



GMES Land Track

Perspectives for the User

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GMES Land Track

- GMES is a joint initiative of the EC and the ESA.
- GSE is the first programme fully dedicated to GMES.
- It focuses upon the delivery of policy-relevant services that support the implementation of European policies in the fields of Environment, Cohesion, Agriculture, Foreign Aid, Security to end-users, primarily (but not exclusively) from EO sources.
- GSE is a key element of GMES, since it enables end-users to become involved in 'closing the loop' between the operational results obtained from the present generation of EO satellites and the definition of future systems.



GMES Land Track

- GSE Land is aimed to deliver geo-information services over large areas and for a wide spectrum of land applications.
- The GSE Land services are based on general geo-information on Land Cover and Vegetation (LC&V) created from Earth Observation (EO) data which is harmonised and standardised allowing cross-border applications and comparisons.
- By integrating this information into existing user-side infrastructure supporting validated and accepted models and management tools, international and national public institutions are supported to fulfill their reporting and management obligations coming from new European Directives and Policies in an improved way.



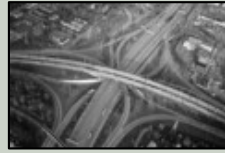
GMES Land Track

- The philosophy of Land Information services is:
 - Demonstrate progress towards long-term sustainability for a set of GMES services
 - Deliver services and benefits to users on progressively larger scales
 - Establish a durable, open, distributed GMES Service Provision Network
 - Establish standards and working practices for GMES services

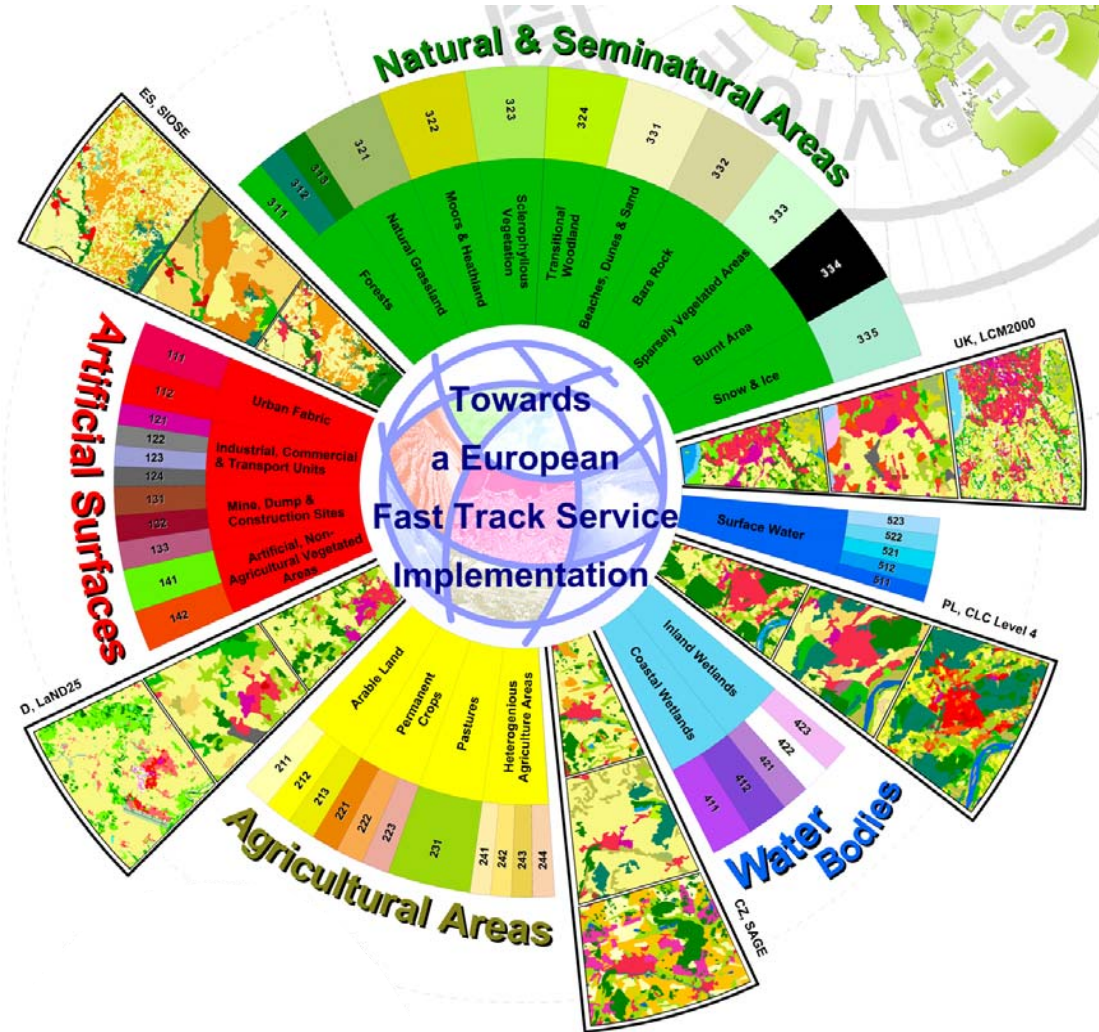


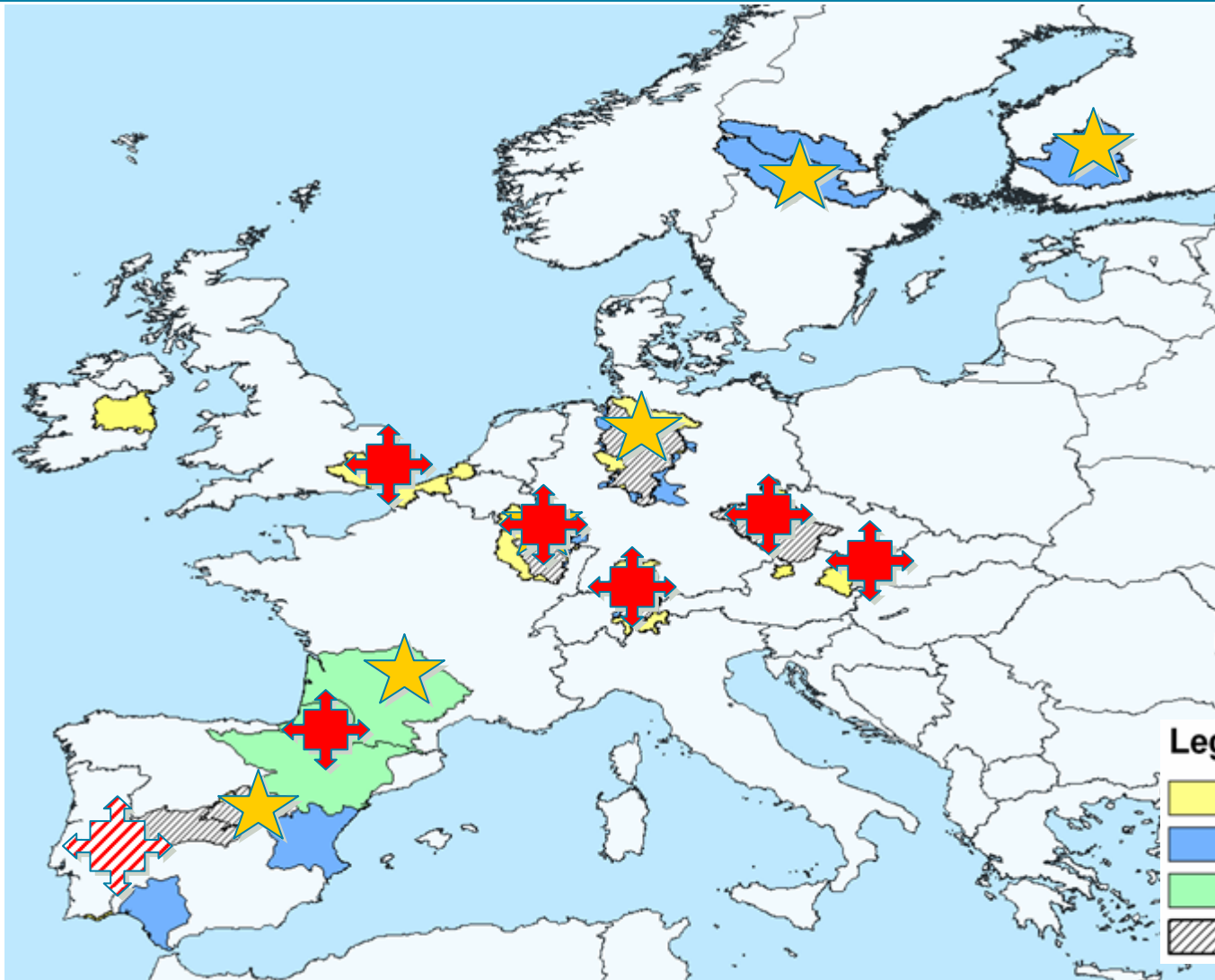
GMES Land Track

- The Strategic Implementation Plan for the Land Monitoring Core Service (LMCS) identifies three dimensions to be taken into account in the definition of this service:
 - The geographical scale consisting of 3 core mapping service (CMS) components
 - global,
 - continental or
 - local;
 - The time scale:
 - 'near real-time' information
 - 'periodic' information
 - The level of elaboration
 - 'basic' mapping products
 - 'downstream' products which will address specific European policies.



