decu|manus

Catalog of Products

Version 1.4
Last update: 04th November 2015

Climatic Parameters

(Yearly Average data)

- *Precipitation (Yearly Total data)*
- *Temperature*
- *Heat waves*
- *Pedestrian Wind and Thermal Comfort*
- *Humidex*
- *Maximum Temperature*
- *Minimum Temperature*
- *Precipitation Events*
- *Summer Days*
- *Tropical Nights*
- *Energy fluxes group*
  - *Downward Ground Heat Flux*
  - *Upward Sensible Heat Flux at the surface*
  - *Upward Latent Heat Flux at the surface*
  - *Surface Runoff*
  - *Underground Runoff*
  - *Canopy Water Evaporation*
  - *Direct Soil Evaporation*
  - *Total Plant Transpiration*
  - *Downward Long Wave Flux*
  - *Downward Short Wave Flux*

Health Indicators

(Yearly Average data)

- *Air quality concentrations: SO2, NO2, NO, CO, O3, PM10*
- *Respiratory Hospital Admissions*
- *Changes in Cardiovascular Hospital Admissions*
- *Changes in Respiratory Hospital Admissions*
- *Mortality – All causes*
- *Mortality – Cardiovascular causes*
- *Mortality – Respiratory causes*
- *Mortality +65 years – All causes*
- *Mortality +65 years – Cardiovascular causes*
- *Mortality +65 years – Respiratory causes*
- *Changes in mortality – All causes*
- *Changes in mortality – All Cardiovascular causes*
- *Changes in mortality – All Respiratory causes*

Energy Efficiency

- *Detailed Roof Thermographic map*
  - *Full thermographic mosaic*
  - *Roof insulation map*
  - *District heating: leakage detection*
- *Detailed Luminance map*
  - *Luminance map*
  - *Over-exposure map*
  - *EN classification map*
- *ISS-based brightness map*
  - *True-color ortho-photo*
  - *Relative brightness map*
  - *Redness index*
- *Photovoltaic Potential map*
  - *Full-resolution insolation map*
  - *Suitable areas for photovoltaic modules*
  - *Max. potential annual electricity yield*
  - *Max. potential annual CO_2 savings*

Land Monitoring

- *Green Roof Detection*
- *Green Roof Potential*
- *Automatic Tree Detection*

Population Impact

- *Day-time population distribution maps*
- *Population impact assessment maps*

Common Technical Characteristics

Climatic Parameters	▪ *Precipitation* ▪ *Temperature* ▪ *Heat waves* ▪ *Humidex* ▪ *Maximum Temperature*	▪ *Minimum Temperature* ▪ *Precipitation Events* ▪ *Summer Days* ▪ *Tropical Nights*

Description

Urban climate variables and indicators are calculated with a very high spatial resolution from full dynamical downscaling simulations including simulation with 5 km and 1 km of spatial resolution and finally CFD simulations with 10 meters of resolution. Products cover RCP 4.5 and 8.5 scenarios.

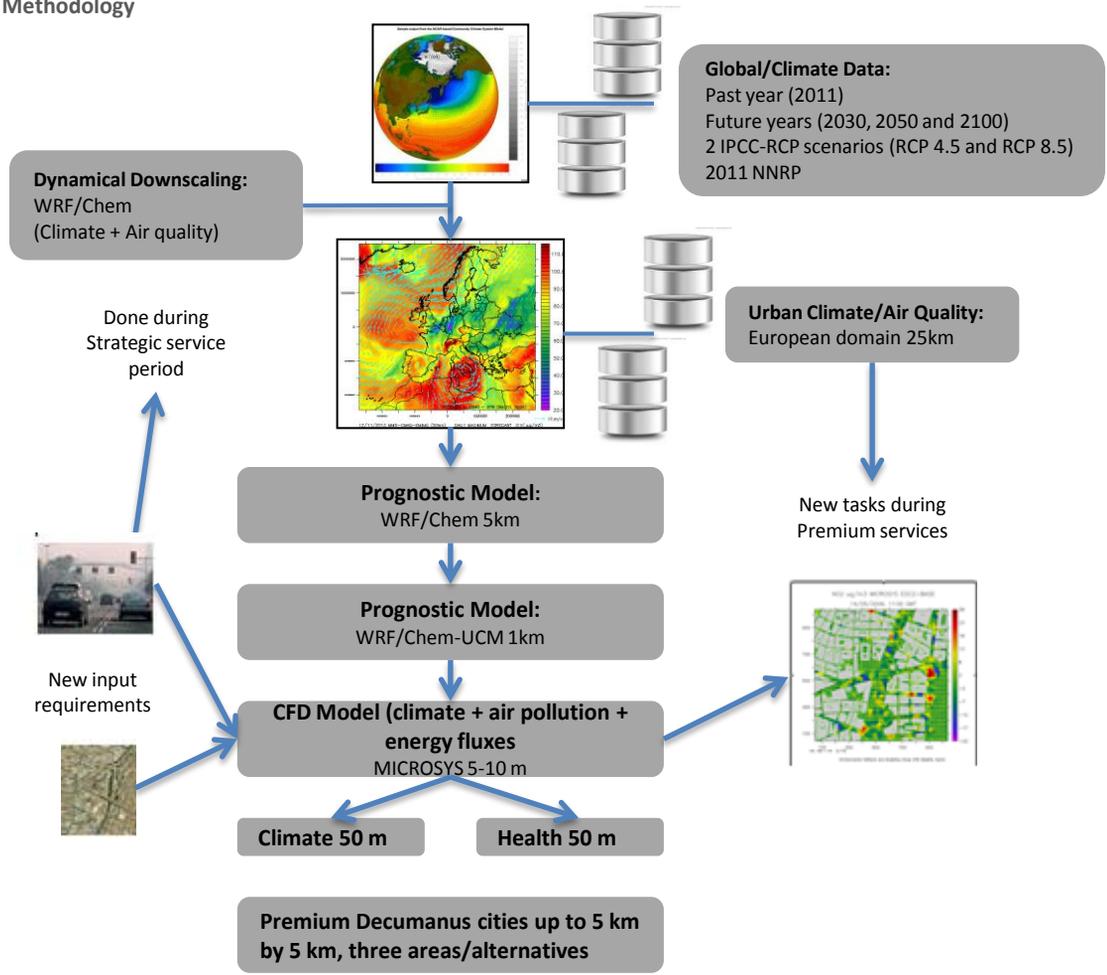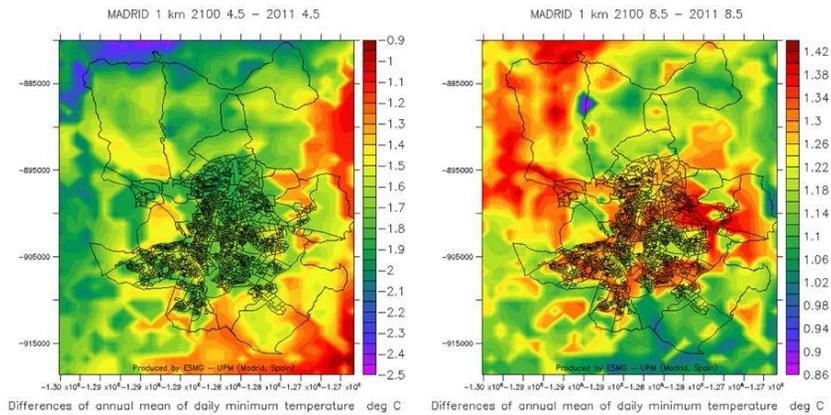| Input data	Topography, Land Use, Soil Type, Vegetation fraction, Population. Meteorological observations. Albedo, emissivity, roughness length, thermal inertia Anthropogenic heat. And For buildings: Heat capacity, Thermal conductivity, Surface albedo, Surface emissivity, Roughness length of roofs, walls and roads.
Reference scale	50 meters
Geographic coverage	Madrid, Milan and Kensington and Chelsea (London)
Temporal coverage	2011, 2030, 2050 and 2100 years

