LUCAS use case: verification of Copernicus high-resolution layers (Copernicus.eu)

George Büttner[1] and Beatrice Eiselt[2]

[1]EEA - [2]EUROSTAT

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Environmental information is of crucial importance. It helps to understand how our planet and its climate are changing, the role played by human activities in these changes and how these will influence our daily lives. The well-being and security of future generations are more than ever dependent on everyone's actions and on the decisions being made today on environmental policies. To take the right actions, decision makers, businesses and citizens must be provided with reliable and up-to-date information on how our planet and its climate are changing. The European Earth observation programme Copernicus, previously known as GMES (Global Monitoring for Environment and Security), provides this information.

The Copernicus programme is coordinated and managed by the European Commission. The development of the observation infrastructure is performed under the aegis of the European Space Agency for the space component and of the European Environment Agency and the Member States for the in-situ component.

Copernicus collects data from multiple sources (Earth observation satellites and in situ sensors such as ground stations, airborne and sea-borne sensors) processes them and makes the information available through user friendly products and applications in six thematic areas:

1) Land Monitoring,

2) Marine monitoring,

3) Atmosphere monitoring,

4) Climate change,

5) Emergency management and

6) Security.

These six services support policy makers and public authorities who need to develop environmental legislation and policies in fields such as environment protection, management of urban areas, regional and local planning, agriculture, forestry, fisheries, health, transport, climate change, sustainable development, civil protection and tourism. Furthermore the services help decision makers in the event of an emergency, such as a natural disaster or a humanitarian crisis. (http://copernicus.eu/)

The Land Monitoring Service provides geographical information on land cover and land use as well as on related variables, for instance, on the vegetation state or the water cycle. It supports

applications in a variety of domains such as spatial planning, forest management, water management, agriculture and food security, etc.

Europe is one of the most intensively used continents on the globe, with the highest share of land (up to 80%) used for settlement, production systems (including agriculture and forestry) and infrastructure. Conflicting land-use demands often arise, requiring decisions that will involve hard trade-offs. There are several important drivers for land use in Europe: the increasing demand for living space per person and the link between economic activity, increased mobility and growth of transport infrastructure usually result in land take. Land is a finite resource: how it is used constitutes one of the principal reasons for environmental change, with significant impacts on quality of life and ecosystems, as well as on the management of infrastructure. (http://www.eea.europa.eu/themes/landuse/intro)

This service consists of three main components: a Pan-European component, a global component and a local component.

One example already available is a local component: the Urban Atlas (http://www.eea.europa.eu/data-and-maps/data/urban-atlas), which is providing detailed pan-European comparable land use and land cover data for Large Urban Zones with more than 100.000 inhabitants as defined by the Urban Audit (reference year 2006).

The next picture shows the first results of the pan European component, and more specifically some High Resolution Layers compared to CORINE Land Cover data. The increased level of detail of the High Resolution layers s clearly visible.

