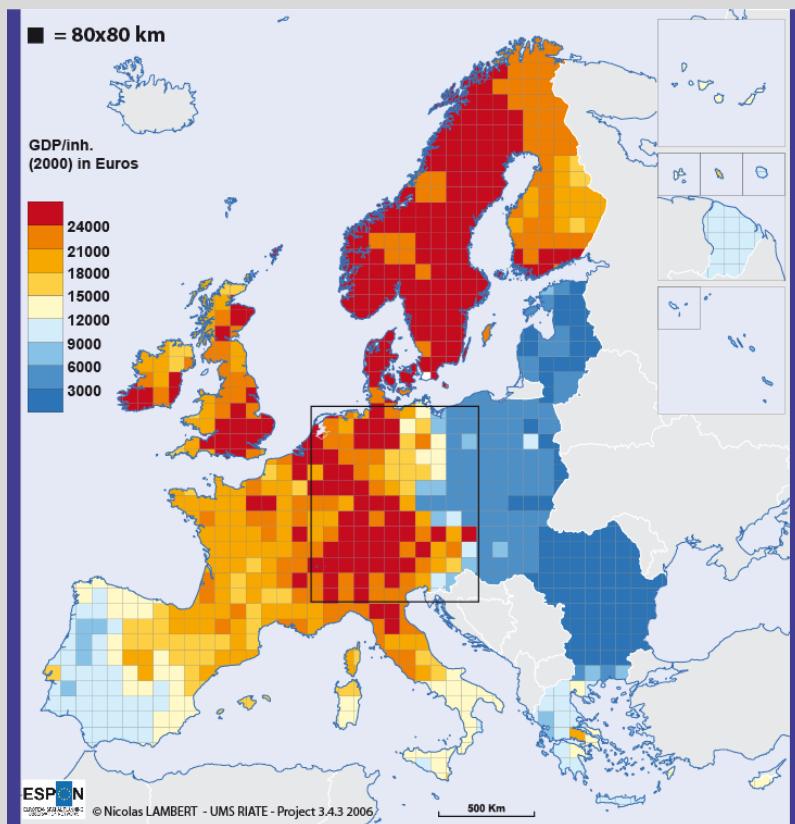
Progress 3 : use of gridding methods



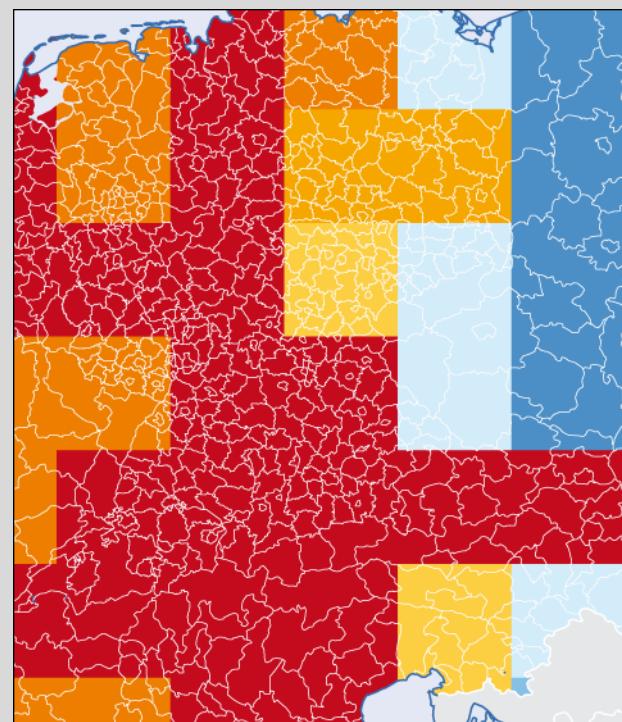
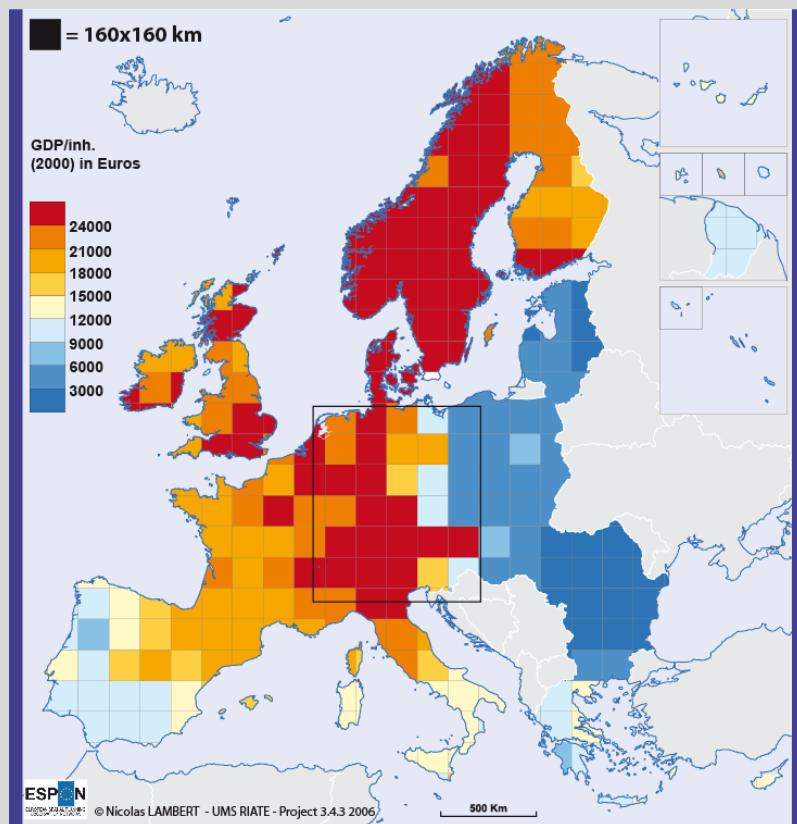
Progress 3 : use of gridding methods