Methodology

Global/Climate Data:
Past year (2011)
Future years (2030, 2050 and 2100)
2 IPCC-RCP scenarios (RCP 4.5 and RCP 8.5)
2011 NNRP

Dynamical Downscaling:
WRF/Chem
(Climate + Air quality)

Done during Strategic service period

Urban Climate/Air Quality:
European domain 25km

Prognostic Model:
WRF/Chem 5km

New tasks during Premium services

Prognostic Model:
WRF/Chem-UCM 1km

New input requirements

CFD Model (climate + air pollution + energy fluxes
MICROSYS 5-10 m

Climate 50 m   Health 50 m

Premium Decumanus cities up to 5 km by 5 km, three areas/alternatives

Climatic Parameters	▪ *Precipitation*	▪ *Minimum Temperature*
	▪ *Temperature*	▪ *Precipitation Events*
	▪ *Heat waves*	▪ *Summer Days*
	▪ *Humidex*	▪ *Tropical Nights*
	▪ *Maximum Temperature*	

Applications

▪ Identify interactions between buildings and climate under different climate scenarios
▪ Identify vulnerability hotspots over the cities

Examples

Madrid differences (ºC) between 2100 and 2011 spatial distribution (1 kilometer of resolution) of one-year average minimum air temperature with RCP 4.5 (left) and RCP 8.5 (right). Downscaled simulations using WRF-Chem.

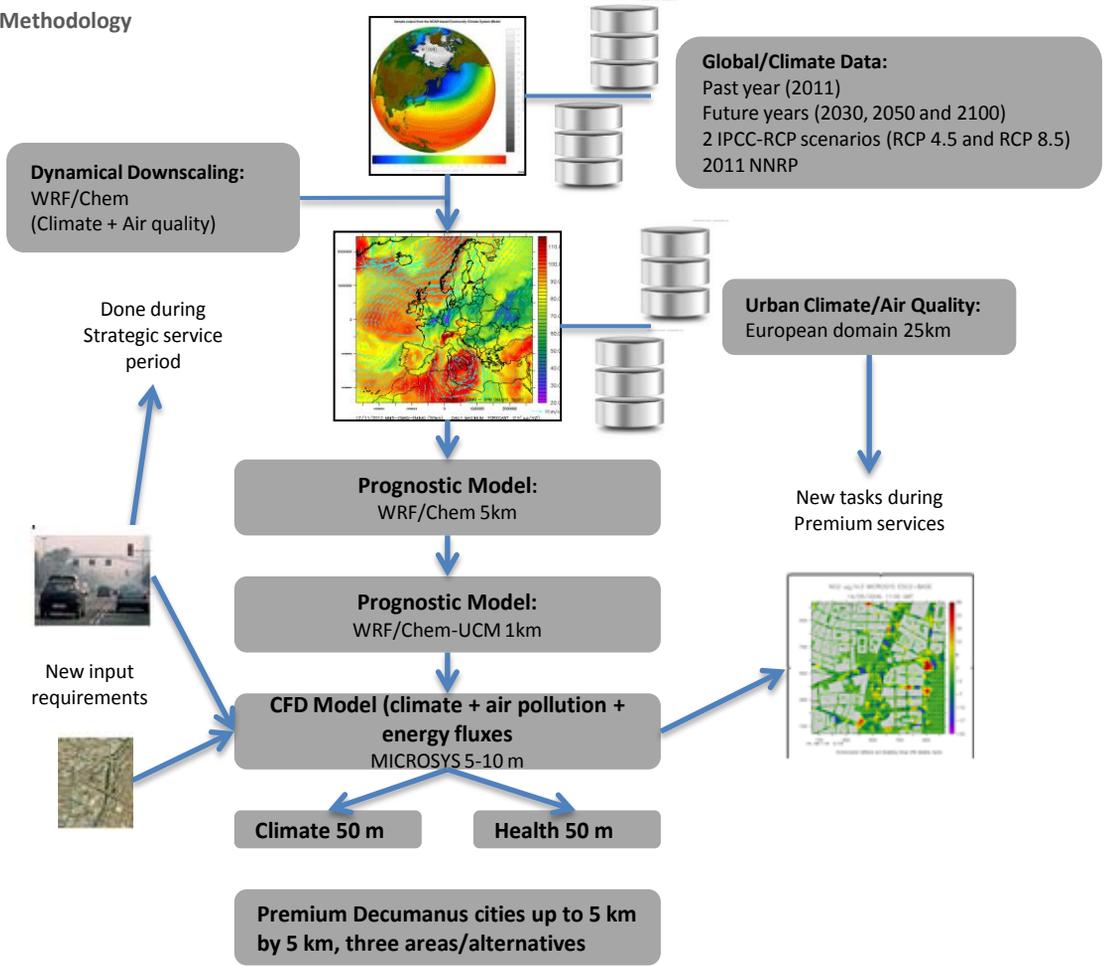## Climatic Parameters ▪ *Pedestrian Wind comfort*

Description

High-rise buildings can introduce high wind speed at pedestrian level, which can lead to uncomfortable or even dangerous conditions. Assessment of wind comfort involves a combination of the meteorological data (model results) with a comfort criterion. We propose to use the Dutch wind nuisance standard (NEN 8100) which applies a discomfort threshold for the hourly mean wind speed (UTHR) of 5 m/s for all types of activities. Depending on the exceedance probability P of the threshold wind speed, the code defines five quality **classes of wind comfort** A–E (table 1).