Core Mapping Service









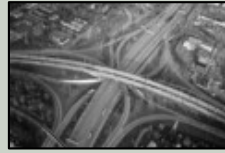
Innovative Regions setting signs



Co-operation of Regions leads to interoperable solutions

Legend

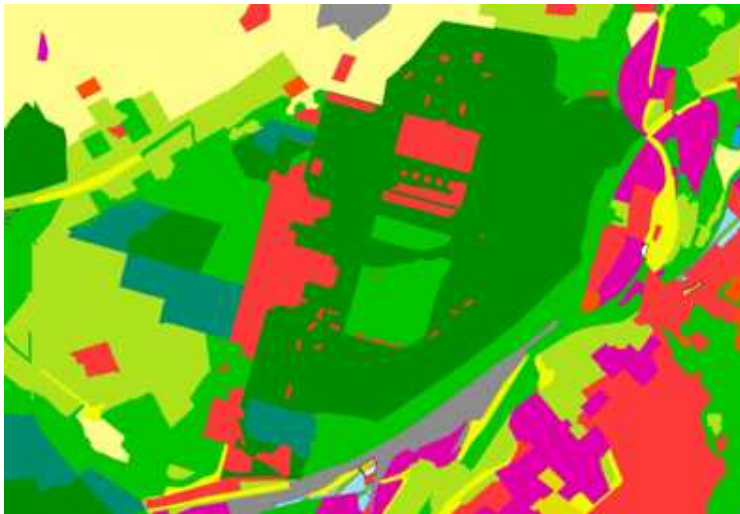
-  Land Take Monitoring
-  Water Quality (Diffuse Pollution)
-  Irrigation
-  Overlap Areas



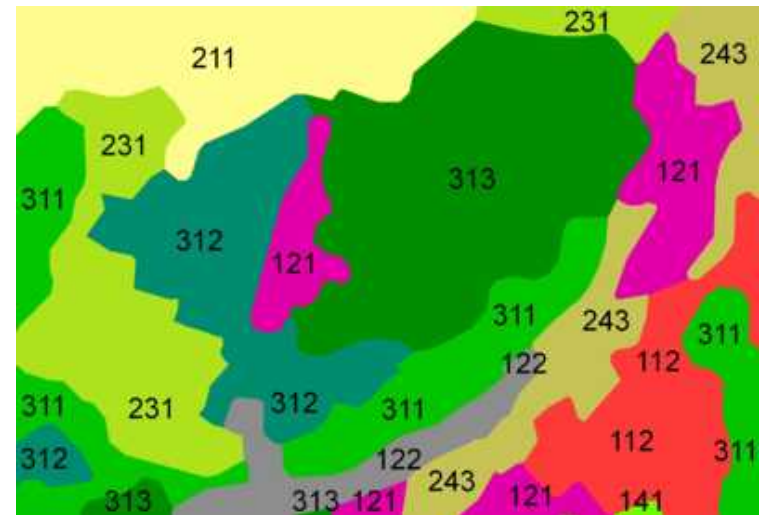
Mapping Service

Level of Elaboration ...

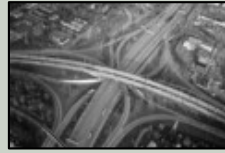
Example from Germany



Topographic Reference
Data (ATKIS)



& Land Cover Data

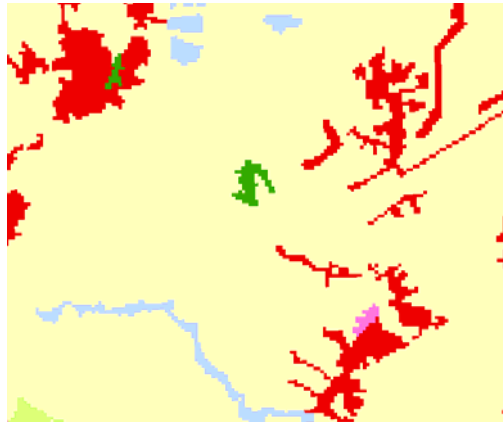


Mapping service

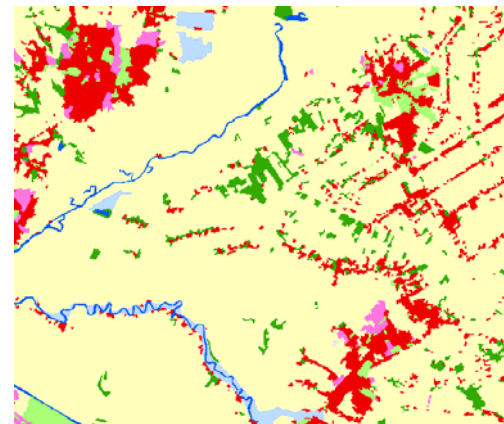
'Improved CORINE'

What does 'improved' mean?

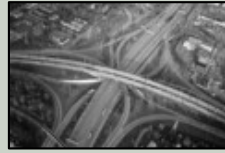
- Geometric refinement:
 - Scale 1: 25.000
 - Minimum mapping unit: 0.25 ha for artificial surfaces, 1 ha for non-artificial surfaces
- Thematic improvement: Accuracy of $> 95\%$ for artificial surfaces (point sampling)



CORINE Land Cover
(MMU 25 ha)

