Earth Observation for Urban Sustainable Management - the DECUMANUS project

Annekatrin Metz, Mattia Marconcini, Julian Zeidler, Thomas Esch

German Aerospace Center (DLR), Oberpfaffenhofen, Weßling, Germany

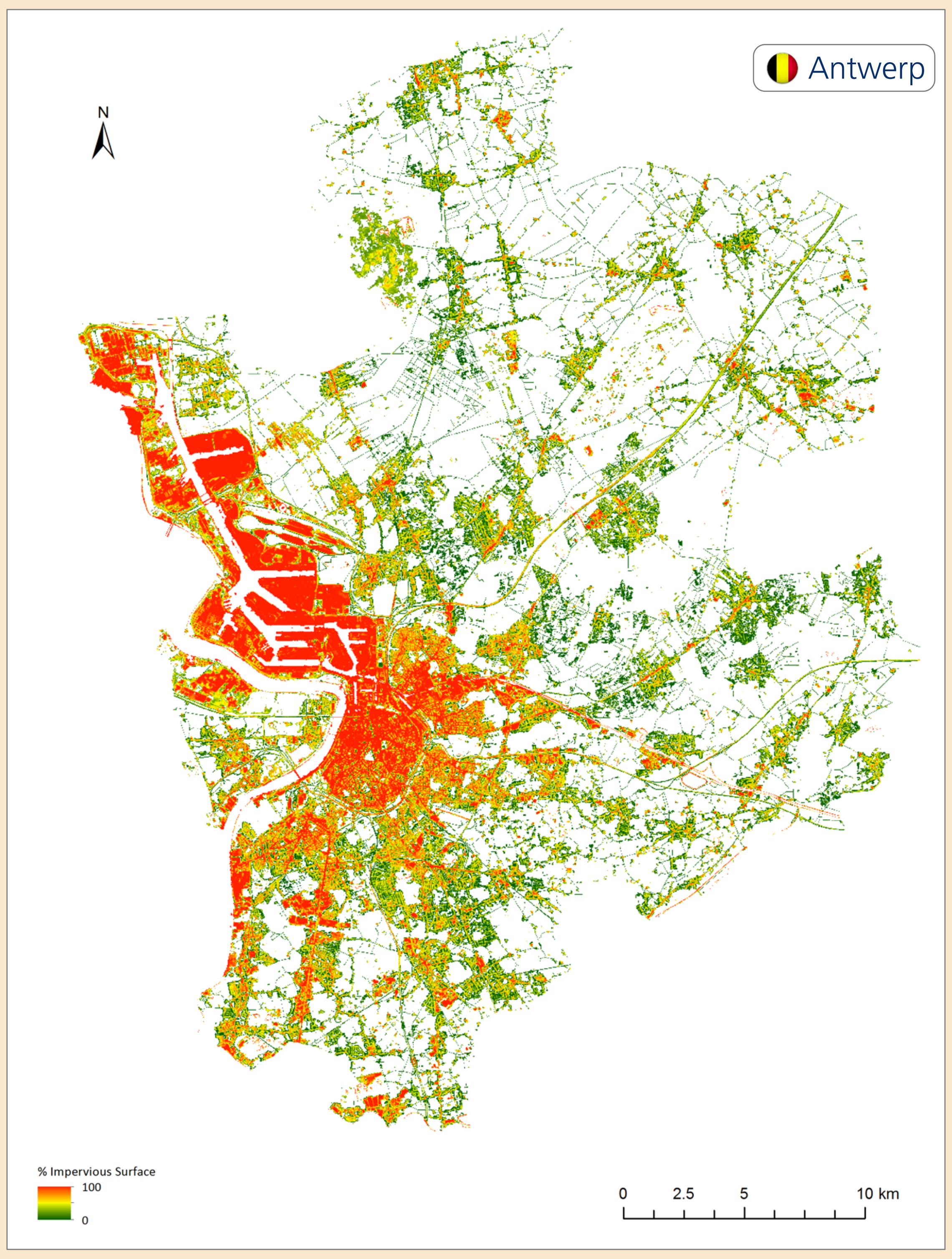
The FP7 DECUMANUS Project

www.decumanus-fp7.eu

- Climate change poses serious challenges to urban areas and affects physical infrastructure, water supply, energy provision, transport and industrial production;
- EO proved to be an effective tool for supporting decision makers in facing climate change; nevertheless, gaps still exist between the current state-of-the-art and the users' requirements;
- DECUMANUS (DEvelopment and Consolidation of geo-spatial sUstainability services for adaptation and environmental and cliMAte chaNge Urban impactS) aims at bridging this gap;
- In particular, the goal of DECUMANUS is to develop and consolidate a set of sustainable services that allows city managers to incorporate EO-based geo-spatial products and geo-information services in their climate and environmental change strategies to support the sustainable management of the cities in Europe;
- The project is user defined and driven; indeed, it has full engagement with the partner cities of **Antwerp**, **Helsinki**, the **Royal Borough of Kensington and Chelsea** (London), **Milan**, and **Madrid**, which are fully integrated in the project workplan by defining requirements, testing products, validating results and acting as ambassadors of these technologies for other cities
- The four categories of DECUMANUS service products consist of: i) an urban climate atlas, ii) **land monitoring services**, iii) city energy efficiency, and iv) citizen health tools;
- For each category, two different types of services have been implemented:
  - **BASIC SERVICES** include products derived from freely-available EO data (suitable for district-level analyses at larger scale and lower spatial resolution),
  - **PREMIUM SERVICES** include products, indicators and models developed and specified on the basis of an active engagement with the planning communities and/or the use of in situ information (suitable for local-level analyses at fine scale and very high spatial resolution).
- **DLR** is responsible of the development of the basic and premium land-monitoring services identified by the project user community as **most relevant and useful for supporting their climate-change adaptation and mitigation plans**.