Table 1: Criteria for wind comfort according to the Dutch wind nuisance standard NEN 8100 (2006)

$P(U_{THR} > 5$ m/s (in % hours per year)	Quality Class	Activity		
		Traversing	Strolling	Sitting
< 2.5	A	Good	Good	Good
2.5 – 5,0	B	Good	Good	Moderate
5,0 – 10	C	Good	Moderate	Poor
10 – 20	D	Moderate	Poor	Poor
> 20	E	Poor	Poor	Poor

Input data	Topography, Land Use, Soil Type, Vegetation fraction, Population. Meteorological observations. Albedo, emissivity, roughness length, thermal inertia Anthropogenic heat. And For buildings: Heat capacity, Thermal conductivity, Surface albedo, Surface emissivity, Roughness length of roofs, walls and roads.
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Health 50 m

Premium Decumanus cities up to 5 km by 5 km, three areas/alternatives
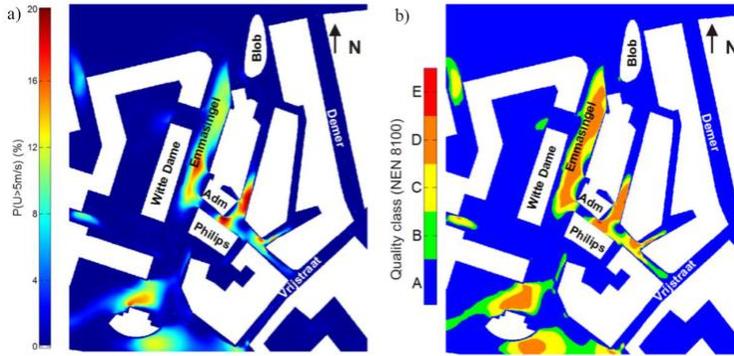
Climatic Parameters ▪ *Pedestrian Wind comfort*

Applications

- Identify interactions between buildings and climate under different climate scenarios
- Identify vulnerability hotspots over the cities

Examples

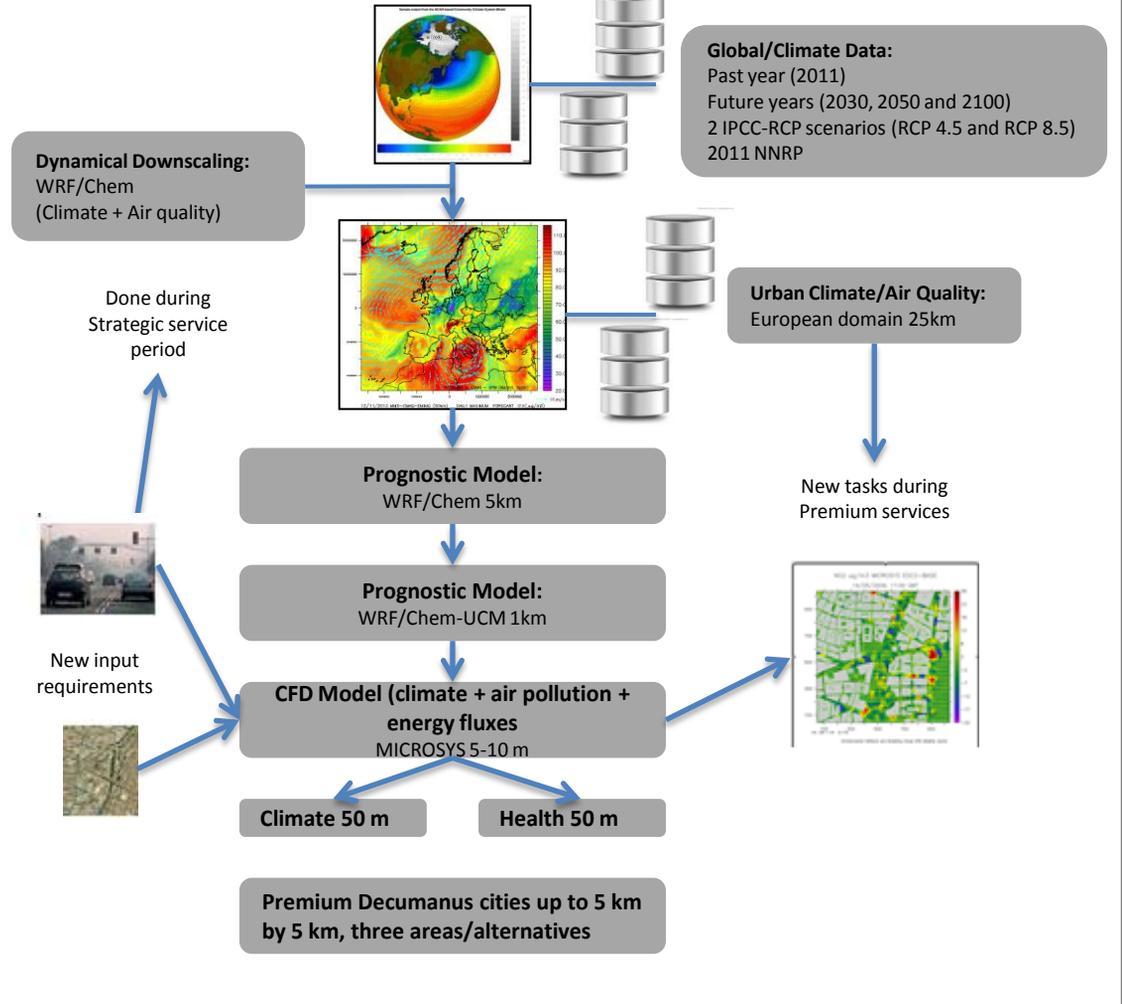*Wind comfort around buildings simulation with CFD model*

Climatic Parameters	▪ *Pedestrian Thermal comfort*

Description

Outdoor thermal comfort is governed by winds conditions, both direct and diffuse solar irradiation, the exchange of long-wave radiation between a person and the environment. A crucial element in the assessment of thermal comfort is the development of a comfort index which appropriately reflects the comfort sensation of a person in a given situation. We propose the following **thermal comfort index: The physiological equivalent temperature (PET).**

Input data	Topography, Land Use, Soil Type, Vegetation fraction, Population. Meteorological observations. Albedo, emissivity, roughness length, thermal inertia Anthropogenic heat. And For buildings: Heat capacity, Thermal conductivity, Surface albedo, Surface emissivity, Roughness length of roofs, walls and roads.
Reference scale	50 meters
Geographic coverage	Madrid, Milan and Kensington and Chelsea (London)
Temporal coverage	2011, 2030, 2050 and 2100 years

Methodology

Global/Climate Data:
Past year (2011)
Future years (2030, 2050 and 2100)
2 IPCC-RCP scenarios (RCP 4.5 and RCP 8.5)
2011 NNRP

Dynamical Downscaling:
WRF/Chem
(Climate + Air quality)