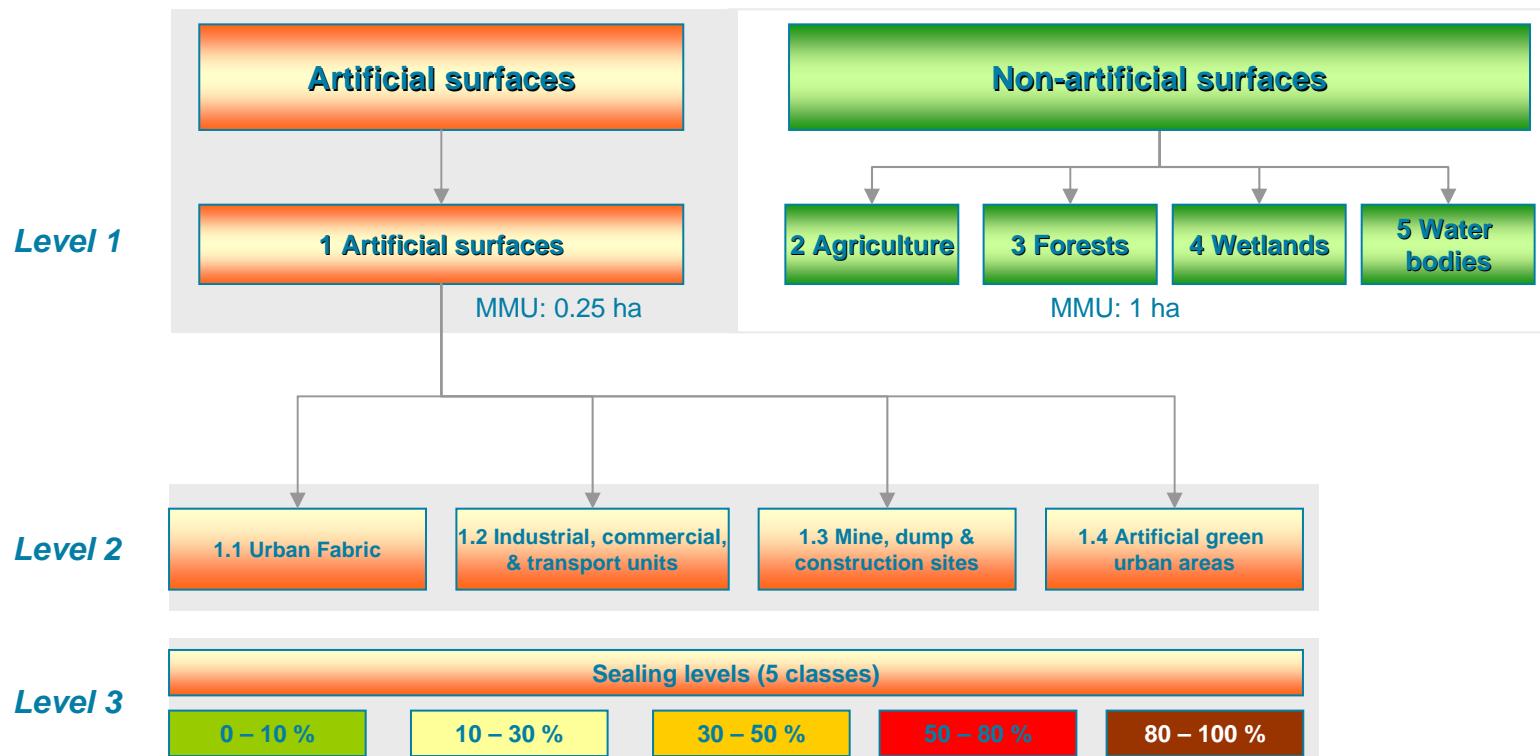


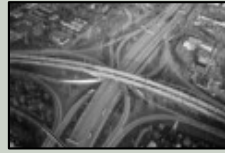
GSE Land - M2.6
(MMU 0.25ha for artificial surfaces)



Mapping Service

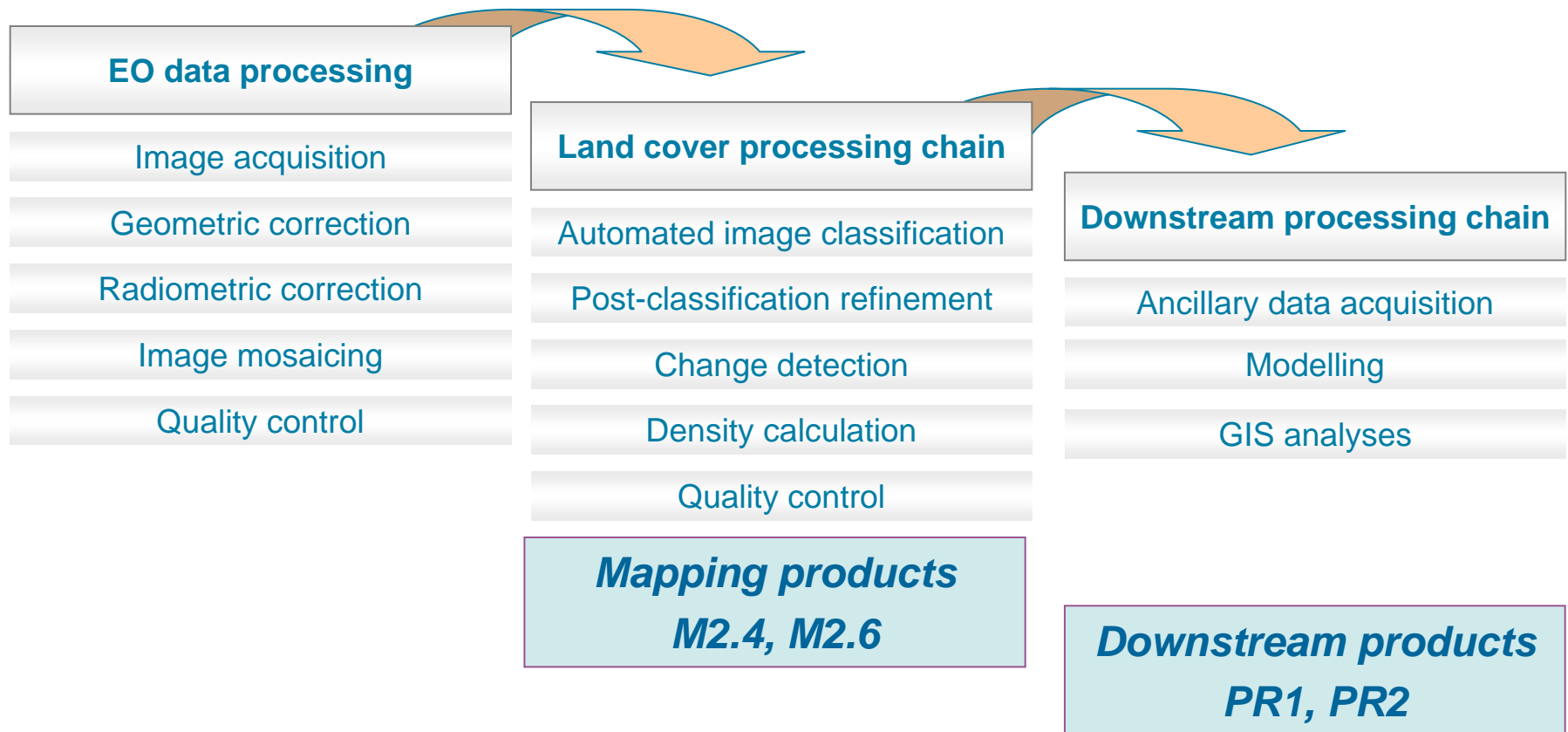
Nomenclature

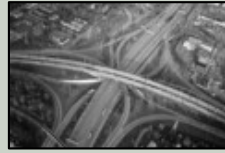




Mapping Service

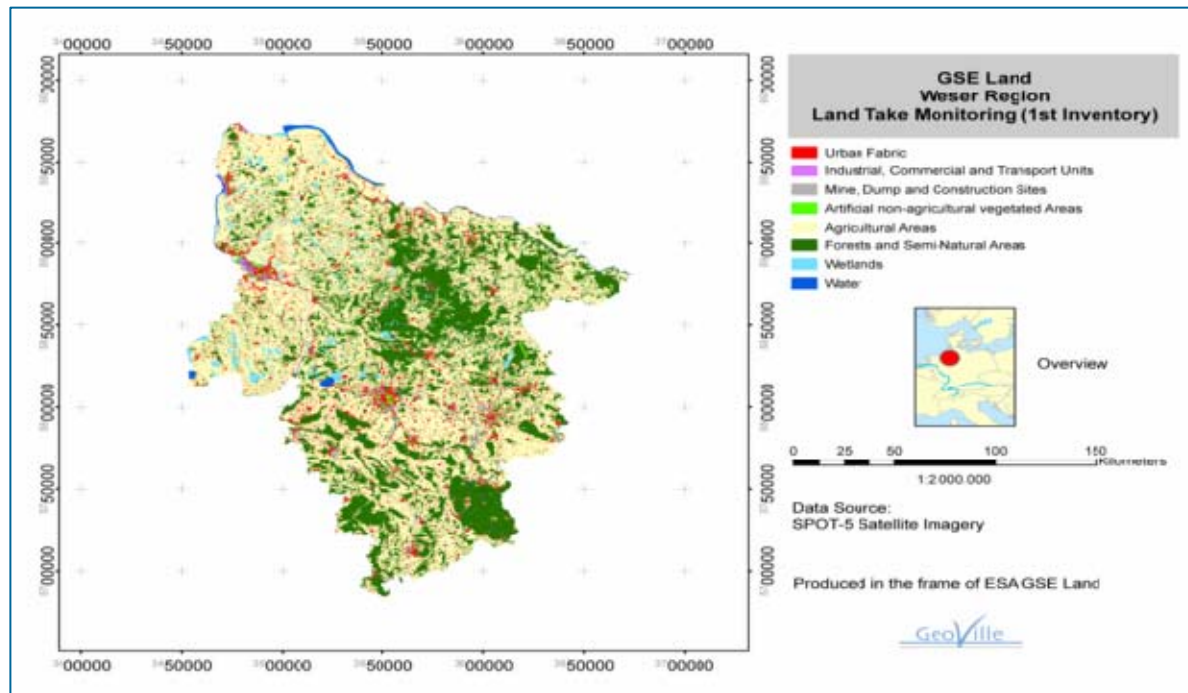
Processing chain





Mapping services

Land cover map



M2.6 – Land Take Map (First inventory)

Inventory of artificial surfaces in relation to other land cover types

M2.4 – Land Take Map (Downdate)

Mapping the evolution of artificial surfaces in relation to other land cover types