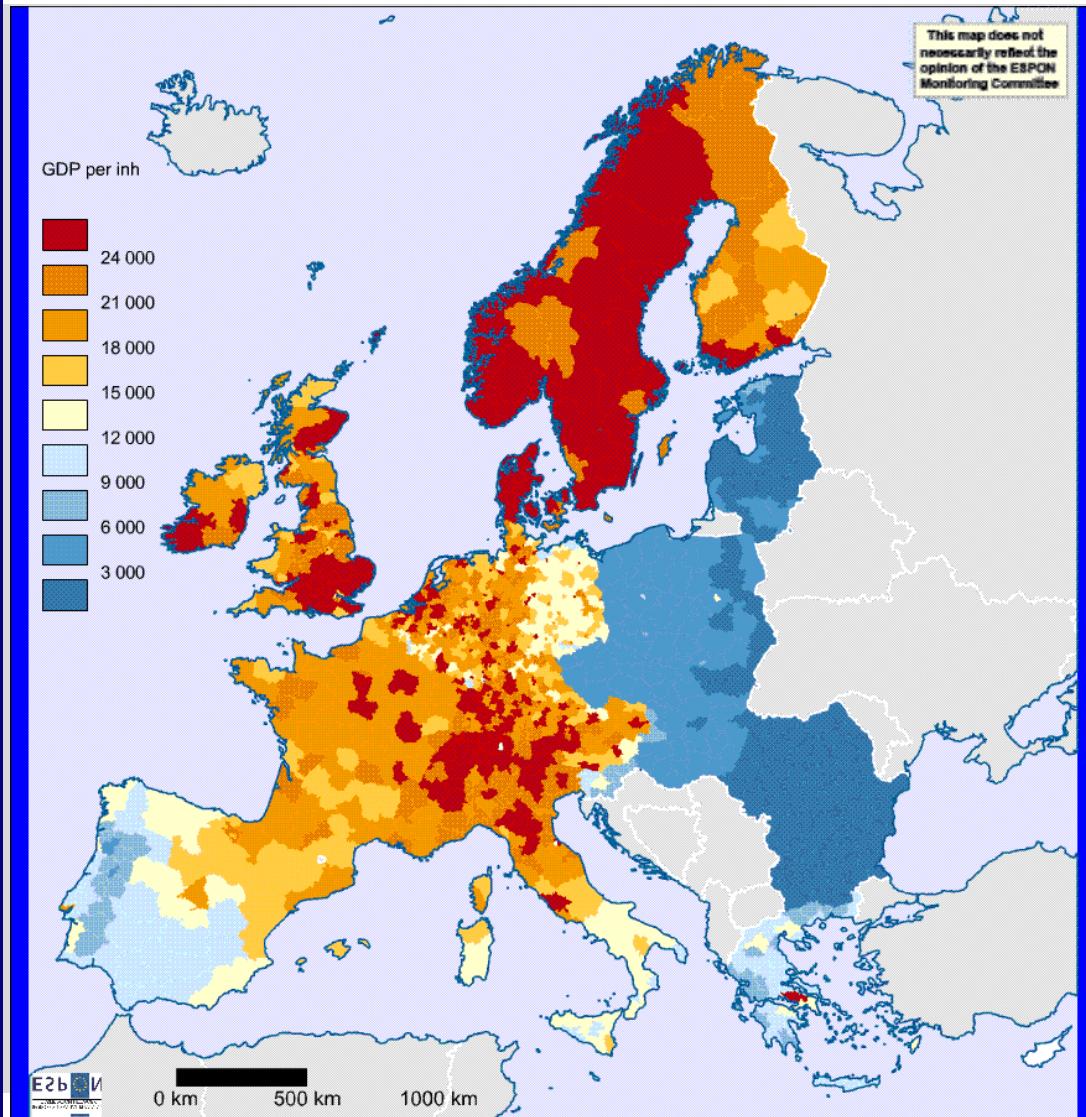
Progress 3 : use of gridding methods



Progress 3 : use of gridding methods



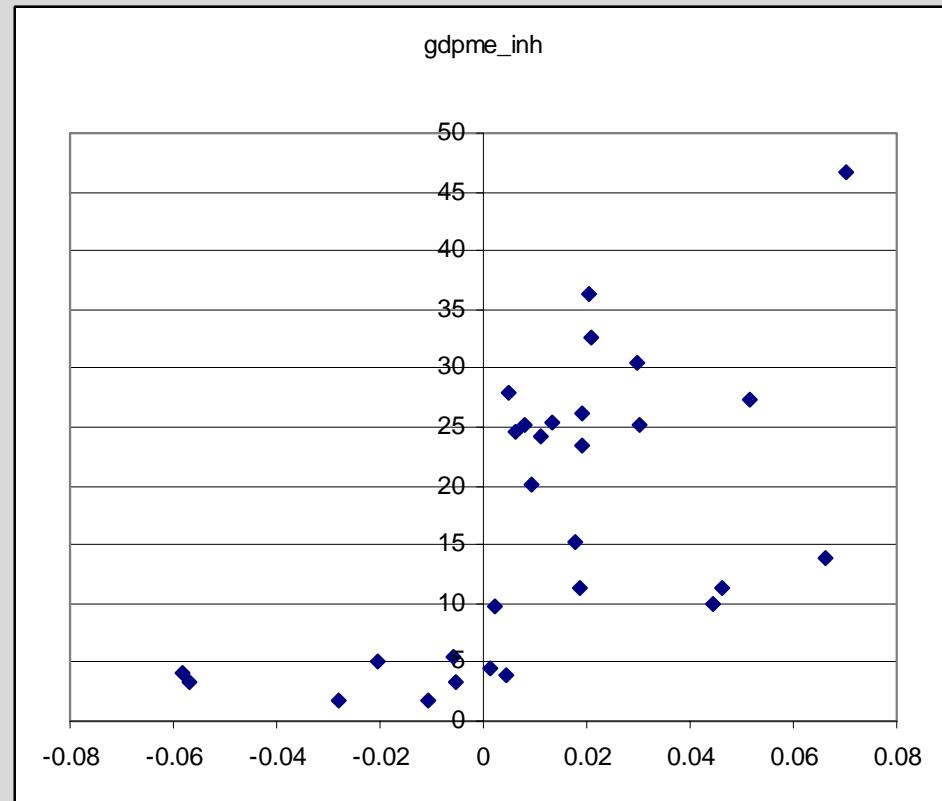
Progress 4 : use of (correct) smoothing methods



Progress 5 : use of new statistical methods