Done during Strategic service period

Urban Climate/Air Quality:
European domain 25km

Prognostic Model:
WRF/Chem 5km

New tasks during Premium services

New input requirements

Prognostic Model:
WRF/Chem-UCM 1km

CFD Model (climate + air pollution + energy fluxes
MICROSYS 5-10 m

Climate 50 m

Health 50 m

Premium Decumanus cities up to 5 km by 5 km, three areas/alternatives

| Climatic Parameters | ▪ *Pedestrian Thermal comfort* |

Methodology

The PET is based on the "Munich Energy Balance Model for Individual" (MEMI) and has taken into account of both the environmental climatic parameters and the human factors. PET is the thermal index used officially by the Germany Meteorological Office. PET has been widely used for outdoor thermal study by researchers around the world.
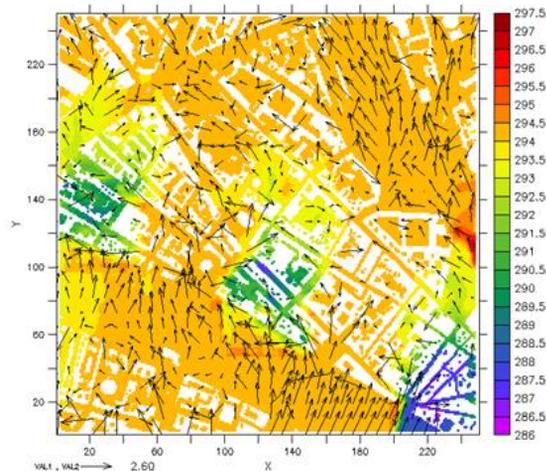
Table 9.2 Ranges of the physiological equivalent temperature (*PET*) for different grades of thermal perception by human beings and physiological stress on human beings; internal heat production: 80 W, heat transfer resistance of the clothing: 0.9 clo (According to Matzarakis and Mayer 1996)

PET	Thermal perception	Grade of physiological stress
4°C	Very cold	Extreme cold stress
8°C	Cold	Strong cold stress
13°C	Cool	Moderate cold stress
18°C	Slightly cool	Slight cold stress
23°C	Comfortable	No thermal stress
29°C	Slightly warm	Slight heat stress
35°C	Warm	Moderate heat stress
41°C	Hot	Strong heat stress
	Very hot	Extreme heat stress

Applications

- Identify interactions between buildings and climate under different climate scenarios
- Identify vulnerability hotspots over the cities

Examples

Temperature and winds flows around buildings simulation with CFD model

Climatic Parameters	• Downward Ground Heat Flux	• Underground Runoff
▪ **Energy fluxes**	• Upward Sensible Heat Flux at the surface	• Canopy Water Evaporation
	• Upward Latent Heat Flux at the surface	• Direct Soil Evaporation
		• Total Plant Transpiration
	• Surface Runoff	• Downward Long Wave Flux
		• Downward Short Wave Flux

Description	
Input data	Topography, Land Use, Soil Type, Vegetation fraction, Population. Meteorological observations. Albedo, emissivity, roughness length, thermal inertia Anthropogenic heat. And For buildings: Heat capacity, Thermal conductivity, Surface albedo, Surface emissivity, Roughness length of roofs, walls and roads.
Reference scale	50 meters
Geographic coverage	Madrid, Milan and Kensington and Chelsea (London)
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Methodology

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New tasks during Premium services

Prognostic Model:
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WRF/Chem-UCM 1km

New input requirements

CFD Model (climate + air pollution + energy fluxes
MICROSYS 5-10 m

Climate 50 m   **Health 50 m**

Premium Decumanus cities up to 5 km by 5 km, three areas/alternatives

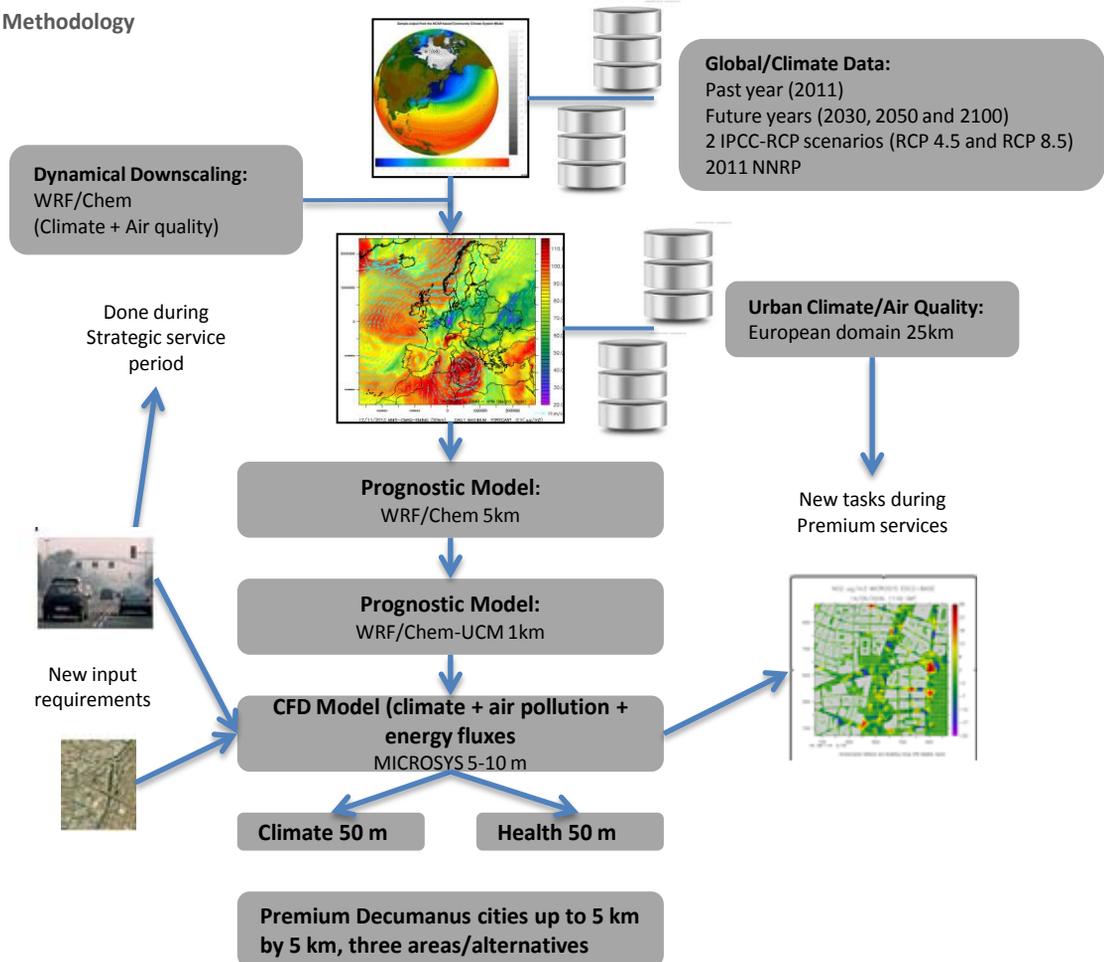| Health Indicators	• *Air quality concentrations: SO2, NO2, NO, CO, O3, PM10* • *Respiratory Hospital Admissions* • *Changes in Cardiovascular Hospital Admissions* • *Changes in Respiratory Hospital Admissions* • *Mortality – All causes* • *Mortality – Cardiovascular causes*	• *Mortality – Respiratory causes* • *Mortality +65 years – All causes* • *Mortality +65 years – Cardiovascular causes* • *Mortality +65 years – Respiratory causes* • *Changes in mortality – All causes* • *Changes in mortality – Cardiovascular causes* • *Changes in mortality – Respiratory causes*