Example for implementation site Weser/Germany: 33.439 km²

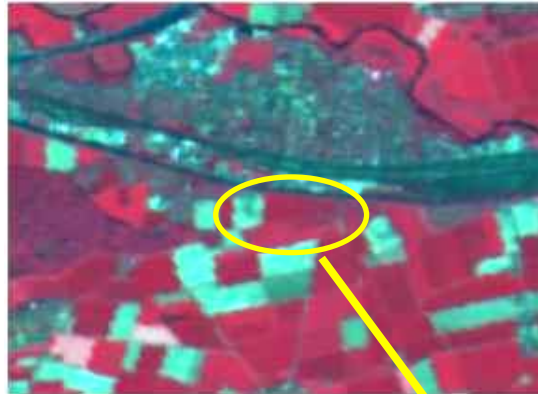




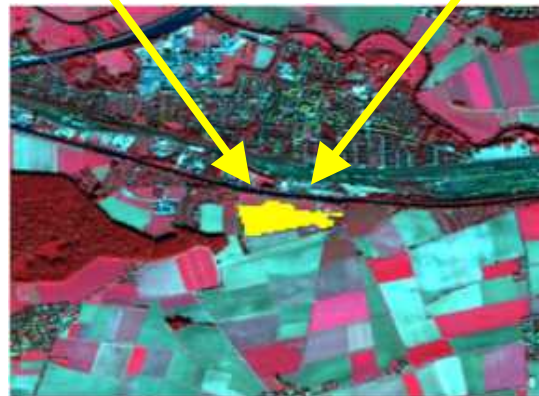
Mapping services

Landcover change

SPOT 2000 (20m)



SPOT 2005 (10m)



 Change





Mapping Service

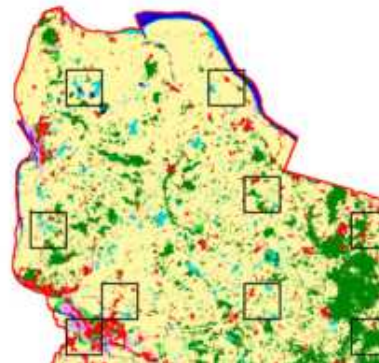
Independent quality control

- Cluster based area sampling
- Stratified random point sample

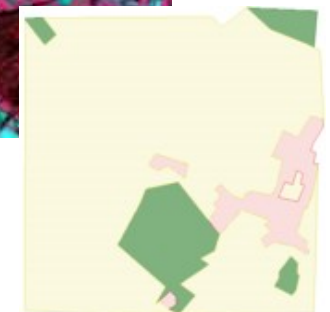
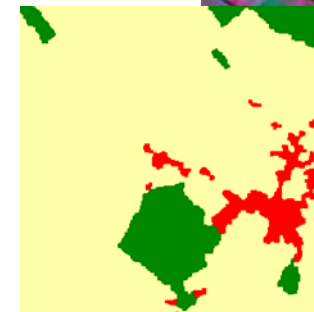
Validation results:

- Buffered cluster approach 20m: **93.8%**
- Buffered cluster approach 10m: **91.8%**
- Cluster approach: **88.8%**
- Stratified random point sampling: **95.7%**

ETC-TE verification: GSU Land product M2.6
Water Region
03.01.2006

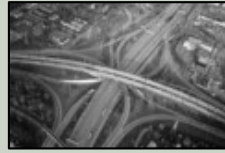


M2.6



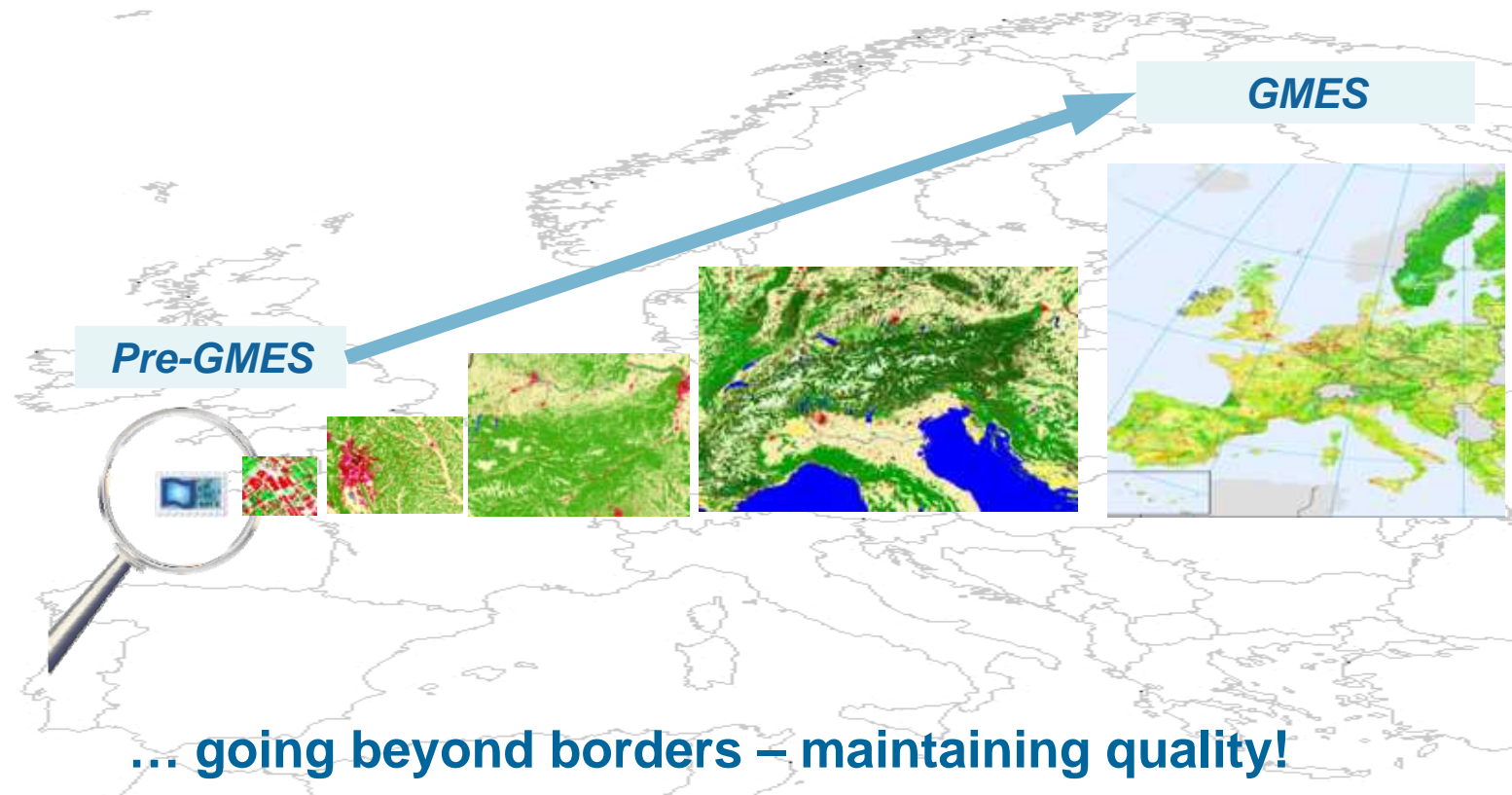
M2.6





Mapping Service

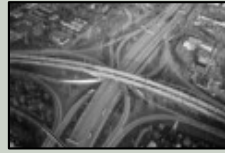
Rollout of stamp' type results to large areas





Examples of Downstream Services

- **Spatial Planning**
describe, explain and forecast urban land use change.
- **Urban Atlas**
land use and land cover mapping of European urban functional areas
- **Impervious areas and sealing levels**
To assess the impact of land consumption on subnational level
- **Water Monitoring**
Integrate EO derived LC/LU data in water quality models that can contribute to water management in a flexible, sustainable and cost-efficient way.
- **Agri-Environmental Monitoring**
Evaluate the utility of the CMS for the supply of EO based indicators assessing the impact of agriculture on the environment and the effectiveness of agri-environmental measures.
- **Forest Monitoring**
Address specific user requirements from the European Environment Agency (EEA), DG ENV and DG AGRI for improved forest class and biodiversity information required for the LMCS at a pan-European level.

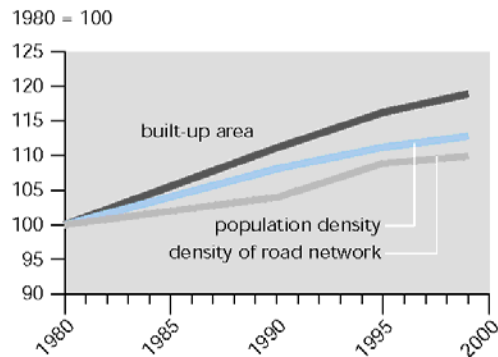


Spatial Planning

What is our topic?