Correlations can be different according to the size of territorial units.

Measuring correlation at different scales of territorial division is very interesting as it indicate at which scale the relation exists or not



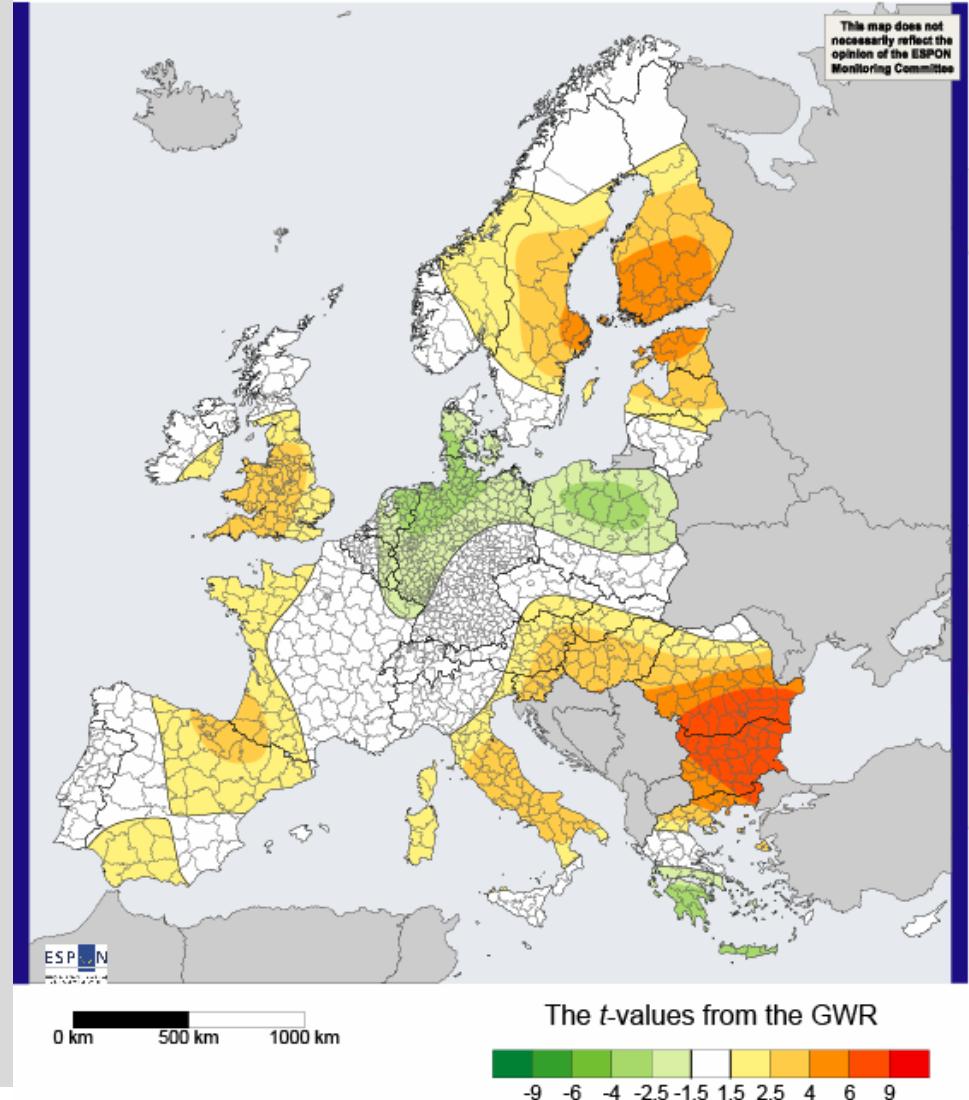
Relation between GDP/Inh. - evolution of population (at Nuts 0 level)