Description

Urban air quality concentrations and health indicators are calculated with a very high spatial resolution from full dynamical downscaling simulations including simulation with 5 km and 1 km of spatial resolution and finally CFD simulations with 10 meters of resolution. City special will be attended, for example two emission alternatives will be simulated over Milan. Products cover RCP 4.5 and 8.5 scenarios.

|	
Input data	Population, Traffic lines (roads, streets), Traffic flows, Categories of vehicles, climate outputs and Relative Risk (RR)
Reference scale	50 meters
Geographic coverage	Madrid (only health from climate) , Milan and Kensington and Chelsea (London)
Temporal coverage	2011, 2030, 2050 and 2100 years

Methodology

Global/Climate Data:
Past year (2011)
Future years (2030, 2050 and 2100)
2 IPCC-RCP scenarios (RCP 4.5 and RCP 8.5)
2011 NNRP

Dynamical Downscaling:
WRF/Chem
(Climate + Air quality)

Done during Strategic service period

Urban Climate/Air Quality:
European domain 25km

Prognostic Model:
WRF/Chem 5km

New tasks during Premium services

Prognostic Model:
WRF/Chem-UCM 1km

New input requirements

CFD Model (climate + air pollution + energy fluxes
MICROSYS 5-10 m

Climate 50 m

Health 50 m

Premium Decumanus cities up to 5 km by 5 km, three areas/alternatives

Health Indicators	▪ *Air quality concentrations: SO2, NO2, NO, CO, O3, PM10*	▪ *Mortality – Respiratory causes*
	▪ *Respiratory Hospital Admissions*	▪ *Mortality +65 years – All causes*
	▪ *Changes in Cardiovascular Hospital Admissions*	▪ *Mortality +65 years – Cardiovascular causes*
	▪ *Changes in Respiratory Hospital Admissions*	▪ *Mortality +65 years – Respiratory causes*
	▪ *Mortality – All causes*	▪ *Changes in mortality – All causes*
	▪ *Mortality – Cardiovascular causes*	▪ *Changes in mortality – Cardiovascular causes*
		▪ *Changes in mortality – Respiratory causes*

Applications

Examine the movement and dispersion of pollutants around buildings. Quantify the effects of climate scenarios on air pollution concentrations and human health. Understand the impact of the global climate change on the local urban environment identifying vulnerabilities taking into account the urban morphology (buildings).

Examples

MICROSYS PM10 ug/m3 28/06/2008 21:00 30.0 min.
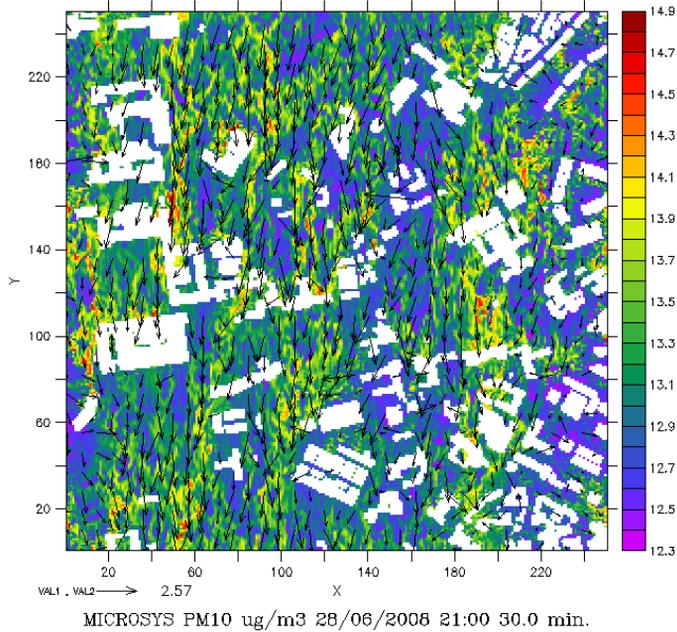
PM10 concentrations (ug/m3) and winds flows around buildings simulation with CFD model
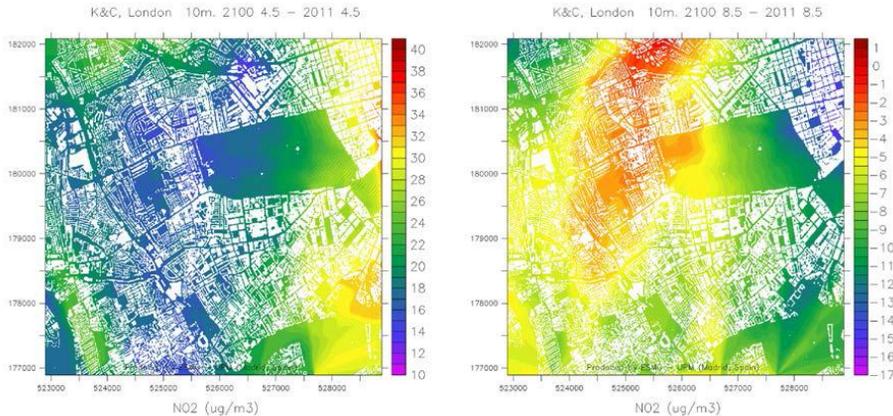
Differences of NO2 concentrations over London (average spring day) between 2100 and 2011 under scenario 4.5 (left) and scenario 8.5 (right).

Energy Efficiency ▪ **Detailed Roof Thermographic map**	• *Full thermographic mosaic* • *Roof insulation map* • *District heating: leakage detection*

Description

Thermography is the measurement of the temperature of the earth surface or an object on the earth surface. Each object radiates a certain amount of heat depending on his temperature. These heat radiations can be detected by a sensor which is fixed on an airplane. Ideal conditions for this data acquisition are: a very cold winter night, absence of snow, rain and low clouds, and almost no wind. Subsequently, the acquired data will be processed and a homogeneous thermographic map will be created. Later this map can be classified or interpreted by the experienced specialists of EUROSENSE.

Input data	Building outlines (city cadaster), Digital elevation model (DEM)
Reference scale	50 centimeter
Geographic coverage	▪ Helsinki: Pre-defined AOI within HSY region ▪ Antwerp: municipal boundaries
Temporal coverage	▪ Helsinki :2009 ▪ Antwerp: 2009 and 2015

Methodology

1. Flight preparation and execution of the flight plan. Temperature ground data are collected in parallel of imagery acquisition.
2. Processing and geo referencing of the imagery
3. Calibrations and homogenization of the mosaic
4. Setting up of an easy-to-use interpretation key with corresponding legends and/or matching buildings with the cadastral database
5. Consultancy and training, community support for communication