Urban growth & land consumption

- > 25% of the EU territory is directly affected by urban land use
- > 75% of the European citizens live in urban areas *Source: European Environment Agency*
- Every day, in Germany approx. 100 ha of soil are lost for urban development and transport infrastructure *Source: Federal Statistical Office Germany*



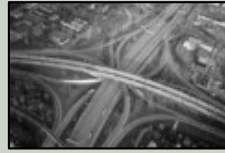
0,5 ha



x 200 =



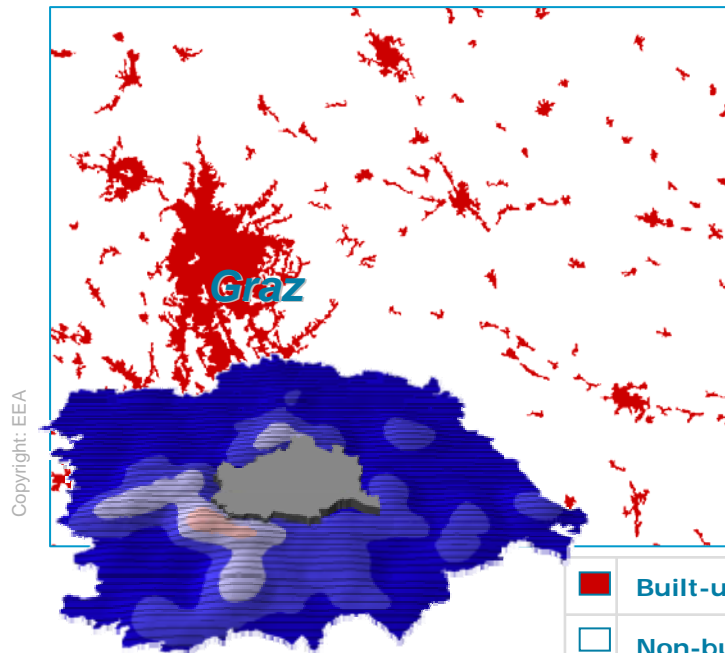
- Strategies for soil protection and monitoring systems are needed on European and national level



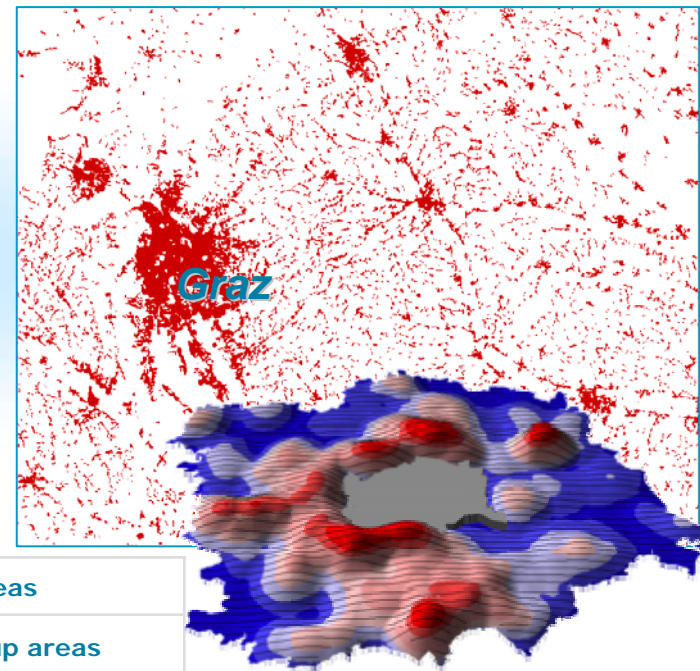
Spatial Planning

from coarse to 'real-world' representations

Pre-GMES monitoring

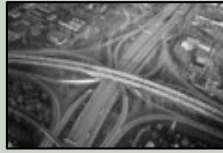


GMES monitoring



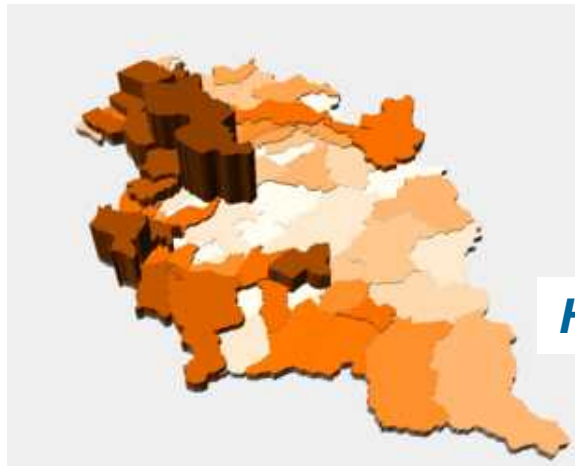
- Built-up areas
- Non-built-up areas

Copyright: ARCSys, GeoVille

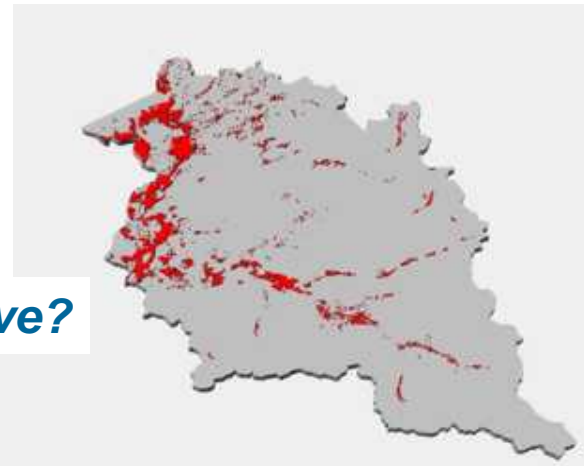


Spatial Planning

Socio-economic analysis and modelling

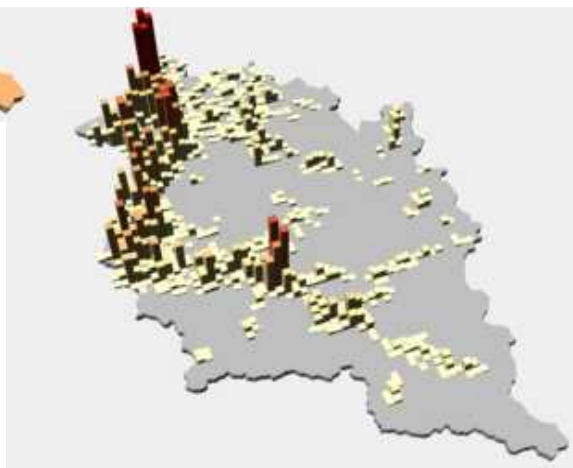


Population (NUTS5 units)



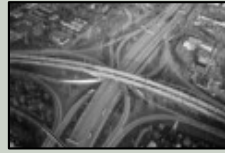
EO based map of artificial surfaces

How densely do we live?