Progress 5 : use of new statistical methods

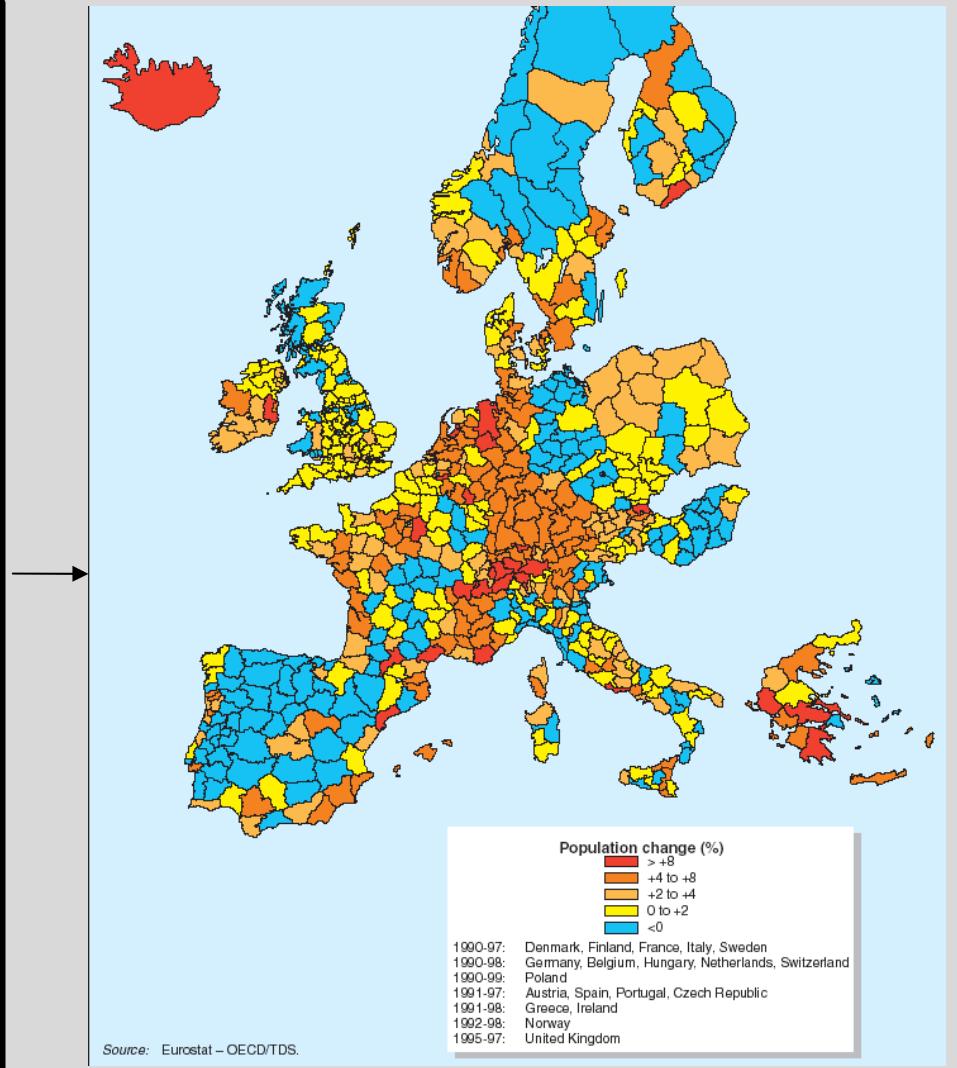
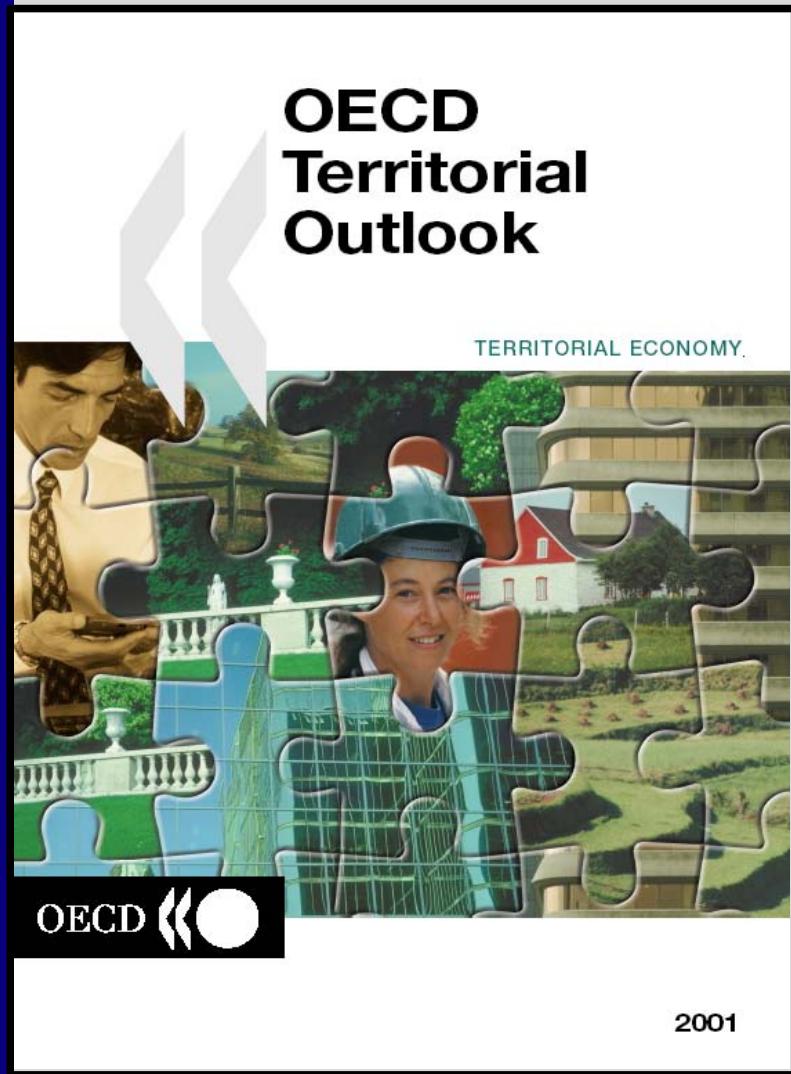
For a given size of territorial units, correlation are also different according to the geographical area (non spatial stationarity)