Applications

Thermographic maps can be used to map heat losses through the roof and as awareness tools to sensitize inhabitants to the importance of good roof insulation. Aerial thermography can be also used for leak detection in district heating and/or for a further analysis of some buildings.
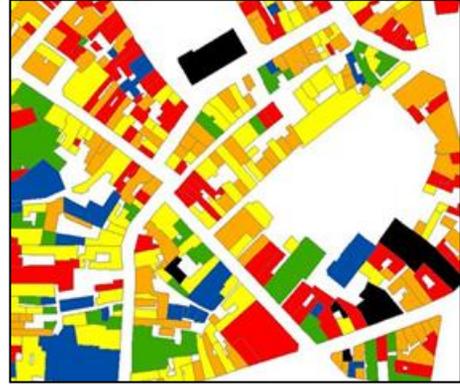
Examples

Full thermographic mosaic

Derived product: detection of leakage in sub-surface district heating network

Energy Efficiency	• *Full thermographic mosaic*
	• *Roof insulation map*
▪ **Detailed Roof Thermographic map**	• *District heating: leakage detection*

Exam

Roof insulation map (left: with full detail; right: median value per building)

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Energy Efficiency	• Luminance map
▪ **Detailed Luminance map**	• Over-exposure map
	• EN classification map

Description

During a night flight EUROSENSE acquires aerial imagery with a light sensitive camera. These "night images" are processed in the same photogrammetric production chain as "day images", resulting in a detailed "night orthophoto" and light maps. The map is calibrated using **luminance** measurements executed on the terrain and a legend in absolute luminance values in Candela/m² is created.

The **"overexposure map"** indicates overexposed areas in colour, as well as the European public lighting classes in grey values. The **"EN classification map"** focuses on the non-overexposed areas, so that a distinction can be made between the different public lighting classes and luminance values displayed by colours.

Input data	Building outlines (city cadaster), Digital elevation model (DEM)
Reference scale	15 centimeter
Geographic coverage	Antwerp: municipal boundaries
Temporal coverage	

Methodology

It concerns a fully operational product, so where possible it is already automated.

Applications

Light maps showing the amount of light are an important policy instrument for cities and municipalities with regard to: Energy saving, Safety and Light pollution.

To allow policy makers to easily interpret the maps, EUROSENSE usually creates two kinds of maps based on the European guidelines for public lighting (EN 13201): the **"overexposure map"** and the **"EN classification map".**

For each zone in the public space it is possible to determine, whether the class rating on the map matches the desired class. If the luminance value is too high, at this location energy can be saved. If the luminance value is too low, this can reduce the safety (traffic and crime).
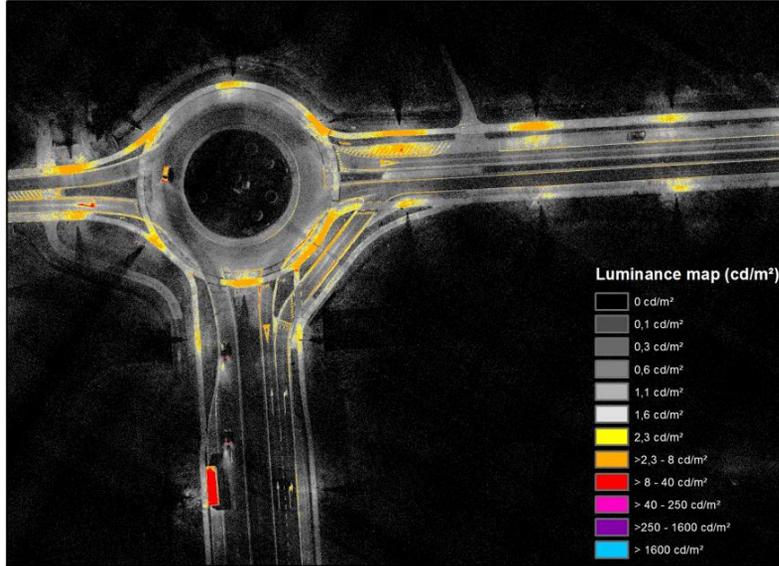
Examples
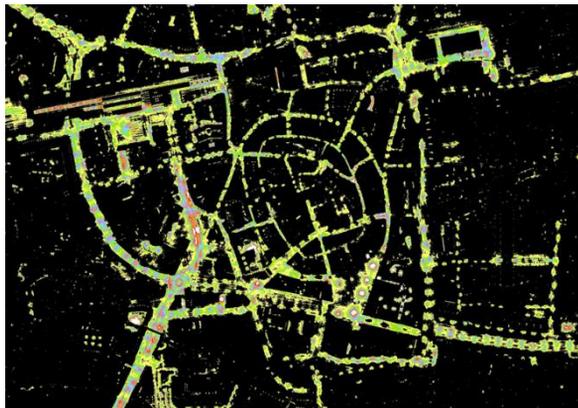

Luminance map

Energy Efficiency	• *Luminance map*
	• *Over-exposure map*
■ **Detailed Luminance map**	• *EN classification map*

Examples

Luminance map (cd/m²)

	0 cd/m²
	0,1 cd/m²
	0,3 cd/m²
	0,6 cd/m²
	1,1 cd/m²
	1,6 cd/m²
	2,3 cd/m²
	>2,3 - 8 cd/m²
	> 8 - 40 cd/m²
	> 40 - 250 cd/m²
	>250 - 1600 cd/m²
	> 1600 cd/m²

Over-exposure map

Examples

EN classification map

Energy Efficiency	• True-color ortho-photo
▪ **ISS-based brightness map**	• Relative brightness map • Redness index

Description

Besides acquiring nighttime imagery with a camera-equipped aircraft, it is also possible to use photographs taken by astronauts onboard the International Space Station (ISS), which typically orbits the earth's surface between 330 and 435km above sea level.

The photographs are taken by very common camera's (e.g. Nikon D3 and similar) and the resulting raw data (.NEF files) are made publicly available by the NASA in an online archive.

Input data	Raw imagery from NASA archive; administrative boundaries of AOI; vector data of roads (e.g. Open street map);
Reference scale	between 10m-50m, depending on conditions during photo acquisition.
Geographic coverage	Municipal boundaries of the Royal Borough of Chelsea & Kensington and adjacent boroughs.
Temporal coverage	

Methodology

1. Browse archive for suitable imagery and select best quality photo
2. Convert raw imagery to 3-channel RGB formatted TIFF file
3. Geo-reference the imagery to create a true-color orthophoto
4. Create relative brightness map by adding the channels
5. Create redness index by calculating the relative proportion of the red channel and the sum of the channels.

Applications

The ISS-derived **orthophoto** provides a nice and cheap alternative for the expensive airborne nighttime flight; Similar to the airborne luminance maps, these maps show the amount of emitted light and are an important policy instrument for cities and municipalities with regard to: Energy saving, Safety and Light pollution.

It can be fully integrated in existing GIS environments of the client, since the imagery is georeferenced. The user can distinguish different **lighting types**, determine spatial patterns of lighting, and identify the sources (although with much less accuracy and detail compared to the airborne product).

The relative brightness map is a quantification of the ortho-photo: because the 3-channel RGB orthophoto is not suitable to perform quantitative analysis, the channels are combined into a single quantity called "relative brightness"; on this map, over-exposed "light spots" are easily recognizable, and the quantitative scale also makes it possible to make classifications and other personalized operations in any GIS environment.