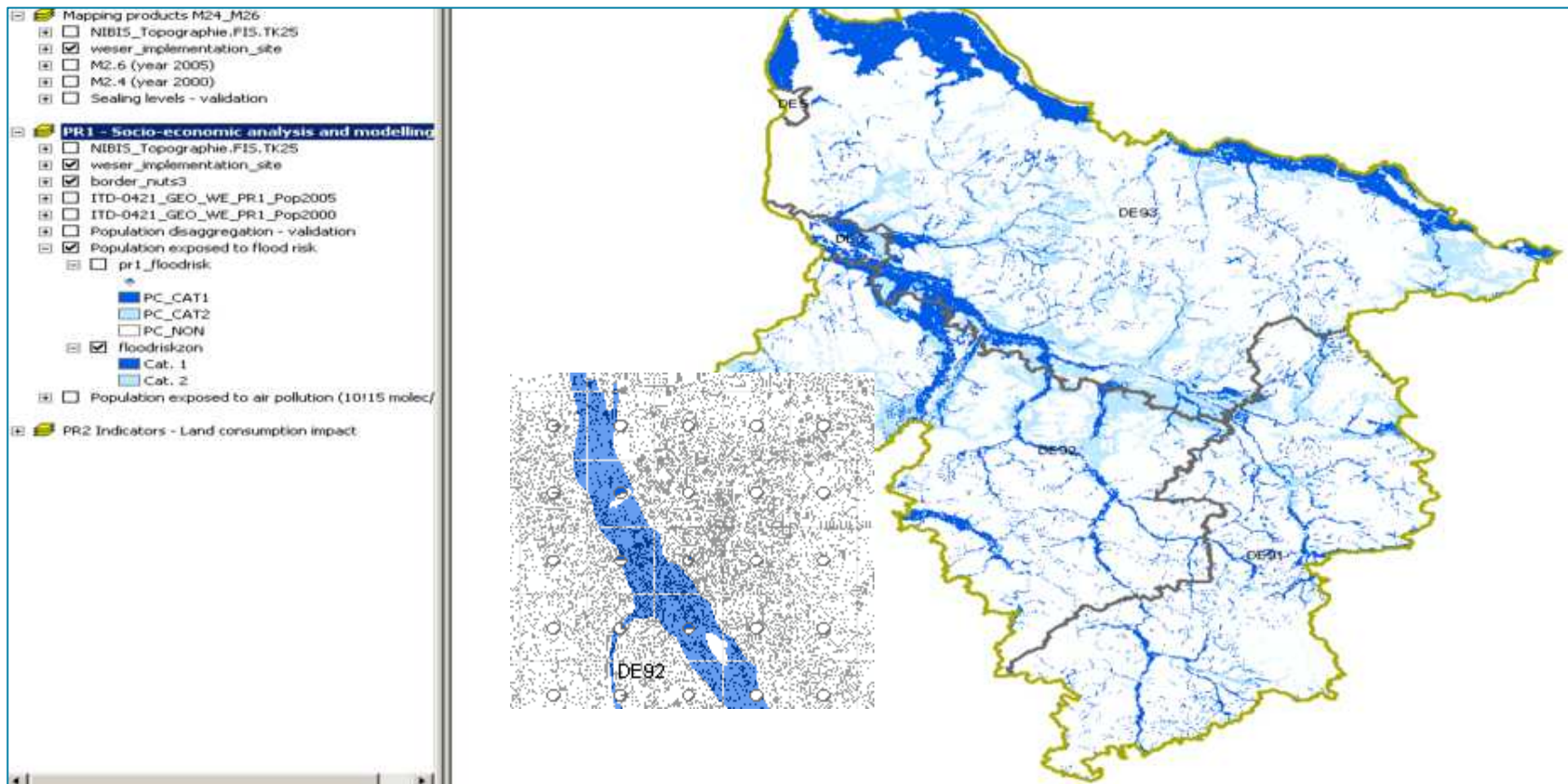
Population (1 km² grid cells) – spatially disaggregated