With **Geographically Weighted Regression** we can produce a set of localised regression models

*Relation between GDP/Inh. - evolution of population
(Nuts3, bandwidth: 250km)*



Progress 6 : Use of new territorial divisions (unofficial !)



OECD propose an alternative harmonisation of levels ...

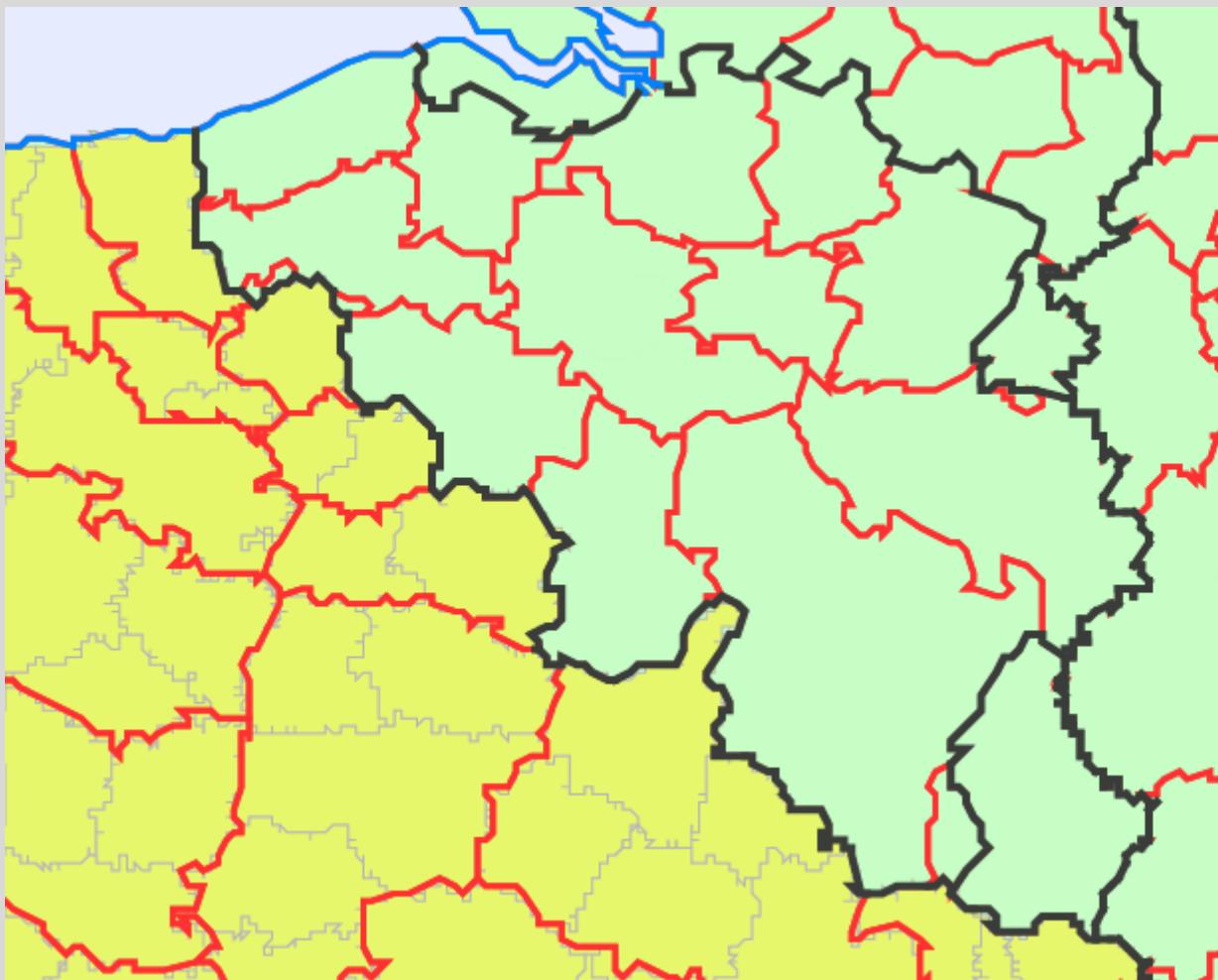
Table / Tableau 1. Territorial levels for statistics and indicators / Niveaux territoriaux pour les statistiques et indicateurs