Finally the so-called **"redness index"** gives an indication about the qualitative characteristics of the light: many cities still rely on high-pressure-sodium lamps, which emit light in a typical orange color. The recent wave of renewal campaigns (mainly towards LED technology) makes the redness index a good proxy for outdated and to-be-renewed luminaire inventory. It could also act as a evidence-based benchmark of past and on-going renewal programs.
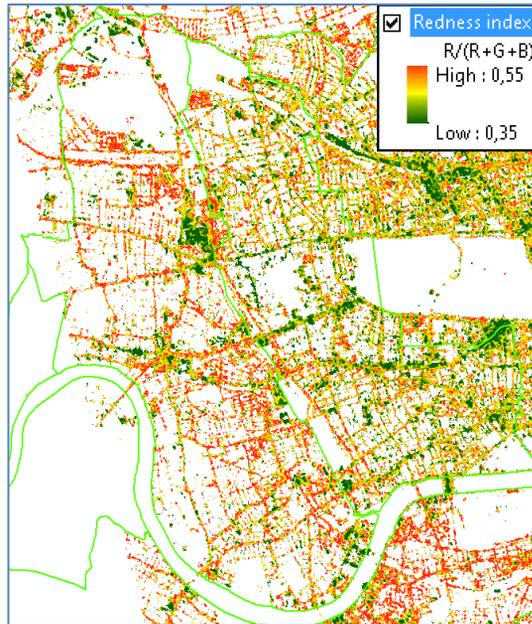
Energy Efficiency

▪ **ISS-based brightness map**

- *True-color ortho-photo*
- *Relative brightness map*
- *Redness index*

Examples
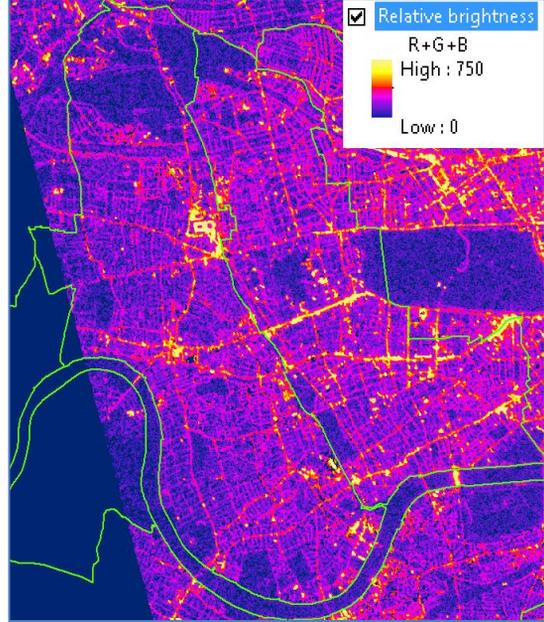
True-color orthophoto (left) and relative brightness map (right)

Redness index

Energy Efficiency	• Full-resolution insolation map
	• Suitable areas for photovoltaic modules
▪ **Photovoltaic Potential map**	• Max. potential annual electricity yield
	• Max. potential annual CO2 savings

Description

The photovoltaic potential map quantifies the suitability of a building roof for installing photovoltaic modules, its expected annual electricity yield, and corresponding CO2 savings. The map is based on a geometric model which calculates, for each grid pixel, the solar irradiance. The model is part of the ESRI ArcGIS software suite, and takes into account the daily and annual cycle of solar angle, average climatological conditions (cloudiness), and shadows casted by neighboring objects such as trees and adjacent buildings.

Input data	Raw imagery data from NASA archive (.NEF file); Digital Elevation model (DEM); Digital Surface model (DSM; Building outlines (city cadaster); (optionally) vectorized high-voltage powerlines
Reference scale	Depending on the resolution of the input data; with a DEM and DSM of 0,5 meters resolution, the output raster data will also have a resolution of 0,5 m.
Geographic coverage	Municipal boundary of HSY, Antwerp, Royal Borough of Kensington & Chelsea, Madrid
Temporal coverage	

Methodology

1. Pre-process the input data: **identify transparent objects** such as high-voltage powerlines and construction cranes from the DSM. These objects erroneously cast large shadows on adjacent building roofs, and hence need to be **removed** from the elevation model prior to the analysis.
2. Build a **solar irradiance (="insolation") model** distributed over multiple computers (to enhance processing speed) and execute it. The model is based on ESRI technology and uses optimized and state-of-the-art input parameters.
3. Collect model output, create annual insolation mosaic
4. Calculate suitable areas by taking into account several constraints (e.g. 0.5m buffer between roof edge and modules, min. area required for modules...)
5. Calculate insolation on suitable areas for each building roof, convert to electricity yield and CO2 savings.

Applications

Solar energy is one of the energy resources that contributes to the reduction of CO2emissions and thus contributes to climate protection. During DECUMANUS Eurosense intends to examine if a specific geo-information service can contribute to investigate if a rooftop is suitable for solar panels and in that way can contribute to, for instance, the promotion of solar panels.
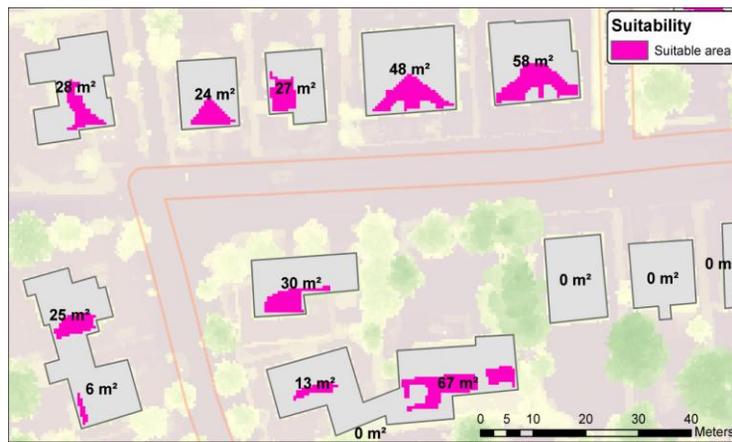
Energy Efficiency	• Full-resolution insolation map
	• Suitable areas for photovoltaic modules
▪ **Photovoltaic Potential map**	• Max. potential annual electricity yield
	• Max. potential annual CO2 savings

Examples
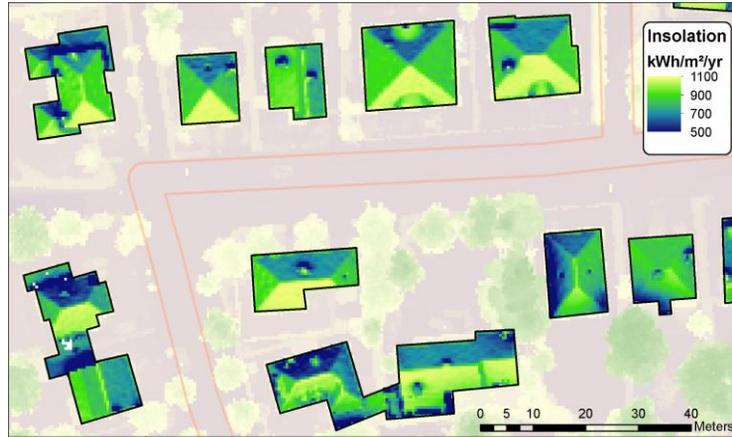
Insolation map

Suitable areas

Max. potential electricity yield

Land Monitoring	▪ *Green Roof Detection*

Description

Green roofs are building roofs partially or completely covered by vegetation. They are absorbing rainwater, providing thermal insulation and reducing air pollution. In this context, the identification of green roofs has great importance and represents the goal of the provided service. Furthermore, this task is carried out automatically - which is a great asset with respect to current approaches based on photointerpretation or even in situ surveys by experts – and allows easy and straightforward update once provided with new suitable imagery.