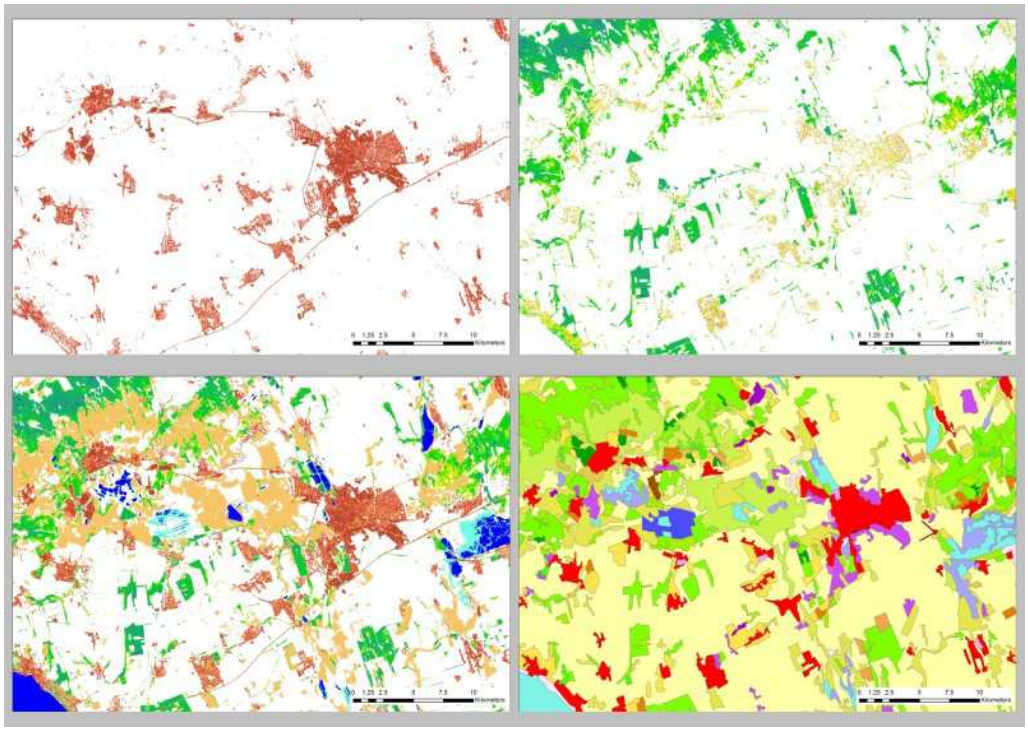

Figure 1: Comparison of High Resolution Layers and CORINE Land Cover. Clockwise: a) Imperviousness density; b) Tree Cover density; c) Integrated High Resolution Layers (Imperviousness, Forest Type, Grassland, Wetland and Water; d) CORINE Land Cover

The Pan-European component is coordinated by the European Environment Agency and will produce 5 high resolution geographic data sets describing the main land cover types: artificial surfaces (e.g. roads and built-up areas), forest areas (forest type and tree cover density), agricultural areas (in practice this is a mapping of permanent grasslands), wetlands, and water bodies.

These high resolution pan-European layers (HRL) are currently under development. Pursuant to the GMES Work Programme 2011 these activities have started in January 2012 through service contracts. Service Providers are in charge of producing the HRLs based on ortho-corrected satellite images. As described in the related guidelines (G. Büttner and H. Dufourmont, EEA, 2013) the thematic data is extracted based on a supervised classification using complex decision rules and possibly on time series of images, while keeping the full resolution of the images. Through this process the so called intermediate products (20m x 20m resolution, national projection) are obtained, which will then be verified by national teams (or if not interested, by Service Providers). This verification phase is aiming at identifying systematic classification errors, which are eligible for later improvement/enhancement. The verification is done by visual inspection of the selected samples with existing reference data (e.g. topographic maps, aerial photography, VHR satellite imagery (≤ 1m resolution)). Furthermore an additional, statistically-based quantitative[1] verification by using randomly selected samples to estimate commission and omission errors is highly recommended. The preferred strategy is the use of in-situ data to compare with and analyse the HRL (taking into account possible differences due to time). The Eurostat - LUCAS 2012 (Land use / land cover micro data, field photographs) data set is listed in the guidelines to the contract among the in-situ data sources for the verification of all the 5 HRL layers.

The results of this verification will be the basis for the enhancement phase, where the "Final" products are derived from the intermediate products, and are produced (following verification and enhancement) in 1 ha resolution (100m x 100m) and in European as well as national projection (see Figure 1).

References

GMES/Copernicus Initial Operations (GIO) Land Monitoring 2011-2013 - Guidelines for verification of high-resolution layers, version 4 - Prepared by: G. Büttner and H. Dufourmont, EEA, 2013

[1] Some member states have proposed quantitative verification methodology instead of / complementing the qualitative verification