OECD countries Pays de l'OCDE	Superficie/ Area (1.000 km ²)	1997 Population (1.000 inh.)	Territorial Levels 2 / Niveau territorial 2 Name / Nom	No.	Territorial Levels 3 / Niveau territorial 3 Name / Nom	No.
Australia / Australie	7 687	18 532	States/Territories	8	Statistical Divisions	58
Austria / Autriche	84	8 072	Bundesländer	9	Gruppen von Politischen Bezirken	35
Belgium / Belgique	31	10 181	Régions	3	Provinces	11
Canada	9 976	30 287	Provinces	12	Census Divisions	288
Czech Rep. / Rép. tchèque	79	10 304	Groups of kraje	8	Kraje	14
Denmark / Danemark	43	5 284	Regions	3	Amter	15
Finland / Finlande	338	5 140	Suuralueet	6	Maakunnat	20
France	633	58 608	Régions (+ DOM)	22+4	Départements (+ DOM)	96 + 4
Germany / Allemagne	357	82 061	Länder	16	Regierungsbezirke (modified)	49
Greece / Grèce	132	10 498	Groups of development regions	4	Development regions	13
Hungary / Hongrie	93	10 155	Tervezési-statisztikai regio	7	Megyek + Budapest	20
Iceland / Islande	103	272	State	1	Landsvaedi	8
Ireland / Irlande	70	3 661	State	1	Regional Authority Regions	8
Italy / Italie	301	56 868	Regioni	20	Province	103
Japan / Japon	378	126 166	Groups of prefectures	10	Prefectures	47
Korea / Corée	99	45 991	<i>not yet available</i>		<i>not yet available</i>	
Luxembourg	3	424	State	1	State	1
Mexico / Mexique	1 996	94 184	Estados	32	Regiones	209
Netherlands / Pays-Bas	41	15 609	Landsdelen	4	Provinces	12
New Zealand / Nouvelle-Zélande	269	3 761	State	1	Regional councils	14
Norway / Norvège	324	4 393	Landsdeler	7	Fylker	19
Poland / Pologne	313	38 650	Wojewodztwa	16	<i>not yet available</i>	
Portugal	92	9 950	Comissões coordenação regional + regiões autónomas	5+2	Grupos de Concelhos	28+2
Spain / Espagne	505	39 323	Comunidades autónomas	16+2	Provincias	48+4
Sweden / Suède	450	8 848	Riksområden	8	Län	21
Switzerland / Suisse	41	7 087	Grandes régions	7	Bassins d'emploi	16
Turkey / Turquie	781	63 745	Regions	7	Provinces	80
United Kingdom / Royaume-Uni	245	59 009	Government Office Regions + Countries	12	Upper tier authorities or groups of lower tier authorities or groups of unitary authorities or LECs or groups of districts	133
United States / Etats-Unis	9 372	266 792	States	51	Commuting zones	765

... with creation of « unofficial » but functional units when necessary



C. Vandermotten (IGEAT) has done a set of proposals in ESPON project 3.4.3 ...



Functional regions ("new NUTS2")