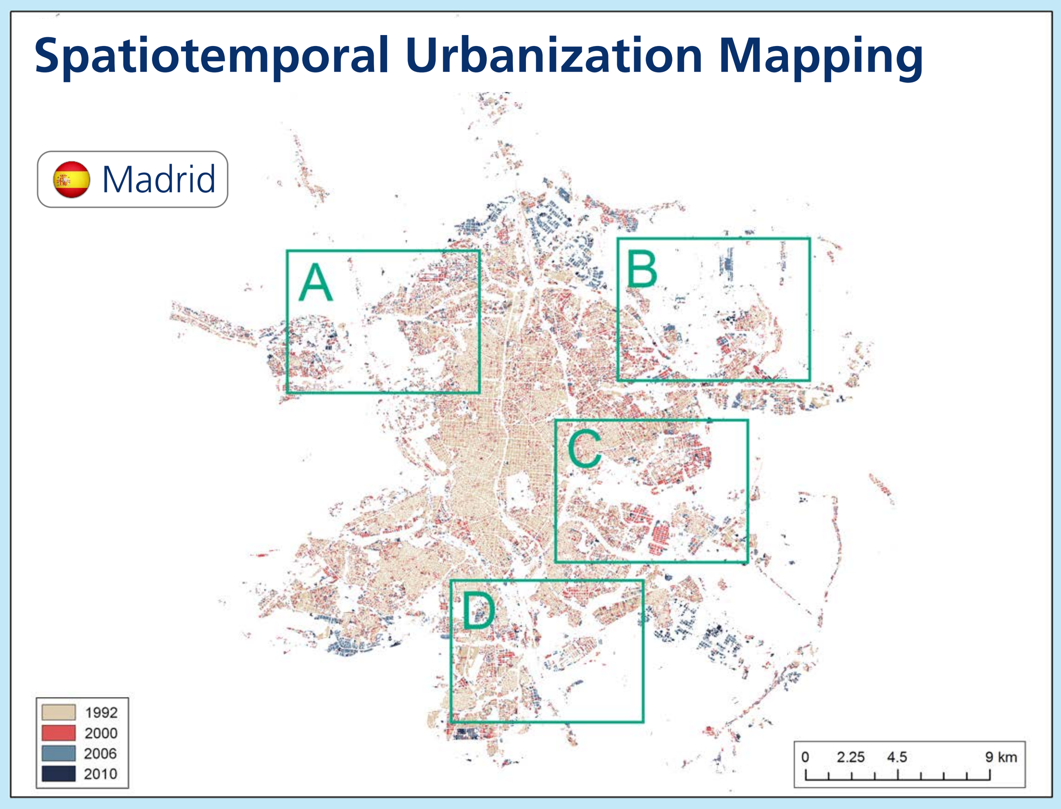
Land Monitoring BASIC SERVICES

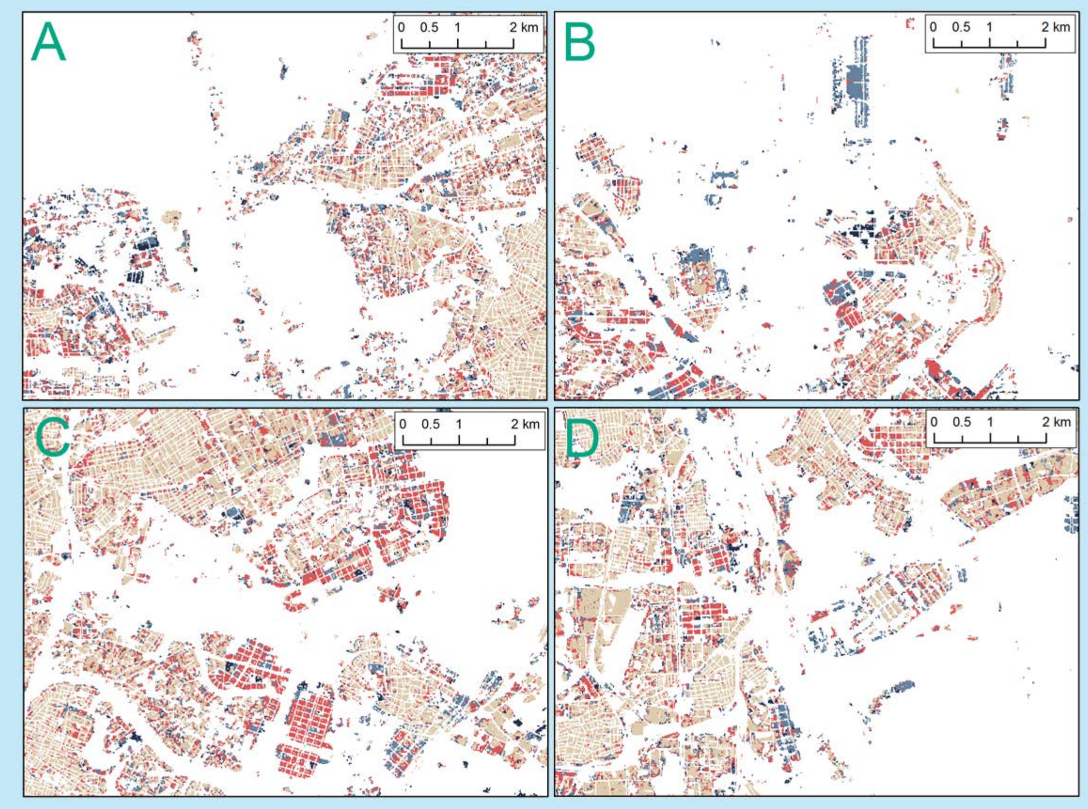
Percentage Impervious Surface Estimation



Objective: estimate the percentage impervious surface (PIS), which describes the entirety of impermeable surfaces including roads, buildings, squares, pavements, parking lots, railroads. **Methodology:** i) compute the mean temporal NDVI from all the Landsat scenes acquired over the study area in a given period of interest; ii) extract training selected areas from OpenStreetMap layers associated with impervious surfaces and then aggregate at the Landsat spatial resolution; iii) derive an empirical model by means of Support Vector Regression (SVR).