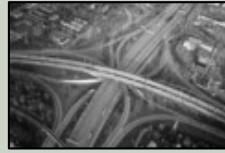
Software operationalisation



Spatial Planning

Population exposed to flood risk

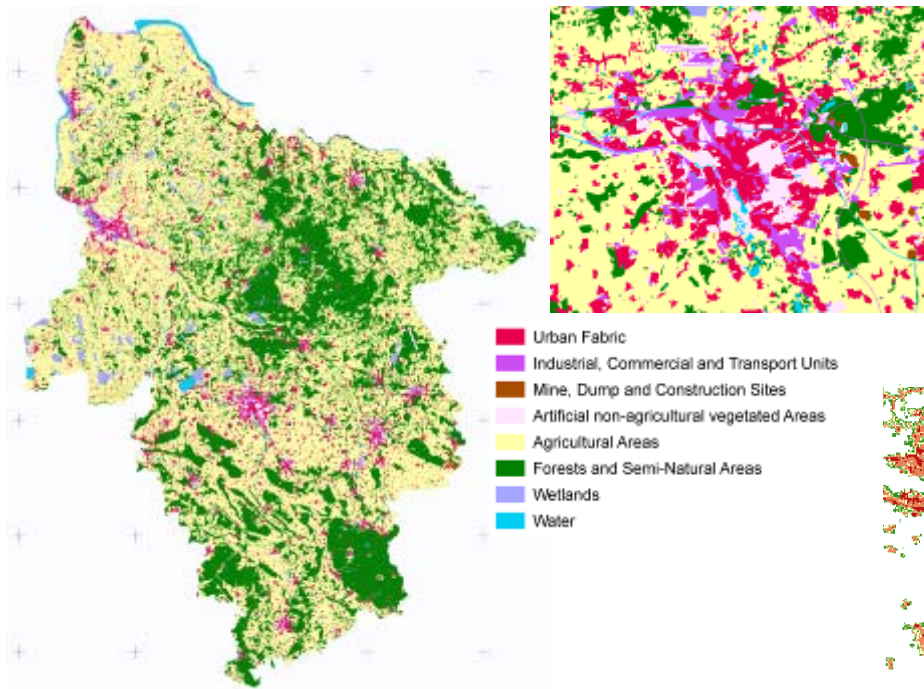




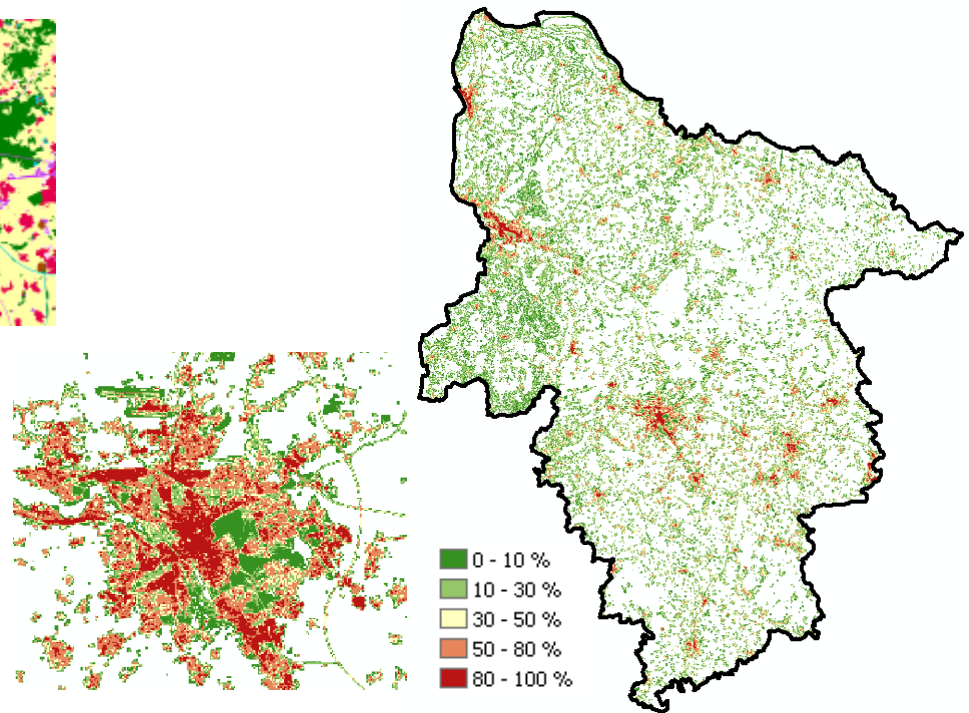
Impervious areas and sealing levels

Land Use maps related to land consumption and soil sealing

Land cover map 2005



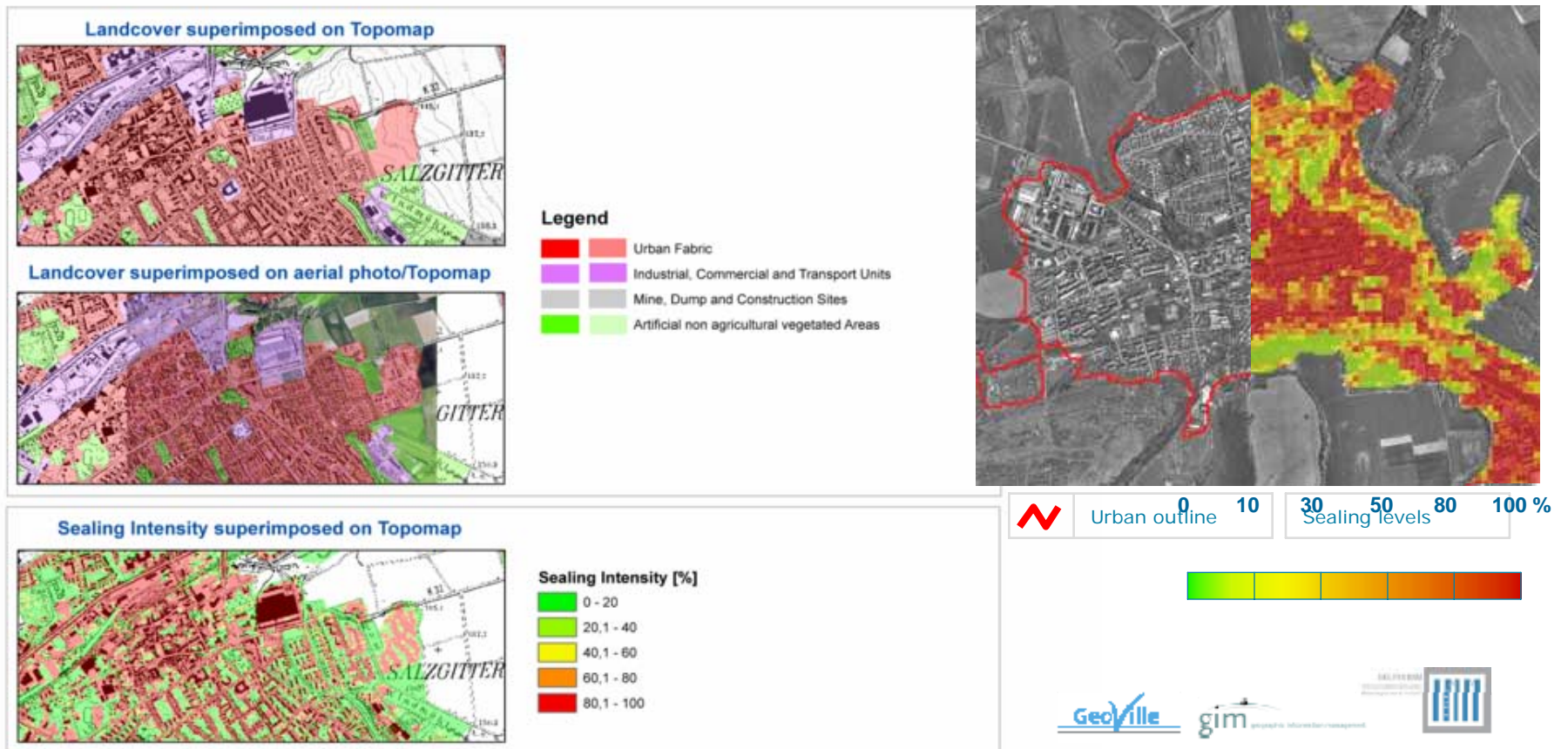
Sealing degrees 2005

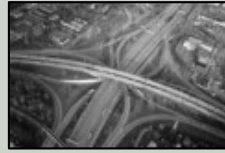




Impervious areas and sealing levels

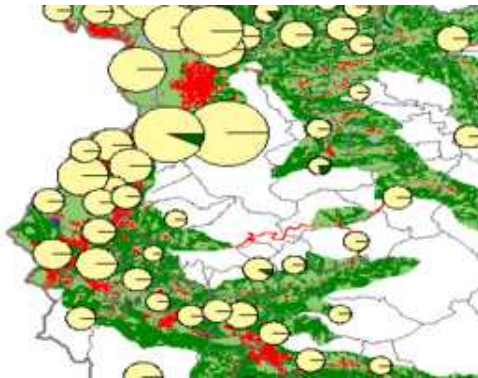
Land cover and sealing maps





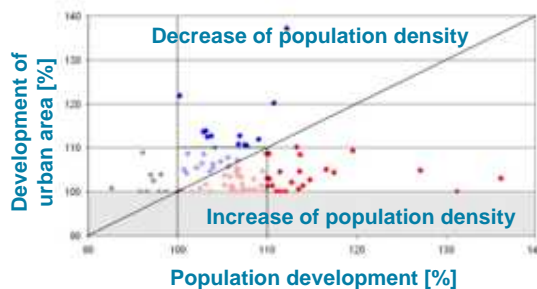
Impervious areas and sealing levels

Land consumption impact – Indicator Service



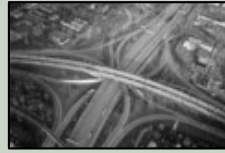
Appraisal of land consumption with regard to

- sealing intensity,
- zoning (e.g. land use zoning, protected areas)
- soil quality and
- socio-economic data.



Validation: plausibility checks





Urban Atlas

VHR Land Use Mapping - Urban Atlas

Sealing Levels

Urban Atlas legend

- artificial surfaces
 - industrial, commercial and transport units
 - industrial, commercial public and private units
 - public and private services not related to the transport system
 - commercial areas
 - industrial areas
 - road and rail networks and associated land
 - airports
- urban fabric
 - discontinuous urban fabric
 - residential urban fabric
 - residential discontinuous sparse urban fabric
 - residential discontinuous urban fabric
 - continuous urban fabric
 - residential continuous medium dense urban fabric
 - residential continuous dense urban fabric
- mine, dump and construction sites
 - mineral extraction sites
 - construction sites
 - dump sites
- artificial non-agricultural vegetated areas
 - green urban areas
 - sport and leisure facilities
- agricultural areas
 - heterogeneous agricultural areas
 - pastures
 - permanent crops
 - arable land
- forest and semi natural areas
 - open spaces with little or no vegetation
 - shrub and / or herbaceous vegetation associations
 - forests
- water bodies
 - inland waterbodies

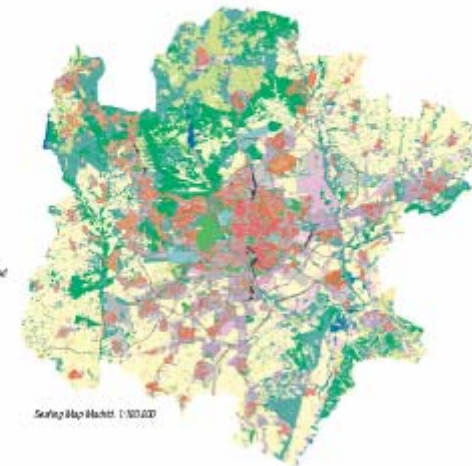
Downstream Service Plan Monitoring: Built-up Ratio



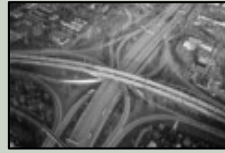
Sealing Level

- 0%
- 1-10%
- 11-20%
- 21-30%
- 31-40%
- 41-50%
- 51-60%
- 61-70%
- 71-80%
- 81-90%
- 91-100%
- not urban

Downstream Service
Sealing Level - legend



Sealing Map Sheet: 1/100,000



Water Management Services

Land Agri-Land Cover & Crops Acreages Maps

LMCS map 2005

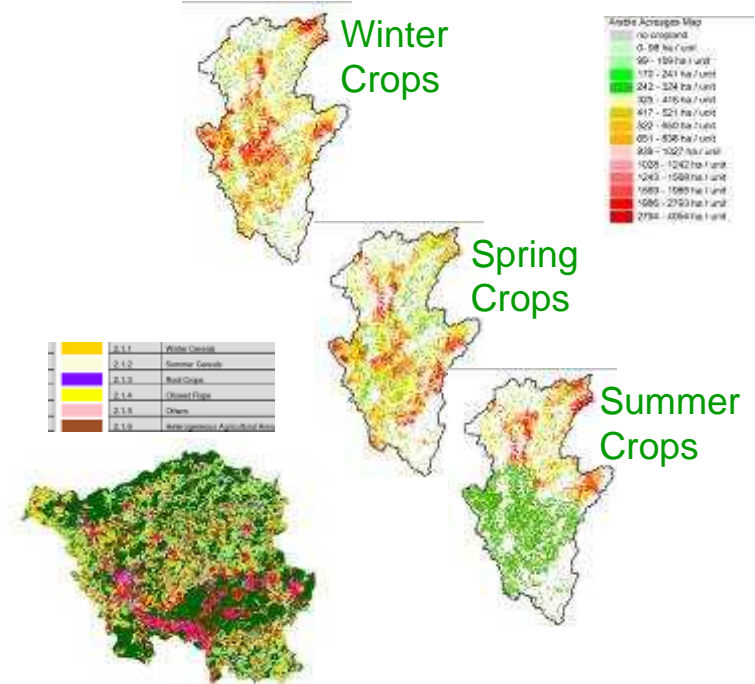
– Moselle / Sarre catchment –

HR & MR agriculture



Legend

- 11000 Urban Fabric
- 12000 Industrial, Commercial & Transport Units
- 13000 Mine, Dump & Construction Sites
- 14000 Artificial, Non-Agricultural Vegetated Area
- 21000 Arable Land
- 22000 Permanent Crops
- 23000 Pastures
- 24000 Heterogeneous Agricultural Areas
- 31000 Forests
- 32100 Natural Grassland
- 32200 Moors & Heathlands
- 32300 Mediterranean Shrubs
- 32400 Transitional Woodland-Shrub
- 33100 Beaches, Dunes, Sands
- 33200 Bare Rocks
- 33300 Sparsely Vegetated Areas
- 33400 Burnt Areas
- 33500 Snow & Ice
- 41000 Inland Wetlands
- 42000 Coastal Wetlands
- 50000 Water Bodies