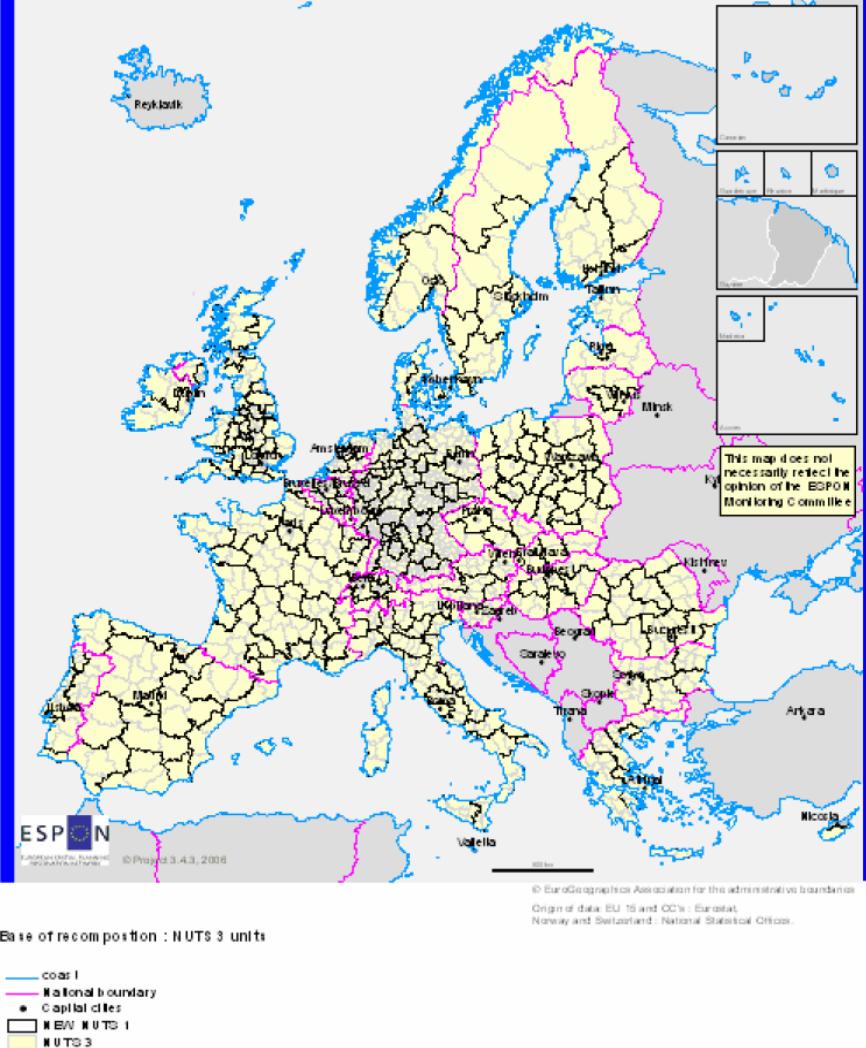
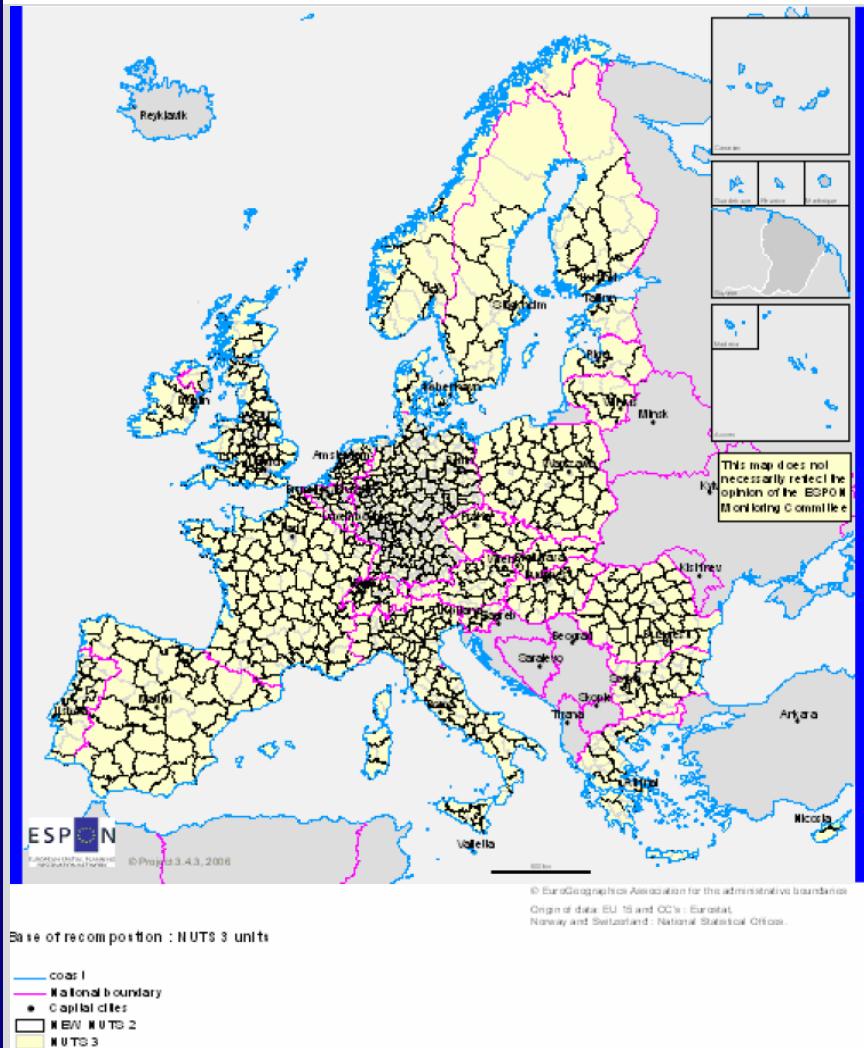
Rules :

- 1) Agregation of urban area with there periurban periphery
- 2) Homogeneity of economic structure (e.g. levels of GDP/inh)