Input data	VHR VIS+IR imagery [either airborne (preferably) or satellite], LOD2 model or DSM/Lidar data, building outlines
Reference scale	same as for the provided building outlines (i.e., each building is associated with an attribute marking whether it has a green roof or not)
Geographic coverage	Municipal boundaries of Antwerp, Helsinki, RBKC and Milan.
Temporal coverage	

Methodology

Given VHR satellite/airborne VIS+IR optical imagery, the building outlines and LIDAR/DSM height information, we estimate the percentage of vegetated areas on the building roofs by computing the NDVI index and determine where we are in the presence of a green roof.

Applications

Mapping current green roofs has high support for a more accurate modeling of stormwater runoff and air pollution. Moreover, being the installation of a green roof usually supported by subsidies, a precise identification of their location will be of great help for planning in-situ survey of their actual status.

Examples

False-color VHR optical imagery including building outlines

and corresponding identified green roofs

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Land Monitoring	▪ *Green Roof Potential*

Description

In addition to the green roof detection premium service, we also provide an additional service dedicated to the identification of flat roofs, which are the only ones suitable to be converted into green roofs. Moreover, we also estimate which impact they would have if the conversion would occur (as an example a new green roof in a highly impervious area has greater impact than one in a rural area).

| Input data	LOD2 model or DSM/Lidar data, building outlines, imperviousness map (also available as DECUMANUS basic service)
Reference scale	same as for the provided building outlines (i.e., each building is associated with an attribute marking whether it has a green roof or not)
Geographic coverage	Municipal boundaries of Antwerp, Helsinki, RBKC and Milan.
Temporal coverage	

Methodology

1. masking the DSM (yet available or derived from LiDAR point cloud data) by means of the available building outlines;
2. computation of the histogram for the pixel height within each building segment;
3. analysis of the histogram: in the case of flat roofs (even multi-level) the histogram is characterized by spikes, rather than ramps typical of non-flat roofs.

Applications

A map of the potential green roofs helps modeling how and how much the stormwater runoff and the air pollution are modified in case a certain number of roofs are converted to green roofs. This would be of high support to green urban planning policies and might help the municipality to target subsidies in areas which would more benefit from this change.

Examples
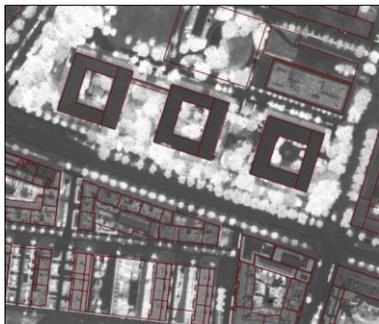
DSM including building outlines

and corresponding identified flat roofs (dark green)

Land Monitoring	▪ *Automatic Tree Detection*

Description

In several cities occurs that, while for public trees inventories are available directly at the municipality, this seldom occurs for private trees. However, this source of information is important for a comprehensive knowledge about urban green areas, which is fundamental for improving mitigation and adaptation activities against climate change.

Presently, this task is carried out by photointerpretation or in situ surveys and requires plenty of time. Accordingly, a service that allows to routinely create a reliable map of the trees in a given study area without the need for manual work would be of great help.

Input data	VHR airborne/satellite VIS+IR imagery, DSM/DTM/Lidar data
Reference scale	Point dataset depicting the location of single trees in the investigated area.
Geographic coverage	Municipal boundaries of RBKC.
Temporal coverage	

Methodology

1. Segmentation of the DSM (yet available or derived from point cloud LiDAR) data;
2. Computation of the mean NDVI (extracted from the available airborne/satellite VHR VIS+IR imagery) per segment;
3. Identification of vegetated segments based on the analysis of the mean NDVI;
4. Derivation - within each segment - of the location of the pixel whose height (computed as a difference between the DSM and the DTM) is maximum.
5. Exclusion of those points whose height is lower than the pre-defined minimum tree height.

Applications

▪ A tree location register is of use in supporting an improved urban planning as well as climate change adaptation and mitigation activities.
▪ Enhance the ability to educate and encourage the public and decision-makers about the importance of trees and the need to care for and protect them.

Examples

True-color VHR optical imagery

and corresponding identified flat roofs (dark green)

Population Impact	▪ *Day-time population distribution maps*
	▪ *Population impact assessment maps*

Description

The service will provide ready-made, easy-to-understand visualizations of the day-time population distribution based on a variety of input data such as communing data, works places, universities and schools, etc. Based on the population distribution, a service is developed dedicated to analyze the impact of climate change scenarios to the population. Therefore, the data on day-time population distribution will be combined with the outcomes of urban climate models and urban air quality models (Milan) and flood risk datasets (Helsinki).

Input data	Commuting data, building outlines, population data, work places/universities/schools, land use, data on air quality, sea & fluvial flood data
Reference scale	Building block level
Geographic coverage	City scale (Helsinki & Milan)
Temporal coverage	

Methodology

1. Calculation of the night population distribution
    *   Pre-processing of census population data
    *   Disaggregation of census population data on building footprints
2. Pre-processing of data on educational establishments
    *   Stepwise and rule based correction of position errors
    *   Localization on building footprints
3. Pre-processing of commuting data
    *   Database conversion and pre-processing
    *   Localization of commuting data
4. Disaggregation of population data
    *   Calculation of building use specific factors (k-factor)
    *   Calculation of day population distribution based on the specific k-factors
5. Intersection of Day population with flood/air quality scenarios

Applications

▪ Derive how many people within the wider city/agglomeration are affected during the day by selected environmental threats/climate change risks

▪ Information can be used for various analysis such as the assessment of air pollution-related health impacts or identification of potential exposure of citizen to flood and heat waves

| Population Impact | • *Day-time population distribution maps* |
| | • *Population impact assessment maps* |

Examples

Day-time population distribution in Helsinki on building block level

population impact by sea flood based on a 250 year flood event

Common Technical Characteristics

The following Technical Characteristics are common for all products present at the Decumanus Geoportal

Product Format:	shp or tif
Projection:	Geographic WGS84 (degrees, minutes, seconds)
Metadata:	ISO 19115 compliance (xml format)
Raster (tif):	8 bits

decumanus

For further assistance, please contact
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