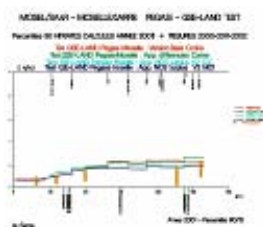
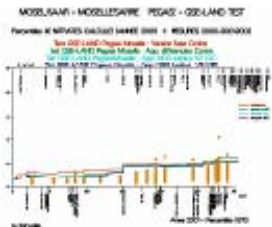
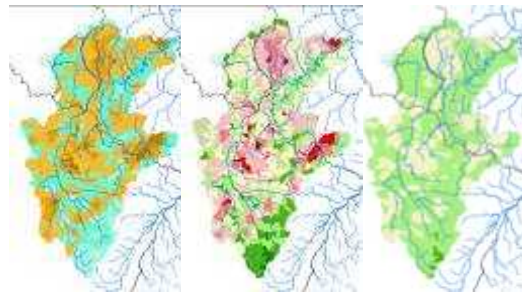
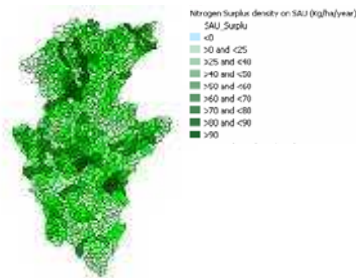


Water Management Services

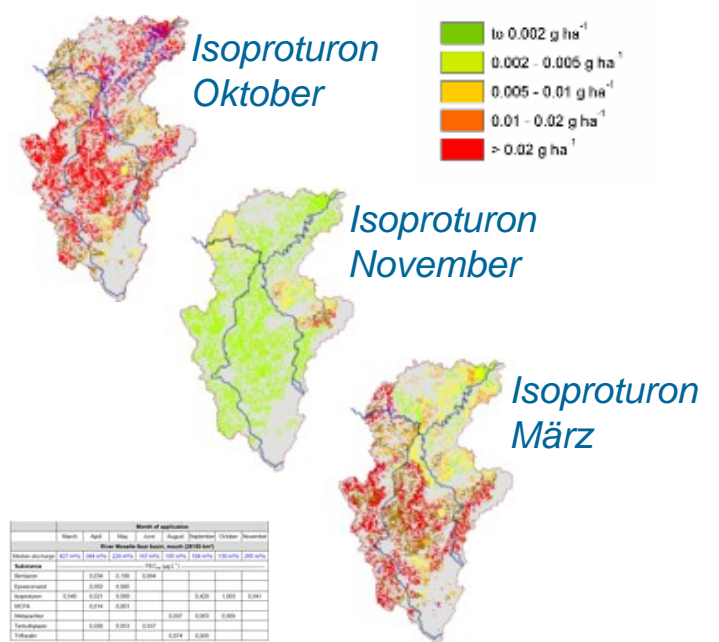
Nutrients and Plant Protection Agents

- Surplus
- Predicted environmental concentration (status and scenarios)

Nutrient Modelling – Nitrogen & Phosphorus



Plant Protection Agents - Pesticides





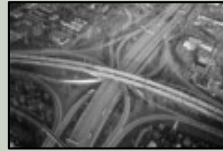
European Cooperation & INSPIRE

- Principles of INSPIRE Directive
 - Harmonisation
 - Interoperability
 - Integration
 - Consistency (Cross Border, Cross Scale, Cross Theme)
- GMES
 - Better Minimum Mapping Units (MMU: 1ha, < 1ha)
 - Better Ground Resolution and Repetition Rates of RS Satellites
 - Need for Interoperability of Remote Sensing Data and In-situ Data, e.g Topographic Data
- Topographic Data have to be geometric reference (skeleton)

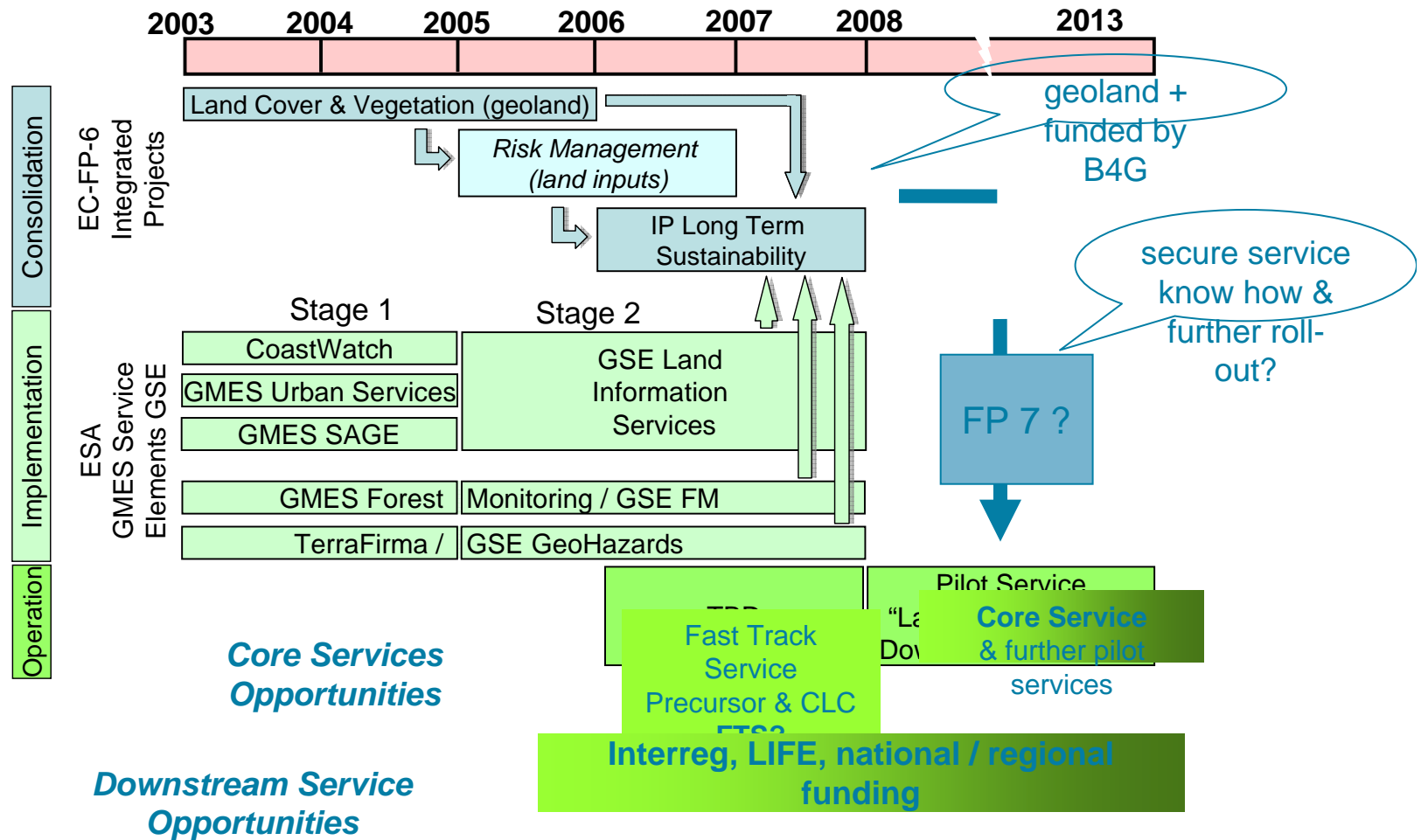


Different focus ?

INSPIRE	GMES	SEIS
Content	Content	Content
Infra structure	Infra structure	Infra structure
Services	Services	Services
Obligation	Obligation	Obligation?
Business	Business	Business?



European Land Monitoring - Outlook





GMES and GSE - Conclusions

GMES Land Service Portfolio

- Consists of *interoperable*, *complementary* and *hierarchically* structured mapping services, based on satellite imagery
- Combines these mapping services with *in-situ* measurements, collected from existing *networks*
- Does not stop at political borders!
- Has developed and implemented *content standards* supported by a large group of international, national and regional users
- Can be *sustainably* and *quality assured* jointly produced for Europe and beyond on large areas by the GMES Land Service Providers Network