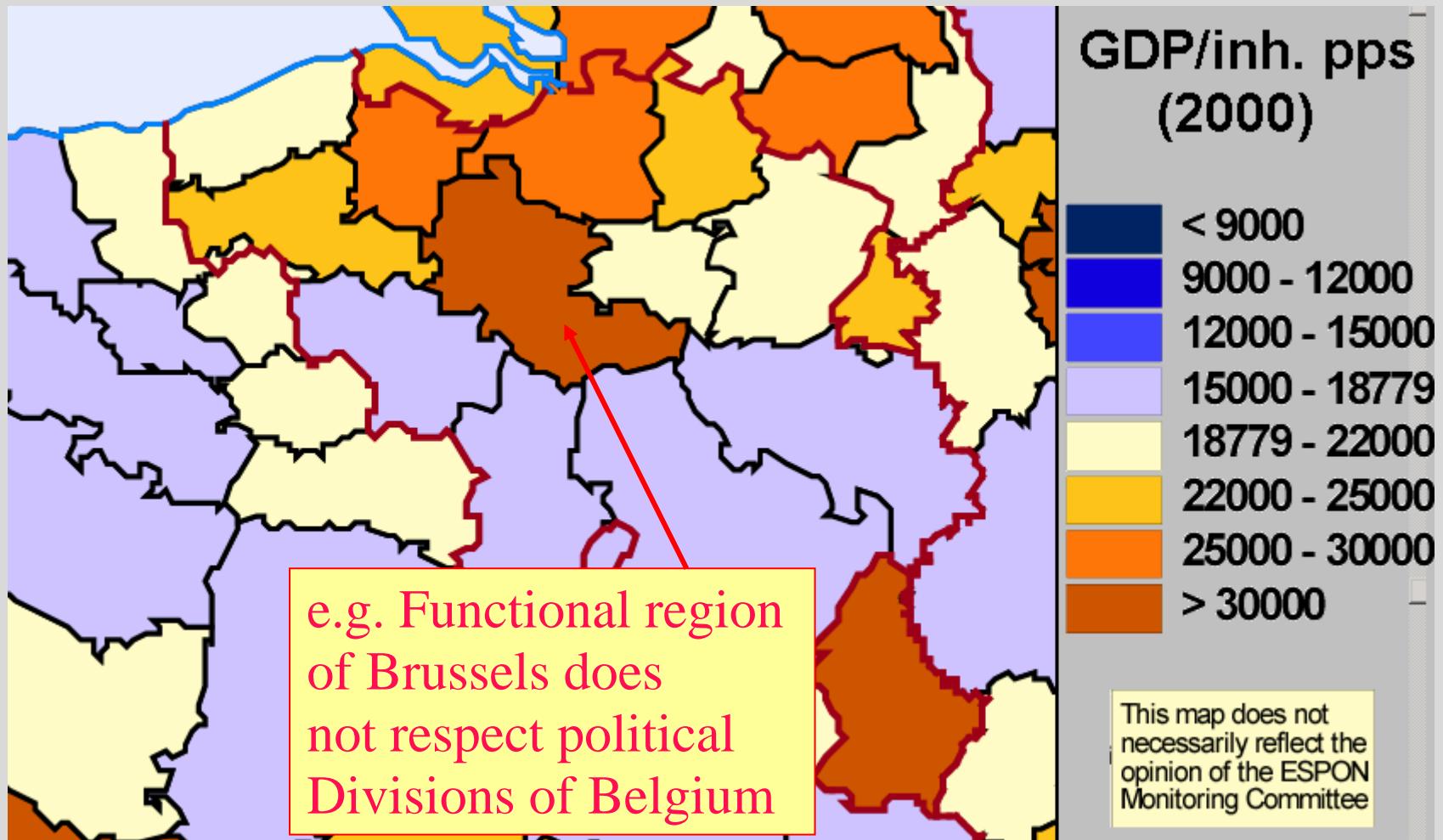
Problems :

- 1) Necessary to use units lower than NUTS3 (french arrondissements)
- 2) Existence of cross border functional areas (Luxembourg)

... but for the moment ESPON has not adopted this new proposals of territorial divisions ...

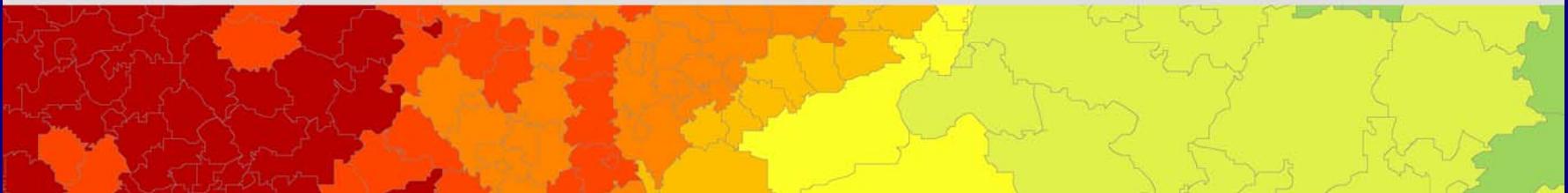


... may be because they are not politically correct ...





EUROPEAN SPATIAL PLANNING
OBSERVATION NETWORK



CONCLUSION : MAUP as mirror of EU building

HARMONISATION OF STATISTICS AND TERRITORIAL UNIT AS POLITICAL SYMBOL ?

**Conflict with
traditional powers
(*States, ...*)**



**Emerging new
political power
(*Europ. Union*)**

**Elaboration of new
statistical data and
territorial units**

**Increasing
autonomy for
political actions**

F. Ratzel, 1897,

Politische Geographie