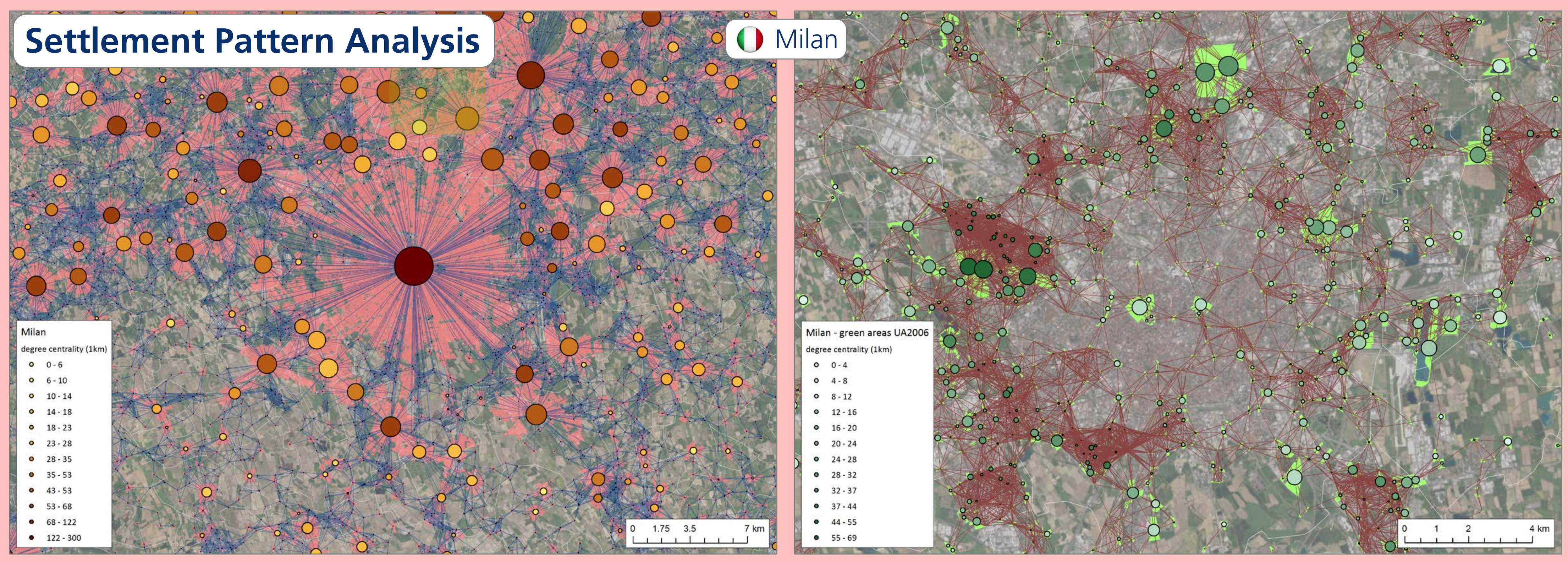
Spatiotemporal Urbanization Mapping





Objective: to reliably characterize the temporal evolution of the urbanization occurred in the last decades, since a precise knowledge of the past is a key for effectively planning the future. **Methodology:** novel technique that allows to automatically and precisely derive the extent of a given urban area by means of ERS-1/2 SAR Precision Image (PRI) products and their Envisat ASAR Image Mode Precision (IMP) products continuation.

Settlement Pattern Analysis



Objective: to effectively characterize different settlements / green-areas in a given region (and hence tune appropriate mitigation strategies) by analyzing their relevance and relations with respect to their neighbors. **Methodology:** novel method based on spatial network analysis where we characterize the local relationships by means of graph theory and, hence, quantitatively and qualitatively assess their significance.

Land Monitoring PREMIUM SERVICES

Current and Potential Green Roof Mapping

Objective: to identify existing and potential green roofs since they are of great importance for several reasons, e.g. absorbing rainwater (and reducing the stormwater runoff), providing thermal insulation and reducing air pollution. **Methodology:** given VHR satellite/airbone VIS+IR optical imagery, the building outlines and LIDAR/DSM height information, we i) determine where flat roofs (i.e., the only one suitable to be converted into green roofs) are located and ii) estimate the percentage of vegetated areas on the building roofs to determine where we are in the presence of a green roof.

Tree Detection

Objective: to create a reliable map of single trees in a given study area without the need for manual work. **Methodology:** i) DSM segmentation; ii) computation of the mean NDVI (extracted from airborne/satellite VHR VIS+IR imagery) per segment; iii) identification of vegetated segments based on the analysis of the mean NDVI; iv) derivation - within each segment - of the location of the pixel whose height is maximum; v) exclusion of points whose height is lower than minimum pre-defined tree height.

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